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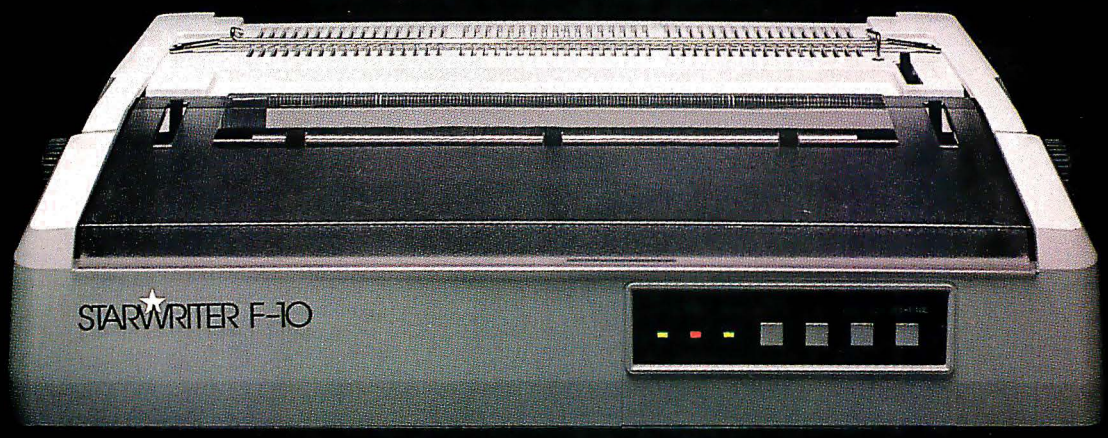

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In addition to our highly-acclaimed CROMIX, there is our CDOS*. This is an enhanced CP/M† type system designed for single-user applications. CP/M and a wealth of CP/M-compatible software are also available for the new System One through third-party vendors.

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Then there's our tremendously wide range of Cromemco software including packages for word processing, business, and much more, all usable with the new System One.

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Physically, the One is small — 7'' high. And it's all-metal in construction. It's only 14⅛'' wide, ideal for desk top use. A rack mount option is also available.

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Get all the details on this important building-block computer. Get in touch with your Cromemco rep now. He'll show you how the new System One can grow with your task.

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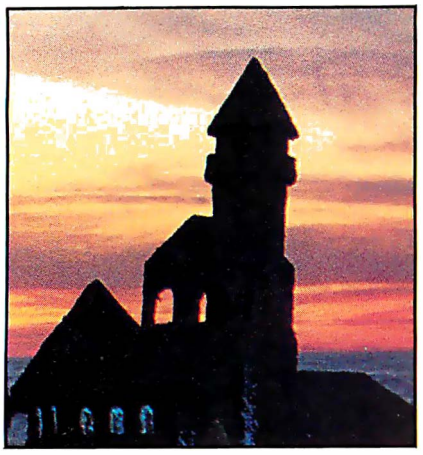

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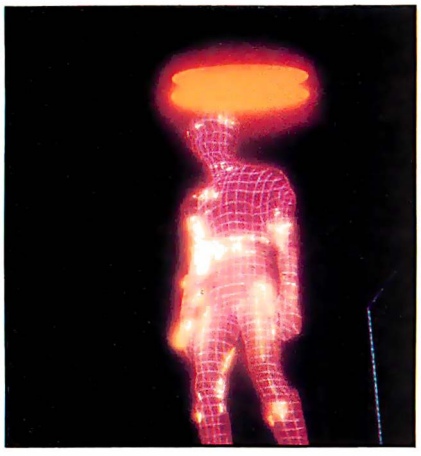

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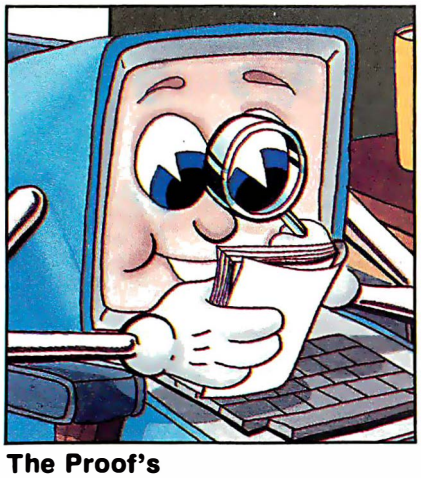

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Contact authors by writing to them at INTERFACE AGE, P.O. Box 1234, Cerritos, CA 90701.

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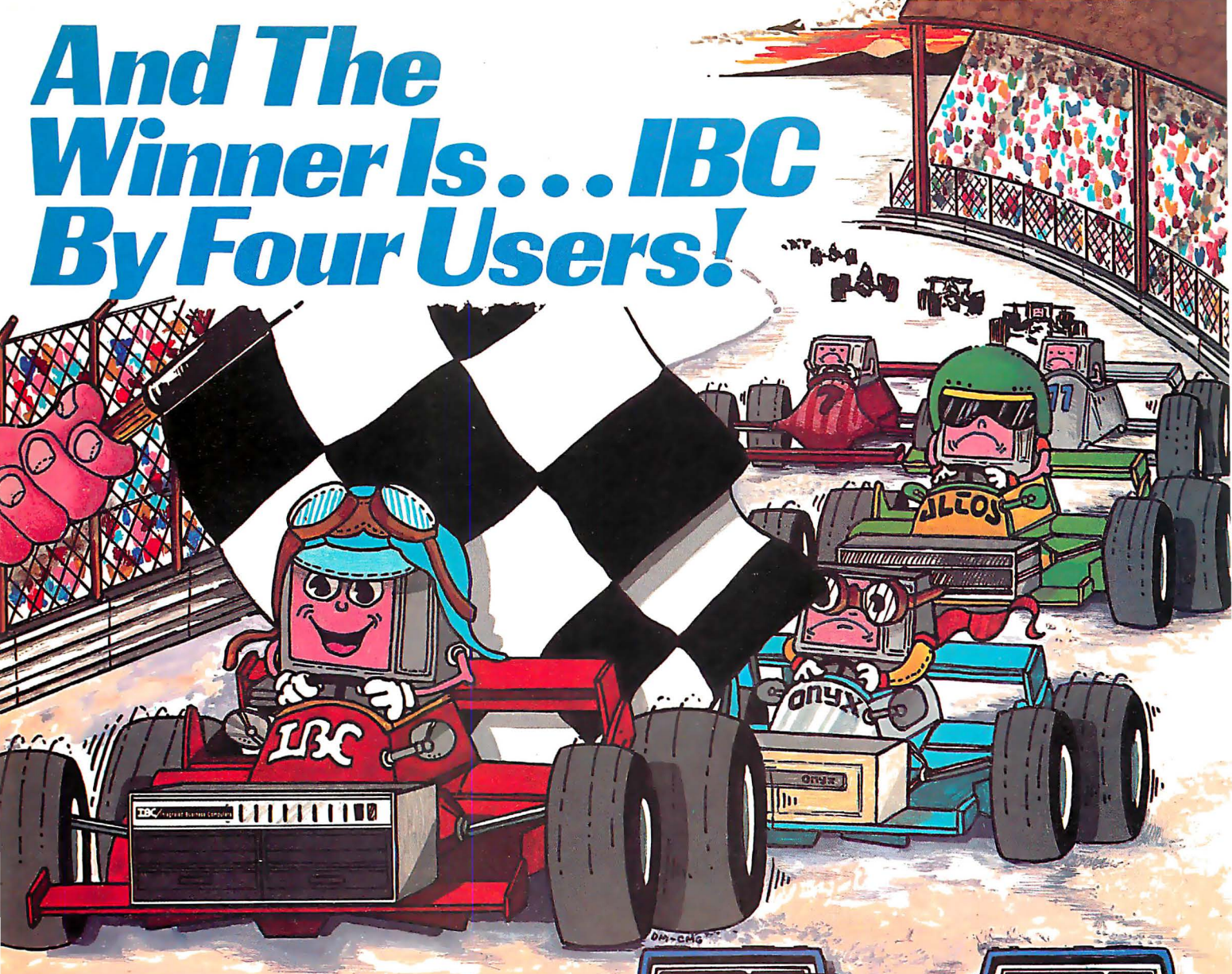

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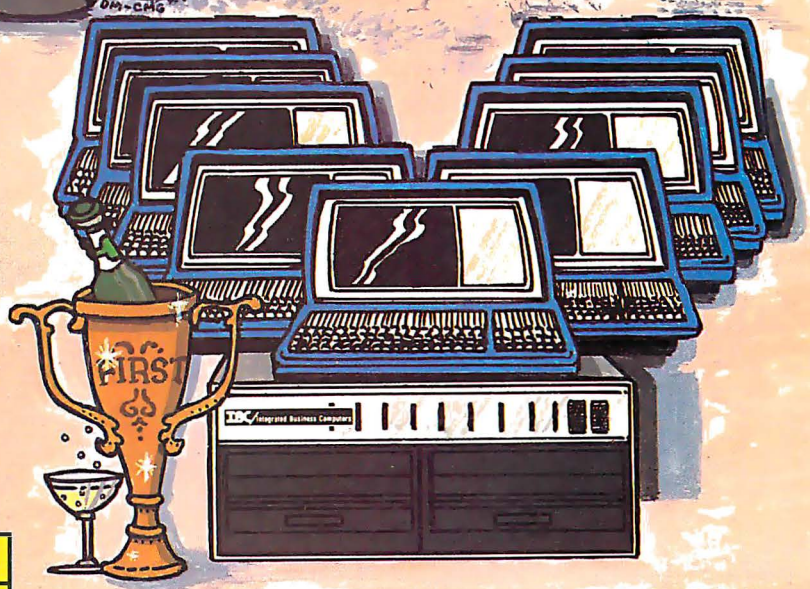

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Advertising

Boston **Dick Green**
7 Lincoln St., Wakefield, MA 01880
(617) 245-9105

New York **John Sensensteln**
355 U.S. Route 46, Mountain Lakes, NJ 07046
(201) 625-8660, (201) 625-8661

Charlotte **Harry Dill**
3938 Sussex Avenue, Charlotte, NC 28210
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Chicago **Al Gravenhorst, Steve Skinner**
5901 N. Cicero Ave., Chicago, IL 60646
(312) 545-8621

Dallas **Mitch Mohanna**
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(214) 596-1139

Santa Clara **Deborah Kenney**
1333 Lawrence Expy., Ste. 150C,
Santa Clara, CA 95051
(408) 296-2121

Los Angeles **Mike Antich**
P.O. Box 1234, Cerritos, CA 90701
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Interface Age Europe

Representative **Gisela Pleperelt**
8046 Garching, Dirnismaning 32A
West Germany
Telephone: 089-3204902

International Newsstand Distribution

Director **Lew Ullian**
Orberstrasse 38, D-6000 Frankfurt/M. 61
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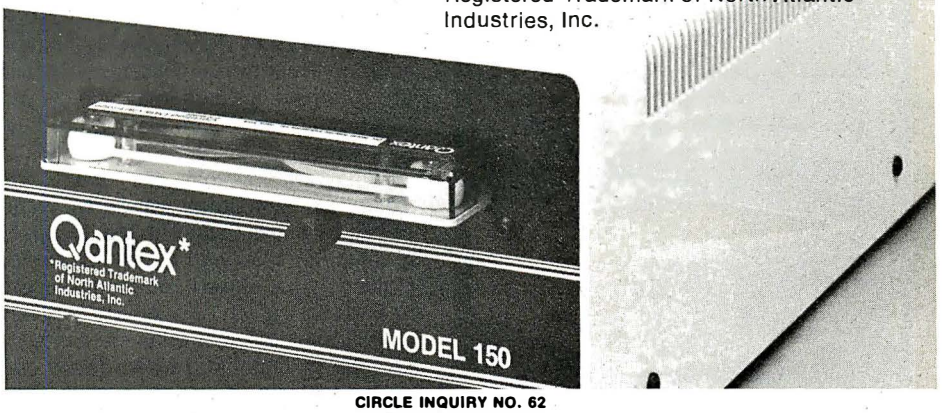

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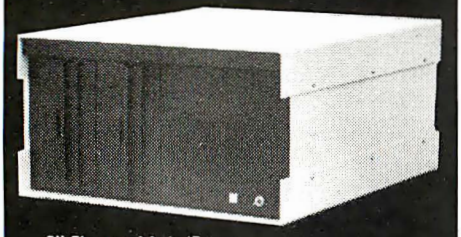
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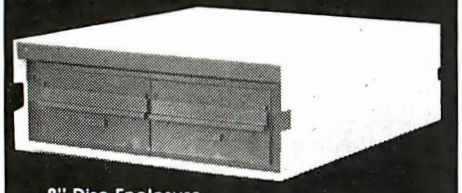
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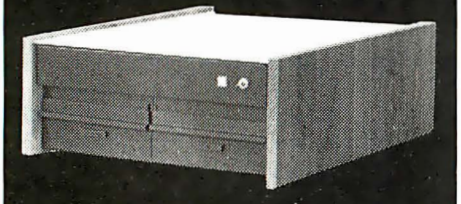
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EDITOR'S NOTEBOOK

Open or closed case?

If the microcomputer industry could be characterized in a single word, that word would be *change*. It's a young industry, pummeled by technological opportunity on one side and a fickle customer base on the other. Customers' tastes alter as soon as they learn of possible new developments. Confusing and undisciplined, the micro business is charged with energy and change.

We see change not only in *what* products are being sold, but in *how* they are marketed. Over the past few months, we have noticed a polarization among the computer makers to a single sales philosophy—a philosophy that is going to have a direct influence on you if you now own, or are planning to buy, a microcomputer.

The issue is that of "open" vs. "closed" computer systems. The words have less to do with the design of a computer than with a manufacturer's philosophy. A closed computer system is one for which the maker actively discourages product enhancements by the use of unauthorized hardware and software items. An open system, conversely, is one whose creator actively encourages other companies to invent add-ons for it.

Once the words are defined, you realize that this sort of thing has been going on for a long time. In the 1960s, IBM fought two monumental battles, and lost both of them. The first IBM computers were tightly closed systems; systems software products from independent vendors were actively discouraged. It was very difficult for an outside disk drive manufacturer (for example) to get the technical information necessary to connect one of its products to an IBM mainframe. Marketing pressures (and the courts) forced IBM to reverse its position and the aftermath placed two new words into our vocabulary: "software unbundling" and "plug-compatible peripherals." Both were just different ways to describe an open system.

On the surface, IBM lost those battles. Retrospect, however, lets us see that the computer industry flourished as a result of the decisions made in those early years. Computer users surely benefited, and IBM itself shared in the computer prosperity that continues to this day. If that's losing the battle, the world needs more such defeats.

And that's our point—one that applies just as well to the infant microcomputer industry. Companies that allow outsiders to create product-enhancing hardware and software have a good chance to succeed; those that close their systems to outsiders tend to disappear into a walled-off existence. There are exceptions, but we have observed that corporate selfishness in this matter often leads a company into a corner from which there is no return.

Some examples: Most S-100 computers are open systems, as their design allows hardware products from various sources to work harmoniously. Computers sporting the CP/M operating system are open, too—a cornucopia of software abounds for these machines.

The Texas Instruments TI-99/4 home computer is a closed system. The manufacturer is not interested in allowing outside manufacturers to connect their enhancements to its computer. Apple II began as a closed system, but outsiders soon learned how to make add-on circuit cards for this popular machine. This is a classic case of a manufacturer profiting by letting a few pieces of pie go to others.

The IBM Personal Computer (*IA* Feb 82) is an active, enthusiastic open system. The manufacturer is betting heavily on the success of this concept; we'll have to see how well it works for them—and for us, the consumers.

Radio Shack TRS-80 computers are perhaps the best example of closed systems that have achieved success without opening the doors to outside accessory manufacturers. It works for them, but no one else has been able to approach the same measure of success without some help from independent vendors.

What's our position on this? From the purchaser's standpoint, we believe that open systems are the way to go. Open systems give a buyer choices. It forces the larger, more successful manufacturer to continue to innovate. It creates an opportunity for new companies to market fresh ideas. Open systems maintain a *status quo* of change—a contradiction of terms, but change is the very thing that keeps the microcomputer industry energized. ***—TF***

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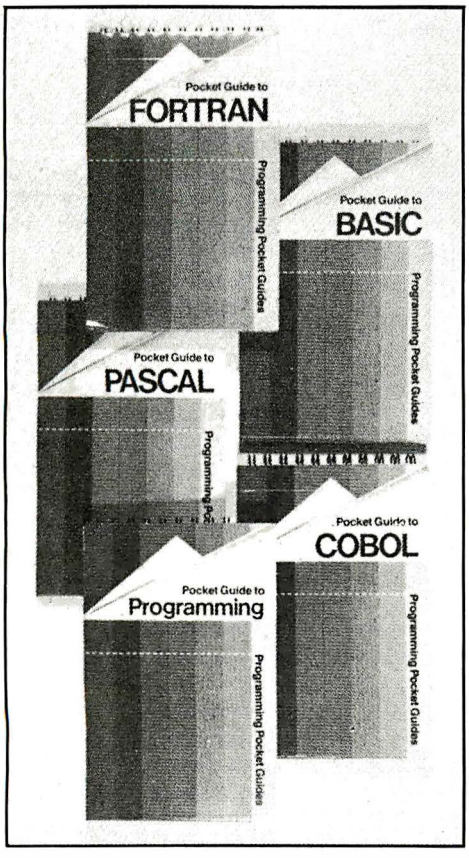

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LETTERS

Pocket bugs

Re: "The Pocket Computer as a Travel Guide" (*IA* Jan 82), please tell me where author David D. Busch got a Sharp or TRS-80 pocket computer that will display lines like "ENTER STARTING ODO READING" and "(E)TA (M)PG (A)VG MPG (G)AL". The TRS-80 I'm familiar with displays only 23 symbols in the execution mode and won't rollover -either automatically or on command - to display more information. The rest of such a prompt is therefore lost forever, unless the user wants to go into source code and dig it out. Or maybe he wants us to figure out how to get that rollover into the program by using additional entries during execution. I finally got a program from a magazine that I can really use in my meager equipment, but still find I have to do much of the programming myself. I gather that's the way of life. But he did say it was written for the Sharp/TRS-80....

Larry Bastian
Salt Lake City, UT

Because I don't have a printer for my pocket computer, the program listing with the errors was obtained by typing the program manually. Apparently, I decided to "enhance" some of the prompts by adding a word or two—chiefly "ENTER" —which makes them too long. If you'll delete the extraneous "ENTER" from prompts such as "ENTER STARTING ODO READING", the program will run properly. The MPH in (A)VG MPH does not belong. Sorry for the unwanted programming practice this error caused you.
—DDB

Slight exaggeration

Re: "Howard Ganz: Portrait of a Computer Artist" (*IA* Feb 82), the article states that 3,500 designs from the Artist Designer program will fit on one disk. Only 35 will fit.

Howard Ganz
Oceanside, CA

Land of Oz

Re: "System of the Month" (*IA* Nov 81). Since, as you say, the Osborne 1 breaks all of your formulated rules, I anticipated a critical review and evaluation of The Great Ozzie with revelations of some as yet undiscovered (by me) defects in the unit. On the contrary, your article was more than fair and (based on my personal experience) valid. It works! Each day I use the unit, I become more and more delighted with Ozzie's powers. Indeed, it functions as a viable system...no frills...just a smooth running workhorse of a micro! The weak documentation is a real but minor inconvenience—a small price to pay, which is more than made up for by Ozzie's value and utility. Adam Osborne and team are to be congratulated on their achievement and encouraged to keep up the good work. I expect further innovations from them in the future.

August E. Brunsman, III
Columbus, OH

On erased CP/M files

Re: "How to Recover Erased CP/M Files" by Gene Cotton (*IA* Dec 81), further discussion of the disk map of sectors is in order. This information is coded in a bit-mapped fashion—that is, one bit per one sector. If the sector is in use, the bit is set to one; otherwise it is zero. When new files are saved, CP/M refers to the bit map for available sectors and sets them to one as they are used. When files are erased, not only is the first byte in their directory entry set to "E5" as Cotton points out, but also (and significantly) the sector that the file had used is made available to future files by setting the corresponding bits in the bit map to zero!

The file that you think you have saved using the program will be overwritten on the disk, as future files are created and CP/M reuses what it thinks are available sectors.

The program can still be used. If "Unerase" is run after an undesired erase (before any new files of any kind have been created and the newly recovered file is PIP'ed to a new file), I believe the file will be successfully recovered.

The bit map for a given disk is located in high memory following the BIOS. The last item in the Disk Parameter Header is called the ALV. This is the Allocation Vector; it is the address of the bit map. For more information on the subject, see the CP/M Alteration Guide version 2.0, chapter 10.

Billy Smith
Valley Ford, CA

Thank you for your reminder that the CP/M allocation bit map is involved. I would like to point out a possible misunderstanding you may have about the use of the allocation bit map implemented by CP/M.

As you know, the bit map is organized as a string of bits with the first bit associated with the first allocation block. If the bit associated with an allocation block is zero, the block is available for use; if the bit is one, the block is already in use. This string of bits is sometimes called the allocation vector. The length of the allocation vector is determined by

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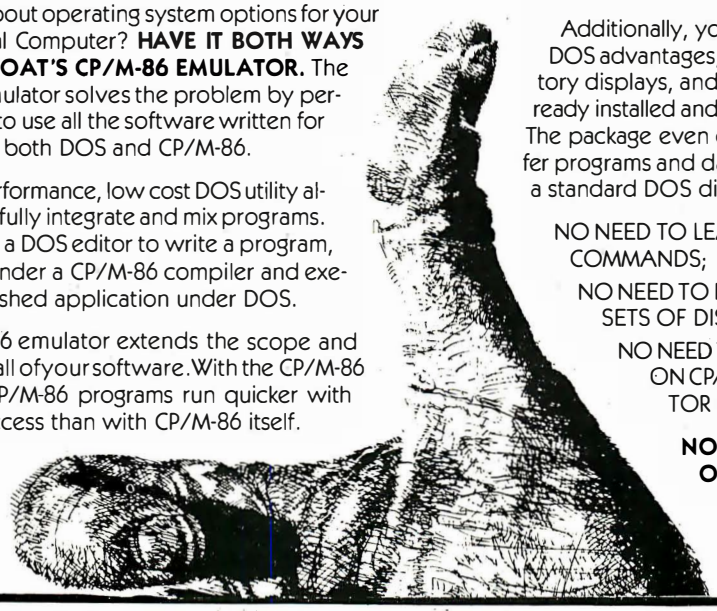

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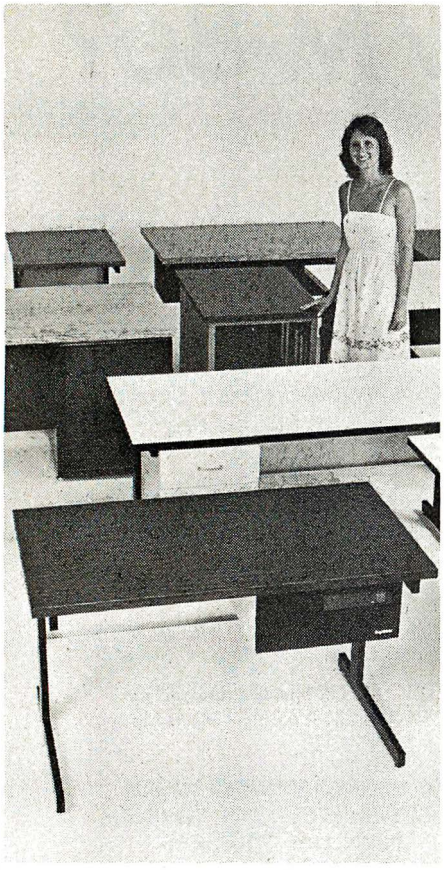

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the number of allocation blocks on a disk. For a single-density, 8-in. disk, this is 242 blocks. This means 242 bits are needed, or 31 bytes. The string of bits reads logically left to right. The few bits on the end of the string not needed are ignored.

When CP/M first reads a disk (drive "A" after a warm boot, for example) the directory is scanned, and the active files are used to produce the active blocks bit map you refer to. Until the drive becomes read-only (usually when the disk drive door is opened), this string of bits is used to "tell" CP/M which blocks are available for use and which are in use already. The simple act of typing "control-C" causes the bit map to go away until the drive is accessed again.

The possible misunderstanding has to do with the life span of the bit map. I inferred from your letter that you believed the bit map to be written on the disk in some fashion. This is true for some other operating systems (MuDOS, for example), but is not true for CP/M.

My mistake was not mentioning the above process to explain why a warm boot should be performed after the execution of the UNERA program. As you correctly point out, if a file is placed on the disk in question before a warm boot is performed, it is possible (but not guaranteed) to corrupt the data blocks just discovered. ***—GC***

Too good to be true?

I keep looking back at the Sinclair ZX81 ad in your December issue: a 16K microcomputer for only $250? Is the ZX81 for real, or is there something that the ad leaves for my overactive imagination? A 16K RAM computer *seems* like it should be fairly usable for home and education uses. But the only peripheral seems to be a printer that "will be available in the near future." I have seen no satellite companies offering software or peripherals for "the world's largest selling personal computer" (the ZX80) or for the ZX81. Or is there more to be said for it? Is the ZX81 just an inexpensive way to learn about computers? Is it just a throwaway computer, to be discarded when I find the need to expand my system?

Jack Ryan
El Dorado, AR

Look for a review of the Sinclair ZX81 in an upcoming issue. ***—ed***

On the IBM Personal Computer

I found your IBM Personal Computer article (*IA* Feb 82) informative, providing information not readily disclosed elsewhere. You made reference to a clever programmer being able to re-define 128 characters. I have an IBM pc with the color adapter, but have not been able to determine the address of the starting address in memory, where the shape table for built-in characters is stored; or the address for changing the "pointer" that the screen display uses to find the character set from its old ROM location in its new RAM location. I would greatly appreciate your assistance.

Peter Grimm
El Paso, TX

The user-defined character set is available only in the graphics mode. Characters are defined as 8 by 8 blocks of bits, with each succeeding byte (8 bits) defining a horizontal row of the individual character. The table can be built in RAM by POKEing the bit pattern from Basic. The first eight bytes define character #128, the next eight, #129, and so on. This table is indicated by the Basic interrupt vector 1F (hexadecimal). (Additional information can be found in IBM's Technical Reference Manual.*) The first 128 characters are pre-defined in ROM at section F000, offset FA6E. See page A-75 of the manual.* ***—TF***

I purchased an IBM Personal Computer last November for business accounting.

When I discovered the disk drive system stored only 160K bytes of data, I became concerned that the storage would be inadequate and almost cancelled my order. But one feature that makes the 160K of disk storage more effective is the method used for compacting data in programs and numbers stored on the disk using either integer variables, single precision variables, double precision variables or string variables that can be intermixed. For example, I store a date on the disk using a two-byte integer (12312 for 12/31/82), instead of using a string variable. Where an accounting program stored accumulative totals, it is important to use double-precision storage to the disk (8 bytes) in order to avoid small addition errors. Otherwise single precision (4-byte storage) is satisfactory.

A.E. Hudeck
Houston, TX

Software problem

I have a software problem; can you help?

I have a Vector System B, running WordStar. WordStar is not too efficient for form letters, so I ordered Postmaster. When I bought the Vector, the vendors copied an 8-in. distribution disk onto my Micropolis format. I also bought CBasic,

which they copied. WordStar later provided a Micropolis disk when I sent in my 8-in. disk for update. Now I need the CBasic (I have 2.04) updated (I need 2.06) and no one will touch it.

I returned to my original vendors and asked them to update my CBasic, or copy an update onto an 8-in. disk. The vendors said the best they can suggest is for me to order a new copy of the program for $125. This seems to be a steep price.

So, here I sit...I can't upgrade my CBasic and, supposedly, can't get an 8-in. upgrade and have it copied.

Robert F. Morrison
Wheaton, MD

Your situation illustrates a telling point: Watch out when you buy non-standard equipment or software. We sympathize with you, but it sounds as if your suppliers have done what they can. Likewise, our suggestion is to buy the newer versions as required. ***—TB***

Program comparison

Have you ever published a comparison of various calculator-type programs such as ViciCalc, SuperCalc and CalcStar?

Sheldon J. Finkel
Montgomery, AL

A comparison of such systems will appear in an upcoming issue.

—ed

Interested in Osborne

I have been checking into the Osborne computer for use in my husband's small business. Both the price and the five software packages that come with the unit impressed us. Have you done any research into the Osborne computer?

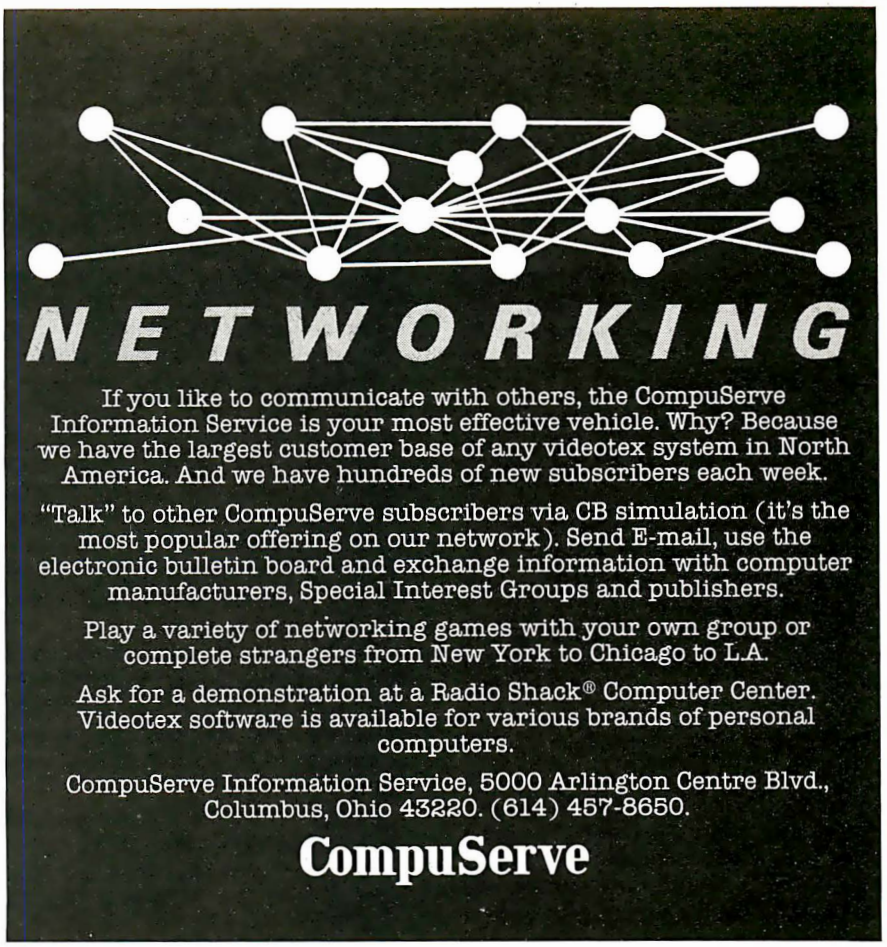
Katherine G. Podwolsky
Santa Fe, NM

See "System of the Month" (IA Nov 81). ***—ed***

Graphics update

I found your article, "Graphics Capabilities for the Small Business" (*IA* Feb 82), informative. However, I must bring some mis-information to your attention. You mentioned that the Freedom Option comes from F.E.C., Ltd. That is no longer true. Freedom Technology International has bought the right to the CP/M enhancements, and now manufactures and distributes them under the names Freedom Option and Freedom Plus.

You also credited the operating system T8/OS to Cromemco. F.E.C., Ltd. developed T8/OS for Cromemco and has also contracted with LNW for its use. In addition, your systems chart



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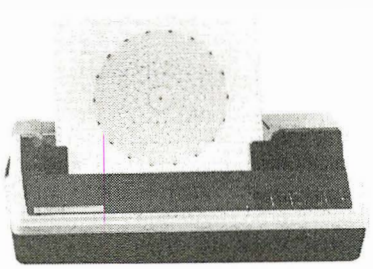

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on page 98 credited M.T.I. with the compatibility of T8/OS; it should have been credited to LNW 80.

Larry Steinberg
Freedom Technology, Int'l.
Philadelphia, PA

Relief for the agonized

I liked Dona Z. Meilach's article "The Agony and the Ecstasy of a New Computer Owner" (*IA* Jan 82), and support your views.

Just wanted to let you know we are working on creating a solution to the problems of supporting new computer owners.

Ron Miskie
Documentation Development
New York, NY

What about consultants?

The article by David Benevy, "Tips on Selecting a Small Business Computer" (*IA* Jan 82), offers a number of points a small businessperson should consider before buying a computer. However, you fail to recognize the significant growth in the microsystems consulting industry.

Independent consultants with no ties to any hardware or software manufacturer can determine potential present and future applications of a computer in a business, can determine the hardware and software capable of meeting those applications, and can assist with installation, software modifications, and training necessary for business staff.

Consultants are expensive, but exist solely because they have a good deal of expertise and spend a good deal of time keeping up with the rapidly changing area of microcomputers and microcomputer software. Consultants can save small businesspeople money, ensuring that business computers will do the job for which they were purchased.

Anthony K. Lima, Ph.D.
San Leandro, CA

Computers by mail

Re: "Editor's Notebook" (*IA* Dec 81), on buying a mail-order computer.

I recently purchased an Apple II +, two drives and a monitor, M-Soft RAM card and Soft Card, and a Videx 80-column card from Consumer Computers, La Mesa, CA. I was overseas at the time and felt that mail order was my only option to get an American-specification computer.

Once I had decided upon the equipment I wanted, it was just a matter of whom to buy it from. My criteria in buying were: price (it ultimately came down to which company's shipping charges were smallest), availability (did the mail-order company have everything I wanted, so that I didn't have to deal with more than one company), and technical help. I made some phone calls to see how helpful the tech reps would be, and everyone I called was helpful.

Everything but my monitor arrived in four weeks. The monitor, although it was in stock when I contacted the company, was not in stock when my payment arrived. It had to be back-ordered. Everything arrived properly packaged and worked as advertised. My only problems, so far, have been operator errors, and although computers weren't totally new to me, this was *my* first computer.

One thing—telephone calls (especially overseas calls) can get expensive and this led me to technical manuals before I made any calls. This was an advantage, as I always found something useful that I wasn't looking for.

Overall, I'd rate my success with mail order as a 9.5 on a scale of 10.

Robert A. Buckman
Cannon AFB, NM

I have used Heathkit equipment for more than 23 years; most of the kits I built were ham radios until I got into computer. Whenever I had trouble with any of my gear, I received plenty of help as long as I sent a good description of my troubles. As long as Heath/Zenith treats me this way, I will stay with them.

I have been less fortunate with a franchise in my area. It doesn't stock software for the Zenith machines, and has turned me and another man who owns a TI computer away because we didn't buy franchise computers.

Robert W. Sloat
Tice, FL

Reader interface

I am interested in joining a users' group catering to Netronics Explorer 85 owners. Can any of your readers put me in touch with one? If there is none, is anyone interested in forming one?

Clarence Heier
3430 93rd St.
Sturtevant, WI 53177

How would you advise a small, non-profit institute to acquire a donated or used home computer system to operate its computer camp? There would be considerable exposure and tax advantages for the donor.

Lawrence S. Kroll
Oz Projects
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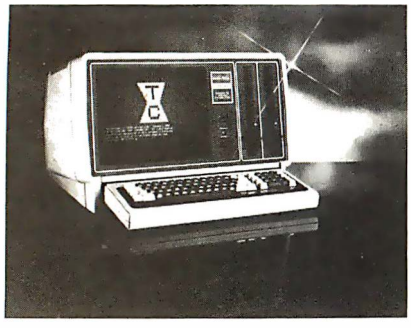
UPDATE

Powerful 16-bit TRS-80 version is announced

Tandy/Radio Shack (Fort Worth, TX) has announced its most powerful version yet in the TRS-80 computer line.

The model 16 computer features 16-bit technology, dual processor architecture and a multi-user operating system. It is capable of 512K internal



RAM memory storage and 2.5M bytes of disk memory using two built-in, "thin line" double-sided 8-in. disk drives. Additional external disk storage may also be added. The desktop computer will be available in two versions, both with 128K memory.

The unit can be expanded to multi-user operation with the addition of one or two terminals, and video data terminals can be used as remote workstations. The computer is equipped with two RS-232C serial interface ports and a parallel interface port. Off-the-shelf TRS-80 peripherals, including printers, plotters, digitizers and telephone modems, may be added.

MIT develops summer course on personal business computers

A personal computer summer course has been developed by The Massachusetts Institute of Technology for businesspeople who want to learn more about the subject but have been unable to decipher all of the information available. The program will provide an in-depth examination of the personal computer and the special applications that make it useful in a business environment.

A comparative study of the architectures and operating systems of the more popular business computers will be presented. The material will review the IBM personal computer, the Apple and TRS-80 among others. Case studies of various computers and operating systems will help the non-technical individual as well as someone with some microcomputer experience learn how to apply a personal computer to specific business applications. Laboratory sessions will be integrated into the course to illustrate the topics presented and assist students in applying material to actual designs and implementations.

The course is offered from June 21-25, 1982. For more information and a detailed brochure, contact MIT, Director of Summer Session, Room E19-356, Cambridge, MA 02139.

Price decreases listed by computer manufacturers

Two popular computer systems—one in the home and one in the business category—recently underwent substantial price reductions.

The suggested U.S. retail price of the basic Atari 800 computer has been cut from $1,080 to $899, a reduction of about 16%, it was recently announced.

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are passing the savings along to our customers. We are increasing our production capacity, as well," said Roger H. Badertscher, president of Atari's Home Computer Division. "We have taken this step, even though we are experiencing significant demand for the product."

The price of the HP-85 system from Hewlett-Packard, Palo Alto, CA, was reduced by 15%, to $2,750. The previous price was $3,250.

The reduction was made possible by increasingly efficient manufacturing processes, according to Deme M. Clainos, marketing manager. These included a new materials-handling system and a new, automated assembly process at the manufacturing site in Corvallis, OR.

Court sets precedent on computer game copyrights

Copyright protection is available for the visual images displayed by video games, according to a recent U.S. 2nd Circuit Court of Appeals decision. The ruling involved the Stern Electronics, Inc., Chicago, IL, Scramble game, which has been the subject of a number of other copyright lawsuits brought by the company.

Those suits resulted in injunctions, seizures and impoundment orders issued by various federal courts.

The Appeals Court held that audiovisual work is fixed in the memory devices of a game and that a "player's participation does not withdraw the audiovisual work from copyright eligibility." The court further held that visual displays can be copyrighted separately from underlying computer programs.

Space Invaders, Pac Man zapping competing technology

With respect to computer applications, many arcade games are well ahead of scientific instruments, according to Michigan State University chemistry professor Dr. Christie G. Enke.

Science-spawned computer technology lags behind other elements of society in benefiting from the technology because more money is made from games and word processors than than from research, Enke said in a February issue of *Science* magazine.

But Enke added that computers and microprocessors are revolutionizing chemical analysis and other laboratory procedures, resulting in greater precision, the ability to carry out operations never before possible, and time-saving automation.

Microcomputers and microprocessors have become integral parts of many instruments, just as they are becoming parts of automobiles. Computers greatly increase the scope and complexity of the tasks that can be undertaken in laboratories, he pointed out.

OEM peripherals network to provide national service

A nationwide microcomputer peripheral sales organization is directed toward the second-tier OEM and medium-to-small system house markets.

Peripheral Marketing Ltd., Palo Alto, CA, will handle a complete product line, including floppy and fixed disk drives, tape drives, CRT terminals, printers, power supplies and printers.

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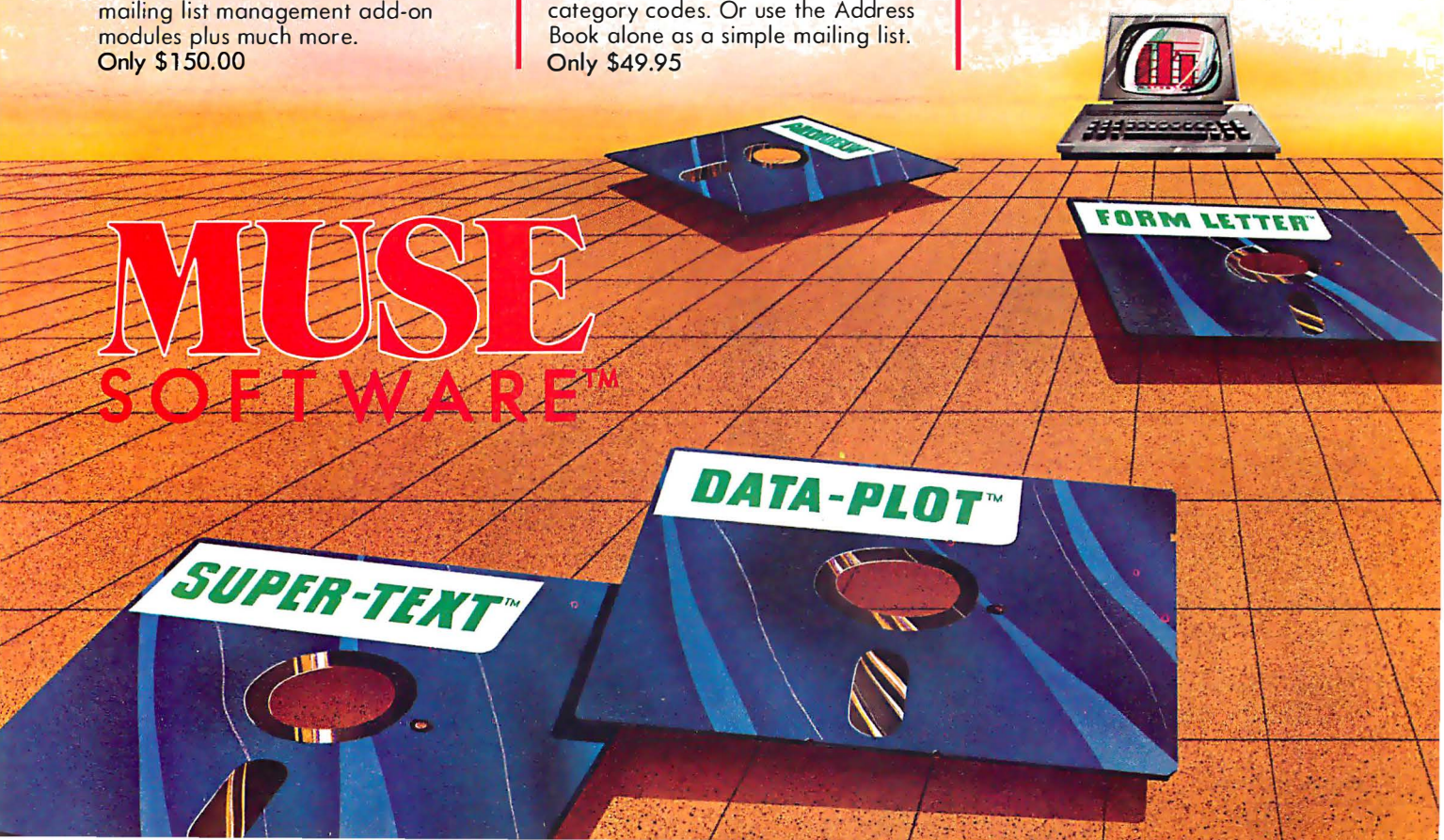

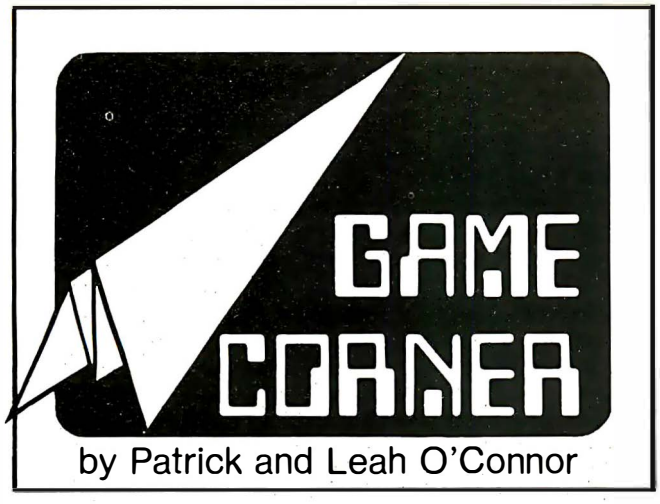

by Patrick and Leah O'Connor

A Look at Four Game Programs

A few months ago, we wrote that we were developing a program to play pocket billiards and noted some philosophical ideas that came to us in the preliminary stages of development.

Shortly after writing that column, we quit developing that program because we got a chance to see *Pool 1.5* (for Apple II) from Innovative Design Software, Las Cruces, NM. We quit writing our program because Pool 1.5 does everything we wanted, the way we wanted.

Pool 1.5 offers a high-resolution graphics display of a pool table and provides four games; Eight-ball, Rotation, Straight Pool and Nine-ball. We played a few practice games to get the feel of the table. The son of a fellow faculty member happened to be visiting the Apple lab and it didn't take much to talk him into a few games of straights. (Pool 1.5 does not play the computer against the human player, so another human is needed for some competition. After a few games of straight pool, we tried each of the other games. Our conclusion: for the most part, Pool 1.5 simulates a real pool table's action very well.

In a real pool game, a player makes the cue ball (the only all-white ball on the table) strike another ball—the object ball—and drive it into a pocket, without pocketing the cue ball itself. The balls may bounce off the cushions and into the pockets (following approximately the laws of reflection for light rays). If the cue strikes the cue ball off-center, it imparts spin, as well as motion in a straight line, to the cue ball. This spin is transferred to the object ball, and makes it act differently from a ball without spin. It caroms off the cushions with unusual bounce characteristics, and travels in a slightly curved path that makes otherwise-impossible trick shots sometimes work. This is called English.

Vector helps line up shots

Good players set up their shots by forming a mental picture of how the cue ball and object ball will look at the moment of impact. A line drawn through the centers of the two balls at this moment shows the direction in which the object ball will be driven. The players use English to get special action out of the object ball, but primarily to place the cue ball in a good position for the next shot after the first shot is pocketed.

While ordinary pool players can line up their shots by getting behind the cue ball and sighting down the cue stick towards the object ball, this game provides only one viewpoint—a view from above. A special method of lining up the shot must be provided. This program helps line up the shot just as well as on a real table. A vector points in the direction a player wants to shoot the cue ball and a phantom cue ball appears at the other end of the vector. The direction of aim changes by turning a game paddle knob. We found that the game paddle only digitizes into 64 different directions around a 360-degree circle, so the direction of aim jumps in steps of more than 5 degrees. For really long shots, this means a player may not be able to place the cue ball where it can hit the object ball at all, much less drive it into a pocket. Fortunately, a special fine aim feature, which roughly quadruples the resolution of the aiming, can be invoked once the vector is close to the object ball.

With these two features (the coarse aim is good enough for close shots), aiming has the same feel as on a real pool table.

Playing on the Pool 1.5 table has the feel of a standard pool table with very unforgiving pockets. The slop factor for getting a shot into a pocket feels more like a snooker table than a standard tournament pool table (to an experienced player). This makes the Pool 1.5 player play a better game than would be expected on a standard table. From an educator's viewpoint, this is excellent. In this case, the game not only realistically simulates the real sport; it forces a player to be a bit better than is needed for the real game.

. . .Pool 1.5 simulates a real pool table's action very well.

Pool 1.5 also permits players to select the speed at which the cue ball moves when cued (trigger on the joystick). The cue ball slows down according to the friction it has with the billiard cloth on the table surface. Unlike real tables, this table can be resurfaced with stickier billiard cloth at the push of a button.

English can be applied to the ball by specifying that the cue strike it at the TOP (follow English), the BOTTOM (draw English), the LEFT or RIGHT edge. The effect is just like English in a real pool game.

Overall, I would rate Pool 1.5 as a 10 on a scale of 10. It's exactly the game I would write if I could write one as good as this.

Castle Wolfenstein, by Silas Warner, Muse Software, Baltimore, MD, is a prison-escape game. While not revolutionary like Warner's Robotwar (IA Nov 81), Castle Wolfenstein is a good maze/puzzle/dungeons-type game with good animation/graphics and excellent documentation. A player becomes an Allied prisoner of war in a Nazi prison castle wherein top-secret war plans for Operation Rheingold are contained. By shooting guards and escaping with the secret plans, the player can be prompted, only to be captured and interned in a castle that's even tougher to escape.

In the dungeons-and-dragons genre (with, perhaps, a touch of zap the Klingons), this game is excellent. If we could really get turned on about violence-oriented games, this one would rate about 8 on a scale of 10. Maze/puzzle and treasure-seeking games appeal to us, and this rates about 8 in this category, also.

Cross Clues is a word-challenge game from S.R.A. (Science Research Associates), Chicago, IL. This educational game is

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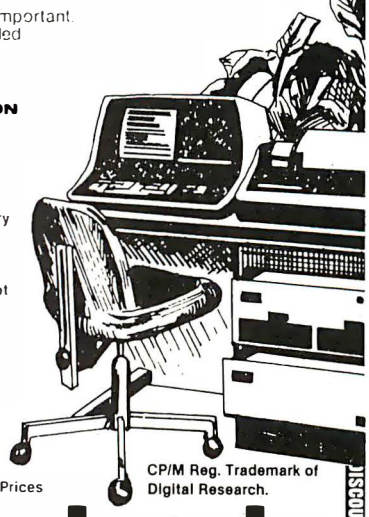
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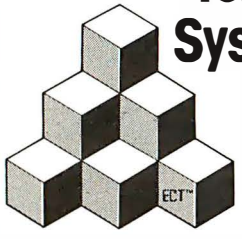

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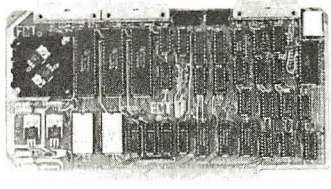
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a combination of a crossword puzzle and Hangman. There is a thorough introduction phase, including a simulated game played with the computer. The computer plays a human game —showing the moves all the way, then leaves the genuine human an easy move. This is a good confidence-builder, just the thing for a beginner. The game is thereafter played between two human players.

The game has good prompts, interaction and instruction. The instructions are thoughtful and the game could be good down to the fourth grade, if suitable crossword-puzzle matrices were provided on disk. Enlisting the aid of the teaching assistants in charge of the DeVry Apple lab at night, I ran through the Cross Clues sample games on the disk. The instructions were very good, the rules were simple, and best of all, the game was fun to play. Players guess consonants and words, in a hangman-like fashion, trying to complete the pattern (an empty crossword puzzle with blanks visible and one letter given as a starter). When a player misses on a guess, the turn goes to the other player. Points are scored on the basis of the number of letters in the words successfully guessed. Consonants in the guessed word are also replicated wherever they appear elsewhere in the crossword array, and counted as part of the points.

Perhaps we like this game because we're good at word games like these, so we'll give this one a 9.5 out of 10 in all categories.

The Alkemstone, from Level-10, a division of Dakin5, Denver, CO, is (and isn't) a computer game.

There is a huge maze, and players keep walking and walking, ever and anon finding a clue and seeing a snake. The corridors have very good animation and graphics, and after a while, players start to believe that the things are really there, even finding places they've seen before. Most maze games are presented in a "God's eye view"—from the top with a transparent roof. In this game, players are the mice—not the researchers. They can't see the entire maze at once, only several feet ahead of them.

The walls are shown in perspective; side corridors branch off. Animation for the walk forward, turn right and turn left commands is very realistic. (Have a pad of paper as you wander around and you may be able to construct a map of where you've been without getting too lost.)

It is surprising how thoroughly engrossed one can become just wandering around these empty corridors. There aren't many things happening or any monsters to fight (not that we saw, anyway), but the imagination does get involved. Someone might think this sort of thing would merely be boring, but it isn't.

There is a point to this game, other than getting familiar with the topology of a corridor map only slightly more complex than Manhattan (and New York City's other four boroughs thrown in for variety).

In the directions, along with a rather sword-and-sorcery sounding story, is the enticement that makes this a real game. Somewhere in the real world, the Alkemstone, an actual physical object, is accessible to the physical public. The directions say a $5,000 reward goes to the person who finds it. Located somewhere within the maze are clues to help find the real Alkemstone, provided the clues can be found. According to Level-10, the bounty on the Alkemstone was raised to $7,500 in January.

An interesting twist! There's actually real money involved in this treasure hunt. However, the clues in the maze, although found in fixed locations, aren't always visible. Hunters could go by the same place several times before seeing a clue. So far, I've never seen a clue, nor have I seen a threat, but I haven't played very long. Since they've sold more than 5,000 copies of Alkemstone, and no one's cracked it yet, the clues must be well hidden.

Correction

In an earlier column, we mentioned Scarfman, by the Cornsoft group, Indianapolis, IN. (It was inadvertently printed as Consoft.)□

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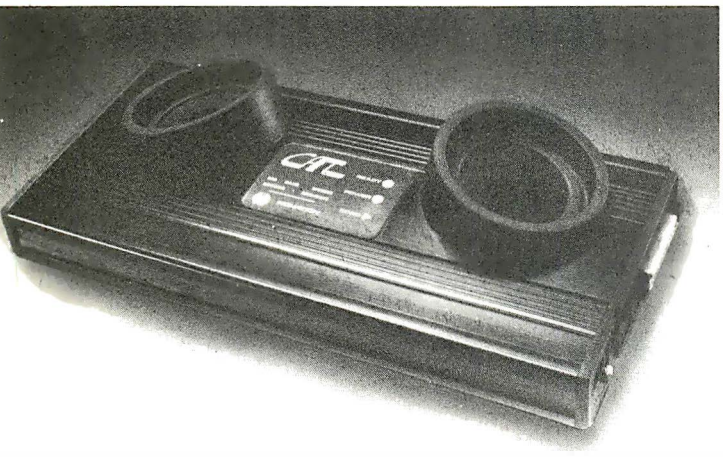

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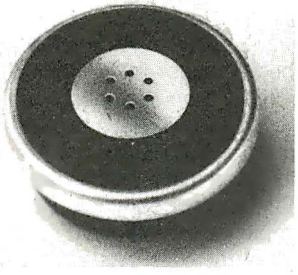

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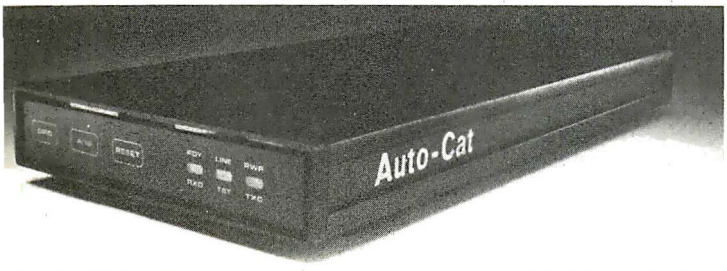

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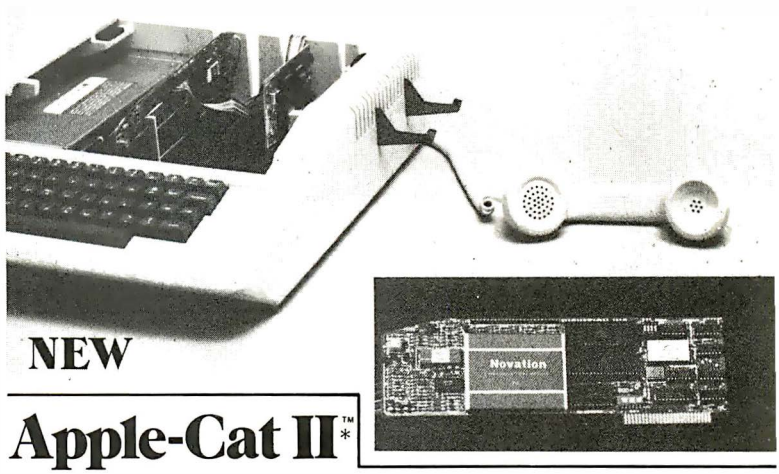

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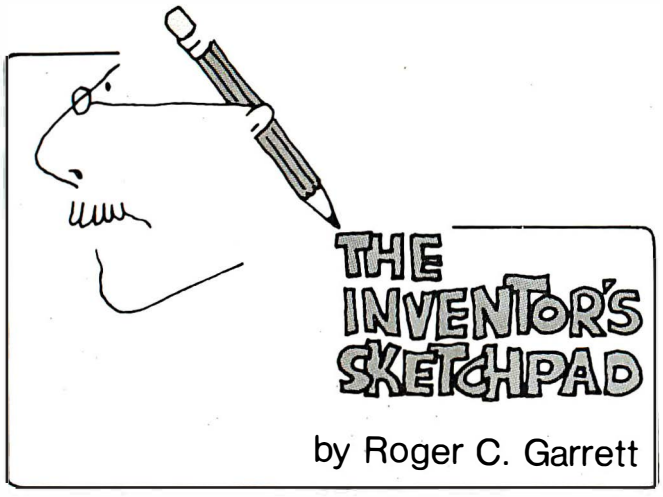

by Roger C. Garrett

A Dumb Spelling Checker

A variety of spelling checkers, software packages that will check the spellings of words in a file, are now on the market. (See article on page 74.)

Most of these packages operate in a batch mode. Once you have prepared the file, you run the spelling checker and specify your file name as input. The checker then examines the file, word by word, and compiles a list of all words it recognizes as misspelled. Some checkers provide an interactive correction facility, which presents each misspelled word to the user as the word is encountered. This allows the user to make the corrections. From that point on, the checker will recognize the corrected word, if it occurs again in the file, as a correctly spelled word so that the user has to make the correction only once.

Other checkers are truly batch and merely present a list of misspelled words at the end of the run. It is the user's job to make the corrections in the original file.

Although I have yet to see one in operation, it is feasible for a spelling checker to be an integral part of a text editor, so that as you edit your file—typing in text, making corrections, additions or deletions—the checker is constantly monitoring your spelling. You would never have to run the file through a spelling checker since all words would always be correctly spelled. If you typed in a wrong word, the checker would notify you—perhaps by using reverse video on the word and sounding an audible beep, requiring you to make a correction. If you insist the word is spelled correctly, you could press an escape character to notify the checker to enter the word into the checker's dictionary.

. . . it is feasible for a spelling checker to be an integrated part of the text editor.

There is one fairly straightforward method by which spelling checkers operate, one rather more ingenious method, and one that I shall propose here.

In the most common method, the checker maintains a dictionary of correctly spelled words. Within more comprehensive checkers, such dictionaries contain upwards of 30,000 words. As each word in the user's file is met, the checker must look it up in the dictionary. If it locates the word, it then assumes correct spelling. If it does not locate the word, the checker assumes a misspelling. More sophisticated checkers will not accept non-inclusion as an absolute indication that a word is misspelled. Some perform an algorithm that looks for common prefixes or suffixes on the word or for simple transpositions (i.e. reversed letters, as in "computre," where the "re" has been transposed), or for missing letters ("mising"), or for any number of other common typing errors.

Clearly, checkers that use dictionaries containing textual representation of words must organize those dictionaries so that words can be quickly and easily found. Some merely alphabetize them, while others attempt to place the high-incidence or low-character-count words near the beginning so these words can be checked first, before the main portion of the dictionary is searched.

Bits matched to correct words

The second approach utilizes a probability matrix and word compression technique. Rather than maintaining a dictionary, it has a section of memory where approximately half of the bits are "on" and half are "off." Each on bit corresponds to a correctly spelled word. The contents of this memory are prepared beforehand.

The memory is initially empty, all bits equal to zero. A standard dictionary is then accessed. Each word in the dictionary is hashed into an n-bit value. The size of the value is such that, used as an address, it can point at any one of the bits in the probability matrix memory. The hashing technique used assures that the probability of any given word from the

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dictionary hashing to a unique bit in the memory is extremely high. The bit at the address created by the hashed word is set. The probability matrix is large enough so that, after all words have been hashed, approximately half of the bits will have been set. This memory matrix then becomes, in effect, the dictionary to be used by the spelling checker.

As each word in a file is checked for correct spelling, it is first hashed by the same technique used to create the matrix; the hashed value is used as an address into the matrix and the status of the bit at that address is read. If the bit is zero, the word is termed misspelled; if the bit is one, the word is considered properly spelled. The key to this method is in choosing a hashing method that substantially reduces the probability that any two words, either correctly or incorrectly spelled, will hash to the same bit in the probability matrix. In fact, some techniques have been developed that reduce the error rate to as low as one in several billion, which is actually better than any of the dictionary look-up type checkers and several times faster. Both of the above methods require substantial memory.

Words given double-byte codes

To work reasonably well, I suggest a more straightforward, but less accurate method that is more conducive to implementation on personal computers. The key to this method is the observation that any given individual has a relatively limited working vocabulary, perhaps a thousand words or less, and that any test file created by an individual consists of a significantly small subset of the individual's total vocabulary.

Rather than maintaining the text file as a simple sequence of the characters typed in by the user, I propose that it consist of a sequence of double-byte word codes so that each corresponds to a unique word (word is used here in the English language sense, not the 16-bit computer sense). Associated with each user text file would be a dictionary of the words used in that file. Each word in the dictionary would correspond to one unique word code.

When the user opens a file for editing, this file-associated dictionary would be empty. As the user begins typing, the editor would accept each new word and compare it with the contents of the dictionary. The first word would not be in the dictionary, so the editor would enter it, assign a word-code to it and associate a usage count of 1 with it. It would then place the word-code into the file and display the word to the user. This would let the user know that the word just typed was not previously in the dictionary. Each new word the user typed (i.e. each unique word not previously in the dictionary) would result in the same feedback. When a user would type in a word that already existed in the dictionary, it would be displayed normally but the usage count for that word in the dictionary would be increased.

At the beginning of any such editing session, the beeps might come quite often, but as the user gets further into the file, they would come less and less frequently. Thus, the sounding of the beep or the reverse video of a word would become an indication that the word most recently typed is probably misspelled. The beep would prompt the user to check its spelling and correct it, if necessary. Also, at the end of any editing session, the editor could bring the user's attention to those words that have particularly low usage counts, since those, too, are most likely misspelled.

Such a system is not foolproof. It assumes that a user is a good speller and can easily recognize whether a particular word is spelled correctly. But perhaps the advantage of such a system is not in general text or word processing, but rather in program writing. Computer programming languages have relatively restricted vocabularies, so recognizing misspelled keywords should be easy. And the common error of simply mistyping, for example, the variable XGFTU12 as XGFUT12, would be quickly recognized by such a spelling checker. Thus, the user would eliminate simple spelling mistakes as well as the compiler errors caused by them. □

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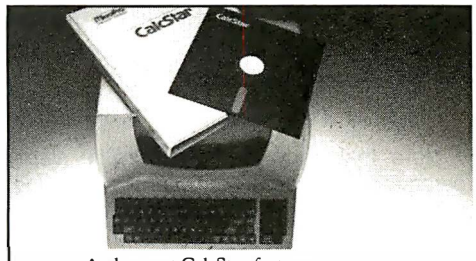

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THE MICRO-MATHEMATICIAN

by Dr. John C. Nash

Function Minimization by Gradient Methods

This column previously presented an outline of optimization (IA Feb 82) and a discussion of the Hooke and Jeeves pattern search method for minimizing a function (IA Mar 82). The only information about the function that the Hooke and Jeeves method needs is its value at any given point. That is, if the function to be minimized is

$$Z(\mathbf{b}) = Z(b_1, b_2, \ldots, b_n),$$

then for any set of parameters **b**, we must provide the value of Z. Let's explore the possibility of using additional information about Z(**b**), namely the gradient of the function, which is the vector **g** of first (partial) derivatives of the function with respect to each parameter,

$$g_i(\mathbf{b}) = Z^{(i)}(\mathbf{b}) = \text{first partial derivative of Z w.r.t. } b_i.$$

Note that each element of **g** is also a function of the parameters. Since g_i represents the slope of the function in the b_i direction, the whole gradient vector $\mathbf{g} = (g_1, g_2, \ldots, g_n)^T$ points in some sense to the most "uphill" direction. By searching from the current point **b** in the opposite direction to **g**, we therefore expect to find at least one point **b'** where Z(**b'**) is lower (less) than Z(**b**). This strategy for searching for a minimum of the function is called the method of steepest descents and has been used for a long time. It appears to have been introduced by the French mathematician A. Cauchy and published in 1848.

The principal complaint about the steepest descents procedure is that it may be very slow to converge when the function is poorly scaled. In particular, if we imagine a function of two parameters as forming a valley (as in the elliptical valley problem in the March issue), then the steepest descents method generates a path on the surface of the valley that is very much like that of a marble rolling on a plaster model of this valley. Thus, if the valley is long and thin, the marble will tend to roll from side to side of the valley, while making very slow progress to its center. If the valley is bowl-shaped, there is a good chance the marble will roll across the minimum point very soon after being released to roll.

The rolling marble analogy is a good one in that it illustrates the two main problems with the steepest descents, the archetype of all gradient methods:

1) Where the function has very rapid change in value in one direction, compared to that in another (as in a narrow, long valley), there is the possibility of criss-crossing from side to side while making very little movement to the center. This is often called hemstitching after the pattern that appears if we draw the search path.

2) If the marble did not have momentum, it would perhaps stop at the floor of the long, thin valley, then roll along the floor of the valley to the minimum. Therefore, what we need is some mechanism to decide which point along the current gradient to accept as a new base for another search. In fact, the problem is referred to as the line search problem, and is common to all gradient methods in some form or another.

Let's consider some aspects of these two parts of the development of a gradient method for function minimization. For readers seeking an efficient minimizer, however, what follows is only an introduction—the program presented is designed to illustrate the ideas without implementing them efficiently.

To begin to change the steepest descents method to give alternative search directions, let us think once again of the long, thin valley. Take two steps of steepest descents without a careful search along the gradient for the lowest point along the path—that is, let the marble roll. We may anticipate a pattern as shown in figure 1. Clearly, if we could search in some direction perpendicular to the gradient, this might be

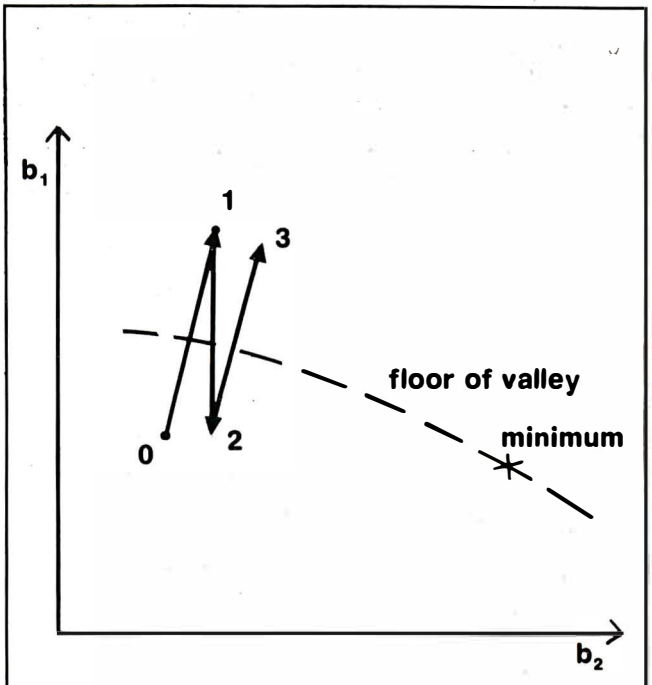


Figure 1. Search for lowest point

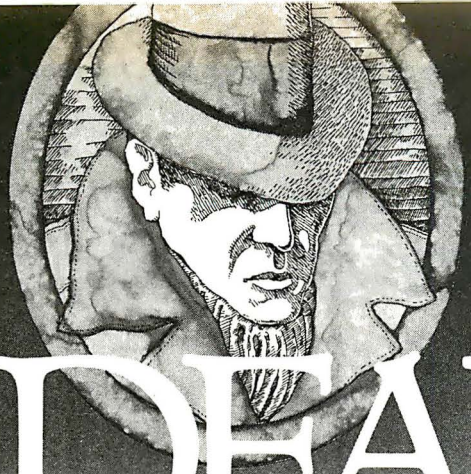
Behavior of steepest descents for the thin, long valley problem. Points 0, 1, 2, and 3 are the initial point and the results of the first three iterations. The movement is largely across the valley rather than toward the minimum point.

quite useful. After all, the gradient is but one direction, and in a problem with n parameters, we could search in any of n directions. However, we do still want to search downhill.

Let us suppose that we can generate several possible search directions, which we can call $\mathbf{u}_1, \mathbf{u}_2, \ldots, \mathbf{u}_j$. Then we can consider the projection of the gradient on each of these, in particular on $\mathbf{u}_j$ (assumed unit length), as

$$q = \mathbf{g}^T \mathbf{u}_j = \sum_{i=1}^{n} g_i u_{ij}$$

This projection, q, describes how much the vector $\mathbf{u}_j$ points in the **g** direction. Clearly, we want q to be negative to go downhill along $\mathbf{u}_j$. This can be shown by expanding the function Z as a Taylor series about the current point **b**, to be true to the extent that if q is negative, there is always one point along $\mathbf{u}_j$ where the function value is lowered. The projection q is the slope of the function with respect to $\mathbf{u}_j$ so we can use it in the linear search—finding the minimum of the



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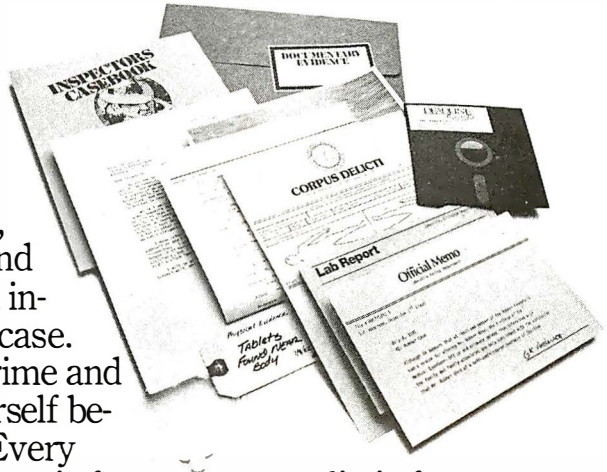

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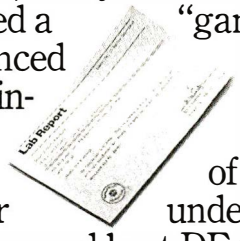

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function along the search direction. If q is positive, we should search in the $-\mathbf{u}_j$ direction.

How can suitable search directions be generated? If we would like a direction perpendicular to **g**, it is possible to subtract the component of an arbitrary vector **v** in direction **g** from **v**, leaving only the part that is perpendicular to **g** (figure 2). Algebraically, we compute

$$\mathbf{v}' = \mathbf{v} - (\mathbf{g}^T \mathbf{v})\, \mathbf{g} / (\mathbf{g}^T \mathbf{g})$$

It is easy to show from this that

$$\mathbf{g}^T \mathbf{v}' = 0$$

that is, that the vectors **g** and **v'** are perpendicular (orthogonal). We can convert the vector **v'** to a unit vector by dividing its elements by the length of **v'**, that is, SQRT($\mathbf{v}'^T \mathbf{v}'$).

The process can be repeated when we wish to find a set of orthogonal vectors (i.e. search directions). If the vectors we compute are of unit length, we have an orthonormal set,

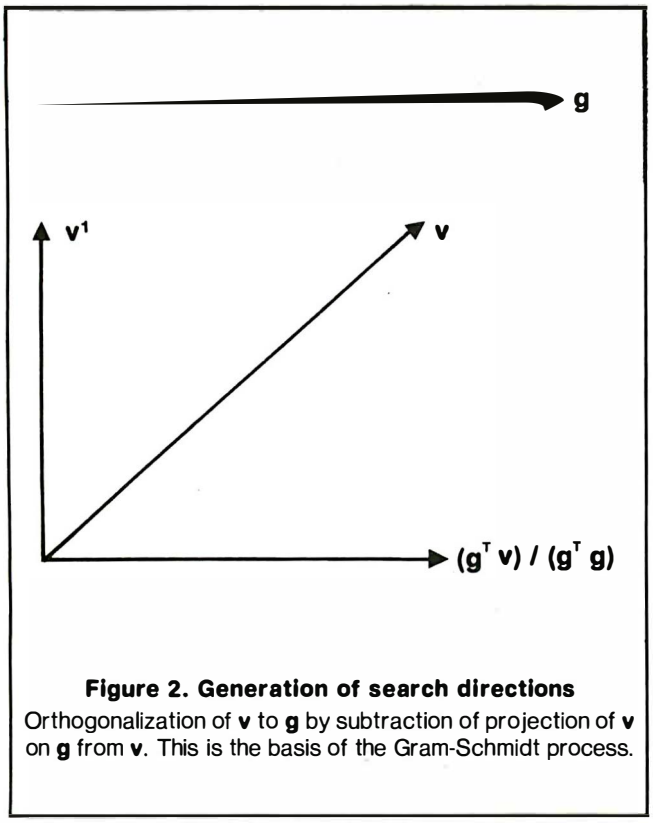

Figure 2. Generation of search directions
Orthogonalization of **v** to **g** by subtraction of projection of **v** on **g** from **v**. This is the basis of the Gram-Schmidt process.

which can be used as axes for the space in which our function is to be minimized. There are, at most, n orthogonal directions for the n-dimensional space, so the process will break down if we try to orthogonalize a new search direction with respect to n orthogonal directions. In fact, we should compute a null vector.

The orthogonalization procedure is called the Gram-Schmidt method and can be described as follows:

1) Choose any vector as $\mathbf{u}_1$, the first direction, and normalize by dividing by the length, SQRT ($\mathbf{u}_1^T \mathbf{u}_1$).

2) For any other vector, say the j'th, with initial value **v**, compute

$$\mathbf{u}_j = \mathbf{v} - \sum_{k=1}^{j-1} (\mathbf{u}_k^T \mathbf{v})\, \mathbf{u}_k$$

and normalize the result.

The reader should be warned that there are potential numerical problems in the Gram-Schmidt process that can be overcome by modifying the order of the calculations. Obviously, if we choose vectors **v**, which are not independent of the

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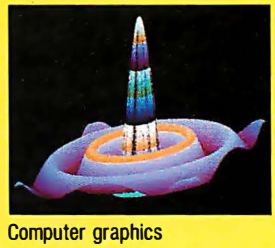
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previously included directions, $\mathbf{u}_j$ may be null, so that the division implied by normalization results in a zero-divide error. In the function minimization applications considered here, search directions that result from normalizing nearly zero vectors may be of little value to the minimization process. A criterion is often needed to decide when the orthogonalization should be restarted with a new set of search directions.

How do we get these search directions? Let us take

$$\mathbf{u}_1 = -\mathbf{g}(\mathbf{b})$$

This is just the steepest descents direction. If we limit ourselves to only one search direction, we have the steepest descents method. If, however, we search along $\mathbf{u}_1$ and find a point where the function value is less than at the current point, we could re-evaluate the gradient at this new point, call it $\mathbf{b}'$, and orthogonalize the new gradient to $\mathbf{u}_1$ to give $\mathbf{u}_2$. If the number of parameters, n, is larger than 2, we could find $\mathbf{u}_3$, $\mathbf{u}_4$, ..., $\mathbf{u}_n$ in like fashion. The only difficulty to be aware of is the possibility that the gradients may not be independent and the normalization phase may fail when one of the vector lengths becomes very small.

The other matter that must be considered in gradient methods is the search for a lower function value along each of the search directions. Let the search direction be called **u**. We will assume that **u** is a unit vector and that

$$q = \mathbf{g}^T \mathbf{u},$$

the projection of the gradient along **u**, negative. This is the slope of the function, so we could write

$$q = d\,Z / d\,u.$$

The main question is this. How big a step should be taken along **u**? If we take too large a step, there is the risk that the minimum along the line is overshot. Too small a step wastes all the effort in computing the search direction. One way to approximate the step size involves an estimate of the minimum value of the function. Call this estimate E. Suppose that the function is linear in the direction of **u**, so that the surface is a straight line of slope q. If the current function value is Z(**b**), then we must take a step

$$s = (Z(\mathbf{b}) - E) / q$$

along **u** to reach the minimum. This estimate of the step size is reasonably good if E is a good approximation of the minimum function value. However, it may be disastrous if E is larger than the actual minimum, because it can then lead to a search in the wrong direction (i.e. away from the true minimum). However, microcomputer users have a big advantage over mainframe users in that their work is usually performed interactively. Therefore, an apparent failure can be an indication that the problem should be rerun with a different estimate of the minimal function value.

Listing 1 presents a program incorporating the ideas in the text above. No pretense is made that this is a highly efficient function minimization program, but it may serve those who wish to learn about functions. The program needs three subroutines:

1) at line 2300, the user must supply a subroutine that initializes any data needed to compute the function;

2) at line 2000, there must be a subroutine that computes the function value at point **b** as stored in B(1), B(2), III, B(N) and the data initialized in the subroutine at 2300, and stores the value in Z;

3) at line 2500, there must be a subroutine to compute the gradient **g** (**b**) and store it in G(1), G(2), ..., G(N).

Listing 2 presents such a set of subroutines for the elliptical valley problem that was used in connection with the Hooke and Jeeves method.

It is very important to compute the gradient correctly. About 90% of function minimization program failures that I have observed have been due to errors in coding the calculations of the derivatives. One way to verify computed derivatives is to compare them with numerical approximations. For example, one can compute the function at the points **b** and (**b** + h $\mathbf{e}_i$) where the vector $\mathbf{e}_i$ has elements

$$e_{ji} = 0,\ j \neq i\ ;\ e_{ii} = 1$$

and h is some small number. The i'th element of the gradient vector is then approximated by

$$g_i \approx (Z(\mathbf{b} + h\,\mathbf{e}_i) - Z(\mathbf{b})) / h$$

In the limit, as h tends to zero, the approximation becomes exact, but for finite h, one obtains useful gradient approximations. For a machine with eight decimal digits' precision, I would use

$$h = 0.0001 * (ABS(b_i) + 0.0001)$$

to carry out these approximations. A severe discrepancy between the approximate and analytic derivatives (those computed by differentiation) is cause to check the subroutines at line 2500 very carefully.

F = the number of function evaluations to find the minimum
G = the number of gradient evaluations to find the minimum
E = initial estimate of the minimum value of the function

Steepest descents

Initial **b** = (0.0, 0.0), E = 0 ; after G = 55, F = 67,
and 24.4 seconds,
Final **b** = (5.9999992, −1.9999992) with Z = 2.56E−12
Final **g** = (−.0000032, 0.0000032)

Initial **b** = (0.0, 0.0), E = −1; after G = 47, F = 316,
and 55.1 seconds
Final **b** = (6.0000027, −2.0000037)
with Z = 5.696E−11
Final **g** = (−0.0000192, −0.0000448)

Orthogonal directions
(search abandoned if $\mathbf{u}^T \mathbf{u} / \mathbf{g}^T \mathbf{g}$ is less than 1E−4)

Initial **b** = (0.0, 0.0), E = 0 ; after G = 43, F = 89
and 24.1 seconds
Final **b** = (5.9999981, −2.0000006)
with Z = 1.0169E−10
Final **g** = (−0.0000826, −0.0000774)

Initial **b** = (0.0, 0.0), E = −1; after G = 37, F = 242
and 42.4 seconds
Final **b** = (5.9999994, −2.0000007)
with Z = 2.705E−11
Final **g** = (−0.0000414, −0.0000418)

Figure 3. Application of the program GRADMIN to the elliptical valley problem

Finally, to give some idea of the utility of the ideas presented, figure 3 gives the results of applying the program to the elliptical valley with various settings of the program options. Note that the number of gradient and function evaluations is reduced by employing orthogonal search directions, but that the overall time requirement may not be reduced. We need more efficient methods for generating the search directions for performing the linear search. In recent years, a lot of research in these areas has resulted in highly efficient codes now finding their way into scientific program libraries. □

Program on page 146

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Learning with Micros

by Louis E. Frenzel

Recent Software Releases

Fractional Sound is a math program from The Innovative Penguin, Harvey, LA. It is a self-instructional program designed to teach fractions. The program generates fractional problems presented with special 2-in. and 5/8-in. characters written as standard fractions. The student works the problems on paper, then enters his answers via the keyboard. The program checks the problem, and if it is correct, presents another problem. If the answer is incorrect, the program automatically solves the problem and presents it to the student a step at a time.

Besides the large character format on the screen, one of the attractive features of this program is the teacher's ability to change it to fit a variety of situations. For example, there are seven parameters that can be changed. These include add, subtract, add/subtract, multiply, divide, multiply/divide or all four operations. Other parameters that can be changed are size of numerator and denominator, number of problems, number of students, mixed fractions or exams. This provides a wide variety of fractional drill and practice exercises for the student. The program was designed for grades 4-10.

Once a student completes the drill, he is rewarded with a special game featuring Marley Mole. Finally, an exam at the end of the program can be administered. If the test mode is selected, the program generates problems. The program keeps track of the students using the program and their scores on the drill, practice and exam. It can give the teacher a complete listing of all this information when requested.

This program includes an audible feature. Students hear the sound by connecting the AUX cassette jack on the computer to an external audio amplifier.

The program is available for Radio Shack TRS-80 models I and III, on cassette ($14.95) or diskette ($18.95). The cassette version will run in a minimum of 16K bytes, while the diskette versions require 32K-byte RAM.

Curriculum Manager, from the Corporation for Public Information and Education, Lawrence, KS, is an instructional management system that can be used on a number of levels in almost any school system.

Few educational publishers have produced administrative and management software for teachers or schools. This offering helps to fill the gap.

The program allows a teacher to set individual student curriculum goals and monitor progress on a daily, weekly or monthly basis. It is capable of monitoring student progress in any two textbook series simultaneously. CM prepares reports by class including student name, attendance, test accuracy, current placement, daily page requirement and year-end goal.

It appears that the program's key feature is goal-setting. The objective is to improve student achievement through setting goals and publishing frequent reports. The teacher chooses curriculum-specific goals in terms of textbook page requirement. The goal states the specific duties of the student in graphic terms. An indication of what must be accomplished in textbook reading during the school year is also included.

The program keeps track of all of the progress towards these goals and generates reports and summaries for students, parents, principals, superintendents and even the school boards. It appears to be usable at almost any school level.

Presently, the software is available for the Apple II + , with 48K-byte RAM, using Apple Operating System 3.2 or 3.3. A single disk drive and an 80-column printer are also required. The program is written in AppleSoft Basic. Versions for the TRS-80 models II and III are also available. The cost is $50.

CAIware from Micro Gnome, Elkridge, MD, is a software system for authoring CAI programs.

One of the main factors limiting the use of computers in education is the lack of good teaching software. In the past two years, there has been a significant increase in the amount of educational programs available for microcomputers. With so much ready-to-use software, teachers can begin applying microcomputers without having to know how to program. Most of the available programs fall into the K-12th grade ranges concentrating primarily on math and grammar skills. Although there is much software available now, there will always be teachers who cannot find software related to their subjects. And there are teachers who want to create special learning programs.

To create educational software for a microcomputer requires a combination of skills. First, it takes subject matter expertise. A person writing a program must know the material he is trying to teach. Second, programming skills are required. The subject matter must be programmed in one of the existing computer languages. All microcomputers use the Basic language, which is relatively easy to learn and use. Nevertheless, it is still a stumbling block for many teachers.

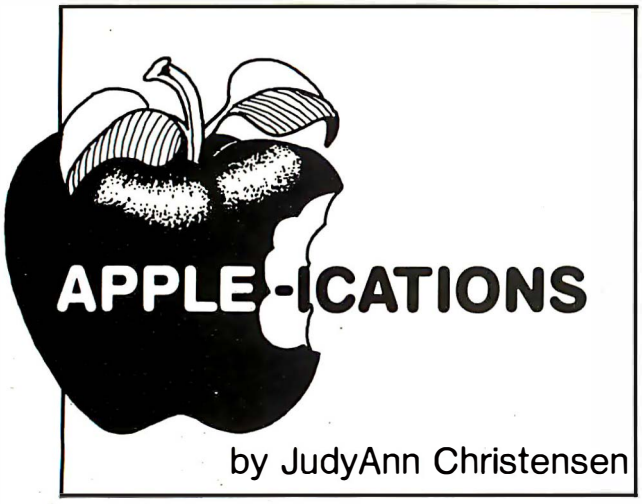
PILOT is another microcomputer language designed specifically for creating software. It is easier to use than Basic, but is not available on as many computers. And it still requires a certain amount of programming expertise. The need to program the microcomputer puts off many teachers who want to create educational software.

Recognizing this problem, a number of educational publishers have created special authoring systems. This is a piece of software that allows the teacher to create an educational program with no programming knowledge. CAIware is not a programming language as such. It is a true authoring system, in that it guides the software writer in well-defined prototypes and formats for organizing educational material. CAIware provides five basic formats. These include multiple choice questions with up to eight choices per screen, four short answer questions per screen, and three different formats for text. To use the program, the author simply selects the desired format and enters the material to be learned.

When using Basic or PILOT, the length of a CAI lesson is usually limited by the computer's memory size. However, with this program, it is mass storage device capacity (cassette or floppy) that limits lesson size. This allows a teacher to create lessons and programs of virtually any desired length.

CAIware is an efficient program in that it allows anyone to create teaching programs quickly and easily. There is no need to learn to use a programming language. Teachers simply organize the material they want students to learn, sit down and enter it into the computer. With programs like this, teachers can immediately begin using the microcomputer to create special testing and teaching programs.

The program is available for the TRS-80 models I and III. The cassette version will run in 16K bytes of RAM and sells for $42.95. A super version is available on cassette form for $64.95. It includes special features for review and editing of the lesson material after creation. A disk version, CAIware 2D, is also available for $125. It includes graphics capability, plus a student record feature that allows a teacher to keep track of each student's performance by session, lessons and question. □



Tire Store Goes Network

You have an appointment for a brake job at the local tire store. Upon reaching the store, you tell the counter salesperson what your car needs and he punches the information into an Apple computer. The system then checks the parts inventory, verifying that your older-model car's parts are in stock, giving their corresponding prices. An estimate is printed, and you're on your way. The service manager looks at your estimate before inspecting your car. To do this, he uses an Apple computer networked to other Apples in the store. When he spots two bald tires on your car, he checks the computer to see if the neighboring tire store carries this hard-to-get stock item. It does, and he adds the other store's price to your estimate. He taps a couple of more computer keys and verifies that these tires are on order. When you call back for your final job quote, the secretary reads it to you from the office terminal. After you okay the work, it's completed. Later that day when you come back for your car, the counterperson prints out your invoice. Your account is cleared as soon as you hand over the check, and you haven't seen a piece of paperwork being shuffled during the whole transaction.

Sound like a store of the future? Not if your local garage is either of Dave Drucker's Goodyear Tire Centers in Wheeling or McHenry, IL.

Drucker is an ex-IBM systems salesman who now manages a Goodyear franchise. When he first saw the mountains of paperwork required of a franchisee, Drucker began to automate the business, realizing that in a year he would save enough money to pay for the system. One good use for his system quickly led to another.

Each computer Drucker uses is a 64K-byte Apple II with Apple Disk II and Controller, Apple Language System, Apple parallel and serial interface cards and a clock card. To network his system, he uses a Corvus 5M-byte hard disk, a Corvus Mirror System, a Corvus Constellation software package and a CRT terminal. The Constellation software secures his information from unauthorized users—even for single-user systems. (Single users may find that 96K-byte Apple IIIs with 5M-byte hard disk drives are cheaper than Apple IIs because the Apple IIIs wouldn't need CRTs, yet would provide ample storage capacity.)

A Centronics interface controls the parallel printers and a Stadfield Parallel Multiplexor lets Drucker run the printers independently. However, dual printer systems can be configured without the Stadfield Multiplexor if at least one of the printers is serial and can be run from slot two.

"In December 1978, I started with a pilot system written in Basic that used seven floppy disk drives. It took 24 seconds to do one inquiry," Drucker explained. "Yet, I saw so much potential in the system that in early 1979 I bought a Corvus hard disk and an Apple Language System and started programming. Since then, I opened a second store in February 1980 and each store went multi-user in October 1981."

Drucker's larger store employs a three-user system. The smaller store is able to get by with a single Apple most of the time, although Drucker powers up a seond Apple during peak periods. All of the systems have independent, separate processors using independently-written programs, yet they share the same data files.

"This means that if the service manager, the secretary and the counterperson all want to use their systems at once, they aren't slowed down by divvying-up computer cycles," Drucker said. "However, much of the credit is due to the Corvus Constellation software, which is the traffic cop checking whether the files are in use or not before proceeding to do a user's request. If the file is already in use, the traffic cop lets the user know and then obtains the file when it's available."

Included in the software is a security system that keeps unauthorized users from accessing the system. Yet Drucker had to create his own application software to handle what Corvus couldn't: he had to protect his sales orders from the duplicate inputs common to multiple-user systems. Corvus will lock users from a file, but Drucker needed to program locks on a record-by-record basis so that multiple users could access individual sales orders from the shared orders file.

"When a sales order is accessed by one system, the locks keep anyone else from accessing it," Drucker said. "Because of the locks, we haven't had any problems with separate computers colliding while trying to update the same file at the same time, and we've avoided data inaccuracy problems such collisions create. This is crucial to us because my mechanic and sales incentive systems, inventory management system and accounting functions are by-products of the counter sales system.

"The record locks would be especially important in larger stores where users run four or five Apples concurrently. However, I'm really happy with my Corvus. The Constellation

software lets me program almost without regard for the collision problem. All that's needed is a branch to a locked procedure before an update and another branch to an unlocked procedure after it's done. Yet I can still find any of my 8,000 inventory items in just two seeks," he said.

"The fantastic thing is that the combination of very fast disk access from the hard disk and the fast execution of compiled Pascal programs has cut the former 24-second inquiries down to one or two seconds, even with multiple computers contending for the files."

Realizing that he'd hit upon a good thing, Drucker created more software as he expanded his system. He developed an intelligent switch that lets him run three printers from one Apple. Drucker managed this by programming a software selectable parallel switch connected to a standard Apple parallel printer card and plugging the card into the input side of a Stadfield Parallel Printer Multiplexor. The multiplexor's circuitry recognizes specific code and, based upon the user's input, tells each of the printers what and when to print.

Drucker included this utility in all his programs to give his users greater flexibility. For instance, one printer can print out a listing of the store's entire inventory while the other two are printing work orders and sales invoices. "The low cost of today's printers allows us to afford separate printers dedicated to continuous forms, work orders, invoices, and stock forms or reports, which eliminates the forms-handling problems attendant with cut forms," Drucker said. Networking between both stores has also increased user and inventory flexibility. Drucker's inventory data base checks stock by size, price, style, product line, whether the products are on order for either or both stores, and what the costs are for each store.

It is especially convenient because the Apples keep tabs on his store's daily activity. The systems control the forms sequence, assigning a number to every document as it is used. "I may use 15 work orders before I use an invoice, so I can't rely on forms coming out of the computer in sequence," Drucker said. "I also found that a heavier stock work order form weathers the garage grease better."

At the end of the day, Drucker's system automatically prints out a one-line recap of transacted invoices. He uses this report to balance the cash drawer and to determine his cash deposit. He then adds any new part numbers that he received to inventory that day and sends a detailed report of all invoices to the Goodyear headquarters.

"The counterpeople used to be completely occupied writing up invoices at the end of the day, since that is when most work is completed and since that is when most customers pick up their cars," Drucker said. "Now the counter force just presses a button and the invoices are out; then they press another button and the close is completed according to standards I have prescribed and enforced by means of the system. Error rates are way down and those that do occur are spotlighted by an exception report. My confidence in the accuracy of my system's cash-handling has increased dramatically. This system saves us so much time, it is almost an employee benefit. Yet it is insurance for me because I can look at a couple of pieces of paperwork and know where we stand, and that the results were computed accurately."

$3,000 savings per store per year

Drucker will continue to expand his system. "In the future I want files on the make and model of each car, but I don't know yet what data I want to save. I also want to start projecting orders by looking at last year's demand and analyzing my product flow. Currently, I use VisiCalc for planning, sales forecasting and expense budgeting. We have a year's sales captured on a month-by-month basis now, and this was a great aid in putting together our major order of the year," Drucker said.

Even though his system isn't in final form, Drucker can already prove he's saving money. He has improved his inventory turnover by one-half-turn a year and expects to improve it another half-turn when he completes his forecasting program. "It costs a minimum of 30% to carry inventory, so I estimate that I've saved $3,000 per store from this year's extra half-turn of inventory. The savings from that one aspect pay for a good deal of my system," he said.

"We have improved sales partly because we do a better job of stocking the right items and partly because the system makes it easy to find an acceptable substitute when we are out of stock. Plus, the computer-printed invoices present a professional image to our customers, which gives them confidence in us. Computer-printed work orders have helped keep our service department from making mistakes arising from illegible handwriting, and the incidence of pulling wrong stock is down as well."

Drucker said that, by some standards, his business is undercapitalized in today's economy, as are many other small businesses. However, his improved inventory control, together with the number-crunching capabilities of his Apple-based system, have allowed him to grow rapidly without a major cash flow problem. Because Drucker feels there are many tire and service centers that would benefit from his software, he recently formed On Time Systems, Wheeling, IL, to market it. □

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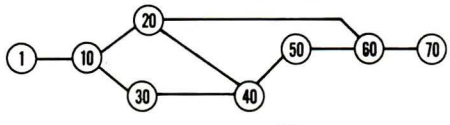

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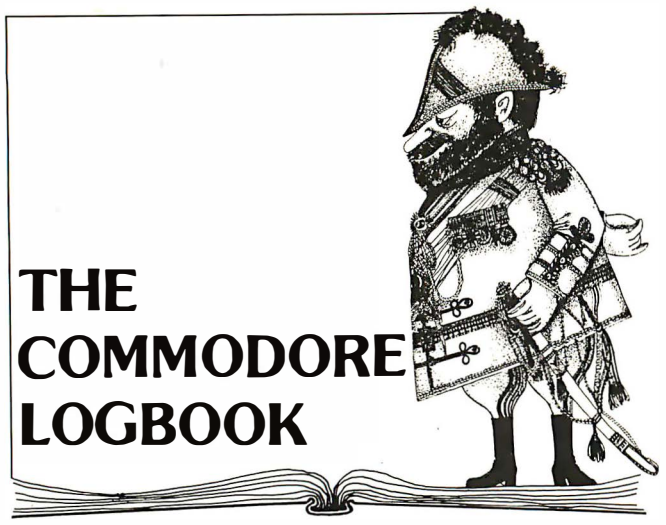

THE COMMODORE LOGBOOK

by Mike Heck

New Systems in Commodore Line

Two computer systems recently introduced by Commodore, King of Prussia, PA, are designed to complement the Vic line at both the high and low ends. The high-end Commodore-64 resembles the Vic-20 and the low-end Vic-10 provides surprising graphic and music-generation capabilities.

Commodore placed the design emphasis on these machines where it would be noticed: computing capabilities, with the 6510A microprocessor; display, using the Vic II chip, and sound, with the 6581 Sound Interface Design Synthesizer.

Both systems rely on a number of state-of-the-art integrated circuits designed and produced by Commodore's MOS subsidiary. The new 6510A microprocessor, using the same instruction set as the familiar 6502, is common to both computers. The 6510A contains additional input/output lines to handle increased processing required by the new systems.

Since the 6510A microprocessor is upward-compatible from the 6502, machine language programs running on other Commodore computers will not require much conversion to run on the Vic-10 or Commodore-64. There will also be a number of Commodore product-emulator programs available for the 64K machine to avoid converting programs.

Both machines also rely on a new 6566 Vic II display chip. This circuit handles all the display characteristics that would normally require a character generator and other supporting circuits for color and graphics.

Video display on both machines is 40 columns by 25 lines with independent foreground and background colors. Sixteen text colors are provided, eight more than from the Vic-20. In the text mode, all the normal Pet graphics, the 64 special symbols standard with all Commodore computers, are available. Additionally, a user can construct programmable characters to replace the normal character set.

Each unit has a high-resolution graphic mode, 320 by 200 points (pixels). Sixteen colors can be used simultaneously. To facilitate game graphics and animation, 256 independently movable display objects (sometimes called sprites) can be created, with up to eight objects per line.

Each object is 21 by 24 pixels and up to three colors per object are allowed. There is also collision detection between objects—a program can tell if one object hits another and can then determine what to do next. You can also select object display priority—whether one object will move in front of or behind another.

Independent magnifications in both horizontal and vertical directions for each object are also possible, adding much versatility in graphics creation. To make movement easier and smoother, you can scroll objects in horizontal and vertical directions, pixel by pixel. Programming movable objects is fairly straightforward, even from Basic. Once a shape is created, its position can be changed by simply updating the X and Y coordinates that determine the object's position on the screen.

The Commodore-64 has a number of high-resolution modes not possible with the Vic-10. These include a multi-color mode with 200 by 160-point resolution, an extended multi-color mode with 320 by 200-point resolution, and two bit-map modes with the same respective resolution as above. These extra modes give additional colors in each pixel zone and allow graphics design flexibility.

Three voices—each spanning nine octaves

SID produces three independent voices, each with a nine-octave range. Four waveforms are possible: sawtooth, triangle, variable pulse and noise. The sound synthesizer also contains a programmable ADSR (attack, decay, sustain, release) generator.

A programmable filter, independently selectable for each voice, is included. This filter contains low pass, high pass, band pass and notch outputs. The sound synthesizer also has variable resonance and a master volume control. With all of these features, you have almost complete control over the type of sound produced by either machine.

Another area common to each machine is an extension of the system bus for plug-in cartridges. The cartridges are small—about 2 in. by 2½ in.—but can contain RAM or ROM. The cartridges will allow up to 16K bytes of ROM and 2K bytes of RAM. Both machines have two game controller sockets accepting a joystick, double paddle or lightpen. Each computer has direct audio and video output for connection to an audio amplifier and video monitor, and an RF modulator is supplied for hookup to a standard TV set. But the similiarities end there, as each machine is designed for a totally different purpose.

The Vic-10 is intended primarily as a game machine with music synthesizer capabilities. It is made up of a flat-panel keyboard, contains 2K bytes of RAM, and can perform limited computing by using a Basic language plug-in cartridge.

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With the Basic language cartridge, it becomes a teaching machine. You can also design some limited applications to fit the available RAM.

Users can add a cassette recorder for program loading and saving through a built-in cassette interface. The mini-Basic doesn't support multiple files or other specialized functions available in the full Pet Basic, but for the minimal computing for which the system will be used, the cassette functions should be sufficient.

The keyboard, identical on all Vic products, supports upper/lower case and shows Pet graphic characters on the key areas. Some of the software initially available will include a number of space games, a music maker cartridge and converted versions of programs currently running on the Vic-20, such as Sargon II chess, and the Bally/Midway arcade gems, such as GORF and Omega Race.

The Commodore-64 has much in common with the Vic-20. On the surface, they look alike—the cases are just different colors. The Commodore-64 has 64K bytes of RAM, has the ability to accept other microprocessors through plug-in cartridges, and supports six levels of high-resolution graphics. The Commodore-64 also contains many of the same interfaces as the Vic-20. An eight-bit user port is retained for attaching the Vic modem or accessory communication cartridges and an RS-232 interface is available for standard printers or other RS-232 devices.

A cassette interface allows use of programs and files created on all other Commodore computers and Basic programs written for 40-column Pet computers should run without modification.

The only exceptions are programs that POKE screen memory locations. This area is different on each Commodore system and to ease the incompatibility problem, Commodore plans to have a Pet emulator to eliminate Basic program conversion. The emulator would make the Commodore-64 operate like a Pet in most areas. But machine language programs would still need some work to operate properly.

The unit can use Vic peripherals such as the single-disk drive and graphic printer and with the addition of an IEEE-488 cartridge, it will run any Commodore peripheral.

There is some thought of implementing a new disk to attach directly to the expansion slot. This would allow a disk with much higher transfer rates than possible with the serial bus or IEEE, traditionally slow with Commodore equipment.

The same software cartridges that work on the Vic-10 will plug directly into the unit. All games designed for the Vic-10 will operate properly, but the Commodore-64 is not a game machine. With its 64K bytes of RAM (40K bytes are user-accessible for Basic programs; 52K bytes for machine language programs), you can apply real business applications on this machine.

A word processor along the lines of Wordcraft-80, a screen-oriented word processor that runs on the CBM line, is planned along with an electronic spreadsheet similar to VIsiCalc. A data base program and dedicated mailing list application are also part of the first software packages designed specifically for the unit.

The unit's most impressive feature is its ability to accept a Z80 microprocessor cartridge. CP/M, a standard operating system, will run on the unit with this cartridge. With CP/M, you have access to a wide variety of business packages that will run without modification.

Where do the new systems fit into the Commodore product line? The Vic-10 is a game machine, music synthesizer and elementary computer, but nothing more. The Vic-20 (see article on page 40) is the base of the Commodore personal computer line (designed first as a game machine and then for people who want to get started in computing at a very low price, with the ability to expand as user needs grow).

The Commodore-64 is a sophisticated personal computer for those who can use its power and capabilities. It can also handle certain business applications. □

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SIMPLE PLUG-IN	?	2	Apple, TRS-80, PET, Atari, HP... you name it. We've got the industry's widest range of interfaces ready to plug into your computer.
3-WAY PAPER HANDLING	?	2	Axiom's IMP-4 lets you use single sheets, roll paper, or continuous tractor-fed forms. On other printers these features are probably expensive options, if available at all.
LIFETIME 9-WIRE PRINT HEAD	?	2	Axiom's rugged head prints good looking tightly formed characters with lower-case descenders, 6 different character sizes and boldfaces too, all printed bi-directionally at up to 100 cps!
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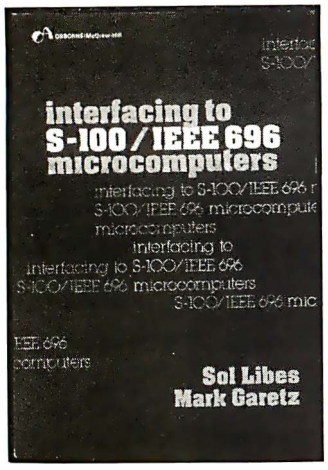

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This book assists S-100 users in expanding the power and utility of their systems. It describes the S-100 bus with precision and detail. Various chapters describe its mechanical and functional design, logical and electrical relationships, bus interconnections and bussing techniques. Both parallel and serial interfacing are described, as well as interfacing the RAM, ROM and the real world. Additional chapters discuss D/A and A/D conversion, interrupts, timers and direct memory access.
Order No. 0-931988-37-3 **$15.00**

Microprocessors for Measurement and Control
David M. Auslander and Paul Sagues

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This book contains program listings and documentations for 76 short programs covering financial, mathematical, statistical and general interest applications. Every program has been tested; examples and sample program runs are published with the source listings for each program.
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Walter A. Ettlin

This book applies a hands-on approach to learning WordStar, an extremely popular and yet practical word processing system. This self-teaching manual allows you to use WordStar starting with Lesson 1. Hours of frustration can be eliminated by following the 14 time-saving lessons and examples presented here. By teaching you to use this contemporary program one step at a time, this book enables you to use WordStar comfortably without the inherent burdens of teaching yourself a new system. It comes with a convenient pull-out Command Chart that can be kept nearby as a quick reference to all of WordStar's most useful commands.
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Thom Hogan

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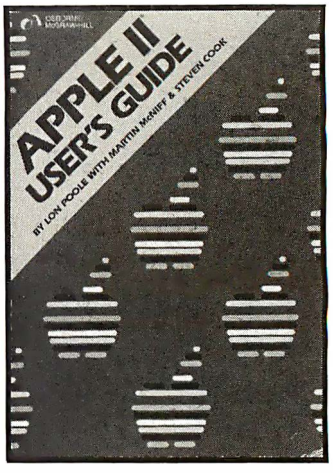

Apple II User's Guide
Lon Poole, Martin McNiff and Steven Cook

It's all here in the new Apple II User's Guide. This guide will compliment your owner's manual and give your a heightened understanding of your Apple II. With this book you'll be able to program in BASIC. You'll be able to use the sound and graphics features of the Apple II to create your own colorful video games. There's also a review of the Apple II printer as well as a chapter on controlling "Real" processes, like burglar alarms and appliances.
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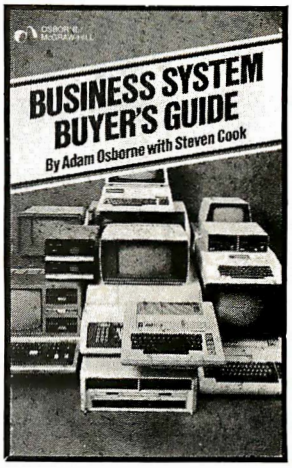

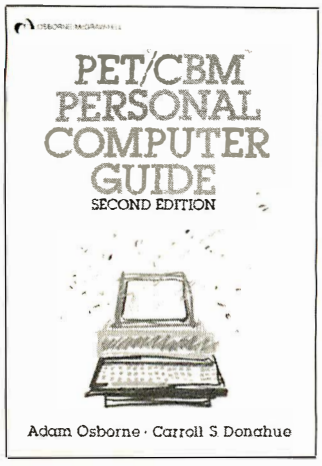

PET/CBM Personal Computer Guide, 2nd Edition
Adam Osborne and Carroll Donahue

If you are thinking about buying any personal computer, this book will show you what the PET can do for you. If you've just bought a PET of CBM, this is the book you must have to really understand your computer. By using the examples found in this book, you'll quickly get your PET/CBM up and running. These examples are thoroughly documented so you can learn how and why the programs work. It's the how and why that are important in learning to make the PET work efficiently for you. This book covers everything you'll need to be a master of your PET.

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Running Wild
Adam Osborne

Take a second look at your calculator or digital watch. These simple devices are the beginning of what promises, or threatens, to be the next industrial revolution; it will be based on microelectronics. Within the next decade, roughly half of today's jobs will change drastically, or disappear altogether. Will the coming years prove to be a dream or a nightmare? Understanding the facts of microelectronic advancements could make the difference.

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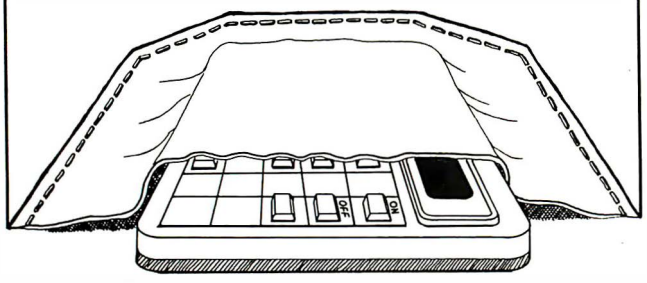
POWER IN YOUR POCKET

by Bob McElwain



Budgets: A Different Approach

Budgets are difficult to set up and impossible to live with. The accompanying program makes the task easier.

The program accepts amounts from your checkbook, requesting a category number for each amount (i.e. Housing, Food, Transportation). At the end of each entry for a month (or any suitable period), the totals for each category and the percent of total expenditures are displayed.

Since there can be unusual variations in any given month, the program continues by averaging the current month with previous months. Averages are displayed in each category, along with the percent of change over the previous average. This procedure, averaging, tends to dampen peaks, such as the cost of a new washing machine or car repairs.

The average is a moving or rolling average. As new averages are computed and compared to the previous average, the data for each period is backed off to the position of the previous period and the oldest period is discarded. (Note that any interruption during these roll-back computations will leave data scrambled and unusable.)

When I use this program, I list the computed totals for each month in a ledger. Then I list the moving average in a separate portion, allowing me to spot spending trends easily.

To use the program, begin by deciding on the important areas in which money spent should be categorized. (See headings in figure 1 as an example.) Almost any category can

CAT # CAT NAME	1 HOME	2 UTILITY	3 CAR	4 MEDIC	5 GROC	6 HOUSEHOLD	7 CLOTHES	8 PERS	9 MISC	10 TOTAL
PER #1	$347	$130	$237	$240	$282	$30	$127	$4	$17	$1,414
% of total	24.5%	9.2%	16.8%	17%	19.9%	2.1%	9%	.3%	1.2%	———
AVERAGE WITH NO PREVIOUS PERIOD	$347	$130	$237	$240	$282	$30	$127	$4	$17	$1,414
% DIFF	100%	100%	100%	100%	100%	100%	100%	100%	100%	———
PER #2	$383	$105	$65	$54	$295	$47	$13	$137	$420	$1,519
% of total	25.2%	6.9%	4.3%	3.6%	19.4%	3.1%	.9%	9%	27.6%	———
AVERAGE W/ONE PREVIOUS PERIOD	$365	$117.5	$151	$147	$288.5	$38.5	$70	$70.5	$218.5	$1,466.5
% DIFF	4.9%	10.6%	−59%	−63.3%	2.3%	22.1%	−81.4%	94.3%	92.2%	———
PER #3	$392	$147	$110	$11	$214	$67	$94	$47	$125	$1,207
% of total	32.5%	12.2%	9.1%	.9%	17.7%	5.6%	7.8%	3.9%	10.4%	———
QUARTERLY AVERAGE BEGINS HERE	$374	$127.33	$137.33	$101.67	$263.67	$48	$78	$62.67	$187.53	$1,380
% DIFF	2.4%	7.7%	−10%	−44.6%	−9.4%	19.8%	10.3%	−12.5%	−16.6%	———

Figure 1.

— Period data - represents totals for a period, accumulated from checkbook entries.
— Percentages following period data are based on the period total.
— Percentages following averages are percent change from last average.

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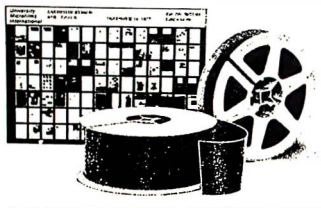

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Organize months worth of data in minutes with the built-in REPORT. Or control every row and column on your CRT and your printer, to format input and output exactly the way you want it.

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With dBASE II, you'll write programs a lot faster and a lot more efficiently. You'll be able to write more programs for more clients. Even take on the smaller jobs that were out of the economic question before. Those nice little foot-in-the-database assignments that grow into bigger and better bottom lines.

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The price of dBASE II is $700 but you can try it free for 30 days.

Call for our Dealer Plan and OEM run-time package prices, then take us up on our money-back guarantee. Send us your check and we'll send you a copy of dBASE II that you can exercise on your CP/M system any way you want for 30 days.

Then send dBASE II back and we'll return all of your money, no questions asked.

During that 30 days, you can find out exactly how much dBASE II can save you, and how much more it lets you do.

But it's only fair to warn you: business programmers don't go back to BASIC's.

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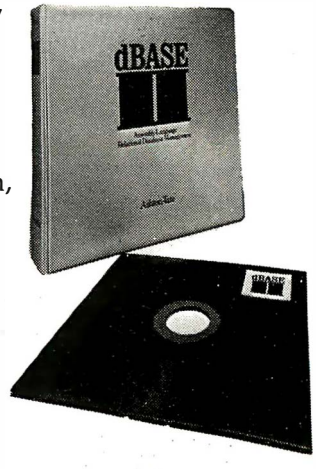

Ashton-Tate

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I(nterchange)

I(nterchange) is a general purpose file maintenance program for use with the CP/M™ operating system. Since it is a single program written in optimized Z-80™ code, it is much faster and easier to use than other file maintenance programs. Features include: DIR as usual *plus* listing all files *excluding* those with a specified character(s), ERA as usual plus *exclusive* erases. Also, a "Q" switch can be used to query each erase, a "W" allows erases of R/O files without query (normally you are queried), and an "R" switch if system files are to be included, LIST permits listings and uses TAB, WIDTH, LINES and WRAP for control, COPY as usual plus *exclusive* copies and supports the "Q", "W" and "R" switches plus an "E" switch for query on existing files, STAT with ambiguous, unambiguous and exclusive listings and produces an alphabetized listing with file length, total directory entries and space used and unused, START-END allows for copying contiguous data files, and RENAME as usual plus ambiguous renames. Other commands include: QT, DATE, TIME and SETIT (for the QT clock board) plus CLEAR, RESET, HELP and TYPE. Disk copies can even be continued after a disk full condition by simply inserting a new disk. All of this in one program without ever having to leave I(nterchange) and wait until you see the speed improvement . . .

The price for I(nterchange) is $59.95 and the manual is available for $10.00 (credited towards purchase). I(nterchange) is recommended for 32K or larger systems using CP/M™ 2.0 or later. It will not run on an 8080 CPU and only User 0 is supported.

All programs are available on 8" SD or North Star 5¼" disk. Microstat is available for North Star Basic, Microsoft's Basic-80 (Rel. 5.0 or later) or compiler Systems CBasic2. Please specify when ordering.

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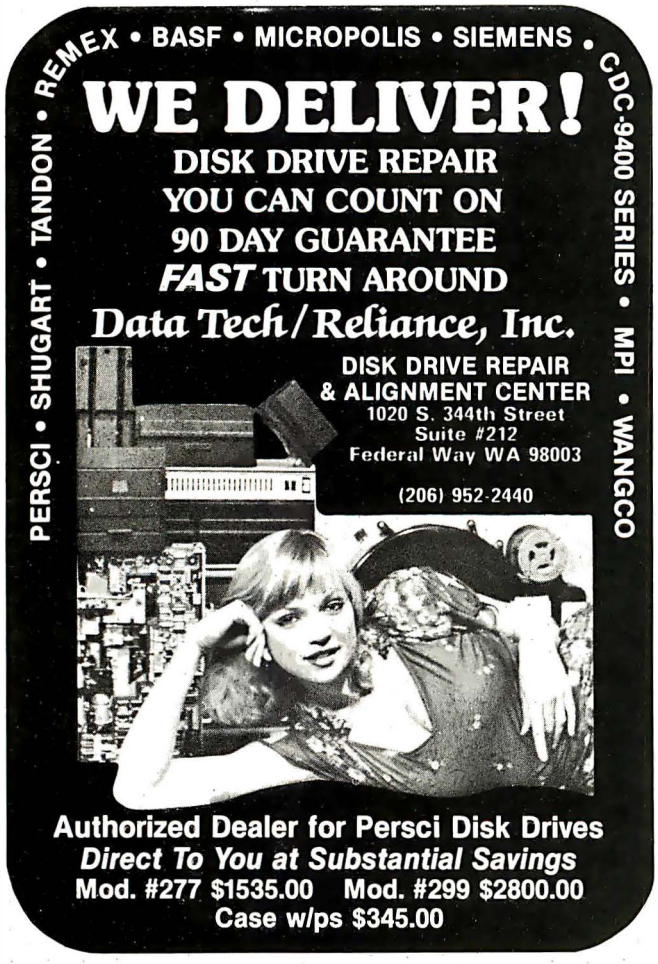

be broken down further. For example, "Phone" could be split out from "Utilities." "Home" could be split into "Payment," "Maintenance," "Improvements" and "Misc." Set A to the number of categories needed plus one. (The extra space is for the total. For 10 categories, set A = 11 in line 10.)

Next, decide on the number of periods to be averaged. A rolling quarterly average works well for me. Set B in line 10 to 4, one more than the number of periods. (The extra space is for the last average computed.)

The size of the data array is limited, as described in line 10 of the program. As listed, you can use 13 categories averaged quarterly (A = 14 and B = 4), seven categories averaged semi-annually (A = 8 and B = 7), or whatever suits your needs. If more space is needed, many deletions are possible. Lines that can be deleted without other changes include 50, 55, 70 and 75, 99, 120, 135 and 140, 150 and 155, 300 and 305, 400, 405 and 410. With care, other lines can be deleted and prompts can be abbreviated.

When the program is run for the first time, be sure to manually CLEAR all variable space. When "Enter only for cont" is displayed, enter any character. This will reset D, the divisor for computing averages, and allow entry of category headings. When continuing from previous data, be certain to press ENTER only to bypass the above. Or RUN 99. (If a mistake is made, recovery may be possible by setting D to B – 1 and RUN 99.)

A	=	Number of categories plus one for the total
B	=	Number of periods plus one for the last average
C	=	Number of program variables
D	=	Number of periods to be averaged. When the matrix is full, D = B – 1
E	=	Temporary value
F	=	Index to element of data matrix. In general, F = D + (G – 1)*A + H
G	=	Row number of data. Note that averages are held in row G = B
H	=	Position in a row of a data element
I$	=	Use to accept ENTER only if display approved. If any character is entered, the program will branch.
J	=	Temporary value
K	=	Temporary value

Figure 2. Variable savings

There is a problem in finding the average when no previous data exists. D is incremented once for each period entered until its value is B – 1, the number of periods to be averaged. Hence the first average is the data for the period, the second is the average of two periods, and so on.

Since you will use this program only occasionally, it's important to save the data to tape for subsequent use. This can be accomplished by the program by adding: 500: PRINT #"S": STOP and 600: INPUT #"S": STOP, where S is any convenient file name.

If totals for each category are available, it's not difficult to restart the program and enter the totals for previous periods. Then the current period can be entered and averaged properly.

After category totals have been displayed for a period, you'll be asked to approve the results. If an obvious error is noted, re-entry of the period is possible. (Period totals will be reset to zero before the return for re-entry.) If only one total is incorrect, you can interrupt the program, restart at line 99 and enter a value, plus or minus, to correct the bad total.

You can interrupt the entry procedure any time. When you want to continue, restart at line 99. Once the computation of averages begins, the program cannot be interrupted without loss of data. □

Program on page 150

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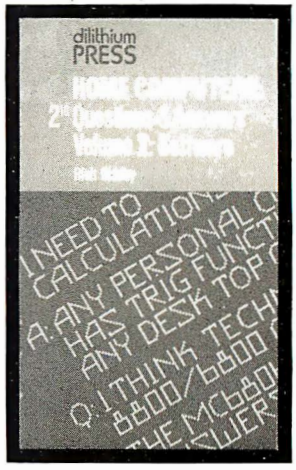

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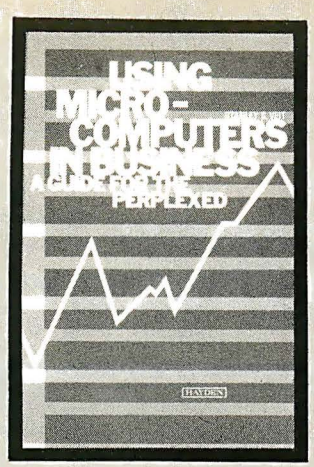

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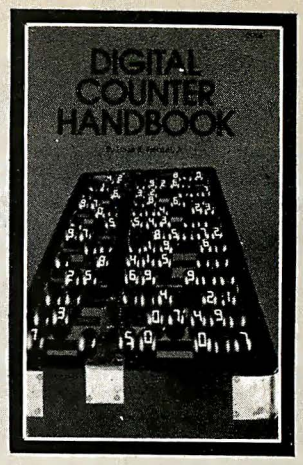

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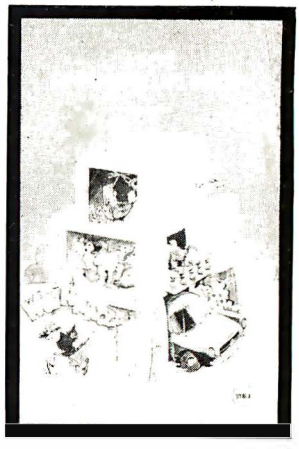

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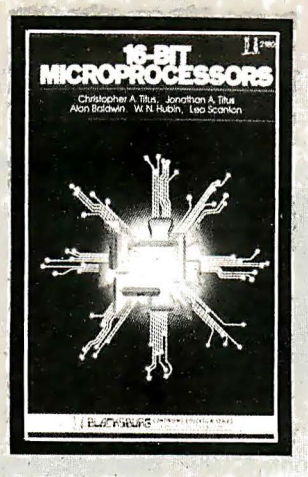

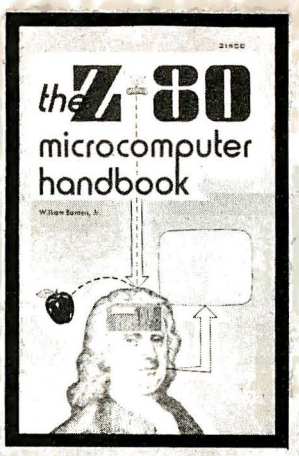

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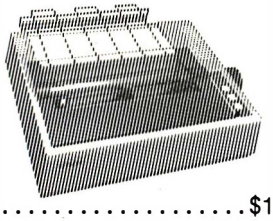

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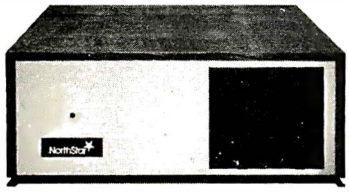

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Apple II +	6:17.4	$ 4,330
Digital Microsystems DSC-2	3:28.8	$ 9,015
Ohio Scientific C3-A	15:49.3	$10,940
Alpha Micro AM-1011	3:25.3	$15,605
Data General CS/10 model C1	**	$13,400

NEC Astra
Dynabyte 5300
Billings BC-12 DF2M
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Commodore CBM-8032
Smoke Signal Chieftain
Vector Graphic 3005
Xerox 820
IBM Personal Computer
IBM 5120

to be covered in future issues

*Result includes both compile and run time.
**Time of 2:40.3 was obtained using hard disk system.

by Hillel Segal

Altos Computer Systems, San Jose, CA, offers a flexible and expandable product line based on the popular Z80 microprocessor. Starting with dual floppy disks in the ACS8000-15, the user can add hard disk drives in increments of 10, 14.5 or 29 million characters. In addition, an extra pair of floppies or a 13M-byte tape drive can be added.

Benchmark tests, sponsored by the Association of Computer Users, cover systems costing up to $25,000. The Altos ACS8000-15 was tested in our continuation of Series 1 and 2.

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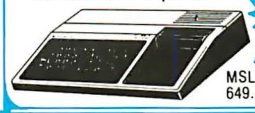

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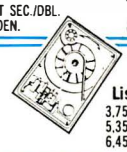

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Computers are tested for single-user performance in a variety of tasks. Reported here is the accounts receivable test, which uses a combination of storage and processing operations in an accounting simulation.

Our test included the processor, 208,000 main memory characters, a pair of double density floppy disks (1 million characters total), and seven I/O ports—one parallel and six serial.

Altos does not make its own display stations or printers, so our test team used a Texas Instruments 810 printer and a Hazeltine 1420 CRT terminal. Including the cost of these components, the system cost $9,875.

We also had an opportunity to test the hard disk capabilities of the equipment. The addition of a 14.5M-byte drive to the system brought the total price to $14,375 and changes the designation to ACS8000-6. The ACS8000-10, using a 10M-byte Winchester-type hard disk, was tested as a multi-user system in our Series 3 benchmark tests.

These prices include software, listed and sold separately. The CP/M operating system and Basic-80 language added $895 to the cost.

Hard disk improves performance

The ACS8000-15 gave a strong performance in a number of the testing categories, but the accounts receivable test time, 10 minutes, 41.5 seconds, seemed to be on the slow side. However, the ACS8000-6, an identical system equipped with hard disk, gave a much-improved time for the test. It is to be expected that a hard disk will improve performance on an accounts receivable problem, which uses much disk access. But here the difference was quite dramatic, cutting the execution time to 1 minute, 35.1 seconds, or better than a six-fold improvement.

The ACS8000 series employs a single-board design that includes the Z80 processor, memory and I/O controllers. The board is housed in a chassis along with the power supply and disk drives. An RS-232 interface is provided for connection to an external display terminal, which can be any standard dumb terminal.

Expansion possible, but limited

Expansion capabilities are good for a system of this size and price, but the one-board design provides some definite upper limits. The memory is designed to allow four users a 48K-byte partition each, plus a 16K-byte system area. Up to four separate user tasks are available, assuming a multi-user operating system is selected.

Users needing more than four terminals would find the newly-released ACS8600 series, based on the 8086 processor, more suitable. The new system also offers a version of the UNIX operating system called XENIX, a Microsoft product.

The ACS8000-15 maximum storage configuration is four floppy disks, two hard disks and a cartridge tape drive. Together, this would provide upwards of 60M bytes of disk storage. The 13M-byte cartridge tape is designed for disk backup.

Altos' approach of supplying systems without a specific terminal or printer allows a great deal of flexibility in putting together a complete package, but places a greater responsibility on the dealer and end-user. Compatibility of equipment and software, availa-

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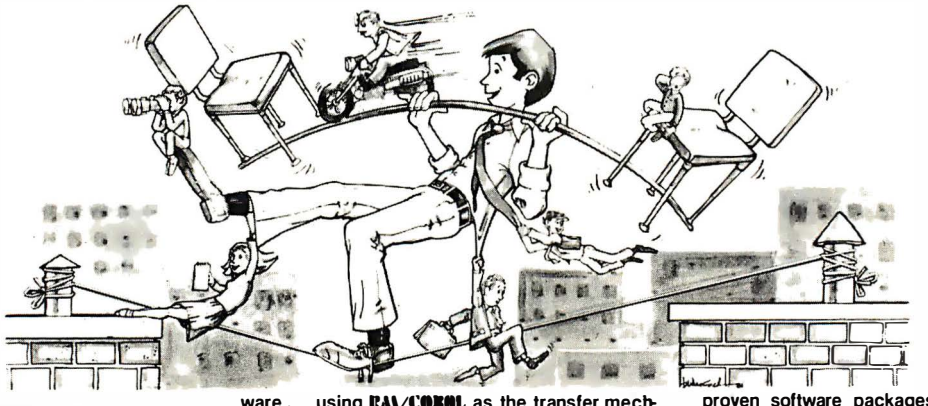

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bility of maintenance service and similar considerations would apply.

Incorporating the popular Z80 microprocessor allows Altos to offer the CP/M and MP/M operating systems (originated by Digital Research) and the OASIS operating system (by Phase One Systems). For single-user systems, CP/M is often preferred because of available software. In multi-user configuration, OASIS is generally chosen.

Languages available for the system include Basic-80, Fortran-80 and Cobol-80 (all by Microsoft), Pascal (Sorcim), APL (Vanguard Systems) and others. Altos publishes a 50-page guide to operating systems, languages and applications software that can be used on ACS8000 systems.

The Basic-80 language includes extras such as the WHILE...WEND structure, automatic line numbering and renumbering, and assembly language subroutine calls. It also allows direct execution of Basic statements.

One criticism is the lack of syntax error-checking immediately after a line is entered; like many versions of Basic, this one requires the user to run the program to find any syntax errors.

One the other side, the testers favorably noted the combination of interpretive and compiled capabilities in Basic-80. Using the interpreter during programming and debugging is convenient. Once fully debugged, a switch to compiled operation gives greater execution speed, and the somewhat time-consuming process of compiling and linking the program need be done only once.

Altos does not offer applications software for business functions such as accounting, leaving the addition of such software to the dealers. There are a number of business packages available for the CP/M operating system, and dealers combine these with the Altos hardware and peripherals of their choice to create a turnkey system.

Survey finds hardware is reliable

Our survey contacted 10 ACS8000 systems users, whose names were supplied by the manufacturer. In most cases, they had purchased a complete system including all software, and were not doing any programming. The majority were using the system for accounting functions, but some were also using it for word processing.

Most felt the hardware was reliable and reported good service. Dealer software support also received favorable reviews. Users mentioned price, flexibility, the hard disk options and multi-user capability as primary reasons for choosing the Altos system.

We agreed with their assessments: the ACS8000-15 allows users to begin with a single terminal running under CP/M, and to later upgrade to additional terminals, a hard disk and multi-user operating system. With these big-system features, Altos supplies a good deal of performance from a relatively inexpensive microcomputer system. □

Research Associate: Vic Schoenberg

Hillel Segal is president of the Association of Computer Users, a non-profit association with members all over the U.S., Canada and several other foreign countries. A complete package of information about membership is available from ACU, P.O. Box 9003, Boulder, CO 80301.

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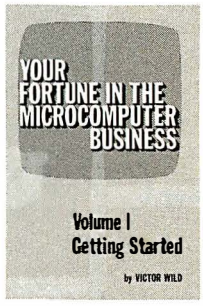

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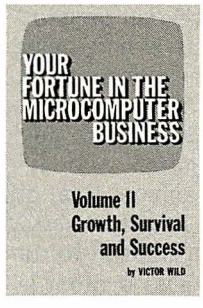

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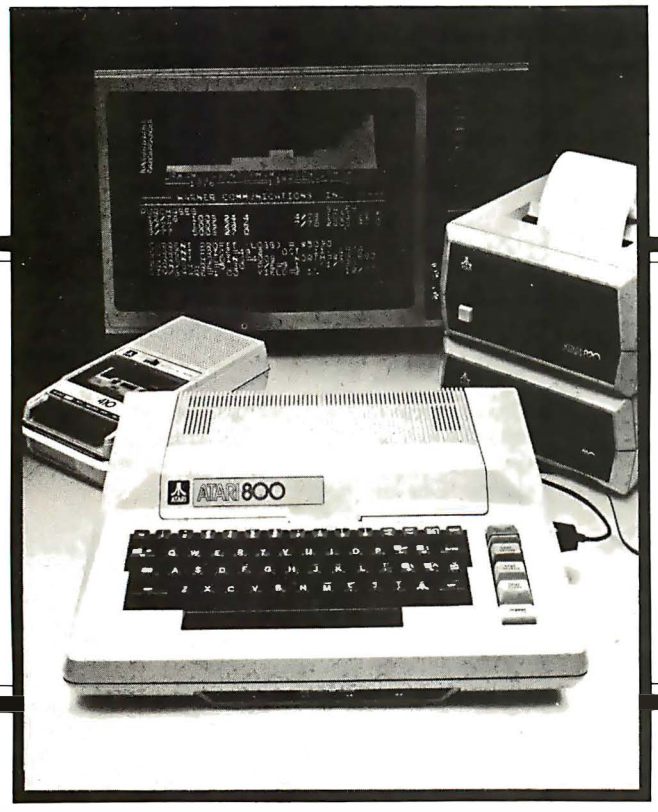
A Personal View of the Atari 800



by Roger H. Edelson

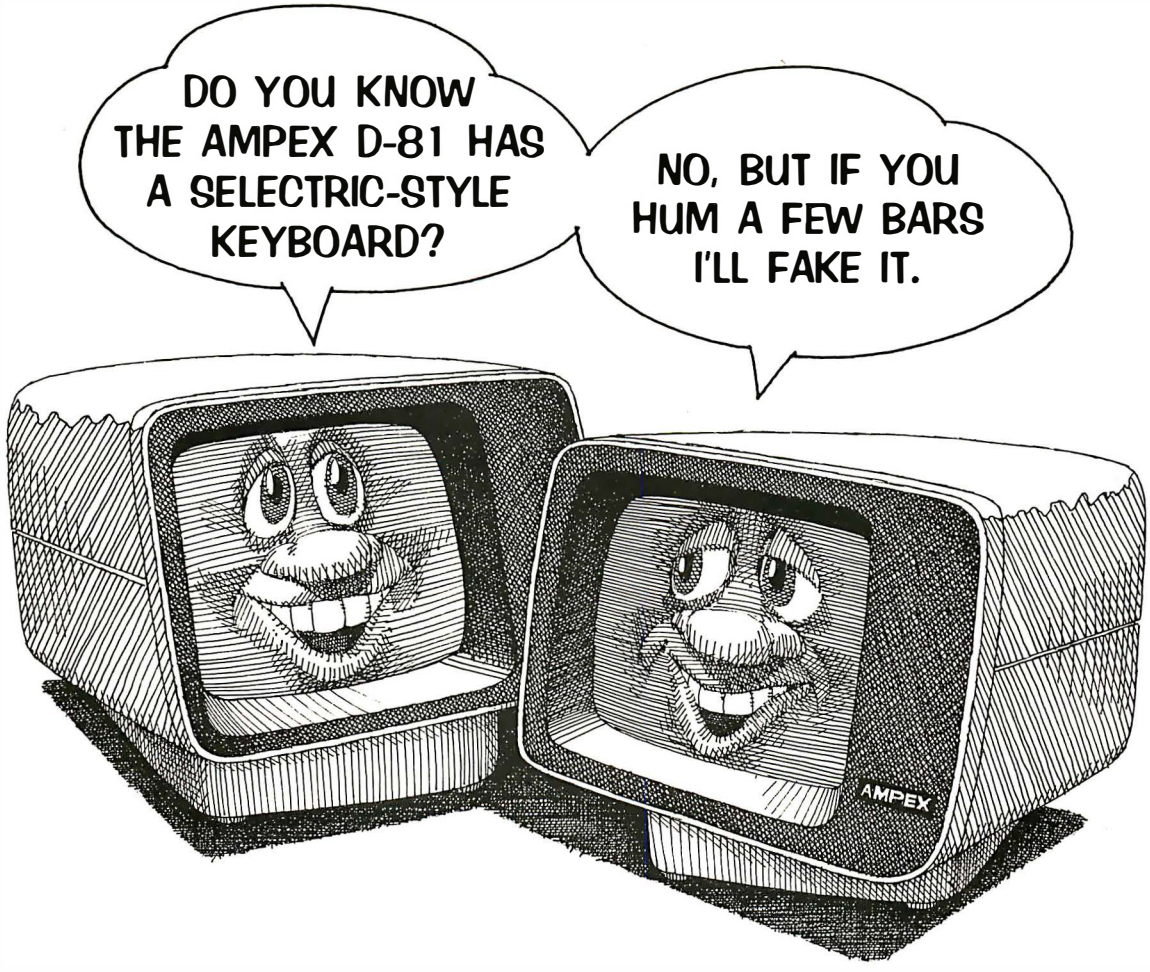
While the model 800 computer by Atari (Sunnyvale, CA) can be used in a small-business environment, this role is now being de-emphasized. In this system, Atari has managed to produce more of a personal computer, excelling as a combination game machine, interactive educational device, home information management system and fully programmable, general purpose machine. It is, primarily, a consumer-friendly system.

Its major shortcoming in the small business arena is its inability to run CP/M programs.

The system is based on the 6502 microprocessor integrated circuit and provides high resolution color graphics and sound. An RF modulator allows a user to select transmission on either television channel 2 or 3, depending upon which frequency is not active in the user's area. If higher resolution display is required, the unit provides composite video output and sound. The system provides a full-sized, full-stroke typewriter-style keyboard packaged in a low-profile plastic case. The keyboard has 57 keys including cursor movement capability, and an additional four function keys are provided in a separate section to the right of the major keyboard. These keys allow system reset and selection of different game features. The SYSTEM RESET key is surrounded, top and bottom, by two fences to prevent inadvertent operation, which wipes the operating program. As a further example of the dedication to consumer friendliness, the ports on the lower front panel of the system, which are used to connect various accessories such as joysticks or paddles, are shaped so that it is impossible to insert the plugs incorrectly. Once inserted, the plugs remain in place even during the most frantic game activity.

The system makes use of two busses: an internal motherboard arrangement that allows the mixing of ROM, RAM and special purpose modules; and an external bus that provides the method for attaching optional items such as the 410 program (tape) recorder, the 810 disk drive (the 800 can support up to four such drives), the 830 modem or other devices. If it is necessary to configure the system with a number of accessory devices, you will need the 850 interface module, which provides four RS-232C ports and one parallel port. Most of the devices that attach to the Atari through this external bus are intelligent, usually with an internal microprocessor, allowing simplified bus structure and control. One of the advantages of this external bus structure is that the accessory devices may be daisy-chained, and each device provides two cable sockets for just this purpose. There is a Catch-22, however; the program recorder, because it is not intelligent, must be the last device in the line and in some cases operation is unreliable in this position. To circumvent this problem, the recorder should be plugged directly into the computer, the program downloaded, the recorder unplugged, and the other accessories reconnected.

As part of the internal bus, the system provides two easily accessible slots (under the plastic cover) to insert ROM cartridges with various programs—either Basic or a growing number of assembly language games. The computer is human-engineered so that when the plastic lid is raised to allow either insertion or removal of the cartridges, the power is cut to prevent damage to the



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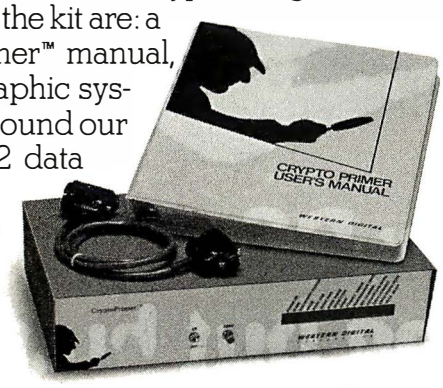

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ROMs inside the cartridge. Another advantage is that this cover contains a fitted piece of aluminum that, when closed, forms part of an RFI tight enclosure making the computer neighbor-friendly. The system may be operated with its associated disk drive close to a portable TV with no interference. The internal bus allows expansion of the RAM memory to 48K bytes plus 10K bytes of system ROM, which may also be expanded with user-purchasable cartridges. One of the problems with the Atari bus is that it is not a true bus—the same signal lines don't go to each card slot. Modules must be placed in their appropriate slots or damage to the computer or module may result.

Atari provides 16K-byte expansion RAM modules, which allow the system to reach its full 48K-byte capacity; other manufacturers supply a variety of Atari-compatible RAM cards with larger capacities. One advantage of these larger cards is that all spare slots are not used when configuring the computer for 48K bytes of RAM. One of these alternate cards provides an additional 128K bytes of memory, which may also be configured as an electronic disk, speeding disk I/O operations. While Atari does not specifically forbid the use of other manufacturers' devices or modules, it does caution that certain items can overload the power supply. It is possible that your warranty will be voided by the use of these units.

The resident operating system ROM, which must be inserted in the first module slot, occupies the 16K-byte addresses from E000 to FFFF. The RAM occupies dedicated locations from 0000 to 7FFF (32K bytes), with at least 4K bytes (from 0000 to 1FFF) needed for minimum system operation. The cartridges (either Basic or other) and RAM share the locations from 8000 to BFFF—16K bytes first overlaying the right cartridge addresses and then the left. In case of an address space conflict, the cartridge disables the conflicting RAM in 8K-byte increments. When DOS 2.0S is in residence, the free RAM space is decreased by almost 8K bytes. The 6502, like most microprocessors (with the exception of the 8080/Z80 class), uses memory-mapped I/O, and the address from D000 to D7FF is reserved for these functions. The peripheral interface adapter is tasked with handling the joystick inputs, and in conjunction with POKEY (the digital I/O chip), takes care of the paddles and the main keyboard. The CTIA accepts inputs from the console switches, joystick triggers, data from ANTIC and sound from the POKEY chip, producing the composite video and sound for the RF modulator as well as sound for the speaker located in the computer. In addition to producing the video data, the ANTIC chip also takes care of the light pen.

Set-up is quick, easy

System set-up is simple; plug in the AC adapter, attach the RF switch box to the back of your TV set with the double sided sticky tape provided, make the appropriate antenna connections, adjust your set and your computer to either channel 2 or 3, and go. With no cartridge inserted in the available slots, the computer comes up in the Memo-Pad mode, indicated by the white text ATARI COMPUTER MEMO PAD on a blue background, which allows writing text in 24 by 40 format onto the television screen. This is another example of the system's consumer-oriented design—

even with no cartridge, or loaded program, the computer does something. If the operator takes no action after a reasonable length of time, the computer will vary the screen colors to prevent damage to the television.

Upon power up, the computer will determine the highest RAM address, clear all RAM to zeroes, establish interrupt vectors and device tables, initialize any cartridges and set the screen to the text mode. Blackboard mode is the lowest priority environment (to use Atari's term)—invoked only if the system cannot support a higher environment, such as Basic, cartridge or DOS. This mode can also be entered, if directed, from a higher environment (i.e. entering BYE while in Basic). Even in this minimal mode, the full-screen editing

. . .Even with no cartridge, or loaded program, the computer does something.

functions are maintained, though all text entered is written directly to the screen without examination. With the Basic cartridge inserted, there is a slight pause, and the computer will then respond with the word ready; at this point you can start to write, and run, Basic programs. The addition of the 410 program recorder doesn't complicate this procedure much more—one additional line plug is added and the recorder is plugged into the external bus port. The computer controls the 410 recorder in the play mode starting and stopping the tape as required by the program.

Adding a disk drive (the single-drive 810 or the dual-disk 815) to the configuration begins to complicate the system both physically and operationally—a factor that limits the model's performance as a small business machine. Each disk drive unit presents the user with another AC adapter/transformer to plug in. If you are planning to configure your 800 system with a 410 program recorder, an 810 disk drive, and possibly a printer (with the 850 interface module), purchasing a plug-strip to allow several plugs and AC adapters to be grouped as desired is recommended. One of several available switch/socket boxes that will also allow easy on/off control of each device can be used. To operate the computer with an attached disk drive, the drive must be turned on before the computer is powered-up and allowed to time out before inserting a disk—then the computer is turned on.

This operational sequence allows the disk drive to initialize itself and presents appropriate information to the computer when it examines the external serial bus to determine which accessories are connected. Once the drive has timed out (an LED indicator labeled BUSY lights up), the disk may be inserted and the computer powered-up. At this point, the system will configure itself dependent upon the computer configuration—with or without Basic or another cartridge and the disk program. The system may power-up with the DOS disk

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utility active, it may come up in the Basic programming mode (in which case the user may get to the disk utility by inputting "DOS" followed by "RETURN"), or the disk booted program may take complete control and begin running a program. As the system is so flexible, it is difficult to generalize about the power-up state. The only requirement is that there must be sufficient RAM to support the program being booted.

The disk utility features a menu-driven, consumer-oriented operating system that is self-prompting and easy to use. With this operating system, it is possible to format disks and transfer the operating system to those disks. The utility allows file transfer, or full disk copy, operations with either single- or multiple-drive system configurations. One can rename or erase a file and the directory command provides file size and available disk space information. The operating system and Basic allow operations with either random or sequential files, and the standard Basic commands such as OPEN, CLOSE, READ and INPUT are supported. The disk drive uses standard soft-sectored 5¼-in. diskettes, which can store up to 88K bytes each; some of this space is used for system software.

14 graphics modes are available

The 6502 microprocessor operates at 1.79 MHz, one-half the standard television chroma oscillator frequency (~3.58 MHz), and provides a maximum resolution of 192 V by 176 H pixels—the maximum horizontal resolution can be 352 pixels. Through the use of the ANTIC graphics/video microprocessor, the 800/400 computer provides 14 different graphics modes (nine are available directly from Basic). Through the use of ANTIC, Atari computers excel in their sophisticated and flexible ability to handle video graphics. Using a technique called DISPLAY LISTS, one can display the machine's full 128-color pallette and even manipulate these colors.

My system consists of an 800 computer, one 810 disk drive, the 410 program recorder, and an Epson MX-80 printer driven by the 850 interface module. To connect this to AC power, I use a combined RFI filter and switch box, which allows individual on/off control for each unit. I plan to design a device to automatically sequence the power to the disk drive and the other items to avoid the annoying operational sequence. The full-stroke keyboard has a nice feel to it, though care is necessary to avoid accidental depression of the reverse video key—identified with Atari's symbol. The Basic is easy to use, though not quite as powerful as those available for my S-100 machines. When in the Basic environment, the programmer has available graphics commands such as DRAWTO, PLOT and POSITION, the ability to easily set the screen and display colors, plus control of four independent sound synthesizers.

My system is reliable and has given me many hours of enjoyable operation. The disk drive has performed without error in a regime that has included many file transfers and disk copies. With its flexible and comprehensive graphics and audio capability, the system ranks as a top-of-the-line personal computer. Its extensive peripheral array and software support make it an excellent choice for those considering a personal computer system.

Next month's *Hardware Evaluation* will discuss the three accessories to the 800. □

ADVERTISEMENT

An open letter to the readers of Interface Age

Hillel Segal, President, Association of Computer Users

My purpose in writing is to tell you that my colleagues and I have decided to launch a program that could dramatically help you manage your computer resources. It will be called *Computer Assistance Teams* or *CATS* for short.

Ever since the Association of Computer Users was formed in 1974, I have been thinking and dreaming about the possibility of starting a program that, quite literally, would allow each member to directly benefit from the experiences of other users. By setting up teams of users around the country, members would be able to draw upon the knowledge and skills of the other team members when looking for software, checking hardware reliability handling the many problems that users face regularly.

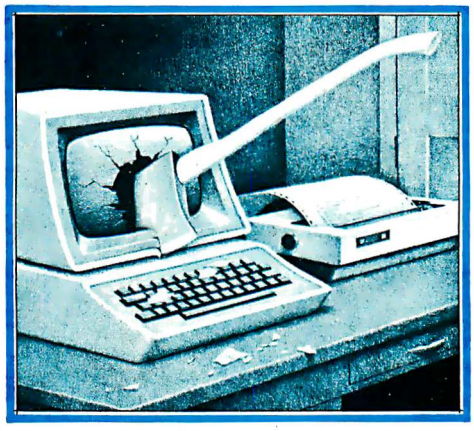
This has never been done before. Usually, each user is on his own—continually reinventing the wheel. This is the traditional way most computer users operate; not that they want to, but simply because they have no other choice. Up until now, a program hasn't existed that easily allowed users to seek and receive advice from other users. ACU is now starting such a program, and we need team members from every city, town, and hamlet in the United States and Canada to make it a success.

My hope, therefore, is that we can find enough readers, in addition to our current members, to make this plan feasible. You can participate by becoming a member of the Association of Computer Users. At the same time, you would also receive all of the other benefits of ACU membership.

What about the Association itself?

We believe that ACU has several unique functions in the computer industry. First of all, as a non-profit *user* organization with elected officers, our primary obligation is to represent and serve computer users and prospective users. (Those involved in the sale of computer products or services are welcome to join too, but they are not permitted to vote or hold office.)

Secondly, our monthly journal *Interactive Computing*, our BENCHMARK REPORTS that review computer systems, and all of our other publications are geared to (1) provide practical "how-to" advice on the selection of hardware and software, and (2) use it productively. What makes ACU special is its unique user-point-of-view.



For example, not long ago we displayed the drawing shown here on the front cover of *Interactive Computing*, along with an article entitled "Ten Pitfalls To Avoid In Buying A Small Computer." The entire issue demonstrated our independent tell-it-like-it-is attitude. Users loved it, and many vendors even ordered reprints.

In addition, many readers of *Interface Age* have followed my regular column in these pages during the last year, so you may already be familiar with ACU's activities.

I think enough has been said to indicate that the new CATS program will direct its central energies to both the users' current needs and future problems. But it would be a mistake, I think, to attempt a full description of the program. Programs like these are not really invented or created. They evolve. They are the product of creative interaction between the special needs and enthusiasms and concerns of those involved.

In this way, ACU serves as a catalyst, and our publications and programs take shape issue by issue and year by year. No single issue of our journal (which carries no advertising), can really be expected to tell a reader everything he may want to know about a particular subject. Similarly, since it might be misleading to try to tell you exactly how the CATS program will work, what I have tried to do is to tell you something about our philosophy and approach—and to seek your participation to make it a success.

Some specifics: Membership in ACU costs $65 per year—which is not a lot compared to other information sources that provide real value. Included with your membership is a binder and all back issues of our journal still in print.

We ask for no money now. That can come later. What we need right now is an expression of your interest.

As I said, in inviting you to join ACU, we realize we are asking for your confidence. We have high hopes of fulfilling your expectations. The process begins with the application form below.

Sincerely,

Hillel Segal

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ARTICLES WANTED..

INTERFACE AGE is seeking articles on computers in education for the October issue. The latest hardware and software for educational applications will be discussed. Specific application articles and case studies of how computers were implemented for classroom use will be considered. Articles intended for this issue should be received no later than June 1 for consideration.

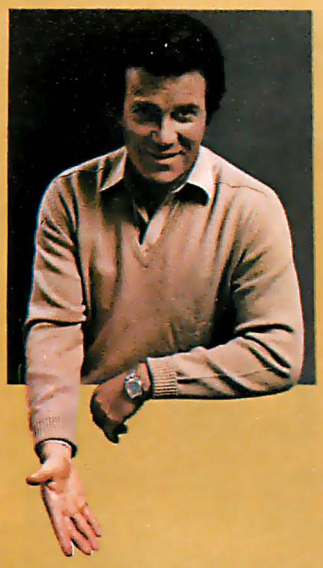
Other topics being solicited during 1982 include: medical applications, word processing, peripherals and interfacing products, home applications, tutorials and utility programs. Special emphasis is placed on business systems and applications.

Program listings should be no more than 60 characters wide, with no wrap-around lines. Unlined paper and a new ribbon should be used. Sample runs should be included. In the article text, variables should be described. The system utilized in composing the program should be detailed — operating systems, language type and version, and any necessary peripherals.

Manuscripts should be typed or printed out double-spaced with one-inch margins. Minimum length is six pages, unless programs are included. Photos should be numbered and have a caption. Authors are requested to submit a statement of background and expertise.

The publisher assumes no responsibility for artwork, photos or manuscripts. No acknowledgement is made unless the submission is accompanied by a large stamped return envelope. A minimum of six weeks should be allowed for response. It is requested that authors do not phone for information about submissions.

The submissions should be addressed to: Editorial Dept., Interface Age, 16704 Marquardt Ave., Cerritos, CA 90701.



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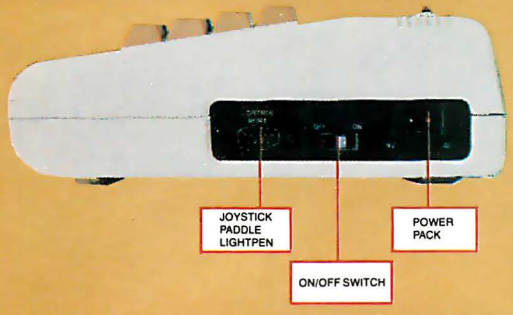

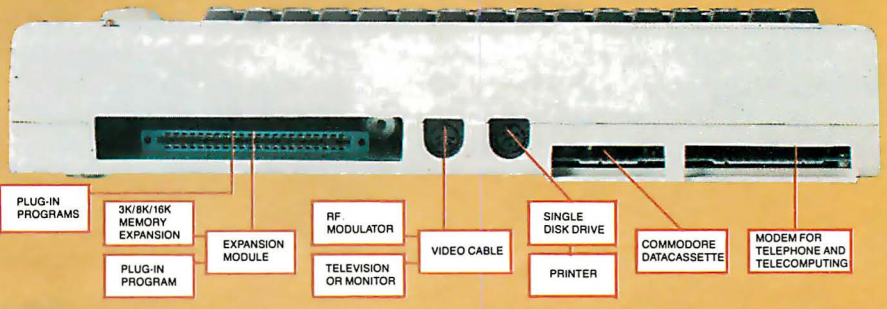

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Number of Keys	66	57	40	53
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Graphic Symbols On Keyboard	62	0	0	0
Displayable Characters	512	256	64	256
Microprocessor	6502	6502	TI990	6809
Accessible Machine Language	YES	YES	NO	YES
Upper/Lower Case Characters	YES	YES	NO	NO
Operates with all Peripherals (Disk, Printer and Modem)	YES	NO	YES	YES
Full Screen Editor	YES	YES	NO	NO
Microsoft Basic	Standard	N/A	N/A	$ 99.00
Telephone Modem	$109.95	$399.95	$450.00	$154.95

*Manufacturer's suggested retail price Jan. 1, 1982. Includes BASIC cartridge required for programming.

Read the chart and see why COMPUTE! Magazine[1] calls the VIC-20 computer "an astounding machine for the price." Why BYTE[2] raves: "...the VIC-20 computer unit is unexcelled as a low-cost consumer computer." Why Popular Mechanics[3] says "...for the price of around $300, it's the only game in town that is more than just a game." And why ON COMPUTING INC.[4] exclaims: "What is inside is an electronic marvel... if it sounds as if I'm in love with my new possession, I am."

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1 April '81 issue 2 May '81 issue 3 November '81 issue 4 Fall '81 issue

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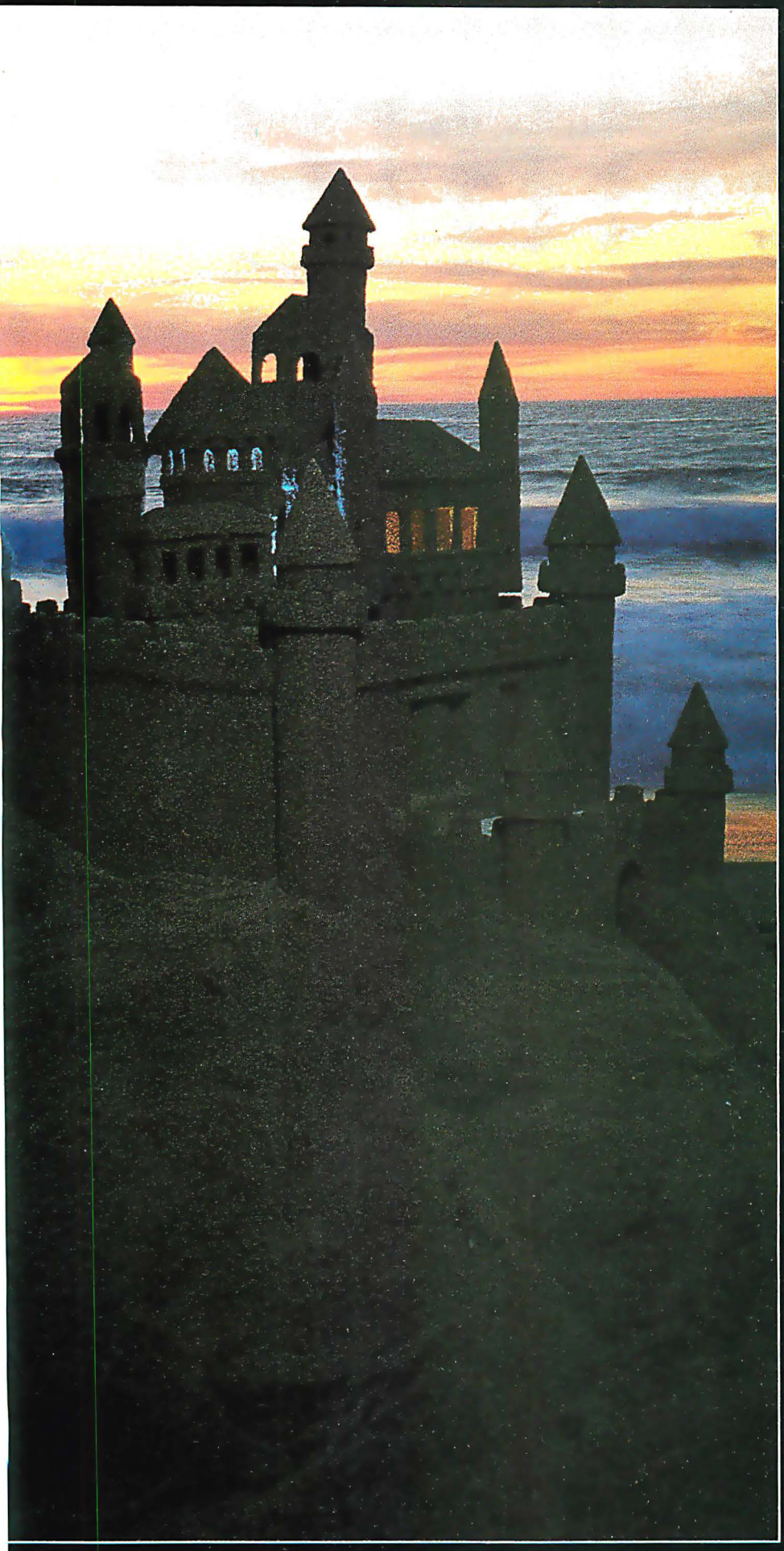
THE APPLE III BITES AGAIN



by Tom Fox

Sitting tall and handsome, the Apple III is the desktop computer of the future—or so it was intended, when introduced about a year ago. Since then, development hangups and production delays have allowed the competition the time to play catch-up. Recently re-introduced as the "new, more powerful Apple III," how does the system measure up to its challengers?

This microcomputer is an attractive, intelligently designed machine, well-suited for many business computing tasks. It combines an appealing packaging arrangement with a superior set of systems software, as compared with most of its existing competition. A 5M-byte hard disk option offers the user a kind of operating convenience merely dreamed of by those stictly confined to floppies.

The main chassis is 17½ in. wide by 18¼ in. deep, and weighs 26 pounds. This unit contains the 6502B 8-bit microprocessor integrated circuit, the main processor chip. It runs at 1.4 MHz average, 2.0 MHz peak. Also included are 128K bytes of dynamic RAM, twice the amount found in an Apple II. The number can be doubled yet again—to 256K bytes—with the optional memory expansion feature.

The Apple III's documentation is exceptional and deserves special note. Manuals are an important part of a technical product and microcomputers have a particular need in this area, since micros are often a new experience for their

owners. Apple III manuals are attractively packaged and expertly edited. They contain detailed, step-by-step procedures for beginners; helpful hints and rules-of-thumb for experts, with photographs and illustrations appropriately placed. Most are spiral-bound and sized to rest handily on a waiting ledge behind the keyboard.

The *Apple III Owner's Guide* is a 172-page introduction to the computer. Both hardware and software are covered, with special attention to the Filer portion of the operating system. This is appropriate, since Filer is the area in which the Apple III's operating system diverges most from CP/M. In the last third of the manual are five appendices with detailed information about subjects such as error messages and electrical specifications of the input/output ports.

Each major hardware item is delivered with an installation and use manual. The *Apple Business Basic* manual occupies some 335 pages in two volumes. The applications program VisiCalc III is delivered with a 300-page user's manual, a 65-page guide to applications samples (provided on a separate diskette) and an accordian-folded pocket reference guide to the VisiCalc commands.

The *Standard Device Drivers* manual is a bit overwhelming, if only because the term "drive" is relatively strange in microcomputing. The concept of drivers is borrowed from larger computers, and is responsible for much of the power in the Apple III's operating system. A driver is a special-purpose computer program whose function is to translate the input and output data from applications programs into the particular requirements of a piece of hardware. Each of the disk devices has a driver, as do the keyboard, printer and other peripherals. Drivers allow the program to be ignorant of the specific needs of the hardware, the programmer to concentrate on what the program is doing, rather than how it is accomplished for each separate device.

In Basic, for example, a hardware device can be opened in much the same manner as a disk file, and data transmitted to, or received from, that device. In the Apple III, the concept includes drivers for the audio circuitry, graphic displays and the RS-232 data communications port. Twenty-four such devices can be defined at one time, although practically speaking, no more than a half-dozen or so will fit into the allocated memory space.

Apple III's Sophisticated Operating System (which generates the unfortunate acronym SOS) is a considerable departure from the Apple II, leaning in the direction of "big computer" software. Disk files can be arranged as a tree structure of catalogs to logically separate applications. This makes a lot of sense in a multi-megabyte, hard-disk drive computer. Floppy disk computers tend to remedy cataloging problems, since only so many files will fit onto a floppy diskette, and they can be labeled with a marker pen.

Data files are managed by a portion of SOS called the Filer, a term familiar to Pascal users, and the utility program giving the most control over the SOS Filer is written in Pascal. This is provided on the Utilities Diskette, one of the system's most important elements. Various utilities functions (disk formatting, etc.) are presented as a series of nearly bulletproof menu selections—much easier to follow than similar functions found on a typical CP/M computer.

Apple Business Basic is this computer's major programming language. It diverts from the Applesoft Basic found on the Apple II+, mainly in those areas needed to make it a more capable vehicle for writing and running serious business programs. It was able to complete our Prime Number Cruncher benchmark program (IA Aug 81) in 929 seconds, 31 seconds faster than the Apple II+. The version we tested was equipped with version 1.1 of both SOS and Apple Business Basic.

A tool for editing computer programs as they are entered is often used with a computer such as this. The Apple III handles this with its escape mode: push the ESC key and the cursor can be moved with the four arrow keys to any spot on the screen. Portions of a program line can be rewritten by typing new text. It's a different, less complex method than that offered by Microsoft's familiar EDIT statement.

The system design is a blend of aesthetics and solid mechanical engineering—a combination that rarely "just happens." Rather it is the result of thousands of hours of invention, refinement and expensive tooling. Sitting on a desk, the Apple III resembles a large floppy disk drive with a separate keyboard. This is an illusion, however, since the machine is built around, and within, a single monolithic pressure die casting of aluminum alloy. Resembling an automobile engine block, this construction conceals enclosures for its essential electronic bits.

The totally hidden power supply, for example, is behind 1/8 in. of aluminum on five sides and a substantial steel plate on the sixth. This, plus a sobering WARNING label, serves to keep the computer operator from potentially dangerous voltage. The built-in floppy diskette drive is similarly housed. The keyboard and main internal circuit boards are buried so deeply that only patience and the knowledge of which screws to remove will permit access.

There is one case, however, where the user is encouraged by Apple to dismantle the device: when it is time to install a new Peripheral Card. Most of the

major add-on peripheral devices (such as the ProFile disk drive) come equipped with such cards, which must be installed in much the same manner as they are in the smaller Apple II. Installation requires removing the Apple III's cover—a simple operation involving a screwdriver and a pair of aircraft-style quarter-turn Dzus fasteners. This reveals four waiting connectors for Peripheral Cards without exposing other internal workings.

Unlike other computers, such as those utilizing the S-100 bus, it's important into which of the four slots a new Peripheral Card is plugged. Apple wasn't too kind to the user in this detail: the slots are not labeled; chances are three-in-four of being wrong on the first try.

If the keyboard on the Apple II was a bit skimpy on key count, the Apple III more than makes up for it. It contains a complete set of 74 keys (42% more than the Apple II), plus a RESET button near the floppy disk slot. Numbers and letters are placed as on an office typewriter, with an extra set of number keys grouped to the right as on a desk calcultor. All four arrow keys for moving the cursor around are included—something we point out only because the Apple II lacks the vertical pair.

There's a push-on/push-off ALPHA LOCK key, a useful kind of SHIFT LOCK affecting only the alphabetic keys (A-Z). Unique to this computer are a pair of extra shift keys marked with the familiar well-chewed apple symbol.

The keyboard is "finger-friendly" in several areas. Keys are arranged in an IBM Selectric-style dish and the tops are finished in a non-glare, mottled finish. Keys located between the SHIFT keys and the front edge of the keyboard are placed a bit lower. Surprisingly, only the four arrow keys are equipped with a tactile feedback and "click" feature so familiar to electric typewriter users.

The main chassis is designed to support the Monitor III video display screen. Hitachi makes the screen and designed it to complement the computer's appearance. It has a green, medium-persistence phosphor, and looks to be an excellent vehicle for Apple III graphics capabilities. New to Apple is a full 80-column by 24-line display. (An Apple II emulator mode is available to display the 40 by 24 format.) This display is memory-mapped to provide maximum display speed.

ProFile, the "professional's file cabinet," is a 5M-byte hard disk Winchester drive, manufactured by Seagate Technology. It fits atop the Apple III to form a tall pedestal for the video monitor. The disk drive iteself is tiny, taking up about a third of the ProFile unit's volume. (Power supply and interfacing electronics fill out the rest of the space.) The data is contained on both sides of a pair of 5¼-in. oxide-coated aluminum disks whirling at 60 revolutions-per-second. The 95 mS seek time is about average for the 5¼-in. units, somewhat slower than some larger, more expensive ones. It is, however, many times faster than Apple III's built-in floppy diskette drive. Oddly, there is no practical way to define the ProFile as the system's "boot" device, a trick other manufacturers have found to take full advantage of the faster Winchester operation.

Adding a high-capacity disk drive such as the ProFile to a previously floppy-equipped machine literally transforms the personality of the computer. Those who have thumbed in vain through stacks of mislabeled floppy diskettes, searching for an important program or data file, can appreciate the ease of simply typing CAT and finding the program or file. ProFile can hold 35 diskettes of data, and costs a great deal less than 35 diskette drives (which could hardly be connected at once in any event).

Computer data must be "backed up," however, and with a ProFile this involves 35 separate copying operations onto floppy diskettes—a tedious and time-consuming operation.

A bare-bones Apple III lists for $3,495. This includes 128K bytes of memory, a built-in floppy diskette drive and SOS operating system software. Add $320 for the Monitor III and $125 for Business Basic (as most do), and the price comes to $3,940.

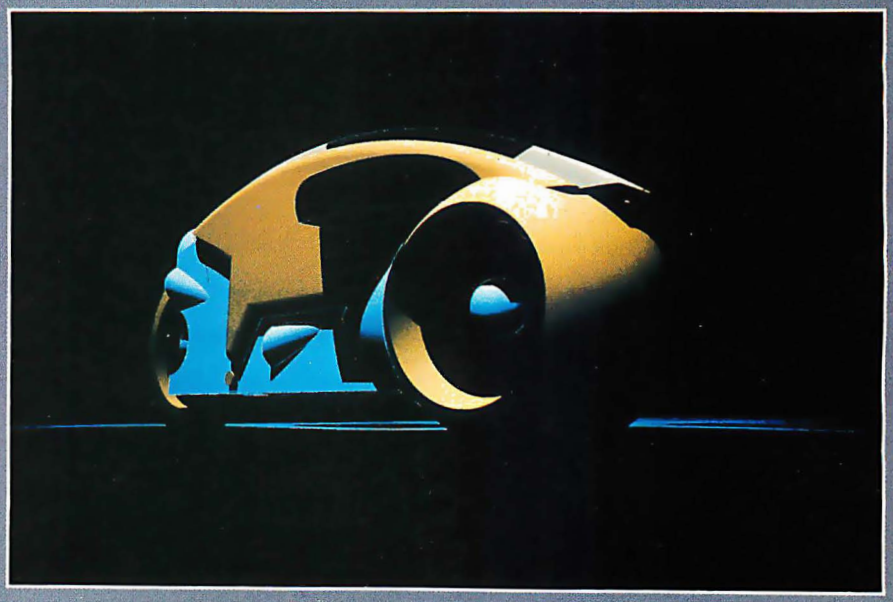
Lots of hardware upgrades are available from Apple. A second floppy diskette drive, termed the Disk III, costs $495. Alternately (or additionally), the 5M-byte ProFile disk drive is available for $3,499—just $4 more than the computer itself. The Silentype III thermal printer is $350, an additional 128K bytes of memory is $800.

Business Graphics III software lists for $175, and Pascal III for $250 plus an additional $75 for a diskette of Pascal Development Tools. The VisiCalc III spreadsheet analyzer is likely to be the best friend $250 can buy for this machine.□

TRON

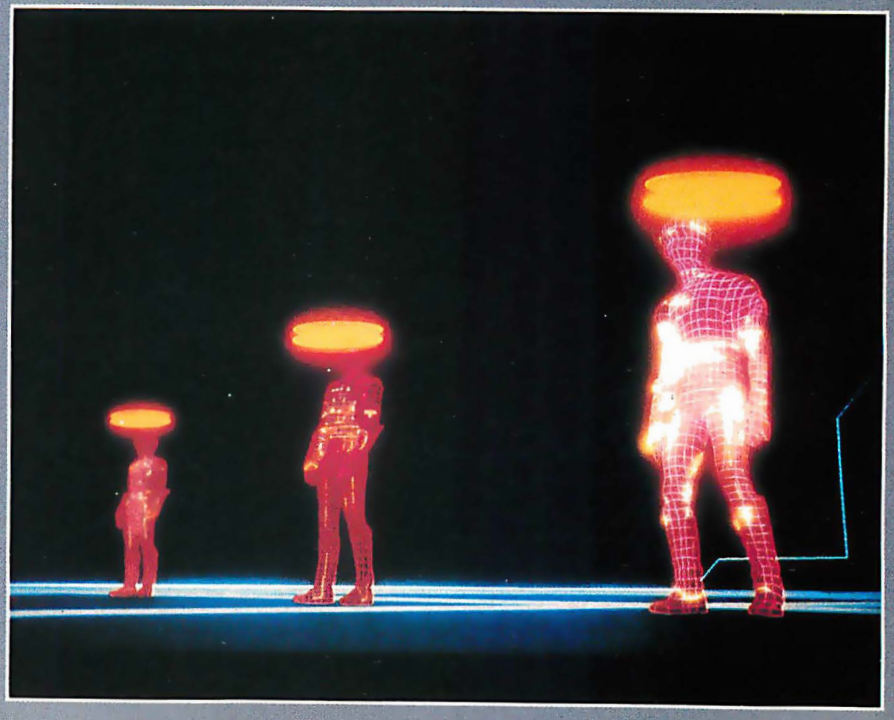
Computer Technology Goes Hollywood

by Jim Cavuoto

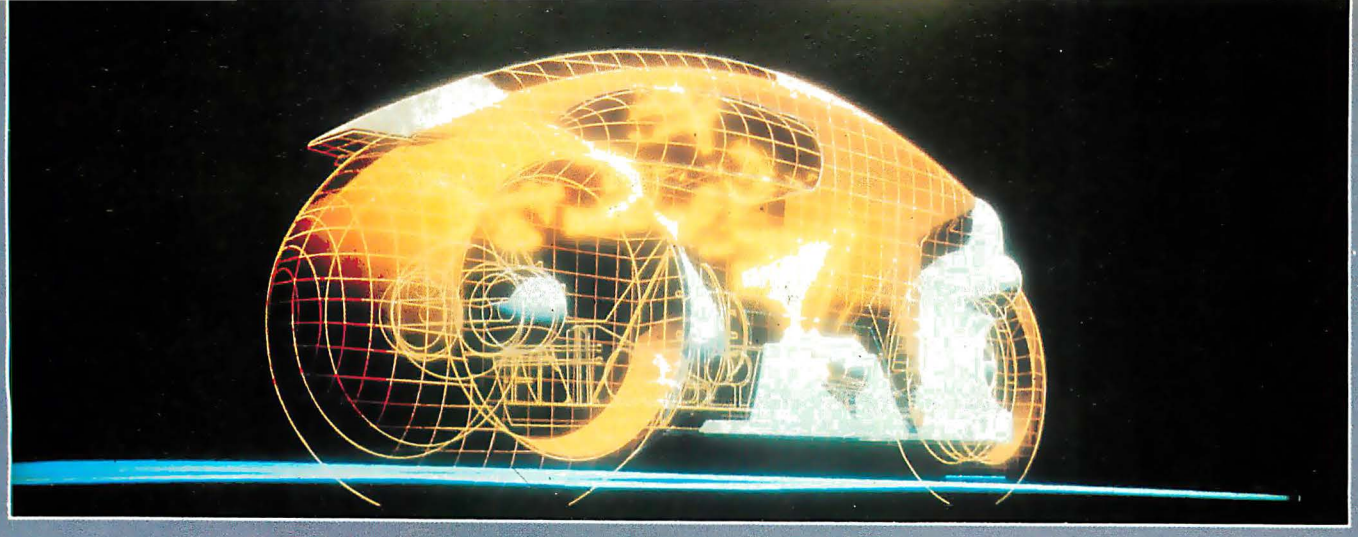


Imagine yourself in a world where software processes determine every aspect of your existence—what you think, where you go, whether you live or die. Imagine that each program in this computer world is the alter ego of some human programmer in another dimension. Imagine a world in which video games are live battles, where file manipulation is behavior control—where simulation is reality.

Some might argue that we are already approaching such a world. Computers are taking more and more functions away from human operators in the factory, in the marketplace and on the battlefield. It's becoming hard to tell where human supervision ceases and where computer control begins. But there's still room to fantasize about what really goes on inside the processor-minds of our computer colleagues. Can they outthink us? Do they ever wonder about us?



Walt Disney Productions, Burbank, CA, will give summer



movie audiences the chance to ponder these questions when a futuristic adventure film, *Tron*, is released next month. *Tron* portrays computers in two domains: in a large communications company in the real world and in a micro-civilization existing within the electronic circuitry of a computer.

Even more significant than the subject matter is the computer technology used in producing the film. The animation and computer-generated scenery for the film are the most advanced ever used in a commercial motion picture. Live actors are merged with computer graphics in a technique being touted by Disney as a milestone in optical and light effects. The film has been in post-production special effects processing for over a year.

The company responsible for producing the majority of the computer animation is Information International Inc. (I.I.I.), Culver City, CA. I.I.I. has been involved with digital simulation for motion pictures for several years, having recorded major scenes in such feature films as *Futureworld*, and it has a $3 million facility devoted to scene simulation technology.

Richard Taylor, director of the company's digital scene simulation division, oversees the design and programming of computer animation in *Tron*. "The film will make computer simulation a household word," he says enthusiastically. "The animation is hypnotic. It has a perfectness that communicates subliminally to the audience." Before joining this firm, Taylor was creative director for Robert Abel and Associates, where he won four Clio awards for excellence in television commercial production.

The film's director is Steven Lisberger, who is making his debut as a live-action director. The idea for *Tron* came from his fascination with video games. The film stars Jeff Bridges, David Warner, Bruce Boxleitner and Cindy Morgan.

The story begins when a young computer expert and video arcade athlete decides to take on a large computer corporation he suspects of software piracy. A menacing control program gets in his way, however, and he finds himself in an electronic domain in which he must fight battles on a brutal video game grid.

It is in this surrealistic computer dimension that the digital scene simulation really shines. One third of the backgrounds are computer-generated, requiring that each artificial landscape be properly joined with the live-action frames. "The entire film uses backlighting, not reflected light," explained Taylor. "As a result, each character is made out of pure light." Multiple camera passes, anywhere from 12 to 20, are made to create a high-contrast image. Color gels are used in a process Taylor likens to "painting by number." Between 5 million and 75 million calculations are required to create one frame of animation. It can take from 15 minutes to an hour to create a frame. Considering that 1,240 frames make up one minute of film, this gives some idea about the complexity of the task.

I.I.I. has developed a four-stage process for developing simulation scenes for films and television commercials. The first stage is design, which involves coming up with an idea and creating a story-board. The next phase is data entry, which can be done in one of three ways. The most prevalent is encoding by hand, whereby the designer generates two orthogonal views of a scene, then uses three cursors to encode points in three-dimensional space. A second method, used for well-behaved geometric shapes, is algorithmic, or mathematical description. The third technique is picture scanning, which is used to add texture to three-dimensional surfaces.

After all the data describing a scene has been entered into the computer, I.I.I. uses its proprietary Director's Language to further specify the image. Size, color, orientation, lighting, reflections and textures can be easily manipulated with this interactive language. All the scene characteristics a studio production company would normally use on a set are accessible with Director's Language. The fourth and final stage of the simulation process is filming, which uses a high-resolution electronic imaging camera in conjunction with a precision graphics recorder.

The main computer used is a Foonley F-1, which Taylor describes as a "souped-up" PDP-10. An auxiliary high-speed, 36-bit computer with 512 bytes of memory available gives the system its high performance. This computer is 10 times faster than the PDP-10. Other hardware making up the image processing

system includes two programmable film readers, a 40-in. by 60-in. Taylos graphics tablet and various display monitors.

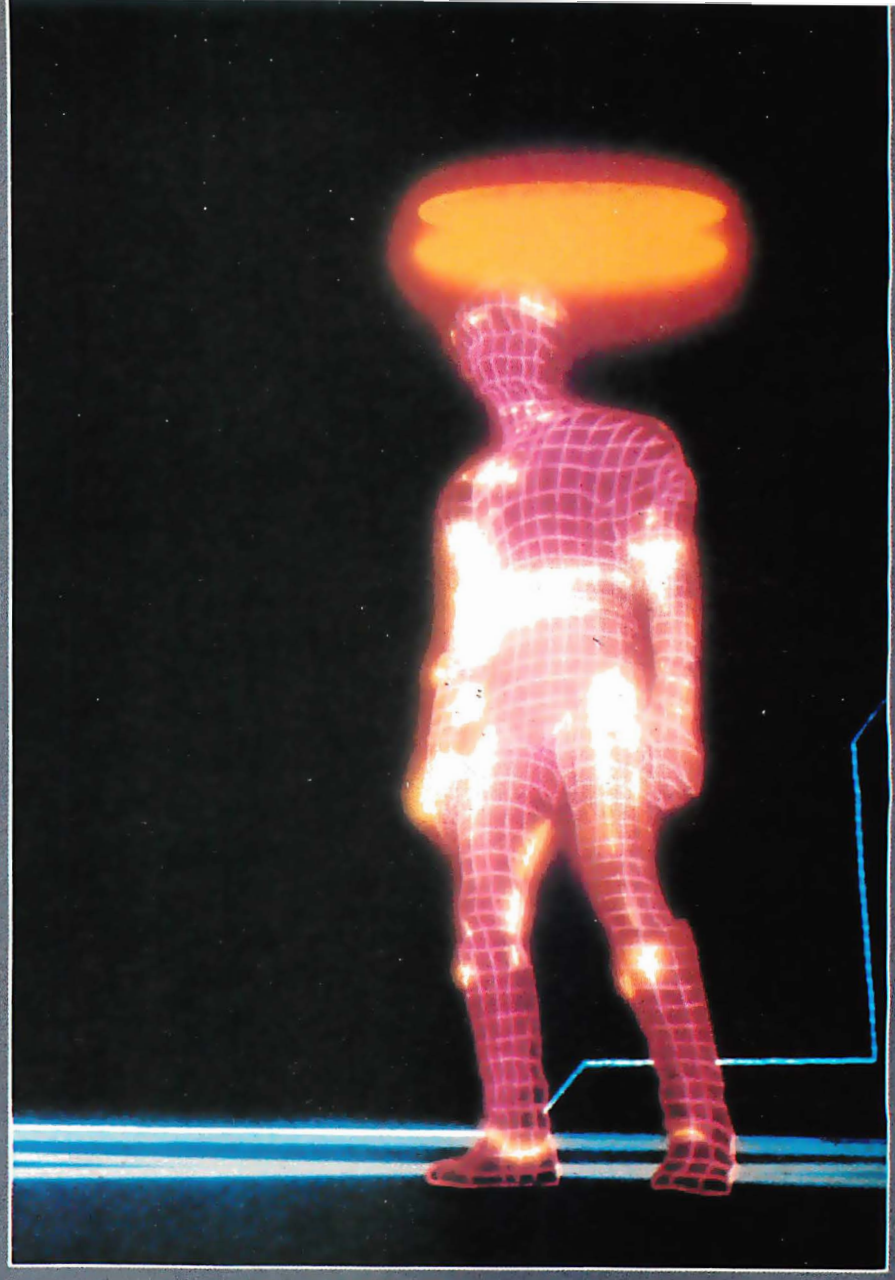
Magi, Inc., Elmsford, NY, which is assisting I.I.I. in the simulation for *Tron*, uses a Perkin Elmer 3240 computer with 2M bytes of memory and two 80M-byte disk drives. A Celco CFR 4000 computer generates Magi's pictures on a monitor.

Concerning the future of computer animation in the film industry, Taylor predicts further improvement of the man/machine interface to enhance a director's ability to control a scene. "Most simulation systems aren't sufficiently user-oriented at this time," he said. "There needs to be refinement of hands-on control of the computer."

He also foresees the need for increased computational abillty to get more realistic imagery and movement. One area that would benefit from greater processing speeds would be the simulation of the human form. At this point, stylized human beings can be created for medium or long shots, but a realistic close-up portrait of the human face—complete with hairs and pores—is beyond the power of computer simulation. Taylor feels it will be 10 years before this challenge is met.

Aside from the movie's superb graphics and special effects, *Tron* is likely to attract throngs of first-time and repeat viewers because of its subject matter—video games. Video arcade games took in about $5 billion in revenue last year, and their popularity is still growing. Ironically, the most successful video game, *Space Invaders*, grosses $600 million each year, three times the income of the most successful movie in history, *Star Wars*. That fact is obviously not lost on Bally Manufacturing, the natlon's largest video arcade game maker, who have introduced a *Tron* video game and will be placing the game in theaters showing the movie.

Meanwhile, Disney accountants will undoubtedly be scrutinizing boxoffice returns, in the hope that computer technology will emerge as the next science fiction formula to challenge the astronomical *Star Wars* grosses. □



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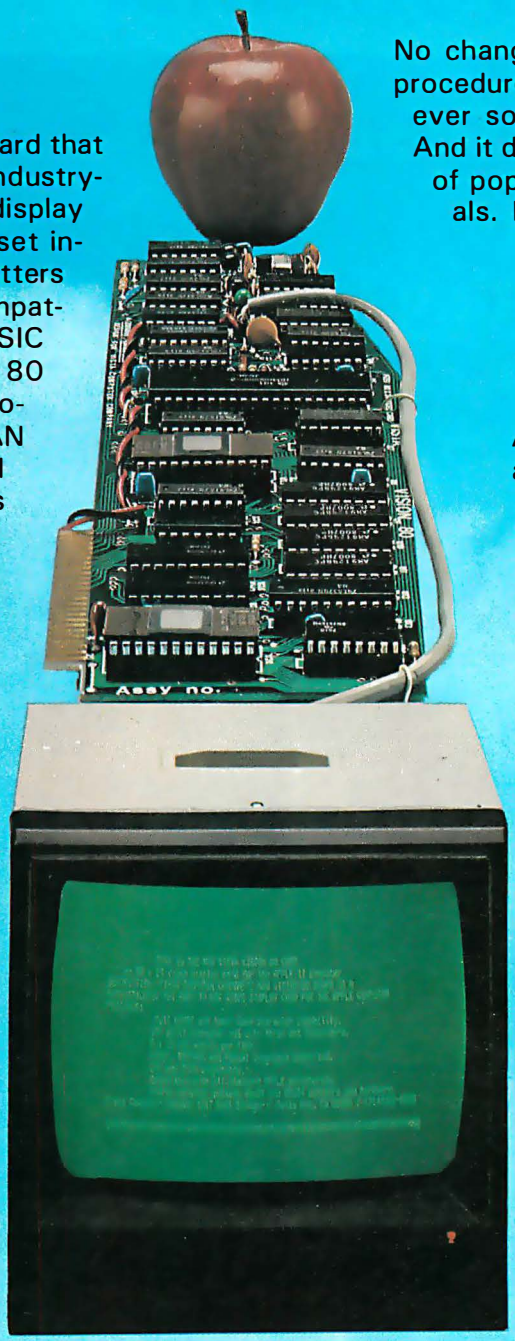

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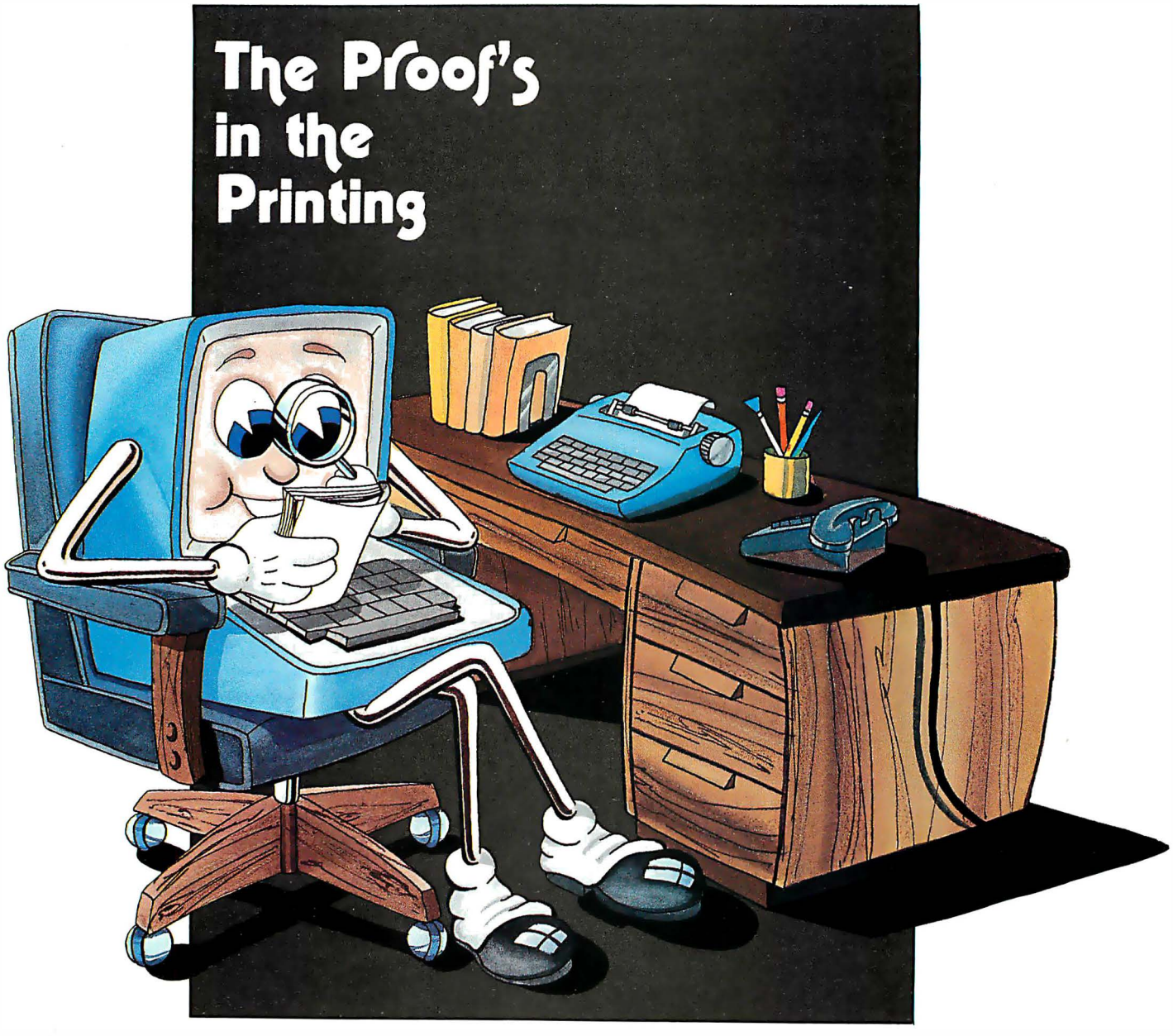
SPELLING PROGRAMS:



by Dona Z. Meilach

You've just finished composing a document. It's been proofread, printed and set aside. An hour later, you reread it and discover two typos and a possible misspelled word, despite the number of times you checked it. Wouldn't it be great if a process existed to make every finished piece perfect before it's finalized? What if misspelled words could be instantly corrected via computer technology?

Recently, several proofreading programs have appeared on the market. While it's not yet advisable to throw your dictionary away, these programs *do* catch many mistakes that might otherwise slip by.

We recently checked 10 widely advertised programs guaranteed to banish spelling woes. Only seven are detailed in the accompanying charts; three weren't included for varying reasons.

SpellStar Version 1.0 (Micropro, San Rafael, CA) had a hangup at the 9,000th word of its 20,000-word dictionary. A telephone consultation with the company indicated a problem with this new offering that is expected to be corrected soon. We know of other users who had success with SpellStar, but we were unable to document it for this survey and plan to present it at a later date.

Hexspell (Hexagon Systems, Vancouver, BC, Canada) provided a version that could not deal with capital letters, which were all we had on the TRS-80 test unit. The system ignored all upper case letters to "save unnecessary word checks, such as names addresses, etc." This also meant it ignored the first word of every sentence. We felt this was an unnecessary limitation that none of the other programs had, so we chose to delete it from the testing. An updated version did not arrive by our press deadline.

Miz'Spell (Programs Unlimited, Jericho, NY) required configuring data that was not clearly understandable in our manuals. A call to both Zobex (the computer) and Zenith (the terminal) did not reveal the required figures. An inquiry to the software company went unanswered. The configuration requests on the terminal were a surprise, resulting in 3½ wasted hours, and considerable frustration. The ad states, "Miz'Spell *permits* user configuration, including specification of default extensions for original and correct text file." "Permits," made to sound like an advantage, was a dismal drawback. The ad also maintains that it will work with words of any length, but the manual states that it is slow with two- or three-letter words and suggests that the user work with words of four or more letters. The program doesn't seem to be worth its $49.95 low price.

It did make us aware that when programs need to be installed with data that most new users will not be able to find, the program is a failure before it begins. It also pointed out the importance of understanding the features of a program to evaluate advertising claims.

Generally, the seven reviewed programs are clever—even brilliant. But they are *not* a substitute for proofreading and knowing how to spell. None of

the systems can *guess* what you mean. If you mistyped the word sin as sign, sine or sing, it would not flag it as a wrong word because all the "typos" are valid words. However if you needed to know both ways to spell sine or sign, some systems would help, and save you the trouble of thumbing through a dictionary.

Manuals and/or on-screen examples ran the gamut from quite good to near-impossible. All had some difficult or ambiguous areas, or sections where directives were not covered. We have indicated them in degrees of "Adequate + or –." Only Spellguard had the foresight to include an index at the back of the manual for an easy reference and a summary of the procedure in the *front* of the book where it could be readily located. The index would have been a substantial help for wading through the wordy Microproof manual.

Several of the programs provide on-screen test documents that lead you through the procedures with an accompanying explanation in the manual. Be prepared to spend a minimum of two to three hours familiarizing yourself with a program.

It is hard to appreciate what happens with a program unless you work with it using your own files. But knowing the existing features in advance can help to evaluate their effectiveness. You may like to use all the features of an involved program for long documents, while a simpler system may be a time saver for short business letters. Ideally, one might own two programs to use for different documents...and to proofread one against all others. Some programs will do more than you want—taking excessive time—if you can't elect to bypass procedures. More is not necessarily better.

Comparing programs for accuracy is difficult because they work differently. We subjected each program to identical manuscripts, and incorrectly spelled words were usually listed as suspect, though not necessarily all of them. Many correct words were suspect. Why? The systems dealt differently with hyphenated words, plurals, abbreviated street names, and numerals such as 3rd and 5th. One system that lists words ending in "ed" missed the typo "guaranteeds." It didn't go far enough to find the s. Another program found it without any problem but missed something else.

Generally, the programs caught words we had missed completely—those we overlooked or did not know how to spell. They can catch other nuances, too. We ran a manuscript through one program with the name of Mr. Minamizawa. When the error listing appeared, I discovered I had spelled his name three different ways.

If you're not sure of rules regarding the use of ly, ed, ies or when to drop the e, the spelling programs providing look-up help can save you time and frustration.

The trade-off is that the more dictionary there is to read against, the longer it will take for a document to be proofed. We used the first 325 words of this manuscript with 10 words purposely misspelled and ran the sample through the seven programs. The results are displayed in chart 1. Bear in mind the difference between the TRS-80 5¼-in. disks and the 8-in. CP/M systems.

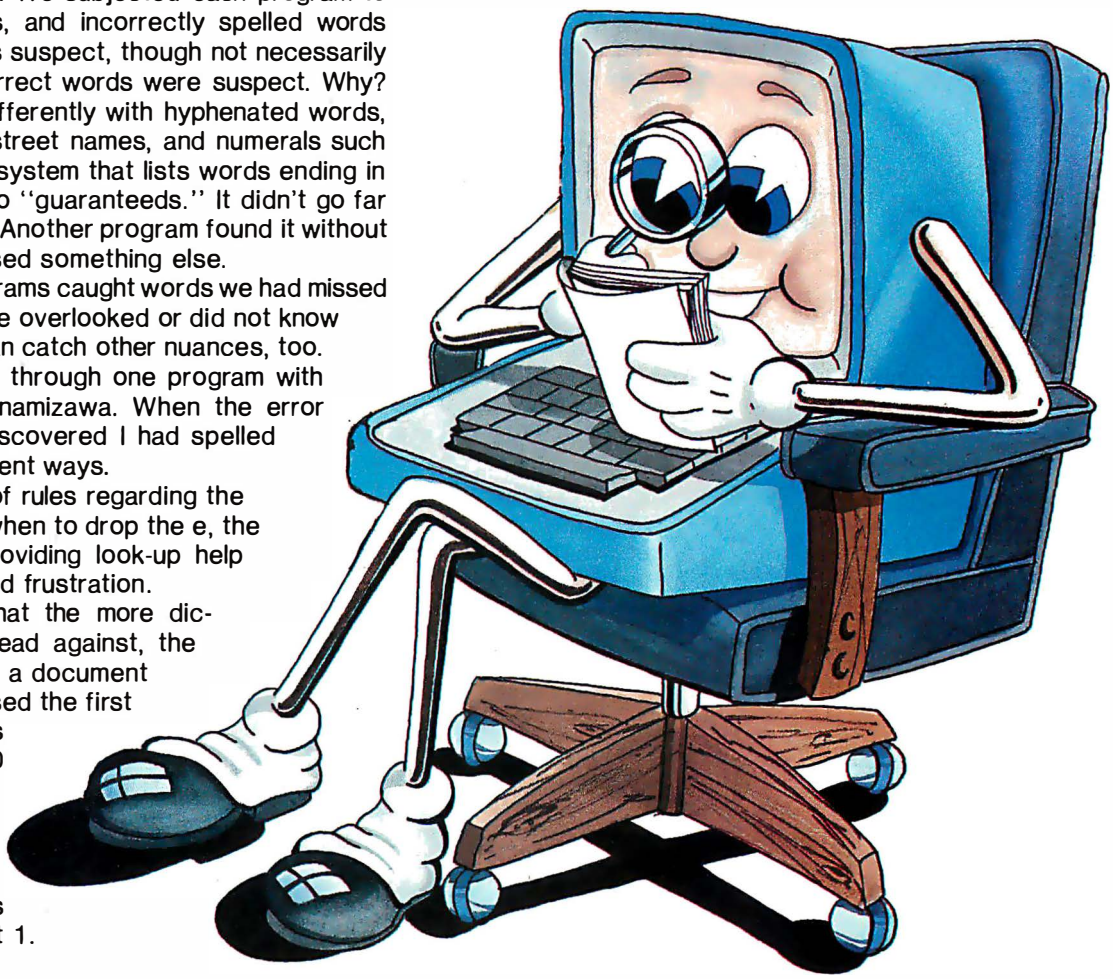
Note that speed refers to the time needed to read the document only, not to correct it. Different types of systems require different procedures; comparing one against another, timewise, is like comparing oranges and potatoes. Disk swapping, finding and replacing time will depend on the user. MicroSpell's reading and correcting can be simultaneous, so timing it against the others is an unfair comparison. The Word was the slowest for straight proofreading, then reviewing, then marking and correcting, but its other features and low price make it attractive.

The longer the document, the longer it will take for a reading. But short documents will not necessarily require too much less time. Why? Because all words must be read against the entire dictionary. The minimum time for reading through the dictionary will always remain the same regardless of document length.

Essentially, most systems provide a dictionary ranging from 10,000 to 50,000 frequently-used words. The program reads a document and rearranges the words so it can match them to its dictionary. Any words in the document that do not match the dictionary are suspect. They may not all be misspelled; some may be technical words, abbreviations, proper names, street names. These will appear and need to be dealt with.

Generally, your decisions involve the following (though the wordings and potential directives vary) correct the word; mark it; ignore it; add it to a dictionary; help; exit to system.

Additionally, some will allow you to: preview the list on the screen or printer; look up the possibilities for



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the correct spelling of a word; see the word in context; have a total word count; check word frequency (often referred to as "unique words"). This indicates how many different words you used in the entire manuscript and reveals the extent of your vocabulary.

Also some systems will allow you to print the error word list as hard copy and/or list it on the screen.

Proofreader and The Word have modular procedures, permitting you to select specific actions such as Word Count or Word Frequency independently of proofreading so you don't have to go through every feature every time.

Defining "usability" for the individual depends on preferences for how a correction happens. We divided the systems into two types—A and M; each with advantages and disadvantages. Type A automatically inserts the correctly typed word into the document in a two-step procedure: 1) proofing; 2) reviewing and correcting simultaneously. Type M marks the incorrect word in the document—a four-step procedure that involves: 1) proofing; 2) reviewing; 3) marking the words in the document; 4) reentering the document and correcting it manually or with the Search-and-Correct facility.

Let's look at the mechanics of using these two types of spelling systems, assuming you are using two disk drives, I and II. Consider type A first. Your word processor is in drive I. Your document is in drive II. The spelling system may or may not (depending on size) reside on the disk with your word processor. (Some may be invoked through the word processor.) You usually remove the word processor in drive I and replace it with the spelling program, write the document filename with the necessary program prompt, and wait while it is proofread.

When proofing is completed, the check list appears, and you deal with the words via the choices presented. The wrong word is typed correctly and the correct word automatically replaces the incorrect word. All other choices are executed as the words are listed. When you complete the proofing and return to the document, the correct words are in place. You may have to reformat to compensate for different word lengths.

Check list provides choices

Now consider type M. As above, your word processor is in drive I, your document in drive II. You remove the word processor and replace it with the spelling system in Drive 1, write the document file name with the necessary prompt, and wait while it is proofread.

When proofing is completed, the check list appears and you deal with the words via the choices presented. Instead of typing the corrected word, you indicate that it is to be marked in the text.

When you complete the choice selection, you swap the spelling disk with your word processor, return to the text and execute a global search for the marking symbol, then proceed to correct each word.

With the difference between A and M clarified, another aspect should be noted. With Type A, you consider each word individually, correct it and are through with it. With Type M, you consider each word, then deal with it. When it is completed, you return to the document and deal with the words again. In both systems, if margins change because of a corrected word, you must reformat.

The dictionaries provide lists of the most commonly used root words with some words constructed from prefixes and suffixes. MicroSpell stores extra dictionaries on a second disk so you may use them to check special vocabularies and words with variations on the root word. For example, it would recognize words with "re" prefixes such as reedit and reunite, while another dictionary might list them as suspect words.

MicroSpell emphasizes these additional dictionaries and a feature that helps you correctly spell words with ed, ing, ment, and other suffixes formed onto root words. Spellguard rejects this as a negative feature and states in its manual: "The Spellguard dictionary includes only actual words. It does not allow nonsense words that are sometimes formed when word endings (i.e. ed, ing) are haphazardly added to root words.

We divided the systems into two types —A and M; each with advantges and disadvantages

With some systems you can examine a dictionary by listing it via the CP/M TYPE command or through your word processor, but others are inaccessible.

All have the ability to add words to an existing dictionary or create new dictionaries. When frequently used words are added to a dictionary, less suspect words will be found during proofreading. Your name and address, for example, might be placed in a dictionary so it doesn't repeat as an error word. Abbreviations, special words or foreign language dictionaries can be established and checked against a document for proofing.

Using type M systems can be tedious in long documents. One alternative (if you elect not to add any of the suspect words to a dictionary) is to print out the error list. Then return to your word processor and use FIND AND REPLACE; type both the incorrect spelling and the correct spelling, especially if a mistyped word appears frequently. Once familiar with a system, you will develop your own routines.

The same procedure can be followed for type A. For example, if only one of two misspelled words appears in a suspect list, it's pointless to go through the entire spelling review.

Those that have review procedures of the complete word list can save you time because you dispose of many of the suspect words before you deal with them individually.

The Word gives you the greatest flexibility for reviewing a previous word. Spellguard and Superspell permit you to return to the previous word. But if you've let a misspelling slip past you on the others, you have to run the entire procedure again, or make a note of the wrong word and pick it up during find and replace. A second proofreading after correcting is recommended.

Viewing a word in its sentence context before you change it can be an advantage, particularly if you don't recognize your typos. Sometimes a mistyped word will suggest another word and you're not sure what you meant. Viewing it in context will clarify it for you

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immediately. The three type A programs have this capability; Microproof and MicroSpell let you decide when you want to see it in context. Proofreader runs the entire document, stops and questions the misspelled word, and asks you what to do with it.

Type M programs that mark the word show it in context before you make the correction. It's such a natural part of the system that as a feature it becomes a moot point.

The programs deal cleverly with capital letters: they usually replace anything that was upper case with another upper case. The Word and MicroSpell provide switches for flexibility in reading uppercase acronyms, for instance, so you can elect to avoid them as errors.

Hyphen handling varied, but all programs warned in advance of how they would be treated. Some reassembled the word; others read them as two words that would be considered errors to be dealt with and some ignored

You have to adjust to the system.

them. You have to adjust to the system. The same is true of apostrophe words and plural formations.

Unique Word Count is a feature that offers help for the writer concerned about word usage. It lists the number of different words appearing in a document. If, for example, a document contains 1,000 words but only 200 unique words, it can indicate a limited vocabulary. The same breakdown may be fine for a legal document.

The Word provides a count of the number of times each word is used; it is contained in a new file called document.freq, accessible with your word processor. It lists the words alphabetically and may print them out. Proofreader provides an interesting use of unique word counts but only with its optional Grammatik program. Spellguard and Superspell automatically tallied the unique word count, but there was no further action you could take to use it advantageously.

Whether or not these factors are important to you should be considered. Knowing how many mismatched words versus actual misspelled words can suggest the necessity of increasing a dictionary, or your own spelling ability. The Word can yield it quickly with its independent word count tool.

When spelling (as opposed to inaccurate typing) is not your strong point, consider seriously The Word and MicroSpell. You can request help from The Word when you think you need it. MicroSpell will give it to you automatically, and there were times when we were incredulous that our spelling was incorrect. We challenged Microproof's guess, but Webster agreed every time. And Microproof usually put the word in place in the document without our retyping it!

The ability to terminate a program anytime is an important feature. Imagine a document listing 30 mismatched words, but only one actually misspelled word. You won't want to deal with all the words, so you can terminate the questions and return to the document to correct only that word. For a quick reading/listing, we liked Microproof.

Following are some specific reactions that we had to each system.

Chextext, a type M system for the TRS-80, is simple, works relatively quickly, and has good prompts, so you never feel lost. But the manual lacks explicit information about what will happen on-screen. The company offers supplementary dictionaries of 20,000-plus words for 35-, 40- and 80-track single/double density disks and other configurations for only a $3 postage fee.

Microproof provides a direct, quick, no-frills, easy-to-learn- and teach type A program—but only with the correcting option. It lacks the overkill features of more involved programs, but simplicity gives it an edge. I found myself using this program to proofread documents after other programs finished. The ability to run the check through WordStar's R command and have the corrected word automatically appear in the document without disk swapping was a time and motion saver. And it's 50,000-word vocabulary caught many words that other systems missed.

The command MICPROOF doc.txt initiates a series of asterisks across the screen with sentences signaling that the document is being found, processed and read. The entire suspect word list appears first, then you may call up individual words. Five choices enable you to type the correct word and insert it into your document, ignore the word, see it in context and/or add the word to the dictionary, or exit the system. When you complete the review, any words you asked to see in context are displayed for further decisions. A word added to the dictionary may be coded as a noun, verb or other part of speech, though it is not necessary. When the word becomes part of the dictionary, it apparently picks up the necessary suffixes and prefixes. The final prompt tells you the document is being corrected.

Note that Standard Microproof alone is a type M that only finds errors which you must print off and correct with the word processor search and find procedure. Without the correcting option, the program loses its vitality and validity and is not worth the money. The printout was clumsy and slow, and included the directives and asterisks.

For convenience, you need Correcting Microproof but must realize it lacks the flexibility and variety of tools in other programs. Because it resides on the word processor disk, space limitations may require supplementary dictionaries on another disk. It works through WordStar and with a TRS-80 package, but requires an additional $35 patch for some word processing programs. Clarify and weigh your needs before considering.

MicroSpell is a type A program utilizing a different methodology than the other spelling programs in this review. Instead of arranging the document words alphabetically and comparing them to the dictionary, MicroSpell looks up words in the order in which they appear and subjects them to review in a split dictionary during a series of four passes.

MicroSpell will display words in context, and provides a list of guesses should you be unsure of the word you meant or its spelling. You can search the dictionary for words that match a misspelled word using wild-card characters.

Depending on your computer and disks, disk swapping is required. The program is supplied on two 8-in. single

density disks. Disk 1 requires 211K and contains the main dictionary of 21,000 word stems and the necessary program supports. Disk 2 contains files with rare vocabulary, extra vocabulary and words ending with ing and ed.

The potential of MicroSpell's versatility requires time to explore. Switches that activate customized features give it a phenomenal flexibility. It's a no-nonsense, full approach to spelling help. Its limitations are clearly outlined in the manual so that if one finds an extra S on a word or a missed word in the manuscript, the reasons are logical.

Proofreader by itself is a type M program, but when coupled with Proof-Edit, it changes to a type A for automatic correcting. With Grammatik (see article on page 112), it can find, evaluate and suggest revisions of potentially incorrect punctuation, trite phrases and incorrect word usage. The three programs together offer a dynamic tool for comprehensive editing beyond spelling corrections. It can begin where your college English teacher left off and help you analyze your documents in a way you may never have thought possible. (It even has a Sexist Dictionary included.)

Proofreader lets you look at every word in context before you deal with it, but does not provide spelling help the same way The Word and MicroSpell do. Instead, when you invoke Grammatik, it may question the use of a word or a string of words. In one manuscript, the following showed up:

-----as long as
* At sentence 17 -'W' Wordy phrase
* Suggestion: when, if

-----alas
* At sentence 58 -'A' -Archaic usage
* Suggestion: revise

Grammatik is the only program that yielded a breakdown of word usage in a sentence: average words per sentence; the number of words in the shortest and in the longest sentences; the number of questions, imperatives, prepositions and other summaries to aid in analyzing writing style.

Grammatik's word frequency program cleverly states which words are used how many times. Example:

*****1*****
addition, alas, become (each word used once)
*****2*****
remain, sink (each word used twice)

and so on down the list, analyzing one document to indicate that "the" was used 333 times.

Spellguard is a type M system that marks the last letter of each word you deem incorrectly spelled. But if you think a mismatched word is correctly spelled and doesn't match a word in the dictionary, it could conceivably remain misspelled. For example, the word "arrangment" came up as an error. Thinking it was correctly spelled, we ignored it. For a quick double-check, we ran the corrected Spellguard document through Microproof and "arrangment" reappeared. I had to consult the dictionary. Using arrangment as a test word, I subjected it to MicroSpell. Now I was presented with the correct spelling and, without even retyping it, the word was corrected directly in the document.

Spellguard has an easy-to-use 1-2-3 system for dealing with errors so you can position your fingers on the number pad of your terminal as you determine your actions. If you are too hasty, you can reverse and review the previous word. It is the only program that allows you to call up your directory should you forget the file name.

Spellguard tallies a word count, unique word count and number and percent of words mismatched. Specialized dictionaries are easy to compile, combine and subtract one from another. The new version also makes it simpler to delete words from a dictionary than in previous versions.

Superspell is not an individual proofreading system to be used in conjunction with other word processors. It is a component, combined into the Select Word Processing package and conveniently cross-referenced through it. It appears to work the same as Spellguard, but has only a 10,000-word basic dictionary. We were unable to fully test its speed because it necessitated learning the commands for another word processor.

The training manual and teach disk were the most impressive of all the systems. It could be given to a new computer-user and within two hours, he or she could conceivably be typing and proofing letters.

The Word has many advantages, one of which is the lookup help it provides for those who are unsure of spelling. More esoteric words may or may not be in its 45,000-word dictionary, which does have some common proper names and street names. With Lookup, you may ask for a short or a long search. A long search for each word would probably require more time than it would take to consult a dictionary. There is also a Homonym

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help and a Find help for errors that most often cause words to be misspelled, but not for all words. The Find feature can be used for puzzle buffs and poets. These helpful bonus functions make it worth its price and on a par with other more expensive systems.

The Word refers to its features as tools that may be used independently or together.

The program works by invoking SPELL (filename) with an assortment of switches that send the suspect words to a variety of places; printer, terminal, error word file, ignore uppercase letters, etc. As the word list is compiled, the number of unique words and the number of unmatched words will also list.

Next you invoke REVIEW and deal with the words, indicating which should be sent to a misspelled word listing, a dictionary or discarded. After REVIEW, you may choose to LOOKUP or FIND corrections for suspect words. Then, you call up MARK: a plus sign (or other symbol you may select) will be placed in front of each error word.

Finally, you swap The Word with your word processor and find the + for a search-and-correct procedure.

A program that was provided so that SPELL, REVIEW and MARK could be accomplished in one key stroke wouldn't work. A call to the author informed us that a typo existed in the manual. This problem, coupled with its relatively slow read time, earned a minus point for the system.

How do they compare?

The CP/M programs tested were accomplished using WordStar in a 64K Zobex computer with 8-in. single density disks in a double drive system. TRS-80 model I with Electric Pencil with 5¼-in. disks in a double disk drive was used for Chextext, and the TRS-80 versions of Microproof and Proofreader.

For TRS-80 users, the Proofreader package would win for versatility and Chextext or Microproof for fast handling.

For CP/M users, The Word, for a type M, when all systems work, is the best buy, keeping in mind that it proofs rather slowly, but faster than Proofreader. If price is no object, MicroSpell is the best tool for spelling help in a type A system. Spellguard is fast with easy-to-use prompts, but misspellings could easily slip by. However, its facility with dictionary maintenance makes it attractive, along with its logical-to-use manual.

Superspell could be a good buy if you're looking for a total package with word processing, spelling and mail merge. Time and inclination would not allow us to do more than go through the excellent teach/train manual and disk, which is part of the package. It is also available for TRS-80 II and Apple II.

All of the programs are usable. We think MicroSpell for long documents, in conjunction with Microproof for short pieces, would be the closest to perfection one could get because of automatic replacement and spelling help features.

It should be pointed out that the programs surveyed are updated constantly, as are the word processors that they work with. Features and system requirements should be reviewed before purchasing. Also, system performance as described here may vary with individual computers. □

Charts follow

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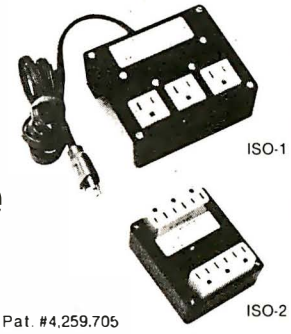
PRINTER INTERACTION?
MEMORY LOSS?
ERRATIC OPERATION?

Don't Blame The Software!



Power Line Spikes, Surges & Hash could be the culprit! Pat. #4,259,705
Floppies, printers, memory & processor often interact! Our patented ISOLATORS eliminate equipment interaction AND curb damaging Power Line Spikes, Surges and Hash. Guaranteed!

- ISOLATOR (ISO-1) 3 filter isolated 3-prong sockets; integral Surge/Spike Suppression; 1875 W Maximum load, 1 KW load any socket $69.95
- ISOLATOR (ISO-2) 2 filter isolated 3-prong socket banks; (6 sockets total); integral Spike/Surge Suppression; 1875 W Max load, 1 KW either bank $69.95
- SUPER ISOLATOR (ISO-3) similar to ISO-1 except double isolation & Suppression $104.95
- SUPER ISOLATOR (ISO-11) similar to ISO-2 except double isolation & Suppression $104.95
- MAGNUM ISOLATOR (ISO-17) 4 Quad Isolated sockets; For ULTRA-SENSITIVE Systems $181.95
- CIRCUIT BREAKER, any model (Add-CB) ..... Add $9.00
- CKT BRKR/SWITCH/PILOT (-CBS) ..... Add $17.00

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171 South Main Street, Natick, Mass. 01760
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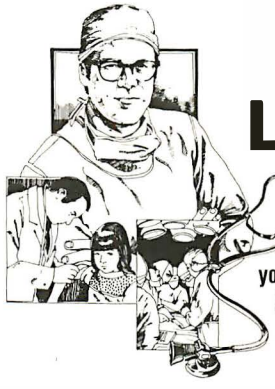
CIRCLE INQUIRY NO. 36



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*THE AUTOMATED MEDICAL ADMINISTRATOR

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AMA Claim Forms
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...and others

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Annual Practice Summary
Annual Account Report
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Printer "Spooling"
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Medical and Dental Systems for the Apple™ computer and soon the IBM™ and TRS-80™ computers.

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Palm Springs, CA 92262-6914
(714) 365-6770

CIRCLE INQUIRY NO. 12

Chart 1. Spelling Programs (primary specifications)

System	Chextext	Microproof (correcting)	MicroSpell
Author	Not documented	Philip Manfield	Bob Lucas
Distributor	Apparat 4401 S. Tamarack Pkwy. Denver, CO 80237 (800) 525-7674 (303) 741-1778	Cornucopia Software PO Box 502B Walnut Creek, CA 94596 (415) 524-8098	Lifeboat Assoc. 1651 Third Ave. New York, NY 10028 (212) 860-0300
Price	$59.95	TRS-80 I or III Standard $89.50 CP/M or TRS-80 II Standard $149.50 Correcting option $60 Patches $35 (see key)	$249
Version	not given	not given	4.3
Minimum System required and/or formats available	TRS-80 I and III. Two-35 track drives minimum with 32K RAM. Requires 2 disks: one for programs one for dictionary.	Z80 CPU with 86K bytes memory. One 5¼-in. or 8-in. disk drive. TRSDOS for TRS-80 I. Apple Osborne	48K CP/M 1.4 or 2.2. 8080, 8085 or Z80 CPU. One disk drive with 150K bytes minimum. If only one drive, need disk with 200K bytes. TRS-80 II avail. (not tested).
For use with word processors	Scripsit Electric Pencil	Any CP/M based system. Patch needed for all but WordStar. Corrective feature and conversion patches needed for TRS-80 I, Electric Pencil and Lazy Writer.	Variety of CP/M systems
Documentation manual-rating description	Adequate –. 12 pages in 3-ring binder. Minimal help.	Adequate – easy to use. Some on-screen symbols unexplained. 33 pages stapled.	Adequate +. 36 pages plus new documentation for version 4.4 in ring binder.
On-screen help?	None	Yes. Document with explanation in manual.	Yes (demo. txt)
Installation required?	No (Electric Pencil) Yes (Scripsit modification)	Yes for word processing other than WordStar	Yes
***Accuracy:** **# errors found** **# suspect words**	TRS-80 10 34	TRS-80 CP/M 10 10 18 15	CP/M 10 19
****Speed-reading**	1 min., 48 sec.	1 min., 25 sec. 35 sec.	1 min., 30 sec. includes read and corrections

*Using first 325 words in this article, including names and address with 10 misspelled words purposely planted.

**Refers to reading only same 325-word article. Does not include any correcting in A systems (except MicroSpell) or any disk swapping or marking in M systems. Swapping time and correcting time would depend on system, word processor and user. Approximate range is 2.25 to 4 minutes for M systems. Microproof (A) system required 35 seconds for CP/M, two minutes for TRS-80.

Chart 2. Spelling Programs (additional features)

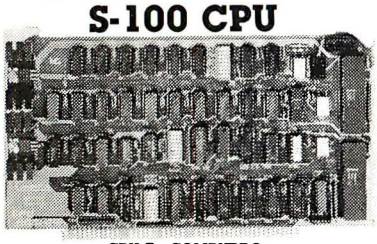
System	Chextext	Microproof (correcting)	MicroSpell
Type **A—automatically corrects word** **M—marks word in file. You correct later.**	Type M—replaces last character in marked word with a #.	Type M—standard Type A—with correcting feature.	Type A—automatically corrects words in document. Type M—option may be invoked with switch.
Size of dictionary descriptions	10,000 word basic version. 20,000 word versions for other tracks/densities. For postage charge only.	50,000 words Type not documented	20,000 literal words in main dictionary. Plus 5,000 additional with suffixes, prefixes. Two disks provided.
Add-to capability? (up to no. words)	Yes to 250 words	Yes (up to disk storage or add disks).	Yes. Can add disks with more dictionary.
Deletion capability?	Yes	Yes	Yes
Full screen list of errors?	Yes	Yes	No
Print out hard-copy?	No	Yes, but clumsy.	Yes
Can you go back one or more words to recheck?	No	No	No
View word in line of context?	No	Yes—your choice.	Yes
Count of unique words?	No	No	No
Count of word frequency?	No	No	No
Count of misspelled words?	Yes	No	No
Total word count?	No	No	Yes—end of document.
Gives spelling help?	No	No	Yes (also guess word intended)
Gives look up help?	No	No	Yes
Interrupt—can you exit at any time?	Yes	Yes	Yes

Proofreader	Spellguard	Superspell	The Word
not documented	Dennis Coleman	Selectmaster	Wayne Holder
Aspen Software Box 339 Tijeras, NM 87059 (505) 281-1634	Innovative Software Applications Box 2797 Menlo Park, CA 94025 (415) 326-0805	Select Information Systems 919 Sir Francis Drake Blvd. Kentfield, CA 94904 (415) 459-4003	Oasis Systems 2765 Reynard Way San Diego, CA 92103 (714) 291-9489
TRS I/III II CP/M Proofreader $54 $119 $129 Proof-Edit $30 incl. incl. Grammatik $59 $99 $149	$295 Incl. manual. Manual alone, $35.	$595	$75
2.2 CP/M	2.0	1.07	2.0
TRS-80 I/III—Proofreader only requires 32K, one disk drive. Model II—64K one disk. Another disk needed for Proof-Edit and Grammatik. Requires two drives, CP/M 8-in. single density, one disk	32K CP/M 1.4 or later or CDOS; 8080/8085 or Z80 CPU with 32K bytes. One or two disk drives. Single density 8-in. and 5¼-in. double and quad density.	2 disk drives. 48K CP/M 1.4 or 2.2. 80 char horiz. display screen. TRS-80 II Apple II	CP/M 1.4 or later. 8080/85 or Z80 CPU with 32K bytes memory, one or two disk drives. 5¼-In. or 8-in. single density.
Soft-Text, Electric Pencil, Scripsit All CP/M word processors	All CP/M-compatible word processors; WordStar, WordMaster, Magic Wand, Electric Pencil, Ed, etc.	Select Word Processing with Superspell	Any CP/M word processor
Adequate +. TRS-80: one separate 5½-in. by by 8½-in. printed booklet/ program. CP/M 16-page 8 by 10 stapled combines Proofreader & Proof-Edit Yes: TRS-80 demo. text. No: CP/M	Adequate +. 116-page bound manual. Yes. Test document	Adequate + +. 65-page looseleaf manual with index in binder. Excellent documentation when used with on screen Teach-disk. Practice and teach documentation for Word processor/Superspeil/Mailmerge in one package.	Adequate –. 42-page stapled Bad typo made one program unusable. No
Yes	No	Yes	No
TRS-80 CP/M 10 10 21 21	CP/M 10 19	Could not test, as system did not prompt through WordStar. Program appears to be similar to Spellguard.	CP/M 10 19
3 min., 15 sec. 2 min., 40 sec.	38 seconds		1 min., 3 sec.

Proofreader	Spellguard	Superspell	The Word
Proofreader—Type M places # at end of word Proof-Edit alters system to Type A, but provides option to correct or mark.	Type M—replaces last letter of error word.	Type M—marks last letter of error word with #.	Type M—marks a * sign in front of the error word.
38,000 compiled words	20,000 compiled words	10,000 compiled words	45,000 compiled unalterable but can add more dictionaries.
Yes in auxiliary files as update dictionaries.	Yes (to disk capacity and auxiliary disks).	Yes (to disk capacity or auxiliary disks).	Yes (to disk capacity and auxiliary disks).
Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes
No	Yes—one word	Yes—one word only.	Yes—many words.
Yes	No	No	No
Yes	Yes	Yes	Yes
No (Proofreader) Yes (Grammatik)	Yes	Yes	Yes
Yes (Grammatik)	Yes	No	Yes
Yes	Yes	Yes	Yes
No	No	No	Yes
No	No	No	Yes
Yes	Yes	Yes	Yes

PRIORITY ONE ELECTRONICS

S-100 CPU



CPU-Z - COMPUPRO

2/4 MHZ Z80 CPU 24 Bit Addressing

WOW!

PART NO.	DESCRIPTION	LIST PRICE	OUR PRICE
IEGBT 160A	A & T	$295.00	$199.00
IEGBT 160C	CSC 3-6 MHZ	$395.00	$375.00

DUAL PROCESSOR 8085-8088 - COMPUPRO

6 or 8 MZ Provides true 16 Bit Power with a standard 8 bit S-100 bus.

IEGBT 1612A	A & T	6 MHZ	$425.00	$399.00
IEGBT 1612C	CSC	6/8 MHZ	$525.00	$498.00

SOLID STATE DISK DRIVE, 3500% FASTER!

Not Really, But the Next Best Thing For Godbout 8085/88 Users. Call for Details on M-Drive. See Page 340 of November **BYTE**

IE GBT MD 128K	$1,550.00
IEGBT MD 256K	$3,000.00

2810 Z80 CPU-CA. COMP. SYST.

2/4 MHZ Z80A CPU with RS232C Serial I/O Port complete with Monitor PROM for 2422 Disk Controller

IECCS 2810A	A & T	$350.00	$280.00

CB2 Z80 CPU - S.S.M.

2/4 MHZ will accept 2716, or 2732, or RAM RUN/STOP and single step switches

IESSMCB2K	Kit		$260.00
IESSMCB2A	A & T	$344.00	$310.00
IESSMZ80M	SSMZ80 Monitor		$69.00

CBIA 8080 CPU - S.S.M.

8080 CPU, 1K RAM, Holds 1 2708, 1 Bit parallel input port.

IESSMCB1K	Kit		$183.00
IESSMCB1A	A & T	$252.00	$225.00
IESSMB080M	SM 8080 Monitor		$59.00

S-100 I/O BOARDS

SYSTEM SUPPORT 1 - COMPUPRO

Serial port (software prog baud), 4K EPROM OR RAM provision, 15 levels of interrupt, real time clock, optional math processor

PART NO.	DESCRIPTION	LIST PRICE	OUR PRICE
IEGBTI62A	Assembled & Tested	$399.00	$380.00
IEGBTI62C	CSC	$495.00	$480.00
IEGBT8231	Math Chip		$195.00
IEGBT8232	Math Chip		$195.00
IEGBTI62AMI	A&T with 8231 Math Chip		$555.00
IEGBTI62CMI	CSC with 8231 Math Chip		$855.00
IEGBTI62AM2	A&T with 8232 Math Chip		$555.00
IEGBTI62CM2	CSC with 8232 Math Chip		$655.00

MPX CHANNEL BOARD - COMPUPRO

I/O Multiplexer, using 8085A-2 CPU on board

	With 4K RAM		
IEGBTI66A4	A & T	$495.00	$445.00
IEGBTI66C4	CSC	$595.00	$535.00
	With 16K RAM		
IEGBTI66A16	A & T	$649.00	$585.00
IEGBTI66C16	CSC	$749.00	$675.00

INTERFACER I - COMPUPRO

Two Serial I/O

IEGBTI33A	A & T	$249.00	$219.00
IEGBTI33C	CSC	$324.00	$298.00

INTERFACER II - COMPUPRO

Three parallel, one serial I/O board

IEGBTI50A	A & T	$249.00	$219.00
IEGBTI50C	CSC	$324.00	$289.00

INTERFACER III - COMPUPRO

Eight channel multi-use serial I/O board

IEGBTI748A	A & T	$699.00	$629.00
IEGBTI748C	CSC 200 hr. Burn In	$849.00	$750.00

INTERFACER 3 WITH 5 SERIAL PORTS

IEGBTI745A	A & T	$599.00	$559.00
IEGBTI745C	CSC 200 hr. Burn In	$699.00	$629.00

MULTI I/O - MORROW DESIGNS

Three Serial, Two parallel

IEMDSM83200	A & T	$359.00	$329.00

SWITCHBOARD - MORROW DESIGNS

Two serial I/O, four parallel I/O, one status port, one strobe port

IEMDSS82411		$299.00	$269.00

I/O4 - SSM

Two serial I/O, two parallel I/O

IESSMI04K	Kit		$210.00
IESSMI04A	A & T	$290.00	$260.00

I/O 5 - SSM

2 Serial, 3 Parallel including 1 Centronics

IESSMI05I	A & T	$329.00	$309.00

I/O 8 - SSM

8 Port Serial I/O with Timer

IESSMI08A	A & T	$550.00	$495.00

2710 4 PORT SERIAL - CCS

4 Full handshaking RS232 ports and optional 2K ROM

IECCS271001	A & T	$360.00	$310.00

2719 2 SERIAL & 2 PARALLEL - CCS

2 RS232C ports, 2 8 bit parallel ports, & optional 2K ROM

IECCS271901	A & T	$360.00	$325.00

2720 4 PORT PARALLEL - CCS

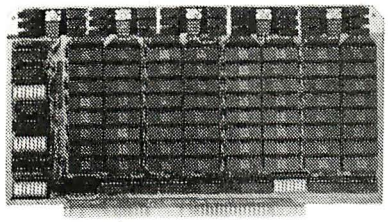
4 8 bit parallel ports and optional 2K ROM

IECCS272001	A & T	$250.00	$225.00

S-100 10 MHZ STATIC RAM

NEW LOW PRICES!

RAM 20 - 32K
SALE $299.00



32K STATIC RAM - COMPUPRO

RAM 20 10 MHZ, 4K byte block disable, bank select or 24 bit addressing available 8, 16, 24 or 32K

PART NO.	DESCRIPTION	LIST PRICE	OUR PRICE
IEGBTI64AA8	8K A&T	$210.00	$190.00
IEGBTI64AC8	8K CSC	$280.00	$260.00
IEGBTI64AA16	16K A&T	$285.00	$260.00
IEGBTI64AC16	16K CSC	$355.00	$325.00
IEGBTI64AA24	24K A&T	$355.00	$325.00
IEGBTI64AC24	24K CSC	$425.00	$385.00
IEGBTI64AA32	32K A&T	$425.00	$299.00
IEGBTI64AC32	32K CSC	$495.00	$450.00

CMOS STATIC RAM

For a complete analysis of the advantages of CMOS memory, see the "Product Description" on page 416 of the January Issue of **BYTE.**

64K CMOS STATIC RAM - COMPUPRO

RAM 17, 10 MHZ, 2 Watt, DMA Compatable 24 Bit Addressing

IEGBTI75A48	48K A&T	$650.00	$619.00
IEGBTI75C48	48K CSC 200hr.	$750.00	$710.00
IEGBTI75A64	64K A&T	$795.00	$755.00
IEGBTI75C64	64K CSC 200hr.	$895.00	$850.00

NEW! 32K x 16 BIT CMOS STATIC RAM - COMPUPRO

RAM 16 10 MHZ, 32K x 16 or 64K x 8 IEEE/696 16 BIT 2 Watt, 24 Bit Addressing

IEGBTI80A	64K A&T	$895.00	$850.00
IEGBTI80C	64K CSC	$995.00	$945.00

NEW! 128K NMOS STATIC RAM - COMPUPRO

RAM 21 10MHZ 128K X 8 OR 64K x 16 IEEE/696 8 or 16 Bit 1.2 Amps 24 Bit Addressing

IEGBTI67A	128K A&T	$1695.00	$1610.00
IEGBTI67C	128K CSC	$1895.00	$1795.00

S-100 PROM

PBI PROM PROGRAMMER - SSM

Programs 2708 or 2716's, operates as a 4K/8K EPROM BOARD AS WELL.

IESSMPB1K	Kit		$179.00
IESSMPB1A	A & T	$265.00	$220.00

ECONOROM 2708 - COMPUPRO

16K x 8 EPROM Board using 2708, Power on jump to any 256 byte

IEGBTI25A	A & T	$135.00	$120.00
IEGBTI25C	CSC	$195.00	$175.00

MB8A - SSM

1K/16K 2708 EPROM board, disable in 1K increments

IESSMMB8AK	Kit		$114.00
IESSMMBBAA	A & T	$179.00	$159.00

S-100 VIDEO BOARDS

SPECTRUM - COMPUPRO

Color Graphics board with Parallel I/O

IEGBTI44A	A & T	$399.00	$349.00
IEGBTI44C	CSC	$449.00	$399.00
IEGBT20	Sublogic Universal Graphics Interpreter Software		$35.00

VB - 3 S.S.M.

80 x 25 or 50 character video display Memory Mapped. Parallel Keyboard port

IESSMVB3K24	80 x 24 Kit		$425.00
IESSMVB3A24	80 x 24 A&T	$499.00	$440.00
IESSMV83UP	80 x 50 Line Upgrade		$ 39.00

VB2-S.S.M.

I/O Mapped Video Board, with Parallel Keyboard port 64 x 16

IESSMVB2K	Kit		$199.00
IESSMVB2A	A & T	$269.00	$229.00

VBBB - S.S.M

Memory Mapped Video Board 64 x 16 character display or 64 x 16 graphics display

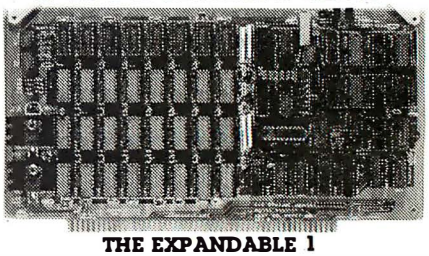
IESSMVB1K	Kit		$179.00
IESSMVB1A	A & T	$242.00	$220.00

S-100 MOTHERBOARDS - COMPUPRO

Active termination, 6-12-20 slot

IEGBTI53A	A&T 6 slot, 2 lbs	$140.00	$126.00
IEGBTI53C	CSC 6 slot, 2 lbs.	$190.00	$175.00
IEGBTI54A	A&T 12 slot, 3 lbs.	$175.00	$155.00
IEGBTI54C	CSC 12 slot, 3 lbs.	$240.00	$220.00
IEGBTI55A	A&T 20 slot, 4 lbs.	$265.00	$235.00
IEGTBI55C	CSC 20 slot, 4 lbs.	$340.00	$310.00

S-100 DYNAMIC RAM



THE EXPANDABLE 1

PRIORITY 1 ELECTRONICS

THE EXPANDABLE 1™ 64K Dynamic Ram board provides your S-100 system with 64K of reliable, high-speed dynamic RAM. Compatable with most of the major S-100 systems on the market, including those with front panels, it supports DMA operations and requires no Wait states with current microprocessors.

- *User expandable from 16 to 64K*
- *Supports DMA*
- *Designed to IEEE proposed S-100 bus standards*
- *2 or 4 MHz operation*
- *Operates with either an 8080 or Z-80 based S-100 system, providing processor-transparent refreshes with both*
- *Supports IMSAI-type front panels*
- *Jumper-selectable Phantom input*
- *Uses Popular 4116 RAMS*
- *All ICs in sockets*
- *Any 16K block can be made bank-independent*
- *Fully buffered address and data lines*
- *Fail-safe refresh circuitry for extended Wait states*
- *Board configuration with reliable, easy-to-configure Berg jumpers*

IEPRIEXP116	16K Assembled & Tested	$299.00
IEPRIEXP132	32K Assembled & Tested	$339.00
IEPRIEXP148	48K Assembled & Tested	$379.00
IEPRIEXP164	64K Assembled & Tested	$409.00

S-100 DISK CONTROLLERS

2422A - CA. COMP. SYST.

I/O Mapped, controls 8", single or double density A&T with CPM 2.2 8" S.D.

	LIST PRICE	OUR PRICE
IECCS2422A	$475.00	$375.00

DISK JOCKEY 2D - MORROW

Memory Mapped, controls 8", single or double density, serial I/O

IEMDIOJ2208	A&T with CP/M 2.2	$399.00	$375.00

S-100 DISK SUBSYSTEMS

DJ2B DISCUS SINGLE SIDED MORROW

8" DBL Density drives with cabinet, power supply controller, with CP/M 2.2 and Microsoft Basic

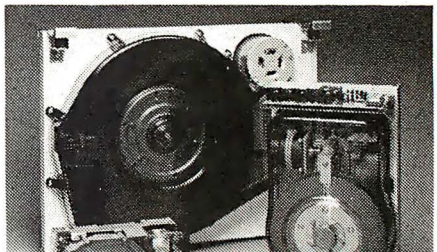
IEMDSFI21B	Single Drive System	$1095.00	$950.00
IEMDSFI22B	Dual Drive System	$1875.00	$1598.00

DJ2B DISCUS DOUBLE SIDED - MORROW

8" DBL Density/sided drives with cabinet Power supply controller, with CP/M 2.2 and Microsoft Basic

IEMDSF221B	Single Drive System	$1395.00	$1250.00
IEMDSF222B	Dual Drive System	$2495.00	$2050.00

S-100 HARD DISK - MORROW



5.25" 5MB, 8" 10 & 20MB, 14" 26MB formatted hard disk complete with cabinet, P.S., Controller, CP/M 2.2 and Microsoft MBASIC 80

		LIST PRICE		SALE PRICE
IEMDSOMAM5	5 MB	$2495.00		$1995.00
IEMDSM10S	10 MB	$3695.00		$2950.00
IEMDSM20S	20 MB	$4795.00	WOW!	$3825.00
IEMDSM26S	26 MB	$4495.00		$3495.00

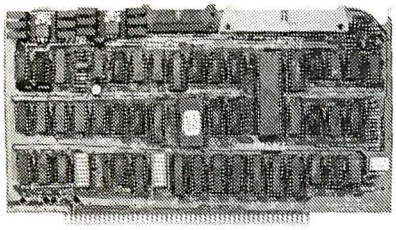
OUTPERFORMS MONITORS OF TWICE THE PRICE

USI has the competition buckling at their knees! You can have a professional performing Video Monitor for a **fraction of the cost!** *The USI EV2131N is a 12" Green, high resolution data display compatable with 80 x 24 computer formats*

IEDUSIEV2131N	24 lbs.		$149.00

PRIORITY ONE ELECTRONICS

COMPUPRO DMA DISK 1 WITH FREE CP/M 2.2 SALE $450.00



SAVE $220.00

Priority 1 Electronics is pleased to offer the GODBOUT DISK 1 High Performance Disk Controller at our regular low price with CP/M 2.2 and BIOS at no additional cost. That's a savings of $220.00 of the manufacturer's list price.

- *Third generation INTEL 8272/NEC 765A LSI floppy disk controller.*
- *High speed cycle stealing DMA interface for processor independent data transfer between system memory and flexible disk.*
- *Handles up to four 8 or 5.25 inch floppy disk drives*
- *Single or double density/single or double sided capability.*
- *Supports IBM 3740 soft sectored formats.*
- *24 bit DMA addressing with data transfer across 64K boundaries for data transfer throughout the 16Mbyte memory map.*

PART NO.	DESCRIPTION	LIST PRICE	OUR PRICE
IEPDB171ACPM	A&Tw/CP/M 2.2& BIOS	$670.00	$450.00
IEGBT171C	CSC	$595.00	$555.00
IEGBTCPM80*	CP/M 2.2 for Z80/8085 with manuals & BIOS 8" S/D disk		$175.00
IEGBTOAS8S	Oasis 8 bit single user 8" S/D disk		$500.00
IEGBTOAS8M	Oasis 8 bit multiuser, 8" S/D disk		$850.00

S-100 SYSTEMS

SUPERSIXTEEN — COMPUPRO

HERE IS WHAT EACH PACKAGE INCLUDES:

IEGBT1612A *6 MHz 8085/8088 Dual Processor Board*
IEGBT171A *High Speed DMA Disk Controller*
IEGBT162A *System Support 1 Multi-Function Board*
IEGBT133A *Interfacer 1 Dual Serial I/O*
IE128K10MHz *Low Power Static Ram*
IEGBTCP/M86 *16 Bit Operating System Ready to Load & Go*
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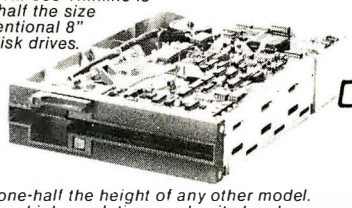

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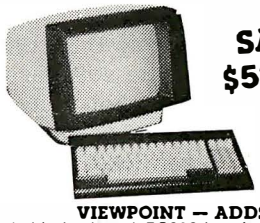

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CASIO'S FX-702P

POCKET COMPUTER

by Bob McElwain

The Casio FX-702P is a fast, powerful computer to satisfy many personal computing needs. It can be mastered in a very short while—the Basic is simple (a subset of the version available on most computers) and an extended set of special functions is available. Although easy to use, the editing functions are limited. Since programs are typically written once and run many times, the fast, powerful performance may be far more important than editing ease.

This computer looks much like any handheld unit. The keyboard is elongated horizontally with alpha characters on the left and a numeric scratch pad on the right. The LCD display handles 20 characters on a 5-by-7 dot matrix. If 20-30 characters are produced, the display automatically shifts as needed. Characters are easy to read and the display brightness level is adjustable with an external control.

It is approximately ⅝-in. by 6½-in. by 3¼-in. and weighs approximately 6.3 ounces, including the soft carrying case. In the soft case, the computer can be carried in a coat pocket. However, a hard case would offer better protection, as a slight twist of the case sometimes causes loss of code. The LCD display is particularly vulnerable.

The computer is powered by two lithium batteries, type CR2032, reportedly good for 200 hours of continuous operation. Rated at .01 watts consumption when in use, the battries will likely last more than 200 hours. An auto-off feature turns the computer off after approximately eight minutes of inactivity. Values and program in memory are held even when the computer is turned off.

The alpha portion of the keyboard consists of four rows of characters, A-Z, in straight alphabetical order, below a row of special function keys. With 65 keys in five rows, the array is formidable and takes some time to sort out.

Everything is directly accessible with two keystrokes. Each alpha key has two additional functions accessible by pressing the appropriate function key, F1 or F2, and the needed key. For example, GO SUB can be entered with F2, GSB (D key). Once the correct key is located, entry is easy and accurate and there is little need to reference the manual. The functions are clearly printed on the keyboard. One only needs to read what's in front of him to find the needed instruction or command. For beginners, this can significantly speed the learning process.

The punctuation symbols are located in the top row of keys. They're easy to find and even easier to use. They're equivalent to lowercase characters, and can be entered with a single keystroke.

The EXE key, execute, is frequently used and equivalent to a carriage return or ENTER on other computers. It would be more convenient if this key were larger—easier to locate and press. A bright color would help.

The computer has built-in capacity to use a ROM cartridge. Unfortunately, cartridges are not yet available. Work is now proceeding on developing ROM software.

In computation (or Basic code), formulas are entered as in mathematics and operations are performed according to mathematical rules. Statement length is limited by the length of the input buffer, 62 characters. Editing is accomplished by positioning the cursor (left and right arrow), then changing, deleting or inserting characters.

When an expression has been entered, the result will display when EXE is pressed and the result can be used immediately in another computation. For example, if 2 + 3 is entered, 5 will display on EXE. Immediately entering + 6 and EXE, will cause 11 (5 + 6) to display. Previously assigned variables can be used. If A were previously set to 4, A + 5 would give 9. A particularly nice feature is the ability to enter the result of the last computation at any point desired. The ANS key will retrieve

this value. For example, if 4 + 1 were entered, the result would be 5. When a new entry is made, 5 is cleared from the display. But 6 + 3*ANS will result in 6 + 3*5 or 21.

Any of the special functions can be used as needed. If a function argument is a single term, the parentheses can be omitted, saving time and space. LOG(3.14) can be entered as LOG 3.14. Parentheses are required only if there are two or more terms (e.g. 3 + 4*A). In like fashion, 3*(– 4) can be entered as 3* – 4.

Variables A-Z are held in a separate part of memory in an area not available for program code. Any of these variables can be used as a string variable, A$-Z$. A string is limited to seven characters, except for the special string, $, described below. A and A$, B and B$, etc., share the same locations. Therefore, A$ can not be used if A contains a needed value.

The special string variable $ has a 30-character maximum length. Two functions are available for string manipulation and are particularly useful with this special string. MID allows access to any part of string $ and LEN gives the present length of any string. Strings can be combined using the plus sign ($ = $ + B$).

Variable A can be subscripted with one or two dimensions can be used as either a numeric or string. The range of A when with a single subscript is A(0)-A(199). These values are also accessible as A0 to A9, B0 to B9, on up to T9. With a double subscript, the range is A(0,0)-A(19,0). Variable space for the subscripted variables must come from program space. This space is set aside in blocks of 10, using DEMF N, where N is the number of blocks requried. For example, if a range A(0,0)-A(3,9) is needed, DEFM 4 will set aside 40 variable locations, 320 bytes or steps from program memory. Since the total memory available is 1,680 bytes, the maximum array sizes given above leave only 80 bytes for code.

Double subscripted variable use has limitations. Given A(M,N), M can range from 0 to 19. N, however, cannot exceed 9 and is in reality always 9. For example, A(2,4) and A(2,9) require the same allotment of memory, even though A(2,4) uses only half the space that must be allocated. Therefore, unless memory space is plentiful, it will be necessary to index A as a singly subscripted variable in all but a few special situations.

Program entry and editing are accomplished in WRT mode. Up to 10 programs can be loaded at one time, with program areas specified from P0 to P9. It is easy to branch from one program to another. When the WRT mode is entered, the program areas in use are indicated. The digits 0-9 are displayed with an underline for each digit representing a program area in use. For example, if programs are loaded in P1 and P3, the display would be 0__2__456789. The memory remaining for programs is constantly displayed to the right when in WRT mode. This space is available to any program. In a specific program area, P0-P9, CLR will delete the program code associated with the particular area. (CLR ALL clears all code in all program areas.) VAC clears all variable memory.

The computer is easy to program. Since complex I/O and file manipulations are not required, beginners will become competent users in a short time. Only a few fundamental instructions, such as PRT, INP, FOR-NEXT, IF-THEN, GO TO, GO SUB-RETURN, are required to

Table 1. Principal instructions compared

CASIO			SHARP	
SYNTAX	**ENTRY**	**FUNCTION OF PRINCIPAL INSTRUCTION**	**ENTRY**	**SYNTAX**
INP	F2,INP	Halt execution for data entry	I.	INPUT
PRT	F2,PRT	Output data	P.	PRINT
FOR	F2,FOR	Begin FOR-NEXT loop	F.	FOR
NEXT	F2,NEXT	End FOR-NEXT loop	N.	NEXT
STEP	F2,STEP	Increment in FOR-NEXT loop	STEP	STEP
IF	F2,IF	Conditional branch	IF	IF
THEN	F2,THEN		T.	THEN
GO TO	F2,GO TO	Unconditional branch	G.	GO TO
GSB	F2,GSB	Branch to subroutine	GOS.	GO SUB
RET	F2,RET	Return from subroutine	RE.	RETURN
STOP	F2,STOP	Halt execution	ST.	STOP
MID	F2,MID	Select specified characters from string $	Not Available	
LEN	F2,LEN	Return length of any string	Not Available	
END	F2,END	End of a program	E.	END
WAIT	F2,WAIT	Causes PRINT statements to display for specified period only	Not Available	
Not Available		Used instead of PRINT to hold display for almost a second	PA.	PAUSE
SET	F2,SET	Set display format of numeric data	Not Available	
RND	F2,RND	Round to specified accuracy	Not Available	
CSR	F2,CSR	Tab to specified position	Not Available	
PASS	F2,PASS	Password control	Not Available	
Not Available		Output specified number of "beeps"	B.	BEEP
Not Available		Documentation in code	REM	REM

accomplish significant programming tasks. These instructions are directly available from the keyboard as described above.

Line numbers can range from 1 to 9,999. FOR-NEXT loops can be nested eight deep and GO SUBs 10 deep. It's difficult to picture a situation these limits would prohibit.

Table 2. Principal commands compared

CASIO		SHARP
VAC	Clear variable memory	CLEAR
CLR	Clear program memory	NEW
RUN	Run a program	RUN
CONT	Continue a halted program	CONT
LIST	List a program	LIST
LIST V	List present values of variables	Not Available
LIST ALL	List entire program automatically	Not Available
Constantly displayed memory space available		MEM
	Cassette Commands	
SAVE	Save a program to tape	CSAVE
LOAD	Load a program from tape	CLOAD
VER	Verifies a program to a tape copy	CLOAD?
PUT	Save data to tape	PRINT #
GET	Load data from tape	INPUT #
Not Available	Chain to a program on tape	CHAIN

Table 3. Mathematical functions

FUNCTION	INSTRUCTION	CASIO	SHARP
Trignometric Functions	SIN	X	X
	COS	X	X
	TAN	X	X
Inverse Trig Functions	ASN	X	X
	ACS	X	X
	ATN	X	X
Hyperbolic Functions	HSN	X	N.A.
	HCS	X	N.A.
	HTN	X	N.A.
Inverse Hyperbolic Functions	AHS	X	N.A.
	AHC	X	N.A.
	AHT	X	N.A.
Square Root	SQR	X	X
Exponential Function	EXP	X	X
Natural Logarithm	LN	X	X
Common Logarithm	LOG	X	X
Integer Function	INT	X	X
Fraction Function	FRAC	X	N.A.
Absolute Value	ABS	X	X
Sign function	SGN	X	X
Convert degrees, minutes and seconds to decimal	DEG	X	X
Convert Decimal to degrees, minutes and seconds	DMS	X	X
Rectangular to Polar	RPC	X	N.A.
Polar to Rectangular	PRC	X	N.A.
Factorial	X!	X	N.A.
Random Number Generator	RAN#	X	N.A.
Round off	RND	X	N.A.

Other functions of a more specialized nature can be mastered as needed. An excellent set of functions provides precise display formats. SET and RND can be used to establish the number of digits to be displayed and to indicate whether the display should be rounded or truncated. CSR is essentially a tab function. Coupled with SET and RND, it is simple to format without PRINT USING or an equivalent, and the related risk of run-time errors. However, formatted output, equivalent to PRINT USING, is also available.

WAIT N causes print statements to display for N periods only. Then execution continues. N ranges from 1 to 1,000, and the display will hold for approximately N*.05 seconds. This is convenient to control the flow of displays. N can be changed within the program as needed. However, once set, WAIT cannot be discontinued without turning the computer off. At the maximum range, the display will hold for nearly a minute.

RAN # generates a pseudorandom number between 0 and 1. In several test runs, it gave good results. The digits passed several tests of randomness and no sign of degeneration in runs of 500 digits appeared. Since no seed is required (RAN # must key off some internal value), some debug problems may occur in that no known pattern of generation is available.

Password control is available to the extent that when set, LIST (the program) and CLR (erase the program) are inoperable without password entry. This command will be useful in protecting code. Passwords are associated with specific program areas, P0-P9. CLR ALL remains operative and can be used to erase all programs in memory.

Editing within a line is simple and straightforward. With the left and right arrow, the cursor can be quickly positioned for a change, addition or deletion. Finding the line to edit, however, is another matter.

There is no scroll feature to allow you to return to a previous line. It must be specifically listed (two keystrokes plus the line number). This can be particularly annoying when editing. The line edited disappears from the display on EXE, replaced by the next line in the program. There is no "last chance" opportunity to see the corrected line and examine it for possible further changes. The line must be relisted.

There are, however, two particularly useful features. LIST ALL lists the entire program, line by line, holding the display briefly, then moving on to the next line. Lines too long to display are shifted into the display, character by character. This ability to view the program without any action is very helpful. LIST V automatically displays the present values of all variables. Often this display alone will show an errant variable and lead to a quick solution.

Corrections require mode changes

Errors are extremely hard to identify, particularly run-time errors. When a run-time error occurs, the program area in use, an error number and line number are displayed. There is no way to display the line in RUN mode. You must change modes (two keystrokes), list the line at which the error occurred (two keystrokes plus the line number), then search the line for a possible error. The error messages seem fairly reliable, but "syntax error" covers a lot of territory. If you've divided by B, which was set earlier in the program to zero, you can list a lot of lines to locate where this error occurred. With no scroll, the task is distinctly tedious. This implies that a correct, up-to-date listing must be maintained throughout any coding session.

A debug mode displaying each line number of the program as it executes is available. This is an excellent tool for locating branches to incorrect addresses.

(Note: The code is not displayed, only the line numbers. Code can be displayed only on STOP. This would be a far more useful feature if the code were displayed automatically as each line is executed.)

One of the real strengths of the unit is the extensive set of mathematical functions available. Particularly welcome will be the random number generator and the trig functions with hyperbolic functions. Those who need statistical functions will be delighted with the 17 stat functions on this device. Not only will coding time be saved, but valuable memory space as well. These functions use dedicated registers, independent of program space, and all functions are also accessible in calculator mode. Real numbers can be converted to sexagesimal, and conversely. Rectangular coordinates can be converted to polar, and conversely.

For the most part, the manuals provide sufficient examples but the accompanying explanations are weak. At those points where the manual is unclear, a few minutes' trial and error with the computer will make the matter clear. The major failing is the lack of an index. The table of contents is helpful, but you can spend a long time searching for a specific item. Beginners will have a particularly difficult time.

A set of 73 programs is provided, giving examples in Mathematics, Electrical Engineering, Mechanics, Physics, Chemistry, Statistics, Medicine, Banking, Navigation and Games. Accompanying notes include good drawings, where appropriate, and a complete statement of formulas used.

In most cases, the programs will be insufficient in their present forms. As near as I've been able to determine, the programs are correct, but do not cover any subject completely. For example, the program to solve a quadratic equation errs if the discriminant is negative. Before using this program, I would add code to handle this case.

A collection of 400 additional programs covering a variety of topics is now in production. It is expected to be available soon for $14.95. Cassettes will also be available.

A cassette interface is provided for saving and loading both programs and data on cassette tape. Most audio cassette players will work well. A verify command is

Table 4. Principal statistical functions (Casio only)

As data is entered, the following are collected and/or computed. The instructions will display results manually or as part of code.

CNT	Number of data items
SX	Sum of X
SY	Sum of Y
SXZ	Sum of squares of X
SXZ	Sum of squares of Y
SXY	Sum of products of X and Y
MX	Mean of X
MY	Mean of Y
SDX	Standard deviation of X
SDY	Standard deviation of Y
LRB	Regression coefficient
COR	Correlation coefficient

Table 5. Edit functions compared

FUNCTION	CASIO	SHARP
Identification of run-time error	Displays line number at which error occured and number of error message.	Displays number of error message. Press up-arrow to display line. Cursor positioned at point of failure.
Error correction	Change to WRT mode. List line number at which program failed.	Change to PRO mode. Press up-arrow. Line with cursor at point of failure will display.
Automatic forward scroll	Displays one line at a time. Display of each line holds approximately two seconds.	Not available.
Backward scroll	Not available.	Press up-arrow. Hold down for rapid scroll.
Forward scroll	Press EXE for each successive line.	Press down-arrow. Hold down for rapid scroll.
Display of edited line	LIST line number.	Automatic.
In calculator mode, restore calculated formula to display	Not available	Press back-arrow.
Computation: Use computed results in subsequent calculation	Automatically available.	RE-ENTER

Table 6. Misc. features compared

FEATURE	CASIO	SHARP
Steps (bytes) of program memory	1,680	1,424
Steps required for an instruction in memory	1	2
Steps required for a line number	3	2
Length of input buffer (Casio: PRT requires 4 steps, each symbol plus a space Sharp: PRINT requires 2 steps, spaces ignored.)	62	80
Maximum number of characters displayed	20	24
Addressing	1-9999	1-999
Number of mathematical functions	27	15
Number of statistical functions	17	0
Depth of FOR-NEXT loop	8	4
Depth of subroutines	10	4
Level of parentheses	20	15
Printer speed, characters/second	2.1	.9

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	TI Insight 10 Terminal	695	67	37	25
	TI785 Portable KSR, 120 CPS	2,395	230	128	86
	TI787 Portable KSR, 120 CPS	2,845	273	152	102
	TI810 RO Printer	1,695	162	90	61
	TI820 KSR Printer	2,195	211	117	80
LEAR SIEGLER	ADM3A CRT Terminal	595	57	34	22
	ADM5 CRT Terminal	645	62	36	24
	ADM32 CRT Terminal	1,165	112	65	42
	ADM42 CRT Terminal	1,995	190	106	72
DATAMEDIA	EXCEL 12 CRT Terminal	1,695	162	90	61
	EXCEL 42 Smart Buffered CRT	995	96	54	36
	COLORSCAN 10 Color CRT	3,195	307	171	116
TELEVIDEO	925 CRT Terminal	850	82	46	31
	950 CRT Terminal	1,075	103	57	39
NEC SPINWRITER	Letter Quality, 7715 RO	2,895	278	154	104
	Letter Quality, 7725 KSR	3,295	316	175	119
GENERAL ELECTRIC	2030 KSR Printer 30 CPS	1,195	115	67	43
	2120 KSR Printer 120 CPS	2,195	211	117	80
HAZELTINE	Executive 80/20	1,345	127	75	49
	Executive 80/30	1,695	162	90	61
EPSON	MX-80 F/T Printer	745	71	42	27
	MX-100 Printer	895	86	48	32
TIMEPLEX	E0400 4 Channel Stat Mux	1,525	147	82	55
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available that compares the memory image to the tape image. SAVE ALL is a useful feature, saving all data along with the program. This is particularly helpful with programs used only occasionally that depend upon previously accumulated data.

The printer can be connected directly to the computer or to the cassette interface when the interface is connected. It's a thermal printer, producing 20 characters per line. Statement numbers are right-justified in the first four print positions and statements exceeding 20 characters are wrapped to subsequent lines as needed.

Perhaps the most interesting feature is that everything displayed by the computer, both input and output, is echoed to the printer when it is connected.

Suggested list price is $199.95; the cassette interface is $49.95; the printer lists for $89.95. Since

Table 7. Speed comparisons

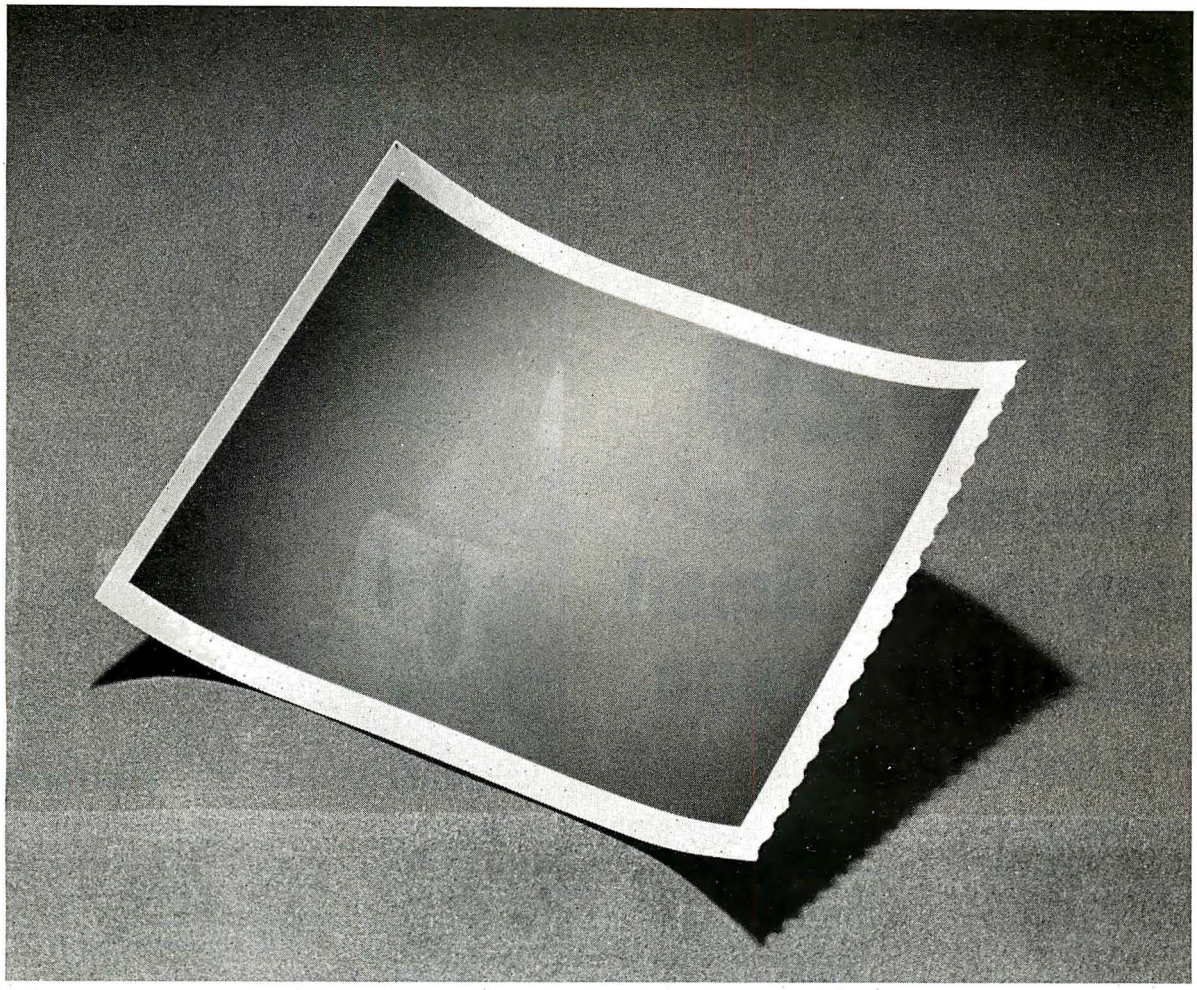
	CASIO	SHARP	SLOWER BY FACTOR OF
4: J = 0 5: J = J + 1 6: IF J<500 THEN 5	0:57	2.25	2.5
5: FOR J = 1 TO 500 : NEXT J	0:08	2:02	15
5: FOR J = 1 TO 500 : A = 5*B + C*D/E – 7 : NEXT J	1.11	4:30	3.8
5: FOR J = 1 TO 500 : A = SQR(LOG15 + LNJ)^14 : NEXT J	5:40	13.28	2.4
5: FOR J = 1 TO 500 : GO SUB 10 : NEXT J 10: GO SUB 15: RETURN 15: A = 5: RETURN	0:58	4:32	4.7
5: W = 0 10: W = W + 1 15: IF W>0;A = SQR(LOG W)^14 20: IF W>0:A = INT(SIN 30*LN W) 25: IF W<300 THEN 10	5:53	13.24	2.3
(OUTPUT TO PRINTER) 5: FOR J = 1 TO 100 : PRINT "1234567890" : NEXT J	0:48	1:52	2.3

Casio products are carried by large discount stores in some parts of the country, it might pay to shop.

Casio may have the best service policy possible. Regardless of the problem, ship the unit to Casio in either Downey, CA, or Fairfield, NJ. Casio will repair the unit at no charge for a full year from date of purchase. You only pay the shipping.

It's inevitable that the FX-702P will be compared to the Sharp PC-1211. (The Sharp unit is identical to the Radio Shack TRS-80 PC. Sharp manufactures both units.) The accompanying tables show the equivalent Sharp item.

Many micro users will not have time to master small micros as programming tools, but most FX-702P users will become at least novice programmers. They'll be able to write a variety of simple programs to fit their personal needs. The FX-702P gives Casio a solid position in the pocket computer marketplace. □



This is a picture of all the printers in the world that outsell the MX-80.

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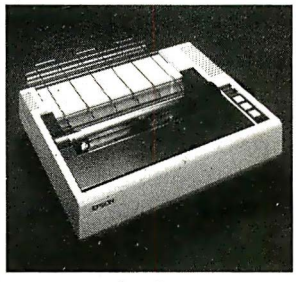
But you don't have to take our word for it. You've got a choice: you can buy the printer that's been embraced by several hundred thousand computer fanatics all over the world. Or you can buy something else. And take your chances.



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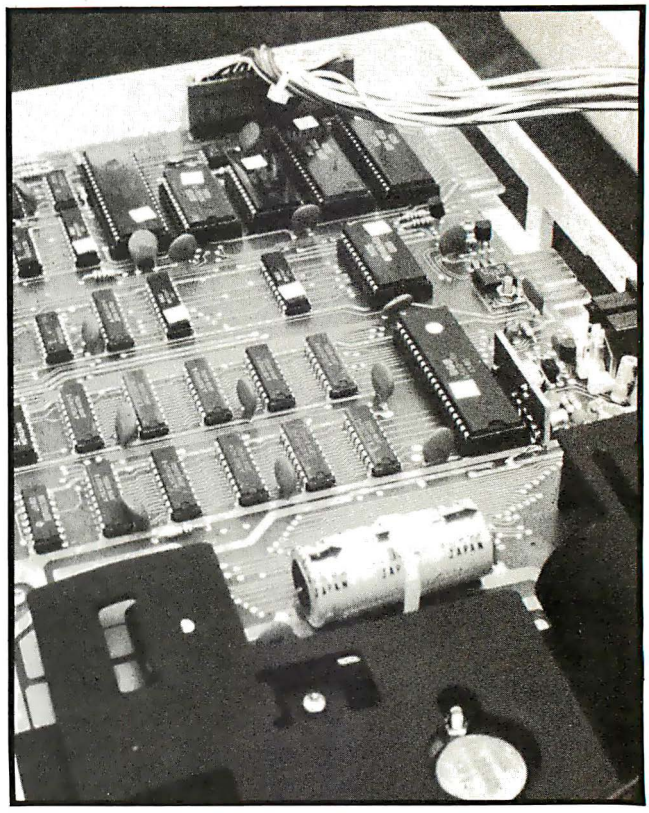
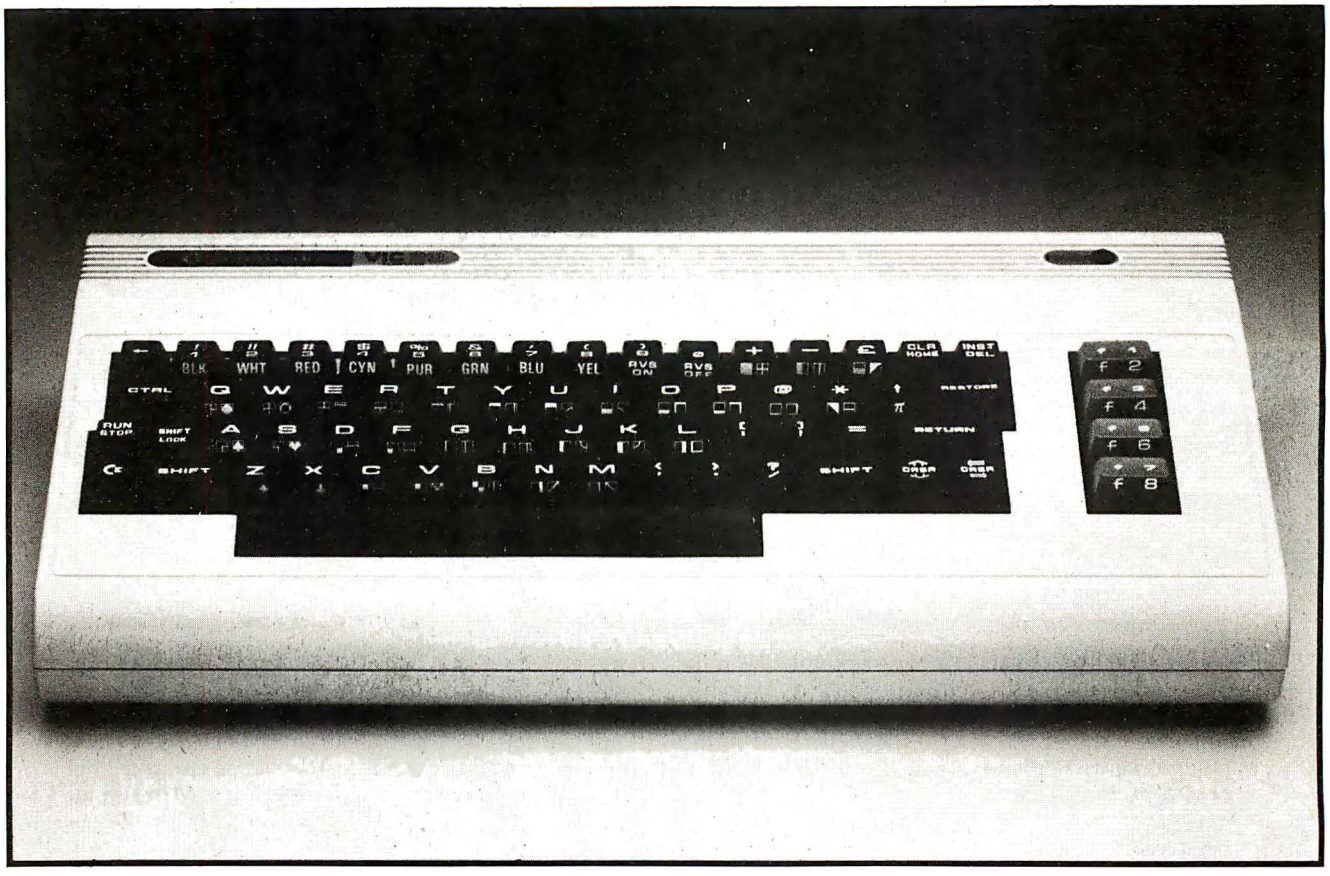
VIC-20
Commodore's Entry in the Small Computer Arena

by David D. Busch





If first impressions stick, the Vic-20 microcomputer by Commodore (King of Prussia, PA) will lodge itself in the mind of any potential purchaser. The 6502 microprocessor-based computer just doesn't look like a $299 machine.

In fact, when I demonstrate the unit to those unfamiliar with it, I always save the price for last. This ploy is especially effective if the potential user already has some familiarity with other microcomputers and their prices.

First, I demonstrate the full-stroke, typewriter-style keyboard, which features four special function keys and a control key. The Pet Basic is identical to that used in higher-priced Commodore machines and comparable to Applesoft or Radio Shack's model III Basic. Lowercase characters are built-in, but the user can define any character set by using an 8-by-8 dot matrix. There are

high resolution graphics (every dot on the screen may be addressed)—in eight colors. Need sound? Four voices are built in, and adding a joystick is as simple as plugging a stock Atari unit into a socket.

I then mention the price. "What's the catch?" I am asked immediately. In truth, there are several. It is not really possible to do anything useful with the system for $299—not even save or load programs. It is necessary to add $75 for the Commodore Datasette cassette recorder. Ordinary tape recorders, which produce sine wave output, cannot be substituted for the square-wave Commodore unit.

Because the unit comes with 5K bytes of RAM and only about 3.5K bytes are available for user programs, it is necessary to purchase additional memory in order to use all of the features to their fullest capacity. For example, in the stock Vic-20, only a small portion of the screen can be manipulated in hi-res graphics. Defining a complete new character set leaves only a small amount of memory for programs. These tools can be best used when an additional $300 investment is made to expand RAM to its 32K-byte limit.

The final catch is that the display is only 22 columns wide. This may also be remedied by add-ons and user programs. However, at a time when many micro users are complaining that 64-character screens should be 80 columns wide, a 22-character display seems less than adequate.

My feeling is that Vic-20 purchasers should appreciate the value they get for $299, but consider the unit for what it really is—a competent $600-$700 color microcomputer.

The company can easily be forgiven for the attention given to the keyboard while offering a less-than-perfect screen display. The screen display is relatively easy to modify with add-on components. Given the wide range of televisions likely to be used as monitors for low-cost micros and narrow bandwidths, Commodore opted to provide a sharp display that can be upgraded to suit the higher resolution of composite video monitors.

As a writer capable of 60-word-per-minute bursts, it was the keyboard that sold me. It's a solid, professional-feeling unit that can accept input as quickly as any user can type. There is no keyboard bounce, and most keys have been laid out in a logical manner.

The biggest drawback is the placement of the RETURN (ENTER) key. It is at the far right of the home row, four keys removed from the L. I am most accustomed to the following layout: "J, K, L, semicolon, ENTER," although one of the computers I use follows a "J, K, L, semicolon, quotation mark, ENTER" format, both standard, typewriter-style layouts. The Vic-20 uses "J, K, L, colon, semicolon, equals-sign, RETURN." As a result, the tendency is to hit the equals-sign key instead of RETURN.

It is relatively easy to learn this unusual layout and by the time I had written two or three programs, I rarely hit "=" by mistake. All other keys have logical or unobtrusive placement.

One welcome feature is the addition of four special function keys. These are marked F1, and so on, and by hitting SHIFT, are used to produce eight separate function keys. They are defined as CHR$(133) through CHR$(140), and are accessible to any Basic program. Business users and game enthusiasts will find special applications for these keys. For example, a menu may be designed instructing the operator to hit F1-F8 to invoke particular subroutines. Then, lines such as IF A$ = CHR$(133) GOTO 100 may be used. An alternative might be: ON VAL(A$) – 133 GOSUB 100,200, 300,400,500,600,700,800.

A large number of characters are available from the 61-key board. The machine powers up in Graphics mode and typing normally produces the uppercase characters and numbers shown on the keytops.

However, each key may also produce one of two graphics characters while in the Graphics mode. Two keys are located on the lower left side of the keyboard; one of two SHIFT keys is to the right, while a special key labeled with the Commodore logo is on the left. Striking the Commodore key and pressing another key produces the graphic character printed on the left side of the keyfront. Pushing the SHIFT key in tandem with another key produces the graphic character printed on the right side of the second keyfront. (Of course, either SHIFT key may be used, but it is easier for a beginner to stick to the one paired with the Commodore key.)

The Vic-20 has a Text mode, and by pressing SHIFT and the Commodore key simultaneously, Text is invoked. The keyboard then functions as an ordinary typewriter with upper and lower case letters. Even so, the graphics on the left sides of the keyfronts (those most likely to be used in business applications) are still available by hitting the Commodore key.

That's not all. Any of the characters available may be printed in any of eight colors, normally or reversed, by

	Commodore Vic-20	Sinclair ZX81	TRS-80 Color	Atari 400	Texas Instruments TI99/4A
Price	$299	$150	$399	$399	$525
Processor	6502A	Z80	6809-2	6502	9900 (16-bit)
RAM	5K	1K	4K	16K	16K
Max. RAM	32K	16K	32K	32K	72K
Display	22 by 23	32 by 16	32 by 16	24 by 40	24 by 32
Keyboard	61-key	40-key	53-key	57-key	53
Voices	4	—	1	4	4
RF Mod.	supplied	built-in	built-in	built-in	$49.95

Vic-20 in comparison

using a Control key. The Vic-20 prints its characters in blue until a color control key is pressed. The color keys are on the top row of the keyboard. CTRL-1 produces black characters, CTRL-2, white, and so on through red, cyan, purple, green, blue and yellow. Reverse On and Reverse Off are also summoned by using the control key. Once one of these has been entered, the display changes to the new parameters for all characters until the next control character is entered.

Vic-20's Pet Basic does not have any graphics or color commands, such as Line or Fill, but I understand that the Super Expander cartridge will provide these capabilities. Graphics characters may be incorporated in programs through time-consuming, but easy-to-use PRINT statements. For example:

```
100 PRINT "(RVS ON)(CTRL-3) THESE CHARACTERS
WILL BE PRINTED IN THE BACKGROUND COLOR
ON RED"
110 PRINT "(RVS OFF) THESE CHARACTERS WILL
BE PRINTED IN RED, OVER THE BACKGROUND
COLOR."
```

For the alpha characters, I could have substituted any of the graphics characters, but, of course, could not reproduce them for the printed page. In fact, the (RVS ON) and (CTRL-3) in the above lines actually appear on the Vic screen, replaced by graphics symbols that denote the function invoked. All screen controls are indicated in this manner—a reverse "Q" means cursor down, while a heart indicates clear screen. I found these symbols confusing at first. Unless you have a printer with graphics capability (Commodore offers one for the Vic-20 at $399), your program listings will be lacking all the needed information.

I found the screen display to be excellent. The unit connects to any color television through a supplied RF modulator. I tried the unit with seven different brands and had no trouble getting a sharp image. One exception was a 10-year-old television with a dirty tuner mechanism. Fine-tuning the TV, and, sometimes, moving the RF modulator to get rid of a residual moire effect produced an excellent picture. My test for picture quality involved the use of a high-resolution game, AMOK, a machine language program with a special character set that makes considerably greater demands on resolution than standard alphanumerics or graphics.

POKE generates color, sound, noise

On some sets, color balance adjustments had to be made to clearly differentiate the eight available colors. Cyan tended to resemble green on a few units, while red often looked more brown or orange. To avoid constant plugging and unplugging, I have dedicated a 13-in. GE television to permanent Vic duty in my office. Until I receive the Super Expander cartridge and begin working more heavily with hi-res graphics, I see no need to invest in a monitor for the Vic.

The display area on the screen is surrounded by a colored border. Both the border and the screen may be changed to other colors with a single POKE statement, either in command mode or from a program. There are 255 color combinations available.

POKE may also be used to generate sound and noise. Three voices, each with a different three-octave

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Apple III 128K	3495.00	2795.00
Profile 5Mb	3495.00	2795.00

Software & access. at similar discounts

range and a fourth white noise tone generator, are available. The Vic introductory guide includes programs to simulate 20 sounds, including laser beams and birds chirping. Some fine tuning on the television may be necessary to optimize the sound with picture.

Programs are loaded and run from the Pet Datasette cassette recorder. This unit is totally slaved to the CPU, deriving its power and on-off signals from the main unit. At 300 baud, it is a little slow, but I found the capability to use long file names extremely helpful. With Radio Shack cassette files, for example, one may CLOAD or CSAVE a file by single letter name—CLOAD A, for example.

The Vic-20 may be commanded to search for a more-detailed file name—LOAD CHECKBOOK 1982—for example. Or if the file name is not known for certain, a partial specification may be entered. LOAD CHECK would cause the Vic to load CHECKBOOK 1981, CHECKBOOK 1982, or CHECKERS, depending on which it found first. However, the system does tell you what files it has found as it passes through.

I have tried several programs that use the Atari joystick. At present, only a single controller may be used. AMOK, based roughly on the arcade standard Berserk, is a Roger Merrit product. Using the joystick, I was able to make the little man run through the maze with ease, zapping robots along the way. The joystick may be read from user programs through a simple PEEKing routine described by Commodore in its *Programmer's Reference Guide*.

Although not tested, light pens and game paddles can also be used with the Vic. I see this machine, because of its low cost, becoming a popular games machine—like the Atari 400—with some serious capabilities as an added attraction.

Those are the current hardware highlights—disk drives, memory expansion and ROM packs. Other enhancements are on the way, but unavailable at press time.

Software base is firm

From a software standpoint, the Vic-20 enters the field from an unusually strong position. All standard Pet Basic programs may be loaded and run, as long as ROM-dependent features (such as PEEK and POKE) are not used. Programs written for 40- and 80-column screens will cause material to wrap around the Vic's 22-character display, but the user can usually remedy this minor annoyance.

Those who already know Pet Basic, or some other Microsoft variation on that theme, will find transition to the Vic painless. TRS-80 owners will be hard-pressed to note any differences at all—GET$ in place of INKEY$ and FRE(X) for PRINT MEM are the two notable examples. Even file handling is very similar to Radio Shack's Disk Basic. Files may be opened and closed, but the Vic-20 allows specification of a device number so that the same syntax may be used for either cassettes or disk data files.

Because of the common language, the Vic-20 should prove to be formidable competition for the Radio Shack Color Computer as a second computer for current model I or III owners.

As a long-time user of line-oriented program text editors, it took me several weeks to become accustomed to the Vic's screen editing. With line editing, the programmer LISTS a section of the program, types in EDIT 20 (or whatever line is to be changed) and then makes changes. The Vic's screen editor works in a very different way.

Any program line that appears on the screen may be edited by moving the cursor to that line, overtyping the text, or making insertions or deletions by hitting an appropriate key. Pressing RETURN makes the changes permanent. One may simply renumber a line by typing over the line number (the old version of the line remains and should be deleted).

Beginners to computing will find the guidebook, *Personal Computing on the Vic-20*, to be a clear, concise and helpful introduction. However, I have seen better Basic courses. The Commodore guidebook is more feature-specific and helps the new user discover the capabilities of the Vic-20 rather than serving as a thorough grounding in Basic programming.

Those already familiar with some dialect of Basic who choose the Vic-20 will find the introductory guide somewhat frustrating. It is difficult to sort through the elementary material to find the "meat" to help you make the switch. The guide is not at all detailed in helpful programming tricks. For example, I could find no reference to using the special function keys. I had to experiment and finally used GET$ to see what ASCII value was returned when the user pressed one of the special keys.

Serious programmers must make the purchase of the *Vic-20 Programmer's Reference Guide* their number one priority. This volume not only contains all the material missing from the user's guide, but has invaluable data I never expected to see. The reference

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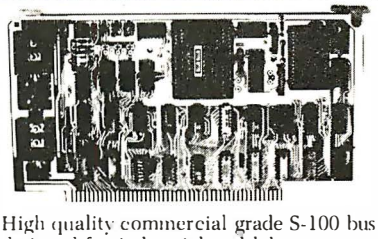

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guide contains techniques—with examples—that left me more impressed than ever with Vic's capabilities.

Consider generating special character sets. There is a register in RAM that controls where the Vic gets its character set information. This location may be changed by hitting the shift Commodore key, or by POKING to toggle back and forth between two ROM addresses which contain the Uppercase/full graphics or Uppercase-lowercase/partial graphics characters. These character sets may also be reversed. Because the characters are stored in ROM, it is obviously impossible for the user to change them. However, by POKING the RAM register which supplies the ROM addresses with a new location in RAM, it is possible to have the system derive its character information from a user-supplied table. Then, when letter A is printed, instead of A, the screen will display whatever character has been created by the user.

Or, most of the existing character set may be copied over from ROM to the RAM table, so that most keys still produce their ordinary output while others generate new characters. Each complete character set takes up 2K bytes of memory, so not much room is left for user programs with an unexpanded Vic.

The method for designing characters is simple to understand. Each is built on an 8-by-8 matrix, so that eight bytes (each containing eight bits) are needed. It's easier to visualize this capability:

	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Bit 8
Byte 1	0	0	0	1	1	0	0	0
Byte 2	0	0	1	0	0	1	0	0
Byte 3	0	1	0	0	0	0	1	0
Byte 4	0	1	1	1	1	1	1	0
Byte 5	0	1	0	0	0	0	1	0
Byte 6	0	1	0	0	0	0	1	0
Byte 7	0	1	0	0	0	0	1	0
Byte 8	0	0	0	0	0	0	0	0

The above eight bytes, translated from binary and POKED to the desired location in the user's character set, will produce the uppercase letter A. By placing X's and O's in a similar matrix, users can custom-design special languages, scientific symbols or flying saucers for games.

Machine language programmers who don't like rewriting their codes to be compatible with every new ROM will appreciate Commodore's dedication to the KERNAL concept. KERNAL, Vic's operating system, contains a standardized jump table to the input, output and memory-management routines in the system. Should Commodore introduce new ROMs for the Vic (as they have done for the Pet), the KERNAL jump table will be changed to match new ROM locations for routines. Serving as a sort of forwarding address, it will allow programmers to address the ROM through the table, confident that JSRs will end up where they are supposed to—even if the ROM has been changed.

The Vic-20 will inevitably be compared with other computers in the low price range. I've owned a Sinclair ZX81, and have investigated both the TRS-80 Color Computer and the Atari 400, and can make some comparisons.

The most significant difference among the four is the keyboard. As a touch typist, I found the tiny Sinclair membrane keyboard almost impossible to use for long periods. The single key entry of most Basic keywords was of no help because I can usually type PRINT faster than I can hunt for the correct key on the ZX81's tiny surface.

The Atari 400 keyboard is only slightly better. It is roughly the size of an actual typewriter keyboard, so the fingers may be positioned for touch typing. However, the flat keys provide no feedback, and it is possible to do only slow, methodical touch typing with it. The Color Computer's calculator keys are better, but still not up to the full keyboard feel of the Vic.

Costs vary with power and equipment

On the basis of price alone, the Sinclair is quite powerful for $150 ($99 as a kit), but its 32-character by 16-line CRT display is black and white only, and resolution may be spotty on a variety of televisions. Of course, the unit comes with just 1K byte of memory, and expanding to 16K bytes raises its price $100. That is still less expensive than the $299 Vic, which actually costs closer to $400 with the required cassette recorder included.

That makes the Vic similar in price to the $399 Color Computer, which may be used with a tape recorder in a pinch. The Atari, also $400, is supplied with 16K bytes of memory, which may make it a better deal if all factors were equal.

The Atari will display 24 by 40 characters, to the Color Computer's 32 by 16, and Vic's 22 by 23 (without expansion add-ons).

The ZX81 is now limited to 16K-byte memory, but the other three systems can be expanded to 32K bytes with memory boards supplied by either their manufacturers or outside suppliers. The three color computers can also use ROM packs.

As far as other peripherals go, the Color Computer has an early lead, because its disk drives are now available. Outside suppliers have also introduced accessories for the Color Computer's expansion bus, which will make that unit very flexible should it remain in the Radio Shack line for a number of years.

Disk drives for the Vic have yet to be introduced, although one is promised. A printer is already available, and third-party suppliers offer RS-232 interfaces and other accessories.

As with any computer purchase, the final decision should be partially based on end-user requirements. On business trips, I carry a complete ZX81 kit in one pocket of my camera bag. For that application, small size and portability were paramount. Now I find the Vic-20 has its advantages. It is a low-cost color computer with a Basic that took me no time to learn. Because it has built-in lowercase and is portable, I may find some future word processing-on-the-road uses for it.

Others may prefer the Atari because an excellent selection of games is already available and the Color Computer might be the choice for some because of widespread Radio Shack support.

To date, support for the Vic from Commodore has been slow. Promised accessories and peripherals were two to three months late. My local dealer noted that he sold 50 units during the Christmas season, but would have been able to move 200 or more if more software and hardware had been available. The thoroughness of the *Programmer's Reference Manual* is a good sign, and could indicate an exciting future for the Vic-20.□

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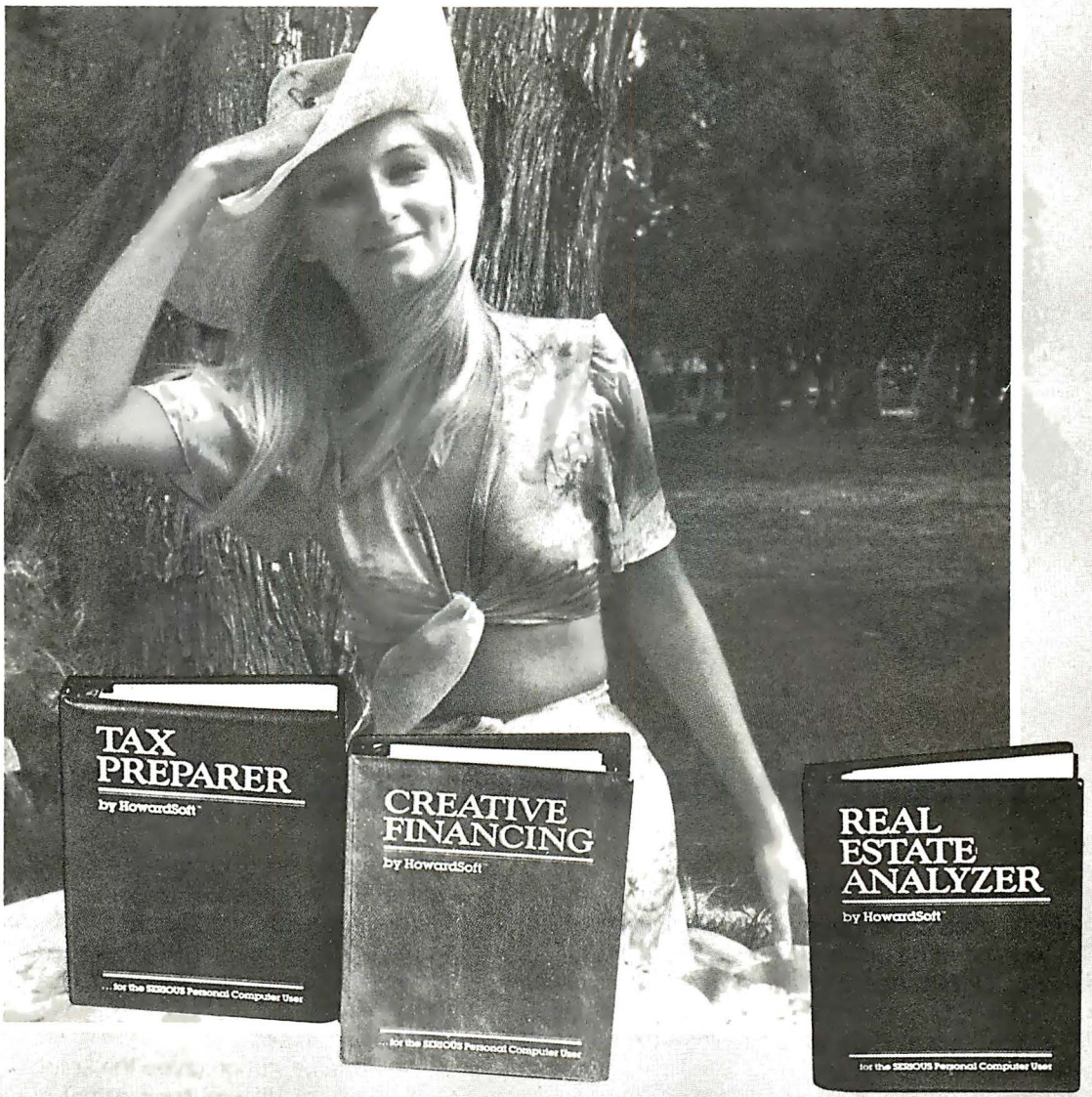

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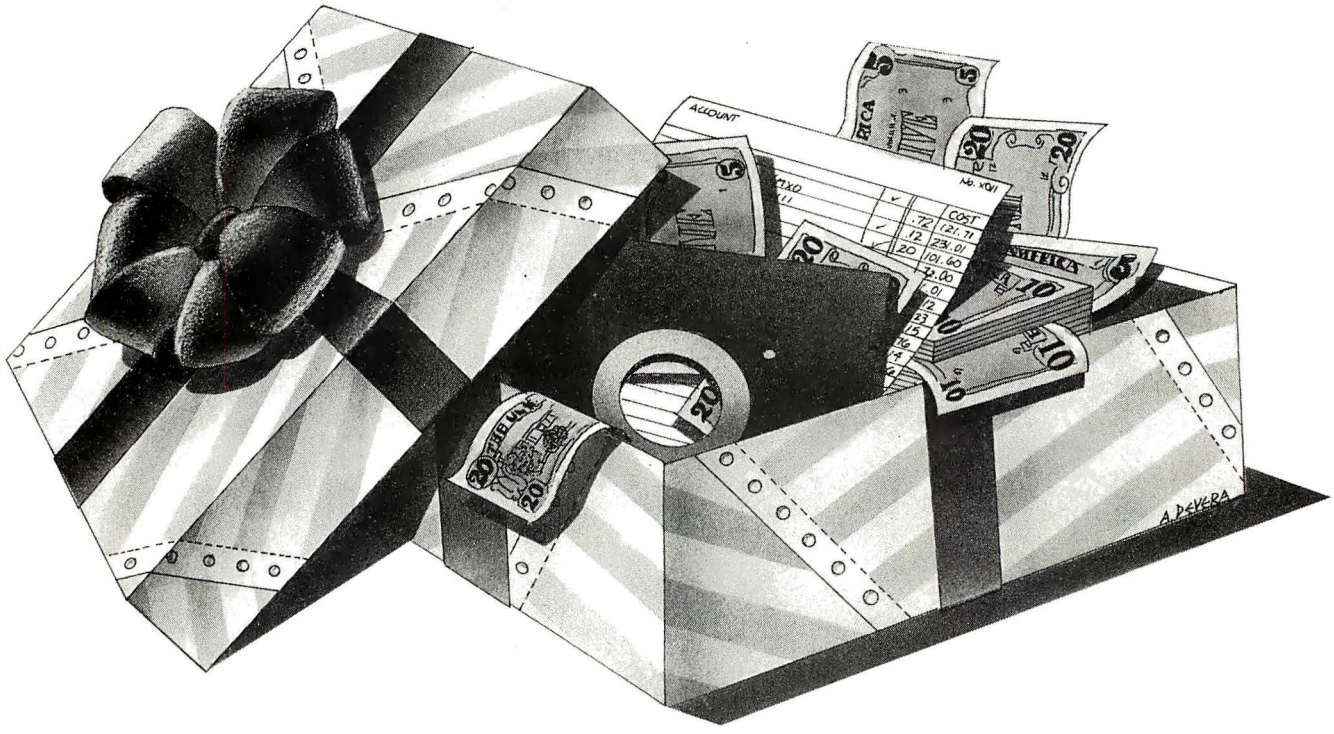

Financial Data and Ratios Program

by Rocky Smolin

Fin-Ratio, a microcomputer package designed to take the drudgery out of financial ratio analysis, is produced and marketed by FPS Assoc., Vancouver, B.C., Canada. The package ($195) is available in Microsoft Basic under the CP/M operating system and requires 48K bytes of RAM. I ran it on an Apple II with one disk drive, a Hitachi green screen monitor and an Epson MX-80 printer.

The program accepts company income statement and balance sheet data in dollar amounts for 26 accounts, as well as industry or company norms (as a percentage of total assets, liabilities, equity or sales). It also accepts industry or company norms for the ratios it produces. These data and norms are then displayed in reports, as illustrated in the accompanying figure.

The company data and norms are disk-stored in separate files. Only one set of company data can be operated on at once.

Operation is simple. Programs are menu driven and the main menu lists six options allowing: 1) entry of company data (the actual dollar figures from one's income statement and balance sheet); 2) entry of company or industry norms; 3) calling up the report generation sub-menu; 4) calling up the file names maintenance menu; 5) setting for disk drive 1 or 2, and 6) exit from the program.

Company and industry data entry proceeds along a list of accounts to be entered. A serious bug was encountered when trying to correct incorrect data: the cursor would go back only as far as the last account entered in the group. For example, if an operator had made a mistake in entering the asset accounts, the program would position the cursor at the "other non-current accounts" figure instead of either asking which account to correct, or placing the cursor at the beginning of the asset group.

The documentation gives the solution to all problems of this nature: "If you realize that something is going wrong in the execution of the program, then you can stop the operation by typing STOP. To get going again, you would just type RUN "FINRATIO" and the program will start over."

I consider this approach to program problems unacceptable. Today's microcomputer software market demands: 1) thoroughly user-friendly prompting and operation; 2) editing all data for correctness; 3) allowance for the correction of user operational or procedural errors through the use of prompts, and 4) total bomb-proofing to prevent unplanned exits from the program (i.e. checking for division by zero).

I had a similar problem while working with the report generation menu. I mistakenly selected the option to transfer calculated percent relations and ratios to the internal norms file. There was no way to exit this program back to the menu without either giving a valid file name and letting the program run its course, or stopping the program and re-running it.

The package maintains a list of file names containing company data and norms. The file name maintenance

Financial data and ratios form

COMPANY : ABC COMPANY

TYPE OF BUSINESS : ANY
NO. OF MONTHS IN P&L : 12
DATE OF FIN. STATEMENT : 12.31.1980
NORMS DESCRIPTION : 9.30.1981
COMMENTS : THIS IS A TEST

BALANCE	COMPANY $(000'S)	COMPANY %	NORM %
ASSETS			
CASH	10,000,000	14.29	10.00
ACCOUNTS RECEIVABLE	10,000,000	14.29	10.00
INVENTORY	10,000,000	14.29	10.00
OTHER CURRENT ASSETS	10,000,000	14.29	10.00
TOTAL CURRENT ASSETS	40,000,000	57.14	40.00
FIXED ASSETS AT COST	11,000,000		
LESS ACCUMULATED DEPRECIATION	1,000,000		
FIXED ASSETS, NET	10,000,000	14.29	20.00
NET INTANGIBLE ASSETS	10,000,000	14.29	20.00
OTHER NON-CURRENT ASSETS	10,000,000	14.29	20.00
TOTAL ASSETS	70,000,000	100.00	100.00
ACCUM.DEPR.% FIX.ASSETS AT COST		9.09	0.00
LIABILITIES			
SHORT TERM DEBT AND OVERDRAFTS	10,000,000	14.29	10.00
ACCOUNTS PAYABLE	10,000,000	14.29	10.00
OTHER CURRENT LIABILITIES	10,000,000	14.29	10.00
TOTAL CURRENT LIABILITIES	30,000,000	42.86	30.00
LONG TERM DEBT	5,000,000	7.14	10.00
OTHER NON-CURRENT LIABILITIES	5,000,000	7.14	10.00
TOTAL LIABILITIES	40,000,000	57.14	50.00
MINORITY INTEREST	5,000,000	7.14	0.00
PREFERRED SHARE CAPITAL	5,000,000	7.14	0.00
COMMON SHARE CAPITAL	10,000,000	14.29	0.00
RETAINED EARNINGS	10,000,000	14.29	0.00
EQUITY	25,000,000	35.71	50.00
TOTAL LIABILITIES & EQUITY	70,000,000	100.00	100.00
NO.OF PREF.SHARES OUTST., (000'S)	100,000		
NO.OF COM.SHARES OUTST., (000'S)	100,000		
TAN.NET WORTH , $/COM.SHARE	150.00		0.00
WORKING CAPITAL, $(000'S)	10,000,000	14.29	0

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menu contains functions to delete and rename files, change file descriptions, and either print out or list the names in the file on the screen. However, there is no correlation between the file of file names and the files actually present on the disk. The program disk I received had more than 50 file names in the file-names file, but only two data files were actually present.

The formats are clear and easy to read, but both the formats and their contents are fixed. If one chooses to suppress the norms on the report, they still print out, but as zeroes.

The program's most serious shortcoming is the fact that there is no way to adjust the accounts displayed to fit the needs of a particular business. For example, inventory turns implies only the presence of finished goods (with labor value added). For a manufacturing operation, consolidating raw materials, work-in-process and finished goods in one inventory figure, while using the cost of sales, would give misleading figures for inventory turns.

The Z ratio is a composite of several ratios designed to give an indicator of a company's likelihood of success or failure. The formula for Z is:

$$Z = 0.0012X(1) + 0.014X(2) + 0.033X(3) + 0.006X(4) + 0.01X(5)$$

where X(1) = working capital/total assets;
X(2) = retained earning/total assets;
X(3) = net profits/total assets;
X(4) = market value of the company/total liabilities, and
X(5) = net sales/total assets.

A Z ratio less than 1.8 indicates an almost certain failure while a ratio greater than 3.0 indicates almost no possibility of failure.

The package is a good idea for a program—generating financial ratios can be a burden. However, the need for financial ratios and the elements that go into them vary from company to company and country to country. They also vary over time as accounting standards and conventions change. To be truly useful, a financial ratios program must be flexible enough to allow for these variations.

It would also be desirable to allow the user to define the desired ratios. Most people who understand these ratios and have a need to apply them in their business decision-making know how they are calculated.

The documentation, whatever its inadequacies, reveals a considerable effort on the part of the authors to research their topic. Given the ease of use, flexibility, and widespread availability of VisiCalc and its cousins, the authors would probably have a more viable product if they were to publish their financial knowledge in a how-to form using VisiCalc to create financial data. Using this approach, a user could easily tailor the ratios and accounts to a company's particular needs. Several quarters or years of data could be kept on one spread sheet, and forecasting through moving average or linear regression could be implemented.

The authors state that the program has been developed over a couple of years and been subjected to many improvements. Apparently, enhancements are still underway, as a statement in the manual encourages constructive input from users. My suggestion to prospective purchasers is to wait until the program includes a more complete list of features than it presently offers. ☐

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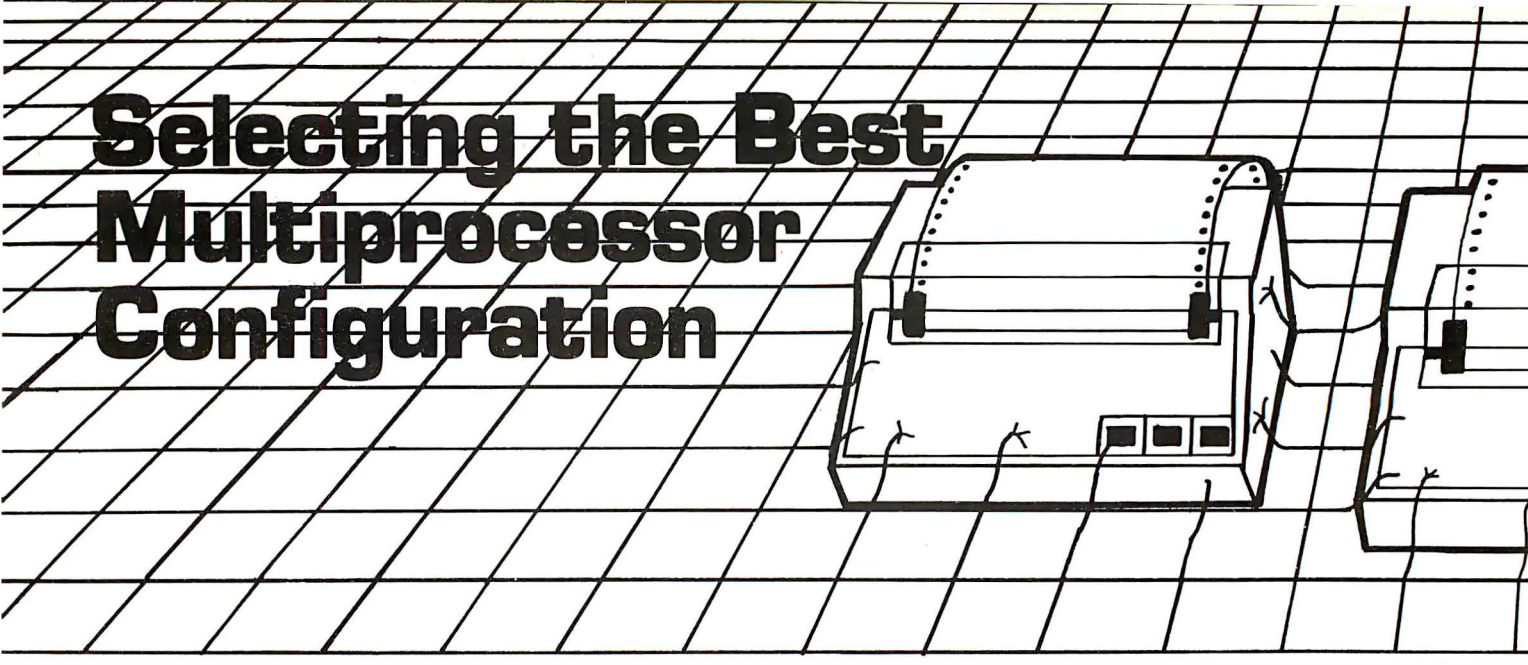


by Bernard Conrad Cole

Last month's introduction to this three-part series examined the pros and cons of using multi-microprocessor networks as an alternative to the traditional mainframe computer. This month, let's take a look at what researchers consider as the most appropriate multi-microprocessor set-up.

Shortly after the introduction of Intel's 8080 microprocessor, many people became fascinated by the possibility of linking multiple microprocessors together to assume computing chores which, up to then, had been handled by large minicomputers and mainframes.

Most of these efforts failed due to a lack of sufficient computing power and memory addressing capability in most eight-bit microprocessors. But these initial failures caused many researchers to investigate the necessary elements to make multiple microprocessor schemes work.

The most productive efforts involved investigation of closely-coupled multi-microprocessor schemes such as Carnegie-Mellon's Cm modular multi-microprocessor system, Digital Equipment Corporation's modular minicomputer using microprocessors, or the University of Texas' cooperative, loosely-coupled microprocessor architectures in an interactive data base task.

Coupling concerns the interaction between processors. In a loosely-coupled system, each processor has some dedicated complement of program and data memory, and, possibly, I/O devices. Each unit, which can function independently, communicates with another using either data transfers over a common bus or point-to-point communication lines. Coordinated signals may also be maintained in a commonly accessible store. A tightly-coupled system involves multiple processors sharing common program and data memory and I/O facilities. All processors access common busses to perform memory and I/O transfers.

Detailed Cm hardware design began in mid-1975 to explore ways in which large-scale integration could be applied to modular computer structures. The Cm architecture allows close cooperation among large numbers of inexpensive processors, each with access to a single virtual memory address space. There are no fundamental size limits for such a system, and processors can be added incrementally to increase power, memory size and communications bandwidth. A 10-processor system was in operation by mid-1977 and expanded to a 50-processor system by the end of 1978.

The Carnegie-Mellon project brought an experimental multi-microprocessor scheme to an operational state, demonstrating that almost-linear speed-up can be achieved. There have been no serious bottlenecks or deficiencies in the processor/memory bus structure precluding configurations with 100 or more processors.

The LSI-11 microprocessor was Digital Equipment's basic LSI-11 machine, and performance was compared against that of the PD11/70 super-minicomputer, the top of the 16-bit PDP-11 line.

Research has shown that in the right batch-processing environment, an eight-processor system could achieve a throughput 6.5 times greater than that of a single-component uniprocessor.

The multi-microprocessor system that most closely parallels a networked personal computer is the loosely coupled configuration. A great deal of investigation into such schemes has been conducted, most recently by researchers at the University of Texas.

Using a specially developed, discrete simulation tool called System-State-Modelling, four different classes of system architecture were analyzed:

System I, fully connected, in which each processor is connected to each other processor by a dedicated link;

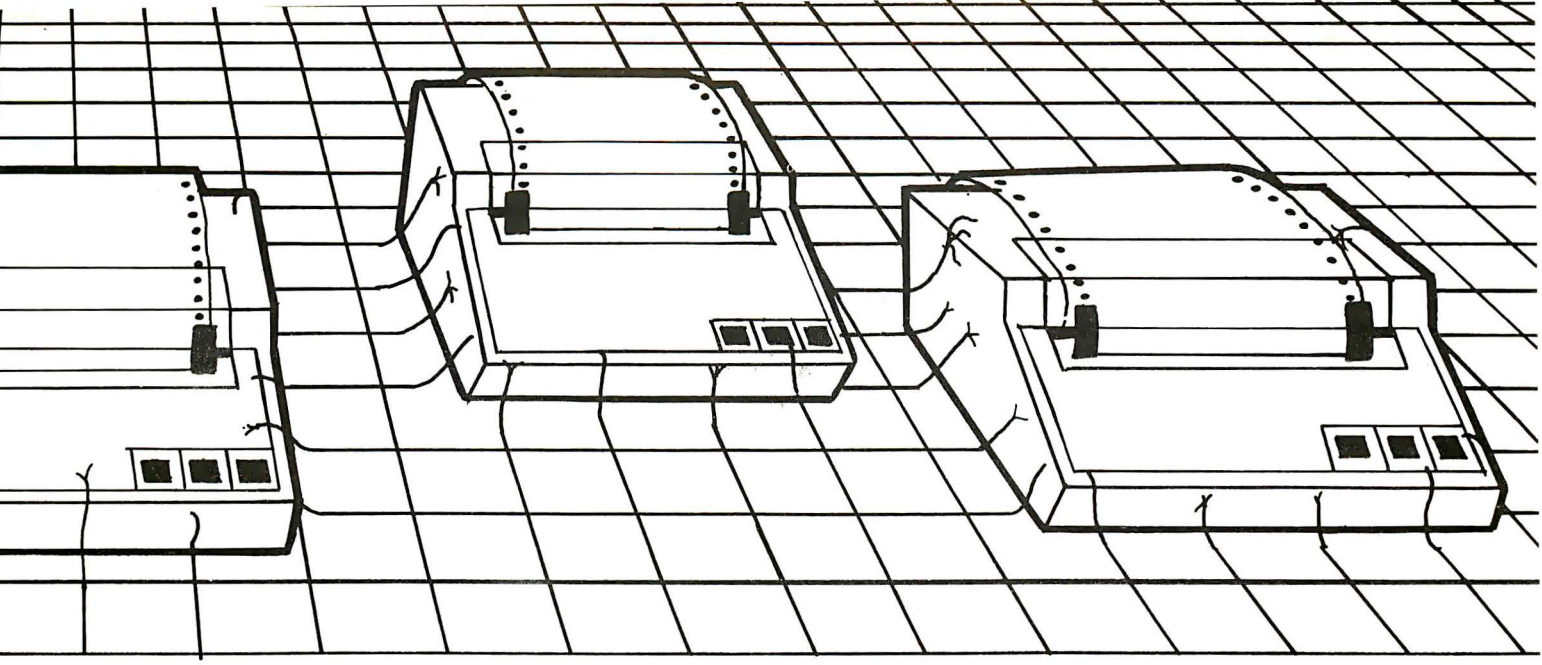
System II, bussed with private primary store, where all processors share a single, common link, allowing any two to establish direct transfers;

System III, also bussed, but with both public and private primary store; and,

System IV, a uniprocessor, for comparison with multi-microprocessor schemes.

In the study, all four classes possessed common features in their basic processor configurations, interprocessor channels, user consoles, secondary storage, operating software, application software and task loads.

Basic processor architectural features included: (1) 15 generic operations; (2) one address, three-field instruction format; (3) single internal data bus comprising separate address and data lines; (4) all registers, data paths and primary store locations 16 bits wide; (5) primary store read/restore cycle of 1 μs; (6) 16 general-purpose registers; (7) average instruction time of 2μs;



(8) primary store organized in blocks of 256 words; (9) indexed, indirect and segmented addressing modes; (10) vectored interrupt mechanism; (11) multiplexor channel; (12) direct-to-primary store selector channel capable of operating in block or word mode.

The multi-microprocessor units were connected by one of two methods, both of which provided 16-bit parallel data transfer. In Class I, a point-to-point selector channel was used between each pair of units. In Classes II and III, a specially-designed interprocessor channel bus was used, to which all processing units were connected by a form of selector channel, allowing any two units to establish exclusive communication. The channel transfer rate was set at 2M bytes per second to match the primary store access cycle.

User console features included a CRT display, an alphanumeric keyboard and a special-function keyboard with display registers. Data transfer rate for each console was 2K bytes per second, equivalent to about 19K baud serial data rate. The number of consoles varied with the number of users, from one to 32 maximum.

Two forms of secondary storage were used, bulk store and fast bulk store. Bulk store, with a moving head disk or equivalent memory, was used for the knowledge base, while fast bulk storage in the form of a fixed head disk was used to perform logical to physical reference mapping and save user states.

No master operating system was used, although most of the functional design was extracted from the operational uniprocessor used for comparison purposes. Processors were task driven, using simple ranked input and output queues to schedule and coordinate activity.

Study results ruled out the Class I fully connected multi-processor. The specialized capability of each processor to communicate directly with any other processor over a dedicated link was not justified for two of the three intercomputer links. Furthermore, the configuration didn't provide an easy or inexpensive means to add computing units.

For a basic task load and a modest number of users —eight or less—the two multi-microprocessor configurations showed responsiveness comparable to the uniprocessor. However, internal activity and utilization are sometimes quite different. For example, if widely varied, dynamic task loading were used, then System II might have been the best alternative. If exclusive tasking were to be included, a public store would not be an advantage, so System II would also be preferred.

For heavy task loads and a larger number of users (16 to 32) System III performed better than the others and it utilized public store effectively. System III would be the best configuration for cooperative tasking.

The multi-microprocessor alternative to the mainframe CPU holds its greatest promise in application between the huge, powerful, special-purpose vector processors and low end, control-oriented tasks now occupied by general purpose business-oriented mainframes and super-minis.

Except for a relatively small class of jobs where a very large amount of computing is required in a very short time, high processing speed is used in present mainframes and superminis to process as many independent jobs in as short a time as possible. This is true when the jobs are being submitted in a batch mode or when interactive computing is required.

This means that as long as a minimum acceptable response or turn-around time is maintained, the same effective processing power could just as well be provided by a set of less powerful multi-microprocessors or multi-terminals concurrently operating on independent jobs.

Based upon various multi-microprocessor networking alternatives, it is clear that with the proper features, there are several ways to configure multiple personal and small business computers to achieve this end.

Local hierachy is basically a scheme without a central processor. There is a central memory accessed through some sort of intelligent interface, which needs to be nothing more than a computer in the local multiprocessor that can hold extra memory. An ordinary personal computer with Winchester-type hard disk capability can be easily adapted to handle such a job.

A more sophisticated solution would be to use an intelligent disk storage system and to configure it as a stand-alone data base management system accessible by one or more CPUs and/or terminals. This field-expandable disk controller, containing interacting microprocessors sharing cache memories, handles all data access work, including indexing, searching, buffering, deblocking, storage management and error recovery

functions. Data transfer consists only of a requested discrete item, record or file, making the use of RS-232 interfaces between the disk systems and the various terminals in the system possible. Such systems can easily handle to 54M bytes of data and is expandable up to 16 drives or 864M bytes.

This system offers high throughput, providing the common-memory hardware is quick. Implementation and development of such a system initially would require only a single intelligent terminal, common memory and an interrupt network. The common memory can be loaded with dummy parameters and variables, and as additional terminals are added, these variables, as well as the corresponding system-state vector entries, become active.

Time-shared/common bus and shared memory is potentially the simplest interconnection scheme for a multi-microprocessor network. It incorporates a common communication path connecting all functional units.

It is easily modified by adding or removing functional units. However, expansion may reduce overall system performance.

Since the common bus is a shared resource, a means to resolve contention in fixed priority, first in-first out or daisy chain schemes is necessary. The organization's most serious limitations are its reliability and interference between processors requesting the bus. Since there is only one path for all transfers, overall transfer rate within the system is limited by bandwidth and the speed of this single path. For this reason, private memory and private I/O are highly advantageous, since the failure of the common path could cause complete system failure.

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If the number of busses in the first organization were increased to the point where there is an available path for each memory and I/O unit, the result would be a crossbar, switch-based multi-microprocessor system.

In an N by M crossbar switch, there are N active elements (in this case microprocessors and I/O units) and M passive memory elements. Functional units in such a system need minimal bus interface logic since they perform neither conflict resolution nor recognition of data intended for them. These functions are performed by a switch matrix, which is necessarily complex, costly to control and physically large.

Requires complex switching

One line of the crossbar carries address, data and control bus signals that might correspond to as few as 32 or as many as 64 wires. The complexity grows exponentially as N and M become large. A major advantage of this approach is its ability to support simultaneous transfers between all processors and memory units. The logic for the switching and arbitration of all transfer requests must be included in the switch—an advantage and a disadvantage in building a multi-microprocessor alternative to a mainframe. On the positive side, it involves the least alteration in personal computer design, since control and switching logic is contained in the switch. On the negative side, it requires development of relatively complex switching interface.

In a multiport memory system, the control, switching and priority arbitration logic is concentrated at the interface to the memory units, rather than being distributed throughout the crossbar switch matrix.

Multiported systems use multiple busses dedicated to connecting terminals with memories and shared I/O units. Contention logic must be built into memory and I/O units to arbitrate between the processors competing for the resource. One way to resolve memory access is to assign fixed priorities to each memory port.

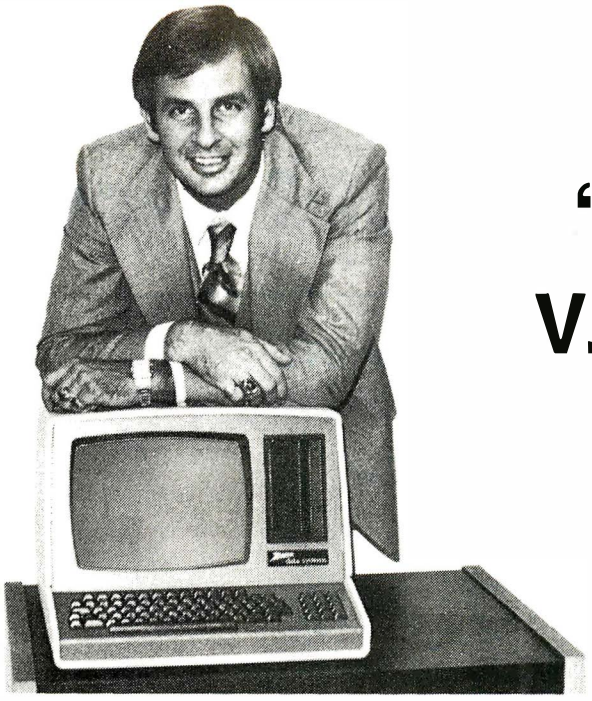
The chief advantage of this approach is the very high total transfer rate. But this is offset by the fact that this approach requires expensive memory units, since most of the control and switching circuitry is included in those units. Moreover, it requires many cables and connectors.

Two variations eliminate many of the disadvantages. The first uses shared memory as a "mailbox," while the second incorporates shared memory into a virtual memory environment.

Mailbox shared memory uses common memory as a message center where each terminal can leave messages for other terminals and pick up messages for itself. Virtual memory incorporates a virtual address space beyond the size of any processor's internal memory and requires address translator hardware and various segmentation techniques.

Ultimately, with the development of higher density memory components, a dispersed processing multi-microprocessor configuration with shared virtual memory and some sort of central indexing scheme would appear to be the best multi-microprocessor network alternative to the mainframe CPU.

The concluding article next month will review commercially available multiprocessor systems hardware, operating systems that address the requirements of multi-microprocessing, and high-speed media improvements being proposed for use in local area networks. □



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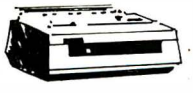

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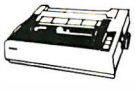

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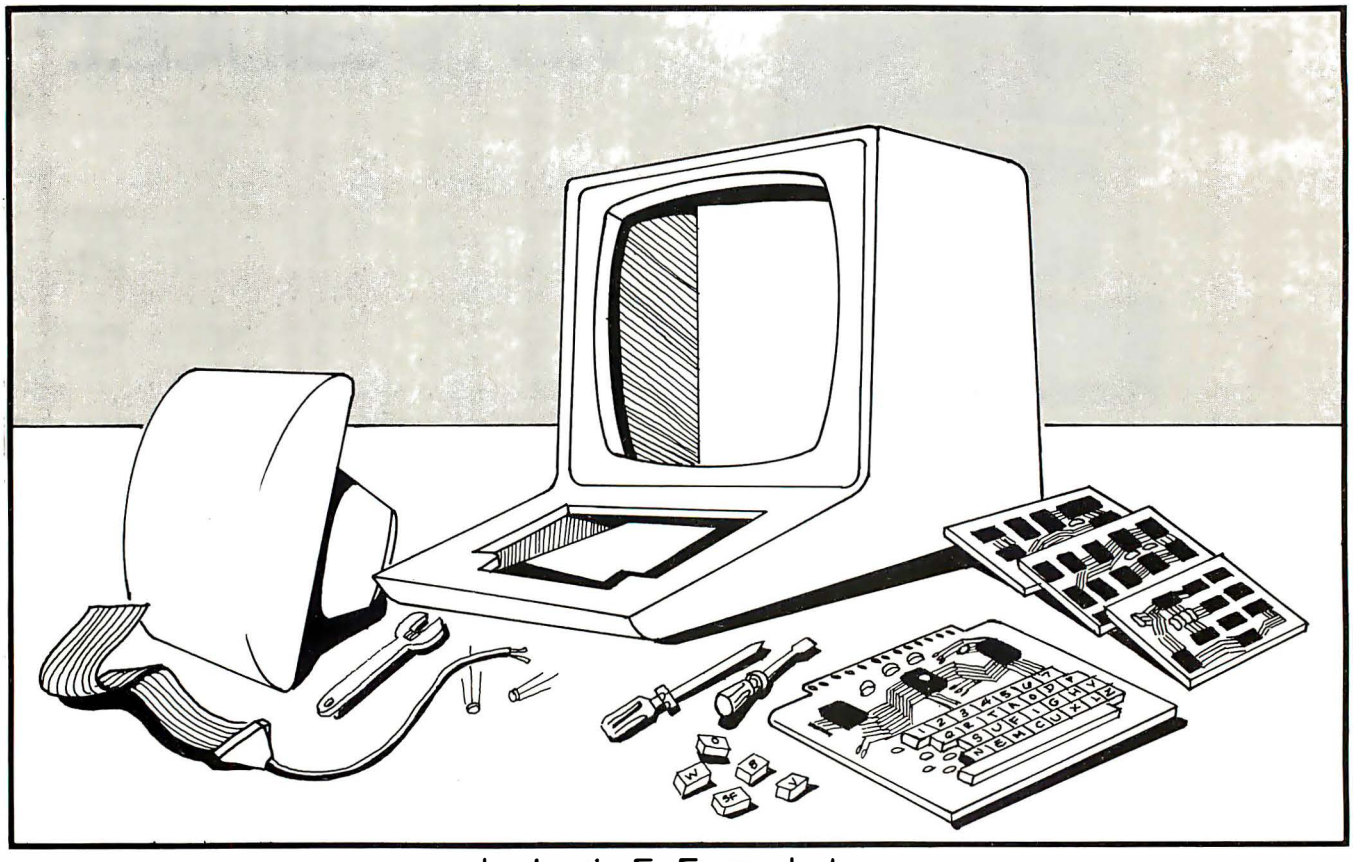
Whatever Happened to Computer Hobbyists?



by Louis E. Frenzel, Jr.

The microcomputer industry, a field pioneered primarily by hobbyists, is now a major U.S. enterprise. Thanks to a never-ending supply of high technology components, good software and major shifts in the marketplace, the microcomputer field is no longer the curiosity it once was.

Those responsible for building the first microcomputers, applying them to a wide variety of tasks and making us all aware of them, were computer hobbyists. But today, the big emphasis is on business, professional and industrial applications. Has the hobbyist disappeared completely? Let's explore the changing role of the hobbyist in the dynamic micro marketplace.

Firstly, how does one define computer hobbyists? One might call them individuals whose spare time is largely taken up with building and experimenting with various types of microcomputer hardware, software and applications. Hobbyists were the first group to take one of the early microprocessors, to combine it with some cheap semiconductor memory, and to build a completely workable digital computer. They built microcomputers in their basements, garages, workshops and back bedrooms, and got the personal computer market on its way.

Of course, the introduction of the microprocessor in the early 1970s stimulated this activity. While the prices of the first microprocessors were more than an individual could bear to spend on a hobby, prices dropped steadily with increased industrial applications. Soon prices came within the reach of the average person. Scelbi introduced a microcomputer using the first eight-bit microprocessor, the Intel 8008, in 1974, and a magazine article published by Johan Titus in *Radio Electronics* gave construction details for a personal computer using the 8008. In 1975, MITS introduced its original Altair computer using the Intel 8080. Computer hobbyists bought these machines, and quickly and effectively brought them to a level of sophistication and practicality.

But the computer hobbyist goes back further than that—to the mid-1960s. It was during the early and mid-60s that the minicomputer was born. As digital integrated circuits became cheaper and more widely available, the prices of digital computers began to go down. It became possible to build a minicomputer for less than $20,000. Within a few years, the $10,000, then the $5,000 barriers, were broken, thanks to integrated circuit advances.

Electronic hobbyists and experimenters were also beginning to discover digital integrated circuits. It didn't take long for them to realize that it was possible to design and build real digital computers. Before the integrated circuit, it was pure fantasy for anyone to dream of owning a computer with its thousands of

tubes or transistors and its requirement for tons of air conditioning in a giant, raised-floor room.

Experimenters began to design and build small-scale digital computers using the RTL and DTL circuits. The biggest problem was memory—semiconductor memories had not yet come on the scene, so the major focus was on finding a cheap, surplus, magnetic core memory. Once the memory problem was solved, it was relatively easy to design the arithmetic, control and input/output circuitry for a small digital computer.

Some hobbyists took another approach. Many attempted to obtain a schematic of Digital Equipment Corporation's low-cost PDP-8 minicomputer series. There were many attempts to copy this machine and other small, low-cost minis of that day.

In 1966, Steve Gray, a magazine editor in Darien, CT, started an organization for computer hobbyists. Known as the Amateur Computer Society, its prime purpose was to help hobbyists who were attempting to build computers to communicate with one another and with potential parts suppliers. A monthly newsletter began in December 1966 and ran well into the early 1970s. Many home-built computer projects were begun and completed with this publication's help. So it was actually during the late 1960s and early 1970s that computer hobbyists began to appear in significant numbers.

Hobbyists followed along with the technological developments, first with semiconductor memory, then with the microprocessor. With each improvement in semiconductor technology, it became faster, easier and cheaper for an experimenter to design and build a computer.

The first microcomputer kits appeared in 1974 and 1975 and the computer hobbyists took a giant step forward. For every experimenter willing to design and build a computer, there were thousands more willing to buy and put together a kit. Thousands of the early kits were sold, many to hobbyists, who dominated the marketplace until 1978.

In 1977, Apple, Radio Shack, Heath and other major manufacturers began to enter that arena. Their products enabled a new wave of applications, particularly in homes, small businesses, education, industry and science. Floppy disks and other software helped these applications to grow quickly.

Hobbyists' interest vary

Today microcomputers are a billion-dollar-a-year business. Hobbyists are still around, but are a much smaller portion of the overall market.

Some hobbyists are interested in hardware, others, software, and others, applications. The great thing about computer hobbyists is that they will never master it all. The field is constantly changing as new technological developments emerge. Denser memory chips, more powerful microprocessors, higher quality I/O devices and higher density mass storage keep things lively. New operating systems and languages constantly challenge hobbyists' software and programming interests. Applications are endless. Because of the general-purpose nature of the microcomputer, hobbyists never run out of ways to apply their machines. Most never grow disinterested.

It was once thought that everyone would like a home computer to do routine chores. While many microcomputers have been sold to play games, to keep checkbooks up-to-date and to store Christmas card lists, the people buying them are consumers rather than hobbyists. The consumer's interest is in what the machine can do for him rather than in the machine itself, how it operates and how to program it. Yet, many manufacturers and most market research studies lump

Hobbyists have been dabbling with 16-bit processors for years . . .

the hobbyists in with the home or consumer market. The two couldn't be more dissimilar. While a hobbyist may play games too and use his computer to control his intrusion alarm, his main interest is more technical nitty gritty than canned applications.

Despite the availability of many high-powered, low cost microcomputers, there are still purists who insist on designing and building them. Microprocessors, memory chips and other devices have never cost less or been more widely available. While many hobbyists enjoy the challenge of designing their microcomputers, others say that what they want is not available. For example, hobbyists have been dabbling with 16-bit micros for years, yet we are only just beginning to see reasonably priced commercial 16-bit machines.

It is easy for an individual to build a microcomputer today. Many do this by buying integrated circuits from a mail order firm, wire-wrapping them on some perfboard, then spending hours debugging the resulting computer. But even when the computer has been built, the hobbyist's work has just begun. In order to make his creation work, a builder has to program it. Sometimes software such as a Basic interpreter or a monitor program is available and can be quickly adapted to a new machine. In other cases, software is written and debugged.

Another class of hobbyists buys inexpensive microprocessor trainers or board level micros and attempts to expand and enhance them. While they have saved themselves the trouble of designing the basic machine, the fun comes from adding memory, attaching peripherals and coming up with additional software.

There is a special group of hobbyists whose only interest is building or enhancing their hardware. They really never actually use their machines and when they can no longer expand a computer, they start on another.

This whole area of expansion and enhancement of small, low-cost microcomputers is a major activity. Hobbyists have banded together to form clubs and users' groups to exchange information and experiences about various computers. Typical of the machines that have been popular in this regard are the old MOS Technology Kim 6502, the RCA VIP, the Heathkit ET-3400 trainer, Netronics Elf, and more recently, the Sinclair ZX80 and ZX81. It is satisfying to take a

small, low-cost machine and add hardware or software, allowing it to do something it was never meant to do.

Because hobbyists pursue their avocation as a sideline, they are, typically, limited in the amount of money they can spend. They constantly shop for bargain equipment. A businessman or home owner may opt for a complete computer with matching peripherals and software. But the hobbyist is willing to mix and match a variety of hardware and software products, prepared for interfacing difficulties and the need to create special I/O drivers to make a particular peripheral talk to a specific computer. Doing this, hobbyists not only save money, but have the satisfaction of making the pieces work together.

One hobbyist, after years of dabbling with home-built machines, purchased a commercial computer, a used, inoperative TRS-80 model I. The model I is no longer produced and there are many on the used market. This one cost very little. He quickly found one defective IC, and for less than $1, had the machine in operating condition. He then bought an interface, also inoperative, made repairs, and also bought surplus RAM chips to expand memory to its 48K-byte limit. He is now operating with audio cassette mass storage and is saving for a floppy, but has purchased some low-cost cassette software still available for the model I. He is writing a Z80 machine code disassembler to dissect other users' programs. Also, he recently found a console I/O typewriter from a Perkin-Elmer minicomputer and has been successful in interfacing this machine to his TRS-80 at very low cost.

Another hobbyist is spending a great deal of time learning Forth. There aren't many books on the subject, but he has obtained some by attending microcomputer shows and carefully scanning mail order ads. After working with Forth on an Apple II computer, he decided to implement a tiny Forth program on his Kim and a TRS-80 model III. He even belongs to a local Forth user's group that meets monthly to share its knowledge and experience with the language.

There are hobbyists who like to build kits, though they may not like to design their hardware. Except for Heath Company (which now belongs to Zenith) and a few small accessory manufacturers, there is a scarcity of kit sources.

The smaller kit manufacturers stick with accessories such as beginner or training kits, or memory and I/O boards. Hobbyists buy them to repeat the feeling of successfully completing a kit, and to save some money by building it themselves.

Programmers are special

A special category of computer hobbyist is the one whose primary interest is software. While the highest percentage of hobbyists probably concentrate their attention on electronic hardware, there are some whose main interest is programming. These hobbyists purchase machines and spend their time creating software. Most interest seems to be in system software, where activities include writing operating systems, learning exotic new languages and creating special utilities. It was hobbyists who largely supported the movement toward the wider use and acceptance of Pascal, C, Forth, LISP and other esoteric languages. A hobbyist will occasionally have a practical streak and be interested in writing down-to-earth, usable applications programs. A major activity in applications software is taking an existing program for one machine and converting it for use on another, and hobbyists are masters at this art.

A major interest for software hobbyists is games. While many games appear trivial or frivolous to the user, they are a real challenge to the programmer. Game writers do some of the more sophisticated and difficult programming today. Games are complex simulations and typically involve a great deal of mathematics and graphics. Games are the epitome of software success to a programmer and some of the best microcomputer programmers in the field are games programmers. It is fun to think up an interesting game, then write the program for it. Many hobbyists like to take their favorite games and attempt to write software for them. And, of course, most hobbyists still play games.

Computer hobbyists are alive and well and living throughout the United States, Germany, Japan, the United Kingdom and other countries. But because hobbyists are now a much smaller part of the overall microcomputer business, attention has shifted from them. While the microcomputer field is expected to continue its enormous growth rates of 30-40% per year, the hobbyist percentage of the market is expected to decline. One recent market study indicated that the home and hobby portion of the micro market represented 25% in 1980 and is expected to decline to 15% by 1985.

But while the percentage is declining, the number of hobbyists is increasing each year. It is a small, very active and healthy market whose growth will continue in the foreseeable future.□

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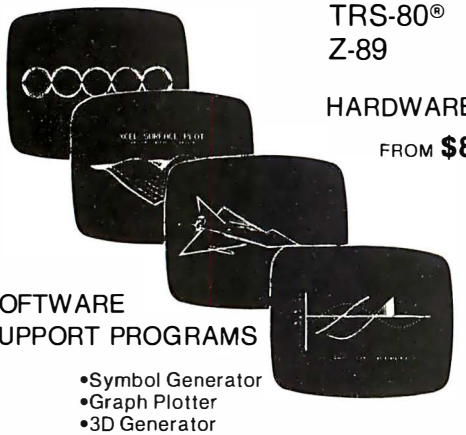

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--TRS-80 Model I/III versions require only one disk drive and 32K of RAM, and are compatible with all TRS-80 word processors and operating systems. Model II version requires 64K and 1 drive. TRS-80 Model I/III: Proofreader - $59.00, Interactive correction option - $30.00, Grammatik - $59.00. All - $139.00. TRS-80 Model II: Proofreader - $99.00, Grammatik - $99.00, Both - $179.00.

--The 8086/8088 version will run under MS/DOS or equivalent (including the IBM Personal Computer DOS). MS/DOS formats available include standard single density 8" and IBM PC 5.25". CP/M-86 versions scheduled for Summer 1982 availability. Proofreader - $129.00, Grammatik-$150.00, Both - $250.00.

IMPORTANT ORDERING INFORMATION: You MUST specify computer model, operating system, memory size, and format and number of disk drives when ordering either software or manuals alone. Please include your phone number. All U.S., Canada, and Mexico orders include first class shipping in price. Overseas please add $5.00. We accept cash, check, money order, VISA and Master Card. Sorry, no UPS or COD service available. Purchase orders accepted from educational institutions and nationally recognized corporations only. Cost of manual only orders can be credited to final purchase. NM residents add 4% sales tax.

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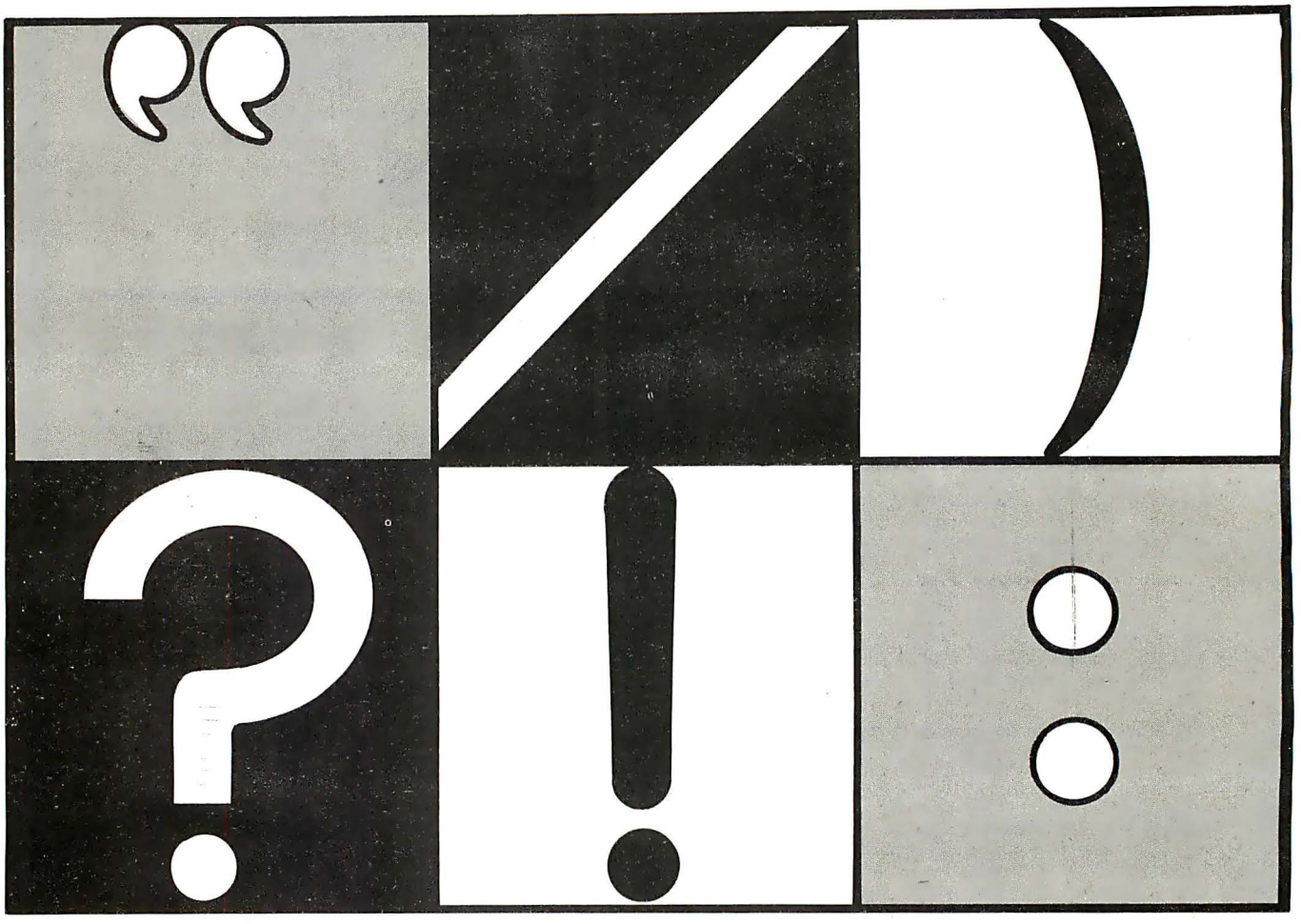
Software Review

Grammatik



Syntax-Checking for CP/M Documents

by Alan R. Miller

Grammatik by Aspen Software (Tijeras, NM) is the perfect complement to a spelling-check program. It can analyze a document for several different kinds of problems, including:

- archaic usage (alas)
- unbalanced parentheses and quotation marks
- capitalization errors (i)
- doubled words or punctuation (the the)
- informal usage (lots of)
- awkward usage (your and my)
- commonly misused words (affect)
- overworked or trite phrases (down to earth)
- punctuation errors (.EQ.)
- redundant expressions (absolutely complete)
- spelling errors (can not)
- trademarks (coke)
- improper usages (somewheres)
- vague adverbs (fairly)
- wordy phrases (as a consequence of)

The mechanical aspects are straightforward. For example, the program checks that parentheses and quotations are paired, that sentences begin with a capital letter, and that the single letter "I" is capitalized. It flags upper-case letters in the middle of words (including the tradename WordStar). Doubled words such as "the the" seem to appear frequently in word-processed documents. Grammatik readily finds them.

Grammatik expects punctuation marks such as a period, comma or semicolon to be at the end of a word, rather than at the beginning. However, Fortran, Pascal and assembly language programs will generate errors. For example, the Fortran expression:

```
IF (A .EQ. B) GOTO 40
```

contains a period at the beginning of the "word" EQ. Comments in assembly language programs may be preceded by a semicolon. For example, the line:

```
;CONVERT BINARY TO ASCII
```

will be flagged.

The less mechanical aspects of writing are more complicated. Wordy, trite or overworked phrases may

be grammatically correct, but experienced writers will want to avoid them. Grammatik readily discovers problem areas.

The package is actually a collection of several programs distributed on a CP/M diskette. The main program, called GMK, performs mechanical tasks such as checking for balanced parentheses and quotation marks, doubled words, capitalization and punctuation errors. A separate disk file, named PHRASES, contains more than 500 entries. It is used for the remaining categories.

If the program is executed without an argument, it presents a list of options. One of these allows the user to select the filename to be checked. Another designates the command character used by the editor (i.e. period at beginning of line). The program will then ignore the remainder of such a line. Additional options are used to send errors to the video screen, to the printer or to a disk file.

An alternate way to use it is to create a separate configuration file containing the desired features. The options are then chosen automatically. With this method, the command line includes the name of the file to be checked. The output file will have the same primary name as the source file. With either method, the user must specifically indicate that the phrase dictionary is to be read into memory.

During the analysis phase, the original text is shown on the video screen. Error messages are embedded directly in the displayed text. The user can decide whether the scrolling will stop at each error or whether the output will scroll continuously through the document.

At the end of the analysis phase, Grammatik provides a summary, giving the number of sentences and words, the average sentence length, the average word length, the number of words in the shortest and longest sentences, the number of infinitives and the number of prepositions.

The entire manuscript of my Fortran book was given to Grammatik. This manuscript was prepared with WordStar, proofed by Spellguard, then checked by an editor at Sybex, Berkeley, CA. Grammatik flagged many locations throughout the book. Most of these cases were proper Fortran constructions such as:

C
C DESCRIPTION OF PARAMETERS (doubled word C C)

and

IF (FUDGE .LT. 0) GOTO 99 (punctuation .L)

Several doubled words were correctly flagged (the the), but so were several that were meant to be double (million million). However, other flagged passages truly needed attention. For example, Grammatik suggested changing the expressions shown in the first column below to those shown in the second.

original expression	**suggested alternative**
utilize	use
in the range of	between
in some cases	sometimes
all of	all
in the form of	as
divide up	divide
one of the	one
in conjunction with	with

Grammatik found a very important pattern; the expression "in this case" appeared 66 times. This phrase expressed four different concepts, and most of the examples were reworded.

During the analysis step, the program was configured to stop at each error. A previously printed copy of the manuscript was then marked with a red pen as each error was located. At the end of the analysis step, WordStar was used to alter the original manuscript.

Besides the main dictionary, there is an auxiliary dictionary of about 100 sexist phrases. Most of the entries contain man, boy or woman as a suffix. The word macho also appears.

Both the main dictionary and the dictionary of sexist phrases are written in ordinary ASCII text. Consequently, they can be altered with any standard text editor. Each entry is written on a separate line and is terminated by a number sign (#) and a reference letter or number, indicating the nature of the entry. If there is a suggested replacement, a "greater than" symbol (>) comes next and is followed by one or more alternatives separated by commas.

Word frequency count available

PROFILE is a completely separate executable program also provided on the diskette. It can be used to determine the frequency of word usage in a document, and the result can be sent to the printer or to a disk file. All words in a document are arranged in order of frequency. Within each group, the entries are sorted in alphabetical order.

Words that are used only once are sorted and shown first. Words used twice are presented next. Then those used three, four and five times are given. There will typically be many words in the first few groups, but only a few in the later groups. Words that are used only once may contain misspellings. The most frequently used words include the, of and a.

SORTDICT is another executable program included in the package. It can sort a user-prepared dictionary or any other ASCII file. Actually, Grammatik does not require its dictionaries to be sorted. However, a sorted dictionary is easier to read and maintain.

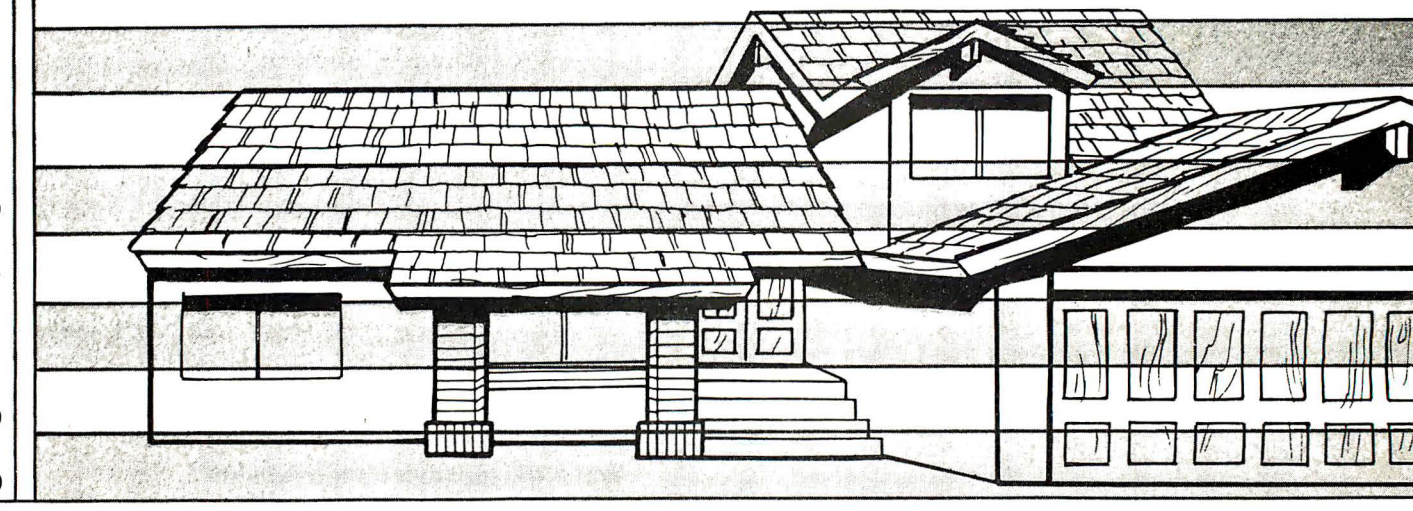
This article was prepared with WordStar, proofed with Spellguard, then checked with Grammatik. The program found all the examples of incorrect phrases that were deliberately included as examples. The following summary was then generated.

Summary for GRAMM.STR / Problems detected: 37

sent: 82 ; # words: 1236
avg sent len: 15.3 ; avg word len: 4.9
questions: 0 ; # imperatives: 0
short sent (< 14 wds) : 51 ; long sent (> 30 wds): 4
longest 83 wds at sent # 23 ; shortest 1 wds at # 31
to be's: 70 ; prepositions: 149
User category totals:
NONE

Grammatik is a useful aid for professional writers. It is the perfect complement to a spelling checker, such as Spellguard or SpellStar. Aspen Software also provides a spelling checker called Proofreader that can be integrated with Grammatik. (See article on page 74.)□

Real Estate Ad Writer



by David D. Busch and Norman Jennings

A basic advertising principle is "sell the sizzle, not the steak," and real estate advertising is no exception. Enticements to lure prospective buyers to a home might emphasize the ease of commuting, the comfort of country living, or the monetary gains possible by fixing a relic for resale. Such mundane concerns as leaking basement (or lack of a basement) rarely find their ways into real estate ad copy. Instead, tried-and-true formulas, designed to capture the interest of the home buyer or investor, prevail.

In fact, there have been some well-publicized efforts to reduce the entire real estate ad-writing procedure to a science, and a computer science at that. One program was fed information about the White House; it was accurately described as a luxurious executive mansion, with plenty of room for entertaining, in an excellent location.

The accompanying program, Ad Writer, is a scaled-down version that will prepare some interesting—and effective—advertisements quickly and painlessly, employing user input to assemble some workable phrases. A data base of more than 240 ad lines is included, and the program has been written to be easily expanded. It will produce a nearly endless supply of ads that will require only minor tailoring or augmenting.

The program is written for TRS-80 models I or III computers, and will work with level II, model III Basic or Disk Basic. You do not need disks to run it, but a printer would be handy for saving the output.

You may not regard the output as a finished classified ad. A line or two with unique features can always be inserted, if you wish. The program simply takes the drudgery out of routine classified ad writing.

Many of the phrases in the data base were taken from *Real Estate Advertising Ideas,* a publication of the Realtors National Marketing Institute. If you want to expand the list of available phrases, you may want to obtain your own copy of this excellent book by writing to: National Association of Realtors, 430 N. Michigan Ave., Chicago, IL 60611. In addition to tips on preparing classified ads, the book contains some valuable information on display advertising, brochures, broadcast media and other marketing tools.

To run Ad Writer, the user is asked to supply certain information about the property. Price of the home is entered first, along with whether or not that price is considered high, low or medium for that particular area. In California, a $100,000 house is practically a rock-bottom bargain, while in the midwest, such a home would be classed as a middle-priced or "bargain prestige" offering. This function also allows the program to keep pace with inflation.

Next, the program asks whether the home is located in the city or country. Suburban homes will most frequently be lumped in with the country classification because of the particular benefits that accrue to each. Number of bedrooms, usually the most important question a buyer has after price, is input, along with whether or not the home needs repair. The user can also flag the offering as an investment property, then indicate whether or not some element of humor is desired in the finished ad.

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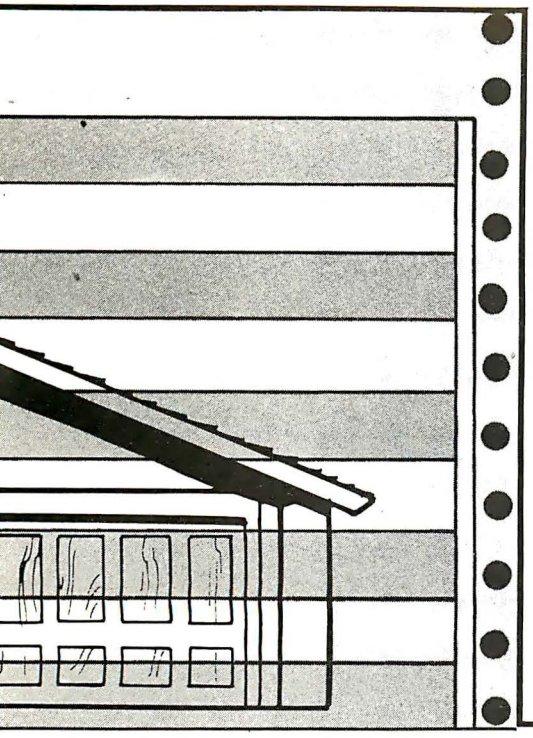

——Expansive, not expensive!——
Close-in location! How would you like your next home to have four bedrooms? The price is right, too—$90,000. Ask to see this soon.

——A little mansion.——
Rolling countryside! Do you need eight bedrooms? A word to the wives is sufficient. Brighten your future for $200,000. Don't miss the boat!

——In the low-cost field.——
Close to everything! Should the home you've been looking for have three bedrooms? A little paint and water will work wonders! Adam and Eve never had it so good. This tops them all at only $30,000. Hurry! Hurry! Hurry!

——Better grade home.——
Rustic privacy! How would you like your next home to have four bedrooms? Psst!!! You can afford it, at only $60,000. Don't delay seeing—someone might beat your time.

Sample ads

Using this information, the program selects appropriate phrases from its data file and composes an ad. The workings of the program have been kept simple, so that even neophyte computer users will be able to modify it for their operations.

The parameters of the home are stored in a series of variable flags, such as PR (price), LC (location) or B (number of bedrooms). You can insert additional input routines for data you would like to include—family room (yes/no), acres of land available, or other information. Each parameter has its own set of ad statements, stored in applicable DATA lines. If you add classifications, it will be necessary to add appropriate DATA phrases.

The ad phrases are read into a series of string arrays at the beginning of the program. For example, the 32 lines that apply to higher priced homes are read into PRESTIGE$(n) at line 60. Those that apply to homes needing repair are read into REPAIR$(n) at line 110, and so forth. To add a new classification, define the array in line 40, add the statements in DATA lines at the end of the program, and put a FOR...NEXT loop to read the lines after line 160.

Perhaps a user will wish to add lines to an existing classification. These should be inserted within the appropriate section of DATA elements—labeled REM. Then, the counter that keeps track of element amounts in each array should be incremented to the new value in line 20. To simplify this process, these counters have been given the same name as the array in which they are used, i.e. PRESTIGE for PRESTIGE$.

Radio Shack's Basics all allow use of long variable names, and recognize PRESTIGE and PRESTIGE$(n) as different. (In fact, PRESTIGE$ would be a third variable, PRESTIGE% a fourth). However, only the first two characters are significant, so COUNTRY$(n) and COST$(n) would be recognized as the same array. The latter has one additional problem, that of an embedded keyword, COS, and would not be allowed. Keywords included after the first two still cause syntax errors, so variables such as HUMOR$ (OR) cannot be used.

Assembly of the finished ad is simple. Each classification is assigned a string variable name, F1$ through F7$, and one DATA line selected for each, depending on the information input. Choice of the specific line is made at random from those that are appropriate.

If a home is medium-priced, a random number smaller than 21 is chosen in line 460, and that element of the array MEDIUM$(n) is applied to F1$. The process continues until all the factors are chosen.

F1$ is used as a headline, centered at the top of the ad, while the others are appended to form AD$. This string is reviewed character-by-character in a routine at lines 730-790, and when the length of a line is greater than 70, a carriage return is inserted (CHR$(13)) after the next space (CHR$(32)) encountered, to produce a linefeed when the string is printed. This keeps the printer from breaking an ad in the middle of a word at the end of an 80-character line. If your printer has a greater number of columns, you can increase the 70-in. line 750 to an appropriate value. This routine is for cosmetic reasons only, as the ad will have to be rekeyed at some point for submission to the newspaper, or at the publication for entry into the phototypesetting machine.

Though Ad Writer will not entirely replace the human input needed for composing clever real estate ads, it provides a basis for automating this procedure. It was prepared with the help of a successful realtor, and with modifications, is being tested in the real (estate) world. □

Program on page 152

Displaying Data with Vertical Rastering —Another Approach

by F. B. McLaughlin

I don't enjoy scanning a data printout for a particular record when the records have been incremented horizontally. I had been trying with no success to develop a program that would print out multiple columns of data with vertical incrementation, when along came the October 1981 issue of *Interface Age*. On page 98 was an article by Robert R. Lewis entitled *Displaying Data With Vertical Rastering*. My problem had seemingly vanished, but not quite. Lewis' algorithm for calculating the subscript numbers for horizontal printing only allowed single row data items.

My specific need was to be able to print a small membership roster (92 records) in three columns of three rows for each record, incremented vertically for easy use. So, I set about adapting Lewis' algorithm to my needs. The accompanying figure shows a sample mailing list, sorted alphabetically by last name.

The problem is, of course, that the printer cannot print a column vertically, return to the top of the page, space over, print another column vertically... It can only print a horizontal row, return, line feed, print another row... So, to print multiple columns vertically, the program must include an algorithm that will determine which data record heads each column, which successive data records comprise row two, and so on.

It is not difficult to write such an algorithm, provided the total number of data items is evenly divisible by the number of columns. But, how about the case where there are three columns and 92 data items? Lewis solved the problem nicely. With the number of columns (C) and the number of data items (N) already established, he determined the successive subscript numbers (J) in the following manner (in Microsoft Basic):

```
.
.
.
100 FOR I = 1 TO N
110 I0 = INT((I – 1)/C)
120 I1 = I – C*I0 – 1        (or I1 = (I – 1) MOD C)
130 I2 = INT(N/C)
140 I3 = N – C*I2            (or I3 = N MOD C)
150 J = I1
160 IF I3<I1 THEN J = I3
170 J = J + I1*I2 + I0 + 1
180 NEXT I
.
.
.
```

By adding line 175 (175 IC = I1 + 1), Lewis' algorithm also counted columns printed. Now the program could direct the printing of C columns of data; then a line feed and carriage return; then loop to determine the value of the next subscript J. You can follow the program through by reading the original article.

To print columnarized data records containing two or more rows, I amended Lewis' program as shown in the accompanying listing. A$(n), B$(n), C$(n) are the previously established fields of the already sorted data records. The successive values of subscript J are saved as A(I) (lines 120-190), using Lewis' algorithm. Next, a loop is set up (line 200) to print the successive data records. A counter (X) is incremented as each column of the row is printed, and the value of J for each column of the row is isolated as B(X). When C columns of row one have been printed, a return and line feed are executed and the next row, containing field two of each data record, is printed using the new subscript B(X). When C columns of row two have been printed, a return and line feed are executed and the next row, containing field three of each data record, and also using the new subscript B(X), is printed. When all fields of C columns have been printed, an extra PRINT #1 is executed to provide a space between records, and the value of X is recycled to zero.

If the number of data records is not evenly divisible by the number of columns of data, N MOD C columns, starting at the left, will carry an extra record each. □

Program on page 156

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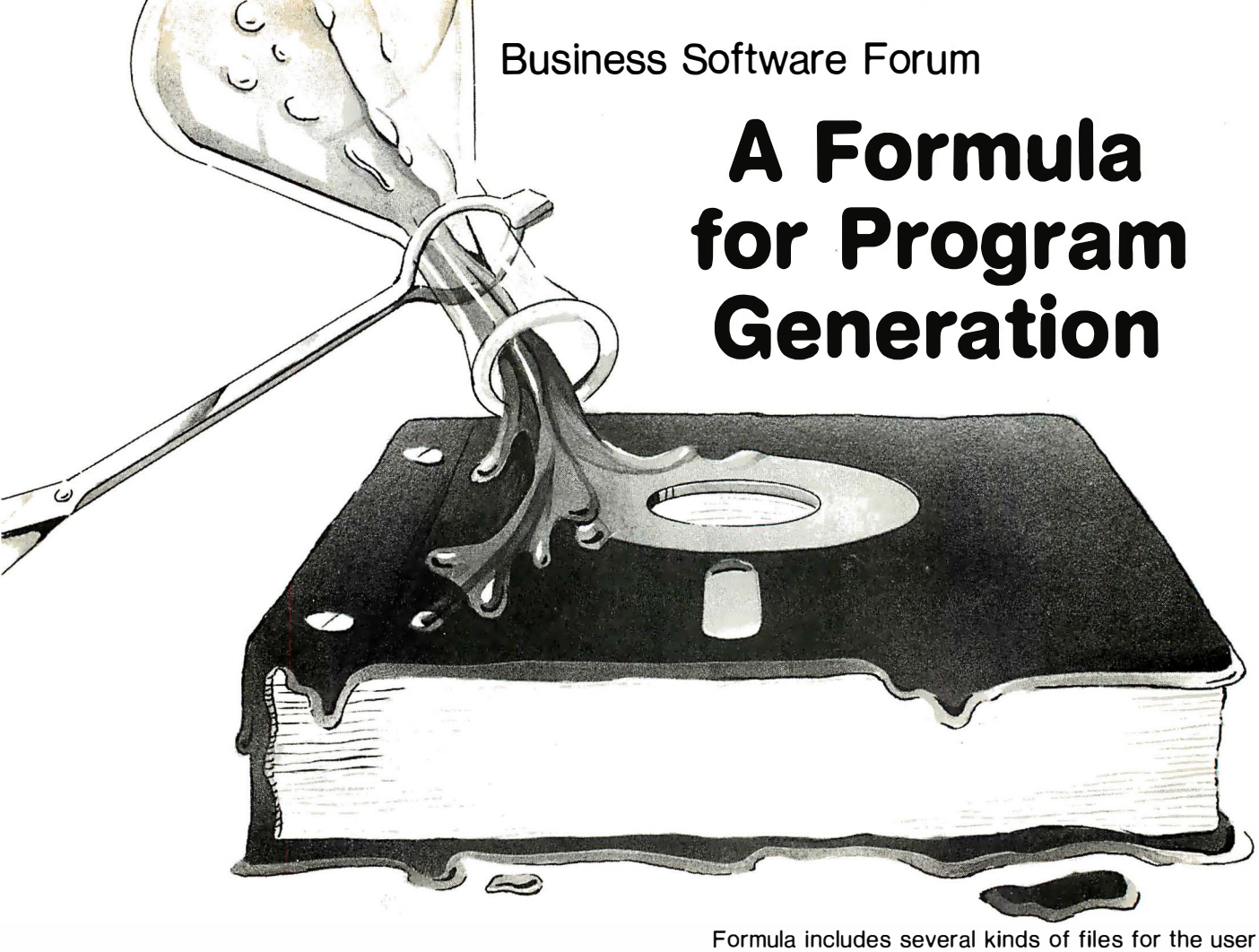
Business Software Forum

A Formula for Program Generation



by Carl Heintz, C.P.A.

The Formula (Dynamic Microprocessor Assoc., New York, NY) is a software package somewhere between Dbase II and Pearl that retails for about $600.

It is a unique set of programs—combining the characteristics of a data base manager, code generator and word processor into one application design package. If all that sounds complex, it is; the manual is two inches thick, and full of fine print. However, the instructlons are not unintelligible; they are targeted at someone who has no more than an appreciation for microcomputers and an elementary understanding of CP/M. The target audience is dealers who write programs for users, or sophisticated users, unable to come to terms with off-the-shelf software but unwilling to devote the time and substantial effort necessary to write a system from scratch. The Formula provides a simple method for that user to generate an impressive custom application.

The authors also include a general accounting system that features general ledger, accounts payable and accounts receivable.

The first steps in using the Formula are taken with the computer off. The Formula forces the user to organize and think before using the system. The types and contents of the files to be used must be specified, and the contents of the various fields within each record of the files must be thought through.

The package is heavily oriented toward different types of files. That is one distinguishing feature of the system. Unlike a data base system in which there is generally only one type of file—a data base file—the Formula includes several kinds of files for the user to create and interact with. The user can create master files, transaction files, report specification files, index files and support files that contain information about the system, sorting, menus and even a file that keeps track of the files in use on the system.

The programs are organized into several modules; file building, user data acquisition, report, update, sorting and utilities.

The first step in any application is to define the master files to be used. In the Formula, these files contain the main data bases necessary for processing an application, and for any one application there may be several master files active at one time.

Master files are kept in a random access format, with at least one major index. Generally there is only one index for a master file—although other indexes may be created.

Transaction files are used primarily to update master files. They are sequential and each can update up to 20 master files. Alternatively, when producing a transaction file, information can be searched from a master file. So, for example, in a general ledger application, when an operator enters an account number, the system could look up the account name and include that in part of the transaction file being created.

Report specification files include information about the parameters required to generate a properly formatted print report. Reports may be sent to the disk, terminal or printer. The balance of the types of files are essentially transparent to the user.

The session to create a file is not too complex: the system asks for a file name, and then for two header

lines, which appear on the terminal when entering data to the file. The various fields for the records of the file are then defined. The system includes a field name, type, length, lower bound and an upper bound, and decimal places in the field. The acceptable field types include alphanumeric, date, integer, spare (reserved for future use), single and double precision.

The lower and upper bounds are user specifications for the smallest and largest values that the system will accept. The final element in creating a master file is to select a key field. Since the speed of a system depends, in part, upon the length of the key field, the system allows the user to specify how long a key field to use. So the user might specify that only the first four characters of the filed were to be used for the key, even though the field in the record might contain 30 spaces.

Entering data into the system files is done with a data entry sequence that is mostly pre-defined. Although it gets the job done, the system is not fancy—it merely asks line by line for the information for each field in the record. There's no online editing and special screen formatting. There are, however, some automatic validation checks that the system performs before accepting the input data.

In setting up a file, the user specifies information for each field in the file, including the type of data (alpha, numeric, date, single or double precision), the length of the data, its decimal precision and the lower and upper bounds of the data. In the entry process, these parameters are checked to ensure that garbage does not enter the system. Once data is entered, the user can alter it before updating the file—either in its entirety or line by line. Even later, after information has been entered, it may be modified by using an inquiry/modification program.

The true worth of any programming system is measured in part by the power of its reporting capabilities. The Formula has a number of impressive characteristics, some of which include: the ability to set page lengths, which allows a user to use different lengths of paper; variable page widths—up to 132 columns; ability to select page margins (to a limited degree), and flexible subtotaling and totaling capabilities.

Definitions are flexible

The definitions established for a report can be changed at will by the user—something that makes generation of a special report easier. However, offset against this flexibility is the complexity of setting a report. Power carries with it a corresponding complexity, and in the case of the Formula, setting up a report does take a bit of pre-planning and work.

Once a report format is created, it is stored in a file for future use. The user must then specify which file is to be accessed and which records in the file are to be chosen for the report. This involves establishing criteria and comparisons. The Formula allows multiple criteria and multiple comparisons to be used to select data. Boolean algebra (AND, NOR, OR) can be used to select records, providing an extremely powerful method of formatting file data into reports.

One of the Formula's unique features is its ability to automatically update one or more fields in a master file, using data obtained from fields in one or more of the transaction files. The system can take data entered as a transaction and extract from it information that can be used to update or modify a master file. A classic example of this function would be in posting a general ledger file (master) with the data from transaction files (journals). The program allows the user to replace, add to or subtract from existing data in the master file. It is also possible for the user to handle situations in which master files for related transactions cannot be found. In such situations, the system can be instructed to create a master file, reject the transaction, or ask the operator for instructions. Once specified, the operation will become entirely transparent to the user. The system even includes the option to automatically delete master accounts based upon an update. Needless to say, this update procedure is somewhat complex. It is, however, impressive and a necessary part of any professional applications program.

Flowcharting is a plus

There are many good data base systems that allow the user to create applications programs based on them. Dbase II is an excellent example. However, in all cases, some programming is required, and the degree of complexity is limited by the user's programming skills. The Formula seems to overcome this major problem. Consider, for example, the flowchart of an applications program in the accompanying illustration.

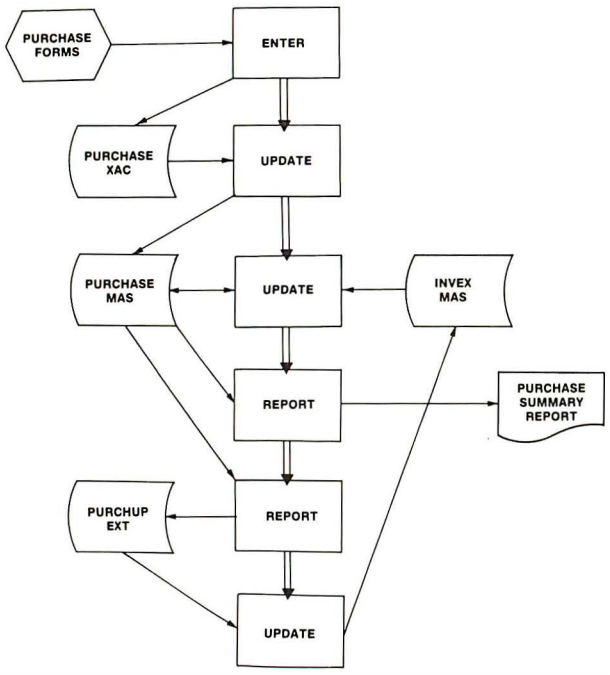
While there is no reason a skilled programmer couldn't create such a system using Dbase, FMS-80 or Selector III, a great deal of programming effort would be required. In all of these systems, the user would necessarily have to have a better than novice grasp of programming. Using the Formula, however, programming skills would be largely unnecessary. That is not to underestimate the amount of skill that would be required, however. An extremely logical mind, a good knowledge of systems design and a familiarity with structured programming would be helpful. However, it is possible to accomplish the taks without programming.

The system can create ASCII output files. Like many data base programs, the Formula creates internal files in packed format—the data cannot be accessed, for example, by the "TYPE" mode under CP/M. The data is locked in the files and neither word processing program nor editor can examine or utilize it. The great advantage of the Formula is that it contains provisions and has the capability to convert files into ASCII format, thus making them readable by almost any word processing program. To top it off, the program allows the user to format the data into a form acceptable to the word processing programs, many of which include certain data conventions.

There is one other module that is one of the most powerful of any micro software on the market. Free Format Reporter is a system that combines many of the features of a word processor, a text editor and an application generator.

The user invokes a screen editor, which is used to lay out a report almost as easily as typing a letter. The user can take advantage of cursor movement and special function keys on the CRT; its power rivals that of a regular word processing program.

While creating a blank format for a report, the user can embed processing control information in the report specifications. This information can include, for



Flowchart of purchase subsystem

example, which information will be included in the report, instructions for extracting and updating data, or computations. Once all this is created, the programs will create the report specifications, compile the report generation code and check for errors and inconsistencies. Output consists of a file that can be used to drive the report generator. The system includes an option allowing the user to create a simulated report to see exactly what the final product will look like from a format standpoint.

Many options available

The Formula has an array of options. For example, it is possible to prepare a financial report with the attributes of a custom-typed statement. Formatting can include multiple columns, subtotaling at specified places, inclusion of calculated information (such as percentages or ratios) and date conversions. In fact, the system has enough power to be used as a word processor to write letters, to prepare financial statements and analyses, and to prepare W-2 forms. Even underlining and bold text is available. This is impressive, but somewhat complex, even though the instruction manual is well-written with many examples.

The Formula is one of the most noteworthy software tools on the market today. It isn't intended for the novice programmer who wants to re-invent the "Big-5" by programming his own version. Rather, it is intended as a tool for those who have some familiarity with programming and need something to assist them in preparing a professional code to accomplish a well-defined objective. It should be considered by anyone who has occasion to write computer programs. □

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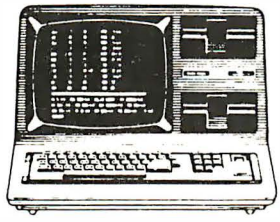

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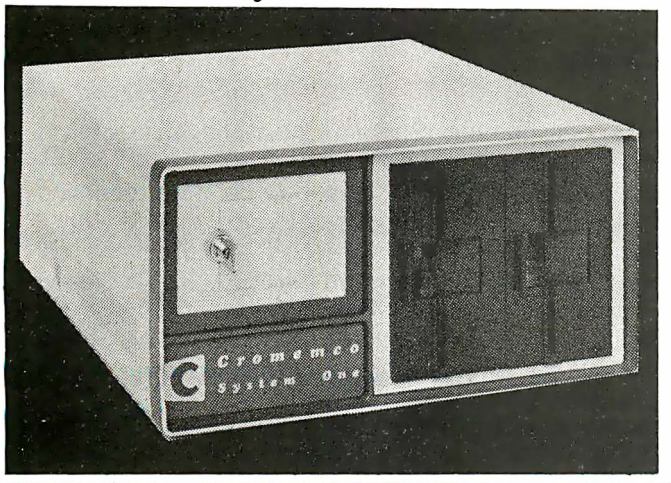

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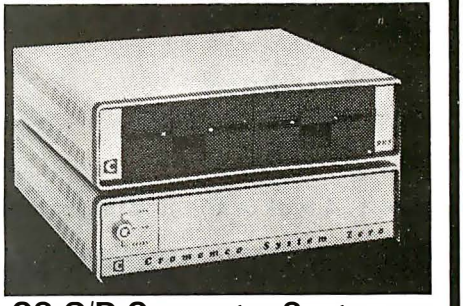

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Evaluation of a Basic Interpreter or Compiler

by Alan R. Miller

To understand the results our Basic programs present, we must be familiar with the limitations of the Interpreter or compiler we are using. This is particularly true with scientific applications programs. Here we present some tools for evaluating the precision and range of Basic. In fact, the examples given here were derived from several popular Basics.

Many programs are sensitive to the precision and dynamic range of the Basic floating-point operations. For example, in one program an algorithm is terminated when a particular term is smaller than a relative tolerance. The formula in this case is:

TERM < TOL * SUM

where TERM is the value of the new term, SUM is the current total, and TOL is an arbitrarily small number known as the tolerance.

It is Important that the value chosen for the tolerance be within the accuracy of the floating-point operations. Otherwise, the summation step will never terminate. Suppose, for example, that floating-point operations are performed to a precision of six significant figures. Then, the tolerance must be set to a value larger than 1.0E-6.

The dynamic range of the exponent is a separate matter. Typical binary, floating-point operations are performed with 32 bits of precision. BCD floating-point packages, on the other hand, will usually retain more significant figures and have a greater dynamic range.

```
10 N% = 18
20 X = 1.0E-4 / 3
30 FOR I%=1 TO N%
40  X = X/10
50  PRINT I%, X,
60  X = X/10
70  PRINT X
80 NEXT I%
90 END
```

Figure 1. A test of the floating-point operations

We now present a Basic program for testing the precision and dynamic range. We will investigate output from several common Basics to illustrate both mantissa and exponent accuracy.

The program given in figure 1 can be used to determine the precision and the dynamic range of Basic. The initial value of X is obtained by dividing 1.0E-4 by 3. Then, successively smaller X values are calculated and displayed on the console. Each succeeding value Is obtained by dividing the previous number by 10 and the process continues until 36 values have been printed.

Let us now use this program to test the accuracy and range of three different Basics.

The initial mantissa is chosen to be ⅓, a repeating fraction that cannot be precisely represented by a floating-point number. Successive multiplications will show the extent of roundoff error. A 32-bit binary, floating-point number typically utilizes three bytes for the mantissa and one byte for the exponent. This usually produces six or seven significant figures of precision and a dynamic range of 10^{+38} to 10^{-38}. The result might look like the output in figure 2. In this example, the dynamic range goes to 10^{-38} and the accuracy of the mantissa is about six significant figures. Notice that no roundoff error is apparent. When floating-point underflow occurs, a value of zero is substituted for the answer and no error message is given.

```
 1            3.33333E-06    3.33333E-07
 2            3.33333E-08    3.33333E-09
 3            3.33333E-10    3.33333E-11
 4            3.33333E-12    3.33333E-13
 . . .        . . .           . . .
14            3.33333E-32    3.33333E-33
15            3.33333E-34    3.33333E-35
16            3.33333E-36    3.33333E-37
17            3.33333E-38    0
18            0              0
```

Figure 2. Precision test: first Basic

```
 1            3.33333E-06    3.33333E-07
 2            3.33333E-08    3.33333E-09
 3            3.33333E-10    3.33333E-11
 4            3.33333E-12    3.33333E-13
. . .         . . .           . . .
14            3.33334E-32    3.33334E-33
15            3.33334E-34    3.33334E-35
16            3.33334E-36    3.33334E-37
17            3.33334E-38    3.33334E-39
18            0              0
19            0              0
```

Figure 3. Precision test: a second Basic

As another example, consider the output in figure 3 from a different Basic that also uses 32-bit binary floating-point operations. The results In this case are similar to the previous example except that roundoff error is evident in the mantissa.

The output from a third Basic that uses 64-bit, BCD floating-point numbers is shown in figure 4. The mantissa contains 12 digits of precision and the dynamic range is 10^{+63} to 10^{-63}. The value of N% at line 10 in

the Basic program is changed to 31 to explore the full potential of the operations.

The previous simple test of the floating-point operations can be supplemented by much more sophisticated techniques. For example, a very good test is obtained from the solution to a set of Hilbert matrices and it is instructive to consider some actual results.

The exact solution for one particular example consists of six values of unity:

1 1 1 1 1 1

But the result calculated by a particular Basic may be very different from this because of roundoff error from the floating-point operations. The following results were obtained from actual calculations with three different Basics:

0.99971 1.00790 0.94840 1.13088 0.85821 1.05507
1.00020 0.99523 1.02799 0.93514 1.06502 0.97640
1.00000 1.00000 1.00000 1.00000 1.00000 1.00000

Clearly, there is a measurable difference in the behavior of these three Basics. The first example

```
1     3.33333333333E-06    3.33333333333E-07
2     3.33333333333E-08    3.33333333333E-09
3     3.33333333333E-10    3.33333333333E-11
4     3.33333333333E-12    3.33333333333E-13
. . .    . . .             . . .
26    3.33333333333E-56    3.33333333333E-57
27    3.33333333333E-58    3.33333333333E-59
28    3.33333333333E-60    3.33333333333E-61
29    3.33333333333E-62    3.33333333333E-63
30    3.33333333333E-64    0
31    0                    0
```

Figure 4. Precision test: third Basic

demonstrates roundoff error in excess of 14% and the second example shows errors around 6%. The last example is best of all. Ironically, the Basic that performed worst with the Hilbert matrix appeared to do quite well with the simpler initial test.

A rather interesting bug contained in several Basics can limit the range of the SIN function.

A SIN function problem can occur as the argument approaches zero. Under this condition, the function should return the value of the argument. However,

```
10 N% = 36
20 X = 1.0E-4/3
30 FOR I%=1 TO N%
40  X = X/10
50  PRINT I%, X,SIN(X)
80 NEXT I%
90 END
```

Figure 5. Test function SIN

several Basics contain an error. They show significant roundoff error or they substitute a value of zero instead of returning the argument.

The program in figure 5 can be used to check the SIN function of your Basic.

```
1     3.33333E-06    3.33333E-06
2     3.33333E-07    3.33333E-07
3     3.33333E-08    3.33333E-08
4     3.33333E-09    3.33333E-09
. .   . . .          . . .
31    3.33334E-36    3.33334E-36
32    3.33334E-37    3.33334E-37
33    3.33334E-38    3.33334E-38
34    3.33334E-39    3.33334E-39
35    0              0
36    0              0
```

Figure 6. SIN test: first Basic

```
1     3.33333E-06    3.37056E-06
2     3.33333E-07    3.74507E-07
3     3.33333E-08    0
4     3.33333E-09    0
```

Figure 7. SIN test: second Basic

Similar to the previous one, this second program tests the built-in SIN function. If your SIN function correctly handles small numbers, meaningful values should be returned over the entire dynamic range of the floating-point operations. In this case, floating-point underflow should occur at the same place as it did for the previous test. In figure 6, the dynamic range of the floating-point operations and the limit of the SIN function are shown

```
1     3.33333333333E-06    3.3333333E-06
2     3.33333333333E-07    3.333333E-07
3     3.33333333333E-08    3.33333E-08
4     3.33333333333E-09    3.3333E-09
5     3.33333333333E-10    3.333E-10
6     3.33333333333E-11    3.33E-11
7     3.33333333333E-12    3.3E-12
8     3.33333333333E-13    3E-13
9     3.33333333333E-14    0
10    3.33333333333E-15    0
```

Figure 8. SIN test: third Basic

to be the same. For the examples given in figures 7 and 8, the SIN function returns incorrect values as the argument approaches zero.

If you find that the SIN is incorrectly implemented in your Basic, you may have to use it with care. The subroutine given in figure 8 shows how this can be done. If you find a problem with your built-in SIN function, you can also expect to find a similar problem with the built-in TAN function. □

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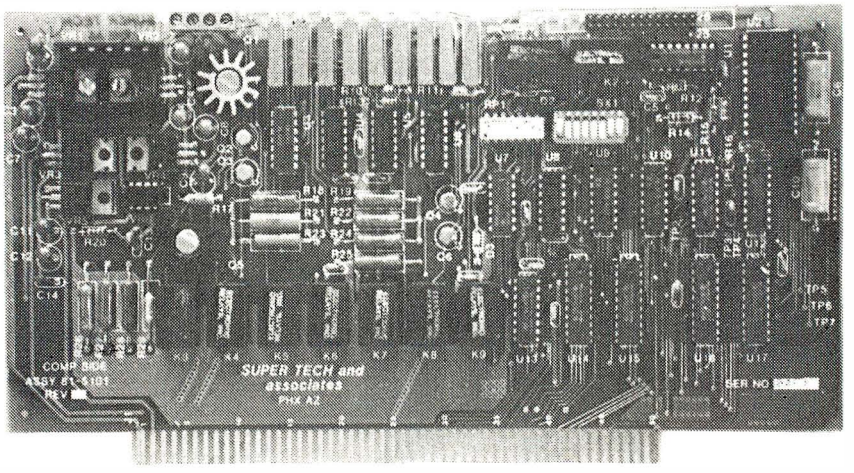

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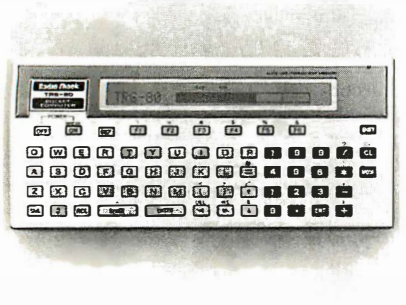

function keys and an LCD display with upper-, lower-case, scientific and user-definable characters. All memory information is retained even when power is off. Computer measures 1-1/16 by 7-11/16 by 3-3/8 in. Price is less than $300. Tandy/Radio Shack, 1800 One Tandy Center, Fort Worth, TX 76102.

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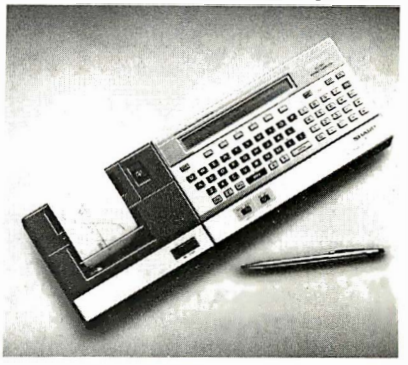
Handheld personal computer, model PC-1500, features a 7-by-156 programmable dot matrix liquid crystal display, an extended Basic language operating system capable of handling two-dimensional arrays, variable string lengths, program chaining, full graphic commands and many other functions. It has 16K bytes of system ROM and 2.6K bytes (expandable to 6.6K bytes) of user-available RAM. The unit can also generate



a full upper and lower case ASCII character set, as well as providing user-definable function keys for rapid programming and operation. The optional printer provides four-color graphic capability, nine different character sizes, bi-directional line feed and x,y plotting capability. The printer also incorporates a dual cassette interface for program and data storage/retrieval. Sharp Electronics Corp., 10 Sharp Plaza, Paramus, NJ 07652, (201) 265-5600.

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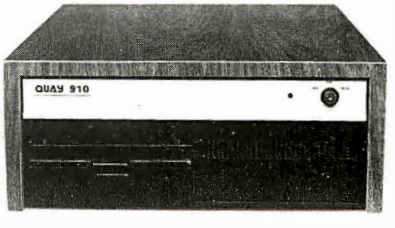

multi-user versions. Other standard features are: Winchester disk and heads; brushless D.C. spindle drive motor; reserve area on disk surface for head landing and takeoff; single board Z80A based micro-computer; IBM 3740 compatibility; and expansion to 33 and 66M-byte Winchester disk drives. Quay Corp., Box 783, 527 Industrial Way West, Eatontown, NJ 07724.

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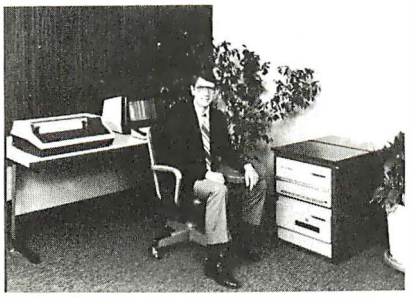
The Software Express Service

Business computer, system 12B, contains 328K of memory and supports four simultaneous users. It employs a 10M-byte fixed/removable hard disk drive, which can support a total of several hundred megabytes of online disk storage.



The system employs the Multi-user SDOS Operating System and runs the complete library of MSI business software modules. System prices start at $2,495. Midwest Scientific Instruments, 220 W. Cedar, Olathe, KS 66061, (913) 764-3273.
CIRCLE INQUIRY NO. 227

Desktop computer, model JD-850M, has been developed to cover a wide range of business applications by making it possible to use with a large variety of software currently available on the world market. It can serve on its own or as an on-line terminal for other computers. Features include a separate-type keyboard with an improved key arrangement, a 12-in., non-

Panasonic Model JD-850M

glare CRT display, two 8-in. double-sided floppy disk drives, an optional parallel interface, GP-IB (IEEE-488), a magnetic tape for memory back-up, and an optional buzzer and interval timer device for operating ease. It can be programmed with a Basic interpreter, a Basic compiler or an 8085 Assembler. Price: $8,000. Panasonic, One Panasonic Way, Secaucus, NJ 07094, (201) 348-5337.
CIRCLE INQUIRY NO. 226

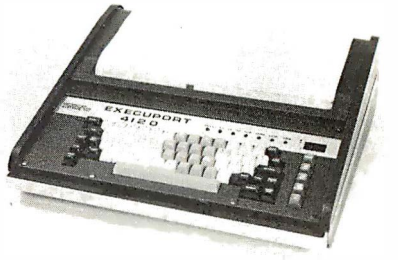
Small business computer features high-resolution color graphics. The BMC if800 system is a fully-integrated work station with keyboard, printer, mass storage disk drives, high-resolution color display, a Z80A microprocessor for speed, and CP/M for convenience. WordStar, SuperCalc, Multiplan, and other CP/M-based programs are also available. Price: less than $12,000. BMC Computer Corp., 860 Walnut St., Carson, CA 90746, (213) 323-2600.
CIRCLE INQUIRY NO. 229

Preprogrammed computer, the 8018 II, provides cost-effective, business-based management decisions provided to end-users through a turnkey system. Preprogrammed application packages include such areas as distribution and

wholesale, construction and contracting, and container-manufacturing. Software is written in Basic. Mitsubishi Electronics America, Computer Div., 2200 W. Artesia Blvd., Compton, CA 90220, (213) 979-6055.
CIRCLE INQUIRY NO. 230

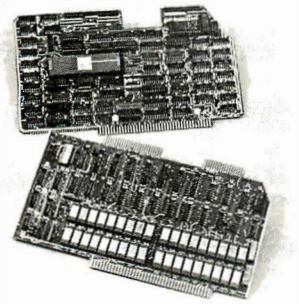
CP/M-compatible system is a multiuser, multiprocessor, multitasking unit, complete with an uninterruptable power supply. It can eliminate computer down time due to short-term power interruptions, electrical powerline transients, voltage spikes—even lightening. Power is maintained for up to 20 minutes without A.C. input. The Zeus II power supply, which consists of batteries, a battery charger, and a set of D.C.-to-D.C. converters that produce all internal D.C. voltages, is located in one of the stackable modules which form the computer. Modular form allows for custom configurations for each application. Hard disk storages from 34M bytes to 600M bytes are available along with a 20M-byte cartridge drive for backup. OSM Computer Corp., 2364 Walsh Ave., Santa Clara, CA 95051, (800) 538-5120.
CIRCLE INQUIRY NO. 231

Portable terminal system produces print copy at 120 characters-per-second. Execuport 4120 has a 16-element columnar printhead that produces virtually solid, high resolution characters and permits printing below the line with no paper movement and no decrease in throughput speed. It is equipped with two



character fonts, 9 by 11-in. and 5 by 7-in. The terminal system can also be customized to reproduce such specialized character sets as Japanese (Katakana), Arabic, Greek and Italic. Computer Transceiver Systems, Box 15, East 66 Midland Ave., Paramus, NJ 07652, (201) 261-6800.
CIRCLE INQUIRY NO. 232

Upgrade board set for the TRS-80 model II provides it with 16-bit, dual-processor, multi-user power. The model 16 Enhancement Option gives Model II owners all of the advantages of a Motorola MC68000 16-bit CPU with 128K bytes of user memory, including dual processors



(MC68000 and Z80A), a multi-user operating system for simultaneous program execution, increased addressable memory (up to 256K) and faster operation with model 16 software. Price: $1,499 (plus installation). Tandy/Radio Shack, 1800 One Tandy Center, Fort Worth, TX 76102, (817) 390-3300.
CIRCLE INQUIRY NO. 233

Portable terminal, Hotline, for the home and business market can be used to transmit and retrieve information from data

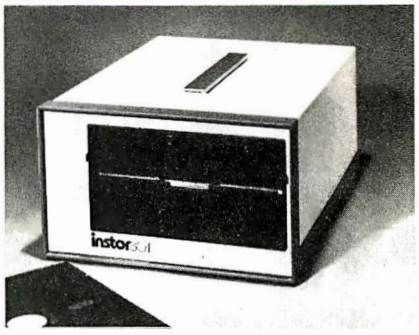
bases as varied as a personal telephone directory to the New York Stock Exchange. The terminal measures 1-5/8-in. by 3-9/16-in. by 6-3/4-in. and weighs less than 11 ounces, providing a truly portable means to communicate with host computer systems. The terminal combines a built-in modem with more familiar features, including an alphanumeric keyboard. The tactile keyboard consists of 43 functional keys arranged in typewriter sequence and provides a 64 upper case ASCII character set. The display is a 16-character fluorescent display, which is tilted for easy viewing. The terminal offers a 96-character display memory, which can be scrolled 16 characters at a time, and a 16-character display memory in the transmit mode. Price: under $400. Axlon, 170 N. Wolfe Rd., Sunnyvale, CA 94086, (408) 730-0216.
CIRCLE INQUIRY NO. 234

Small-format pen plotter, HP 7470, features high resolution, speed and repeatability, as well as color pens. The unit is compatible with the Hewlett-Packard series 80 and 125 personal computers, as well as with personal computers from IBM, Apple and Commodore. Price: $1,550. Hewlett-Packard, 1820 Embarcadero Rd., Palo Alto, CA 94303.
CIRCLE INQUIRY NO. 235

8.4M-byte hard disk memory eliminates the need for repetitive handling of floppy disks when using different programs, since

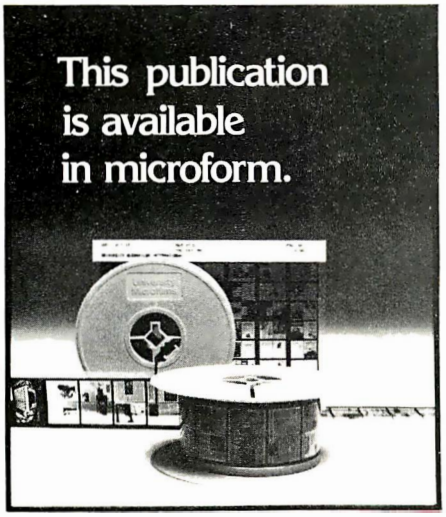
multiple programs can reside simultaneously in the hard disk system. The system incorporates Radio Shack's TRSDOS operating system, making it immediately compatible with most existing TRS-80 model II software. All current TRSDOS library commands are available, plus two new utilities—Save and Restore. The Save utility saves data from the hard disk onto one or more back-up floppy disks; Restore writes data from a floppy disk onto the hard disk. The system incorporates two 8-in. platters, permanently sealed in a dust-free environment. Both surfaces of each platter are accessed by their own read/write heads. Winchester technology assures extremely fast read/write times and high-speed data transfer. Price: $4,495. Tandy/Radio Shack, 1800 One Tandy Center, Fort Worth, TX 76102.
CIRCLE INQUIRY NO. 236

Floppy disk system, INSTOR/801, is for the IBM Personal Computer, using the IBM Diskette I Basic Data Exchange (3741) format. With the INSTOR/801 and IBM's asynchronous communications adaptor card, the system can read and write an 8-in. IBM 3741 format diskette. This



diskette is then compatible with any computer that uses the IBM 3741 format. Price: $2,000, complete with interfacing software. INSTOR Corp., 175 Jefferson Dr., Menlo Park, CA 94025, (415) 326-9830.
CIRCLE INQUIRY NO. 237

Add-on 16K-byte board for the Apple systems, Add-Ram, includes full buffering to ensure reliable performance, even in a fully-loaded system. It is energy-efficient,



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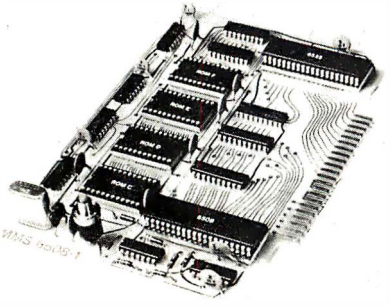
and is fully-socketed for easy troubleshooting. It is completely compatible with CP/M, Apple DOS, Apple Pascal and VisiCalc, as well as the Smarterm 80-column display board for the Apple systems and Z-Card, the company's outstanding Apple-CP/M interface board. The three Apple peripherals form the Synergizer. Used together, the three provide a synergism that would be impossible to duplicate with similar products from different manufacturers. Because they are designed specifically to work with one another, they operate faster and increase user capabilities dramatically. Price: $149. ALS, Inc., 1195 E. Arques Ave., Sunnyvale, CA 94086, (408) 727-6805.

CIRCLE INQUIRY NO. 238

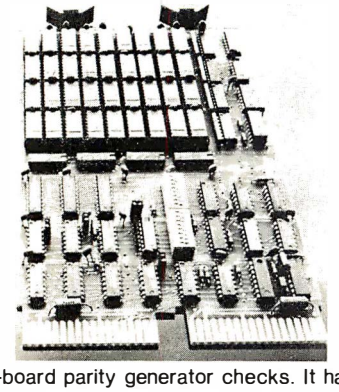
Microcomputer board, the MMS 6508/1 Micromodule, was designed for control applications where a microcomputer with a moderate amount of program storage and read/write memory, and powerful I/O control capability, is needed. Sockets are provided for up to 16K bytes of ROM or EPROM, and there are 1,280 bytes of



RAM. The printed circuit board measures 5-in. by 7-in. Price is $99 each for one to nine units, $89 each for 10 to 24 units, and $75 each for 25 or more. Commodore Semiconductor Group, 950 Rittenhouse Rd., Norristown, PA 19403, (215) 666-7950.

CIRCLE INQUIRY NO. 239

256K-byte memory is for LSI 11/23 and PDP 11/23 microcomputers. The CI-1123 memory module is a high-density add-in expansion memory requiring only a single slot for 128K words of memory. It includes on-board distributed refresh, is addressable as a contiguous block in 4K word increments through 4M bytes, and offers



on-board parity generator checks. It has an access time of 240nS and a cycle time of 400nS, allowing maximum utilization of the LSI 11/23's speed capability. It measures 8 1/2-in. by 5 1/4-in. Price: $1,795. Chrislin Industries, 31352 Via Colinas, No. 102, Westlake Village, CA 91362, (213) 991-2254.

CIRCLE INQUIRY NO. 240

Data line analyzer offers separate monitoring and breakout functions. The Grey Box model 4050 is a service aid to support RS-232-based data communications repair and maintenance activities. It includes the model 41 Data Line Monitor and the model 50 Breakout Box. The model 41 features superbrite LEDS, a tri-state LED for signal probing and test, and test points for the entire RS-232C interface. The model 41 uses no AC or DC power and derives power from the signal

monitored through its current limiting circuitry, to maintain a nominal current drain of 3 mA over a +3 to +25 voltage range. The model 50 Breakout Box provides 24 DIP switches and test points on both sides of the switches to enable reconfiguration of the RS-232 interface. For multiple terminations, it provides common bus points. Price is $195. Remark Datacom, 4 Sycamore Dr., Woodbury, NY 11797, (516) 367-3806.

CIRCLE INQUIRY NO. 241

Auto-answer/originate modem, PDM103A, is packaged on a board designed to be installed in a CRT terminal or other computer device. Price: $229. Interplanetary Computer Systems Ltd., 950 Denison St., Unit 17, Markham, Ontario, Canada L3R 3K5, (416) 498-6836.

CIRCLE INQUIRY NO. 242

Synchronous limited distance modem, the SLDM-1, replaces more costly modems in applications where amplifiers and repeaters are not required. It operates over distances of up to 17 miles at 1,800 bps (up to 7 miles at 19,200 bps). It operates full-duplex over four-wire circuits or half-duplex with two-wire twisted pair. Price: $895. Timeplex, One Communications Plaza, Rochelle Park, NJ 07662, (201) 368-1113.

CIRCLE INQUIRY NO. 243

Data modem, T212A, eliminates DDD timer. It transmits and receives serial binary data full-duplex over the two-wire DDD network. Speed selections include up to 300 BPS asynchronous in the low speed mode and 1200 BPS synchronous or character asynchronous in the high speed mode. It is available as either a standalone desktop unit or a card modem for multi-modem rack mounting. In either configuration, the T212A is available with or without a DDD timer. Price, T212A standalone with DDD timer: $945, T212A standalone without DDD timer: $895. Rixon, 2120 Industrial Parkway, Silver Spring, MD 20904, (301) 622-2121.

CIRCLE INQUIRY NO. 244

ALS Z-Card gives Apple II and III users CP/M capabilities. It contains a Z80A microprocessor, allowing Apple to run virtually any software designed for CP/M-based microcomputers. It is easily installed with no hardware or software modification. The Z-Card allows Apple owners to run many popular software packages including Wordstar, CBasic, VTS/80, Accounting Plus and SuperCalc. ALS, 1195 E. Arques Ave., Sunnyvale, CA 94086, (408) 727-6805.

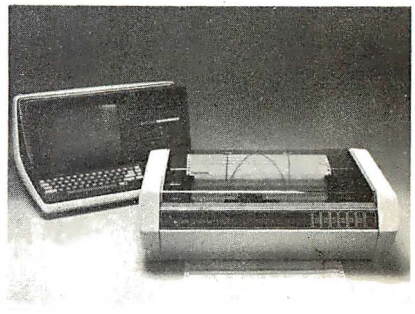
CIRCLE INQUIRY NO. 245

Communications processor, called the Office Systems Interface, is designed to improve communications flow and permit expansion of NCR computer networks. It uses a 16-bit MC68000 microprocessor and load-leveling software to allow full flow control without altering mainframe hardware. It contains a 256K byte microprocessor memory. A single unit will

support up to 20 full-time, multi-function work stations. More stations can be added by interconnecting two or more units. A remote option permits the OSI to service clusters of up to seven remote stations on a single modem line. Century Analysis, 114 Center Ave., Pacheco, CA 94553, (415) 680-7800.

CIRCLE INQUIRY NO. 246

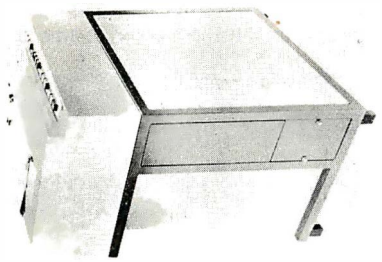
Technical desktop computer printer offers 150-character-per-second, bi-directional print mechanism. Model 4422 printer is designed to be used with Data General's MPT/80-series intelligent workstations and MPT/100 Technical Desktop Computer. The printer's 9 by 9-pin dot-matrix print head enables the



user to produce reports containing the full 96 upper- and lower-case ASCII character set, with true risers, descenders, underlining and boldface text. The user selects either 80- or full 136-character print line lengths. It is priced at $2,290.

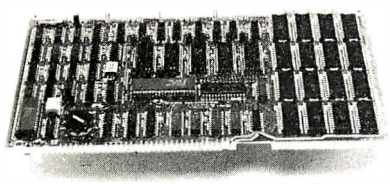
Data General, 4400 Computer Dr., Westboro, MA 01580, (617) 366-8911.
CIRCLE INQUIRY NO. 247

Braille line printer can be incorporated into a complete braille terminal for use with a computer. It can turn out 10 pages of braille per minute, and interface with other equipment such as punched tape, magnetic tape and floppy disks is possible. The printer can be used to produce braille books when the text is available on punched tape, magnetic tape cassettes or floppy disks, and can also turn out agendas



for meetings, programs for events, sports results and similar items. The terminal's operating panel has a full typewriter keyboard with connections for additional facilities such as speech recognition and computer speech. Consulate General of the Netherlands, Economic Section (55), One Rockefeller Plaza, New York, NY 10020-2094.
CIRCLE INQUIRY NO. 248

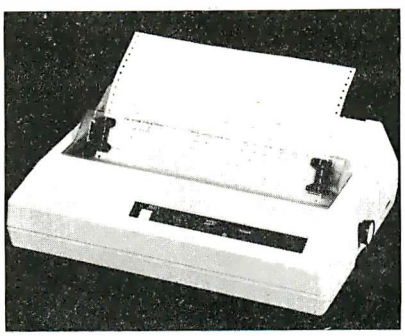
Quad serial and 16K byte RAM board for the Multibus, ZX-118, features AM9517-4 DMA channels for the four 8251A usarts with RS-232 interfaces. It can send or receive serial data packages into and out of main system memory



without CPU intervention. Included is full byte-swapping logic and ability to implement special hardware required for bank-switching. Zendex Corp., 6680 Sierra Lane, Dublin, CA 94566, (415) 829-1284.
CIRCLE INQUIRY NO. 249

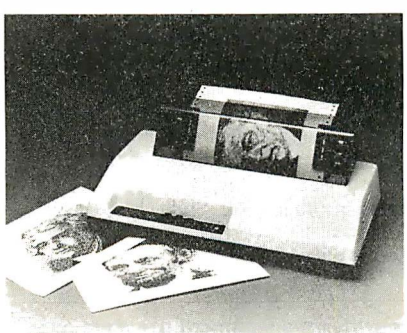
Computer carrying case is for the IBM personal computer. The IB501 case will hold the basic computer unit with a storage for the keyboard, manuals and working papers and sells for $129. The IB502 case, selling for $99, will hold the IBM black and white monitor while the P403 case, selling for $89, will hold the matrix printer. The cases provide portability and a convenient method of storage free from possible damage and dust accumulation. By replacing and locking the lid, the computer and software are protected from tampering and unauthorized use. Access is controlled without the necessity of dismantling the setup. Cables and plugs are protected from possible inadvertent damage or failure due to repeated connecting and disconnecting. The cases are constructed of luggage material with hard sides, padded handles, brass hardware and key locks. Rubber pads provide furniture protection and steel lugs on the bottom protect the case when transporting. The outside is covered in the highest quality scuff resistant textured vinyl in rich brown. The tops are easily removed so that the equipment can be operated without removal from the case. Computer Case Co., 5650 Indian Mound Ct., Columbus, OH 43213, (614) 868-9464 or (800) 848-7548.
CIRCLE INQUIRY NO. 252

132-column desktop printer, model 152, features 150 cps print speed bi-directional



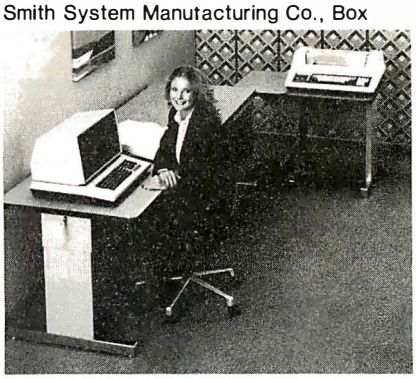
logic-seeking printing, adjustable tractors, clean hands ribbon cassette, top-of-form, compressed print which allows 132 columns to be printed in an 8-in. print line of 216 columns in a 13.2-in. print line. Centronics, Hudson, NH 03051, (603) 883-0111.
CIRCLE INQUIRY NO. 250

Professional printer, IMP-4, gives high throughput speeds. Up to 19,008 individual dots can be precisely bi-directionally printed within a single square inch. Alphanumerics are bi-directionally printed in up to six different sizes and in boldface. A IMP-4 three-way paper



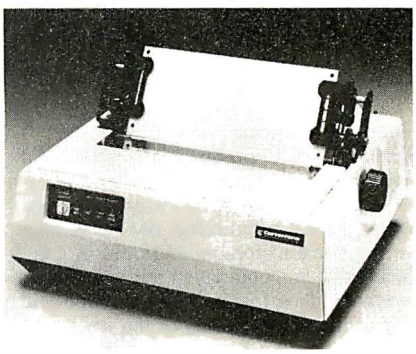
handling capability allows use of single sheets, continuous forms or roll paper. Interfaces for Apple, TRS-80, Pet, Atari, HP, RS-232C and other printer ports allow easy connection. Price: $699. Axiom, 1014 Griswold Ave., San Fernando, CA 91340, (213) 365-9521.
CIRCLE INQUIRY NO. 251

Electronic furniture system accommodates electronic office machines. The system tilts and adjusts for height. Other system components include work stations, printer stands, tilting turntables, mobile media storage, rack mount cabinets and other media storage accessories. Smith System Manufacturing Co., Box



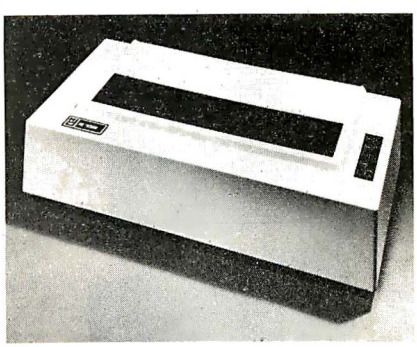
43515, St. Paul, MN 55164, (612) 636-3560.
CIRCLE INQUIRY NO. 253

Dot matrix impact printers produce 120 characters per second. The 5082 and 5083 are functionally compatible with the IBM 3287 printer. At 10 characters per inch, the 5082 prints an 80-character line and the 5083 prints a 136-character line. Both printers have 9-by-9 dot matrix print



heads which produce upper and lower case copies. Each offers both friction feed and a forms tractor. Prices, 5082: $750; 5083, $1,150. Carterfone Communications Corp., 1111 W. Mockingbird Lane, Suite 1400, Dallas, TX 75247, (214) 630-9700.
CIRCLE INQUIRY NO. 254

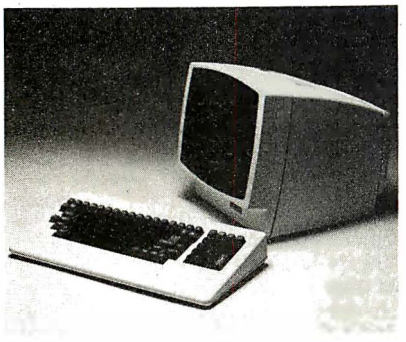
Dot matrix printers, models 9/80 and 9/132, offer: 80 or 132 columns; 150 cps; bidirectional, logic seeking; 9-by-9 matrix;



6 or 8 LPI; 10, 12 or 16.5 CPI; 96 ASCII printable characters; Centronics-compatible, Serial RS-232C or current loop interfaces; 350-character standard buffer

expandable to 3,422 characters; cartridge ribbon; expanded, condensed and double density characters; standard, alternate and downloadable character sets; 600 million character life printhead; tractor and optional friction feed; multiple copies (6-part maximum); quiet operation (60 dba); and graphics. Suggested list prices for the 80-column model, $995, for the 132-column model, $1,195. Hi-G Co., Printer Products, 580 Spring St., Windsor Locks, CT 06096, (203) 623-3363.
CIRCLE INQUIRY NO. 255

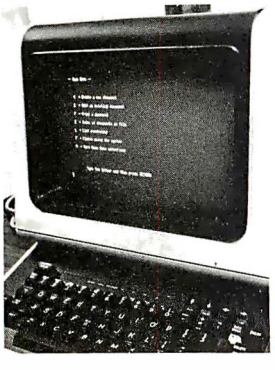
CRT terminal, model 932, incorporates a 6800 microprocessor, is equipped with 8K bytes of RAM, includes RS-232 and synchronous or asynchronous TDI



interfaces, and features an independent addressabie printer port. Price: $1,895. Emulog, 3730 Yale Way, Fremont, CA 94538, (415) 490-1290.
CIRCLE INQUIRY NO. 256

Financial program, Desktop/Plan III, enables users to do financial analysis and modeling on the Apple III. The program takes advantage of extra internal memory, higher resolution graphics, 5M bytes of hard-disk mass storage, and other Apple III features. It is menu-driven and comes with two model files that can be examined and altered by the user. Size of the row-and-column computer ledger pad is 8,000 locations and calculation abilities include 20 built-in functions. Requires Apple III 128K system, at least one external storage device, hard-copy printer and video display. Price: $300. VisiCorp., 1330 Bordeaux Dr., Sunnyvale, CA 94086, (408) 745-7841.
CIRCLE INQUIRY NO. 257

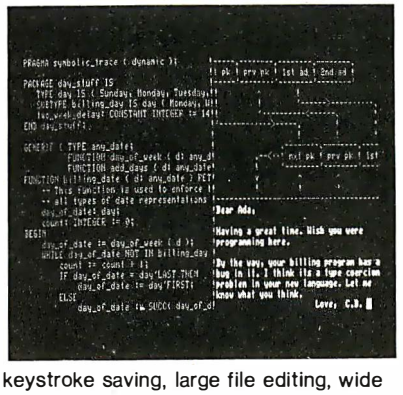
Word Processing software includes operating system for single terminal use, allowing it to operate in the full range of DEC LSI-11, PDP-11 and VAX systems.



Menu driven CT*OS provides a smooth transition from manual to DP operations. Functions include global search and replace, cut and paste files, list processing, ASCII file handling, 132-column document width, stored text libraries, right justified margins, sub and superscripts, centering and automatic pagination. Prices: standalone, $2,200 (single CPU license): RSTS/E and RSX-11M versions, $3,600; VAX, $4,200. Compu-Tome, 234 E. Colorado Blvd., Pasadena, CA 91101, (213) 960-2895.
CIRCLE INQUIRY NO. 258

Resource management system, RMS-II, allows definition of up to 96 resource centers. It requires PMS-II, any microcomputer system with the CP/M operating system, a 132-column printer, an 80-character by 24-line video display, and either three dual density eight-inch disk drives or a hard disk. Price: $995. North America MICA, 11772 Sorrento Valley Rd., San Diego, CA 92121, (714) 481-6998.
CIRCLE INQUIRY NO. 259

Multi-window text editor runs on Z80-based microcomputer systems using standard CP/M operating system. The Electric Blackboard requires 48K bytes of main memory, one floppy disk drive and a CRT with cursor addressing. Features automatic horizontal and vertical scrolling,



keystroke saving, large file editing, wide file editing, automatic memory management and a "picture cursor" that lets the user set the direction the cursor will move after a character is typed. Price: less than $200. Santa Cruz Software Services, 1711 Quail Hollow Rd., Ben Lomond, CA 95005, (408) 336-2170.
CIRCLE INQUIRY NO. 260

General accounting software is available for Mercator System 3000 small business computer system. The package includes modules for general ledger, accounts payable, accounts receivable, sales order processing, job costing, payroll and inventory control. It includes 64K bytes of memory, 8-in. Winchester disk and tape cartridge backup. Price: $19,900. Mercator Business Systems, 1294 Lawrence Station Rd., Sunnyvale, CA 94086, (408) 734-5134.
CIRCLE INQUIRY NO. 281

Securities management program runs on an Apple II computer. Portfolio Master 3.1 includes automatic access to the Dow Jones computer for current prices, up-to-date calculations of current portfolio values, and reports and displays to provide portfolio information. Price: $195. Investors Software, 48 Iron Ship Plaza, San Francisco, CA 94111, (415) 981-5261.
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Statistical analysis package is for the Apple II computer system. This package contains 24 statistical programs. It includes regressions, distributions, hypothesis testing and probability. This enhanced version allows reading of data from a user-generated file or from a file created with the package. Price: $75. Basic Business Software, Box 26311, Las Vegas, NV 89126, (702) 876-9493.
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Accounting software integrates all journals needed in small business accounting. The Accounts Journal is designed to be easy to learn. Because its commands are all English words, little

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Cassette business package runs on a TRS-80 model III computer with 16K memory. It contains the following programs: cassette data base manager, word processor, inventory control, stock management, check balancing, label printer, deposit calculator, statistics, sort utility, and key access utility. Price: $59. Manual only, $5. Micro Architect, 96 Dothan St., Arlington, MA 02174, (617) 643-4713.
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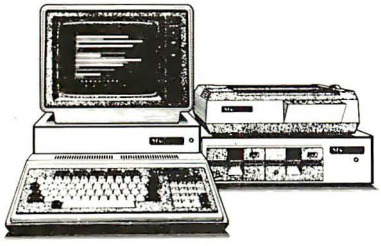

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Multi-processor operating system, MTOS-68K, is a real-time, multi-tasking system. It manages task coordination, memory pools, input/output, priority scheduling, interrupt processing, and multiple processors. Application software may be written in assembly language or in a higher-level language, such as Pascal or C. Price: $9,500. Industrial Programming Inc., 100 Jericho Quadrangle, Jericho, NY 11753, (516) 938-6600.
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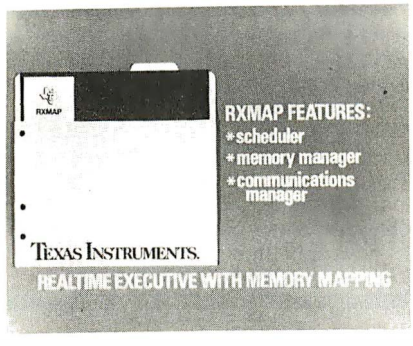
High-level language provides full memory-mapping capabilities for 16-bit microprocessor applications. Advanced Microprocessor Pascal was developed to support the TMS9900/99000 family. It combines the advantages of Pascal with features that address a critical problem—



maintaining uniformity in complex software-development programs. Prices are: floppy diskette, $3200; DS31, DS10 hard disk, $3500; and T25, T50 hard disk, $3900. Texas Instruments, Central Literature Response Center (SC-348), Box 202129, Dallas, TX 75220.
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Machine language program allows disassembly and examination of program instructions from any part of a computer's memory. It also allows single-stepping through the computer's ROM. It is available for the TRS-80 model I: cassette, $54.95; disk, $59.95. Also available for the TRS-80 model III, disk $69.95. Advanced Operating Systems, 450 St. John Rd., Michigan City, IN 46360. (800) 348-8558.
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Educational program, Score, scores multiple choice tests, conducts comprehensive item analyses, maintains academic records, prepares frequency distributions and individualized student feedback. It interfaces the Apple with the Chatsworth, HEI, or Scan-tron optical mark readers. Scientific Software Associates, Box 208, Wausau, WI 54401, (715) 845-2066.
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Source code software, Cobol Animator, provides for Cobol source code to be displayed on the screen as it is being executed. The cursor is moved from statement to statement as execution proceeds. The program can be run one statement at a time or continuously. In continuous animation, speed can be chosen to match the operator's pace. The program can also be run normally—in which case only the user displays are shown—then switched back into animation mode at any time. Cobol Animator has advanced interactive debugging capabilities. During debugging, the programmer can set execution breakpoints and change the path of execution at will, so as to omit or repeat parts of the program. At any time that he has halted the program's execution, the programmer can query the value of a data item simply by moving the cursor onto it and issuing a simple command. If he chooses he may then change its value before continuing. The value of an item can also be monitored so that it is displayed after executing each program statement. This programming concept gives more information than can be obtained from a listing, because it shows the programmer the actual statements executed in a particular logical path through the program. Cobol Animator can be used on any Cobol source program that conforms to the ANSI 1974 standard, regardless of the original compiler used to write it. It operates with either Micro Focus' CIS Cobol or level II Cobol compiler. Micro Focus, 1601 Civic Center Dr., Santa Clara, CA 95050, (408) 496-0176.
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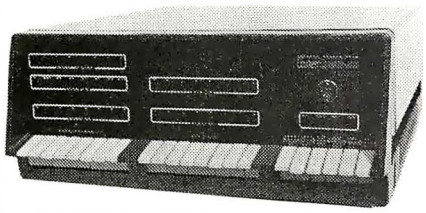

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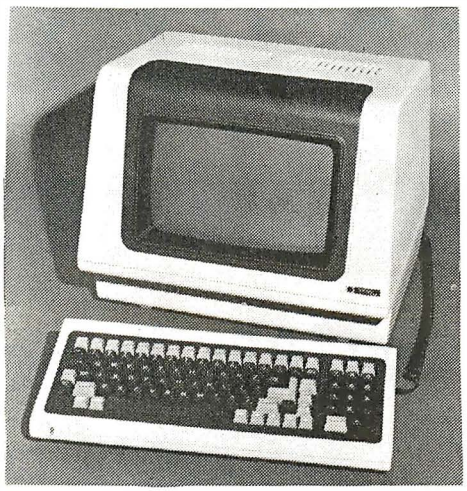

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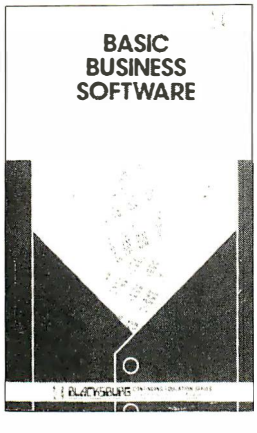

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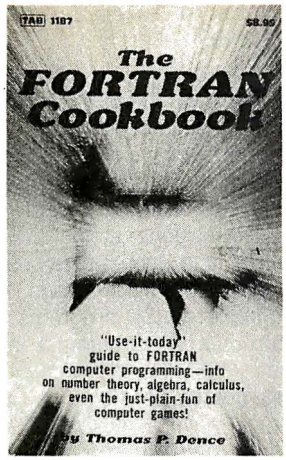

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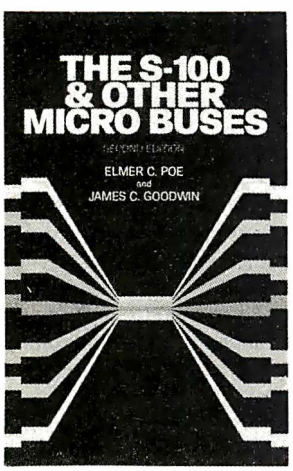

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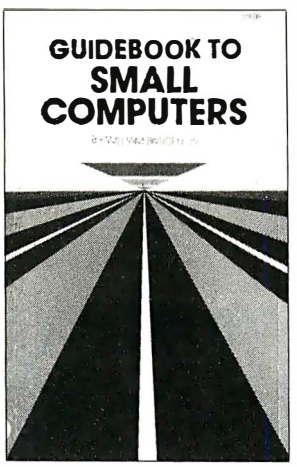

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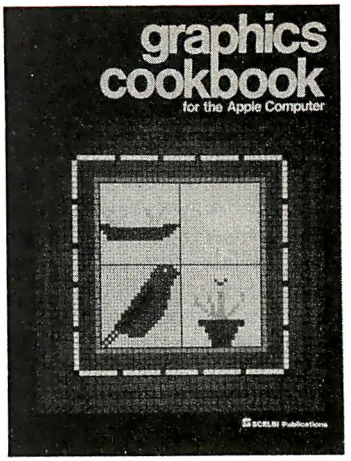

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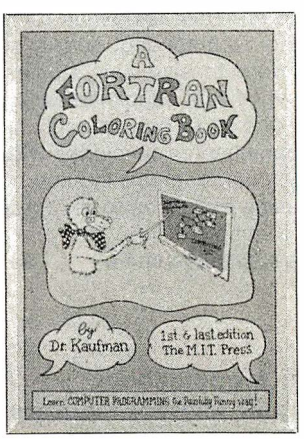

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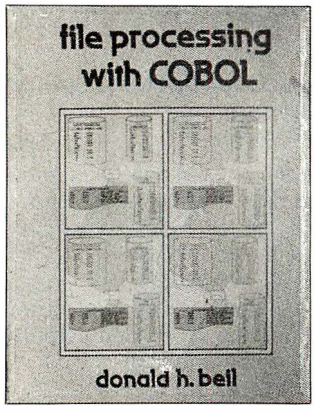

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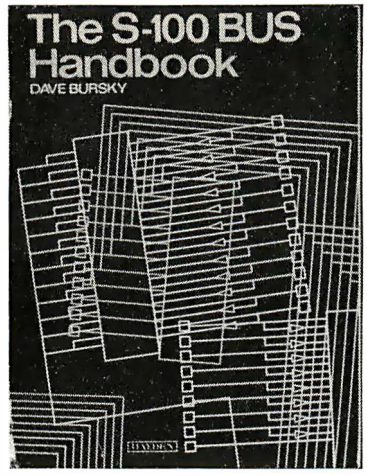

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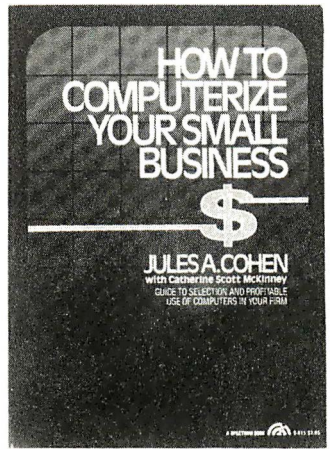

How To Computerize Your Small Business
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This is a complete step-by-step guide to selecting data processing equipment and services, and shows you how to plan a computer system tailored to the needs of your small business. It not only describes the basics of how a computer works, but also advantages and limitations of the most popular types of computer equipment.

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Programmer's Guide to LISP
By Ken Tracton

This fact-filled handbook offers a simplified method of learning LISP, the best known language of artificial intelligence. The first part of the book follows a logical progression to guide you through the basics of algebraic functions, expressions, atoms, symbols, lists, sublists, and subexpressions. The last part of the book shows how to write complete LISP programs, and offers instructions on computer input and output.

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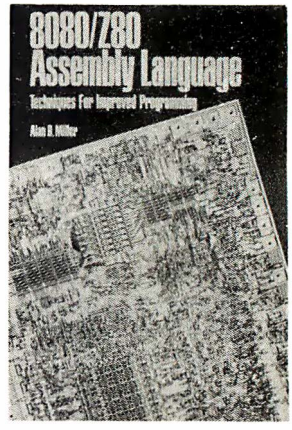

8080/Z-80 Assembly Language
By Alan Miller

For both intermediate and advanced programmers, this complete guide to programming the 8080 and Z-80 microprocessors lets you get every response your computer is capable of generating. Learn the details of assembly language programming easily and quickly—as you develop a powerful system monitor in a step-by-step, top-down approach. You'll start with number bases and logical operations, then move on to branching, rotation and shifting, one's and two's complement arithmetic, and stack operations. You'll find out how your assembly language programs can utilize the CP/M operating system for all input and output.

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The Joy of Minis and Micros
By Philip Stein and Howard Shapiro

Here's a collection of pieces covering technical and management aspects of the use of small computers for business or science. It emphasizes the use of common sense and good systems design for every computer project. A strong technical background is unnecessary, which makes the book neither difficult to read nor to understand.

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Managing Software Development and Maintenance

By Carma L. McClure, Ph.D.

In this book, the author points out how to control rising software costs by the application of software engineering principles and methodologies to software maintenance, as well as to software development activities. The author shows you how to build the quality of maintainability into a software system during the development phase and how to preserve software quality during the operation and maintenance phase. System design methods emphasizing creating software that is easy to change is the key.

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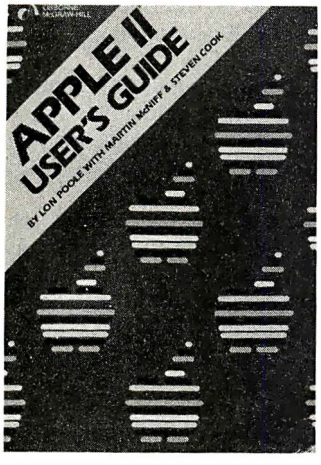

Apple II User's Guide

By Lon Poole, Martin McNiff and Steven Cook

It's all here in the new Apple II User's Guide. This guide will compliment your owner's manual and give your a heightened understanding of your Apple II. With this book you'll be able to program in BASIC. You'll be able to use the sound and graphics features of the Apple II to create your own colorful video games. There's also a review of the Apple II printer as well as a chapter on controlling "Real" processes, like burglar alarms and appliances.

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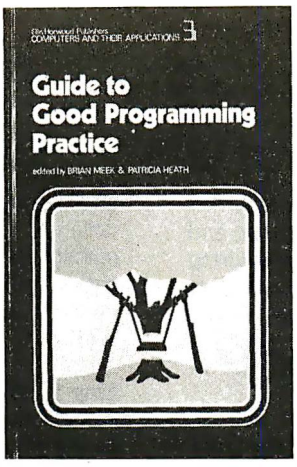

Guide to Good Programming Practice

Edited by Brian Meek and Patricia Heath

This is the first book to bring together in a compact format, real guidance on the many aspects of a computer programmer's work. The book covers structural programming and program writing techniques. But it goes further by explaining much more than that. It covers analysis, design, testing, debugging, "Tuning" for better efficiency, copying with a computer's limitations. selecting a language, language standards, program documentation, taking on another programmer's work, and more.

ORDER NO. 0-470-27150-7 $19.95

Some Common BASIC Programs

By Lon Poole and Mary Borchers

This book contains program listings and documentations for 76 short programs covering financial, mathematical. statistical and general interest applications. Every program has been tested; examples and sample program runs are published with the source listings for each program.

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Sargon: A Computer Chess Program

By Dan and Kathe Spracklen

Here is the computer chess program that won first place in the first chess tournament at the 1978 West Coast Computer Faire. It is written in Z-80 assembly language, using the TDL macro assembler. It comes complete with block diagram and sample printouts.

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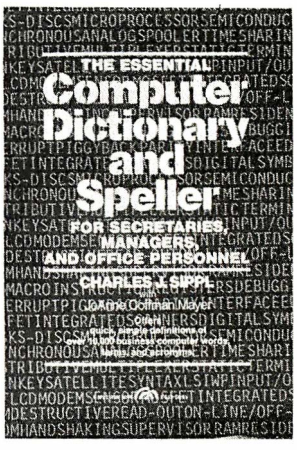

The Essential Computer Dictionary and Speller

By Charles J. Sippl

This book is for anyone whose job requires familiarity with computer or electronic words. This book provides a reliable, fingertip source of both spellings and meanings. Handy, business-oriented dictionary defines more than 15,000 computer terms and acronyms, simply and practically. More than 100 pictures, line drawings, and other figures assist in providing clarity and greater ease-of-use for browsing and learning.

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CALENDAR

May 4-6 Plant Engineering and Show/West, Convention Center, Los Angeles, CA, will address plant engineering and maintenance problems that affect all types of manufacturing and processing plants, with special emphasis on companies operating in the West. Such industries as electronics, aerospace and defense will receive special attention. Clapp & Poliak, 245 Park Ave., New York, NY 10167, (212) 661-8410.

May 6-9 Washington Home Entertainment Show, Sheraton Inn, Washington, D.C., will concentrate on total home entertainment. Displays will include home video, personal computers, electronic and video games, video clubs and libraries, photography, arcade games, telephone systems, home communications. National Trade Productions, 9418 Annapolis Rd., Suite 206, Lanham, MD 20706, (301) 459-8383.

May 10-11 Network Cost Management, Ambassador E. Hotel, Chicago, IL, will address bottom-line issues in controlling developmental and operational network costs. Datapro Research, 1805 Underwood Blvd., Delran, NJ 08075, (609) 764-0100.

May 10-14 International Assoc. of Educational Data Systems, Sheraton Twin Towers, Orlando, FL, including exhibitions and demonstrations for college and university data processing directors, administrators and teachers who use computers in the classroom. Florida Assoc. for Educational Data Systems, 1311 Executive Center Dr., Suite 220, Tallahassee, FL 32301, (904) 878-4178.

May 11-14 Computer Aided Quality Show, Inner Harbor Convention Center, Baltimore, MD, is dedicated to the application of mini, micro, and mainframe computers—as well as microprocessors and programmable controllers—to improve manufacturing quality. Technical sessions will cover testing and measurement, artificial intelligence, materials analysis, quality planning, dynamic measurement/adaptive controls, quality standards for software development, electronic circuit inspection, process controls, computer-human interface, and use of computer simulation for design/performance checking and verification. CAM-I, 611 Ryan Plaza Dr., Suite 1107, Arlington, TX 76011, (817) 265-5328.

May 12-14 Midwest Accounting Show, Expocenter, Chicago, IL, will feature the latest in business systems and services for accountants as well as educational programs covering various accounting, tax, finance and management fields. Illinois CPA Society, 135 S. La Salle St., Chicago, IL 60603, (312) 346-7957.

May 12-15 International Business Show, Exhibition Halls, Tokyo International Trade Fairgrounds, Haruml, Tokyo, will feature business computers, word processors and peripherals. Nippon Administrative Management Assoc., Seikyo Kaikan Bldg., 1-13, Sendagaya 4-chome, Shibuya-ku, Tokyo 151, Japan, 03 (Tokyo) 403-1331.

May 13-14 Selecting Computer Terminals for Improved Productivity, Ambassador E. Hotel, Chicago, IL, is designed to help data processing and non-technical people in purchasing a terminal, identifying requirements, evaluating vendors. Datapro Research Corp., 1805 Underwood Blvd., Delran, NJ 08075, (609) 764-0100.

May 14-15 Southern California Computers-In-Education Conference, University High School, Irvine, CA, will cover applications of computers from kindergarten through junior college, including reading, math, science, language, classroom management, school attendance, multicultural, special education, business education. Craig Walker, Arrowview, Intermediate School, 2299 North "G" Street, San Bernardino, CA 92405, (714) 886-9118.

May 14-16 OS-9 User's Seminar, Marriott Inn, Des Moines, IA, is designed to allow OS-9 users to meet with the designers of the 6809 program for training and briefing sessions. The seminar will also include exhibits by major 6809 hardware manufacturers and producers of applications software available under OS-9. Microware Systems Corp., 5835 Grand Ave., Box 4865, Des Moines, IA 50304, (515) 279-8844.

May 15 Deadline for research papers for the Third International Conference on Information Systems, University of Michigan, Ann Arbor, to be held in December this year. Authors whose papers are selected for the conference will have an opportunity to have their papers published in information systems journals. Graduate School of Business Administration, The University of Michigan, Ann Arbor, MI 48109, (313) 763-1179.

May 15-16 North American Computer Othello Championship, Learning Resources Center, Anderson Hall, Northwestern U., Evanston, IL, will sponsor a two-day tournament to identify computer champions in three categories: microcomputer systems, mainframe systems, special-purpose Othello machines. Prof. Peter W. Frey, Department of Psychology, Norwestern University, Evanston, IL 60201.

May 18-20 Northcon/82, Seattle Center Coliseum, Seattle, WA, is a high-technology electronics convention and exhibition serving the Pacific Northwest region. Northcon/82, 999 N. Sepulveda Blvd., El Segundo, CA 90245, (213) 772-2965.

May 18-20 Microcomputers In Education, Gutman Library, Cambridge, MA, offers one-day workshops for educators. Topics include: overview of educational uses of microcomputers; microcomputers in math education; Basic and Graphics I and II; Logo; Pascal, and others. Technical Educations Research Centers, 8 Eliot St., Cambridge, MA 02138, (617) 547-3890.

May 18-20 Control Engineering Conference and Exposition, O'Hare Expo Center, Rosemont, IL, will display a wide range of control equipment, systems and components to engineers and production people who specify controls for industry use. Tower Conference Management, 143 N. Hale St., Wheaton, IL 60187, (312) 668-8100.

May19-21 Computer Hong Kong 82, Regent Hotel, Hong Kong, is its first international computer technology exhibition. Kallman Associates, 5 Maple Court, Ridgewood, NJ 07450, (201) 652-7070.

May 20-21 Computer Law Institute, USC Law Center, Los Angeles, CA, will present an in-depth program on antitrust, proprietary rights and contractural issues confronting the computer industry. Among the subjects discussed will be trade secrets and copyrights in software, licensing of software, practical applications of the 1981 tax act, R and D tax partnerships and the effective use of insurance by vendors and users. USC Law Center, University Park, Los Angeles, CA 90007, (213) 743-2582.

May 20-21 Third Annual Electronic Mail Seminar, BBN Conference Center, Cambridge, MA, will address the technical, social and managerial issues involved in operating an electronic mail program and will offer hands-on experience. It is designed for people who are investigating, planning, implementing or expanding computer-based message systems. B BN Information Management Systems, 68 Moulton St., Cambridge, MA 02238, (617) 497-2929.

May 22 First Regional Conference on Technology and Special Education, Mill Neck Manor Lutheran School for the Deaf, Mill Neck, NY, will be a session for teachers, administrators and parents. It is sponsored by the New York State Assoc. for Educational Data Systems. Commack Public Schools, Indian Hollow Computer Lab, Kings Park Rd., Commack, NY 11725, (516) 493-3431, or Half Hollow Hills High School, Dix Hills, NY 11746, (516) 549-5416.

May 25-27 Europe Software 1982, Jaarbeurs fairgrounds, Utrecht, The Netherlands, will showcase a complete range of computer software products, including applied and systems software, as well as allied goods and services including software services and consultants, training courses, seminars and trade literature. U.S. Consulate General, Amsterdam, The Netherlands, (20) 790321.

June 5 Swapfest/Exposition, Minnesota State Fairgrounds, St. Paul, MN, will be the state's largest show for personal computer software and communication equipment. Amateur Fair, Box 30054, St. Paul, MN 55175.

June 6-8 Sixth International Conference on Computers and the Humanities, McKimmon Center, Raleigh, NC, will present a pre-convention workshop and speakers during the conference. Department of English, North Carolina State University, Raleigh, NC 27650.

June 7-10 National Computer Conference, Astrodomain, Houston, TX, will display the latest advances in computer hardware, software and services. Will include technical session, speakers from both industry and government, and films relating to computer technology. American Federation of Information Processing Societies, 1815 N. Lynn St., Arlington, VA 22209, (703) 558-3610.

June 8-9 Confronting the Communications Revolution, McGraw-Hill World Headquarters Conference and Exposition Center, New York, NY, will discuss current and future industry changes. Hands-on strategy workshops will concern broadcasting, newspaper, consumer and trade publications, and information systems. Business Week Executive Programs, 1221 Ave. of the Americas, 40th Floor, New York, NY 10020, (212) 997-4930.

June 20-Aug 6 Young people's Basic training camps, Lake Forest College, Lake Forest, IL, will give high school-aged students hands-on experience with computers. Camps are one week long and are open to students 12 to 18 years old. Lake Forest Computer Camp, Lake Forest College, Lake Forest, IL 60045.

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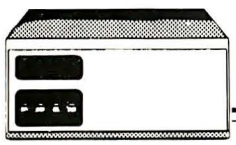

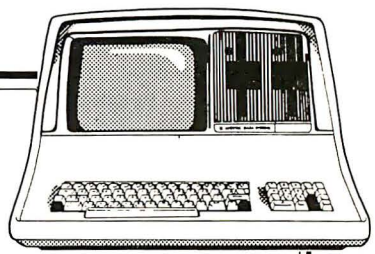

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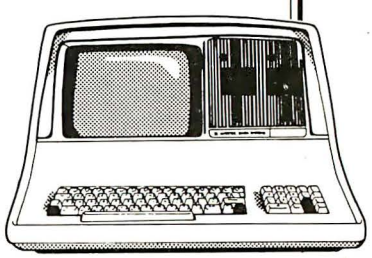

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BOOK REVIEWS

Practical Data Base Management
edited by Auerbach Publishers
Reston Publishing, Reston, VA

Reviewed by Rocky Smolin

In this tightly written, rather academic book, the editors, have compiled just about everything one would want to know about the components, evaluation, selection, implementation and administration of a data base. It is intended as an organized guide to the pragmatic problems associated with data base systems. Since they have written for the DBMS manager or prospective manager, the authors have omitted much technical detail relevant only to those dealing with the internals of a DBMS. They have concentrated instead upon presenting practical experience and insight.

The organization of the book is excellent. It is broken into five sections: Management Perspectives and Planning; Data Base Environment Components; Evaluation and Selection of Software; Administration of the Data Base Environment; Design and Development of Data Bases; and Current and Future Directions of Data Base Technology. Each section is broken into three-to-five chapters.

It will also provide a reference to those involved in the field, and to students and teachers of data base management classes.

430 pages $24.95

Basic Programs for Scientists and Engineers
by Alan R. Miller
Sybex, Berkeley, CA

This book is virtually identical in format to the Pascal version by the same author (reviewed *IA* Dec 81), resulting in another excellent book.

The author has struck exactly the right balance between tutorial and program solutions to the basic scientific and engineering problems. The typesetting job lends itself to easy reading and location of the desired information. Reserved words are in bold type, figures are bounded by rule. To the author's credit, all the programs are copiously remarked. The index is not extensive, but appears to cover all the topics in the book.

Exercises are included at the end of each chapter, which makes this an excellent textbook for a second programming course in the science or engineering disciplines.

Two appendices, listing the reserved words and functions and a summary of Basic, and a bibliography, round out the book.

318 pages $14.95 ***—RS***

Inside Basic Games
by Richard Mateosian
Sybex, Berkeley, CA

Reviewed by David D. Busch

If you are more heavily into logic problem-solving than math, and feel that you are still far from exhausting all the programming possibilities of Basic, you may be interested in this exploration of computer games. The author uses an easy-to-understand "free Basic" pseudocode to explain some complex gaming topics. Though the technique is simple, the concepts are not. Beginners will find this a challenging introduction to the ideas behind basic games. The most advanced Basic programmer will find his skills tested and honed sharply.

Eight different kinds of computer games are described, explained and analyzed in detail. Simple arithmetic drills and guessing games progress to building a sophisticated *Alien Life* version of the *Game of Life*. The latter is a new game formed by grafting *Alien Encounter* (a simple graphics game developed by Mateosian) with the popular *Life*, which is not so much a game as a computer simulation microcosm.

The programmer is shown how to design these programs using elegant techniques. Then, final versions in Microsoft Basic are presented, with specific changes recommended to adapt them to Apple, Commodore or Radio Shack computers. The author was wise not to limit these concepts to one particular brand of computer, or restrict the programs to a Basic subset common to them all.

328 pages $8.95

Computing Using Basic: An Interactive Approach
by Tonia Cope
John Wiley, New York, NY

Reviewed by Richard Krajewski

There are three things that make a good textbook: technical accuracy, readability and examples. This book has all three.

The first section, "The Basic Language," is a thorough treatment of the most important Basic commands; the usual PRINT, GOTO, and FOR NEXT statements are well-covered. Technical content is thorough.

The second section, "Applications," which demonstrates a number of uses for Basic, is the answer for readers who wonder what Basic can do besides calculating the volume of a sphere. It is a stimulus to the newcomer's imagination, and may be responsible for launching many computer careers. Mathematics, games, computer-aided design and book indexing are covered.

The stick figure illustrations are primitive. Though entertaining, they seem to add almost nothing to the understanding of Basic.

A final quarrel: The author asks a question in the beginning of the book she never answers: "Why have a chapter 0?" The answer: zero is the first counting number in the world of computing.

351 pages $19.95

Developing Stuctured Systems: A Methodology Using Structured Techniques
by Brian Dickinson
Yourdon Press, New York, NY

Reviewed by John Edwards

This book is not geared to the personal computer user. It is aimed at computer systems routinely used by large corporations.

Based on a methodology funded by The Bank of America, IBM and others, this book is written for system project leaders and middle-to-upper managers who are interested in a complete system development process that can be applied with a minimum of confusion and effort. It looks to an integrated approach of system development with the ultimate achievement of a quality standardization system for all. This is a fine reference work that should prove indispensible for system builders. Gone is much of the mumbo-jumbo in most books of this type; replacing it is clear information and instruction with enough leeway to allow the user personal discretion in creative problem solving.

Helping this process along is the book's organization, logical in progression, yet grouped independently enough to allow a reader to tackle specific sections without being forced to read all that comes before them. Included are 37 leveled flow diagrams and a data dictionary with roughly 400 entries and more than 140 process descriptions. The book takes a no-nonsense approach that helps the harried professional rapidly find solutions to his problems.

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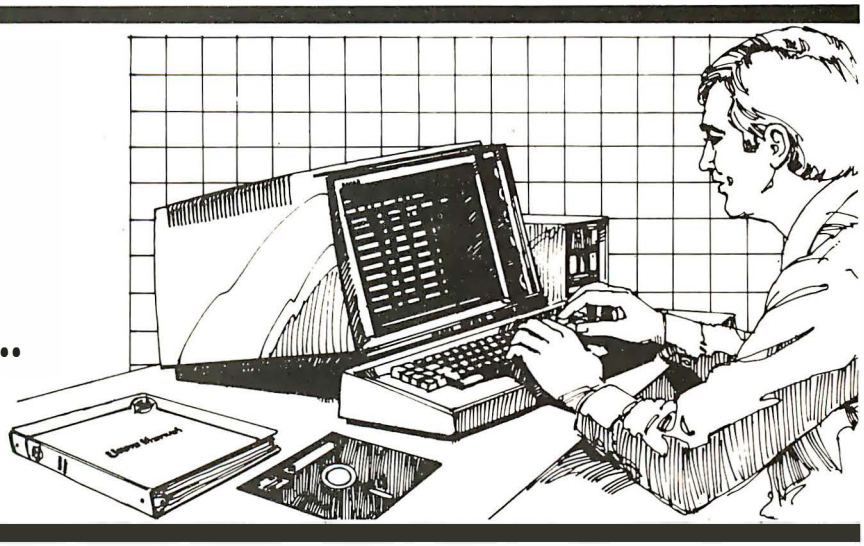

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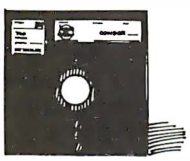

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How to Break into the Computer Field
by L. Peter Carron
L.P. Carron Publishers, Easton, PA

This book is aimed at those interested in forging a legitimate career in the computer world. It is full of information useful to the prospective computer job seeker. Full attention is paid to subjects such as the range of positions available, educational requirements and necessary background. The book presents a realistic view of the field, striking down popular misconceptions, but sustaining the hope of a profitable future even for those with little current practical experience.

Jobs explored cover the entire computing field, from data entry operator through computer operator, programmer, systems analyst and data processing manager. To guide his readers into these positions, Carron looks at job entry methods from various approaches. Tips are given to job seekers with minimal education, to those with education or experience in another field, and to readers with a direct background in computer science. From this point, information is provided on the different paths the reader can follow to get the job of his choice.

While most of the book is devoted to the task of preparing for the job hunt, about one-third of the text is devoted to a look at simple computer theory and application. A brief examination of the various languages and a reasonably thorough treatment of the spectrum of computer tasks are included. It all adds up to a very satisfying work that should go a long way in answering most questions for prospective job seekers.

138 pages $7.95 **—JE**

The Basic Handbook—2nd Edition
by David A. Lien
Compusoft Publishing, San Diego, CA

David A. Lien has updated his monumental work, *The Basic Handbook*, and whether you're using Basic on a mainframe or pocket micro, owning this volume is essential. With almost 500 separate word definitions, test programs, sample runs and other relevant material, this book covers just about every significant Basic word used by virtually every Basic-speaking computer in the world.

One of the nice things about the book is Lien's reluctance to get into arguments over which computer is best or which Basic dialect is superior. There are no value judgements made here, no diatribes on proper language usage, just an abundance of facts. The problems are left for the user to assess.

480 pages $19.95 **—JE**

Intimate Instructions in Integer Basic
by Brian D. Blackwood and George H. Blackwood
Howard W. Sams, Indianapolis, IN

Reviewed by James C. Graves, Jr.

Often the microcomputing neophyte is faced with the frustration of trying to understand his new computer as well as its language. This book is designed to relieve the aggravation of learning Basic programming. Although it is based exclusively on Apple computer Basic, it can easily be applied to any Basic programming language.

The book is composed of lessons instead of chapters. Each lesson sets out to achieve specific objectives. For example, after completing the first few lessons, the reader should have a thorough understanding of Basic syntax and Basic commands. In addition to setting objectives, a vocabulary of computer terms and programming examples is included in the lessons. Finally, at the end of each lesson, an exercise tests the reader's understanding of the material.

After covering the Basic syntax and commands, the book continues by discussing flowcharting, loops and counting, decision statements, programming style and debugging.

The final lessons explain advanced programming techniques. Among these are GOSUB, SORT, MIN-MAX, functions and graphics.

158 pages $7.95

68000 Assembly Language Programming
by Gerry Kane, Doug Hawkins and Lance Leventhal
Osborne/McGraw-Hill, Berkeley, CA

This book is directed toward the assembly language programmer who will probably be working with the MC68000 16-bit microprocessor. A microcomputing beginner may find the book difficult, but worthwhile in that the material applies to most assembly languages. The book takes the reader through fundamental concepts, software development and programming problems consistent with the MC68000 microprocessor.

The book's first section introduces the MC68000. A description of the machine structure, internal registers, flags and assembly language directives begin to illustrate the power this microprocessor holds. A refresher in fundamental assembly language directives is also presented in this section. EQUATE, ORIGIN, and RESERVE are examples of these directives.

The next section introduces the reader to elementary programs written in 68000 assembly language. Examples of these programs include: 16-bit addition, 64-bit addition, table of factorials and sorting. Program looping is discussed, using some of the preceding program examples.

The software development portion of the book should prove to be of particular interest to any microcomputer owner. It is an excellent guide to the stages that should be followed when designing software or writing a program.

The book ends with a description of individual MC68000 instructions and the instruction set summary. The book is not recommended for anyone who does not have a fundamental knowledge of computers and programming. However, for those that do possess a computer background and want to expand their knowledge into the realm of 16-bit machines, it is an excellent book.

600pages $16.99 **—JCG**

Applesoft Language
by Brian D. Blackwood and George H. Blackwood
Howard W. Sams, Indianapolis, IN

This book assumes the reader has no previous knowledge of the Applesoft Basic language, and presents it in 28 lessons. The book proceeds from the roots of the language to advanced programming principles. The language is contained in one section in the book, while two other sections cover programming and graphics.

Lesson 1 begins by introducing the load and save features for the Apple II. From there, subjects such as loops, efficient programming, double subscripted variables and reserved words for Applesoft are discussed.

The methodological manner in which the book presents the material adequately teaches programing principles. A shortcoming in the programming examples, however, is the lack of good comments throughout the body of the programs.

254pages $10.95 **—JCG**

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Micro Mathematician

Continued from page 33

Listing 1. Function minimization program

```
10 PRINT "FUNCTION MINIMIZATION BY GRADIENT METHODS"
20 REM DESIGNED TO ILLUSTRATE THE METHODS RATHER THAN
30 REM   BE EFFICIENT IN EXECUTION
40 REM   J C NASH  JANUARY 1982
50 INPUT "NUMBER OF PARAMETERS=",N
60 DIM B(N),C(N),G(N),U(N,N)
70 FOR I=1 TO N
80 PRINT "INITIAL B(",I,")=",
90 INPUT B(I)
100 NEXT I
110 REM INITIALIZE FUNCTION CALCULATION
120 GOSUB 2300 \ REM FUNCTION SETUP & PARAMETERS
130 INPUT "ORTHOGONALITY TOLERANCE=",T9
140 INPUT "ESTIMATED MINIMUM FUNCTION VALUE=",F9
150 INPUT "DEBUG(0=NONE,1=FN,2=FN & GRADIENT)?",Z9
160 PRINT "NUMBER OF ORTHOGONAL SEARCH DIRECTIONS"
170 INPUT "1 GIVES STEEPEST DESCENTS, N FULL SPACE ?",N1
180 IF N1<1 THEN 160 \ REM SAFETY
190 GOSUB 2000 \ LET I9=1 \ REM INITIAL FUNCTION COUNT
200 LET F0=Z \ LET I8=0 \ REM INITIAL GRADIENT COUNT
210 PRINT "INITIAL FUNCTION VALUE = ",F0
220 LET S=1 \ REM INITIAL STEP SIZE
230 REM ORTHOGONAL DIRECTIONS
240 FOR J=1 TO N1 \ REM NOTE MAY HAVE N1=1
250 GOSUB 2500 \ LET I8=I8+1 \ REM GRADIENT
780 LET B(I)=C(I)+K*S*U(I,J)
790 IF (B(I)+100)=(C(I)+100) THEN LET L=L+1
800 REM NOTE USE OF FACTOR 100 TO ENSURE SMALL  VALUES
810 REM      ARE NOT COMPARED FOR EQUALITY
820 NEXT I
830 IF L=N THEN 910 \ REM DONE?
840 GOSUB 2000 \ LET I9=I9+1 \ REM PRINT FN
850 IF Z9<>0 THEN GOSUB 940 \ REM GOOD POINT?
860 IF Z<F0 THEN 890 \ REM GOOD POINT?
870 LET K=0.2*K \ REM REDUCE STEP
880 GOTO 760 \ REM AND TRY AGAIN
890 LET F0=Z \ REM SAVE NEW LOW FN VALUE
900 RETURN
910 LET Z=F0+10*(ABS(F0)+10) \ REM ENSURE Z>F0
920 REM Z>F0 FLAGS FAILURE TO FIND LOWER FN VALUE
930 RETURN
940 REM PRINT FUNCTION AND POINT
950 IF Z9=0 THEN RETURN \ REM NO PRINT
960 PRINT "AFTER ",I8," GRADIENT AND ",I9," FUNCTION ",
970 PRINT "EVALUATIONS,"
980 PRINT "FUNCTION =",F0
990 IF Z9=1 THEN RETURN
1000 FOR I=1 TO N
1010 PRINT "B(",I,")=",B(I),
1020 IF Z9=2 THEN PRINT "   G(",I,")=",G(I)
1030 NEXT I
1040 RETURN
```

Listing 2. Elliptical valley subroutines

```
2000 REM ELLIPTIC VALLEY FUNCTION
2010 GOSUB 2100 \ REM COMMON FIRST PART WITH GRADIENT
```

```
260 LET G2=0
270 FOR I=1 TO N
280 LET U(I,J)=-G(I)
290 LET G2=G2+G(I)*G(I)
300 NEXT I
310 IF G2=0 THEN EXIT 650 \ REM STATIONARY POINT
320 REM DO NOT WANT ORTHOGONALIZATION FOR FIRST G
330 IF J=1 THEN 450
340 REM GRAM-SCHMIDT ORTHOGONALIZATION
350 FOR L=1 TO J-1
360 LET Q=0 \ REM OVERLAP
370 FOR I=1 TO N
380 LET Q=Q+U(I,J)*U(I,L)
390 NEXT I
400 REM NOW REMOVE EFFECT OF J'TH VECTOR
410 FOR I=1 TO N
420 LET U(I,J)=U(I,J)-Q*U(I,L)
430 NEXT I
440 NEXT L
450 LET U2=0 \ REM NORMALIZE SEARCH VECTOR
460 REM ALSO CALCULATE PROJECTION OF G ON U(,,J)
470 LET Q=0
480 FOR I=1 TO N
490 LET U2=U2+U(I,J)*U(I,J)
500 LET Q=Q-U(I,J)*G(I)
510 NEXT I
520 LET U2=SQRT(U2) \ LET Q=Q/U2
530 IF U2/SQRT(G2)<T9 THEN EXIT 630
540 FOR I=1 TO N
550 LET U(I,J)=U(I,J)/U2
560 LET C(I)=B(I) \ REM SAVE BEST POINT
570 NEXT I
580 GOSUB 730 \ REM LINEAR SEARCH
590 IF Z=F0 THEN 610 \ REM LOWER FN VALUE FOUND
600 IF J=1 THEN EXIT 650
610 NEXT J
620 GOTO 240
630 IF Z9>0 THEN PRINT "NOISE LEVEL SEARCH DIRECTION"
640 GOTO 240
650 PRINT "DONE"
660 FOR I=1 TO N
670 LET B(I)=C(I) \ REM RESTORE POINT
680 NEXT I
690 GOSUB 2500 \ REM LAST GRADIENT
700 LET Z9=2
710 GOSUB 940 \ REM PRINT RESULTS
720 STOP
730 REM SEARCH
740 LET K=1 \ REM STEPSIZE ADJUSTMENT
750 LET S=(F0-F9)/Q \ REM STEPSIZE ESTIMATE
760 LET L=0 \ REM EQUAL ELEMENT COUNT
770 FOR I=1 TO N
2020 LET Z=16*T1*T1+T2*T2
2030 RETURN
2100 REM SETUP, S9 IS SCALING ON B(1)
2110 LET T1=S9*B(1)+B(2)-4
2120 LET T2=S9*B(1)-B(2)-8
2130 RETURN
2300 REM INITIALIZATION FOR ELLIPTIC VALLEY FUNCTION
2310 INPUT "SCALING FOR B(1)=",S9
2320 RETURN
2500 REM GRADIENT
2510 GOSUB 2100
2520 LET G(1)=S9*(32*T1+2*T2)
2530 LET G(2)=32*T1-2*T2
2540 RETURN
```

Listing 3. Steepest descents method

```
RUN

FUNCTION MINIMIZATION BY GRADIENT METHODS
NUMBER OF PARAMETERS=2
INITIAL B( 1)=?0
INITIAL B( 2)=?0
SCALING FOR B(1)=1
ORTHOGONALITY TOLERANCE=1E-2
ESTIMATED MINIMUM FUNCTION VALUE=0
DEBUG(0=NONE,1=FN,2=FN & GRADIENT)?0
NUMBER OF ORTHOGONAL SEARCH DIRECTIONS
1 GIVES STEEPEST DESCENTS, N FULL SPACE ?1
INITIAL FUNCTION VALUE =  320
DONE
AFTER  55 GRADIENT AND  67 FUNCTION EVALUATIONS,
FUNCTION = 2.56E-12
B( 1)= 5.9999992  G( 1)= -.0000032
B( 2)= -1.9999992  G( 2)= .0000032
STOP IN LINE 730
READY

RUN

FUNCTION MINIMIZATION BY GRADIENT METHODS
NUMBER OF PARAMETERS=2
INITIAL B( 1)=?0
INITIAL B( 2)=?0
SCALING FOR B(1)=1
ORTHOGONALITY TOLERANCE=1E-2
ESTIMATED MINIMUM FUNCTION VALUE=-1
DEBUG(0=NONE,1=FN,2=FN & GRADIENT)?0
NUMBER OF ORTHOGONAL SEARCH DIRECTIONS
1 GIVES STEEPEST DESCENTS, N FULL SPACE ?1
INITIAL FUNCTION VALUE =  320
```

```
DONE
AFTER  47 GRADIENT AND  316 FUNCTION EVALUATIONS,
FUNCTION = 5.696E-11
B( 1)= 6.0000027   G( 1)= -.0000192
B( 2)= -2.0000037  G( 2)= -.0000448
STOP IN LINE 730
READY
```

Listing 4. Orthogonal directions method

```
RUN

FUNCTION MINIMIZATION BY GRADIENT METHODS
NUMBER OF PARAMETERS=2
INITIAL B( 1)=?0
INITIAL B( 2)=?0
SCALING FOR B(1)=1
ORTHOGONALITY TOLERANCE=1E-2
ESTIMATED MINIMUM FUNCTION VALUE=0
DEBUG(0=NONE,1=FN,2=FN & GRADIENT)?0
NUMBER OF ORTHOGONAL SEARCH DIRECTIONS
1 GIVES STEEPEST DESCENTS, N FULL SPACE ?2
INITIAL FUNCTION VALUE =  320
DONE
AFTER  43 GRADIENT AND  89 FUNCTION EVALUATIONS,
FUNCTION = 1.0169E-10
B( 1)= 5.9999981   G( 1)= -.0000826
B( 2)= -2.0000006  G( 2)= -.0000774
STOP IN LINE 730
READY

RUN

FUNCTION MINIMIZATION BY GRADIENT METHODS
NUMBER OF PARAMETERS=2
INITIAL B( 1)=?0
INITIAL B( 2)=?0
SCALING FOR B(1)=1
ORTHOGONALITY TOLERANCE=1E-2
ESTIMATED MINIMUM FUNCTION VALUE=-1
DEBUG(0=NONE,1=FN,2=FN & GRADIENT)?0
NUMBER OF ORTHOGONAL SEARCH DIRECTIONS
1 GIVES STEEPEST DESCENTS, N FULL SPACE ?2
INITIAL FUNCTION VALUE =  320
DONE
AFTER  37 GRADIENT AND  242 FUNCTION EVALUATIONS,
FUNCTION = 2.705E-11
B( 1)= 5.9999994   G( 1)= -.0000414
B( 2)= -2.0000007  G( 2)= -.0000418
STOP IN LINE 730
READY
```


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Power in Your Pocket

Continued from page 46

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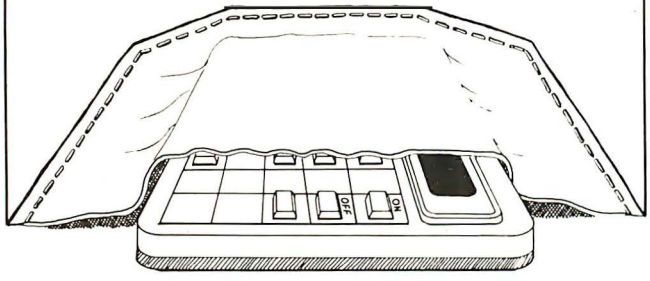
by Bob McElwain



Listing

```
 5: PRINT "WHERE IT WENT"
```

- CLEAR is not used in the program in order to protect data. Use CLEAR manually on initial start only to set all variales to zero.

@@@ INITIAL PARAMETERS @@@

- A-1 is the number of categories needed. B-1 is the number of periods to be averaged. Change to suit. Note that A*(B+1)+C-26 cannot exceed the number of memories remaining when the program is loaded. If A=10 and B=4 then 34 memories must be available. (10*(4+1)+10-26=34) C is the number of variables used in the program and must not be changed.

```
10: A=10: B=4: C=10
```

- Enter any character if a start is needed. To continue, without a start, press ENTER only. In order to prevent accidental destruction of data, Lines 15-80 can be deleted after the first run.

```
15: INPUT "ENTER ONLY FOR CONT";I$:
  : GO TO 25
```

- Bypass headings and reset of counter, D.

```
20: GO TO 99
```

- Here if start or re-start. D is the count of periods entered and the number of periods to be averaged.

```
25: D=0
```

@@@ ENTER CATEGORY HEADINGS @@@

```
50: PRINT "ENTER HEADINGS NOW"
55: PRINT "MAX LENGTH IS 7"
```

- C+1 is the first location for a heading. C+A-1 is the last. Position C+A is for the total.

```
60: FOR J=C+1 TO C+A-1
65: INPUT "HEADING? ";A$(J)
```

- Display for approval.

```
70: E=J-C: PRINT "COL #";E;" ";A$(J)
```

- Use ENTER only if OK. Return for re-entry if any other character is entered.

```
75: INPUT "OK? ";I$: GO TO 65
80: NEXT J
```

@@@ ENTRY FROM CHECKBOOK @@@

- Can re-start program from this point to continue a previous entry session. RUN 99.

```
99: PRINT "ENTER AMOUNTS NOW"
120: PAUSE "USE ZERO TO EXIT"
```

- Get a category and amount.

```
125: INPUT "CAT # ?";H
```

- Exit entry routine on zero.

```
130: IF H=0 THEN 200
```

- Test range.

```
135: IF (H>0)+(H<A)=2 THEN 145
140: PRINT "BAD ENTRY. TRY AGAIN."
   : GO TO 125
145: INPUT "AMOUNT? $";E
```

- Display for approval.

```
150: PRINT A$(C+H);" - ";E
```

- Return for re-entry if any character entered.

```
155: INPUT "OK ? ";I$: GO TO 120
```

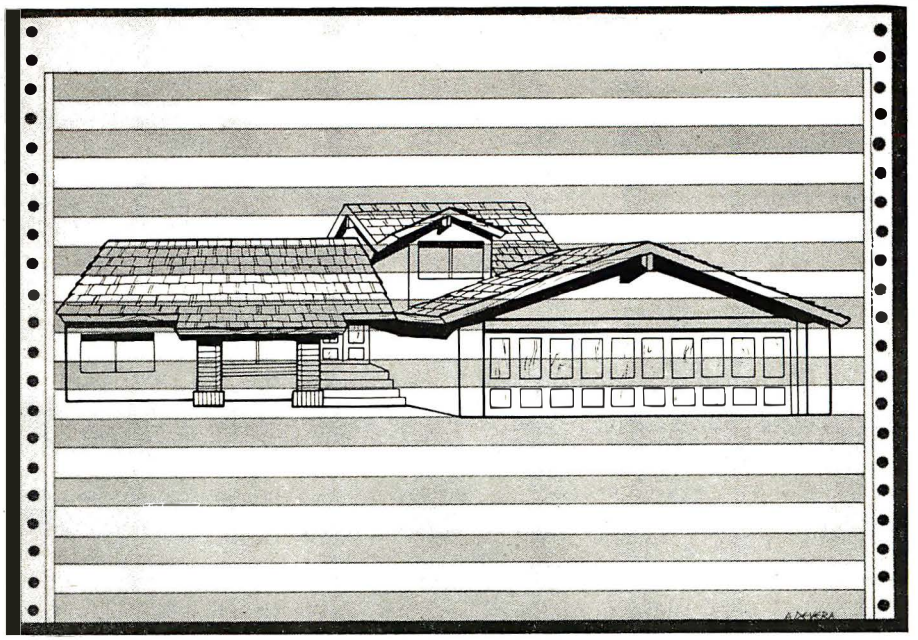
- Accumulate for category total. Index is to category total in the next-to-last row of data.

```
160: F=C+(B-1)*A+H: A(F)=A(F)+E
```

```
     - Return for next amount.
165: GO TO 125
     @@@  DISPLAY TOTALS  @@@
     - Find total of all categories
       and save.  Set to zero for
       sum.
200: F=C+B*A: A(F)=0
     - Loop for accumulation.
205: FOR H=F-A+1 TO F-1
210: A(F)=A(F)+A(H)
215: NEXT H
     - Compute percent of total for
       each category and display with
       total.
220: FOR H=1 TO A-1
     - Index to element needed, cate-
       gory total is in next to last
       row.
225: J=C+(B-1)*A+H
     - Compute percent and round off.
230: E=INT(A(J)/A(F)*100+.5)/10
235: PRINT A$(C+H);" $";A(J);" ";E;"%"
240: NEXT H
     - Display total.
245: PRINT "TOTAL IS $";A(F)
250: INPUT "RESULTS OK? ";I$
   : GO TO 260
     - Here if results were good;
       ENTER only was pressed.  Con-
       tinue.
255: GO TO 299
     - Here if any character was
       entered.  If ENTER is pressed,
       period will be reset to zero.
260: PRINT "PRESS ENTER FOR RERUN"
     - Reset next to last row to zero.
265: F=C+(B-1)*A
270: FOR H=1 TO A-1
275: A(F+H)=0
280: NEXT H
     - Return for re-entry of orig-
       inal amounts.
285: GO TO 99
     @@@  FIND NEW AVERAGE  @@@
     - On initial runs, the number of
       periods averaged is less than
       B-1.
299: D=D+1: IF D=B LET D=B-1
300: PRINT "DO NOT BREAK"
305: PRINT "DATA WILL BE SCRAMBLED"
     - Loop for categories.
310: FOR H=1 TO A
     - Find sum of B-1 items in same
       category.
315: J=0
320: FOR G=1 TO B-1
     - Index to element and accumu-
       late to sum.
325: F=C+G*A+H: J=J+A(F)
330: NEXT G
     - Find average to nearest
       hundredth.
335: J=INT(J/D*100+.5)/100
     - Index to last average this
       category.
340: F=C+B*A+H
     - Find change from previous
       average as a percent rounded
       to tenths.
345: E=INT((J-A(F))/J*1000+.5)/10
     - Display average and percent of
       change.
350: PRINT A$(C+H);" $";J;" ";E;"%"
     - Save new average.
355: A(F)=J
     - Discard oldest data, roll
       other data back one period and
       set next to last period to
       zero.
360: FOR G=2 TO B-1
     - Find index to element to be
       rolled back.
365: F=C+G*A+H
     - Element in A(F) will replace
       data in A(F-A).
370: A(F-A)=A(F)
375: NEXT G
     - Set element in next to last
       row to zero for next accumu-
       lation.
380: A(C+(B-1)*A+H)=0
395: NEXT H
400: PRINT "DATA SHIFT COMPLETE"
405: PRINT "BREAK OK"
410: GO TO 99
999: END
```

Real Estate Ad Writer

Continued from page 115



Program listing

```
10 CLEAR 10000
20 PRESTIGE=32:COUNTRY=15:IVEST=16:BEDROOM=6:CITY=15:REPAIRS=17
30 LOW=40:MEDIUM=20:FUNNY=22:CST=30:CLOSR=31
40 DIM PRESTIGE$(PR),COUNTRY$(CO),IVEST$(IV),BEDROOM$(BE),CITY$(CI),
      REPAIR$(RE),LOW$(LO),MEDIUM$(ME),FUNNY$(FU),CST$(CS),CLOSR$(CL)

50 ' ****** Read descriptions into arrays ******

60 :      FOR N=1 TO PR:READ PRESTIGE$(N):NEXT N
70 :      FOR N=1 TO CO:READ COUNTRY$(N):NEXT N
80 :      FOR N=1 TO IV:READ IVEST$(N):NEXT N
90 :      FOR N=1 TO BE:READ BEDROOM$(N):NEXT N
100 :     FOR N=1 TO CI:READ CITY$(N):NEXT N
110 :     FOR N=1 TO RE:READ REPAIR$(N):NEXT N
120 :     FOR N=1 TO LO:READ LOW$(N):NEXT N
130 :     FOR N=1 TO ME:READ MEDIUM$(N):NEXT N
140 :     FOR N=1 TO FU:READ FUNNY$(N):NEXT N
150 :     FOR N=1 TO CS:READ CST$(N):NEXT N
160 :     FOR N=1 TO CL:READ CLOSR$(N):NEXT N

170 ' ****** Input data for ad ******

180 :  CLS:PRINT:PRINT
190 :      INPUT "Enter price of home : ";PR$
200 :      PR=VAL(PR$)
210 :  CLS:PRINT:PRINT

810 PRINT F1$
820 PRINT AD$
830 LPRINT F1$
840 LPRINT AD$
850 END

860 '          ****** PRESTIGE HOMES ******

870 DATA " A home you'll be proud to own. "
880 DATA " A little mansion. "
890 DATA " A love nest. "
900 DATA " A man's ambition-a woman's dream. "
910 DATA " A rare find. "
920 DATA " Value with elegance. "
930 DATA " A symphony in every room. "
940 DATA " Achievement in luxury. "
950 DATA " All-American beauty. "
960 DATA " All the beauty of perfection. "
970 DATA " An Architects dream. "
980 DATA " Architectually perfect. "
990 DATA " Architectural masterpiece. "
1000 DATA " Architectural poem. "
1010 DATA " Aristocratic style. "
1020 DATA " Artistically landscaped - stunning departure. "
1030 DATA " Beauty beyond belief. "
1040 DATA " Beauty has been captured. "
1050 DATA " Challenges comparison. "
1060 DATA " Character plus charm. "
1070 DATA " Designed for prestige. "
1080 DATA " Designed for luxury. "
1090 DATA " Distinctive, remarkably spacious. "
1100 DATA " In a class by itself. "
1110 DATA " Looking for the best. "
1120 DATA " Luxury plus! "
1130 DATA " One of our best offerings. "
1140 DATA " Planned for important people. "
1150 DATA " Plush and lush! "
1160 DATA " The answer to your dreams. "
1170 DATA " Where only the best is good enough. "
1180 DATA " Where quality is king. "

1190 ' ****** IN COUNTRY ******

1200 DATA " Accent on view. "
1210 DATA " Deluxe COUNTRY living ! "
1220 DATA " Head for the HILLS! "
1230 DATA " In the country - low taxes! "
1240 DATA " Just far enough away! "
1250 DATA " Out of CITY LIMITS! "
1260 DATA " Peaceful, restful seclusion. "
1270 DATA " Robins, roses and COUNTRY! "
1280 DATA " Rolling countryside! "
1290 DATA " Rustic privacy! "
1300 DATA " Tired of CITY living! "
1310 DATA " Tucked away! "
1320 DATA " Want breathing space. "
1330 DATA " Why not s-p-r-e-a-d   o-u-t ! "
1340 DATA " Rich as country cream. "

1350 ' ****** INVESTMENT PROPERTY *****

1360 DATA " Attention INVESTORS! "
```

```
220 :       PRINT "For your area, is this considered :"
230 :       INPUT " 1.) High    2.) Medium    3.) Low  priced ";AN$
240 :       AN=VAL(AN$)
250 :       IF AN<1 OR AN>3 GOTO 210
260 :    CLS:PRINT:PRINT
270 :       PRINT "Is this home located in the "
280 :       INPUT "  1.) Country    2.) City  ";LC$
290 :       LC=VAL(LC$)
300 :       IF LC<1 OR LC>2 GOTO 260
310 :    CLS:PRINT:PRINT
320 :       INPUT "Number of bedrooms :";B$
330 :       B=VAL(B$)
340 :    CLS:PRINT:PRINT
350 :       INPUT "Does this home need repairs  (Y/N) ";R$
360 :    CLS:PRINT:PRINT
370 :       INPUT "Is this an investment property";I$
380 :       IF LEFT$(I$,1)="Y" GOTO 430
390 :    CLS:PRINT:PRINT
400 :        INPUT "Would you like humor in the ad (Y/N)";H$
410 :        R$=LEFT$(R$,1)
420 :        H$=LEFT$(H$,1)


430 ' ****** Build ad ******

440 RANDOM
450 IF AN=1 F1=32:F=RND(F1):F1$=PRESTIGE$(F):GOTO 480
460 IF AN=2 F1=20:F=RND(F1):F1$=MEDIUM$(F):GOTO 480
470 IF AN=3 F1=40:F=RND(F1):F1$=LOW$(F):GOTO 480
480 L=LEN(F1$)
490 L1=68-L
500 L1=L1/2
510 F1$=STRING$(L1,32)+" ---- "+F1$+" ---- "
520 F=RND(15)
530 IF LC=2 GOTO 550
540 F2$=COUNTRY$(F):GOTO 560
550 F2$=CITY$(F)
560 F=RND(6)
570 F3$=BED$(F)+STR$(B)+" bedrooms? "
580 IF R$="n" OR R$="N" GOTO 610
590 F=RND(17)
600 F4$=REPAIR$(F)
610 IF H$="n" OR H$="N" GOTO 640
620 F=RND(22)
630 F5$=FUN$(F)
640 IF LEFT$(I$,1)="N" OR LEFT$(I$,1)="n" GOTO 670
650 F=RND(16)
660 F5$=IVEST$(F)
670 F=RND(30)
680 F6$=CST$(F)+STR$(PR)+"."
690 F=RND(31)
700 F7$=CL$(F)
710 AD$=F2$+F3$+F4$+F5$+F6$+F7$
720 A=0
730 :   FOR N=1 TO LEN(AD$)
740 :      A=A+1
750 :      IF A<70 GOTO 790
760 :      IF MID$(AD$,N,1)<>CHR$(32) GOTO 790
770 :      AD$=LEFT$(AD$,N-1)+CHR$(13)+MID$(AD$,N)
780 :      A=0
790 :    NEXT N
800 CLS:PRINT:PRINT
```

```
1370 DATA " Constant income producer. "
1380 DATA " Dividend - paying real estate! "
1390 DATA " Don't bypass this annual income! "
1400 DATA " Excellent investment buy! "
1410 DATA " Good investment! "
1420 DATA " Good money maker! "
1430 DATA " Income PLUS! "
1440 DATA " Income property in the PINK - not 'in the red'. "
1450 DATA " Invest don't SPEND! "
1460 DATA " Make money here! "
1470 DATA " Money making proposition! "
1480 DATA " Profitable investment! "
1490 DATA " Prudent investment! "
1500 DATA " Real money maker! "
1510 DATA " Want to make a little money? "

1520 '         ****** BEDROOM & FEATURE LEAD ******

1530 DATA " Looking for a home with "
1540 DATA " Do you need "
1550 DATA "If your family has been growing, we have what you need.
     Would you believe a home with "
1560 DATA " Almost too good to be true -- do you need "
1570 DATA "Should the home you've been looking for have "
1580 DATA " How would you like your next home to have "

1590 '****** CITY LOCATION ******

1600 DATA " City's beauty spot! "
1610 DATA " Close-in location! "
1620 DATA " Close to everything! "
1630 DATA " So near so wonderful!
1640 DATA " Convenient to most everything! "
1650 DATA " Don't ride WALK! "
1660 DATA " Home for lunch! "
1670 DATA " Inside the city but out of this WORLD! "
1680 DATA " Near schools, bus and shops! "
1690 DATA " Next door to everything! "
1700 DATA " Short walk to stores and transportation! "
1710 DATA " Walk downtown! "
1720 DATA " Walking distance! "
1730 DATA " Walk to work! "
1740 DATA " Charm, location and convenience! "

1750 '          ****** NEEDS REPAIRS ******

1760 DATA " Handy man's haven. "
1770 DATA " Attention Handy Man! "
1780 DATA " Diamond in the rough! "
1790 DATA " Do it yourself, double the value! "
1800 DATA " Do-it-yourself opportunity! "
1810 DATA " For a Mr. Fix-it! "
1820 DATA " Hammer, saw and a little work! "
1830 DATA " Has that 'lived-in' look! "
1840 DATA " Paint brush special! "
1850 DATA " Don't read this ad unless you need work! "
1860 DATA " Old, run-down and dirty! "
1870 DATA " Sad shack! "
1880 DATA " Plenty of fixing required! "
1890 DATA " Like to fix up an old house?? "
1900 DATA " Dirty, rundown and dreary, but..... "
1910 DATA " Hammer happy?? "
```

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```
1920 DATA " A little paint and water will work wonders! "
1930 '          ****** LOW PRICED ******
1940 DATA " A family delight. "
1950 DATA " A careful buyer's dream. "
1960 DATA " A lot for a little. "
1970 DATA " A most tempting buy. "
1980 DATA " A fabulous bargain. "
1990 DATA " Accent on value. "
2000 DATA " An amazing value. "
2010 DATA " Another tempting buy. "
2020 DATA " Are you budget wise? "
2030 DATA " Bona fide bargain. "
2040 DATA " Buy for profit. "
2050 DATA " For the thrifty. ";
2060 DATA " Get the most for your money. "
2070 DATA " Scotch? then see .... "
2080 DATA " A terrific buy. "
2090 DATA " Bombshell buy. "
2100 DATA " Best buy in the area. "
2110 DATA " Can you top this. "
2120 DATA " Dandy discount. "
2130 DATA " Dollars count here. "
2140 DATA " For the smart buyer. "
2150 DATA " Hard to beat at the price. "
2160 DATA " Here is a real honest bargain. "
2170 DATA " Hard to believe. "
2180 DATA " Here's a hot one! "
2190 DATA " The time to buy is NOW! "
2200 DATA " This is not a misprint. "
2210 DATA " Today's believe it or not! "
2220 DATA " Why not now! "
2230 DATA " Why pay rent! "
2240 DATA " Maybe we're crazy. "
2250 DATA " Once in a lifetime. "
2260 DATA " Opportunity is knocking. "
2270 DATA " Outstanding value. "
2280 DATA " Jackpot savings. "
2290 DATA " Little cash need. "
2660 DATA " Glory be! ! ";
2670 DATA " Hey folks! Look here! ";
2680 DATA " Hey, PoP! ";
2690 DATA " Hum boy!! ";
2700 DATA " I need a Lover! ";
2710 DATA " L (O) (O) K what you can find. ";
2720 DATA " Love at purse sight! ";
2730 DATA " Lucky you! ";
2740 DATA " My, oh my! ";
2750 DATA " Psst!!! ";
2760 DATA " Quick Henry, the car! ";
2770 DATA " Snappy delight!! ";
2780          ****** PRICE, TERMS OR VALUE ******
2790 DATA " A terrific buy at only $"
2800 DATA " The time to buy is now at only $"
2810 DATA " This is hard to beat at the low price of only $"
2820 DATA " Get the most for your money at only $"
2830 DATA " This tops them all at only $"
2840 DATA " The low price will surprise you at only $"
2850 DATA " The answer to a bargain at only $"
2860 DATA " A sizzling buy at only $"
2870 DATA " Wow! What a value at $"
2880 DATA " We challenge you to find a better buy at only $"
2890 DATA " Say 'Hello' to a good buy only $"
2900 DATA " The mostest for the leastest only $"
2910 DATA " And all for $"
2920 DATA " We know of nothing comparable in comfort, appearance and location only
2930 DATA " Won't wait at $"
2940 DATA " All for $"
2950 DATA " Brighten your future for $"
2960 DATA " You can well afford it only $"
2970 DATA " Worth your careful consideration at only $"
2980 DATA " Would you believe only $"
2990 DATA " Wonderful buy at only $"
3000 DATA " Try to match this at only $"
3010 DATA " Unusually good house and exceptionally low priced at $"
3020 DATA " The price is right too $"
3030 DATA " Outstanding value at $"
```

```
2300 DATA " Low price will surprise you. "
2310 DATA " Hottest home buy today! "
2320 DATA " In the low-cost field. "
2330 DATA " Call - look - buy - must sell now! "
2340 ' ****** MEDIUM PRICE RANGE ******
2350 DATA " Cadillac taste and Model T pocketbook? "
2360 DATA " For the family with more taste than $$$. "
2370 DATA " Home pleases eye and price pleases budget! "
2380 DATA " Inexpensive - not cheap! "
2390 DATA " Most liveable home for the money. "
2400 DATA " Nifty for the thrifty! "
2410 DATA " Pay more? What for? "
2420 DATA " You don't need a fat pocketbook. "
2430 DATA " Better grade home. "
2440 DATA " Built for FUN! "
2450 DATA " Charm with economy! "
2460 DATA " Expansive, not expensive! "
2470 DATA " Hitch your wagon to a STAR! "
2480 DATA " Pleasure you'll treasure! "
2490 DATA " Unique - not just unusual! "
2500 DATA " Save $$$$ in your own home! "
2510 DATA " A place to hang your heart! "
2520 DATA " Live BETTER in your OWN home! "
2530 DATA " Like findins $$$$. "
2540 DATA " Unbelievable but TRUE! "
2550 ' ****** HUMOROUS ******
2560 DATA " A word to the wives is sufficient. "
2570 DATA " Adam and Eve never had it so good. "
2580 DATA " Adventure ..... in good taste. "
2590 DATA " All you've been seeking. ";
2600 DATA " Aloha! (means good buy). ";
2610 DATA " Beauty and the best. ";
2620 DATA " Attention, Mr. Homeseeker! ";
2630 DATA " Does this make sense? ";
2640 DATA " Don't be a square. ";
2650 DATA " Frantic ? ? ";
3040 DATA " You'll agree it's a bargain at $"
3050 DATA " You can't beat this for real value at only $"
3060 DATA " Worth seeing, worth owning only $"
3070 DATA " Tremendous value at $"
3080 DATA "Don't wait. It won't last at $"
3090 ' ****** AD CLOSERS ******
3100 DATA " Don't miss the boat! ";
3110 DATA " Hurry! Hurry! Hurry! ";
3120 DATA " Don't delay seeing -- someone might beat your time. ";
3130 DATA " You can well afford it. ";
3140 DATA " If you take your time you'll miss this one. ";
3150 DATA " See this and stop looking. ";
3160 DATA " Don't dilly-dally on this one. ";
3170 DATA " Well worth a phone call! ";
3180 DATA " If dollars count - see this in a hurry! ";
3190 DATA " Act fast on this or forget it! ";
3200 DATA " Here today--gone tomorrow. ";
3210 DATA " The price is right too! ";
3220 DATA " Stop looking this is it! ";
3230 DATA " Let us tell you more! ";
3240 DATA " Worth your time to investigate. ";
3250 DATA " Don't miss a good bet. ";
3260 DATA " Take this one seriously. ";
3270 DATA " Act fast on this or forget it! ";
3280 DATA " If you miss this one blame no one but yourself! ";
3290 DATA " Stop looking! This is it! ";
3300 DATA " Don't buy anything until you see this! ";
3310 DATA " Don't cry if it's gone. ";
3320 DATA " A beautiful opportunity for you. ";
3330 DATA " Act quick on this genuine bargain. ";
3340 DATA " You can't beat this for a real value. ";
3350 DATA " As close as your telephone. ";
3360 DATA " Ask for our brochure. ";
3370 DATA " Ask to see this soon. ";
3380 DATA " Tommorrow may be too late! ";
3390 DATA " You will agree it's a bargain. ";
3400 DATA " Better be an early bird. "
```


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Displaying Data with Vertical Rastering

Continued from page 117

Displaying Data with Vertical Rastering —Another Approach

Program listing

```
.
.
.
100 I2=INT(N/C)
110 I3=N-C*I2       (or I3=N MOD C)
120 FOR I=1 TO N
130 I0=INT((I-1)/C)
140 I1=I-C*I0-1     (or I1=(I-1) MOD C)
150 J=I1
160 IF I3<I1 THEN J=I3
170 J=J+I1*I2+I0+1
175 A(I)=J
180 NEXT I
190 X=0
200 FOR I=1 TO N
210 PRINT #1,USING "\                              \";A$(A(I));
220 X=X+1:B(X)=A(I)
230 IF X=C OR I=N THEN PRINT #1,:GOSUB 270
240 NEXT I
250 IF X<>C THEN PRINT #1,
260 END
270 FOR X=1 TO C
280 PRINT #1,USING "\                              \";B$(B(X));
290 IF X=I3 AND I=N THEN PRINT #1,:GOTO 320
300 NEXT X
310 PRINT #1,
320 FOR X=1 TO C
330 PRINT #1,USING "\                              \";C$(B(X));
340 IF X=I3 AND I=N THEN 360
350 NEXT X
360 PRINT #1,:PRINT #1,
370 X=0
380 RETURN
```

Sample printout from amended algorithm

```
A. Able                 E. Easy                 H. How
123 Albion St           567 Eldora Wy           890 Havana St
Albany  NY              Easton  PA              Honolulu  HI

B. Baker                F. Foxtrot              I. Item
234 Bellaire Ct         678 Fillmore Av         901 Iowa St
Buffalo  NY             Ft Collins  CO          Indianapolis  IN

C. Charlie              G. George               J. Juliet
345 Cherry St           789 Girard Dr           102 Jasmine WY
Chicago  IL             Georgetown  CA          Joliet  IL

D. Delta
456 Dover Pl
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```

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Consult and advise on purchase	**87%**	**53%**
Review alternatives and options	**87%**	**80%**
Recommend specific manufacturers	**85%**	**54%**
Prepare and develop equipment needs	**82%**	**47%**
Approve the final purchase	**42%**	**69%**

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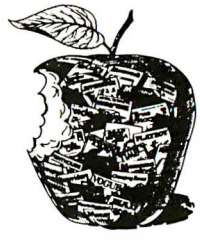

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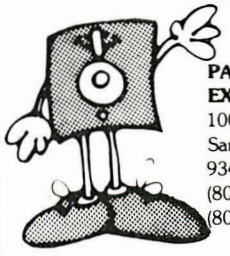

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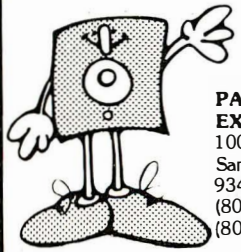

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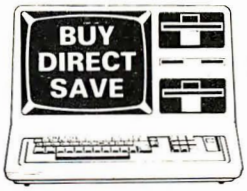

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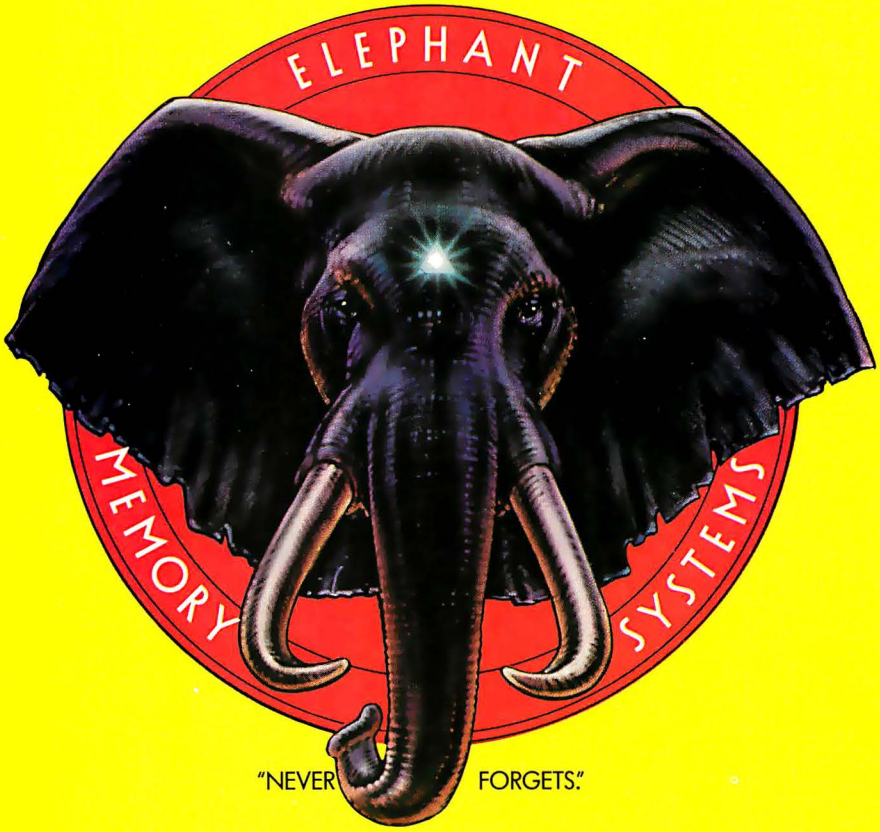

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