

## S/09 THE MIGHTY MICRO

## MC6809 PROCESSOR — 20-BIT ADDRESS BUS DIRECTLY ADDRESSES UP TO 768K OF RAM

Performance and capabilities never before possible are now available to you in the SWTPC S/09. Computer System. The S/09 uses the Motorola MC6809 processor, the most powerful 8-bit general purpose MPU available. It features more addressing modes than other 8-bit MPU's and an optimized consistent instruction set enhanced by powerful 16-bit instructions. This, plus 24 indexing submodes, promote the use of modern programming techniques like position independent code, re-entrancy and recursion.

The 20-bit address bus makes possible direct addressing of up to 768K of memory without any slow or clumsy processes such as bank switching. RAM memory is designed with independent control and array cards for economical expansion of memory. The DMA and the processor boards can access memory independently for different tasks.

Multiuser capability is "built-in". No additional hardware is required to operate additional terminals. A dynamic memory management system can allocate available RAM in as small as 4K blocks to the various users or tasks.

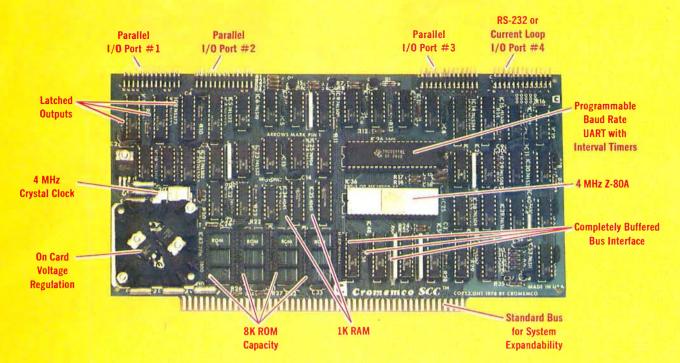
The dual-bus motherboard design used in the S/09 makes adding I/O ports to the system quick and economical. I/O address decoding for all I/O slots is supplied with the system. All serial I/O cards may be quickly programmed to run at standard baud rates from 110 to 38,400.

Both multiuser and multitasking/multiuser operating systems are available for the S/09. BASIC, PASCAL and an Assembler are immediately available. Editor and Debug programs are also available for use in system development.

Circle 356 on inquiry card.



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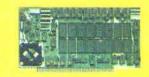
Other features include 24 bits of bidirectional parallel I/O and five onboard programmable timers.

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32K BYTESAVER PROM card

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And the computer has a full 12-slot card cage you can use for additional RAM and interface cards.

#### **BROADEST SOFTWARE SUPPORT**

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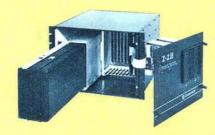
microcomputer field. Software Cromemco is known for. Software like this:

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- RATFOR (RATional FORtran)
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- Z80 Macro Assembler
- Word Processing System
- Data Base Management

with more coming all the time.

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We've kept you in mind, too. Ask about the new Model HDD Disk Drive which can combine with your present Cromemco computer to give you up to 22 megabytes of disk storage.



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ID	PITCHERS	F-1	HITS
0	WISE	0	.253
1	TIANT	0	.250
2	LEE	1	.259
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Cover Art: The Magic of Computers by Robert Tinney

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## In This BYTE



#### About the Cover

The theme for this issue is "Fun and Games", using the personal computer to implement dynamic interactive forms of enjoyment not otherwise possible. In the cover by Robert Tinney, entitled "The Magic of Computers", we find the essence of an ancient shell game applied with a desk top computer as the missing pea.

One of the quickest ways to gain experience with a processor is to actually program and interface to it. The Intel 8086 16-bit processor is now available for evaluation as the SDK-86 single board computer. Steve Ciarcia evaluates the SDK-86 board. Page 14

The solution of games such as Soma Cubes and polyominoes presents the computer programmer with a nontrivial problem. Although the method of solution may seem quite straightforward, the actual implementation may use up excessive amounts of memory or time. This was one problem facing Douglas Macdonald and Yekta Gürsel when they started Solving Soma Cube and Polyomino Puzzles Using a Microcomputer. Their final program is capable of solving many problems of this

sort in reasonable lengths of time on an 8 K byte machine.

Page 26

Peter B Maggs takes readers behind the scenes to show how a programmer can design a board-game program using minimax theory, a technqiue used to maximize one's chances of winning a game. Read Programming Strategies in the Game of Reversi, a tutorial article with broad applicability in the field of computer games.

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Implementing the data structures needed to simulate a chess game is a task that the average programmer is quite capable of performing. However, developing an effective method of defining the respective priorities for all the possible moves is a

cumbersome task whose solution has eluded many programmers. W D Maurer illustrates the use of the game-tree diagram in a method called Alpha-Beta Pruning, a technique that offers a possible solution to this problem.

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Owners of Commodore PETs often wish to have hard-copy printouts of data appearing on their machine's video displays. P K Govind gives advice on how to obtain hard copy in Interfacing the PET to a Line Printer.

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Escape all your earthly restrictions and go into orbit with A Spacecraft Simulator. Gary Sivak has put together a BASIC program to put your celestial flight skills to the test.

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One type of popular computer-game activity is the simulation of sports events. If you have ever wondered if the best baseball team of today could beat the best team of some long-past season, you may now be able to get at least a theoretical answer. Joseph J Roehrig developed a system that uses real statistical data to simulate the play of baseball games, and he now shares it with us in The National Micropastime.

Using stacks can help to simplify otherwise very complex programming problems. In Stack It Up,

Page 113

Charlton H Allen demonstrates a simple procedure for evaluating mathematical expressions that employ stack control. Page 140

Have your recent endeavors with your personal computer been all work and no play? Tony Estep discusses some of the basic principles involved in Writing Animated Computer Games. The software was written for the SOL-20, but with minor modifications will run on any VDM-based 8080 computer.

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Even if you own a minimum computer system, you can still do interesting things with it. Charles A Kapps gives Five Useful Programs for the SC/MP which are suitable for minimum systems. The routines can be converted to other systems, such as the COSMAC VIP and KIM.

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Do you need a simple device to show logic signals compared to the system clock? Frank DeCaro can help you to Build a Simple Digital Oscilloscope.

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Where most people are particular about the computer they buy, they don't think twice about the most frequently used component of a system: the keyboard. The Cherry PRO Keyboard is Dan S Parker's choice and he tells us why.

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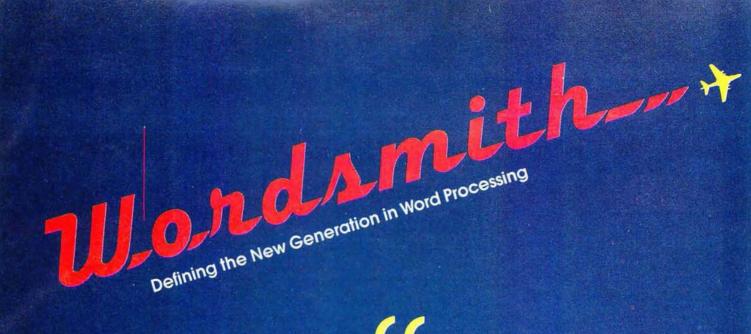
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## **Editorial**

## Is Pseudoscience Done by Computer Pseudo-Computer-Science?

#### by Carl Helmers

One of my main tasks each month is reading all the manuscripts which are sent to BYTE by authors, who are often our readers. The number of well-prepared manuscripts which come our way is fantastic, and for obvious reasons of space we can only accept so many in a given interval of time. Thus, when an unsolicited article is received, we look for a certain uniqueness of idea and appropriateness for our readers. The article content of BYTE magazine is approximately 90% the result of unsolicited articles. Of course, exceptions occur, for example, the 6809 series by Joel Boney and Terry Ritter (which required a bit of encouragement in advance of its writing), or several of the articles on LISP in our August 1979 issue, which were solicited explicitly by guest editor John Allen.

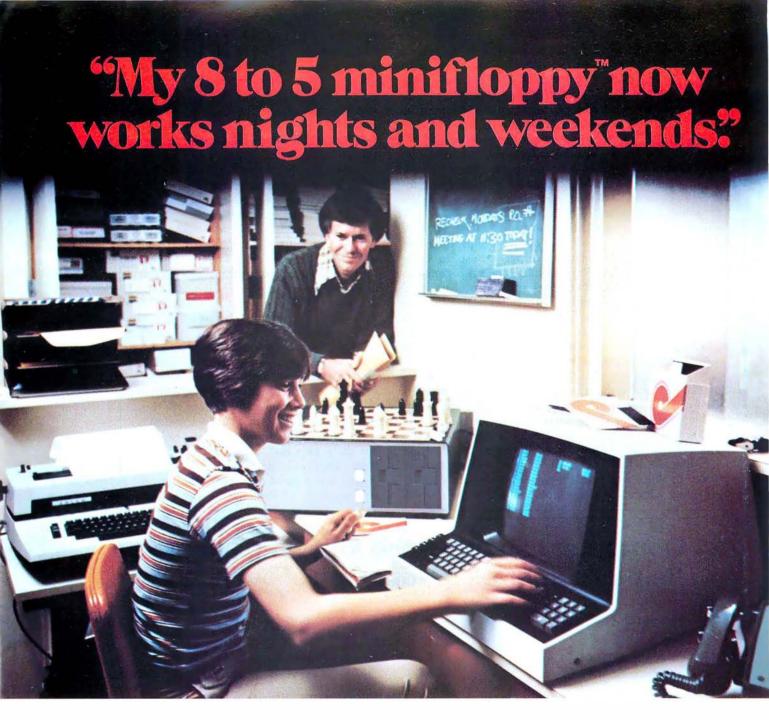
Thus, a magazine like BYTE has proven to be a self-generating forum, as the readers interact with authors and, as they write about their own particular experiences or pet concepts, even become authors.

This month our featured theme for the issue is loosely entitled "Fun and Games," ie, how computers can be used in various forms to implement mental recreations. We describe how to use computers to simulate mythical worlds and situations and to examine logically defined games and their states. All these topics and more fit under this general category of fun and games.

Readers who examine our table of contents, however, will find that not one of our recent articles has been devoted to the subject of "biorhythms," this in spite of the immense popularity of biorhythm programs at every convention or computer demonstration and a virtual flood of prospective article submissions on this topic. Far be it from me to belittle the concept of having harmless fun with computers by creating fantasy trips and games. Just because one can program a computation does not make that computation a valid representation or model of the real world — witness the fun and humor we get out of fantasy games. Humor is in large measure due to a gentle (or not so gentle) bending of reality in a specific and limited context.

But some biorhythm writers start out by pontificating the veritable truth of a hypothesis and its implications, and fail to make the point that it is all a fantasy simulation. Most people writing about the biorhythm algorithm assume that it corresponds to a proven, well-documented and scientifically valid field of endeavor.

I am reminded of the epistemology of a former associate of mine, who shall remain anonymous. His epistemology essentially boiled down to "if it is printed on paper it must be true . . . ." Much has been printed about the alleged validity of the biorhythm mythology; there is an entire branch of the special-purpose computer industry devoted to cranking out biorhythm calculators. And biorhythm programs do indeed appear in much of the sales promotional literature of personal computing. But that does not make the results a science any more than the prevalence of adventure-style games in tomorrow's computers makes any statement about the real world, other than mankind's characteristic love of fantasy. A corollary of the "if it's printed" epistemology is the statement "if it is represented in a programmed calculation, it must be true . . . ."



"I own a fast-growing business and before I bought my computer system I put in a lot of late hours keeping up with my accounting and inventory control. Now the computer does my number crunching quickly, so I have time after hours to have some fun with the system. My son and I started out playing Star Trek on the system, and now we're learning to play chess.

"When I was shopping around for my system, the guys in the computer stores demonstrated all the unique features of the minifloppy. I've got to admit that at first I didn't really understand all the technical details. But now that I use the system every day, I really appreciate the minifloppy's fast random access and data transfer. I like the reliability, too.

"I'm glad I went with Shugart drives. Look, when you lay out your own money for a system, you want dependable performance and good value. Do what I did. Ask for the system with the minifloppy."

## If it isn't Shugart, it isn't minifloppy.



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As commonly stated, the biorhythm hypothesis has two major assertions. The first is that there exists a fixed point in time, namely the date of birth, when each individual's biological clock starts ticking. The second is that there are three well-defined periods which start in phase at that reference point and have an integer relationship to one another. The particular integers are unimportant. Then, by doing a Fourier summation with unit amplitudes on the three periodic waveforms, we come up with the time domain evaluation of one's state for any given date after birth. Much graphic display programming can be done to make the results of this meaningless calculation look beautiful on a color terminal.

The holes in this hypothesis are obvious. First, why are integer ratios used? After all, nature seems to abhor integers in physical constants, especially so in complicated systematic entities such as biological organisms. At the level of physical constants and ratios of physical constants, there is only one experimental near-integer of any prominence: the reciprocal fine structure constant (137.0360) — and even its "integerness" has become less significant of late as the limits of physical precision of measurement have improved.

Then, in a fallacy shared with astrology, biorhythm calculations assume that the date of birth somehow determines the whole of one's life. In view of even recent knowledge of biological organisms, why not use the date of conception? Replies the "biorhythmaticianologist," "Oh, but we don't know that precisely! So let's use something we know instead!" Thus, if there were any validity to a lifelong cycle, the hypothesis would start off by picking a random phase point which is the date of

birth relative to the whole lifetime of the organism. But living systems do not fit ad hoc assumptions. It is true that we observe periodicities in life, even in our own personal lives. But, in order to study such rhythms, the spirit of the natural science investigator must be invoked, obviously aided by the tools of calculation which are now so widely available.

A detailed scientific dissection of biorhythms can be found in William Bainbridge's article "Biorhythms: Evaluating a Pseudoscience," in *The Skeptical Enquirer*, published by the Committee for the Scientific Investigation of Claims of the Paranormal. Editor Kendrick Frazier and the editorial board (which includes such luminaries as Martin Gardner and Philip J Klass) are fighting a valiant fight against the doctrines of pseudoscience in today's world. The magazine is published four times a year. Subscriptions are \$10 a year and are available from the Executive Editor, *The Skeptical Enquirer*, POB 5 Amherst Br, Buffalo NY 14226.

Thus, the dearth of biorhythm calculation articles in BYTE will continue. But, on quite a different plane, there is ample room for appropriate articles on personal information analysis — possibly with some attention to the idea of biological rhythms, which forms the basis for the genuine science of chronobiology. Here we make the hypothesis that there are obvious rhythms of some variables of daily life which go up and down.

To explore this hypothesis, we begin to take data on our daily personal lives using an appropriate measurement. This could be a single bit of information such as "today was a good day" or "today, on the balance, was not so good." Or it could be a series of integer evalua-

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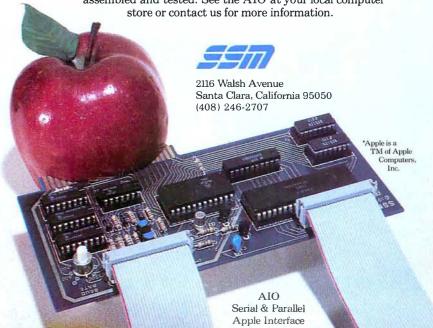


This interface can be used to connect your Apple\* to a variety of parallel printers. The programmable I/O ports have enough lines to handle two printers simultaneously with handshaking control. The users manual includes a software listing for controlling parallel printers or, if you prefer, a parallel driver routine is available in firmware as an option. And printing is only one application for this general purpose parallel interface.



#### Two boards in one.

The AIO is the only board on the market that can interface the Apple to both serial and parallel devices. It can even do both at the same time. That's the kind of innovative design and solid value that's been going into SSM products since the beginning of personal computing. The price, including PROMs and cables, is \$135 in kit form, or \$175 assembled and tested. See the AIO at your local computer



To explore this hypothesis, we begin to take data on our daily personal lives using an appropriate measurement. This could be a single bit of information such as "today was a good day" or "today, on the balance, was not so good." Or it could be a series of integer evaluations of the form "on a scale of 1 to 10, today rated 8." The important idea here is to begin taking measurements. When a real sequence of data has been built up over several hundred days, we can begin to check the hypothesis for validity by using a Fourier analysis of the data to isolate periodic effects. Due to the sampling time of once per day, no periods could possibly be present shorter than two days, and the longest periodicity component would be half the number of days in the sample. But the result would be a calculated spectrum for this "how I feel" variable. Then, one could check this continuing curve for function for predictability. Besides the Fourier decomposition approach, other methods of analysis are of course possible. Any of the commonly used methods for stock market "prediction" could certainly be applied.

But the result of this "biological rhythm" exercise would be very specific and only applicable to the individual who makes the measurements. There would be no reason to assume that any period found in this data would be the same length as the period for any other person. I do not know what the results would be, but the method of checking the hypothesis is present, and the means of doing such an experiment are within the grasp of every reader who owns a personal computer and who can find access to a Fourier analysis program — such as the Fast Fourier Transform. (See BYTE December 1978 and February 1979 for articles on the Fast Fourier Transform technique.)

So, to answer the question raised by this editorial, I would conclude with several points. First, pseudoscience is pseudoscience. Second, pseudoscience done by computer is still pseudoscience, for the tools of implementation hardly affect the imprecision of thought used in ignoring reality.

Finally, what makes the pseudoscience a pseudoscience is its element of pious fraud, an attempt to ignore contrary data and purport that its premises describe and predict reality. When we remove any intention of purporting that the given hypothesis is anything other than a fantasy, then the pseudoscience classification goes away and we can enjoy it as a game or fantasy.

Thus, pseudoscience done by computer is most definitely not pseudo-computer-science, for even a biorhythm program can be correctly implemented from its premises! And, with the caveat of not purporting a false scientific validity to our fantasies, we can have lots of fun correctly implementing quasi-computer science fantasies and games which make absurd premises.

Circle 335 on inquiry card.

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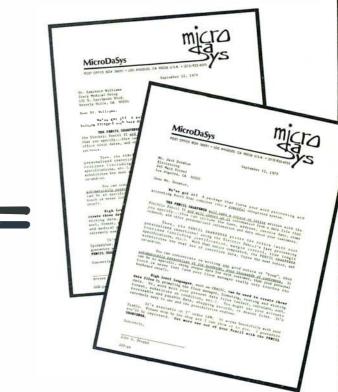
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## Letters

#### Mind Over Matter Expansion

I found your article "Mind Over Matter" (June 1979 BYTE, page 149) very interesting. When all the components arrive, I hope to have an operational muscle monitor. A friend of mine has a great deal of enthusiasm for brain wave monitors, and, although I do not quite see the magic he sees in them, the idea is intriguing.

My difficulty with building the brain wave monitor is that my knowledge of electronics has never gotten past the reading the Heathkit-instructions-stage. You mentioned changing the 100 K ohm

resistor on IC2 to 1 M ohm for brain wave amplification, which is OK; however, then you said that bandpass filters must be added, and you have lost me.

I know it would be a time-consuming project, but I thought that I would try and trouble you for a circuit and parts list at the Heathkit-level for brain wave monitor expansion. I assume that, along with input to an oscilloscope (Heathkit, naturally), the analog output could be used as input to my Cromemco D+7A I/O board?

Frank Gizinski 2060 St Clair St Racine WI 53402

#### Author Ciarcia Replies:

I hope you will have an operational muscle monitor by the time you read this. I regret, however, that I cannot comply with your request. Heathkit and the Muppets both have something in common: because the original is done so well and anything equivalent could only be accomplished with a similar effort, there are no copies. Except through the effort of a complete article on the subject, I hesitate to do only half the job by sketching out a

few filter circuits which ultimately demand a great deal of technical ability.

In addition to yours, many letters have requested expansion information. In actuality, the required circuitry would constitute a low-frequency spectrum analyzer. I will look into the design, and use it either as an article specifically on expansion of the "Mind over Matter" introduction, or as an additional supplement with one of my regular monthly offerings. I am aware of the obvious interest in expansion, and I do try to present circuits that can be readily constructed.

Finally, the biofeedback interface can be readily used with the Cromenico A/D board, if the analog output from the monitor is scaled down to 0 to 2.56 V. This can be done with a 500 K ohm potentiometer serving essentially as a volume control. Analysis of the acquired data is another subject entirely.

Perhaps your strength is really software, and you will achieve success better by this method. The ultimate goal is to analyze the low-frequency spectrum. This can be done either through hardware or software.

#### A Rejoycing LISPer

Had James Joyce been a computer scientist, he would have created LISP.

Martin D Sandman 10720 Cariuto Ct San Diego CA 92124

#### Move Segmenting

I was gratified to see some evidence ("A Digital Alphanumeric Display," April 1979 BYTE, page 218) that someone is beginning to realize that 7 segments can portray alphanumerics, but noted that Daniel Chester's 7-segment set is confusing in these respects:

A "G" could be a "9," a "Q" could be a "9," an "S" could be a "5," and a "Z" could be a "2."

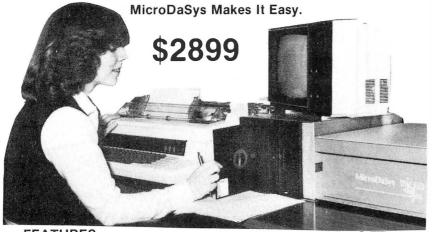
The following is a set which I devised two years ago:

AbcdEFGHZJHLNnºPºr5Eu PU(Eorh)YandZ 0123456789

You will note that none of these characters are ambiguous. Furthermore, they do not conflict with Mr Chester's set of special characters.

Alex Funk 110 E Lynch St Durham NC 27701 ■

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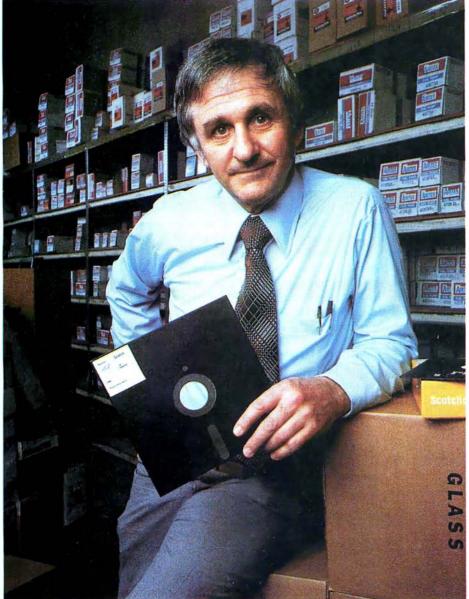
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3M

Circle 368 on inquiry card.

BYTE November 1979 13

### Ciarcia's Circuit Cellar

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## The Intel 8086

Steve Ciarcia POB 582 Glastonbury CT 06033

There has been a lot of talk about 16-bit microprocessors lately. You are probably interested in how they work and how they differ from present 8-bit microprocessors. This may seem more important to someone designing systems for a living rather than to the casual computer experimenter; but ultimately personal computing will be affected.

The majority of systems currently available use 8-bit processors primarily because few cost-effective 16-bit processors were available when these systems were designed. As new

personal computers are conceived, the designers will have more 16-bit microprocessors to choose from, and in my opinion, the latter will win out.

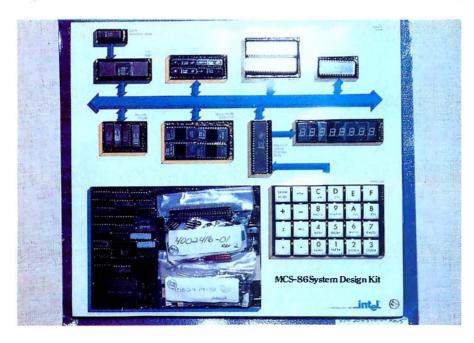
Software development is much more expensive than hardware development. It is much cheaper to write one line of code executing a hardware multiply instruction than to write an algorithm to do the same function on a processor devoid of this direct capability. Reduced cost of development should be reflected in lower retail cost. There are always exceptions to the rule, but once amor-

tized and in volume production, the 16-bit microprocessor should prove to be the logical choice for medium to high-level applications.

#### The Intel 8086

It isn't necessary to wait any longer if you have a burning desire to learn about 16-bit microprocessors. The latest one available and in volume production is the Intel 8086. The 8086 is a 16-bit microprocessor which is upward-compatible from the 8-bit 8080/8085 series processors. The 8086 contains a set of powerful, new 16-bit instructions. This enables a system designer familiar with 8080 devices to start coding immediately and gradually gain expertise in using the additional 16-bit instructions. It is important to realize that when I refer to compatible instructions I mean functional compatibility. A program written for an 8080 would have different object code than an 8086. This is only a slight inconvenience considering that this former 8080 program should run about ten times faster on an 8086. The evolutionary step between the 8086 and 8080 is far greater than that between the 8080 and 8008.

The apparent goal of Intel designers was to extend existing 8080 features symmetrically and add a wide range of new processing capabilities. The added features include 16-bit multiply and divide, interruptible byte-string operations, 1 M byte direct addressing, and enhanced



**Photo 1:** SDK-86 system as delivered from factory.

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Make your own comparison wherever personal computers are sold.
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bit manipulation. Arithmetic operations are accomplished in American Standard Code for Information Interchange (ASCII) or binary-coded decimal with a one-instruction hardware conversion.

EXECUTION UNIT

REGISTER FILE

1a

In addition to the capability of handling data in bits, bytes, words, or blocks, the 8086 incorporates many features formerly found only in minicomputer architecture. It also supports such operations as reentrant

BUS INTERFACE UNIT

RELOCATION

REGISTER FILE

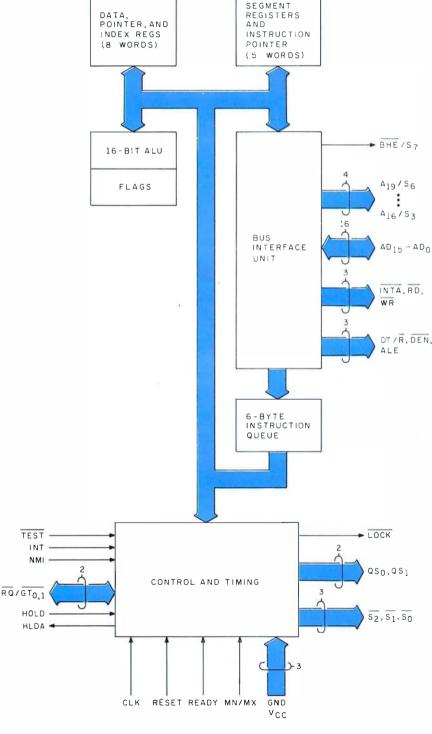
code, position-independent code, and dynamically relocatable programs.

The 8086 is fabricated with a newly developed, high-speed metal-oxide semiconductor (H-MOS) process which is considerably faster than standard MOS. Running up to 8 MHz, the 29,000-transistor 8086 is the fastest single-chip central processor currently available. Unlike the 8080/8085 processor's registers, the 8086's registers can process 16-bit as well as 8-bit data.

Figure 1a shows an internal block diagram of the 8086. The 16-bit arithmetic/logic instructions are handled within the general register files. This section contains four 16-bit general data registers, two 16-bit base pointer registers, and two 16-bit index registers. Figure 1b illustrates an 8086 register model for comparison to the 8080.

The four data registers, addressable also in 8-bit partitions, are primarily from the original 8080. There are twice as many general-purpose registers as there are on 8-bit processors.

The relocation register file is the other unique 8086 enhancement. This group is referred to as the segment register file, and extends direct addressing capability to a full megabyte of memory. This file has four address pointers which contain program relocation values for up to four 64 K byte program segments. In addition, a fifth pointer serves as an I/O (in-



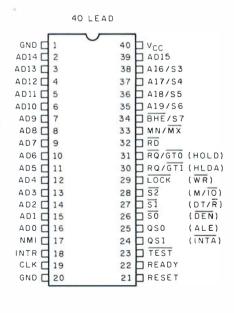
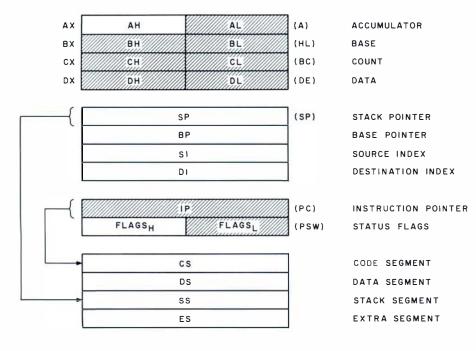


Figure 1: An internal block diagram and pinout specifications of the Intel 8086 (figure 1a). Figure 1b shows the 8086 register model illustrating the differences between the 8086 and the 8080. Figure courtesy Intel Corp.



put/output) control providing address space for a full 65,536 I/O ports.

Logically the 8086 operates more like larger computers than like a classical microprocessor. This is accomplished through independently controlled bus interface and execution units (figure 2). The major contribution is to speed processing by overlapping instruction fetch and execution. Up to six bytes of instruction are placed in a queue before execution. As each instruction is processed, the following instructions move up one position and a new instruction is fetched and placed in the queue. This simultaneous fetch and execute capability induces more efficient use of the memory bus. It is possible for two single-byte 8086 instructions to be executed within the time for one memory cycle. The result is improved performance, given the same bus bandwidth and memory speed as other systems.

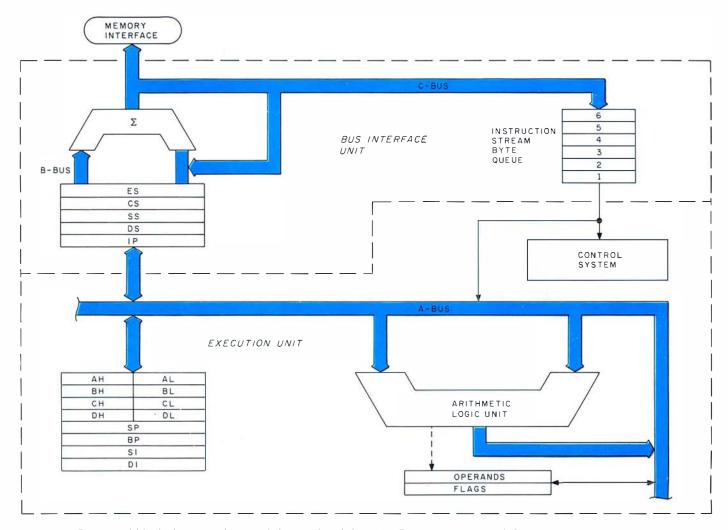


Figure 2: Functional block diagram of internal data paths of the 8086. Figure courtesy Intel Corp.

#### **Table 1:** Summary of specifications for the SDK-86 board.

#### Central Processor

Processor: 8086

Clock Frequency: 2.5 MHz or 5 MHz (jumper selectable)

Instruction Cycle Time: 800 ns (5 MHz)

#### Memory Type

Read-Only Memory: 8 K bytes

Programmable Memory: 2 K bytes (expandable to 4 K bytes) (2 bytes equal one 16-bit word)

#### Memory Addressing

Read-Only Memory: FE000 thru FFFFF Programmable Memory: 0 thru 7FF (0-FFF with 4 K bytes)

#### Input/Output (I/O)

Parallel: 48 lines (two 8255As)

Serial: RS232 or current loop (8251A)

Data Transfer: Rate selectable from 110 to 4800 bps Display: On-board, 8-digit, light-emitting diode (LED) readout

#### Interface Signals

Processor Bus: All signals transistor-transistor logic (TTL)

compatible

Parallel I/O: All signals TTL compatible Serial I/O: 20 mA current loop or RS232

#### Interrupts

External: Maskable and nonmaskable; Interrupt vector 2 reserved for nonmaskable

interrupt (NMI)

Internal: Interrupt vectors 1 (single-step) and 3 (breakpoint) reserved by monitor

#### **Direct Memory Access**

Hold Request: Jumper selectable, TTL compatible input

#### Software

System Monitors: Preprogrammed 2316 or 2716 read-only memories

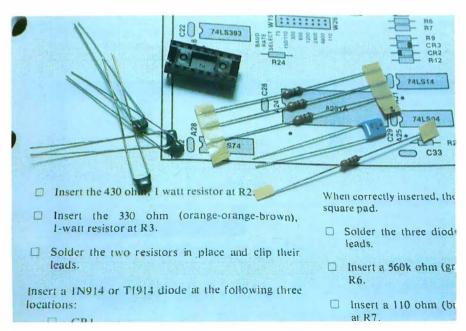
Addresses: FE000 thru FFFFF

Monitor I/O: Keypad and Serial (teletypewriter or video display)

#### Power Requirements

 $V_{cc}$ : +5 V (±5%), 3.5 A

V<sub>TTY</sub>: -12 V (±10%), 0.3 A (required if teletypewriter (TTY) or video display terminal connected to serial interface port)



#### The Intel SDK-86

Perhaps this brief introduction has sparked your curiosity and you wish to know more about the 8086. Of course, the best method of learning is to use one. Since at this writing the 8086 is still so new that it is not incorporated into any general-use personal computer, we are left to our own resources and construction abilities. Fortunately Intel realizes that the success of any new product depends on evaluation by as many potential users as possible. For this reason the System Design Kit (SDK) series of products were conceived.

The SDK-86, shown prior to assembly in photo 1, is a singleboard, 8086-based computer. Intel's pricing policies make the purchase of the SDK-86 kit far more attractive than a single 8086 chip. It results, in the name of advertising, in one of the better computer offerings on the market. At \$780 the SDK-86 fits within most budgets. It is a complete computer including processor, programmable memory, read-only memory, I/O (input/output), and display. Table 1 is a more explicit listing of specifications and figure 3 is a detailed block diagram.

The SDK-86 is very easy to assemble. As shown in photo 2, it comes packaged so that all components are easily recognizable, even for a novice. Documentation includes an Assembly Manual, User's Manual, User's Guide, and Monitor listings (see photo 3). The assembly procedures are written at such a level that even a person having limited technical knowledge may assemble the kit. The assembly manual progresses from basic solder techniques and component identification to stepby-step assembly and checkout. The only microcomputer assembly literature I have read which was as easily understandable as this comes from the Heathkit people.

All major components are socketed, but to be on the safe side it is a wise idea to purchase additional integrated-circuit sockets. This will allow all integrated circuits to be removed in case troubleshooting is necessary. The fully constructed com-

Photo 2: Typical page from the construction manual. Each instruction step is clearly explained and each component is accurately identified.

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North Star Horizon Computer Prices (includes 32K RAM, one parallel and two serial I/O ports), assembled, burned-in and tested:

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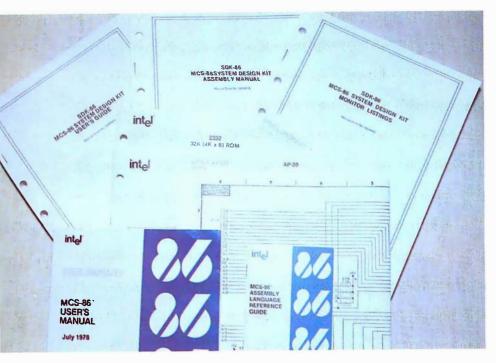
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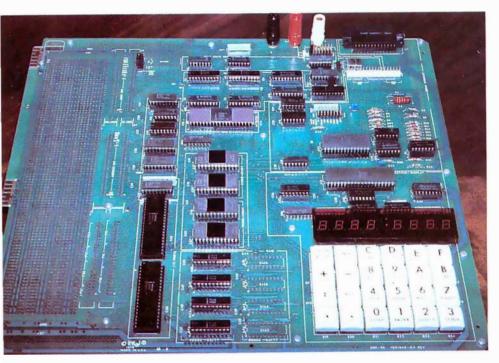
puter is shown in photo 4. Checkout, after determining that there are no obvious errors, is simply a matter of

applying power and pressing the system reset button.

When the SDK-86 is reset, the 8086



**Photo 3:** The SDK-86 board comes complete with well-written documentation manuals for assembly and use.



**Photo 4:** Assembled SDK-86 board. Note the prototyping area on the left-hand side.

executes the instruction at hexadecimal location FFFF0. The instruction at this location is an intersegment direct jump to the beginning of the monitor program that resides in readonly memory, hexadecimal locations FF000 to FFFFF. The monitor is comprised of two programs resident in programmable read-only memory; one for use with the on-board keypad, and the other a serial monitor that supports a video display or teletypewriter connected to the Electronics Industries Association (EIA) serial interface connector. This latter communication mode is preferable if the SDK-86 is to be used efficiently for software development. Even though the system is constructed to vector to the keyboard monitor on power up, simply interchanging the two sets of programmable read-only memory will allow the unit to start up immediately in the

#### The SDK-86 Monitor

serial mode.

Both monitors share similar command capability. The keyboard monitor is optimized for the 8-digit, light-emitting-diode (LED) display while the serial monitor is obviously for a video display or teletypewriter. The only dissimilarity is that the latter has the additional ability to read or write to a paper-tape punch, or with the addition of a Frequency-Shift-Keying (FSK) modulator/demodulator, cassette storage. Table 2 lists the serial monitor I/O commands.

Of particular importance are the single-step and go commands. Single step allows a program to be executed one instruction at a time, while the go command allows the user to specify a breakpoint which returns control to the monitor while preserving the machine's status. This allows a program to be run in segments facilitating checkout.

While the monitor does provide some powerful routines, the PL/M listings provided in the documentation do not directly give the addresses of the individual routines. Enough effort is required to extract this information, that rewriting particular routines in user memory is a worthwhile consideration.

Text continued on page 24

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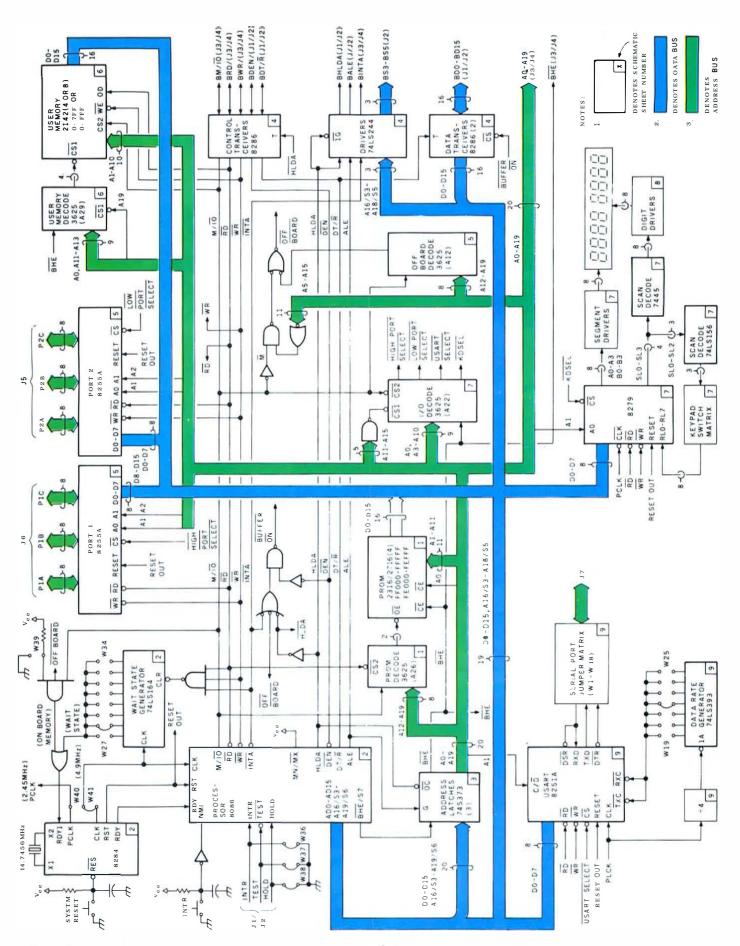


Figure 3: A detailed block diagram of the SDK-86 evaluation board. Figure courtesy Intel Corp.

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The powerful 16-bit WH11A Computer (DEC® PDP 11/03 compatible) is designed around the DEC KD11-HA CPU and accommodates up to 64K bytes of memory. Add the WH27 Dual 8" Floppy (DEC RX01 compatible) for vast storage capacity and immediate access to programs and data. For video output, add the WH19 Smart Terminal with professional keyboard, direct cursor addressing and eight user programmable keys. The WH19 is compatible with the DEC VT52 and ANSII Escape Mode. The WH11A System is ideal for the complex problems of business and education.

#### Software

The WH11A Computer runs all systems and applications software written for the DEC PDP-11/03 and that includes scores of practical programs for business, technical users and education. It also accepts the powerful DIBEX<sup>14</sup> Operating System which is compatible with Dibol, and all Dibol-based software.

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#### In Conclusion

If you have an interest in 16-bit

microprocessors, perhaps the best place to start is with the SDK-86. The 8086 is a quantum leap forward for

**Table 2:** The commands which are available for use with the serial monitor.

Command	Monitor Command Summary FUNCTION/SYNTAX		
S (Substitute Memory)	Displays/modifies memory locations S[W] < addr > ,[[ < new contents > ],]* < cr >		
X (Examine/Modify Register)	Displays/modifies 8086 registers X[ <reg>][[&lt; new contents&gt;],]*<cr></cr></reg>		
D (Display Memory)	Moves block of memory data D[W] <start addr="">[,<end addr="">]<cr></cr></end></start>		
M (Move)	Moves block of memory data M <start addr="">,<end addr="">,<destination addr=""><cr></cr></destination></end></start>		
l (Port Input)	Accepts and displays data at input port I[W] < port addr > ,[,]* < cr >		
O (Port Output)	Outputs data to output port O[W] <port addr="">,<data>[,<data>]*<cr></cr></data></data></port>		
G (Go)	Transfers 8086 control from monitor to user program G[ <start addr="">][,<breakpoint addr="">]<cr></cr></breakpoint></start>		
N (Single Step)	Executes single user program instruction N[ <start addr="">],[&lt;<start addr="">],]*<cr></cr></start></start>		
R (Read Hexadecimal File)	Reads hexadecimal object file from tape into memory R[ bias number>] cr>		
W (Write Hexadecimal File)	Outputs block of memory data to paper tape punch $W[X] < \text{start addr} >, < \text{end addr} >[, < \text{exec addr} >] < \text{cr} >$		

microprocessors and the SDK-86 is a cost-effective method of evaluation, complete with all the hardware of a basic computer system. It must be cautioned that a first-time user, unaccustomed even to 8-bit microprocessors, may find the learning process somewhat complicated. The SDK-86, while packaged and assembled in a Heathkit fashion, is an industrial training device and not aimed specifically at the personal computing market. Beyond the minimal checkout procedures and brief description of the monitor commands, there are no sample programs which can be immediately entered and executed. This unit must be thought of as a rather sophisticated trainer. The mechanism is provided in the form of the board, but the actual course of education is completely in the hands of the user. ■

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# Solving Soma Cube and Polyomino Puzzles Using a Microcomputer

Douglas A Macdonald Yekta Giirsel 130-33 Theoretical Astrophysics California Institute of Technology Pasadena CA 91125

The genesis of this article was an inexpensive puzzle consisting of twelve plastic pieces which are supposed to be fitted into a rectangular cardboard box. Despite assurances by experts (see bibliography, Martin Gardner) that there are 2339 separate and distinct ways of solving the puzzle, a year's work by a veritable platoon of people (mainly Yekta) produced only slightly more than 150 solutions.

#### Introduction

Polyomino puzzles and Soma Cubes are examples of a class of problems which are particularly suited to solution on a small computer. The amount of data needed in each case is relatively small, but the amount of calculation needed to do an exhaustive search for solutions is staggering.

For a set of Pentominoes, for instance, you need only encode the shapes of the twelve pieces and provide an array of sixty spaces into which you try to fit them. For a Soma Cube there are only seven pieces, which fit into an array of twenty-seven spaces. In both cases, all of the necessary data will easily fit into 2 K bytes of memory. However, the number of individual situations that would have to be considered in an

Acknowledgment

The authors would like to thank Mark Zimmermann for teaching them assembly language, and for allowing generous amounts of computer time to write and debug the program.

unoptimized exhaustive search would be  $3.2 \times 10^{16}$  for the Pentomino puzzle and  $4.7 \times 10^{11}$  for the Soma Cube.

In this article, we will present a 6502 assembly language program which will solve a wide variety of puzzles of the sort where a given region, either two or three dimensional, must be filled with a given set of pieces. The program has been written in a general manner so that the shape of the region can be easily changed and certain pieces can be specified as fixed, in order to take advantage of symmetry. The number and shape of the pieces themselves can also be easily changed.

Due to a clever search method, the program given here actually considers many fewer cases than the unoptimized search mentioned above. Using a Commodore PET with a clock frequency of 1 MHz, most of the problems for which we have generated a complete set of solutions have taken from a few minutes to a few hours to run. The longest running problem we have considered, that of Pentominoes in a 10 by 6 rectangle, took slightly less than two days to generate all of the 2339 solutions.

If the program is run in BASIC, which we actually tried, this problem takes more than two months. The large difference in running speeds is due to the fact that BASIC on the PET is an interpreted language, each line of which must be decoded every time it is executed. This should serve as a caveat to anyone intending to write a

BASIC interpreter version of this program.

The search algorithm used in the program is extremely general, as is illustrated by the fact that there are only three places in the assembly code where a check is made to see if the region under consideration is two or three dimensional. Thus the user should find it easy to modify the program to consider more complicated or exotic problems, such as those involving oddly shaped pieces or more than three dimensions.

The program given here is written in the symbolic assembly language of the 6502 microprocessor, but users of other microprocessors should be able to adapt the fundamental algorithm to their own machines without much trouble. The accompanying BASIC routines are written in Commodore's version of BASIC (a Microsoft product), but they should also be easily adaptable to other machines. Since "safe" memory locations vary from machine to machine, users should be aware of the quirks of their own particular computer when they choose the addresses for the variables in the program.

#### **Polyominoes**

Polyominoes are planar objects consisting of a number of squares connected at their edges (see figure 1). The simplest such object is a monomino, which is just a single square. Next is the domino, consisting of two squares joined at a side, which has the shape of the familiar game pieces.

Both monominoes and dominoes have only one possible shape. Trominoes consist of three squares and there are two possible shapes, as shown. Similarly, there are five different tetrominoes, twelve different Pentominoes (photo 1), thirty-five different hexominoes, and so on. Interestingly, the formula for the number of n-ominoes as a function of n is not known.

The type of puzzle that we considered was the problem of using a given set of polyominoes to *tile*, or fill in, a region with a given boundary. For instance, the twelve Pentominoes can be used to tile a 20 by 3 rectangle (there are only two different ways of doing this), a 10 by 6 rectangle (2339 ways), a 15 by 4 rectangle (368 ways), or a 12 by 5 rectangle (1010 ways).

We do not even have to be restricted to rectangular shapes: we can give the computer some arbitrary region consisting of sixty squares, and ask it to find all the solutions or a subset of the solutions. One of the more interesting of the Pentomino problems is the case of an 8 by 8 chessboard with the four center squares filled in and not used (65 solutions).

A variety of problems can be developed using the various polyominoes, but the ones to which computer solution is most applicable seem to be those involving Pentominoes. The smaller polyominoes, especially monominoes and dominoes, are so few in number and simple in shape that any puzzle involving them is trivial and can be easily solved without a computer. On the other hand, for hexominoes and higher orders of polyominoes, the number of objects in a complete set is so great that an exhaustive search is impractical, even on a large computer. For this reason, the only examples that we have actually run on the computer have been Pentomino puzzles, although the program is general enough to consider other polyominoes.

In order to make a tractable problem using hexominoes or other higher-order polyominoes, a reasonably sized subset of the complete set of pieces should be chosen. For instance, one could try to tile a sixty square region using ten of the thirty-five hexominoes, or a seventy-two square region using twelve of the hexominoes.

#### Soma Cubes

The Soma Cube (trademark of Parker Brothers Inc., Salem MA) is a puzzle invented by Piet Hein, consisting of seven pieces which can be fitted together into a 3 by 3 by 3 cube (and other more exotic shapes). Each of the pieces consists of a number of cubes joined together at their faces. Six of the pieces are composed of four cubes, and the seventh piece is composed of three cubes, as shown in photo 2. Note that piece 2 is just a three-dimensional version of the second tromino in figure 1, and that pieces 5, 6, and 7 are three-dimensional versions of three of the tetrominoes.

There are 240 different ways of constructing a cube out of these pieces. If rotations and reflections of the cube itself and of individual pieces within the cube are treated as different solutions, this number is increased by a factor of 4608 to make a total of 1,105,920 solutions.

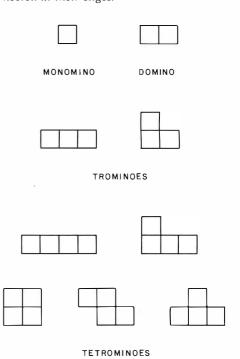
As with polyominoes, we can generalize the problem by using more than one set of pieces, or by trying to fill a noncubical region. The program can be easily adapted to consider these situations.

#### Encoding

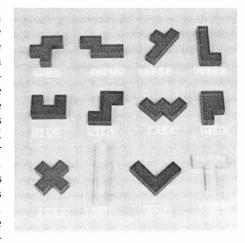
In order to make the problem understandable to the computer, we represent the box into which we are trying to fit the pieces as an array in memory. Each of the pieces is assigned a number. An empty square in the box is represented by a zero in the appropriate array cell, and squares which are filled by piece number K are represented by the actual number K in the corresponding array cells. For convenience, the entire array is surrounded by a boundary of cells into which we put the number -1. This speeds up the search since the machine does not have to make a distinction between cells which are filled and cells which are off the edge of the

As an example, consider the Pentomino problem for the 10 by 6 rectangle. The pieces would be assigned numbers between one and twelve, and the array plus boundary would have dimensions of 12 by 8. The number -1 is also put into any square which is off-limits. Thus, an 8 by 8 square with the center four squares off-limits would be represented in memory by a 10 by 10 array

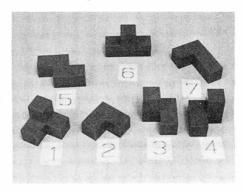
Figure 1: Polyominoes are planar objects consisting of a number of squares connected at their edges.



**Photo 1:** The twelve different Pentominoes, showing their assigned number and letter designations. Pentominoes is a registered trademark of Solomon W Golomb.



**Photo 2:** The seven Soma Cube pieces with their assigned numbers.



Solomon W Golomb originally introduced the terminology and many of the problems associated with polyominoes.

with -1s around the boundary and in the four center squares.

Unfortunately, things are not quite this simple, since we cannot specify a two-dimensional array in assembly language, and must therefore store it as a linear array in memory. The mechanics of how we encode and decode the coordinates of a particular square will be explained later.

The numbering of the pieces is somewhat arbitrary, but it is convenient to put the most symmetric pieces first. This makes it easy to have the computer fix one of the pieces on the board in order to take advantage of symmetry. Again using the Pentominoes as an example, the X Pentomino should always be assigned the number 1, since it has the fewest orientations of any of the pieces (ie: only one). If you look at a 10 by 6 board, it is easy to convince yourself that any solution can be rotated or reflected to get the X in the lower lefthand quarter of the board. Thus, a simple way to keep from generating rotations and reflections of already known solutions is to constrain the X to the lower left-hand quarter of the board. Furthermore, it is easy to see that only seven different positions of the X in this corner can possibly lead to solutions: so successive consideration of these seven cases is the quickest way to generate all of the 2339 solutions. For these reasons, the program allows the user to specify any number of pieces as fixed.

The numbering of the Pentominoes and the Soma Cube pieces shown in photos 1 and 2 will be used in the program. Also shown in photo 1 are mnemonic letters assigned to each of the twelve Pentominoes. These letters are used in printing out the solutions to make the output easy to read. For the Soma Cube we used the numbers one thru seven for the printout symbols, but you can easily change these to any symbols you choose.

The option of fixing pieces also

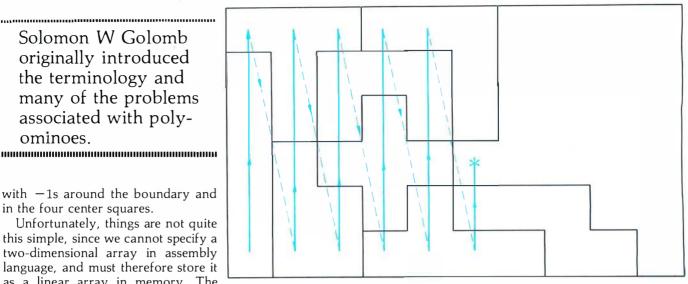


Figure 2: The scan procedure starts in the lower left-hand corner of the defined area and proceeds up the first column. When the top of the column is reached, the scan returns to the bottom of the second column, which is scanned from bottom to top. This procedure is repeated until an empty square is encountered. This empty square is then the base square. If no empty squares are found, the problem has been solved.

allows the user to specify part of the solution. For instance, if you want to know whether or not a solution exists when a certain number of the pieces are fixed, enter the positions of these pieces from the keyboard, and the computer will hold them fixed and fiddle around with the remaining pieces. The parts of the program which initialize the positions of the pieces and print out the solutions have been written in BASIC because they are not time-critical. These will be easy for the user to change.

#### Algorithm

The program has to order the solutions so that it knows what solutions have already been found and what possibilities are yet to be tried. The program does this by considering the permutations of the piece numbers in ascending order. The meaning of ascending order is best illustrated by considering a simple example. If we have three pieces, numbered 1, 2, and 3, then the permutations in ascending order are:

That is, considering the permutations as three-digit numbers, these threedigit numbers are in ascending order. The generalization of this example to higher numbers of pieces is selfevident.

The total number of permutations of N pieces is given by the product of all of the numbers between 1 and N. which is denoted by N! (read N-factorial):

$$N! = N \times (N-1) \times (N-2) \times \dots \times 3 \times 2 \times 1$$

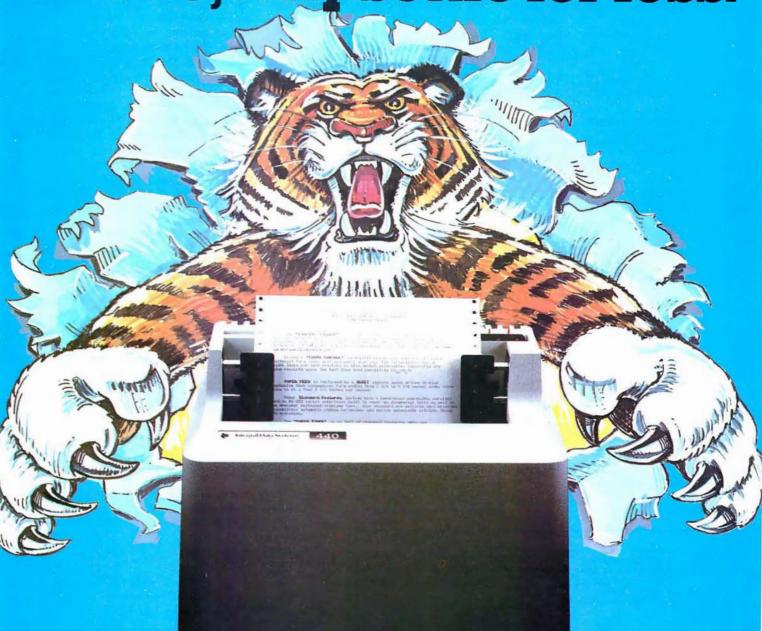
Thus for the twelve Pentominoes, we have 12! = 479,001,600 permutations to consider! This is not, however, cause for despair; an efficient search procedure will reduce the possibilities to a small fraction of this number.

In order to make the search procedure clear, we will describe it for the special case of the 10 by 6 Pentomino puzzle. It will be obvious how the method can be generally applied to other cases.

The board is arranged with the long dimension placed horizontally and the short dimension placed vertically. The program applies a scan procedure which starts in the lower left-hand corner and scans up the first column, then goes to the bottom of the second column and scans up this column, and so on, for the third through tenth columns. The first empty square which it runs across in this search is called the base square (see figure 2).

The search procedure is summarized in the flowchart in figure 3. Just before the BASIC initialization routine is finished, it performs the search

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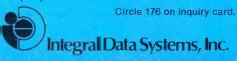
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described above and finds the first base square. If the user has not specified any pieces as fixed, this is just the lower left-hand corner square. If fixed pieces were specified, it need not be this square (figure 2). The computer has in mind a particular permutation of the twelve pieces which was specified by the user. The program chooses the appropriate piece and

START

SET UP BOUNDARY

PIECE CONFIGURATION
AND PERMUTATION

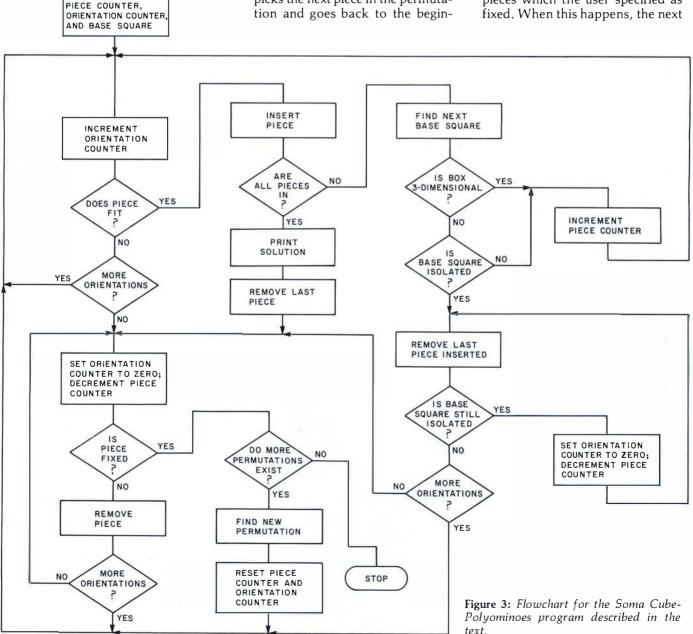
AND INITIAL

INITIALIZE

looks up its orientations in a table. If the first orientation that it tries does not fit, it goes on to the second, and keeps trying until one of two things happens:

• It finds an orientation which fits, in which case it puts the piece in the box and then scans as described above for the next base square. It then tests this new base square to see whether or not it is isolated (ie: whether or not it is completely surrounded by four filled squares). If the base square is isolated, it cannot serve as the new base square, so the program jumps to the isolated square routine which will be described later. If the new base square is not isolated, the program picks the next piece in the permutation and goes back to the begin-

- ning to look up the orientations of this new piece.
- None of the orientations fit, in which case the program takes out the last piece it put in and tests that piece to determine if it has any orientations which have not vet been considered. If there are additional orientations, the program jumps back to the beginning to try these. If all orientations have been considered, the program removes the preceding piece and tests that piece for any more orientations. Pieces are removed in this manner until either a piece is found which has more orientations, in which case the program branches back to the beginning to consider them; or the program reaches the nucleus of pieces which the user specified as



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permutation in the ascending sequence described above is generated and tested. If there are no permutations left, execution stops.

Immediately after any piece is placed, the program checks to see if the board is full. If the board is filled, control is transferred back to BASIC to print out the solution.

Two refinements have been added to the above bare-bones routine. which together result in a considerable savings of time:

The isolated square routine mentioned above saves time by immediately recognizing and rejecting isolated base squares. Otherwise, the machine would have to make many tests before rejecting an obviously invalid base square. The routine works by successively removing pieces until the square under consideration is no longer isolated. This routine results in a savings of time only in the twodimensional case: in three dimensions, it is no more efficient than the basic search described above. This is mainly due to the fact that an isolated square seldom occurs in the threedimensional case because of the large number of cubes (six) which must be filled to isolate a given cube. For this reason, the isolated square routine is bypassed when the program is used to run the Soma Cube.

The other refinement allows the machine to avoid considering permutations of the pieces which are certain to lead to no solutions. For instance, if the machine never succeeded in fitting more than five pieces into the box in a particular permutation, it will do no good for the permutation routine to interchange the eleventh and twelfth pieces: no progress will be made until the position of the sixth piece is changed. The program takes account of this, and the result is that while the permutations are still done in the ascending order previously described, a large fraction are simply skipped since they cannot lead to solutions.

The method of scanning for the base square in the two-dimensional case is implemented in two loops: the Y-scan loop nested inside the X-scan loop. The scan method for the threedimensional case is similarly defined by three nested loops: the Z-scan loop is nested inside the Y-scan loop, which is in turn nested inside the X-scan loop.

#### Orientation Table

We should explain the meaning of the phrase which was used above when we said that the computer "looks up" the orientations of the pieces. This phrase means exactly what it says: the machine looks up the orientation from a table in memory which has been entered by the user.

But why can't the computer figure the orientations itself? The answer is, of course, that it could. However this would increase the running time of the program by a factor of ten to one hundred. The orientation checker is the most often-used routine in the program, and it is important to have it run as quickly as possible.

The user does not actually have to enter the entire table. Listing 1 is a BASIC program which automatically generates the orientation table in memory. In using this program, the user need enter only one orientation for each piece. The computer automatically generates and encodes the rest of the orientations. This can result in a considerable savings in time and frustration, since a polyomino can have as many as eight orientations, and a Soma Cube piece can have as many as twenty-four orientations.

Although this BASIC program makes it possible to use the program without understanding how the orientation table works, it is worthwhile for anyone who intends to use this program to learn how the table is set up, since it is fundamental to the operation for the entire program.

In a BASIC routine, the table would be a four-dimensional array B(K, J, M, I). In the assembly language routine, the table is onedimensional, but we will explain the mechanics of this shortly. At the moment, an explanation of the fourdimensional array will be more helpful.

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**Listing 1:** BASIC program to generate the orientation tables for polyominoes and Soma Cube. The computer generates all possible orientations after the first orientation has been entered.

```
1 REM COPYRIGHT 1979 ORIENTATION TABLE GENERATOR
10 INPUT "NUMBER OF DIMENSIONS": D: Q=8: IF D=3 THEN D=24
20 INPUT"NUMBER OF PIECES": P: INPUT"NUMBER OF SQUARES PER
   PIECE":S
30 PRINT"ENTER RO:FIRST ADDRESS OF ARRAY OF LENGTH":P:INPUT RO
40 PRINT"ENTER BO: PIRST ADDPESS OF ARRAY OF LENGTH": (S-1) **P*D
   : INPUT BO
50 DIM X (20), Y (20), Z (20): T=0: M=P*Q* (S-1): FOR L=R0 TO RU+P
   :POKE I, 0:NEXT I
60 FOR I=80 TO B0+(S-1) *P*Q*D:POKE I,0:NEXT I
70 REM ENTRE X, Y, Z COORDINATES OF EACH SQUARE OF EACH PIECE
80 FOR K=1 TO P
90 FOR I=1 TO S:X(I)=0:Y(I)=0:7(I)=0:NEXT I
100 PRINT"PIECE #"; K: FOR I=1 TO S: PRINT"
                                             SQUARE #":I
             ENTER X"; X (I)
    : INPUT"
110 INPUT"
             ENTER Y"; Y(I): IF D=3 THEN INPUT"
                                                    ENTER Z":Z(I)
120 NEXT I:PRINT" STANDBY ....."
130 REM TRANSLATE PIECE SO THAT BASE SQUAPE IS AT ORIGIN
140 A=0:B=0:C=0:E=0:F=0
150 U=100:FOR I=1 TO S:IF X (I) <U THEN U=X (I)
160 NEXT I: FOR I=1 TO S: X (I) = X (I) -U: NEXT I
170 U=100: FOR I=1 TO S: IF Y (I) <U AND X (I) = 0 THEN U=Y (I)
180 NEXT I:FOR I=1 TO S:Y(I)=Y(I)-U:NEXT I:IF D=2 GOTO 220
190 U=100:FOR I=1 TO S:IF Z(I) <U AND X(I) =0 AND Y(I) =0 THEN
    U = Z(I)
200 NEXT I: FOR I = 1 TO S: Z(I) = Z(I) -U: NEXT I
210 REM ORDER SQUARES ACCORDING TO THEIR DISTANCE FROM THE BASE
    SQUARE
220 FOR I=1 TO S=1:FOR J=I+1 TO S
    : G = X(I) * X(I) * Y(I) * Y(I) + Z(I) * Z(I)
230 H=X(J)*X(J)+Y(J)*Y(J)+Z(J)*Z(J):IF G<H GOTO 270
240 IF G=H AND (X(I) < X(J) OR (X(I) = X(J) AND Y(I) < Y(J))) GOTO 270
250 IF G=H AND X(I)=X(J) AND Y(I)=Y(J) AND Z(I) <Z(J) GOTO 270
260 W = X(I) : X(I) = X(J) : X(J) = W : W = Y(I) : Y(I) = Y(J) : Y(J) = W : W = Z(I)
    : Z(I) = Z(J) : Z(J) = W
270 NEXT J:NEXT I:IF A=0 GOTO 380
280 REM COMPARE ORIENTATION TO THOSE ALREADY OBTAINED
290 FOR I=1 TO A:FOR J=1 TO S-1:U=B0+J-1+(S-1)*()*(K-1)+I-1)
300 V=Y(J+1):IF V<0 THEN V=V+256
310 IF X (J+1) <>PEEK (U) OR V <>PEEK (U+M) GOTO 360
320 IF D<>3 GOTO 350
330 W=Z(J+1):IF W<O THEN W=W+256
340 IF W<>PEEK (U+2*M) GOTO 360
350 NEXT J: GOTO 440
360 NEXT I
370 REM PUT ENTRIES IN TABLE
380 J=0: A=A+1: FOR I=2 TO S: J=J+1: U=B0+J-1+(S-1) * (Q*(K-1)+A-1)
390 V = Y(I) : IF V < 0 THEN V = V + 256
400 \text{ W} = \text{Z}(I) : IP \text{ W} < 0 \text{ THEN W} = \text{W} + 256
410 POKE U, X (I): POKE U+M, V: IF D=3 THEN POKE U+2*M, W
420 NEXT I
430 REM ROTATE TO NEW ORIENTATION
440 B=B+1:IF B=4 THEN B=0:GOTO 460
450 FOR I=1 TO S:W=X(I):X(I)=Y(I):Y(I)=-W:NEXT I:GOTO 150
460 C=C+1:IF C<>2 GOTO 520
470 C=0:IF D=2 GOTO 530
480 E=E+1:IF E>1 GOTO 500
490 FOR I=1 TO S:W=Z(I):Z(I)=X(I):X(I)=-W:NEXT I:GOTO 150
500 F=F+1:IF F>1 GOTO 540
510 FOR I=1 TO S:W=Y(I):Y(I)=7(I):Z(I)=-W:NEXT I:GOTO 150
520 FOR I=1 TO S:X(I)=-X(I):Z(I)=-Z(I):NEXT I:GOTO 150
530 REM PRINT NUMBER OF ORIENTATIONS AND PUT IT IN ARRAY R
540 PRINT A, "ORIENTATIONS": POKE RO+K, A: IF T=1 GOTO 570
550 NEXT K
560 REM GO BACK AND CORRECT MISTAKES
570 T=1:INPUT"ENTER I.D. NUMBER OF A PIECE YOU NEED TO
    CORRECT (O IF NONE) "; K
580 IF K<>0 GOTO 90
590 PRINT" ****
                   DONE
                          ******
600 PRINT"RECORD ARRAYS R AND B ON TAPE TO SAVE": END
```

The first index, K, is the assigned number of the piece whose orientations are being considered. Thus, for the case of Pentominoes. K ranges from one to twelve, and for the Soma Cube pieces it ranges from one to seven.

The second index, J, labels the individual squares or cubes that make up the piece under consideration. The positions of these squares will be defined in the table by their Cartesian coordinates relative to the base square, which is taken at the origin, ie: at (0,0) in the two-dimensional case, and at (0.0.0) in the three-dimensional case. Since the coordinates of the base square are fixed in this way, we need only tabulate the positions of the other squares relative to it. Thus, for Pentominoes, J ranges from one to four (not five), and for the Soma Cube it ranges from one to three (not four).

The ordering of the J values assigned to the various squares is determined by their distance from the base square. It is important that the squares nearest the base square have the lowest values of J because of the method we use to define the boundary of the box (ie: putting -1s around it). Unless the J values are in ascending order with increasing distance from the base square, there is a chance that the program might try to access a memory location which is not a part of the box. The BASIC table-generating program automatically takes care of this ordering.

The third index, M, labels which Cartesian coordinate is referred to by a given table entry. M=1 refers to an X-coordinate, M=2 refers to a Y-coordinate, and M=3 refers to a Z-coordinate. For any polyominoes M can be either one or two, and for the Soma Cube M can be one, two, or three.

The fourth index, I, labels which orientation is being described. The number assigned to a given orientation has no significance except for labelling purposes. The range of I is given by the maximum number of orientations of the pieces under consideration, which is eight for all polyominoes, and twenty-four for the Soma Cube pieces.

To sum up this information with an example, the table element B (1, 2, 3, 4) gives the Z-coordinate of square number 2 in the fourth orientation of

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K=9	J	1	2	3	4	М
3 4 B 1 2	1	1	1	1	2	1
2	Ţ	Ø	-1	1	1	2 -
B 1 3	2	1	1	2	2	1
B 1 3		Ø	1	0	-1	2
3 2 4 B 1	3	1	1	1	2	1
B 1	J	Ø	1	2	1	2
1	1	0	1	1	2	1
1 B 2 4	4	1	0	-1	Ø	2
B 1 3	5	1	1	2	2	1
B 1 3	J	0	-1	Ø	1	2
B 1 2 4	h	1	1	1	2	1
2 4	U	0	-1	1	-1	2
3 1 2 4	7	0	1	1	2	1
1 2 4 B	/	1	1	2	1	2
B 1	Q	1	1	1	2	1
B 1 2 4 3	()	0	-1	-2	-1	2

**Table 1:** Orientation table entries for example of Pentomino 9. In the diagrams, the base square is labeled B and the other squares are labeled by their J values. The base square is always the lowest square in the leftmost column of the figure, and the table gives the coordinates of the other squares with respect to it.

piece number 1. Table 1 clarifies this by showing all of the orientations of Pentomino number 9 and the table entries which go with each figure.

The main program *looks up* values in the orientation table by calling a subroutine called LOOKUP. This subroutine is called many times during each loop of the main program and is therefore the most time-critical portion of the program.

In the program given here, a certain amount of speed has been sacrificed for the sake of generality. If the user is interested only in a particular problem, the subroutine can be speci-

fically rewritten for this problem, and the running time may be cut considerably. For instance, the first program that we wrote considered only the Pentomino problem for a 10 by 6 box, and ran almost twice as fast as the general routine given in this article. Clearly, however, it is most desirable to start with a completely general program like the one given here.

#### Definition of Variables

As mentioned before, any arrays of more than one dimension must be stored as linear arrays in memory.

The array A, representing the playing region, is two-dimensional when we are considering polyominoes and three-dimensional when we are considering Soma Cubes. In both cases the linearized array is arranged in memory so that the scan procedure described above goes through the linear array in ascending order. For instance, the Soma Cube array is stored with the Z index varying fastest and the X index varying slowest:

$$A(1,1,1), A(1,1,2), \ldots, A(1,1,5),$$
  
 $A(1,2,1), A(1,2,2), \ldots,$   
 $A(1,2,5), \ldots, A(5,5,1),$   
 $A(5,5,2), \ldots, A(5,5,5)$ 

(Remember that we put a boundary of —1s around the box, so the dimensions of the array are 5 by 5 by 5 rather than 3 by 3 by 3.) The dimensions of array A vary depending on the problem being considered, but a reserved memory space of about 300 bytes is sufficient for most reasonably sized problems. Array A begins at an address denoted by A0 in the BASIC and assembly listings, and is indexed by the value stored in variable L.

In the linearization of the orientation table, the elements B(K, J, M,I) are stored with the index J varying fastest, I varying next fastest, K next, and finally M, varying slowest. More specifically, if we define the following quantities:

P: number of pieces,

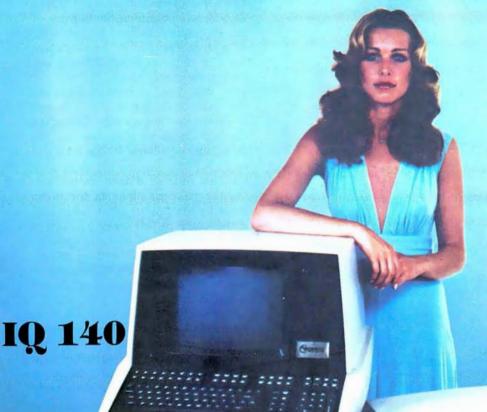
S: number of squares or cubes per piece,

Q: maximum number of orientations for any one piece (eight for polyominoes and twenty-four for Soma Cube pieces),

D: number of dimensions (two for polyominoes, three for Soma Cube), B0: beginning address of orientation table.

then the location in memory of the element B(K,J,M,I) is given by  $B0+J-1+(S-1)\times\{Q\times[P\times(M-1)+K-1]+I-1\}$ , and the number of elements in the table is given by  $(S-1)\times Q\times P\times D$ . In assigning array space, the user should provide enough space for this table. Note that in the symbolic assembly program, the letters P,S,Q,D,I,J,K are used to denote the addresses of these quantities rather than the quantities themselves. Henceforth we will

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**Listing 2:** BASIC driver and printout routine for Soma Cube — Polyominoes program. The "blackout" in line 1070 indicates use of the PET Shift-& graphics character.

```
1 REM POKE 135,20 TO PROTECT MACHINE CODE FROM BASIC INTERPRETER 2 REM 85 HOLDS PRINTOUT SYMPOLS FOR PIECES
3 B$="XIVTHSQPRZYL"
10 REM COPRIGHT 1979 BUMA-POLYDMINO DRIVER PROGRAM
11 INPUT" ENTER NUMBER OF DIMENSIONS": D
13 INPUT" ENTER THE NUMBER OF PLECES"; P
14 POKE 27, P
15 INPUT"NUMBER OF SQUARES PER PIECE"; S
16 POKE 25, S
17 PRINTMENTER DIMENSIONS OF THE BOX":INPUT"WX";WX:INPUT"WY";WY
18 WZ=-1:IP D=3 THEN INPUT"WZ":WZ
19 WX=WX+2:WY=WY+2:WZ=WZ+2:POKE 28,WX:POKE 29,WY:POKE 30,WZ
20 REM ASSIGN VALUES TO AUREO, BO, C1, C2, EO AGGREEING WITH
   ASSEMBLY PROGRAM
21 A0=6300:80=6580:80=6600:C1=6200:C2=6220:E0=6240
30 REM AS HOLDS EACH SOLUTION FOR PRINTOUT
40 REM ARRAYS R AND B ARE PRODUCED BY TAB. GEN. PROGRAM AND
   LOADED FROM TAPE
50 POKE 26,3-1: POKE 32,9-1
60 Q=8: IF D=3 THEN Q=24
70 POKE 33, 2:SPACE=Q*P*(S-1):I=INT(SPACE/256):J=SPACE-256*I
   :POKE 36, J:POKE 3/, I
80 INDEX=B0-1-(S-1)*(Q+1):I=INT(INDEX/256):J=INDEX-256*I
   :POKE 39, J:POKE 39, 1
1 TX3M:0,1 3X04:1-SW*YWX+WX+UA OT CA=1 RC4 00
100 FOR I=C2 TO C2+P:POKE I.O:NEXT I
110 REM PLACE BOUNDARY OF (-1) 'S AROUND BOX
120 J=(XX-1)*YY*WZ:K=(WY-1)*WZ:M=WY*WZ
130 FOR I=A0 TO A0+M-1:POKE I, 255:POKE I+J, 255:NEXT I
    : FOR L=1 TO WZ
140 FOR I=A0+M+L+1 TO A0+J+L-M-1 STEP M:POKE I,255:POKE I+K,255
    :NEXT I:NEXT L
150 IF D=3 THEN FOR I=A0+M+W2 TO A0+J-2*W2 STEP MZ:POKE 1,255
160 POKE I+WZ-1, 255:NEXT I
170 PRINT"ENTER COORDINATES OF OFF-LIMITS SQUARES."
    :PRINT"WHEN DONE ENTER 999 FOR X"
180 INPUT" X":X:IF X=999 GOTO 210
190 INPUT" Y"; Y: Z= 0: IF D= 3 THEN INPUT" Z"; Z
200 POKE A0+WZ* (WY*X+Y)+Z,255:PFINT:GOTO 180
210 PRINT: PRINT" ENTER INITIAL PERMUTATION OF PIECES": PRINT
220 FOR I=1 TO P:INPUT X:POKE C1+I, X:NEXT I
230 INPUTMENTER NUMBER OF PIECES FIXED": Z
240 POKE 15, Z:POKE 0, Z+1:POKE 14, Z+1:IF Z=0 GOTO 300
250 REM PUT IN FIXED PIECES, IF ANY
260 FOR I=1 TO Z:PRINT:PRINT"ENTER COORDS. OF EACH SQUARE OF
     PIECE"; PEEK (C1+I)
270 FOR J=1 TO S:PRINT"SQUARE"; J:INPUT" X"; X:INPUT" Y"; Y:Z=0
    :IF D=3 THEN INPUT" Z";7
280 PE=PEEK (C1+I): POKE A0+WZ*(WY*X+Y)+Z, PE:NEXT J:NEXT I
290 REM INITIALIZE BASE SQUARE
300 FOR I=1 TO WX*WY*WZ-1:IF PEEK(AC+I)=3 THEN POKE 11,I
    :GOTO 320
310 NEXT I
320 POKE 18,1
330 SYS (5120)
999 C = 0
1000 REM PRINT A SOLUTION
1010 IF PEEK (18) = 0 THEN PRINT: PRINT" DONE !!!!!!": END
1020 C=C+1:PRINT:PRINT"SOLUTION #":C:PRINT
1030 Z=0:A$="":FOR Y=WY-2 TO 1 STEP -1
     :IF D=3 THEN FOR Z=1 TO WZ-2
1040 FOR X=1 TO WX-2:A=PREK (A0+WZ*(WY*X+Y)+Z
1050 IF X=1 AND Z<>0 AND Z<>WZ-2 THEN AS=AS+" "
1060 IF A=0 THEN A $= A $ + " 0" : GOTO 1090
1070 IF A=255 THEN A5=A5+"blackout":GOTO 1090
1080 A$= A$+MID$ (B$, A, 1)
1090 NEXT X:IF D=3 THEN NEXT Z
1100 NEXT Y
1110 U = WX - 2 : IF D = 3 THEN U = (WX - 1) * (WZ - 2) + 1
1120 POR I=1 TO WY-2: PRINT MID$(A$, U* (I-1) +1,U) : NEXT I
1130 REM TYPING "S" WILL CAUSE EXECUTION TO STOP ON NEXT RETURN
     TO BASIC
1140 GET YG5:IF YG5="S" THEN PRINT:PRINT" STOP": END
1150 SYS (5759)
1160 GOTO 1010
```

use (P) with parentheses to denote the contents of memory location P, etc.

Other symbolic addresses appearing in the program include:

N: address containing 1 plus the number of pieces currently in the box, Z: address containing the number of pieces specified as fixed by the user, T: address containing the maximum number of pieces fitted into the box during the current permutation,

WX, WY, WZ: addresses containing the width of the box in the X, Y, and Z directions respectively (including the boundaries of -1s). For two-dimensional problems, WZ is set equal to 1,

C1: first address of an array containing the piece numbers in the order given by the current permutation, (P) is the length of this array,

C2: first address of an array containing the orientation numbers of the pieces in the order corresponding to that in the table beginning at C1, (P) is length,

R0: first address of an array, the N-th element of which is the number of possible orientations of piece number This table is automatically generated by the BASIC program which generates the orientation table B. (P) is length.

E0: first address of an array, the N-th element of which gives the position of the base square of piece number N, (P) is length.

The user should choose absolute addresses for the arrays so that they do not overlap; note that the array at B0 is particularly long. Since the arrays at R0 and B0 are both generated by the BASIC orientationtable routine, it simplifies matters if R0 is about 30 bytes in front of B0 so that the two arrays can be recorded on tape as a single file.

Although the assembly language part of the program (listing 3) is completely symbolic and therefore relocatable, the BASIC driver routine in listing 2, which contains the initialization and printout routines, must refer to the absolute addresses of some of the variables. Table 2 is a list of the absolute hexadecimal addresses used in running the program on a Commodore Pet with 8 K bytes of memory. In relocating the program, the user should be careful to make the addresses referred to by the two routines consistent. Listing 4 (see

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**Table 2:** Absolute hexadecimal addresses used in running the Soma Cube — Polyominoes program on an 8 K byte Commodore Pet. This table includes the addresses of all symbolic variables used in listing 3.

Variable or Location Name	Location (Hexadecimal)	Variable or Location Name	Location (Hexadecimal)
N I K J L U T Z SAFE V FLAG BXLO BXHI BYLO BZHI S SM1 P WX WY WZ D PM1 Q OLDK OLDI SPACELO SPACEHI INDEXLO INDEXHI TEMP START LOOP1 TEST INSERT LOOP2 NXTBASE INCX ISOTEST REPLACE JSTART	0 1 2 A B D E F 10 111 122 13 24 225 226 27 28 29 2A 2B 2C 2D 3E 2C 2D 3E 21 22 23 24 25 26 27 28 29 21 22 23 24 25 26 27 28 21 21 22 23 24 25 26 27 28 21 21 21 21 21 21 21 21 21 21 21 21 21	REMOVE SAVE LOOP3 JUMP1 ISOSQ LOOP4 LEAVE JUMP2 REPEAT PERMUTE ILOOP MAX SWITCH ZEROC2 ORDER NEXTJ NEXTU NOSWTCH LSTPCE TAKEOUT LOOKUP TOP MULT1 STEP1 STORE1 MULT2 STORE2 MIDDLE MULT3 STEP3 ADD DIM3 MULT4 STEP4 END C1 C2 E0 A0 R0 B0	14CD 14ED 1508 1524 1527 1547 159C 15A8 15AB 15C2 15CC 15D7 15F4 1612 162B 1643 164A 1651 166C 167F 16BC 16CD 16D7 16DE 16E5 16EB 16E5 16EB 1721 1729 1730 1737 174F 1753 1754 1754 1755 1756 1757 1757 1758 1758 1758 1758 1761 1838 1840 1890 1890 1890 1890 1890 1890 1890 189

**Listing 3:** Symbolic 6502 assembly code listing for Soma Cube — Polyominoes program. The nonrelative variables addressed are given in table 2. Listing 4 is a hexadecimal dump of the program for people who do not have an assembler available.

```
START: LDX N
        INC C2, X
                     :increment orientation counter
        LDA C2, X
        STA I
                     ; (I) = orientation number
        LDA C1,X
        STA K
                     : (K) = piece number
        LDY #1
        STY J
 LOOP1: JSR LOOKUP
                     ;check if orientation (I) of
                     piece (K) will fit into box
        LDA AO.X
        BNE TEST
                     ; if no, check for other orientations
        INC J
        LDA SM1
        CMP J
        BCS LOOP1
                    ;if yes, insert it
        JMP INSERT
  TEST: LOK K
                     ;check if piece (K) has any
                      more orientations
        LDA I
        CMP RO, X
        BCC START
                     ; if yes, go check them out
        JMP REMOVE
                     ;if no, remove previous piece
INSERT: LDY #1
        STY J
```

Listing 3 continued on page 42

page 52) is a hexadecimal object code dump of the main assembler routine of listing 3.

#### Using the Program

The assembly language program (listing 3), the BASIC driver routine (listing 2), and the table-generating routine (listing 1) should each be recorded on tape in separate files.

Once a specific problem has been chosen, the table-generating program should be loaded and run. As input, this program requires the number of dimensions (D), the number of pieces (P), the number of squares or cubes per piece (S), and the array addresses R0 and B0, defined above. The computer then asks for the X and Y (and Z if (D) = 3) coordinates of each square of each piece. When entering these, the chosen location of the origin of coordinates is not important. For instance, the second tromino in figure 1 could be entered in either of these two ways:

$$(X,Y) = (1,0)$$
  $(X,Y) = (4,2)$   
 $(0,0)$  or:  $(3,2)$   
 $(0,1)$   $(3,3)$ 

After the data for each piece has been entered, the computer pauses, prints out the total number of different orientations of that piece, and then asks for the data on the next piece. After all of the pieces have been entered, the program asks if any were entered incorrectly, and gives the user an opportunity to go back and correct any mistakes. Once the program stops, the arrays beginning at R0 and B0 should be recorded on tape. They can be recorded as one file if R0 and B0 were chosen close together as suggested.

There is one slight difficulty. In running the Soma Cube, the program will ask for the positions of four cubes for each of the seven pieces, even though one piece, the second, is made up of only three cubes. This problem can be sidestepped by simply entering one of the cubes of this piece twice. A slight redundancy during running will result, but the increased generality in the problems that can be run will more than compensate.

Once the orientation table has been generated and saved, the assembly language module and the BASIC driver routine should be loaded into memory along with the table. In the

Text continued on page 48

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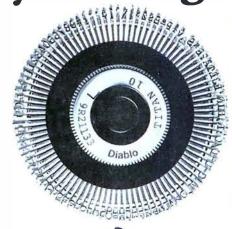
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| Listing 3 continued:

```
LOOP2: JSR LOOKUP ;insert piece (K) by putting the
                       number (K) into the appropriate
         LDA K
         STA AO.X
                       squares of the box
         INC J
         LDA SM1
         CMP J
         BCS LOOP2
         LDX L
         LDA K
         STA AO.X
         TAX
         LDA L
         STA EO, X
                      ;save base square of piece (K)
                      ; if all of the pieces are in the box,
         LDA P
         CMP N
                       return to BASIC to print solution
         BNE NXTBASE ;otherwise, find next base square
         RTS
NXTBASE: LDX L
                      ;scan for next base square
   INCX: INX
         LDA AO, X
         BEQ ISOTEST
         JMP INCX
ISOTEST: STX J
                      ;put new base square in location J
         LDA D
         CMP #3
         BEQ REPLACE; if (D) = 3, skip isolated square test
         TXA
                      test if new base square is isolated
         CLC
         ADC #1
         TAX
         LDA AO,X
         BEQ REPLACE
         TXA
         CLC
         ADC WY
         TAX
         DEX
         LDA AO, X
         BEQ REPLACE; if it is not, go to REPLACE
                     ; if it is, go to isolated square routine
         JMP
             ISOSQ
REPLACE: LDA J
         STA L
                      ;set new base square
         INC N
                      ;increment piece counter
         LDA T
                      :(T) = greatest number of pieces
         CMP N
                       successfully fitted into box in
         BCS JSTART
                       current permutation
         LDA N
         STA T
JSTART: JMP START
                      ;return to START
REMOVE:
         LDX N
                      ;remove last piece inserted
         LDA #0
         STA C2, X
                      ;set orientation number to zero
         DEX
                      :decrement piece counter
         STX N
         LDA C1, X
         STA K
         LDA C2.X
         STA I
         LDA Z
                      ;check if new piece is fixed
         CMP
         BCC SAVE
                      ; if no, take it out
         JMP PERMUTE ;if yes, go to next permutation of pieces LDY K : recover base square of the
   SAVE: LDY K
         LDX EO.Y
                       piece to be taken out
         STX L
         LDA #0
         STA AO,X
         LDY #1
         STY J
  LOOP3: JSR LOOKUP
                      ;take out piece by putting zeroes
         LDA #0
                       in each square it occupies
         STA AO, X
         INC J
         LDA SH1
         CMP J
         BCS LOOP3
         LDX K
                      ; check if piece has any more orientations
         LDA I
```

```
CMP RO. X
         BCS JUMP1
                      ; if no, remove a further piece
         JMP START
                      ; if yes, go check them out
  JUMP1: JMP REMOVE
  ISOSQ: LDY K
                      ;recover base square of piece to be taken
         LDX EO, Y
                       out to cure isolation of new base square
         STX L
         LDA #0
         STA AO, X
         LDA J
         STA SAFE
                      ;store base square in safe place
         LDY #1
         STY J
  LOOP4: JSR LOOKUP
                      ;remove last piece inserted
         LDA #0
         STA AO, X
         INC J
         LDA SM1
         CMP J
         BCS LOOP4
         LDA SAFE
                      recover base square
         STA J
         CLC
                      ; test if it is still isolated by checking
         ADC #1
                       if each of the four squares around it is
         TAX
                       filled
         LDA AO.X
         BEQ LEAVE
         DEX
         DEX
         LDA AU.X
         BEQ LEAVE
         TXA
         SEC
         SBC WY
         TAX
         TNX
         LDA AQ.X
         BEO LEAVE
         TXA
         CLC
         ADC WY
         ADC WY
         TAX
         LDA AO, X
                      ; if it is not still isolated,
         BEO LEAVE
                       prepare to return to normal routine
                      ; if it is, repeat isolated square routine
         JMP REPEAT
  LEAVE: LDX K
                      ;check if piece (K) has any
         LDA I
                       more orientations
         CMP RO, X
         BCS JUMP2
                      ;if no, remove previous piece
         JMP START
                      ; if yes, go check them out
  JUMP2: JMP REMOVE
 REPEAT: LDX N
         LDA #0
         STA C2.X
                      :set orientation number to zero
         DEX
                      :decrement piece counter
         STX N
         LDA C1, X
                      ;set new values of (K) and (I)
         STA K
         LDA C2.X
         STA I
         JMP ISOSO
                      :repeat isolated square routine
PERMUTS: LDA T
                      :find new permutation, making sure that
         STA I
                       the repermutation goes at least as far
         CMP P
                       back as the (T)-th piece of the old
                       permutation
         BNE ILOOP
         DEC I
  ILOOP: LDA #127
                      the nested I and J loops pick two elements
         STA U
                       of the permutation to be interchanged.
                       These are: the last element of the
         LDA I
         CLC
                       permutation, which has a larger element
         ADC #1
                       following it, and the smallest element
         STA J
                       following this element which is greater
  JLOOP: LDX I
                       than it
         LDY J
         LDA C1, Y
         CMP C1, X
         BCC MAX
```

Listing 3 continued on page 46

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> LDA #0 STA AO, X

INC J

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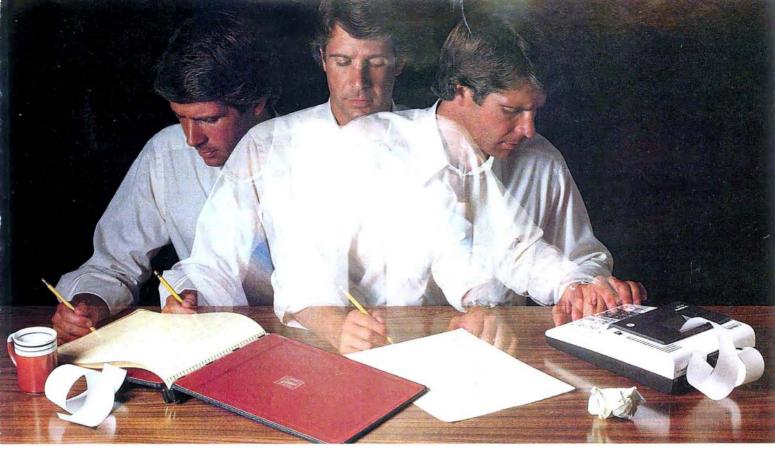
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Listing	.3	continued:

```
LDA U
          CMP C1.Y
          BCC MAX
          STY V
          LDA C1, Y
          STA U
    MAX: INC J
          LDA
              Р
          CMP
          BCS JLOOP
          LDA U
          CMP #127
          BNE SWITCH
          DEC I
          LDA
              2
          CMP
          BCC ILOOP
                       ; if such elements cannot be found, clear
          LDA
              #0
                        FLAG and return to BASIC to stop
          STA FLAG
          RTS
 SWITCH:
          INC
              N
                       ;interchange elements found by
          LDA N
                        I and J loops
          STA T
          LDX I
          LDA C1,X
          LDY V
          STA C1, Y
          LDA U
          STA C1, X
          LDA N
          STA
 ZFROC2: LDA #0
                       reinitialize orientation numbers:
          LDX J
          STA C2, X
          TNC J
          LDA P
          CMP
             J
          BCS ZEROC2
                       ; if repermutation only interchanged last
          LDA PMI
          CMP I
                        two pieces, return to START
          BNE ORDER
          JMP START
  ORDER: LDA I
                       ;otherwise, reorder new permutation
                        into ascending order
          C LC
          A DC
          STA
  NEXTJ: LDA
          C LC
          A DC
          STA U
  NEXTU: LDX
              J
          LDY U
          LDA C1, X
          CMP
             C1, Y
          BCC NOSWTCH
          STA V
          LDA C1, Y
          STA C1, X
          LDA V
          STA C1, Y
NOSWTCH: INC
             []
          LDA P
         CMP U
          BCS NEXTI
          INC J
         LDA PM1
         CMP
         BCS NEXTJ
          JMP
              START
                       ;return to START
 LSTPCE: LDX
                       ; BASIC returns control to here after
         LDA EO, X
                       printing a sclution so that the (P)-th
          STA L
                        piece can be taken out
          LDA #1
         STA J
TAKEOUT: JSR LOOKUP
```

Listing 3 continued on page 48



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```
Listing 3 continued:
         LDA SM1
         CMP J
         BCS TAKEOUT
         LDX L
         LDA #0
        STA AO, X
        JMP REMOVE
                      ;put square number in Y register
LOOKUP: LDY J
                      ; if (I) and (K) are the same as in the
         LDA I
         CMP OLDI
                       previous call to LOOKUP, go to MIDDLE,
         BNE TOP
                       otherwise to TGP
        LDA K
         CMP OLDK
         BNE TOP
        JMP MIDDLE
   TOP: LDA Q
         STA BXLO
         LDA #0
         STA BXHI
        LDX #8
 MULT1: ASL BXLO
                      ; one byte multiplication
                      routine figures (Q) * (K)
         BCC STEP1
        CLC
         ADC K
 STEP1: DEX
        BEQ STORE1
         ASL A
         JMP MULT1
STORE1: ADC I
                     ; add (I) to it
                     :store result in BXLO
        STA BXLO
        LDX SM1
 MULT2: DEX
                      ;multiply this by (S) -1 and store the
        BEQ STORE2
                      two-byte result in BXLO and BXHI
        ADC BXLO
        BCC MULT2
         INC BXHI
        CLC
        JMP MULT2
STORE2: ADC INDEXLO ; add the two-byte quantity (INDEX) to (BX)
         STA BXLO
        LDA BXHI
        ADC INDEXHI
        STA BXHI
        LDA SPACELO ; add the two-tyte quantity (SPACE) to (BX)
        ADC BXLO
                      to get (BY)
        STA BYLO
        LDA SPACEHI
        ADC BXHI
        STA BYHI
        LDA D
                     :if (C) \neq 3, go to MIDDLE
        CMP #3
        BNE MIDDLE
        CLC
        LDA SPACELO ; add the two-tyte quantity (SPACE) to (BY)
        ADC BYLO
                      to yet (BZ)
        STA BZLO
        LDA SPACEHI
        ADC BYILL
        STA BZHI
MIDDLE: LDA (BXLO),Y ;load X coordinate of square
        STA TEMP
        LDA #0
        LDX #8
 MULT3: ASL TEMP
                     ;multiply it by (WY)
        BCC STEP3
        CLC
        ADC WY
 STEP 3: DEX
        BEU ADD
        ASL A
        JMP MULT3
   ADD: CLC
        ADC (BYLO), Y ; add Y coordinate of square
        STA TEMP
                       ;store result in TEMP
                       ; if (D) = 3, go to DIM3
        LDX D
        CPX #3
        BEQ DIM3
        CLC
```

Listing 3 continued on page 50

Text continued:

case of the Commodore PET, the BASIC driver should be loaded last. Before it is loaded, the page number on which the assembly routine starts should be placed into location 135 decimal, using the POKE statement. This insures that the arrays defined by BASIC will not interfere with the assembly routine or the table.

Before running, the user should check lines 3 and 21 of the BASIC driver routine, to determine whether or not they are correct for the problem under consideration. When run, the driver routine asks the user for input with prompts that are fairly self-explanatory. However, a few specific hints may be helpful.

Although the program will work no matter how the box is oriented, it will run fastest if the dimensions WX, WY, and WZ are chosen to be in descending order (ie: WX>WY> WZ), due to the mechanics of the search procedure. Failure to do this may lengthen the running time by a factor of ten or more.

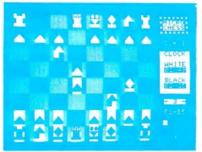
When entering the off-limits squares, and also the coordinates of any fixed squares, the coordinates are defined for polyominoes so that the lower left-hand corner of the box (excluding boundary) has the coordinates (1,1); and for Soma Cubes the corner with the lowest coordinate values has coordinates (1,1,1).

In entering the initial permutation of pieces, the order in which the machine goes through the permutations should be kept in mind. Thus, entering the piece numbers in ascending order: 1,2,3,...,P will result in an exhaustive search, whereas any other initial permutation will cause only a subset of the complete set of permutations to be considered.

Any pieces which are to be specified as fixed should be put at the beginning of the initial permutation. For example, to find all of the solutions with pieces 2 and 4 fixed in particular locations, the initial permutation array should have 2 and 4 at the beginning, and the rest of the numbers in ascending order, (ie: 2, 4, 1, 3, 5, 6, 7, . . . , P). The number of fixed pieces should then be entered as two, after which the computer will ask for the coordinates of each square of pieces 2 and 4.

The program does not check to see if the coordinates entered by the user for a fixed piece correspond to a legal

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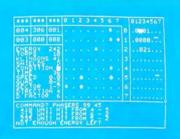


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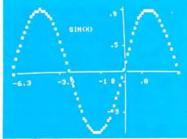
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```
Listing 3 continued:
```

```
ADC L
                    ;otherwise, add base square index
                    transfer result to X register
       TAX
       LDA K
                    ;store old (K) and (I) values
       STA OLDK
       I.DA I
       STA OLDI
       RTS
                    :return to main routine
DIM3: LDA #0
       LDX #8
MULT4: ASL TEMP
                    ;multiply (TEMP) by (WZ)
       BCC STEP4
       CLC
       ADC WZ
STEP4: DEX
       BEQ END
       ASL A
       JMP MULT4
                      ; ald base square index
  END: ADC L
       ADC
           (B2LO) , Y
                      ;add Z coordinate of square
                      transfer result to X register
       TAX
       LDA K
                      ;store old (K) and (I) values
       STA OLDK
       LDA I
       STA OLDI
       RTS
                      return to main routine
```

SOLUTION # 1 SOLUTION # 2 SOLUTION # 3 SOLUTION # 4

Photo 3: All of the solutions for Pentominoes in a 20 by 3 box. Solutions three and four are mirror images of solutions one and two, so there are only two fundamentally different solutions.

orientation of that piece, so care should be taken to insure that all of these numbers are entered correctly.

To stop the program in mid-run, the S key may be pressed at any time. This will cause execution to stop on the next return to the BASIC printout routine.

Photo 3 is a typical output of the Soma Cube — Polyominoes problem solver. The solutions are for Pentominoes in a 20 by 3 box.

#### Conclusion

GPI8 MCD

As general as this program is, it by no means exhausts the possibilities inherent in problems such as these.

In addition to squares, it is possible to tile the plane with other figures such as triangles and hexagons. It should not be hard to modify the program to consider figures made out of these shapes. At a more abstract level, since the assembly language routine depends so little on the dimensionality of the pieces under consideration, the user could extend it to consider analogous problems in four or more spatial dimensions. Hard as these might be to visualize, the computations involved are not fundamentally different from those encountered in two and three-dimensional problems.

Another possibility is to assign colors to the various pieces and look for interesting properties of the resulting solutions. For example, the plastic Pentomino puzzle which provided the inspiration for this article had the following piece colors:

> X.P.Y : Red : Yellow I.T V,U,S, : Blue W,R,Z,L : Green

There is one and only one 10 by 6 solution using this set which is a true four-coloring (ie: a solution in which no two pieces of the same color touch each other). Can you find it?

These are only suggestions. The capabilities of the program and the uses to which it can be put depend ultimately on the interests and ingenuity of the user.

#### **BIBLIOGRAPHY**

- 1. Golomb, Solomon W, Polyominoes, Charles Scribner's Sons, New York 1965.
- Gardner, Martin, The Scientific American Book of Puzzles and Diversions, Simon and Schuster, New York, 1959.
- 3. Philpott, Wade E, Polyomino and Polviamond Problems, Journal of Recreational Mathematics, 10:1, pages 2 thru 14 and 10:2, pages 98 thru 105, Baywood Publishing Company Inc, 1977-78.
- Introducing Soma, Parker Brothers Inc, Salem MA, 1969.

#### cmc

#### ANALOG PET

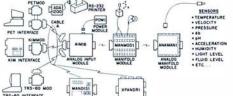


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**Listing 4**: Hexadecimal object code dump for the Soma Cube - Polyominoes program given in listing 3.

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1400 65 00 FE 40 18 BU 40 18 . . 1408 85 0.1 BI 38 18 85 02 A0 . : 0A 20 BC 16 BD 1410 0.1 84 90 . : DO OD E6 OA 1418 18 A5 1A C5 . : 1420 0A 80 FO 40 37 14 EA EA . : 1428 A6 02 A5 01 0D B4 19 . : 1430 CF 40 CI 14 EA EA EA . . 1438 01 84 0A 20 BC 16 A5 0.7 1440 9 [i 90 18 E6 0A A5 1A C5 1448 OA BO FO A6 OB EA EA EA 1450 EA EA EA A5 02 9D 9C 18 1458 A6 02 A5 0B 9D 60 18 EA 1460 EA EA EA EA A5 18 C5 00 DO 03 60 EA EA A6 90 18 E0 17 4C 6F EA 86 OA A5 0.9 03 F0 20 8A EA EA EA 18 49 OT AA BO FΑ FA FA 1440 913 18 10 EA EA 8A 18 AA CA BB 9C 18 FO 1448 65 1.0 14R0 03 4C 27 15 A5 0A 85 0B EA EA EA E6 00 A5 0E 1488 FΑ 0.5 BO 04 A5 00 85 1400 00 0 F 14C8 4 C 00 14 EA EA A6 00 9T1 4C 1410 0.0 18 CA 86 00 H I 02 BD 4C 18 1418 38 18 85 85 **A**5 14F0 01 0F EA EA EA C5 00 14E8 90 0.3 4C C2 15 A4 02 EA 14F0 EΑ EΑ BE 50 18 FΑ FA 14F8 OB FΑ FΑ EA EA EA EA A9 911 90 1500 0.0 18 A0 01 84 0A 20 A9 00 90 90 1508 RC. 1.5 1510 E6 ÓΑ A5 1A C5 0A B0 1518 A6 02 A5 0.1 DD B4 19 1520 0.3 4C 00 14 4C CT 14 A4 02 EA EA EA EA EA BE 1528 40 18 86 OB EA EA EA EA EA 1530 A9 00 91 90 18 EA A5 1538 FΑ 1540 0A 85 10 A0 01 84 0A 20 1548 BC 16 A9 00 9D 9C 18 E6 1550 0A A5 1A C5 0A B0 F0 A5

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1558 10 85 0A EA EA EA EA EA

1568 18 FO 31 CA CA EA EA EA

1570 EA EA EA EA EA EA EA

1580 FO 1A 8A 38 E5 1D AA E8

1578 EA EA EA EA EA BD 9C

18 69 01 FA FA AA BII 9C

1560

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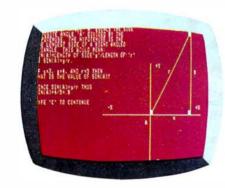
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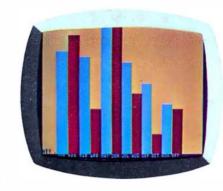
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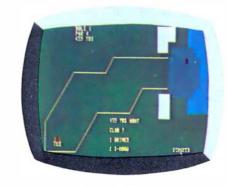
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	bases, and more.	Ψ	23
MDMS-	–EDUCATION SYSTEM. Easily creat	е	
	your own quizzes and tutorials with	•	20

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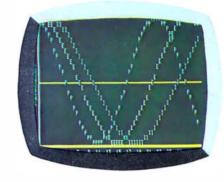
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	BD1	Ratio analysis, bonds, loan interest,	1)	29
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		list, address book, advertisement	T.	20
	550	demo and more.	<b>Þ</b>	29
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		management systems. Master file		
		create, edit, dump, report writer and much more.	Φ.	49
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		age analysis, customer list	_	
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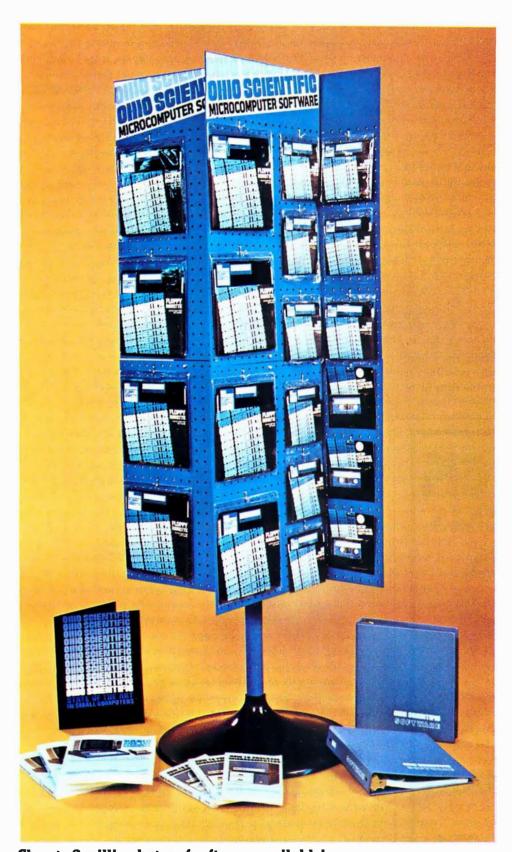
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	powers, integrals and more.	4 20



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#### **Programming Ovickies**

## BASIC Game: GOBANG

John Allwork, 21 Brook Rd, Heaton Chapel, Stockport, ENGLAND

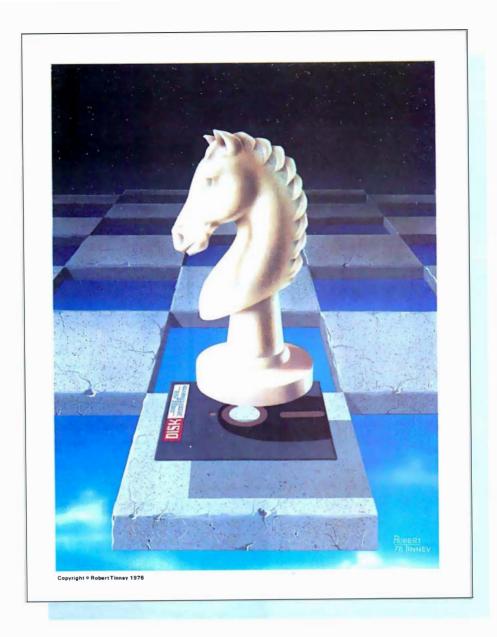
GOBANG is, as far as I can tell, a traditional game of the Orient. It is a large game of tic-tac-toe (noughts and crosses), played on a 19 by 19 inch board. The object of the game is to get 5 adjacent markers in a row horizontally, vertically or diagonally.

The program in listing 1 is written in BASIC; the only deviation from standard BASIC being that of the IF...THEN IF... rather than the less flexible IF...GOTO. The BASIC I used is a version of the MicroBASIC supplied by SwTPC, and the program was run on an EXORciser system. The program and BASIC interpreter fit into 8 K bytes of memory, if the remark statements are omitted. Alternatively, the size of arrays T and M can be reduced, but reducing them too much inhibits the game. A 9 by 9 board appears to be the smallest size possible for a reasonable game. (Listing 2 shows a sample output of the 19 by 19 board.)



Listing 1: BASIC listing of the GOBANG game.

```
0001
        REM
                   GOBANG
                   M IS ARRAY HOLDING BEST MOVE
0002
        REM
                   T IS BOARD, S IS PRIORITY OF THAT POSITION
0003
        RFM
                   M[19,19],T[27,27],S[81]
SET UP PRIORITIES—SEE TABLE 1
0004
        DIM
        REM
0005
                   I = 1 TO 81
0006
        FOR
0010
                LET S[I] = 0
0015
        NEXT I
0019
        LET
                    S[20] = 1
        LET
                    S[10] = 40
0020
                   S[12] = 30
S[13] = 47
S[27] = 15
0021
        LET
        LET
0022
0023
        LET
                   S[28] = 20
S[29] = 10
0024
        LET
0025
        LET
0026
        LET
                    S[30] = 40
0027
        LET
                    S[31] = 50
0028
        LET
                    S[32] = 30
                    S[24] = 1
0029
        LET
                    S[36] = 39
0030
        LET
        LET
                    S[37] = 65
0031
                   S[38] = 40
        LET
0032
0033
        LET
                   S[39] = 70
0034
        LET
                    S[40] = 100
        LET
                    S[41] = 60
0035
                    S[42] = 30
        LET
0036
        LET
                    S[43] = 30
0037
        LET
                    S[44] = 30
0038
        LET
LET
LET
                   S[62] = 41
S[72] = 31
0040
0041
                   S[73] = 11
S[74] = 41
0042
        LET
0043
                   S[78] = 51
S[80] = 90
0044
0045
        LET
0046
        LET
                    S[26] = 21
0047
        LET
                    S[79]
                         =40
        LET
                    S[60] = 21
0048
0049
        LET
                    S[61] = 11
                    CLEÁR BOARD AND BEST MOVE ARRAYS
0050
        REM
0051
        FOR
                    I = 1 TO 27
0055
                FOR J = 1 TO 27
0060
                    IF I < 19 THEN IF J < 19 THEN LET M[I, J] = 0
0065
                    REM MAKE FIRST MOVE
0070
0075
        NEXT I
0076
        LET
                    C = -1
        LET
0085
                    W = 14
        LET
0086
                    N = 14
        LET
0087
                    0 = 14
0090
0091
        GOTO 0300
0095
        GOSUB 0800
0096
        REM REQUEST MOVE AND CHECK FOR VALIDITY
0097
        INPUT Z,Y
0099
        LET
                    Y = Y + 4
        LET
0100
                    Z = Z + 4
        IF Y > 23 THEN GOTO 0097
0101
        IF Z > 23 THEN GOTO 0097
IF Y < 5 THEN GOTO 0097
0102
0103
0104
        IF Z < 5 THEN GOTO 0097
0106
        IF T[Y,Z]>0 THEN GOTO 0097
        ĽEŤ
0110
                    T[Y,Z] = 2
        LET
0115
0120
        LET
                    J = Z
0125
        REM STUDY LAST TWO MOVES
0127
        GOSUB 1000
        IF C< > -1 THEN GOTO 0310
0128
0129
        REM
                    IF C = 0 COMPUTER HAS LOST
0130
        LET
                   I = W
0131
        LET
                    J = X
        GOSUB 1000
0141
        REM SCAN BOARD FOR BEST MOVE
0145
0150
        REM NOTE LIMITS TO SPEED UP PROGRAM
0160
0161
                    I = N - 1 TO O + 1
        FOR
                 FOR J = 5 TO 23
0162
                   IF T[I,J]>0 THEN GOTO 0220
0200
0201
                    LET A = M[1 - 4, J - 4]
                    IF A < Q THEN GOTO 0220
0205
                   LET W = I
LET X = J
0210
0215
0216
                    LET Q = A
                NEXT J
0220
        NEXT I
0225
```



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_	1 continuea:
0299	PRINT ''MY MOVE'';X – 4;'','';W – 4
0300	LET T[W,X] = 1
0300	IF $M[W - 4, X - 4] < 100$ THEN GOTO 0095
0307	PRINT "I WIN"
0310	IF C=0 THEN PRINT "YOU WIN"
0330	GOTO 0050
0799	REM SUBROUTINE TO DISPLAY BOARD
0800	PRINT '' 1 2 3 4 5 6 7 8 910111213141516171819''
0805	FOR I = 5 TO 23
0810	F   - 4 < 10 THEN PRINT   - 4;'' '';
0811	F   - 4 > 9 THEN PRINT   - 4;
0815	FOR J = 5 TO 23
0820	IF [I,J] = 0 THEN PRINT '' :'':
0825	IF ┪(,,)] = 1 THEN PRINT '' Х'';
0830	IF ┪(,,) = 2 THEN PRINT '' О'';
0835	NEXT J
0840	PRINT '' ''
0845	NEXT I
0850	RETURN
0990	REM SUBROUTINE TO CALCULATE BEST MOVE
0991	REM SCAN THRU MOVE AT I,J
0992	REM FOR FIVE SQUARES EITHER SIDE OF MOVE
0993	REM IN EIGHT DIRECTIONS, AND UPDATE BEST MOVE ARRAY
1000	LET K=1
1001	LET L=-1
1002 1003	IF I < N THEN IF I > 5 THEN LET N = I IF I > 0 THEN IF I < 23 THEN LET O = I
1004	REM UPDATE SCAN LIMITS LET U=I
1005 1006 1007	LET V = J REM I,J IS MOVE TO CHECK,D IS LOOP COUNT
1008	REM K,L ARE X AND Y DIRECTIONS THRU MOVE
1010	LET D = 0
1011	LET D = D + 1
1013	LET P = 81
1020	REM CHECK STILL ON BOARD
1026	IF U>23 THEN GOTO 1090
1027	IF V>23 THEN GOTO 1090
1028	IF U < 5 THEN GOTO 1090
1029	IF V < 5 THEN GOTO 1090
1030	LET $E = U - 4$
1031	LET G = V - 4
1032	LET A = M[E,G]
1033	LET $Q = T[U + K, V + L]$
1034	REM CALCULATE PRIORITY OF POSITION
1035	LET R = T[U - K,V - L]*27 + T[U - 2*K, V - 2*L]*9
1036	LET R = R + T[U - 3*K,V - 3*L]*3 + T[U - 4*K,V - 4*L]
1037	LET B = Q*27 + T[U + 2*K,V + 2*L]*9 + T[U + 3*K,V + 3*L]*3
1038	IF R = 80 THEN IF T[U,V] = 2 THEN LET C = 0
1039 1040	IF T(U,V) < >0 THEN GOTO 1075  REM S(R) IS PRIORITY; THE FOLLOWING ARE EXCEPTIONS
1041	REM SÉÉ TABLE 2
1042 1044	IF R < 14 THEN IF R > 11 THEN IF Q = 1 THEN LET P = 37 IF R > 71 THEN IF B > 53 THEN IF B < 63 THEN LET P = 80
1046	IF R>71 THEN IF B>71 THEN LET $P = 80$
1048	IF R>53 THEN IF R<63 THEN IF $Q = 2$ THEN LET $P = 72$
1050 1052	IF $P = 72$ THEN IF $R = 60$ THEN LET $P = 31$ IF $Q < > 2$ THEN GOTO 1058
1053 1054	IF R = 78 THEN LET P = 80 IF R = 79 THEN LET P = 80
1056 1058	IF R = 41 THEN LET R = 81 IF R < 42 THEN IF R > 35 THEN IF Q = 1 THEN LET P = 41
1059	IF R < 33 THEN IF R > 29 THEN IF Q = 1 THEN LET P = 41
1060 1061	IF R>53 THEN IF R<63 THEN IF B>71 THEN LET P=80 IF R>38 THEN IF R<42 THEN IF Q=1 THEN LET R=40
1062	IF R>35 THEN IF R<45 THEN IF B>35 THEN IF B<45 THEN LET R=40
1063	IF R>27 THEN IF R<54 THEN IF B>38 THEN IF B<42 THEN LET R = $40$
1064	IF $R = 79$ THEN IF $A = 51$ THEN LET $M[E,G] = 41$
1065	IF $R = 0$ THEN LET $R = 81$
1066	IF S[P]>S[R] THEN LET R = P
1067	IF S[R] – S[R]/10*10 = 1 THEN IF A – A/10*10 = 1 THEN
1068	IF S[R] < 41 THEN LET R = 74  IF S[R] - S[R]/10*10 = 9 THEN IF A - A/10*10 = 9 THEN
1069	IF S[R] < 65 THEN LET R = 37  REM UPDATE BEST MOVE ARRAY
1070	IF $S[R] > M[E,G]$ THEN LET $M[E,G] = S[R]$
1075	IF D>4 THEN GOTO 1090
1081	LET U = U + K
1082	LET V = V + L
1085	GOTO 1011
1089 1090	REM CHANGE DIRECTION IF $K = 0$ THEN IF $L = -1$ THEN RETURN
1095	IF $K = -1$ THEN IF $L = -1$ THEN LET $K = 0$

1100	IF $K = -1$ THEN IF $L = 0$ THEN LET $L = -1$
1105	IF $K = -1$ THEN IF $L = 1$ THEN LET $L = 0$
1110	IF $K = 0$ THEN IF $L = 1$ THEN LET $K = -1$
1115	IF $K = 1$ THEN IF $L = 1$ THEN LET $K = 0$
1120	IF $K = 1$ THEN IF $L = 0$ THEN LET $L = 1$
1125	IF $K = 1$ THEN IF $L = -1$ THEN LET $L = 0$
1130	GOTO 1005

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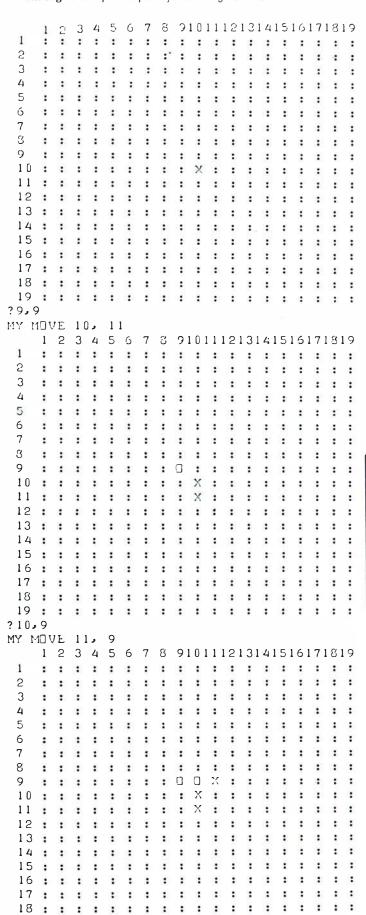
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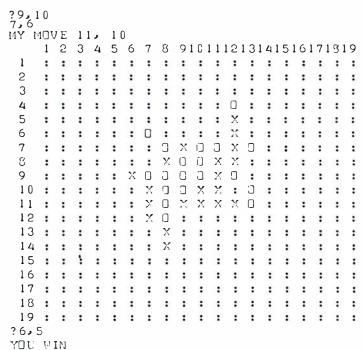


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Listing 2: Sample output of the 19 by 19 board.





I hope I have eradicated most of the bugs, but some may still exist (as with all programs); for example, I do not check to see if the board is full, because I have never encountered this situation with a 19 by 19 board.



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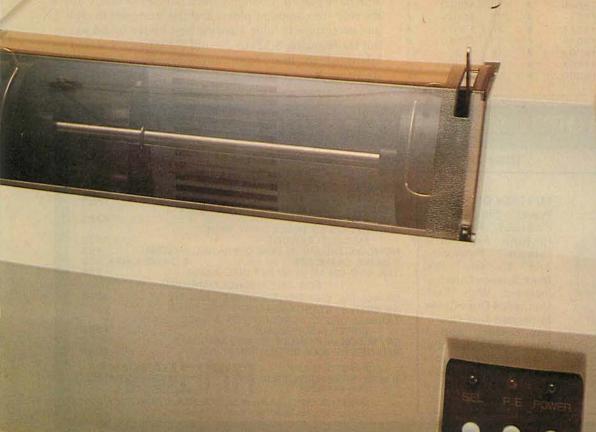
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**Table 2:** Some exceptions encountered by the computer that necessitate redefining its strategy.

LINE	PATTERN	PRINRITY					
NUMBER	1						
1842	x + _ x x	65					
11144	-U+00	91					
1046	00+00	9 W					
104B	0+0-	31					
1050	0+0-0-	5ø					
1053	0 + 0 0 0 -	911					
1854	0 † () 0 0 X	9 p					
1056	() <b>†</b> X X X ()	Ø					
1058	x + x x –	68					
1058	X+XXX	60					
1059	$X \uparrow X - X$	6 Ø					
1060	$\Omega(1 \uparrow 0) =$	911					
1061	$x * x \times x$	100					
1062	XX+XX	100					
1063	XXX + X	1 W W					
1860	REDUCES PR	[OR]TY ()F	-000)-	11 11 () I	HL OCKED	AT ON	i Nili
1867	INCREASES	PRIORITY	OF INTE	ARECTING.	80 <b>\</b> S OF	() <sup>*</sup> S	
1060	INCREASES	PRIURITY	UF INTE	RSLUTING	ROWS OF	x * 6	

**Table 1:** A lookup table that defines the computer's strategy.

P	t	89	27	1 X	15	54	• 0	8
1	•X	A	28	• xx	20	55	♦()——×	N
2	† O	A	29	+ X ()	10	56	• nu	Ø
3	+X-	41	3 11	+ X - X -	40	57	• ∩-x-	(7)
4	+XX	P	31	* X – X X	5 <b>0</b>	58	()-XX	N
5	•×0	W	32	+ X - XO	30	59	• U - X O	V
6	• - <b>-</b> 0 -	N	33	+ X - O -	Ø	6 W	†()-()-	21
7	+0x	Ø	34	+ x - 0 x	Ø	61	↑ () ~ () X	11
8	•OO	W	<b>3</b> 5	+ X = 0 ()	Ø	62	<b>♦</b> 0-00	41
9	•-X	Ø	36	* X X ~ -	39	63	10 Y	W
10	† - X - X	46	37	* × X – X	65	64	†() X = X	8
11	•-X-O	0	38	†××⊸D	44	65	↑ () X — ()	Ø
12	+-XX-	30	39	*XXX-	70	66	•□××-	W
13	1-XXX	47	40	*XXXX	100	67	*()×××	P
14	•-XXO	Ø	41	†XXXU	60	68	♦ 🗆 X X 🗅	9
15	•-XO-	Ø	42	txx0-	30	69	†()X()=	89
16	•-XOX	W	43	* XXOX	311	70	♦ N x N X	89
17	1-X00	Ø	44	†XX00	30	71	↑ () X () ()	P
18	•-O- <b>-</b>	89	45	+x0	Ø	72	<b>♦೧೧</b> 1−−	31
19	1-0-X	Ø	46	+ X O - X	Ø	73	↑00-X	11
211	•-0-n	1	47	+x0-0	P	74	100-0	41
21	• - O X -	8	48	1 X O X -	Ø	75	100x-	P
22	†-0xx	0	49	†XOXX	0	76	↑ O O X X	Ø
23	•-0x0	P	50	†XOXΩ	Ø	77	100x0	0
24	<b>9-00-</b>	1	5 <b>1</b>	†X00-	8	78	<b>♦</b> () () () <b>–</b>	51
25	1-00x	P	52	<b>↑</b> X O O X	0	79	♦000×	Ø
26	t=000	21	5.3	♦ x000	Ø	80	<b>†0000</b>	94

The program relies on a lookup table (entry S, table 1) and some exception conditions (table 2) to determine the priority of move of the square in question. The last 2 moves (by nought and cross) are scrutinized, scanning through these squares for 4 squares either side of the move in all 8 directions. The priority is calculated and updated if greater than previously calculated. Finally the board is scanned for the highest priority and the move made in this square.

The computer always goes first, and is X, although this can easily be modified. On the EXORciser, it takes about 40 seconds to think of the best move, compared with 10 seconds on a NOVA 2 using the same program and a BASIC interpreter, so do not worry if there is not an immediate response.

The program plays a very good game, occasionally almost beating the author, and has beaten several people who have played. Changing the strategies radically alters the way the computer plays, and the strategies in table 1 and exceptions in table 2 are the best I have found so far, but try changing S(12) to 29, and S(13) to 49. I would be interested to hear from anybody who finds better strategies.

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#### **Programming Duickies**

#### **Shape Table Conversion** for the Apple II

Dave Partyka, 1707 N Nantuckett Dr, Lorain OH 44053

If you own an Apple II with highresolution graphics, I'm sure you have tried using the shape table. If you are like me, you converted the points to their hexadecimal values, ran the shape subroutine, and got a completely different shape from what you wanted. After two or three tries and a lot of time, you finally got the shape the way you wanted it.

There has to be a better way, and there is. The program in listing 1 performs the plot conversion to hexadecimal and puts the values in the table starting at the decimal location you specify. After using this program, you will find it very easy to build shape tables. Instead of drawing arrows, you can use just the points.

This program follows the rules of the Apple II Reference Guide: a double move up or 00 will end the program and put a 0 at the end of the table. The value of the moves are the same as in the Reference Guide:

- 0 = Move up
- 1 = Move right
- 2 = Move down
- 3 = Move left
- 4 = Plot and move up
- 5 = Plot and move right
- 6 = Plot and move down
- 7 = Plot and move left

The program does not require that the user press the return key while entering the plot values. You can try this program using the example given in the Apple II Reference Guide on page 53. Assign the correct values to the shape vectors at the top of the page and the hexadecimal values given will be in your table. Remember that this program requires a decimal location, while the shape subroutine requires the hexadecimal value.

Listing 1: Shape table program for the Apple II.

10 INPUT "STARTING DECIMAL LOCATION",L 20 N = N + 1 : PRINT "PLOT "; N ; "-"; 30 Z = PEEK(-16384) : IF Z < 176 OR Z > 183 THEN 30 :

POKE -16368,0 : Z = Z-176 : PRINT Z : IF N#1 THEN RETURN

40 E = 1 : IF Z = 0 THEN D = 1 : A = Z : GOSUB 20 50 IF Z#0 THEN 60 : IF D = 1 THEN 90 : E = 0 : GOTO 70

50 IF Z#0 THEN 60: IF D = 1 THEN 90: E = 0: GOTO 70
60 D = 0: IF Z = 2 OR Z = 4 OR Z = 6 THEN 70:

Z = Z-1: A = A + 8

70 B = Z/2: GOSUB 20: IF Z#1 AND Z#2 AND Z#3

THEN 80: B = Z\*4 + B: E = 1: GOSUB 20

80 B = B\*16 + A: POKE L,B: L = L + 1: IF E#0 THEN 40:

A = 0: D = 1: E = 1: GOTO 50

90 PRINT "END OF TABLE": POKE L,0: END

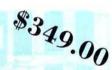
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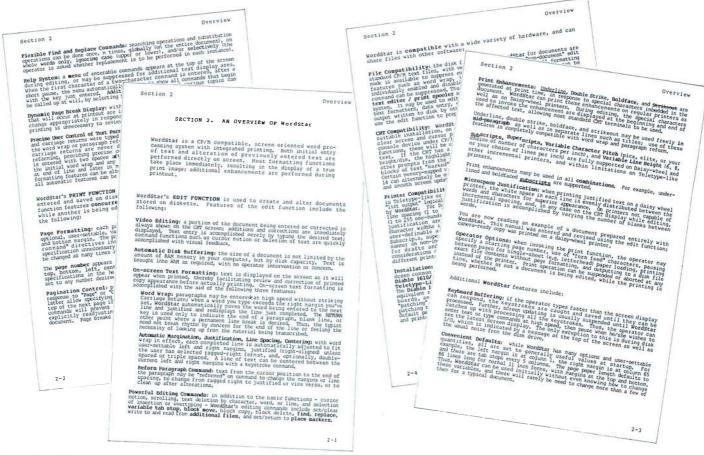


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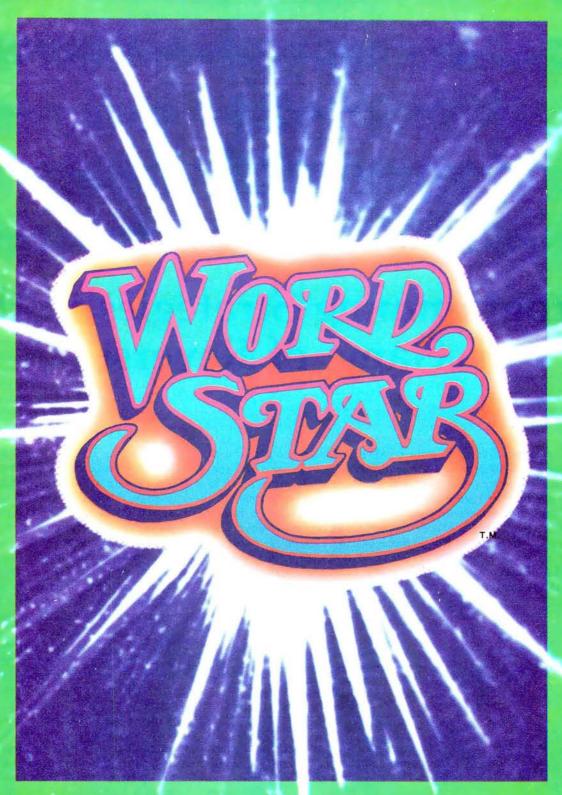
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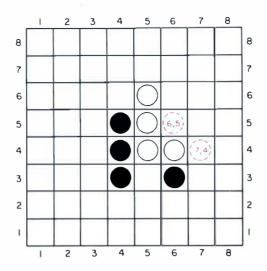
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## Programming Strategies in the Game of Reversi

Figure 1: Typical position in the game of Reversi. The game is played with counters having two different colors, one on each side. A player's turn consists of placing a counter (with the player's color face up) on the board so that it traps one or more enemy pieces between it and another friendly piece in a straight line. The trapped enemy pieces are then reversed in color. Thus, a play by Black to square (6,5), with the horizontal coordinate given first, would allow Black to turn over White's pieces at (6,4), (5,4) and (5,5). A play by Black to square (7,4) would allow Black to turn over White's pieces at (6,4) and (5,4). Play ends when neither player can make a legal move. The player with the greater number of counters showing wins the game.

Peter B Maggs 2011 Silver Ct E Urbana IL 61801

Board games such as checkers or chess can be fun and challenging to play, and programs that play these games can be fun and challenging to write. This article covers some of the decisions I made and methods I used in the programming of a board game called Reversi. It examines in turn the choice of a game, the programming language, the data structure and the details of the program structure.

#### Choosing a Game

There are both legal and practical considerations in choosing a game to program. Since I earn a living teaching law, and program as a hobby, I will start with the legal aspects. Many games present no legal problems. For instance, chess and checkers are in the public domain and anyone is free to write programs for them, but copyrighted games could pose serious legal problems. While writing a program to play a copyrighted game solely for your own amusement at home would probably fall within the fair use exception to the copyright law, any attempt to distribute, publish or sell the program could be made only with the permission or tolerance of the copyright and trademark owner. There is a third category of game wherein the game itself is in the public domain, but playing equipment is sold under a trademark. Thus, while no one has any rights to three-dimensional tic-tac-toe, the manufacturer who sells sets for playing three-dimensional tic-tac-toe under a trademark has the right to prevent you from distributing a computer game with the same name. So, you are free to program and even sell three-dimensional tic-tac-toe, but you will have to make up your own name for it.

There are also practical problems in

choosing a game. The game you select should not only be free of serious legal complications, it should also be complex enough to be challenging, yet simple enough to be implemented with the hardware and software at your disposal (taking account of your own programming ability and free time). If you are clever enough, you can choose an extremely complex game like chess or Go. If you are a novice programmer with only a small programmable calculator, you might want to begin with something simple like tic-tac-toe.

Since my own equipment (A SOL-20 computer with 16 K of programmable memory, video monitor, Teletype, two cassette drives, BASIC and assembler languages) and my own programming ability both fall somewhere between the two extremes, I sought a moderately difficult game to program.

The game I selected is called "Reversi." According to the Oxford English Dictionary, Reversi was first mentioned in print in the 1880s and its rules were first published in the 1890s; thus the game has long been in the public domain. It is now enjoying a revival because of the marketing of a board and set of playing pieces for the game by Gabriel Industries under that firm's trademark, "Othello," and the publication of a well written book on the game. (See "Othello, a New Ancient Game," October 1977 BYTE, page 60, and the bibliography at the end of this article.)

The rules of the game are simple, but play can be quite complicated. The game is played on an 8 by 8 square board like a standard chess or checkerboard. The players start with a supply of 64 playing pieces, each shaped like a checker piece, but black on one side and white or red on the other. Players take alternate turns. If a player has no legal play, he or she loses his turn. When neither player has a legal play, the game ends.

A play consists of placing a piece on an unoccupied square on the board with the player's color up. Each of the first two plays by each player must be made to one of the four center squares. Thereafter, each player may place a piece on any unoccupied square that will result in the formation of an unbroken line (horizontal, vertical, or diagonal) of pieces, with one of his own pieces on each end and one or more of his opponent's pieces in the middle. The opponent's pieces in the middle are then turned over (see figure 1). At the end of the game, the player with the most pieces showing his color wins.

Strategy for the game can be complex — only the most basic ideas are covered in the

200 page book by Hasegawa mentioned in the bibliography. However, the various writers on the game do agree on some basic points: Corner squares are very valuable because they can never be taken; squares next to corners are dangerous because they can make it possible for one's opponent to take corners. Edge squares are usually valuable because they can be used to force turnovers of large numbers of opponent's pieces in middle squares. Control of strategic squares in the middle of the game is more important than having a substantial material advantage at that time.

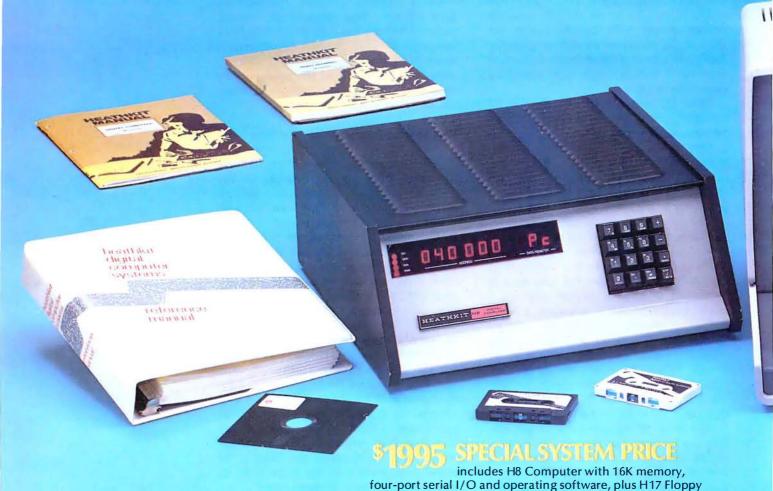
#### Programming Language

After I chose the game, the next step was to choose a programming language for the game. I really had only two choices because of the limitations of my own software library - BASIC or assembler. I chose BASIC because I can program much more easily in BASIC and because BASIC programs are more generally transferable to other computers than are assembler language programs, which will work with only one type of processor. With transferability in mind I made considerable efforts to avoid the use of the fancy special features available in the BASIC interpreters I have, since their use would make transfer a nightmare. Now that I have finished the programming, I am still happy with my choice, though I am now tempted to convert a few of the critical subroutines (which I will discuss later) into assembler language. This conversion would make the program run faster or to allow it to make a deeper analysis of its plays while running at the same speed.

#### Data Structure

Before starting programming I had to choose a suitable data structure. Following methods used in one of the leading computer chess programs (see the article by Gillogly in the bibliography), I decided to represent the standard 8 by 8 chessboard as being surrounded by a border of out-of-bounds squares, thus making a 10 by 10 board. For computer purposes, this augmented board could most naturally be represented as a 10 by 10 array dimensioned by the BASIC statement DIM B(10,10). However, because many BASIC interpreters for microcomputers allow only one-dimensional arrays, and because use of a one-dimensional array simplified my program in various ways, I decided instead to represent the board by a single array of 100 elements: DIM B(100). (See figures 2 and 3.) Another array, DIM E(100), was

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Figure 2: Integer numbers used to identify Reversi squares, These numbers correspond to the elements of one-dimensional 100 element BASIC arrays used by the author in his program to store a given Reversi board pattern.

Figure 3: Initial board position. These values are stored in the one-dimensional 100 element matrix B (see listing 1). They enable the program to tell where the four center squares and out-of-bounds squares are located. (The first four moves of the game must be made to the four center squares.)

			0 13						
3	3	3	3	3	3	3	3	3	3
3	0	0	0	0	0	0	0	0	3
3	0	0	0	0	Ò	0	0	0	3
3	0	0	0	0	0	0	0	0	3
3	0	0	0	2	2	0	0	0	3
3	0	0	0	2	2	0	0	0	3
3	0	0	0	0	0	0	0	0	3
3	0	0	0	0	0	0	0	0	3
3	0	0	0	0	0	0	0	0	3
3	3	3	3	3	3	3	3	3	3

91	92	93	94	95	96	97	98	99	100
81	82	83	84	85	86	87	88	89	90
71	72	73	74	75	76	77	78	79	80
61	62	63	64	65	66	67	68	69	70
51	52	53	54	55	56	57	58	59	60
41	42	43	44	45	46	47	48	49	50
31	32	33	34	35	36	37	38	39	40
21	22	23	24	25	26	27	28	29	30
11	12	13	14	15	16	17	18	19	20
-	2	3	4	5	6	7	8	9	10

0	0	0	0	0	0	0	0	0	0
0	64	-30	10	5	5	Ю	-30	64	0
0	-30	-40	2	2	2	2	-40	64	0
0	10	2	5		1	5	2	-30	0
0	5	2	1	t	1	1	2	5	0
0	5	2	ł	1	1	1	2	5	0
0	10	2	5	1	1	5	2	10	0
0	-30	-40	2	2	2	2	-40	-30	0
0	64	-30	10	5	5	10	-30	64	0
0	0	0	0	0	0	0	0	0	0

Figure 4: Initial strategic values of the board squares stored in the E matrix (see listing 1), used by the program to evaluate it using a minimax strategy. The higher the value, the more desirable the square.

#### Text continued:

declared for storage of the strategic value of each square (see figure 4). Two more 100 element arrays were declared for use in saving different versions of the board while the computer was considering possible plays.

This rather lavish use of storage was made possible by the fact that I was using a 5 K BASIC package in a 16 K memory. If memory were at a premium, it would have been necessary to use a much more complex board representation which could pack each square into a few bits (see the article by Yost in the bibliography) and perhaps necessary to develop a method for storing changes in board positions without storing whole boards. However, if you have the storage you might as well use it.

Several simple techniques could be used to adapt my program for users with less memory space. If a BASIC with strings is available, board squares can be stored in 1 byte string variables rather than in multibyte numerical variables. Alternatively, several board squares could be stored in one numerical variable, using the 1's position for the first square, the 10's position for the second square, etc. If the BASIC package has POKE and PEEK instructions, still another possibility is to store each square as 1 byte in memory with a POKE instruction and retrieve each square as needed with an appropriate PEEK instruction.

#### Program Structure

Having chosen the data structure, I next had to choose a program structure. Just as I chose a simple data structure so that it would be easily adaptable to many types of games, I selected what I hoped would be a very adaptable program structure. In designing the program structure, I drew upon

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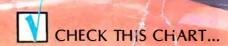
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the rich body of published descriptions of chess playing programs on the theory that a program structure capable of supporting a chess game should be adequate for most simpler board games. (See the computer chess material listed in the bibliography.)

The program structure consists of the following parts which will be analyzed in turn: the main game control routine and subroutines for initialization; board display; move input; legal move checking; legal move generating; computer move selection; and board evaluation. The following discussion will consider each of these, since each typifies a routine needed for almost any board program.

First I'll discuss the main game control procedure. This procedure must first call the subroutine that gives initial values to the board squares and to the board evaluation array. Then it must display the board on the video screen or paint it on the Teletype and ask Black to make the first move. It must call the appropriate subroutine to check each move made for legality, and must terminate the game and declare the score if there are no legal moves. If the user wants the computer to make a play, it must call the subroutine that selects a move for the computer.

The board initialization routine is the simplest: Since the board is empty at the start of the game, it is filled with zeroes, except for the four center squares that must be covered in the first four moves. The out-ofbounds squares are filled with threes (see figure 3). If this were a game such as checkers, which starts with pieces on the board, they would have to be indicated by assigning appropriate initial values for the occupied squares. The strategic value of each square (high for corner squares, low for center squares, negative for next to corner squares, etc) is also entered by the initialization subroutine into the evaluation array (see figure 4).

Next comes the board display routine. Here a simple Teletype oriented printout of the 8 by 8 board was chosen. It would have been more elegant and little more trouble to use POKE commands to directly alter squares on a board displayed on the video monitor, and to represent the pieces with good-looking symbols from my character generator, but I decided to forego these luxury features in the interests of program portability. I also made an effort to limit each display frame to 15 lines so it would not disappear off the top of a 16 line video display monitor.

Before a player is asked to move, the computer must see if that player has any legal moves. This is done by a subroutine that checks for the existence of a legal move. It first searches for an empty square; if it finds one, it checks to see if there is an adjacent square occupied by an opponent. The flattening of the two-dimensional board into one dimension causes adjacent squares to be in positions that are +1, +11. +10, +9, -1, -11, -10, or -9 squares away from the square in question (see figure 2). These adjacent squares are checked in turn. If a square is found that is occupied by an opponent, the search continues in the same direction as long as more opponent's pieces are found. When the first square that does not have an opponent's piece is found, it is examined. If it contains one of the player's pieces, the move is legal; if it is empty or out-of-bounds, the move is illegal. This search process is continued until a legal move is found, or it is established that there is no legal move. Modifications of this search routine will work for games anywhere in the range between tic-tac-toe and chess, inclusively.

The next routine used is the input routine. I decided to ask the user to input two numbers, giving the x and v coordinates of the square to which the player wishes to move. I avoided alphabetic input since I wanted the program to work for BASIC without string variables. I also provided that the input of the coordinates (0,0) would be a signal that the user wants the computer to make the next move. Both approaches can be used for almost any board game.

Once a play is entered, the next step is to see if it is legal. If so, the computer must make the play and change the color of any pieces turned over by the play. If it is not legal, the computer must ask the player to try another play. The routine used to check and execute the move is very similar to that mentioned earlier for checking the legality of moves. However, unlike the legal move routine, the routine cannot stop after finding that a play allows turnovers in one direction, but must continue to make all turnovers in all directions the player is entitled to.

Some moves may affect the strategic value of board squares. For instance if a piece is placed in a corner, the squares next to that corner no longer are dangerous, so their values in the evaluation array must be changed from highly negative values to slightly positive. This is the only change in evaluation values made during the running of the present program. Undoubtedly it could be improved by introducing a number of other changes reflecting particular board configurations and the possibility that a square might have different values for

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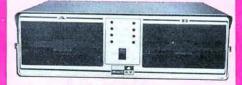
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Black and White in some circumstances. Chess playing programs often have entirely separate evaluation routines for beginning, middle and end game positions.

Finally come the most complicated and interesting subroutines, those for choosing a move for the computer. These use an approach suggested by Shannon in his classic article, an approach later refined by numerous other researchers (see the bibliography). This is the minimax algorithm. Assume that the computer is to make a play for White. It generates all legal moves for White (using the legal move checking procedure discussed above). As each legal move is generated, the computer considers all possible replies by Black. An evaluation routine is called to calculate the strategic value to Black of the board position after Black has played. The minimax strategy calls for the computer to select that legal play for White that minimizes the maximum value of the response Black can make.

For instance, suppose White has two legal plays, and that for the first play Black may make reply A with value to Black of 80, or reply B with value 90. For White's other possible move, Black may make reply C with value to Black of 100, or reply D with value 50 (see figure 5). Using the minimax strategy, White will choose the first move. This ensures that even if Black makes his best reply, he cannot achieve a board position worth more than 90 evaluation points.

This procedure can be extended to any depth. However, the number of moves to be evaluated, and consequently the computer time needed, rises at an astronomical rate. In the middle game in chess, each side may have 50 legal moves. This means that the complexity of search is of the order of 50<sup>n</sup>, where n represents the depth of the search. This is a very large number even for a relatively shallow search, which may explain why world championship computer chess matches are usually won by very large and fast computers. In Reversi there is an average of approximately 8 possible legal plays per turn. This means that

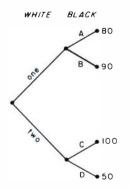


Figure 5: Minimax strategy tree, showing alpha-beta pruning. Minimax is a game theory strategy in which the object is to minimize the value of the opponent's maximum response. In this illustration, White has two moves to choose from: move one enables Black to counter with moves having strategic values of 80 or 90 (the higher the number, the better). Move two, on the other hand, enables Black to respond with moves having values of 50 or 100. Move one is the preferable move for White, since it minimizes Black's maximum response to 90, rather than 100. It is not necessary for the computer, playing the role of White, to analyze the move two branch any further, since it has already been eliminated by the minimax strategy. That branch can therefore be pruned to save computing time.

for a search of depth 2 (ie: to consider all possible moves by White and all possible replies by Black) 64 final board positions would have to be evaluated. A search of depth 4 would require 2796 evaluations.

Computer chess programmers have adopted a number of tricks to speed up the search process. Many of these tricks are adaptable to other types of board games; one of them is used here. This is what artificial intelligence specialists call alpha-beta pruning. A simple example may be given. Consider again the situation mentioned above, in which White has two legal plays. For play one, Black may make play A with value 90 or play B with value 80. For play two, Black may make play C with value 100 or play D with value 50 (see figure 5). Suppose the computer evaluates play one first. It discovers that the best that Black can do if White makes play one is to achieve a 90 point position. Now the computer starts to evaluate White's play two. It finds that Black has reply C which gives it a 100 point position. It need consider no further replies to play two, since it already knows enough to realize that play two is inferior to play one under the minimax approach, ie: Black has at least one reply to play two which is better for Black and hence worse for White than any of Black's replies to play one.

Another important method used for speeding the operation of chess programs, but not yet incorporated in my Reversi program, is that of saving particularly good moves (or particularly harmful replies by an opponent) and trying them in other situations. Thus Black may have a reply that is extremely damaging for almost any move White makes, plus a number of weaker replies. It pays to check Black's most powerful replies to previously checked White moves first, since a good reply to one move is often a good reply to other moves.

A sure way to speed up evaluations substantially and allow a deeper search is to use a compiled rather than interpreted language or to rewrite the program (or at least the move selection strategy) in assembler language. Again it is instructive to note that most championship chess programs are written in assembler language to obtain an extra edge in the depth of search possible under the time limits enforced in chess tournaments.

Once a game program is up and working, the most interesting point for further effort is to try to improve the program's strategy. It certainly helps to be a good player of the game, or at least to have read some background material on the theory of play. One ingenious method sometimes

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```
Listing 1: BASIC program for playing the game of Reversi.
       REM **** REVERSI ****
1
       REM ALL REMARKS MAY BE OMITTED TO SAVE MEMORY
50
       REM VARIABLES
       REM A(100) - FOR SAVING BOARD
55
       REM B(100) - BOARD
       REM C(100) - FOR SAVING BOARD
62
       REM D(8) - DISTANCE TO NEXT SQUARE IN 8 DIRECTIONS
63
       REM E(100) - VALUE OF BOARD SQUARES
64
65
       REM F - VALUE OF OPPONENT'S BEST REPLY TO
       REM COMPUTER'S BEST PLAY
67
       REM G - VALUE OF OPPONENT'S BEST REPLY TO
       REM COMPUTER'S CURRENT PLAY
       REM H - VALUE OF OPPONENT'S CURRENT REPLY
69
       REMI - NOT USED
70
       REM J, K, L – COUNTERS
REM M – PLAY
71
74
       REM N - COUNTER
75
76
       REM O - NOT USED
       REM P - PLAYER, BLACK=-1, WHITE=1
77
       REM Q - TOTAL MOVES
78
79
       REMR, S - NOT USED
       REM T - LOGICAL VALUE, TRUE=1, FALSE=0
REM U - COUNTER
REM V, W - TO SAVE PLAY
REM Z - COUNTER
80
81
82
84
       DIM A (100)
105
110
       DIM B(100)
112
       DIM C(100)
       DIM D(8)
113
114
       DIM E(100)
115
       REM RANDOMIZE
       REM IF YOUR COMPUTER HAS A RANDOMIZE COMMAND, SUBSTITUTE
118
       REM IT FOR LINE 115 AND OMIT LINES 118 THROUGH 150 PRINT "TYPE A NUMBER BETWEEN 100 AND 1000":
119
123
       INPUT N
125
130
       IF N<100 THEN 123
       IF N>1000 THEN 123
PRINT "RANDOMIZING"
135
137
       FOR J=1 TO N
140
145
          LET Z=RND(0)
       NEXT J
150
171
       LET D(1)=1
172
       LET D(2)=11
       LET D(3)=10
173
       LET D(4)=9
174
175
       LET D(5) = -1
176
       LET D(6) = -11
177
       LET D(7) = -10
       LET D(8) = -9
178
       REM INITIALIZE
182
       GOSUB 9000
185
       REM DISPLAY BOARD
190
       GOSUB 8000
200
205
       IF Q<5 THEN 295
       REM CHECK FOR LEGAL PLAY
210
215
       GOSUB 1300
       IF T=1 THEN 295
220
225
       LET T3=T3+1
        IF T3<2 THEN 254
226
       PRINT "THE GAME IS OVER"
228
       LET N≃∩
229
230
        LET J=0
231
        FOR Z=12 TO 89
232
           IF B(Z)=-1 THEN 239
           IF B(Z) <> 1 THEN 244
234
          LET J=J+1
235
           GOTO 244
237
239
           LET N=N+1
       NEXT Z
PRINT "BLACK HAS ";N;", WHITE HAS ";J;" PIECES"
244
245
        PRINT "DO YOU WANT TO PLAY AGAIN (0=NO, 1=YES)";
248
       INPUT T
250
        RESTORE
251
        IF T=1 THEN 185
252
        GOTO 9998
253
254
        PRINT
       IF P=1 THEN 260
PRINT "BLACK HAS NO PLAY, LOSES TURN"
255
256
       GOTO 950
PRINT 'WHITE HAS NO PLAY, LOSES TURN'
258
260
        GOTO 950
270
295
        GOSUB 1100
        IF M<> 1 THEN 500
380
```

```
395
       REM COMPUTER PLAYS
400
       REM FIRST 4 PLAYS
402
       LET M=45
403
       IF B(M)=2 THEN 540
404
       LET M=M+1
       GOTO 403
405
430
       GOSUB 3000
      REM CHECK PLAY
450
       IF M<1 THEN 800
500
       IF M>100 THEN 800
510
520
       IF Q>4 THEN 600
      IF B(M) <>2 THEN 800
530
540
       LET B(M)=P
550
       GOTO 830
600
       GOSUB 1400
640
      IF T<>0 THEN 950
       PRINT "ILLEGAL PLAY"
800
      GOTO 200
820
       I ET Q=Q+1
830
```

Listing 1 continued on page 78

IET P=-P

950

used in order to find better parameters for evaluation routines is to select a variety of values for use in these routines and to have the program run a tournament against itself using the different values. The winning values are then incorporated in the revised and improved program.

I hope this description and the listing of the Reversi program will inspire readers to make their own game playing programs. The books about board games mentioned in the bibliography list over 700 games, so there are plenty of games waiting to be programmed.

### **BIBLIOGRAPHY**

- 1. Bell, R C, Board and Table Games From Many Civilizations, volumes 1 and 2, Oxford University Press, London, 1960 and 1969.
- 2. Gardner, Martin, Martin Gardner's New Mathematical Diversions from Scientific American, Simon and Schuster, New York, 1966, pages 75 thru 81.
- 3. Gillogly, J J, "The Technology Chess Program," Artificial Intelligence, volume 3, 1972, pages 145 thru 163
- 4. Hasegawa, Goro, with Brady, Maxine, How to Win at Othello, Jove Publications, New York, 1977.
- 5. Levy, David, Chess and Computers, Computer Science Press, Woodland Hills CA, 1976.
- 6. Murray, HJR, A History of Board Games Other Than Chess, Oxford University Press, London, 1952.
- 7. Newborn, Monroe, Computer Chess, Academic Press, New York, 1975.
- 8. Shannon, CE, "Programming a Computer to Play Chess," Philosophy Magazine, series 7, volume 41, March 1950, pages 256 thru 275.
- 9. Yost, R R Jr, "Computer Models for Board Games," BYTE, January 1977, pages 78 thru

390

IF Q>4 THEN 430



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Listino	71, continued:	3860	LET M=M+1	
		3865 3870	IF M<90 THEN 3752 LET M=W	
955 960	IF E(M) <> 64 THEN 200 GOSUB 5000	3875	PRINT	
970 1099	GOTO 200 REM * GET A PLAY *	3880 3899	RETURN REM * CHECK OPPONENT'S REPLIES *	
1100	PRINT	3900	LET H=-99999	
1101 1115	PRINT "IF YOU WANT THE COMPUTER TO PLAY, ENTER 0,0" IF P=1 THEN 1140	3920 3925	FOR Z=12 TO 89 LET A(Z)=B(Z)	
1120	PRINT "BLACK";	3930	NEXT Z	
1130 1140	GOTO 1145 PRINT "WHITE";	3935 3940	LET P=_P LET V=M	
1145	PRINT "'S TURN, ENTER X,Y";	3950	LET M=12	
1150 1160	INPUT X,Y LET M=X+1+10*Y	3970 3980	GOSUB 1400 IF T=0 THEN 4080	
1170	RETURN	3990	GOSUB 4130	
1299 1300	REM * CHECK FOR LEGAL PLAY * LET T=1	4000 4014	IF G < F THEN 4030 REM FORGET THIS PLAY	
1301	PRINT "CHECKING";	4016	LET H=G	
1302 1310	LET M=1 IF U<4 THEN 1318	4020 4030	GOTO 4100 IF G < H THEN 4050	
1316	LET U=0	4035	REM FOUND MORE HARMFUL REPLY	
1317 1318	PRINT "."; LET U=U+1	4040 4050	LET H=G FOR Z=12 TO 89	
1320	IF B(M) <>0 THEN 1390	4060	LETB(Z)=A(Z)	
1330 1340	LET N=1 LET J=D(N)	4070 4080	NEXT Z LET M=M+1	
1350	IF B(M+J) <> –P THEN 1385	4090	IF M<90 THEN 3970	
1370 1380	LET K=M+J+J IF B(K)=3 THEN 1385	4100 4105	LET M=V LET P=_P	
1381	IF B(K)=0 THEN 1385	4110	RETURN	
1382	IF B(K)=P THEN 1394	4129 4130	REM * EVALUATE * LET G=0	
1383 1384	LET K=K+J GOTO 1380	4140	LET Z=12	
1385 1386	LET N=N+1	4150 4160	IF B(Z)=P THEN 4190 IF B(Z)=0 THEN 4300	
1390	IF N<9 THEN 1340 LET M=M+1	4170	LET G=G-E(Z)	
1391	IF M<90 THEN 1310	4180 4190	GOTO 4300 LET G=G+E(Z)	
1392 1394	LET T=0 RETURN	4195	REM FORGET THIS PLAY	
1399	REM * MAKE A PLAY *	4200 4300	IF G>F THEN 4500 LET Z=Z+1	
1400 1410	LET T=0 IF B(M)=0 THEN 1430	4400	IF Z<90 THEN 4150	
1420	RETURN	4500 4999	RETURN REM ADJUST CORNER VALUES	
1430 1440	LET N=1 LET J=D(N)	5000	IF M<>12 THEN 5100	
1444	IF B(M+J) <>-P THEN 1700	5010 5020	LET E(13)≃5 LET E(22)=5	
1470 1480	LET K=M+J+J IF B(K)=3 THEN 1700	5030	LET E(23)=5	
1490	IF B(K)=0 THEN 1700	5100 5110	IF M <> 19 THEN 5200 LET E(18)=5	
1500 1510	IF B(K)=P THEN 1530 LET K=K+J	5120	LET E(28)=5	
1515	GOTO 1480	5130 5200	LET E(29)=5 IF M<>82 THEN 5300	
1530 1531	LET T=1 LET L=M	5210	LET E(72)=5	
1532	IF L=K THEN 1700	5220 5230	LET E(73)=5 LET E(83)=5	
1533 1534	LET B(L)=P LET L=L+J	5300	IF M<>89 THEN 5400	
1535	GOTO 1532	5310 5320	LET E(77)=5 LET E(78)=5	
1700 1705	LET N=N+1 IF N < 9 THEN 1440	5330	LET E(88)=5	
1710	RETURN	5400 7999	RETURN REM DISPLAY THE BOARD	
2999 3000	REM CHECK COMPUTER'S PLAYS * PRINT 'THINKING'';	8000	PRINT " 1 2 3 4 5 6 7	8"
3680	LET F=9999	8200 8300	FOR Y=8 TO 1 STEP -1 PRINT Y: ":	
3690 3700	FOR Z=12 TO 89 LET C(Z)=B(Z)	8400	FOR X=1 TO 8	
3710	NEXT Z	8500 8550	IF B(X+1+Y*10)=1 THEN 8700 IF B(X+1+Y*10)=—1 THEN 8900	
3750 3752	LET M=12 IF U<4 THEN 3759	8600	PRINT "-";	
3753	LET U=0	8650 8700	GOTO 8990 PRINT "W";	
3755 3759	PRINT "."; LET U=U+1	8800	GOTO 8990	
3770	GOSUB 1400	8900 8990	PRINT " B "; NEXT X	
3780 3790	IF T=0 THEN 3860 GOSUB 3900	8995	PRINTY	
3800	IF H > F THEN 3840 IF H < F THEN 3810	8996 8997	NEXT Y PRINT " 1 2 3 4 5 6 7	8"
3802 3803	REM CHOOSE RANDOM OF EQUAL PLAYS	8998	RETURN	U
3804 3806	LET Z=RND(0) IF Z>0.7 THEN 3840	8999 9000	REM * INITIALIZE * FOR N=11 TO 90	
3810	LET F=H	9050	READ E(N)	
3815 3820	REM FOUND BETTER MOVE LET W=V	9060 9066	NEXT N FOR N=1 TO 100	
3840	FOR Z=12 TO 89	9068	LETB(N)=0	
3850 3855	LET B(Z)=C(Z) NEXT Z	9070 9074	NEXT N FOR N=1 TO 10	
0000	, =	007-		

```
9076
                 LET B (N)=3
9078
                 LET B(90+N)=3
                 LET B(10*N-9)=3
9080
                 LET B(10*N)=3
9082
9085
           NEXT N
           LET B(45)=2
9087
9088
           LET B(46)=2
9089
           LET B(55)=2
9090
           LET B(56)=2
9172
           LET U=5
           LET Q=1
9186
9190
           LET P=-1
9191
           RETURN
           DATA 0, 64, -30, 10, 5, 5, 10, -30, 64, 0
DATA 0, -30, -40, 2, 2, 2, 2, -40, -30, 0
DATA 0, 10, 2, 5, 1, 1, 5, 2, 10, 0
DATA 0, 5, 2, 1, 1, 1, 1, 2, 5, 0
DATA 0, 5, 2, 1, 1, 1, 1, 2, 5, 0
9220
9222
9224
9226
9228
           DATA 0,10,2,5,1,1,5,2,10,0
DATA 0,-30,-40,2,2,2,2,-40,-30,0
DATA 0,64,-30,10,5,5,10,-30,64,0
9230
9234
9236
9998
           STOP
9999
```

# Listing 2: Sample output of the program in listing 1.

IF YOU WANT THE COMPUTER TO PLAY,

BNIER O, U
BLACK'S TURN, ENTER X, Y
23,4

1 2 3 4 5 6 7 8

8 - - - - - - - 8

7 - - - - - - - - 6

5 - - W B - - - 5

4 - B B B - - 4

3 - - - - - - - - 3

2 - - - - - - - - 2

1 1 2 3 4 5 6 7 8



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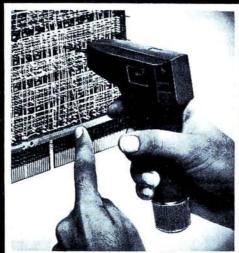
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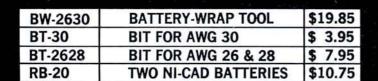
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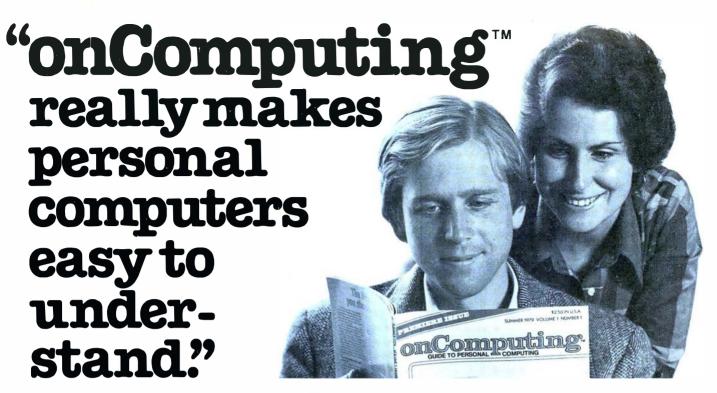


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# BYTE News

HOME BUS STANDARD BEING DEVELOPED: Stanford Research Institute, Menlo Park California, and the Home Bus Standard Association, Washington DC, are conducting a feasibility study to develop a home bus standard. It will allow home electronic appliances to interact with one another over regular home wiring.

TI MICROCOMPUTER PICTURE IN TRANSITION: Although Texas Instruments finally introduced its 99/4 personal computer system in June, it is expected to be an interim product. TI failed to get FCC approval for the original version and also ran into processor production difficulties which forced the introduction of a high-priced personal computer system (\$1150). TI is still pursuing a rule change request with the FCC and the development of its 9985 stripped down version of its 9940 16-bit processor. TI hopes to then introduce a personal computer system for under \$500 which connects to a standard color-television receiver.

TI has also expanded its small business computer (99/7) marketing efforts. The 99/7, which starts at \$5000, will be marketed by Moore Business Forms, through over 750 sales offices as well as through computer stores and TI's own retail outlets.

AT&T TESTING HOME INFORMATION SYTSTEMS: American Telephone and Telegraph Co has undertaken customer acceptance tests of several home information systems similar to the Viewdata system. Among the systems AT&T will test are the Knight-Ridder system (reported in the August BYTE News), a system developed by McDonnell Douglas, and a Bell Labs developed system.

The Knight-Ridder system test will take two years and involve 150 to 200 families in Miami, Florida. The system will transmit news, sports results, weather, and public information. The McDonnell Douglas system will be tested in Kansas City, Michigan, and New York. It will allow users to call a special number, key a special code on a push button phone, and receive the requested information in audible form. No details are as yet available on the Bell system.

HEATH ACQUIRED BY ZENITH: Heath Co, a leader in the consumer electronic kit business, was sold by Schlumberger Ltd to Zenith Radio Corp for \$64.5 million. In 1977 Heath introduced two personal computer kit systems, the H-8 which is based on the 8080 processor, and the H-11 which is based on the Digital Equipment Corp (DEC) LSI-11. Heath entered into a three-year contract with DEC. Heath also entered the adult-education market. Heath sales for the last several years have declined at a 3 to 5% rate.

Zenith, a manufacturer of radio and television receivers, has been diversifying. They have been making video monitors for terminals and cable-television converters. Immediately after the acquisition was completed, Heath announced an aggressive marketing program to sell assembled computer systems through a network of distributors and original equipment manufacturers.

8-INCH WINCHESTER DISK MARKET STILL TRYING TO GET OFF THE GROUND: Despite the publicity and advertising, only one manufacturer is presently shipping production quantities of 8-inch hard-disk drives. The company is International Memories Inc (IMI), which is currently shipping limited quantities of their 11 M byte drive at \$1775. IMI will introduce a 20 M byte unit early next year, and expects to reduce the price on the 11 M byte unit 10 to 20% by midyear as production is increased.

Micropolis expects to start shipping limited quantities of its 27 and 45 M byte drives soon. The introductory price for the 45 M byte drive is \$2688 and should drop to under \$2000 by midyear. Shugart has not yet revealed its marketing plans for its 8-inch rigid drive.

COMPUTERIZED PORTABLE HOME ENTERTAINMENT CENTER SHOWN: Sharp Electronics recently showed a portable unit, about the size of a typical portable stereo system, which included the following: a television receiver with a 4.5 inch screen, an AM/FM radio, a stereo cassette, a digital clock, a calculator, and a personal computer. The computer's 48-key keyboard slides into the unit for storage, when it becomes necessary to transport the unit. The video screen is used for display, and the audio cassette recorder is for data and program storage. It uses BASIC, has graphics capabilities, and is expandable. No immediate marketing plans have as yet been announced.

LOOK IT UP IN THE DATA DICTIONARY: Data base management (DBM) systems are growing in size, sophistication, and popularity. Users, therefore, need more advanced tools for defining and keeping track of their data resources. Data dictionaries have been developed to do this and to augment existing data base management systems. The data dictionary is integrated into the data base management system's nucleus and utilities as well as managing the data resources.

On large computer systems such as the large IBM mainframes, the problem of managing these systems is acute, and data dictionaries are popular here. However, data dictionaries are now being developed for minicomputer systems as they increase in complexity. Someday you can expect to see them on microcomputer systems.

IEEE-488 BUS INTERFACING SIMPLIFIED: Now you can interface your computer system to the IEEE-488 bus without a special bus interface. ICS Electronics Corp, San Jose, California, has come up with an easy way of doing it. They have developed a 488-to-RS-232C interface and controller. Just place this device in the line between your terminal and processor and plug your IEEE-488 cable into the device. Now you can program your computer to process data coming from all those instruments with 488 interfaces.

SILICON VALLEY-II DEVELOPING: "Silicon Valley" is the nickname given to the area in California just south of San Francisco that has the highest concentration of integrated circuit manufacturers. A regional shift now appears underway as more and more integrated circuit manufacturers are opening facilities in Texas. Long the stronghold of Texas Instruments, the Dallas and Austin areas have seen the opening of plants by Mostek and Hitachi. Now, Motorola and Advanced Micro Devices are following suit. The desertion of California appears to be due to high operating costs.

GTE TAKES ON VIEWDATA: General Telephone and Electronics Corp has been licensed to offer Viewdata information services in the USA and Canada. Viewdata was developed by the British Post Office, and is a data base information system allowing users to access data on their television receivers via telephone lines.

DUAL-SIDED FLOPPIES STILL IN SHORT SUPPLY: Shugart expects to finally get into quantity production on dual-sided floppy disks by the end of the first quarter of 1980. Presently they are shipping only limited quantities. Originally introduced in early 1977, Shugart did not start shipping until early 1979. Media wear problems caused these delays and has limited production to 100 drives per day at best. Shugart has designed a completely new double-sided head which they expect will cure these problems. However, Shugart has found it necessary to increase the price of the drives. The SA850, an 8-inch drive, in 500-lot quantities will be priced from \$485 to \$580.

FCC COMPLETES RADIO FREQUENCY RADIATION TESTS: The FCC has completed its test of six personal computer systems and will release its data soon. Reportedly, the FCC has found that all but one exceed the interference levels permitted for devices that connect to television receivers (eg, games). The test included the Atari, Apple, PET, Heath, Southwest Technical Products, and Radio Shack systems. Only the Atari system passed. The rest caused excessive radio frequency (RF) radiation interference on nearby television receivers. None of these systems are required to meet the existing regulations. In the meantime, the large numbers of personal computer systems in use are beginning to generate interference complaints.

8080 STILL GOING STRONG: The 8080 microprocessor, introduced by Intel in 1974 and the integrated circuit that started the microprocessor "revolution," is still going great. This is despite improved successors such as the Z80 and 8085. An estimated 500,000 8080As are being made each month, and many purchasers are finding them in short supply. The 8080A is currently being made by five manufacturers. Prices for large quantities have gone back up to the \$3 to 4 range, after they had dipped as low as \$2.75 each in late 1978. Demand for the 8080A is expected to continue strong through mid-1980, and it should continue in production for several more years.

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# Alpha-Beta Pruning

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Get your shears out, and get ready to cut back your game trees, thereby saving both space and time

.....

Sooner or later, almost everyone with a small system gets the idea of programming it to play chess, checkers, or some other two-person board game. Most of us give up before we start because we have no idea how to determine the best move in any given situation. The other aspects of playing a game are generally no problem.

We can see how to represent 64 squares on a board by 64 bytes in memory, each of which contains a code number which might be 3 for Bishop, 6 for King, or 0 for a blank square, and so on. We can see how to write a program for each piece, determining where it can move in a given situation depending upon the rules of the game. For example, a Bishop can move as far as possible in any of four directions, so we have to write a program to search in one direction until it finds a square that is not blank (ie: the corresponding byte does not contain 0, the code for a blank square). If this square is n squares away from where the Bishop is currently positioned, then there are n-1 possible moves that the Bishop can make in that direction. This loop is then repeated, once for each of the four directions.

Finally, we can see how to write a

program that would find all of the pieces on the board, would determine the type of each piece, and would find all possible moves for each piece, according to its type. In this way we could get a list of all of the moves that could be made by one player in any given situation. But to find the best of these defies the low-level intuition that most of us rely upon.

In this article, I will describe a general procedure for programming board games, relying heavily on chess in my examples, but utilizing procedures that can be applied in any board game where you have to "look ahead." The logic is roughly as follows: if I make move X, then my

I. N-R6 dbl ch 2.Q-N7 ch 3. N- B7 mate

Figure 1: Chessboard layout just prior to the conclusion of a famous dramatic ending to a chess game.

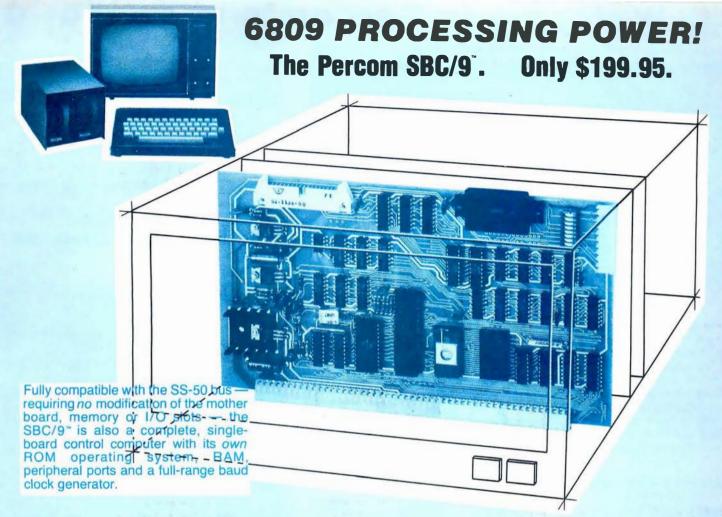
opponent will make move Y; if I make move Z, then my opponent can make move U, which is better for him than move Y, so I shouldn't make move Z; but if I make move W...and so on.

The first illustration will be from a famous dramatic finish to a chess game. This is illustrated in figure 1. White is already far ahead, having a Oueen and a Knight, whereas Black has only a Rook and two pawns. To finish the game quickly, White lets Black capture his Queen, then gives checkmate with his Knight. For those who have forgotten their chess (and also to illustrate what the computer does when it sees this position), the entire finish of the game is illustrated in figure 2 (see page 88).

It is clear that the computer has to perform a complete analysis of the given position in a game; much more complete than that given in either figure 1 or figure 2. For example, look at White's first move: N-R6 double check. In chess terminology, as soon as White makes this move, Black's next move is "forced." There is nothing that Black can do except move K-R1. But what does this mean? Black actually has several moves, but all of the others are illegal because White would be able to capture his King. Specifically:

- If Black plays R-B2 (interposing the Rook), then White plays NxK (capturing the King with his Knight).
- If Black plays PxN (capturing the Knight), then White plays QxK

Text continued on page 90



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on 77-track disks.

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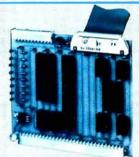
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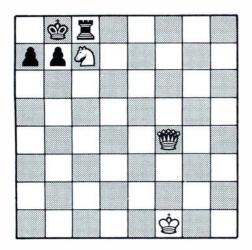
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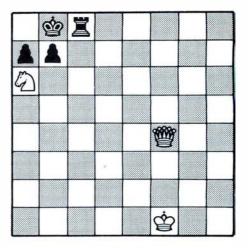
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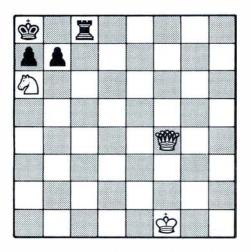
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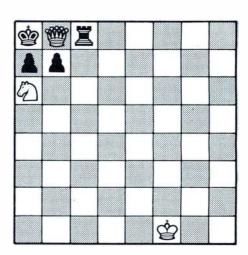
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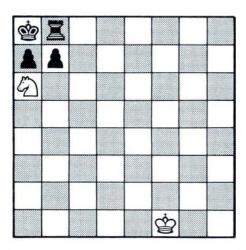


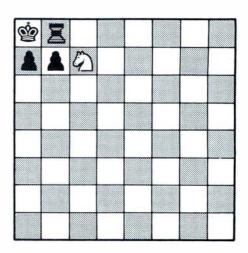
KNIGHT. BLACK IS FORCED......





....TO MOVE INTO THE CORNER, AND......NOW WHITE SACRIFICES THE QUEEN.





THERE IS NOTHING THAT BLACK CAN DO BUT .... WHEREUPON WHITE GIVES CHECKMATE. TO TAKE THE QUEEN.....

Figure 2: The sequence of moves that White makes to capture Black's King . . . CHECKMATE!

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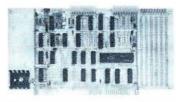
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Text continued:

(capturing the King with his Queen).

 If Black plays anything else, then White can play either NxK or OxK.

You might argue that the computer does not need to perform all of this analysis, because there is an old rule that states when you are in double check, you have to move your King—there is no other way out. This is perfectly true, but how do you know that you are in double check in the first place, without a similar analysis? It is easier to run through all of the moves, as described above, and verify that, in every case but one, Black's King would be captured. Additionally, look at the next position. Black does play K-R1, and now White plays Q-N8 check. This time Black is not in double check, but his next move is still forced, and Black's King can be captured in two different ways if he does not make the move he is forced to make. Specifically:

• If Black plays KxQ (capturing with

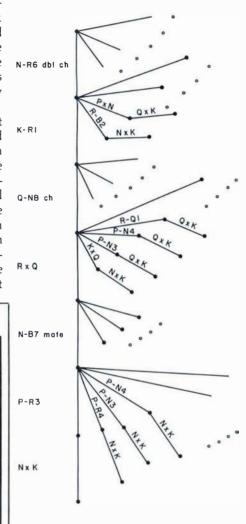
- the King instead of with the Rook), then White plays NxK.
- If Black plays P-N3 (or any other move than RxQ or KxQ), then White plays QxK.

When Black plays RxQ, White plays N-B7, which is checkmate. But the computer's job is still not finished. How can you tell that this is checkmate? The only way to tell is to look at all of Black's possible moves and make sure that White can capture Black's King in each case. From the computer's point of view, the game is never over until the King is actually captured.

A diagram of the analyses that have been carried out so far would look like figure 3. Each point (dot) in this figure denotes a position of the board. The lines between board positions denote moves. The actual moves that have been made are at the left, but there are other moves which were not taken. In Black's case, each of these led to Black's King being captured. In White's case, they were simply other possible moves that

were not made because White has a way, as shown, of winning the game. This diagram is called a *game tree*.

**Figure 3:** An illustration of the game tree diagram. A complete game tree diagram would enumerate all possible moves so that the optimum move could be chosen.



The game tree of figure 3 is a bit hard to visualize because there are so many possible moves. Therefore, in order to illustrate the processing of game trees by computer, I have drawn a simplified game tree in figure 4. In this game tree there are only two possible moves for White at each point, and only two possible moves for Black. This will almost never be the case in a real game situation; here it allows the tree to fit easily on one piece of paper, so that it can be readily visualized. Like any tree, this tree has leaves, branches, and a root; in this case A, B, C...through P are the leaves, 5 is the root, and all of the other nodes are branches.

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In any game tree, the first question vou must ask is whether or not it is complete. A game tree is complete if every one of its leaves corresponds to the end of the game. In figure 3, all leaves that are shown correspond to the end of the game (the King is captured), but there are some other leaves, not shown, that do not have this property. If a game tree is complete, it should be obvious that we can tell who ought to win, and the winning strategies. Suppose that the leaves B, L, A, C, and K represent a win for Black, and all other leaves represent a win for White. White (moving first) can win by moving to branch 4. Black will move to branch 1. and White now moves to branch U, winning regardless of Black's move (moving to leaf I or J).

Furthermore, this is the only winning strategy for White. If White's first move is to branch 3, then Black moves to branch Y, and Black now wins, no matter what White does (moving to branch Q or R). If White moves to branch V on his second move, then Black wins by moving to either K or L. This state of affairs will not always hold. There are positions in which White can win no matter what his first move is (suppose, for example, Black's winning positions were B, L, A, E, K...figure it out for yourself). There are also positions in which White cannot win, no matter what his first move is. If Black's winning positions are B, L, I, C, and K, and White starts by moving to 3, then Black moves to Y, whereas if White starts by moving to 4, Black moves to 1. In either case, Black can eventually

Now suppose that the game tree is not complete. This is presumably because it is so large that you would run out of memory if you tried to store the complete tree, so you would only store part of it. In this case it is still quite possible that there is a winning strategy for one player or the other. Suppose that Black's winning positions are B, L, I, C, and K, as in the last of the three examples above, but the other leaves of the tree are not winning positions for either White or Black. (In fact, these are not really leaves; if I had room to keep more of this game tree, I could consider further moves beyond each of these points.) It is clear that Black can still

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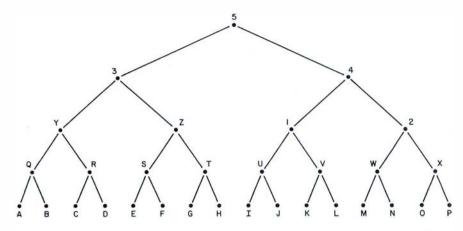


Figure 4: Simplified version of the game tree that assumes each player has only two possible moves.

win, no matter what White does, and for exactly the same reason as before.

In most cases, however, the game tree will be far from complete. In chess, for example, you might be in the middle of the game, and neither White nor Black can win the game in the next twenty-five moves. You can

still use game trees, but in a slightly different way. The first thing to do is code your knowledge as to when one position is better than another in terms of material gained and lost. For example, if White captures a pawn and loses a Bishop, or captures a Knight and loses a Rook, then Black

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is obviously ahead. But what if White captures the Queen and loses both Rooks? Is that good or bad? What if White captures two pawns, but loses a Knight?

The usual pawn and piece values are: Queen = nine pawns, Rook = five pawns, Bishop and Knight are three pawns apiece. Greatly improved tables of values have been constructed; table 1 is a reprint of values (in abridged form) from R M Hyatt, the author of a chess program called BLITZ. Through the use of such a table, you can derive, for any position, a total numerical score that represents the value of that position. The function which computes this score is called the *evaluation function* corresponding to the given table.

You might think that with such an evaluation function there would be no further need for game trees. You could simply try all of the possible moves, and then choose the one with the largest value of the evaluation function. This, however, would lead to a very bad chess-playing program, rather like someone who had been playing for only a few months. The reason, of course, is that the evaluation function is only an approximation. It is very easy to lose a piece after you have made what seems to be the best move according to your evaluation function, because you have not looked far enough ahead. The best game programs use a combination of game trees and an evaluation function, together with the special technique of alpha-beta pruning, the subject of this article.

Once more I will set up an artificially small and simple game tree, in order to illustrate how this works. Consider the game tree of figure 5, which is exactly the same as the game tree of figure 4 except that a value of the evaluation function at each of the leaves of the tree has been specified. The evaluation function at the branches has not been specified, because this will be computed in a different way. Specifically, look at the leaves A and B. Since the value of the function is 26 at A, and 37 at B, you can conclude that, since it is Black's turn to play, at the branch Q Black will play to branch A. (This move assumes that the higher the value of the evaluation function, the better the position is for White, and the worse

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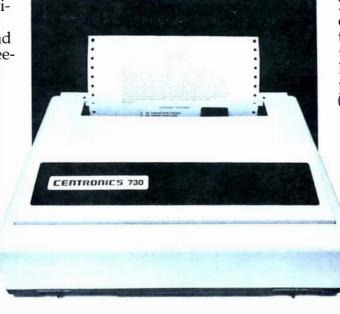
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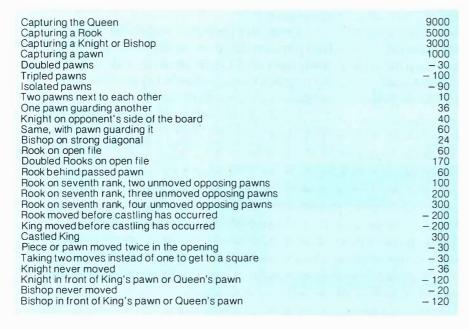
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the position is for Black. Black will make the move that gives the *lower* evaluation function value. Again, this is only an approximation, but it becomes a better one as the tree gets larger.)

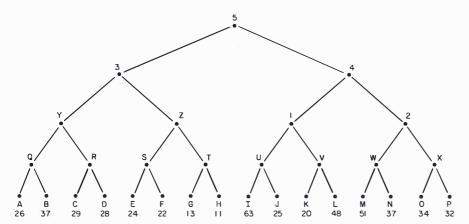
In the same way you may conclude that, since it is Black's turn to move, at branch R Black will move to branch D, since 28 is less than 29. Let us go back to branch Y. Here it is White's turn to play, and White wants to make the move that results in the *highest* value of the evaluation function. Does this mean 37, the largest of the four values at A, B, C, and D? No, it does not. If White plays

to Q, Black will play to A. If White plays to R, Black will play to D. Therefore, you should compare only A and D. Since 28 is larger than 26, White should play from Y to R.

This potential source of confusion suggests that you should mark the nodes Q, R, S, T, and so on, with the *expected* evaluation function values (ie: the values that would ensue if Black makes the best play, in a highly approximate sense, on the next move). In this case Q would receive the value 26, R would receive the value 28, and in general each node would receive the *lowest* of the values of the nodes below it. This, of course,



**Table 1:** An abbreviated table of the approximate numerical values assigned to a variety of possible moves.



**Figure 5:** Same game tree as that shown in figure 4, along with a specification of the evaluation function at each leaf of the tree.

is only because it is Black's turn to move. On the next level up, it is White's turn to play, and you can mark each of the nodes Y, Z, 1, and 2 with the *highest* of the values of the nodes below it, because White now wants to make the ultimate value of the evaluation function as large as possible. Continuing this all the way to the top of the tree, you get the situation illustrated in figure 6. The expected value for White at the top of the tree is 25. By following the figure 25 down through the tree, you will see that, at this point in the game, White is expected to move to node 4, Black to reply by moving to node 1, White to then move to U, and Black to play to J.

This does not, of course, have to be what actually happens in the game. Black might be a poor player, and play to node 2 instead of node 1, or Black might discover, upon looking more moves ahead, that node 2 is actually a better play than node 1. This tends to happen in actual games. As you look further ahead (ie: as you consider trees with greater and greater numbers of levels), expected moves at all levels, even the top level, can change.

At this point a very important question is raised: is it really necessary to generate this whole tree? It would be nice to find certain nodes that do not have to be constructed.

Consider the situation at node Z. White has two possible moves: one to node S and one to node T. At node S, White gets a score of at least twenty-two on the next move. Is this a better move for White than the move to node T? To determine the answer, look at node T. The first thing you will see is that if White moves to node T, then Black can move to node G. If Black does that, White ends up with a score of only thirteen. By this point you already know what White should not move to node T because he can do better by moving to node S.

Now look at node H. If White moves to node T, then Black could also move to node H, leaving White with a score of eleven. This is a better move for Black than the move to node G. The point is that *this does not matter*. As soon as you look at node G, you know that White should not move to node T. When you are aware of this it does not matter what

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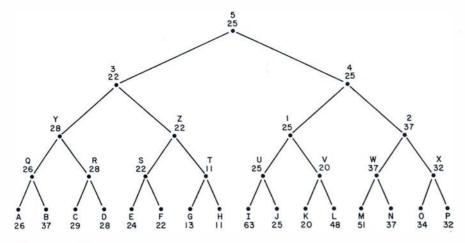


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**Figure 6:** A more informative version of the game tree shown in figures 4 and 5. Here the expected evaluation function values are shown at each of the nodes.

score node H has—in fact, you do not have to generate node H at all. This kind of logic can be applied to either

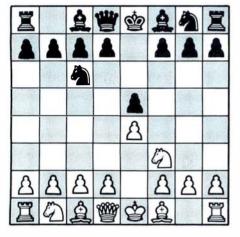


Figure 7: A simple example to illustrate the principle of alpha-beta pruning. It is now White's turn to move. An obvious bad move would be NxP. Black's reply would be NxN, and White would have captured a pawn but lost a Knight.

player; it is called alpha cutoff in a case like this, where it is White's original move that is being considered (as at node Z here). It is called beta cutoff when it is Black's original move that is being considered. Alphabeta pruning is the combination of alpha cutoff and beta cutoff within the general framework described here.

For an example of beta cutoff, look at node 4. It is Black's turn to move. By considering node 1 and all the nodes beneath it (that is, nodes U, V, I, J, K, and L), you will note that Black can eventually expect a score of twenty-five if he moves to node 1. The next question is whether or not a move to node 2 would be any better for Black, Suppose Black moves to node 2, and that White moves to node W. By analyzing the nodes (M and N) beneath node W, you will find that Black can achieve a score of either fifty-one or thirty-seven. Black would naturally choose thirty-seven, that is, node N. But if that is the best

that Black can do, then the answer to the original question must be no; that is, a move from node 4 to node 2 would not be any better for Black than a move to node 1. Once you know this, it is not necessary to consider node X at all and, more important, you do not have to consider nodes O or P either. In other words, you have pruned not just a single leaf. but a branch with leaves below it.

An informal example of alpha-beta pruning is given in figure 7. Here it is White's turn to move. White has many possible moves, but an obvious bad move for White is NxP. In order to determine that this move is bad, it is not necessary to figure out Black's best move; it is only necessary to note that Black can move NxN. Any other possible moves need not be considered as long as White has any move that does not result in the loss of a piece, and as long as NxP is not really a viable sacrifice.

# Glossary

alpha-beta pruning: In order to guarantee a winning strategy an entire tree search of a complete game tree would be necessary. Alpha-beta pruning is an algorithm devised to optimize the use of game trees by reducing the number of branches needed to be searched.

game tree: A graphic representation of the decision making process involved in a sequence of moves between two opponents. A complete game tree is a representation in which all the terminal nodes correspond to the end of the game.



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# Interfacing the PET to a Line Printer

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# Introduction

From both software and hardware points of view, this article presents a design example for interfacing the 8-bit user port on the Commodore PET 2001 personal computer to an external device. The design example will show how the user port may be used to develop a handshake interface to a line printer. We shall begin with a brief discussion of the programmable features of the user port.

# Peripheral Interface Port

The 8-bit port, described in the PET user manual, is actually a part of the MCS6522 peripheral interface adapter (PIA), manufactured by MOS Technology. The 6522 is a general purpose I/O (input/output) device, configured as two 8-bit I/O ports A and B. It provides handshaking logic associated with parallel data transfers occurring through I/O port A. Counter and timer, and elementary serial I/O logic are associated with the MCS6522 port B. In the PET 2001, most features of port B are reserved for internal use, leaving port A as the only peripheral interface port available to the user.

To the user, the MCS6522 peripheral interface adapter appears as sixteen contiguous memory locations. Table 1 identifies the sixteen ad-

PET Memory Location	Function Provided by the 6522
59456 59457 59458 59459 59460	Output register for I/O port B. Data register for port A with handshake. I/O port B data direction register. I/O port A data direction register. Read timer 1 counter (low-order byte).
59461	Write to timer 1 latch (low-order byte). Read timer 1 counter (high-order byte). Write to timer 1 latch (high-order byte).
59462 59463 59464	Access timer 1 latch (low-order byte).  Access timer 1 latch (low-order byte).  Access timer 1 latch (high-order byte).  Read low-order byte of timer 2 and reset counter interrupt.  Write to low-order byte of timer 2 but do not reset interrupt.
59465	Access high-order byte of timer 2; reset counter interrupt on write.
59466 59467 59468 59469 59470 59471	Serial I/O shift register. Auxiliary control register. Peripheral control register. Interrupt flag register. Interrupt enable register. Data register for I/O port A without handshake.

**Table 1:** Internal registers of the 6522 peripheral interface adapter given in terms of addresses in the PET memory address space. Addresses that are of direct concern to the PET user (for interfacing to port A) are shown in italics.

dressable locations of the 6522. Locations of direct concern to the PET user (for interfacing to port A) are in italic characters.

The characteristics and functions of the interface lines on the peripheral interface port A are determined by the operating mode selected under program control. Two modes of operation may be selected under program control: basic input/output

without handshake, *strobed input/output* with handshake. By selecting the correct operating mode for the data direction register (this may be done using the BASIC statement POKE 59459,X where X = 0 for input and 1 for output), interface lines may be configured to fulfill specific interface requirements. Device strobes may be easily generated by software without utilizing external logic by



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Listing 1: PRINTSCREEN, a program in BASIC which provides a hard copy of any characters displayed on the PET's video display. An image of the text appearing on the screen is sent to the printer. Note that here the program was used to create its own listing. The data transfer rate is about 6 characters per second.

5 REN FILENAME "PRINTSCREEN" 10 REM OUTPUT DATA TO EXTERNAL DEVICE 15 REM HANDSHAKE WITH LINE PRINTER 16 REN CB2 FOR DATA STROBE; TO DEVICE 18 REM CAL FOR ACKNOWLEDGE; FROM DEVICE 20 POKE 59459,255:REM DIRECTION OUT 25 GOSUB 100: REM HANDSHAKE NOT READY 34 FOR I=1 TO 25 : REM SCAN ROWS 35 FOR J=1 TO 40 : REM SCAN COLUMNS 36 V=PEEK(32767+J-1+40\*(I-1)) 37 IF V>64 THEN V=V+32 : REM LOWER CASE 38 IF VC=26 THEN V=V+64: REM UPPER CASE 39 IF V=128 THEN V=V-96:REM SPACE 40 IF J=1 THEN 180 : REM PRINT SPACE 50 POKE 59457, V AND 127: REM SEND VALUE 51 GOSUB 150: REM READY TO OUTPUT

56 ACK=PEEK (59469) AND 2: REM INT FLG REG

58 IF ACK (> 2 THEN 56:REN ACKNOWLEDGE

52 GOSUB 100: REM NOT READY

READY. LIST 98-199

98 REM

100 REM SET CB2 TO LOGIC 1:NOT READY 110 POKE (59468), PEEK (59468) OR 224 120 RETURN 150 REM SET CB2 TO LOGIC 0 : REM READY 160 POKE (59468), PEEK (59468) AND 310R192 170 RETURN 180 V=32 AND 127 : REM SPACE 182 GOSUB 150: REM READY 184 GOSUB 100: REM NOT READY 186 GOTO 50

SUBROUTINES

READY. RUN

READY.

70 NEXT J

RUN

READY. LIST 71-97

72 POKE 59457, 13: REH CR 73 GOSUB 150: REM READY 74 GOSUB 100: REM NOT READY 76 POKE 59457, 10: REM LF 78 GOSUB 150: REH READY 80 NEXT I 82 GOSUB 100 84 POKE 59457,128 : REM STOP PRINT 85 PRINTCHR\$(147) : REM CLEAR SCREEN 86 END

READY. RUN

READY. POKE 59468,14

READY. LIST 200-

200 PRINT" Upper and Lower Case " 240 PRINT"ABCDEFGHIJKLYNDP9RSTUVNXYZ" 250 PRINT"abcdefshijklmnopgrstuvwxyz" 300 PRINT" These listings were made on 310 PRINT" TI Model 810 printer" READY. **RUN 200** Upper and Lower Case

**ABCDEFGHIJKLANDPORSTUVNXYZ** abcdefahijklmnoparstuvwxyz These listings were made on TI Model 810 printer

READY. RUN 5

changing the contents of decimal location 59468 (the peripheral control register).

# Interfacing to a Line Printer

This example demonstrates how the PET parallel port can be interfaced to a line printer. The first step in the design is to examine the specification for the printer, and to identify the control and data signals

face. Figure 1 is a block diagram of the interface design. A data strobe/ acknowledge interface is supported. The ACKNLG signal notifies the PET that a character transferred to the printer by a data strobe has been accepted. After ACKNLG is issued, the printer is considered idle.

### Software Driver

The software driver implemented which must be supported by the inter- for the example was specifically

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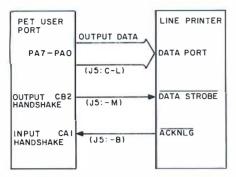
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PA7 - PA 0:

Output data used to support printer data port.

DATA STROBE:

Signals to printer that data is available at the printer data

ACKNLG:

Signals to the PET that the printer has accepted the data

J5:-A PET user port connector J5-Pin A. Figure 1: Block diagram of printer interface using the PET user port (MCS6522 port A). J5 is the PET user port connector; pins are labeled alphabetically. Pin assignments at the line printer are not given since they vary between different manufacturers.

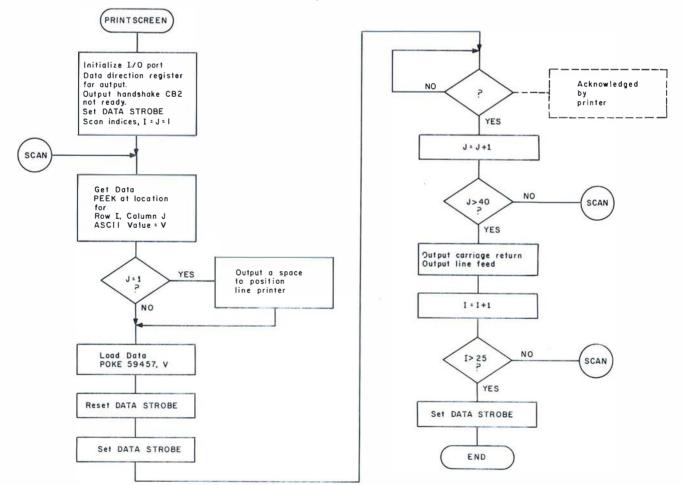
designed to generate a hard copy listing of the image displayed on the PET screen.

The PET video display presents 1000 characters arranged in twenty-five lines of forty characters each. The display is continuously refreshed from a section of memory called display memory. By direct access to these 1000 locations, and using the programmable I/O port connected to a line printer, you can generate a hard copy of the screen image. The flow-chart of the procedure is shown in

figure 2, and a program listing is included in listing 1. The program is called PRINTSCREEN. It scans the twenty-five lines on the PET screen and transmits the data displayed there to the user port, one character at a time. You will observe that transferring data to the parallel port using BASIC is relatively slow. In this example, the data transfer rate is about six characters per second.

### REFERENCES

- An Introduction to Your New PET Commodore Systems, 901 California Ave, Palo Alto CA 94304.
- PET User Notes, Volume 1, Issue 2, January 1978. PET User Group, POB 371, Montgomeryville PA 18931.
- An Introduction to Microcomputers, Volume II: Some Real Products Adam Osborne and Associates, POB 2036, Berkeley CA 94702.



**Figure 2:** Flowchart of the BASIC program PRINTSCREEN. This program transmits images of text on the PET video display screen to the line printer.

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# A Spacecraft Simulator

# Gary Sivak 19 Madison Trail Hopatcong NJ 07843

This article describes a BASIC program that enables the user to design and put into orbit a multistage spacecraft launched from Earth-based conditions. By asking for engine throttle settings, thrust angles, and firing times, your computer puts you at the controls of a multistage spacecraft of your own design as you pilot it from the Earth's surface into orbit. Continuous data displays of the user's status after each maneuver are presented, as well as arrays of altitude and range information for possible plotting at the end of the mission. The following is a description of the program operation.

The program first asks for and verifies all ship design parameters, the first being the number of stages. Then the iteration time (dt) in seconds and the height in miles of the desired orbit are required. During each iteration, the computer calculates formulas of the form:

 $V_{final} = V_{initial} + acceleration \times dt (1)$ 

The final values are then taken as the initial ones for the next iteration. An iteration time evenly divisible into one second is recommended; 0.1 seconds is suggested for faster than realtime computation. A figure of 0.01 seconds, for example, will give a slightly better mathematical accuracy but at the expense of ten times more processing time.

The craft is assembled from top down, the weight of the payload in Text continued on page 108

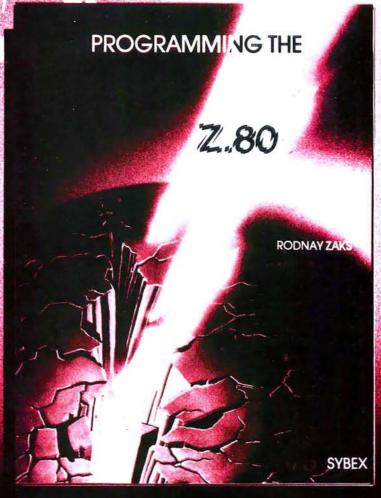
**Listing** 1: BASIC listing of the rocket launcher program.

### ROCKET LAUNCHER PROGRAM

```
10 DIM A(100), A0(100), A1(7), A2(7), A3(6), A4(6)
20 PRINT "DESIGN AND ORBIT A SPACE SHIP. TYPE NO. STAGES UP TO 6. "
30 INPUT A5
40 PRINT "VERIFICATION, "; A5; " STAGES."
50 A6 = A5 + 1
60 PRINT "ENTER ITERATION TIME IN SEC., AND ORBIT HEIGHT IN MI.
70 PRINT ".1 SEC. IS OK AND .01 BETTER, BUT WITH MORE CPU TIME. "
80 INPUT A7,A8
90 PRINT "VERIFICATION, ITERATION TIME "; A7; ", ORBIT HEIGHT "; A8
100 PRINT "ENTER PAYLOAD WEIGHT IN POUNDS.
110 INPUT A2(A6)
120 Al(A6) = 0.0
130 PRINT "VERIFICATION, PAYLOAD WEIGHT, "; A2(A6)
140 \text{ FOR A9} = 1 \text{ TO A5}
150 \ 8 = 46 - 49
160 \ 80 = 3 + 1
170 PRINT "ENTER STAGE ";3;" FUEL AND HULL WEIGHTS IN LBS. "
180 INPUT A1(B), A2(B)
190 PRINT "STAGE ";B;" FUEL ";A1(B);" LBS., HULL ";A2(B);" LBS. "
200 \text{ A2(3)} = \text{A2(B)} + \text{A2(B0)} + \text{A1(B0)}
210 B1 = A2(B) + A1(B)
220 PRINT "ENTER STAGE ";3;" THRUST AT LEAST ";31;" .LBS. "
230 INPUT A3(B)
240 PRINT "STAGE "; B; " THRUST, "; A3(B); " LBS. "
250 PRINT "ENTER SPECIFIC IMPULSE OF STAGE "; B; " FUEL/OXIDIZER. "
260 PRINT "THIS IS THE THRUST-TO-BURN RATE RATIO. "
270 PRINT "FOR GASOLINE =250, PEROXIDE =300, LIQUID HYDROGEN =500. "
280 INPUT A4(3)
290 PRINT "VERIFICATION, STAGE "; B; " SPECIFIC IMPULSE "; A4(B)
300 NEXT A9
310 \ 32 = 10
320 \ 33 = 82 * A7
330 B4 = 360
340 \ 95 = 33 / 100.0
350 B6 = 5280. * .3048
360 B7 = 6.67E-11 * 5.983E24
370 B8 = ATN(1.) / 45.
380 \ 39 = 90.
400 \text{ CO} = SQR(B7/9.80665)
410 C1 = C0
420 C2 = 3QR(B7/(C0+36*A8)) / .3048
430 C3 = 0.0
440 C4 = 0.0
450 C5 = 0.0
460 C6 = 0.0
470 C7 = 0.0
480 \ C8 = 0.0
```

Listing 1 continued on page 108





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```
490 \text{ C9} = 0.0
500 D = 0.0
510 D\dot{0} = 0.0
520 D1 = 0.0
530 D2 = 0.0
540 D3 = 0.0
550 PRINT "THE SHIP CAN SWIVEL ";32;" DEG/SEC. "
560 PRINT "EARTH'S GRAVITY IS 32.174 FT/SEC/SEC. "
570 PRINT "FORWARD VELOCITY NEEDED FOR ORBIT ";C2;" FT/SEC. "
580 D = D + 1
590 D4 = A2(D) / 2.2046
600 D5 = A3(D) / A4(D) / 2.2046
610 D6 = A1(D) / 2.2046
620 D7 = D6
630 D8 = A3(D)/2.2046*9.80665
640 PRINT "IGNITION OF STAGE ";D;", ENTER THE STAGE NUMBER. "
645 INPUT X1
650 GO TO 1090
660 PRINT "ENTER THROTTLE SETTING IN %, FROM 0 TO 100, "
670 PRINT "THRUST ANGLE IN DEG. FROM -";34;" TO ";84
680 PRINT "AND BURN TIME IN SECONDS. "
690 INPUT D9, E, E0
700 D9 = ABS(D9 / 100.0)
710 E1 = D9 * D8
720 E2 = D9 * D5 * A7
730 E3 = E2 / 100.
740 E4 = E0 - (A7 / 100.0)
750 E5 = C5 * C1
760 E6 = 0.0
770 IF EO = 0.0 THEN 1030
780 IF C1 < C0 THEN 1080
790 E6 = E6 + A7
800 E7 = D7 - E2
810 E8 = E1 / (D4 + (D7 + E7 ) / 2.0 )
820 IF E7 >= E3 THEN 850
830 E7 = 0.0
840 E8 = 0.0
850 IF A3S( E - B9 ) < B5 THEN 930
860 IF E < 39 THEN 890
```

Listing 1 continued on page 110

Text continued:

pounds being required first. For each stage, the computer then asks for the weights of the fuel and hull (or tanks), the maximum thrust desired, and the specific impulse of the fuel. To insure the possibility of achieving orbit, a fuel to hull weight ratio of 4 or 5 to 1 is suggested. A thrust of about 20 percent more than the minimum amount required to lift the ship is suggested, so that the ship has sufficient acceleration, even when heavily laden with fuel.

Specific impulse is a figure of merit for fuel performance, the thrust to burn-rate ratio. Suggested values for different fuels are given in the program. Knowing the thrust and specific impulse defines the burn rate, and knowing the amount of fuel on board designates how long it will last at full throttle expenditure. Next, a printout chart, to be described shortly, displays initial fuel, altitude, and the velocity status of the ship.

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BYTE November 1979 109

```
Listing 1 continued:
```

```
870 \ 39 = 39 + 83
880 GO TO 900
890 89 = 39 - 33
900 E9 = 39 * B8
910 \text{ C4} = \text{COS}(E9)
920 C = SIN(E9)
930 F = \Xi8 * C4
940 FO = E8 * C
950 \text{ Fl} = \text{C5} + \text{F} * \text{A7}
960 C6 = (C5 + F1) / 2.0
970 C7 = C7 + C6 * A7

980 F2 = F0 + C6**2 / C1 - B7 / C1**2
990 \text{ F3} = \text{C8} + \text{F2} * \text{A7}
1000 \text{ F4} = \text{C1} + (\text{C8} + \text{F3}) / 2.0 * \text{A7}
1010 IF D9 <> 0.0 THEN 1030
1020 \text{ F1} = \text{E5} / \text{F4}
1030 D7 = E7

1040 C5 = F1
1050 C8 = F3
1060 C1 = F4
1070 IF E6 < E4 THEN 770
1080 \text{ C3} = \text{C3} + \text{£6}
1090 D2 = D2 + 1
1100 \text{ A(D2)} = (C1 - C0) / .3048

1110 \text{ IF } C9 >= \text{A(D2)} \text{ THEN } 1130
1120 C9 = A(D2)
1130 IF A(D2) >= 0.0 THEN 1150
1140 A(D2) = 0.0
1150 IF A(D2) < 400000.0 THEN 1170
1160 D3 = D3 + 1
1170 \text{ F5} = A(D2) / 5280.
1180 F6 = C8 / .3048
1190 F7 = F6 * 15./22.
1200 F8 = C5 / .3048
1210 F9 = F8 * 15./22.
1220 A0 (D2) = C7 / B6
1230 G = 100. * D7 / D6
1240 \text{ G}0 = D7 / D5
1250 G1 = 87 / C1**2 - C6**2 / C1
1250 G1 = 67 / C14 = C(02 / C)

1260 G2 = D8 / (D4 + D7) / .3048

1270 G3 = G2 * 15. / 22.

1280 G4 = G2 - (G1 / .3048 )

1290 G5 = G4 * 15. / 22.
1300 G6 = G1 / .3048 / G2
1310 G7 = 100. * G6
1320 \text{ G8} = 90.0
1330 IF G6 >= 1.0 THEN 1350
1340 G8 = ATN( G6 / SQR( 1.0 - G6**2 ) ) / 38
1350 G9 = SQR( B7 / C1 ) / .3048
1360 H = 100. * F8 / C2
1370 H0 = 100. * A (D2) / ( A8 * 5280. )
1380 H1 = 100. * F8 / G9
1390 H2 = ( C2 - F8 ) / G2
1400 H3 = ( G9 - F8 ) / G2
1410 \text{ IF } \text{F6} = 0.0 \text{ THEN } 1440
1420 \text{ H4} = (A8*5280. - A(D2)) / F6
1430 IF H4 <= 9999.99 THEN 1460
1440 \text{ H4} = 9999.99
1450 REM-TIMES OVER 9999.99 SET TO 9999.99 TO NOT EXCEED DISPLAY.
1460 IF D3 <> 1.0 THEN 1480
1470 PRINT "400K FT. ACHIEVED, YOU ARE IN VACUUM. "
1480 PRINT "FLIGHT TIME", "FUEL LEFT", "AT FULL THROT.", "SHIP ANGLE" 1490 PRINT C3; "SEC, ",G; "%",G0; "SEC, ",89; "DEG."
1500 PRINT " "
1510 PRINT "ALTITUDE", "ASCENT RATE", "FORWARD V.", "RANGE"
1520 PRINT A(D2); "FT.", F6; "FT/SEC", F8; "FT/SEC", A0(D2); "MI."
1530 PRINT F5; "MI.", F7; "MI/HR.", F9; "MI/HR.
1540 PRINT "
1550 PRINT "MAX ACCEL", "MAX VERT ACCEL", "ANGLE (C.A.) ", "THROT (C.A.) "
1560REM-ANGLE (C.A.), CRITICAL ANGLE FOR CONST. ASCENT AT FULL THROT. 1570REM-THROT(C.A.), CRITICAL THROT. OF CONST. ASCENT AT FULL THROT. 1580 PRINT G2; "FT/S/S", G4; "FT/S/S", "FULL THROT.", "VERT. POS." 1590 PRINT G3; "MI/H/S", G5; "MI/H/S", G8; "DEG.", G7; "%"
1600 PRINT "
1610 PRINT H; "% ORBITAL VELOCITY", HO; "% ORBITAL HEIGHT."
1620 PRINT H1; "% VELOCITY NEEDED FOR ORBIT AT CURRENT ALTITUDE."
1630 PRINT "
1640 PRINT " "," ","TIME TO ACHIEVE:"
1650 PRINT "ORB. ALT.", "ORB. VEL.", "CUR. ALT. ORB. VEL."
1660 PRINT "AT CUR. RATE", "AT FULL THROT.", "AT FULL THROT."
1670 PRINT d4; "SEC.", H2; "SEC.", H3; "SEC."
1680 PRINT "
```

Listing 1 continued on page 111

and maximum specified thrust. Also, note that a firing angle of ninety degrees is vertically upward, and angles less than ninety degrees are to the right, or east, etc. A one hundred percent throttle setting at ninety degrees for fifteen or twenty seconds is suggested to gain altitude before beginning to swivel the ship to achieve horizontal orbital velocity.

The amount of fuel used during an iteration is simply the throttle setting, times the maximum burn rate, times dt. This amount, subtracted from the weight of the fuel at the beginning of an iteration, gives the amount remaining at the end. The amount of fuel available during an iteration is taken as the average of the amounts before and after. This is added to the weight of the tanks and the upper stages that the engines must lift, and is the instantaneous weight (in kilograms) of the craft. Dividing into the thrust force yields the current engine thrust acceleration A, during the iteration, in meters per second per second (m/s<sup>2</sup>).

For a given firing angle, the horizontal and vertical components of this acceleration,  $a_{th}$  and  $a_{tv}$ , are taken. Horizontal velocities and the range are computed by:

$$V_{jh} = V_{ih} + a_{ih} \times dt$$
 (2)

$$V_{uvh} = (V_{ih} + V_{fh})/2 \tag{3}$$

$$range = range + V_{avh} \times dt$$
 (4)

where, for a particular iteration,  $V_{ih}$ is the initial horizontal velocity,  $V_{th}$  is the final horizontal velocity, and  $V_{avh}$ is the average of the two.

The total outward vertical acceleration  $a_{rr}$  is computed by adding centrifugal acceleration to the engine acceleration and subtracting gravity's downward contribution as follows:

$$a_{rv} = a_{tv} + (V_{avh}^2/r_{iv}) - GM/r_{iv}^2$$
 (5)

where,  $r_b$  is the initial value of the vertical distance of the ship from the Earth's center, G is the gravitational constant, and M is the mass of the Earth. From the vertical acceleration, the velocities and altitude are computed just as the horizontal components were computed in equations 2 thru 4.

From physics, it will be noted that if no external force is applied by the engines, the rocket's angular momentum is a constant. For each maneuver, therefore, the computer retains

The following constants were used in listing 1:

G: Gravitational constant,  $6.67 \times 10^{-11} \text{Nm}^2/\text{kg}^2$ M: Mass of the earth,  $5.983 \times 10^{24} \text{kg}$ g: Gravitational acceleration, 9.80665 N/kg,  $m/\text{sec}^2 = 32.174 \text{ ft/sec}^2$ 

0.3048 meters/foot 2.2046 pounds/kg

the product of horizontal velocity and distance from the Earth's center. If the engines are off during an iteration, the new horizontal velocity is set equal to this product divided by the new vertical distance value at the end of the iteration. Thus, angular momentum is conserved. As the ship coasts towards Earth, its horizontal velocity increases slightly, and would decrease slightly if the ship were receding. Quantities are then reinitialized and the next iteration begins.

When a firing sequence is completed, an important quantity Q is computed. It is the ratio of the net downward acceleration (gravitational minus centrifugal) to the total acceleration. The engines can currently deliver:

$$Q = \left(\frac{GM}{r_{i\nu}^2} - \frac{V_{avh}^2}{r_{i\nu}}\right) / a_r$$
 (6)

Multiplied by 100, this is the critical throttle setting which will cause the ship to hover if stationary, or move vertically at a constant speed without accelerating. It is also the sine of the critical angle of ascent at which the vertical component of thrust equals the current weight of the ship. The angle, equal to the inverse sine of Q is alternatively computed from:

```
Listing 1 continued:
```

```
1690 IF H < 100.0 THEN 1760
1700 IF HO < 100.0 THEN 1760
1710 D0 = D0 + 1
1710 00 - 00 1
1720 IF DO > 1 THEN 1760
1730 PRINT "IN DESIRED ORBIT. TO CONTINUE ENTER 1, TO PLOT ENTER 2. "
1740 INPUT H5
1750 \text{ IF H5} = 2 \text{ THEN} 1920
1760 IF C3 = 0.0 THEN 660
1770 IF D7 <= E3 THEN 1800
1780 IF A(D2) <= 0.0 THEN 1800
1790 GO TO 660
1800 \text{ IF A (D2)} = 0.0 \text{ THEN } 1890
1810 IF D < A5 THEN 580
1820 D1 = D1 + 1
1830 IF D1 <> 1 THEN 1850
1840 PRINT "LAST STAGE SHUTDOWN."
1850 IF DU <> 0.0 THEN 1880
1860 IF A(D2) <= 0.0 THEN 1880
1870 GO TO 660
1880 IF A(D2) > 0.0 THEN 1920
1890 \text{ H6} = INT(SQR(F6**2 + F8**2) + .5)
1900 H7 = INT( SQR( F7**2 + F9**2 ) + .5)
1910 PRINT "YOU CRASHED AT ";H6;" FT/SEC, ";H7;" MI/HR. "
1920 PRINT "AFTER ";D2;" PLOT POINTS: "
1930 FOR H8 = 1 TO D2
1940REM-PLOT A(H8) Y-AXIS, VS. A0(H8) X-AXIS, ALTITUDE VS. RANGE.
1950 NEXT H8
1960 H9 = 25.0
1970 REM-LOWER 25% CUTOFF OF ALTITUDE FOR A BLOWUP PLOT.
1980 I = C9 * H9 / 100.0 * 1.0001
1990 I0 = D2 + 1
2000 I0 = I0 - 1
2010 IF A(IO) > I THEN 2000
2020 \text{ II} = 100.0 * A0(I0) / A0(D2)
2030 PRINT "LOWER ";H9;"% OR ";I;" MI. OF MAX ALT. ATTAINED."
2040 PRINT "FIRST ";I1;"% OR ";A0(I0);" MI. OF TOTAL RANGE."
2050 PRINT "WITH ";I0;" STEPS:"
2060 FOR I2 = 1 TO I0
2070 REM-PLOT A(I2) Y-AXIS, VS. A0(I2) X-AXIS, LOWER ALT. VS. RANGE."
2080 NEXT 12
2090 END
```

angle = 
$$tan^{-1} (Q/\sqrt{1.0 - Q^2})$$

At this time, distance and velocity values are converted from metric to English units for display purposes.

The first information printed consists of the elapsed flight time, the current ship angle, and the fuel left, both as a percentage of the original amount, and the number of seconds left at full throttle. Next, the program prints the altitude in miles and feet, the ascent rate and forward velocity in miles per hour and feet per second, and the number of miles down range.

The next printed information consists of the critical angle and throttle values of constant ascent, the maximum acceleration the engines can deliver, and the maximum vertical acceleration against gravity in both miles per hour per second and feet per second<sup>2</sup>. For example, if the engine can deliver about 40ft/s<sup>2</sup> the

ship can accelerate at 8ft/s<sup>2</sup> against gravity.

Next the percentages of the orbital velocity and altitude are presented. The final items displayed are the time to achieve orbital altitude at the current ascent rate, and the time to achieve orbital velocity at the current full throttle rate of horizontal acceleration.

At this point the user is ready for the next move, and must again specify a new throttle setting, firing angle, and burn time. Finally, at the end of the mission (either when you achieve orbit, or run out of fuel), you can plot a picture of your trajectory, altitude versus range, and an expanded plot of the start of your mission, the lower 25 percent of your total attained altitude.

Have fun. As you will soon learn, getting your spacecraft to achieve orbit is no easy task. ■



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# The National Micropastime

Joseph J Roehrig JJR Data Research **POB 74** Middle Village NY 11379

During the past few years I have spent too many Saturdays soldering integrated-circuit sockets into printed-circuit boards and have not had enough time to enjoy a good baseball game. I fulfill my need to participate in our national pastime by having my personal computer simulate the play of a baseball game. I can be the manager of any team I choose. All I have to do is input a few baseball statistics. Presto! Out comes a baseball simulation (assuming that the system I shall describe is set up).

### System Demonstration

The search for baseball statistics is easy. The Sports Encyclopedia: Baseball, published by Grosset and Dunlap, has all that you could want. A program called Input (shown in listing 1) is used to enter the statistics into the computer. Figure 1 shows the program Input working.

First you enter a file name to correspond to the team (the 1975 Boston Red Sox in the sample run) whose statistics are being entered. Next, the program requires the name and data for seventeen players who are not pitchers. Yastrzemski is input along with his batting code of 1 (0 = bats right, 1 = bats left, 2 = bats from either side), number of times at bat (543), hits (146), doubles (30), triples (1), home runs (14) bases on balls (87), and strikeouts (67). The computer asks us if the data input is correct. A carriage return indicates **Listing 1:** Program Input which accepts data from the terminal and stores it in disk files for use by the baseball simulation. This program and others in the system are written in North Star BASIC and use the North Star disk system.

```
10 DIMB(7),N$(10)
12 J$= --
15 INPUTITEAM FILE ? ",F$
20 OPEN#0.F$
90 ! "HITTERS"
100 FORA≔0T016
110 INPUT NAME ? ",N$
120 ! BATS, AB, H, D, T, HR, BB, KO.
130 INPUT1*? *,B(7),C,B(1),B(2),B(3),B(4),B(5),B(6)
132 IFC=OTHENC=1
| 135 INPUT* OK ?*,Z$\IFZ$<>**THEN110
137 B9=B(1)\H=C-B(1)
140 C=C+B(5)\B(1)=B(1)/C
142 FORF=2TO4\B(F)=B(F)/B9 \IFF=2THEN146
144 B(F)=B(F)+B(F-1)
146 NEXT\B(5)=(B9+B(5))/C\B(6)=B(6)/H
155 NS=NS+JS
160 WRITE#0,N$,B(7)\FORE=1TO6\WRITE#0,B(E)\NEXT\NEXT
190 ! PITCHERS
200 FORA≃0TO9
210 INPUT NAME ? ",N$
220 ! THROWS, IF', H, BB, KO',
230 INPUT1 ? *,B(0),C,B(1),B(2),B(3)
232 1FC=OTHENC=1
235 INPUT OK ? ",Z$\IFZ$<>"THEN210
237 D≔C*2.75
240 C=(C*2.75)+B(1)+B(2)
250 B(1)=B(1)/C
260 B(2)=(B(2)/C)+B(1)
270 B(3)=B(3)/C
275 NS=NS+JS
280 WRITE#0,N$,B(0),B(1),B(2),B(3)
290 NEXT\Z=0\F0RA=1T0138\WRITE#0,Z\NEXT\CLOSE#0\END
```

```
TEAM FILE ? 75-BOSTON
HITTERS
NAME ? YASTREMSKI
BATS, AB, H, D, T, HR, BB, KO
? 1,543,146,30,1,14,87,67 OK ?
PITCHERS
THROWS, IP, H, BB, KO ? 0,255,262,72,141 OK ?
```

Figure 1: Portion of sample execution of the program Input of listing 1. Normally data is entered for sixteen nonpitching players and ten pitchers.

**Listing 2:** A program, Roster, which reads data from a disk file concerning composition of a given baseball team and displays it on the terminal for inspection by the user. Figure 2 shows an example of its use.

```
10 DIMB(6),N$(10)
15 INPUT'TEAM FILE ? ",F$
20 OPEN#O,F$
25 ! 1D *:
30 ! HITTERS
                 BATS HITS
                                    3R
                                               RR
                                                    KO*
40 FDRA#0TD16
50 READ#0,N$\FORB=OTO6\READ#0,B(B)\NEXT
55 !X21,A," ",
  !N$, TAB(16), B(0),
65 | Z5F3,B(1),B(2),B(3),B(4),B(5),B(6)
70 NEXT
75 !* *\!* "\!*III *,
80 ! PITCHERS
                  R-L HITS
                                    KO.
90 FORA=0T09
100 READ#0,N$,B(0),B(1),B(2),B(3)
105!%21,A,* *,
110 !N$,TAB(16),B(0),
120 !%5F3,B(1),B(2),B(3)
130 NEXTLEND
```

everything is all right. Any other input allows for the reentry of the data.

Figure 1 omits the other sixteen entries and shows the first of ten pitcher entries. Here, the player's name Wise is entered along with his throwing arm designation of 0 (0=right, 1=left), innings pitched (255), hits (262), bases on balls (72), and strikeouts (67).

The next step is to see what information was entered and how the computer translates this data. In order to accomplish this program Roster (listing 2) is run. Figure 2 shows that the execution of this program asks for a file name, and 75—BOSTON is entered to correspond to the information just fed into the computer. The computer assigned identification numbers to the seven-

TEAM FILE ? 75-BOSTON

II	HITTERS	BATS	HITS	:5E	33	HR	BB	KO
0	YASTREMSKI	1	.232	.205	.212	.308	. 370	.169
1	DOYLE	1	.296	.219	.240	.231	.340	.051
2	BURLESON	0	.234	.171	.178	.219	.306	.101
3	PETROCELLI	0	.217	.156	.167	.240	.309	.199
4	EVANS	0	.246	.212	.265	.381	.349	.201
5	LYNN	1	.297	.269	.309	.429	.402	.255
6	RICE	0	.290	.167	.190	.316	. 350	.313
7	FISK	0	.300	.161	.207	.322	.393	.182
8	COOPER	1	. 293	.179	.242	.389	+ 352	.157
9	CARBO	1	.204	. 2556	.293	.476	.410	.291
10	GRIGGIN	0	.226	.087	.087	.101	.285	.133
11	BENIQUEZ	0	+262	·192	.247	.274	.351	.144
12	MILLER	1	.163	.095	.143	.143	.326	.230
13	HEISE	0	.208	.111	. 111	.111	.238	.061
14	MONTGOMERY	0	.221	+227	.250	.295	.241	.245
15	BLACKWELL	2	.172	.115	.192	. 192	.298	.123
16	CONEGLIARO	0	.108	.143	.143	.429	.231	.180
ΙĐ	PITCHERS	R-1.	HITS	вв	KO			
0	WISE	0	.253	.323	.136			
1	TIANT	0	.250	.318	.135			
2	LEE	1	.259	.324	.074			
3	MORET	1	.218	.343	.132			
4	CLEVELAND	0	.249	.324	.112			
5	WILLOUGHBL	0	.237	.320	.149			
6	F'OLE	()	.267	.351	.110			
7	DRAGO	0	.229	+ 3333	.143			
8	SEGUI	0	.230	.369	.146			
9	BURTON	1	.260	.346	.175			

**Figure 2:** Execution of the program Roster of listing 2. The file name is the same as that used for program Input.

teen nonpitchers and ten pitchers, and translated all of the historical statistics into percentages.

That was a lot of data entry. Since I would not want to redo the entire input job again to change one player, program Fix (listing 3) was written; its execution is shown in figure 3. All that must be done to change an entry is to enter a file name and a hitter's identification number (from 0 thru 16), or a number greater than 16 as the identification number to change a

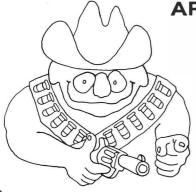
pitcher. Once the pitcher correction section is entered, an identification number greater than 9 ends the program execution.

### Hypothetical Matchup

With this data I am ready to play a fictitious World Series between the 1961 New York Yankees (led by Roger Maris, who hit 61 home runs that year, along with Mickey Mantle and Whitey Ford) and the 1963 Los Angeles Dodgers (who beat the 1963)

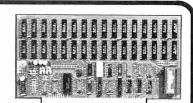
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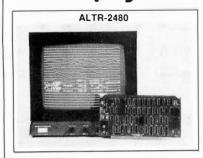
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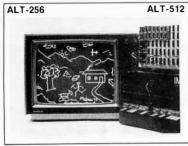
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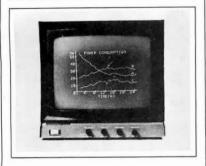
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**Listing 3:** A program, Fix, which allows the user to selectively correct data for a single player that has been stored on the disk by the Input program.

```
10 DIMB(7),N$(10)
12 J$='-----'
15 INPUT'TEAM FILE ? 'yF$
20 OFEN#0,F$
90 L'HITTERS'
100 INPUT'# ? ',A\IFA>16THEN190\A=A*47
120 L'BATS, AB, H, D, T, HR, BB, KO*
1.30 INPUT1*? *,B(7),C,B(1),B(2),B(3),B(4),B(5),B(6)
132 IFC=OTHENC=1
135 INPUT* OK ?",Z$\IFZ$<>""THEN110
137 B9=B(1)\H=C-B(1)
140 C=C+R(5)\R(1)=R(1)/C
142 FORF=2TO4\B(F)=B(F)/B9 \IFF=2THEN146
144 B(F)=B(F)+B(F-1)
146 NEXT\B(5)=(B9+B(5))/C\B(6)=B(6)/H
155 NS NS+15
160 WRITE#0%A,N$,B(7),B(1),B(2),B(3),B(4),B(5),B(6),NOENDMARK
170 GOTO100
190 L'FITCHERS
200 INPUT*# ? *,A\IFA> 9THEN310\A=799+(A*32)
210 INPUT NAME ? ",N$
220 L'THROWS, IP, H, BB, KO',
230 INPUT1 * * *,B(0),C,B(1),B(2),B(3)
232 IFC=OTHENC=1
235 INPUT* OK ? ",Z$\IFZ$<>"*THEN210
237 D≔C*2.75
240 C=(C*2.75)+B(1)+B(2)
250 B(1)=B(1)/C
260 B(2)=(B(2)/C)+B(1)
270 B(3)=B(3)/C
275 N$ N$+J$
280 WRITE#0%A,N$,B(0),B(1),B(2),B(3),NOENDMARK
300 GOTO 200
310 CLOSE#O\FND
```

```
TEAM FILE 2 75-ROSTO
HITTERS
# 2 0
NAME ? YASTREMSKI
BATS, AB, H, D, T, HR, BB, KO
7 1,543,146,30,1,14,87,67 OK ?
# 7 99
PITCHERS
# % 0
NAME % WISE
THROWS, IP, H, BB, KO 3 0, 255, 262, 72, 141 OK 3
```

**Figure 3:** Sample execution of the program Fix of listing 3. This program allows selective correction of the input data.

Yankees in four straight games in the 1963 World Series on the strong pitching of Sandy Koufax and Don Drysdale). To play this hypothetical series, all that is necessary is to load the program called Game and enter the file names 61-YANKS and 63-LA (assuming these files have been created in the manner just described).

Simulation of the first five games of this hypothetical World Series obtains the following results:

```
Game 1: Dodgers 6, Yankees 2.
Game 2: Yankees 3, Dodgers 1.
```

Game 4: Yankees 11, Dodgers 4. Game 5: Yankees 2, Dodgers 1.

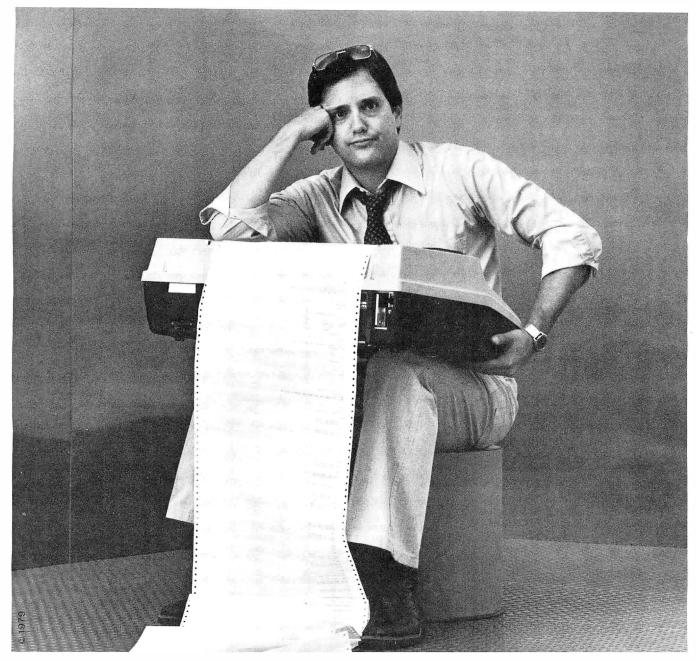
Game 3: Dodgers 6, Yankees 3.

### Detailed Play of Game 6

The series now stands with the Yankees having won 3 and the Dodgers 2 games. A win by the Yankees ends the series, so I will show the details of the sixth game. Program Game is loaded and executed as shown in figure 4. The computer asks for a random number; 41 is input. Next, the file name of the visiting team is entered, followed by that of the home team. It is now time to enter the Dodger batting order.

This is done by entering the identification number (taken from the computer roster, a sample was shown in figure 2) and position number of

Text continued on page 122

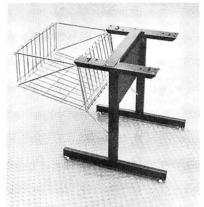


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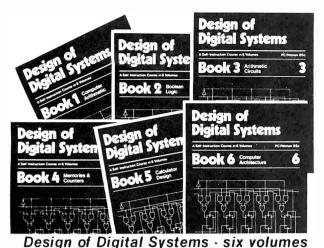
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Figure 4: Predicted play of a hypothetical baseball game between the 1961 New York Yankees and the 1963 Los Angeles Dodgers, using the Game program described in this article. The entry for NUM? is a seed for generating random numbers; the entries for the TEAM? inquiries are file names to reference data stored on disk by the Input program. The user enters the batting order and pitching staffs, and play of the game proceeds according to statistical probabilities.

```
NUM? 41
TEAM ? 63-LA
TEAM ? 61-YANKS
GIVE THE LINE--UP
BATTING 1
           ID, POS # ?2,6
                                          WILLS----
                                                        SS OK ?
                                          GILLIAM -----
           ID, FOS # ?1.4
                                                        2B OK
BATTING 2
BATTING 3 ID, FOS # 75,8
                                          DAVIS W---
                                                       CF
                                                           OK
                                          DAVIS T---
                                                       LF OK
BATTING 4
           ID, POS # ?6,7
                                          HOWARI -----
BATTING 5 ID, FOS # ?4,3
BATTING 6 ID, FOS # ?3,5
                                                       1B OK
                                          MCMULLEN---
                                                       3B OK
                                          ROSEBORO--
BATTING 7 ID, POS # ?7,2
                                                        C \cap OK
BATTING 8 ID, FOS # 70,9
BATTING 9 ID, FOS # 710,10
                                          FAIRLY----
                                                       RF OK
                                           OLIVER-----
                                                       DH OK ?
 ID# OF PITCHER ? 3
                                          FOURES----
GIVE THE LINE-UP
BATTING 1
                                                        FOK ? NO
           ID, POS # ?15,1
                                           GONDER----
ID, FOS # ?1,4
                                          RICHARDSON
                                                       2B OK
BATTING 2 ID, POS # ?2,6
                                           KUBEK----
                                                       SS OK
BATTING 3 ID, FOS # ?4,9
                                           MARIS----
                                                       RF OK
                                          MANTLE ----
                                                       CF OK
BATTING 4 ID, FOS # 75,8
                                          HOWARI----
BATTING 5 ID, FOS # ?7,2
                                                        C OK
                                           SKOWRON----
BATTING 6 ID. FOS # 70.3
                                                        1B OK
           ID, FOS # 710,7
                                          CERV-----
BATTING 7
                                                       LF
                                                           OK
BATTING 8 ID, POS # 78,10
BATTING 9 ID, POS # 73,5
                                          LOPEZ -----
                                                        TIH OK
                                                        3B OK ?
                                           BOYER -----
 ID# OF PITCHER ? 6
                                           DALEY ----
                                                           OK ?
INNING # 1
WILLS
            IS OUT
GILLIAM----
            SINGLE
RUNNER ON FIRST
DAVIS W--- DOUBLE PLAY
RICHARDSON SINGLE
RUNNER ON FIRST
KUBEK---
            SINGLE
RUNNER ON FIRST
                 RUNNER ON THIRD
MARIS---- IS OUT
 1 RUNS SCORE 63-LA
                           0 61-YANKS
                                           1
RUNNER ON SECOND
P.H. OR B ?
MANTLE---- H. R.
 2 RUNS SCORE 63-LA
                           0 61-YANKS
P.H. OR B ? P
HOWARD---- IS OUT
SKOWRON---- SINGLE
RUNNER ON FIRST
CERV---- STRIKES OUT
INNING # 2
DAVIS T--- STRIKES OUT
HOWAR II----
            H. R.
 1 RUNS SCORE 63-LA
                           1 61-YANKS
FyH, OR B ?
MCMULLEN-- STRIKES OUT
ROSEBORO-- IS OUT
LOPEZ---- SINGLE
RUNNER ON FIRST
BOYER ----
            IS OUT
RUNNER ON SECOND
RICHARDSON IS OUT
KUREK---- WALK
RUNNER ON FIRST RUNNER ON SECOND
MARIS -----
            IS OUT
INNING # 3
FAIRLY -----
            IS OUT
OLIVER-----
            IS OUT
WILLS----
MANTLE-----
            SINGLE
RUNNER ON FIRST
HOWARD---- SINGLE
```



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Figure 4 continued:

RUNNER ON FIRST RUNNER ON THIRD SKOWRON---- DOUBLE PLAY 1 RUNS SCORE 63-LA 1 61-YANKS P.H. OR B ? CERV---- SINGLE RUNNER ON FIRST LOFEZ---- SINGLE RUNNER ON FIRST RUNNER ON SECOND BOYER---- STRIKES OUT INNING # 4 GILLIAM---SINGLE RUNNER ON FIRST DAVIS W--- IS OUT DAVIS T--- SINGLE RUNNER ON FIRST RUNNER ON SECOND HOWARD--- STRIKES OUT MCMULLEN-- IS OUT RICHARDSON WALK RUNNER ON FIRST KUBEK---- DOU DOUBLE RUNNER ON SECOND RUNNER ON THIRD MARIS---- IS OUT H. E. 2 RUNS SCORE 63-LA 1 61-YANKS P.H. OR B ? P P# ? 22@ HOMARTI----SINGLE RUNNER ON FIRST SKOWRON--- IS OUT RUNNER ON SECOND CFRU-----THNING # 5 ROSEBORO-- STRIKES OUT FAIRLY--- IS OUT OLIVER WALK RUNNER ON FIRST WILLS---- WALK RUNNER ON FIRST RUNNER ON SECOND GILLIAM--- SINGLE 1 RUNS SCORE 63-LA 2 61-YANKS 6 RUNNER ON FIRST RUNNER ON THIRD P.H. OR B ? DAVIS W--- IS OUT LOPEZ---- IS OUT BOYER---- WALK RUNNER ON FIRST RICHARDSON DOUBLE PLAY INNING # 6 DAVIS T---- IS OUT HOWARD---- STRIKES OUT MCMULLEN-- IS OUT KUBEK---- SINGLE RUNNER ON FIRST SINGLE MARIS RUNNER ON FIRST RUNNER ON THIRD MANTLE--- DOUBLE PLAY 1 RUNS SCORE 63-LA P.H. OR B ? 2 61-YANKS 7 HOWARD IS OUT INNING # 7 ROSEBORO---IS OUT FAIRLY---- IS OUT OLIVER----SINGLE RUNNER ON FIRST SINGLE WILLS ----RUNNER ON FIRST RUNNER ON SECOND GILLIAM--- IS OUT SKOWRON--- SINGLE RUNNER ON FIRST CERV---- IS OUT LOPEZ---- IS OUT

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Text continued:

each player. The position numbers are standard baseball scoring symbols: 1 = pitcher, 2 = catcher, 3 = first baseman, 4 = second baseman, 5=third baseman, 6=shortstop, 7=left fielder, 8=center fielder, 9=right fielder, and 10=designated hitter (yes, I am using the designated hitter). The computer asks OK? and a carriage return signifies that all is well. This is done for the nine batting positions, and then the pitcher identification number is entered.

When the Yankee batting order is entered, I intentionally make a mistake. Jesse Gonder was entered as the pitcher, batting leadoff. The comuter asks OK?, but this time "NO" is entered (anything except a carriage return will do) and the computer rejects the input.

Game 6 matches pitchers Podres and Daley. The Yankees start quickly and score 3 runs in the first inning powered by Mickey Mantle's two-run home run.

After each run is scored, the Game program branches to the substitute subroutine. As seen in figure 4, that

Figure 4 continued:

TNUTNG # 8 TS OUT DAVIS W---DAVIS T--- IS OUT HOWARD---- H. R. 1 RUNS SCORE 63-LA 3 61-YANKS P.H. OR B ? B P# ? 9 BATS, F4 ? 6,13 POS 7 5 BATS, F# 7 0,0 IS OUT ZIMMER----RICHARDSON IS OUT KUBEK----IS OUT MARIS---- H. R. 1 RUNS SCORE 63-LA 3 61-YANKS P.H. OR B ? MANTLE---- SINGLE RUNNER ON FIRST HOWARD---- IS OUT TNNTNG # 9 ROSERORO ---IS OUT FAIRLY----IS OUT

in the first inning after Maris made an out to score the first Yankee run, the computer asked "P, H or B". A carriage return in response to this inquiry means "no substitute" and the game continues. Entry of P means a pitching change, H means a substitute for any of the players on the team currently batting, and B means that

OLIVER----

both changes P and H are desired.

Following Mickey's home run, a pitching change is made—Norm Sherry replaces Podres. The game continues with the Yankees pecking away and adding to their lead. The Dodgers score a run in the eighth inning, but it appears certain that they will lose the game and the series. For

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140.	Interpreter	Compiler	Interpreter	Compiler	Interpreter	Compiler
1	2.8 SEC	2.3 SEC	1.2 SEC	0.9 SEC	0.86 SEC	0.71 SEC
2	11.4	2.1	7.7	0.9	5.45	0.72
3	25.5	8.6	16.6	1.9	11.6	1.45
4	25.0	8.9	16.4	1.9	11.6	1.54
5	26.7	9.0	17.2	2.0	12.2	1.55
6	42.4	20.1	27.4	7.0	19.3	5.2
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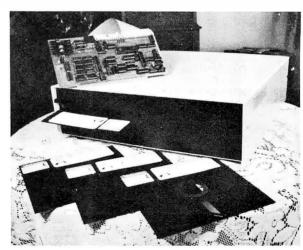
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63-LA									61	YANKS					
NAME	FOS	Al	B	Н	HR	RB	1		NAM	iE.	POS	AB	Н	HŔ	RBI
WILLS	SS		3	1	0	(	0		RIC	HARDSON	28	4	1	0	0
GILLIAM	28		4	3	()		1.		KUE	EK	55	4	3	0	()
DAVIS W	C.E.		9	()	()	(	0			:15		5	2	1	5
DAVIS T	L.F		4	1	()		0		MAN	ITLE	CF	5	4	2	5
HOWARI	1 B		4		2		2		HOW	JARD	C	5	2	0	()
MCMULLEN	3B		3	0	0		()		SKC	JWRON	1 F	4	2	()	1
ZIMMER	3B		1	0	()		()								
ROSEBORO	C		4	()	0		()		CER	(·V	L. F	4	1	0	0
FAIRLY	RE		4	()	0		0			EZ		4	2	0	0
OLIVER	DH		3	1	()		0		BOY	'E.R	3B	3	0	()	0
FITCHERS	11	ь н	Fi I	ER	K I	E									
PERRANOSKI	4.	7 6	2	1	()	1.									
FOURES		3 3	3	3	0	0	L.059	BER							
SHERRY	3.0	0 8	3	3	2	2									
DALEY	7.	7 8	3	(2)	5	2	MINI	VER							
DUREN	1.	3 0	0	()	0	0									
1	2	3 4	5	6	7	8	9	-	Τ						
VISTORS 0		0 0			0	1	()	0	3						
HOME 3 8324 READY	0	1 2	0	1	0	1	0	()	8	RETURN	TO EN	D?			

Figure 5: Box score from the game played in figure 4.

this reason, a pinch hitter and a new pitcher are entered in order to illustrate all of the possible input situations occurring in this simulation.

In answer to the question "P, H or

B" in the Dodgers' half of the eighth inning, a B is input. A pitcher's identification number is solicited and 9 is entered, corresponding to Yankee Ryne Duren. Next, the computer asks

for the batting (Dodgers) team's substitutes with the question "Bats, P#". Here it is necessary to input what place in the nine batting positions (1 thru 9) the substitute will bat in and the player's identification number. The numbers 6 and 13 are typed in. Six is the sixth batting position; 13 represents Don Zimmer's identification number.

The "Bats, P#" question is again asked, and the user can continue to make substitutes or you can enter a 0 for the batting position in order to end the substituting. In the example, 0,0 is input and the game continues.

The Yankees go on to win the sixth game 8 to 3 and the series 4 games to 2 games. Figure 5 shows the box score for the final game of the series. Typing a carriage return ends the game at this point; typing any other character plays another game between the same two teams.

If the option to play another contest is selected, the computer asks "Line-ups OK"; and typing a carriage return lets the programmer play another game just by entering the identification numbers of two new

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21= UPDATE END MONTH FILES
22= PRINT CASH FLOW FORECAST
23= ENTER/UPDATE PAYROLL (NOT YET AVAILABLE)
24= RETURN TO BASIC

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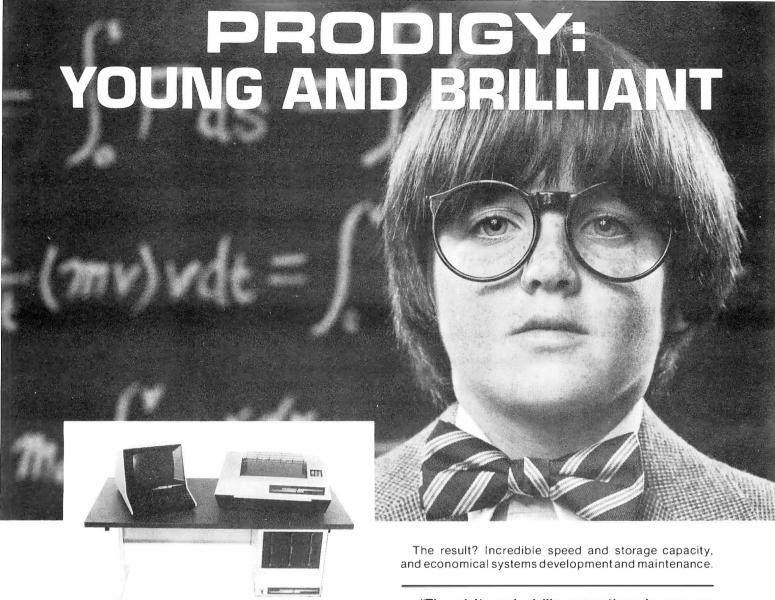
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riage return is entered, the computer branches to the lineup entry section of the program and the user will be required to enter new lineups.

You can keep track of batting averages, earned run averages, and other statistics by loading the program Stats (listing 4) and entering the appropriate file name. This will give you a complete printout of all the statistics as shown in figure 6. The statistics shown are for all six games of the "World Series" that was just played.

The statistics keep accumulating each time the program is run. Therefore, I have provided program Erase (shown in listing 5). Figure 7 shows this program being used; the user merely supplies the file name. This program erases statistics extracted only from the games played, not the ratings information shown on the roster (figure 2) for each player. That

pitchers. If anything other than a car- Listing 4: The Stats program, which computes and displays statistics from box scores of simulated baseball games. An example of its use is shown in figure 6.

```
1 DITMN# (270)
5 LINE 80
10 INFUT*FILE NAME ? *,F$\OPEN#O,F$
12 FORA=OT016\N=(A*10)+1\READ#0,N$(N,N+9),Z,Z,Z,Z,Z,Z,Z,Z,XNEXT
14 FORA=OTO9\N=170+((A*10)+1)\READ#O,N$(N,N+9),Z,Z,Z\NEXT
20 ! NAME AR H HR RRI AVE NAME IF H R ER",
30 ! KO RE W L ERA'\FORA=1TO79\!"=",\NEXT\!"
40 FORA=OTO16\B=1119+(A*20)\READ#0%B,C,D,E,F\G=0
50 IFC>OTHENG=D/C\T1=T1+C\T2=T2+D\T3=T3+E\T4=T4+F
60 N=(A*10)+1\!N$(N,N+9),Z4I,C,D,Z3I,E,Z4I,F,Z5F3,G,**,
70 IFA>9THEN90\B=1459+(A*35)\N=171+(A*10)
72 READ#0%B,C,D,E,F,G,H,I\J=INT(I/100)\K=I-(100*J)
74 P1=P1+C\P2=P2+D\P3=P3+E\P4=P4+F\P5=P5+G\P6=P6+H\P7=P7+J\P8=P8+K
76 E9=0\IFC>OTHENE9=(F*27)/C\C=INT(C/3)
78 1N$(N;N+9),24I,C,D,E,F,G,H,23I,J,K,26F2,E9,
90 ! " \NEXT
100 FDRA=1T079\L*-*,\NEXT\!*"
*,241,T1,T2,231,T3,241,T4,25F3,T5,
120 1
130 1
                  *,%4I,F1,F2,F3,F4,F5,F6,%3I,F7,F8,%6F2,F9
```

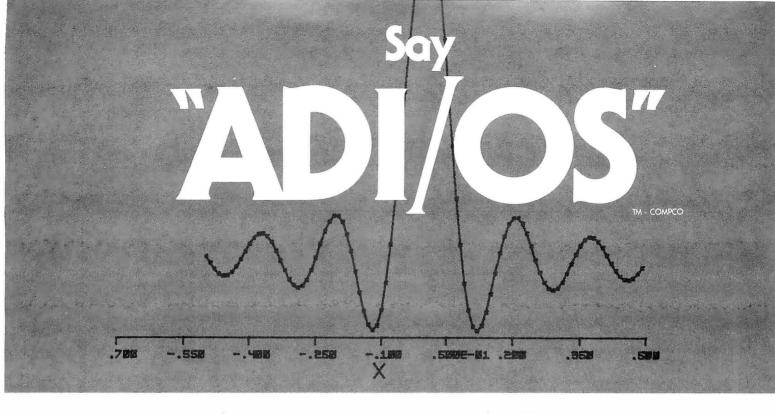
is how I run my complete computerized baseball simulation.

### **Necessary System Components**

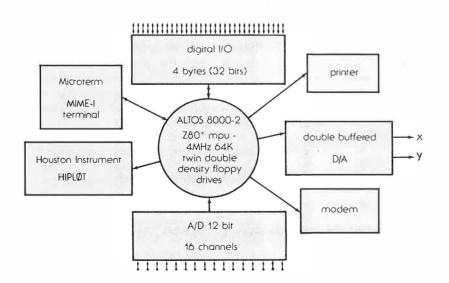
What do you need to run these programs? An 8080-based microprocessor system that can be linked to a North Star floppy-disk system, a North Star disk-operating system including BASIC, 24 K bytes of memory, and a terminal. The memory requirement is large because of the size

FILE NAME	AB	Н	HR	RBI	AVE	NAME	1F	Н	R	ER	ко	EE	W	l.	ERA
SKOWRON	20	4	0		.200	F OR D	8	12	10	3	5	7	0	1	3.12
RICHARDSON	24	4	0	(1)	.167	TERRY	13	9	2	1	83	6	2	0	. 68
KUBEK	23	7	()	0	.304	ARROYO	8	3	0	0	5	3	0	()	.00
BOYER	19	3		0	.158	STAFF ORD-	0	0	0	0	0	0	0	0	.00
MARIS	23	9	4		.391	COATES	0	0	()	0	0	0	0	0	.00
MANTLE	23	ć	2	5	.261	SHELDON	0	0	0	0	0	0	0	0	.00
BERRA	7	()	()	()	.000	DALEY	11	14	7	5	8	3	1	0	3.86
HOWARD	2.3	8	2		348	TURLEY	0	0	0	()	()	0	()	0	.00
BLANCHARD-	16 7	5	0	4	.313	RENIFF	4 6	ა გ	2	2	0 5	2	1	0	4.15 2.84
CERV	16	9	2		500	Tit'l L'E' 14 - Title Barrell	C)	C)	C)	A		O	U	1	2+04
GARDNER	0	0	0		.000										
DEMASTRI	0	Ó	Ö		.000										
REED	0	0	0		.000										
TORGESSON-	0	()	0	0	.000										
GONDER	()	0	0	()	.000										
JOHNSON	0	0	0	()	.000										
	201		10	/	.284		53	50	24	13	31	21	4	2	2.21
FILE NAME (	? 63- AB	LA H	HR	RBI	AVE	NAME	IF.	Н	R	ER	KO	BB	W	L.	ERA
NAME	? 63- AB	LA H	HR	RBI	AVE	NAME IXDUFAX	IF.	Н	R	ER	KO	BB	W	L.	ERA
NAME	? 63- AB	LA H	HR	RBI 1	AVE		IF.	Н	F.	ER	KO	BB	W	L	ERA
NAME FAIRLY	? 63- AB	·LA H	HF:	F.B.I 1 4	AVE	KOUFAX	IF 13	H 14	Ft ====	ER 4	KO ====	BB =====	₩ =====	L 0	ERA 2.70
NAME FAIRLYGILLIAM	? 63- AB 22 24	LA H 3 12	HR 1 1 0 0	FBI 1 4	AVE .136	KOUFAX DRYSDALE	IF 13 17	H 14 13	R 8 5	ER 4 4	KO ==== 9 8	BB 5 5	₩ 1 0	L 0 2	ERA 2.70 2.12
NAME FAIRLY GILLIAM WILLS MCMULLEN HOWARD	? 63- AB 22 24 24 20 21	LA H 3 12 4 3	HR: 1 1 0 0	RBI 1 4 1 2 4	AVE .136 .500 .167 .150 .238	KOUFAX DRYSDALE PERRANOSKI PODRES MILLER	IF 13 17 9	H 14 13 8 9	R 8 5 2 6	ER 4 4	KO 9 8 0	BB 5 5	₩ 1 0	L 0 2	ERA 2.70 2.12 1.00
NAME FAIRLY	? 63- AB 22 24 24 20 21 24	LA H 3 12 4 3 5	HR 1 1 0 0 2 1	RBI 1 4 1 2 4 5	AVE .136 .500 .167 .150 .238 .333	KOUFAX DRYSDALE PERRANOSKI FODRES MILLER RICHERT	1F 13 17 9 5 0	H 14 13 8 9	R 8 5 2 6 2	ER 4 4 1 5 0 0	K0 9 8 0 2 0	BB 5 5 1 1 0	ω 1 0 1 0 0	L 0 2 0 1 1 0	ERA 2.70 2.12 1.00 9.00 .00
NAME FAIRLY	22 24 24 20 21 24 25	LA H 3 12 4 3 5 8 6	HR 1 1 0 0 2 1 0	RBI 1 4 1 2 4 5	AVE .136 .500 .167 .150 .238 .333 .240	KOUFAX URYSUALE PERRANOSKI PODRES MILLER RICHERT CALMUS	IF 13 17 9 5 0	H 14 13 8 9 1	R 8 5 2 6 2 0	ER 4 4 1 5 0 0 0 0	K0 9 8 0 2 0 0	BB 5 5 1 0 0	ω 1 0 1 0 0 0	L 0 2 0 1 1 0 0	ERA 2.70 2.12 1.00 9.00 .00 .00
RAME FAIRLY GILLIAM WILLS MCMULLEN HOWARD DAVIS W DAVIS T ROSEBORO	? 63	LA H 3 12 4 3 5 8 6	HR 1 1 0 0 2 1 0	RBI 1 4 1 2 4 5 4	AVE .136 .500 .167 .150 .238 .333 .240 .048	KOUFAX DRYSDALE PERRANOSKI PODRES MILLER RICHERT CALMUS WILLHITE	1F 13 17 9 5 0 0	H 14 13 8 9 1 0 0	R 8 5 2 6 2 0 0 0	ER 4 4 1 5 0 0 0 0 0	KO 9 8 0 2 0 0 0 0 0	BB 5 5 1 1 0 0	ω 1 0 1 0 0 0	L 0 2 0 1 1 0 0 0 0	ERA 2.70 2.12 1.00 9.00 .00 .00
NAME FAIRLY GILLIAM WILLS MCMULLEN HOWARD DAVIS W IAVIS T ROSEBORO MOON	? 63	LA H 3 12 4 3 5 8 6 1 3	HR 1 1 0 0 2 1 0 0	RBI 1 4 1 2 4 5 4 0	AVE .136 .500 .167 .150 .238 .333 .240 .048	ROUFAX DRYSDALE PERRANOSKI FODRES MILLER RICHERT CALMUS WILLHITE ROEBUCK	1F 13 17 9 5 0 0 0	H 14 13 8 9 1 0 0	R 8 5 2 6 2 0 0 0 0 0	ER 4 4 1 5 0 0 0 0 0 0	K0 9 8 0 2 0 0	88 5 5 1 1 0 0	1 0 1 0 0 0	0 2 0 1 1 0 0	ERA 2.70 2.12 1.00 9.00 .00 .00 .00 .00
RAME FAIRLY GILLIAM WILLS MCMULLEN HOWARD DAVIS W POSEBORO MOON TRACEWSKI	? 63 AB 22 24 24 20 21 24 25 21 6	LA H 12 4 3 5 8 6 1 3 0	HR 1 1 0 0 2 1 0 0 0	RBI 1 4 1 2 4 5 4 0 0	AVE .1.36 .500 .167 .150 .238 .333 .240 .048 .500	KOUFAX DRYSDALE PERRANOSKI PODRES MILLER RICHERT CALMUS WILLHITE	1F 13 17 9 5 0 0	H 14 13 8 9 1 0 0	R 8 5 2 6 2 0 0 0	ER 4 4 1 5 0 0 0 0 0	KO 9 8 0 2 0 0 0 0 0	BB 5 5 1 1 0 0	ω 1 0 1 0 0 0	L 0 2 0 1 1 0 0 0 0	ERA 2.70 2.12 1.00 9.00 .00 .00
NAME FAIRLY GILLIAM WILLS HOWARD DAVIS W DAVIS T ROSEBORO MOON TRACEWSKI OLIVER	? 63- AB 22 24 24 20 21 24 25 21 6 0	H 3 12 4 3 5 8 6 1 3 0 5	HR 1 1 0 0 2 1 0 0 0 0 0 0 0	RBI 1 4 1 2 4 5 4 0 0 0	AVE .136 .500 .167 .150 .238 .333 .240 .048 .500 .000 .357	ROUFAX DRYSDALE PERRANOSKI FODRES MILLER RICHERT CALMUS WILLHITE ROEBUCK	1F 13 17 9 5 0 0 0	H 14 13 8 9 1 0 0	R 8 5 2 6 2 0 0 0 0 0	ER 4 4 1 5 0 0 0 0 0 0	K0 9 8 0 2 0 0	88 5 5 1 1 0 0	1 0 1 0 0 0	0 2 0 1 1 0 0	ERA 2.70 2.12 1.00 9.00 .00 .00 .00 .00
NAME FAIRLY GILLIAM WILLS HOWARD DAVIS W DAVIS T ROSEBORO MOON TRACEWSKI OLIVER WALLS	22 24 24 20 21 24 25 21 6 0 14 0	H 3 12 4 3 5 8 6 1 3 0 5 0	HR 1 1 0 0 0 2 1 0 0 0 0 0 0 0 0 0 0	RBI 1 4 1 2 4 5 4 0 0 0 0 3 0	AVE .136 .500 .167 .150 .238 .333 .240 .048 .500 .000	ROUFAX DRYSDALE PERRANOSKI FODRES MILLER RICHERT CALMUS WILLHITE ROEBUCK	1F 13 17 9 5 0 0 0	H 14 13 8 9 1 0 0	R 8 5 2 6 2 0 0 0 0 0	ER 4 4 1 5 0 0 0 0 0 0	K0 9 8 0 2 0 0	88 5 5 1 1 0 0	1 0 1 0 0 0	0 2 0 1 1 0 0	ERA 2.70 2.12 1.00 9.00 .00 .00 .00 .00
FAIRLY	22 24 24 25 21 6 0 14 0 0	LA H 3 12 4 3 5 8 6 1 3 0 5 0	HR 1 1 0 0 0 2 1 0 0 0 0 0 0 0 0 0 0 0 0 0	RBI 1 4 1 2 4 5 4 0 0 0 3 0 0	AVE -1.36 -1.50 -1.50 -2.38 -3.33 -2.40 -0.48 -5.00 -0.00 -3.57 -0.00	ROUFAX DRYSDALE PERRANOSKI FODRES MILLER RICHERT CALMUS WILLHITE ROEBUCK	1F 13 17 9 5 0 0 0	H 14 13 8 9 1 0 0	R 8 5 2 6 2 0 0 0 0 0	ER 4 4 1 5 0 0 0 0 0 0	K0 9 8 0 2 0 0	88 5 5 1 1 0 0	1 0 1 0 0 0	0 2 0 1 1 0 0	ERA 2.70 2.12 1.00 9.00 .00 .00 .00 .00
FAIRLY	22 24 24 20 21 24 25 21 6 0 14 0	H 3 12 4 3 5 8 6 6 1 3 0 0 0 0 0	HR 1 1 0 0 0 2 1 0 0 0 0 0 0 0 0 0 0 0 0 0	RBI 1 4 1 2 4 5 4 0 0 0 0 0 0 0 0	AVE	ROUFAX DRYSDALE PERRANOSKI FODRES MILLER RICHERT CALMUS WILLHITE ROEBUCK	1F 13 17 9 5 0 0 0	H 14 13 8 9 1 0 0	R 8 5 2 6 2 0 0 0 0 0	ER 4 4 1 5 0 0 0 0 0 0	K0 9 8 0 2 0 0	88 5 5 1 1 0 0	1 0 1 0 0 0	0 2 0 1 1 0 0	ERA 2.70 2.12 1.00 9.00 .00 .00 .00 .00
FAIRLY	24 24 24 24 25 21 6 0 14 0 0	LA H 3 12 4 3 5 8 6 1 3 0 5 0	HR 1 1 0 0 0 2 1 0 0 0 0 0 0 0 0 0 0 0 0 0	RBI 1 4 1 2 4 5 4 0 0 0 0 0 0 0 0 0 0	AVE -1.36 -1.50 -1.50 -2.38 -3.33 -2.40 -0.48 -5.00 -0.00 -3.57 -0.00	ROUFAX DRYSDALE PERRANOSKI FODRES MILLER RICHERT CALMUS WILLHITE ROEBUCK	1F 13 17 9 5 0 0 0	H 14 13 8 9 1 0 0	R 8 5 2 6 2 0 0 0 0 0	ER 4 4 1 5 0 0 0 0 0 0	K0 9 8 0 2 0 0	88 5 5 1 1 0 0	1 0 1 0 0 0	0 2 0 1 1 0 0	ERA 2.70 2.12 1.00 9.00 .00 .00 .00 .00
FAIRLY—— GILLIAM— WILLS—— MCMULLEN— HOWARD—— DAVIS T— ROSEBORO— MOON— TRACEWSKI— OLIVER—— WALLS—— CAMILLI— ZIMMER—— FERRIA	2 63-AB 22 24 24 20 21 24 25 21 6 0 14 0 0 1 0	3 12 4 3 5 8 6 1 3 0 0 0 0	HR 1 1 0 0 2 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0	RRI 1 4 1 1 2 4 4 0 0 0 0 3 3 0 0 0 0 0 0 0 0 0 0	AVE .136 .500 .167 .150 .238 .333 .240 .048 .500 .000 .357 .000 .000	ROUFAX DRYSDALE PERRANOSKI FODRES MILLER RICHERT CALMUS WILLHITE ROEBUCK	1F 13 17 9 5 0 0 0	H 14 13 8 9 1 0 0	R 8 5 2 6 2 0 0 0 0 0	ER 4 4 1 5 0 0 0 0 0 0	K0 9 8 0 2 0 0	88 5 5 1 1 0 0	1 0 1 0 0 0	0 2 0 1 1 0 0	ERA 2.70 2.12 1.00 9.00 .00 .00 .00 .00

Figure 6: Statistics for six games of the "World Series" between the 1961 Yankees (6a) and the 1963 Dodgers (6b).



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Listing 5: The Erase program, which deletes from the data file statistics developed from the games which have been simulated by the Game program. The roster ratings information is retained. See figure 7 for an example.

```
10 INPUT'FILE TO BE ERASED ? ",F$
20 OPEN#0,F$
30 B=1114\READ#0ZB,C\FORA=1T0138\WRITE#0,Z\NEXT
40 CLOSE#0
```

Listing 6: The Game program, written in North Star BASIC, which uses data based on historical performance of real baseball players to simulate any desired contest between various teams. This program occupies 24 K bytes of programmable memory when used with the North Star BASIC system.

```
1 INPUT NUM? ",ANFORE=OTOANC=RND(O)NEXT
5 LINE80
10 DIMH(1,16,14),F(1,9,17),N$(540),S(1,8,2,1),F$(20),T$(20)
15 DIMH$(24),S1(1,10),B(8),R(8)
17 Hs="SINGLEDOUBLETRIPLEH. R.
20 P$= P C1B2B38SLFCFRFDH*
30 FORA=OT01\B=(A*10)+10\INFUT*TEAM ? *,T$(B-9,B)\F$=T$(B-9,B)
40 OFEN#0,F$\B=270*A\FORC=OTO16\B=B+10
50 READEO, N$ (B-9, B)\FORD=OTO6\READEO, H(A, C, D)\NEXTD\NEXTC
60 FORC=OTO9\B=B+10\READ#O,N$(B-9,B)\FORD=OTO3\READ#O,F(A,C,D)\NEXTD
65 NEXTC\CLOSE#O\NEXTA
67 FORA *OTO1
70 | 'GIVE THE LINE-UP '\FORC=OTO8\!'BATTING',C+1,'
80 INPUT1'ID, FOS # ?',D,E\S(A,C,O,O)=D\S(A,C,O,1)=E
81 TEE<10RE>10THEN80
82 F=(A*270)+(D*10)+1\G=E*2
83 IFD016THEN80N!TAB(40),
84 !N$(F,F+9), * *,F$(G-1,G),\INFUT* OK ? *,Z$
86 IFZ$ THEN80\NEXTC
90 INFUT1 * ID# OF FITCHER ? *,W(A+2)
91 IFW(A+2)>9THEN90\!TAB(40);
92 F=(A*270)+170+(10*W(A+2))+1\\N$(F,F+9),*
94 INPUT* OK ? ",Z$\IFZ$<>**THEN90\NEXTA
100 1=9\Q=1
110 FORA=@TOI\!""\!"INNING #",A\FORB=OTO1
112 IFA 90RB 1THEN115\IFS1(1,10)>S1(0,10)THENEXIT970
115 C=W(B)\D=1\IFB=1THEND=O\F=W(D+2)
120 FORE=OTO2\IFS(B,C,E,1)>OTHENF=S(B,C,E,O)\NEXT
125 G=(270*B)+(10*F)+1
127 L=0\IFH(B,F,0)=2THEN130
128 IFH(B,F,0)=P(D,F,5)THEN129\L=.015\G0T0130
129 L=m.015
130 H=.5*(H(B,F,5)+F(D,F,2))+L+W(D+4)\H(B,F,7)=H(B,F,7)+1
135 !N*(G,G+9),* *,
140 G=RND(O)\IFG>HTHEN800
150 H=.5*(H(B,F,1)+F(D,F,1))+L+W(D+4)
160 IFG>HTHEN700\P(D;P;5)=P(D;P;5)+1
170 H=RND(O)\FORG=2TO4\IFH(B,F,G)>=HTHENEXIT190
180 NEXT\G=1
190 H=G*6\!H$(H-5,H)\H(B,F,8)=H(B,F,8)+1\GOSUB7000\GOSUB5900
195 IFG=4THENH(B,F,9)=H(B,F,9)+1
200 C=C+1\IFC>8THENC=O\W(B)=C\E9=0
     IFA>8AND8#1ANDS1(1,10)>S1(0,10)THENEXIT960
205
210 IFO<>3THEN120\G0T0950
700 | "WALK"\H(B,F,7)=H(B,F,7)-1\P(D,F,9)=P(D,F,9)+1\G=1\GOSUB6950
710 GOSUB5950\GOTO200
800 H=.5*(H(B,F,6)+P(D,F,3))\IFRND(O)>HTHEN820
810 ! STRIKES OUT
815 P(D,P,8)=P(D,P,8)+1\G0T0830
820 JFRND(0)<.98THEN825\G=1\K=1\!*ERROR*\09=09+1\GOSUB6000\GOTO200
825 IFRND(0)>.50RB(1)=00RO>1THEN828\!'DOUBLE FLAY'\O=0+2\B(1)=0\O9=09+2
826 R(1)=0\IF3>09THENGOSUB7000
827 G=0\K=1\IF3>0THENGOSUB6000\F(D;F;4)=F(D;F;4)+2\G0T0200
928 | "IS OUT" \G=0\IFRND(O)>.5THEN830\K=1\IFO9<2THENGOSUB7000
829 IFU <2THENGOSUB6000
830 U=0+1\F(D,F,4)=F(D,F,4)+1\09=09+1\G0T0200
950 FORG1=1TO8\B(G1)=0\R(G1)=0\NEXT\O=0\09=0\!**\NEXT\NEXT
960 IFS1(0,10)<>S1(1,10)THEN970\Q=10\I=10\GOTO110
970 G1=W(6)\G2=W(7)\G3=W(8)\G4=W(9)\F(G1,G2,10)=F(G1,G2,10)+100
971 P(G3,G4,10)=P(G3,G4,10)+1
972 GOSUBLOOO\FORG1=OTO1\FORG2=OTO16\FORG3=7TO10
```

Listing 6 continued on page 130

FILE TO BE ERASED ? 61-YANKS READY RUN FILE TO BE ERASED ? 63-LA READY

**Figure 7:** Sample execution of the program Erase of listing 5. This program purges statistics from simulated games; it does not alter the roster ratings information.

of program Game. With Game loaded in memory, only 132 bytes out of 24 K bytes are free, even after releasing the memory allocation for the functions ATN, SIN, COS, LOG, and EXP. The actual memory used by Game is 11,432 bytes.

Table 1 shows the North Star directory of the disk used to store the six programs of the package and the data files. Each team data file is eight blocks long. Five of the programs in the package are short. Programming details will be given only for the one long program, Game. It is likely that if the user wishes to enhance or modify the package, program Game will have to be changed. If you understand the workings of Game, the rest is simple. The North Star BASIC code for Game appears in listing 6.

Table 2 describes the operations of Game by line number groups, while table 3 defines the key variables. Figure 8 is a flowchart of the major divisions of program operation.

### Use of Statistics

The program determines if a batter gets a hit by adding his hits rating to the pitcher's hits rating (consult figure 2). This result is combined with the pitcher's tiring factor and a factor determined by the relationship between the batter's hitting side (right or left) and the pitcher's throwing arm (right or left). This result is then multiplied by 0.5 and compared to a random number. Look at table 4 for an example.

If the random number is below the final hit factor, the batter gets a hit. Note that the hits rating is not the player's batting average, because the player has the possibility of walking. Next, a walk rate is determined: Yastrzemski's .370 plus Wise's .323 multiplied by 0.5 = .3465.

This walk rate is compared to the same random number as before to

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```
Listing 6 continued:
```

```
973 H(G1,G2,G3+4)=H(G1,G2,G3+4)+H(G1,G2,G3)\H(G1,G2,G3)=O\NEXT\NEXT
974 FDR62=0T09\F0R63=4T010\F(61,62,63+7)=F(61,62,63+7)+F(61,62,63)
976 F(G1+G2+G3)=0\NEXT\NEXT\NEXT\FORG1=0T010\W(G1)=0
978 S1(0.G1)=0\S1(1.G1)=0\NEXT\W9=0
990 INFUT' RETURN TO END ? '.Z$\IFZ$="'THEN998 992 INFUT'LINE-UPS OK ? '.Z$\IFZ$<-''THEN67
 994 ! [$(1,10), \ ENPUT PITCHER ? ", W(2)
995 !T$(11,20),\INFUT* FITCHER ? *,W(3)
996 GOTO100
998 GOSUB2000\!FREE(O)\END
1000 !*BOX SCORE*\!**
 1010 FORG=OTOT\B=(G*10)+10\G1=40*G
 1020 !TAB(G1),T$(B-9,B), NEXT\!"
 1022 ! * *\FORG =OTO1\G1=40*G
 1024 !TAB(G1), NAME
                                                    POS
                                                                  AR
                                                                            H HR RBI",
 1026 NEXT\! * \! * *
 1030 FORG=0T08\FORG1=0T02
 1050 G4=0\F0RG3=0T01\IFS(G3,G,G1,1)=0THEN1080\G5=40*G3\G6=S(G3,G,G1,0)
1060 \quad B = (270*G3) + (10*G6) + 10 \times G4 = 1 \times G7 = (S(G3*G*G1*1)*2)
1070 !TAB(G5),N$(B-9,B), ",F$(G7-1,G7),"
 1075 FORG8=7T010\\\24I,H(G3,G6,G8),\NEXT
1080 NEXT\IFG4=1THEN!"\NEXTG1\NEXTG
1090 '"\\!"FITCHERS IP H R ER K BR*\!""
1110 FORG1=OTO1\FORG2=OTO9\IFF(G1,G2,4)>OTHEN1130
1120 IFF (G1,G2,5)>OTHEN1130\IFF (G1,G2,8)>OTHEN1130\GOTO1160
 1130 G3=(G1*270)+170+(10*G2)+1\G4=F(G1,G2,4)/3
1140 !N$(G3,G3+9),Z5F1,G4,
1150 FORG4=5T09\\Z3I*F(G1,G2,G4),\NEXT\IFF(G1,G2,10)=100THEN! WINNER*,
1152 IFF(G1,G2,10)=1THEN! LOSSER',\!' '
1160 NEXT\NEXT\!''\!' 1 2 3 4 5 6 7 8 9 - T'
1170 ! "VISTORS", \FORG1=OTO10\!%31,S1(O,G1), \NEXT\!""
                           •,\FORG1=0T010\!Z3I,S1(1,G1),\NEXT\RETURN
1180 1 HOME
 2000 FORA=OTO1\B=(A*10)+1\OFEN#0,T$(B,B+9)\B=1114
 2010 REAU#0%B,CNFORB=0T016NREAU#0,H(A,B,7),H(A,B,8),H(A,B,9),H(A,B,10)
 2020 FORC=11T014\H(A,B,C)=H(A,B,C)+H(A,B,C-4)\NEXT\NEXT
 2030 FORB=OTO9\READ#O,P(A,B,4),F(A,B,5),F(A,B,6),F(A,B,7),F(A,B,8)
 2035 REAL (0, P(A, B, 9), P(A, B, 10)
 2040 FORC=111017\F(A,B,C)=F(A,B,C)+F(A,B,C-7)\NEXT\NEXT
 2050 B=1114\READ#0%B,C\FORB=0T016
 2060 WRITE#0,H(A,B,11),H(A,B,12),H(A,B,13),H(A,B,14)\NEXT
 2070 FORB=OTO9\WRITE#0,F(A,B,11),F(A,B,12),F(A,B,13),F(A,B,14)
 2075 WRITE#0,F(A,B,15),F(A,B,16),F(A,B,17)\NEXT\CLOSE#0
 2080 NEXT\RETURN
 5900 K@G\IFRND(0)>.6THENK=K+1\GOTO6000
 5950 K=1\IFB(1)=OTHEN6005\IFB(2)=OTHEN5960\GOTO6000
5930 R(2)=P+1\G0T06005
6000 FORG1=3T01STEF-1\B(G1+K)=B(G1)\B(G1)=O\NEXT
6005 IFG=4THENB(8)=F+1\IFG<>4THENB(G)=F+1\G4=0
6010 G2=0\F0RG1=4T08\IFB(G1)=0THEN6040\G4=G4+1\V=E(G1)=1\E(G1)=0
6020 L=A-1\IFA>9THENL=9\S1(B,L)=S1(B,L)+1\S1(B,10)=S1(B,10)+1
 6030 \quad \texttt{B(G1)=0} \\ \texttt{H(B,F,10)=H(B,F,10)} \\ +1 \\ \texttt{H(D,V,6)=F(D,V,6)} \\ +1 \\ \texttt{H(B,F,10)} \\ +1 \\ \texttt{H(B
6040 NEXT\IFG4<1THEN6042\\G4,* RUNS SCORE *,
6041 !T$(1,10),S1(0,10),* *,T$(11,20),S1(1,10)
6042 IFG4<2THEN6043\W(4+D)=W(4+D)+.025
6043 m=0
8048 IFE(1)=OTHEN6050N!*RUNNER ON FIRST */NM=1
6050 IFB(2)=OTHEN6060N!*RUNNER ON SECOND */NM=1
6060 IFB(3)=OTHEN6070\!"RUNNER ON THIRD ",\M=1
6070 IFM=1THEN! " \IFG4=0[HENRETURN\GOSUB6200\GOSUB6100\RETURN
6100 INPUTTE, H, OR B ? . ,Z$\IFZ$=""THENRETURN\IFZ$="H"THEN6150
6110 W(D +4)=0\INFUT*F# ? *,Z\IFZ>9THEN6110\W(2+D)=Z\F=Z
6120 IFZ$= *F * THENRETURN
8150 INPUT BATS, F# ? *,Z,Z1\Z=Z-1\IFZ>8THENRETURN\IFZ<OTHENRETURN
6160 FORG1=0T02\IFS(B,Z,G1,1)=0THENEXIT6180
6170 NEXTNETTWO SUBS ALREADY USED THERE \GOTO6150
6180 S(B,Z,G1,0)=Z1\INFUT*POS ? *,Z1\IFZ1>1OTHENZ1=10
6190 S(B, Z, G1, 1) = Z1\GOTO6150
6200 IFW9=OTHEN6220\IFB+1=W9THENRETURN
6210 IFSt(0,10)=S1(1,10)THEN6230\IFSt(B,10)>S1(D,10)THEN6220\RETURN
8220 W(8) =D\W(9)=W(2+D)\W(6)=B\W(7)=W(2+B)\W9=1+B\RETURN
6230 W9=0\RETURN
6950 K=1\IFR(1)=OTHEN7005\IFR(2)=OTHEN6960\GOTO7000
6960 R(2) =P+1\GOTO7005
 7000 IF09>2THENRETURN\F0RG1=3T01STEF-1\R(G1+K)=R(G1)\R(G1)=0\NEXT
7005 IFG=4THENR(8)=F+1\IFG<>4THENR(G)=F+1
 7010 FORG1=4TO8\IFR(G1)=0THEN7040
 7020 V≕R(G1)-1
```

?			
*LI			
ERASE	4	4	2
ERASE2	8	4	2
INPUT	12	6	2
INFUT2	18	6	2
ROSTER	24	6	2
ROSTER2	30	6	2
GAME	36	22	2
GAME 2	58	22	2
STATS	80	6	2
STATS2	86	6	2
61-YANKS	92	8	3
69-METS	100	8	3
75-BOSTO	108	8	3
63LA	116	8	3
62-METS	124	8	3
I <sub>E.</sub> I X	132	6	2
FIX2	138	6	2
*			

Table 1: Directory of the disk files consisting of the baseball-simulation programs and data. Each team data file is eight blocks long on this North Star Comvuter flovvy disk system.

determine if the batter gets a base on balls. Assuming that the batter makes an out, a strikeout possibility is determined in a similar manner with a new random number  $(.169 + .136 \times 0.5 =$ .1525 is the Yastrzemski/Wise strikeout factor). If the batter is not a strikeout victim, another random number is generated to see if he hits into a double play, reaches base on an error, or advances the runners that might be on base.

### Hits, Runs, and Errors

On the occasions when a batter gets a hit, a random number is compared first to his double rate, then his triple rate, and finally his home run rate (Yastrzemski has ratings of .205, .212, and .308 for these hits). |By a pleasant coincidence, this article was edited on the same day that Carl Yastrzemski hit his home run number hexadecimal 190....RSS). If at any point in the comparisons the rate exceeds the random number, the comparison process ceases and the batter is awarded the type of hit currently being considered. If all comparisons fail, the hit is assumed to be a singlebase hit. A new random number is generated to see if the possible base runners advance one base more than the hit is valued at (single = 1, double = 2, etc).

The variable array (with seven elements) is used to keep track of base

Text continued on page 134

7040 NEXT\RETURN

2030 R(G1)=0\P(T)+U+7)=P(T)+U+7)+1

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30 thru 65	Read data from disk files
67 thru 94	Batting order input section
100	Set start and end inning
110 thru 990	Play game
992 thru 998	Select pitchers for new game
1000 thru 1180	Subroutine for printing box game
2000 thru 2080	Subroutine to write updated statistics to disk file
5900 thru 6070	Subroutine to determine run scored and position of base runners
6100 thru 6190	Subroutine for player substitutions
6200 thru 6230	Subroutine for determining winning and losing pitchers
6950 thru 7040	Subroutine for calculating earned runs

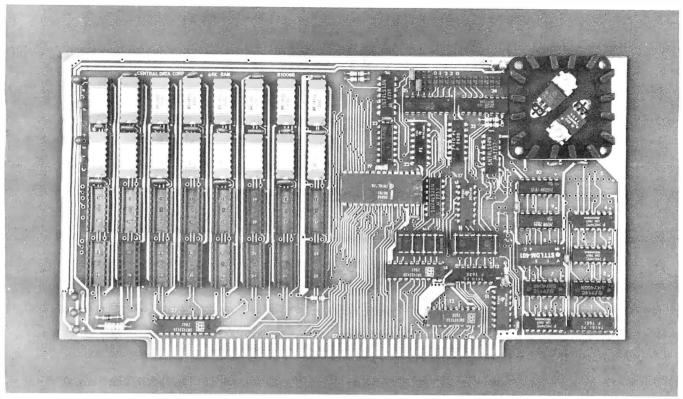
**Table 2:** Operations performed by various lines of BASIC code in the Game program of listing 6.

Variabl and Dimensio	
S(1,8,2,1)	1 = Teams 8 = batting order 2 = up to three players in each batting position 1 = identification number and position
T\$(20)	Team names
P\$(20)	Position names
H(1,16,14)	1 = Teams 16 = seventeen players 14 = 0 to 6 = player ratings 7 to 10 = at bats, hits, home runs, and runs batted in for the game 11 to 14 = total at bats, hits, home runs, and runs batted in as read and written to disk
P(1,9,9)	1 = Teams 9 = ten pitchers 9 = 0 to 3 = player ratings 4 to 10 = innings pitched, hits, runs, earned runs, strikeouts, walks and win or loss for the game 11 to 17 = total innings pitched, hits, runs, earned runs, strikeouts, walks and wins or losses as read and written to disk
W(9)	0 who's up (visiting team) 1 who's up (home team) 2 visiting team's pitcher 3 home team's pitcher 4 visting team pitcher's tiring factor 5 home team pitcher's tiring factor 6 leading team number (0 or 1) 7 identification number for leading pitcher 8 trailing team number
	9 identification number for trailing pitcher 1 runner on first 2 runner on second 4-3 runner on third
R(7)	4-7 runs scored same as B(7), but tracks earned runs

**Table 3:** Use and size of array variables in the Game program of listing 6.

Yastrzemski Hits Wise Hits Pitcher tiring factor (assume 0) Left handed batter versus right handed pitcher	$= .232$ $= .253$ $= .000$ $= .015$ $500 \times .5 = .250$
--	--

**Table 4:** Statistical determination of the probability of batter Yastrzemski producing a safe hit from a pitch thrown by Wise. The hits factors for pitcher and batter are added together, along with a factor for pitcher tiring and a factor for the relationship of a left-hunded batter facing a right-handed pitcher. The sum of these factors is multiplied by 0.5 and then compared with a random number. If the random number is less than the computed probability, Yastrzemski has hit safely.



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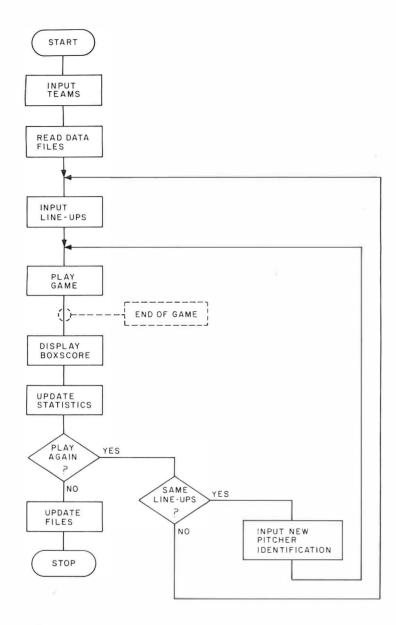
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### **Central Data**



**Figure 8:** Flowchart of the major divisions of operation of the Game program of listing 6.

### Text continued:

runners; all B values are set to 0 every half inning. If a batter gets a single that advances all runners by one base, variable B(4) is set to equal the value of B(3), B(3) is set to B(2), B(2) to B(1), and B(1) is set to a value of 1 plus the opposing pitcher's identification number. If a batter gets a singlebase hit that moves runners two bases, B(5) is set to the value of B(3) and B(3) is set to 0, B(4) is set to the value of B(2) and B(2) to 0, B(3) to B(1) and B(1) to 0, and B(1) is set to a value of 1 plus the opposing pitcher's identification number. A similar process is used on outs that advance runners.

This procedure is done in the sub-

routine beginning with line 5900 in listing 6. The second half of this subroutine determines if any runs are scored by seeing how many of the B array elements with subscripts between 4 and 7 are not 0. Each positive number indicates one run. When I first wrote the program, the B array elements were set to either 0 or 1. However, by using the pitcher's identification number plus 1, all runs scored can be attributed to the record of the appropriate pitcher.

A similar tracking of runners and runs is recorded in the variable array R (with seven elements). This is needed to register earned runs only. All errors are assumed to be outs. Therefore, certain runners and advances are ignored, and innings end earlier with this variable allowing for the proper calculation of earned runs.

A subroutine for calculating winning and losing pitchers (beginning with line 6200 in listing 6) is consulted after each run is scored. If the particular run scored breaks a tie (the game starts with the score 0 to 0), a new winning pitcher is recorded. If the run causes a tie, the current winning and losing pitchers are removed from their particular status.

As demonstrated in the sample, a substitution can be made only after a run is scored. This is due to the fact that the subroutine at line 6100 is currently consulted only at that point. If you desire the option of a substitution after every play, merely add the program line:

122 GOSUB 6100

and remove the current:

"GOSUB 6100"

from line 6070.

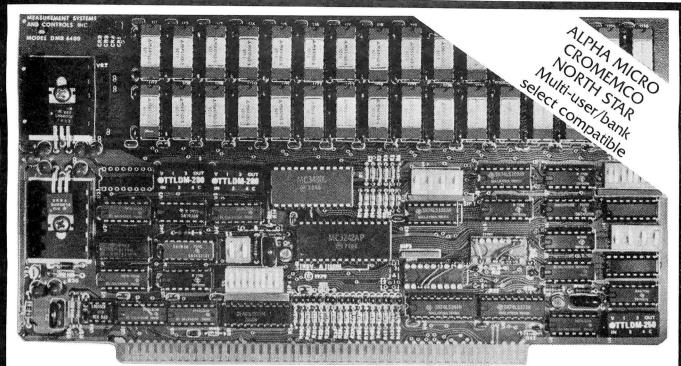
Program Testing

After you enter the Game program into your computer, a test routine will be necessary to check for possible errors made during the program's entry. Changes in line 990 and in line 6100 of listing 6 will permit the program to loop and play numerous games without requiring any input from the user after the lineups are assigned. The revised lines are:

990 C9 = C9 + 1: IF C9 = 50THEN 998: GOTO 100 6100 RETURN

These modifications make the program play fifty consecutive games (C9=50 determines the number ofgames) with the same lineups and without asking the user for any substitutions.

In order to test the program after I wrote it, I played the 1961 New York Yankees against the 1962 New York Mets for fifty games. The results were amazing. The Yankees (who won 109 of 162 real games for a winning percentage of 67% in 1961) won 35 of the 50 games in the simulation for a 70% winning average. The Mets (who won 40 of 160 games, or 25%,



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NAME ==========	AB		HR	RBI	AVE	NAME	16	Н	R	ER	KO	EE	W	I.
SKOWRON 1		43	3		.244	FORD				202	291	251	39	11
RICHARDSON 2		68	4		,292	TERRY	()	0	()	0	()	0	0	C
KUBEK 2	220	70	6	32	.318	ARROYO	0	0	0	0	0	0	0	C
BOYER 1		48	()	15	.249	STAFFORD	0	0	0	0	0	0	()	C
MARIS 2		71	29	84	.313	COATES	()	0	()	0	0	0	0	(
MANTLE 1	184	56	10	29	.359	SHELDON	0	0	()	0	0	0	()	C
BERRA 1	199	54	9	33	.271	DALEY	0	0	()	0	0	0	0	C
HOWARD 2	204	90	25	67	.441	TURLEY	0	0	0	0	0	()	0	0
LOPEZ	0	0	0	0	.000	RENIFF	()	()	()	0	0	0	0	0
BLANCHARD- 1	194	45	18	38	.232	DUREN	0	0	0	0	0	0	0	0
CERV	0	0	0	()	.000									
GARDNER	0	0	0	0	.000									
DEMASTRI	0	0	0	0	.000									
REED	()	0	0	0	.000									
TORGESSON-	()	0	0	0	.000									
GONDER	()	0	0	0	.000									
JOHNSON	0	0	0	0	.000									
ETLE NAME 2				JUE	.303		4/6	4/1	228	202	291	251	39	1.1
FILE NAME ?	62- AB	-METS	3 HR	RBI	AVE	NAME.	ΙΡ	Н	Ŕ	ER	KO	FF	W	l.
	62- AB	-METS	3 HR	RBI	AVE		IP	Н	Ŕ	ER	KO	FB	W	l.
NAME ========	62- AB 0	-МЕТ: Н	S HR	RBI O	AVE.		IP	Н	F:	ER	K0	FB	W	L 39
NAME THRONEBERR	62- AB 0 228	-METS H 	3 HR ====	RBI 0 11	AVE	CRAIG	IP 455	H 555	R 332	ER 270	KO 158	RB ==== 178	W 11	L 39
NAME THRONEBERR NEAL 2	62- AB 0 228	-METS H -==== 0 48	3 HR 0 3	RBI 0 11 14	AVE .000	CRAIG	IP 455 0	H ===== 555 0	R 332 0	ER 270 0	K0 158 0	EE 178 0	W 11 0	3 9 0
NAME THRONEBERR NEAL 2 CHACON 1	62- AB 0 228 170	-METS H 0 48 49	6 HR 0 3 0	RBI 0 11 14 0	AVE .000 .211	CRAIG HOOK JACKSON	IF 455 0	H 555 0 0	8 332 0 0	ER 270 0	K0 158 0	EB 178 0	W 11 0	3.9 0.0
NAME THRONEBERR NEAL	62- AB 0 228 170 0	-METS H 0 48 49 0 58 51	6 HR 0 3 0	RBI 0 11 14 0 24	.000 .211 .288	CRAIG HOOK JACKSON MACKENZIE-	IF 455 0 0	H 555 0 0	8 332 0 0	ER 270 0 0	K0 158 0 0	178 0 0	W 11 0 0	3.9 () ()
NAME THRONEBERR NEAL 2 CHACON 1 MANTILLA ASHBURN 2	62- AB 0 228 170 0 207	-METS H 0 48 49 0 58	6 HR 0 3 0 0 4	RRI 0 11 14 0 24 29	AVE .000 .211 .288 .000	CRAIG HOOK JACKSON MACKENZIE- ANDERSON	1F 455 0 0	H 555 0 0 0	8 332 0 0 0	ER 270 0 0 0	158 0 0 0	178 0 0 0	W 11 0 0 0	3 9 0 0
NAME THRONEBERR NEAL 2 CHACON 1 MANTILLA ASHBURN 2 HICKMAN 1	62- AB 0 228 170 0 207 195 220	-METS H 0 48 49 0 58 51	6 HR 0 3 0 0 4 5	RBI 0 11 14 0 24 29 35	AVE .000 .211 .298 .000 .280 .262	CRAIG—— HOOK——— JACKSON—— MACKENZIE— ANDERSON—— HILLER———	1F 455 0 0 0	555 0 0 0 0	332 0 0 0 0	ER 270 0 0 0 0 0 0	K0 158 0 0 0	178 0 0 0 0	11 0 0 0	1. 39 (0 (0 (0 (0
NAME  THRONEBERR NEAL 2 CHACON 2 MANTILLA 3 ASHBURN 1 HICKMAN 1 THOMAS 2 CANNIZZARO 1 KANEHL 1	62- AB 0 228 170 0 207 195 220 175 0	-MET! 0 48 49 0 58 51 59 39	6 HR 0 3 0 0 4 5 8 0	RBI 0 11 14 0 24 29 35 15	AVE .000 .211 .288 .000 .252 .258 .223 .000	CRAIG HOOK JACKSON MACHENZIE ANDERSON HILLER CISCO IAVIAULT HUMTER	1F 0 0 0 0 0 0	555 0 0 0 0 0 0	332 0 0 0 0 0 0	270 0 0 0 0 0	158 0 0 0 0 0	FR 178 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	W 11 0 0 0 0 0	I. 359 (((((((((((((((((((((((((((((((((((
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NAME  THRONEBERR NEAL 2 CHACON 1 MANTILLA ASHBURN 2 HICKMAN 1 THOMAS 2 CANNIZZARO 1 KANEHL CHRISTOPHE 1 WOODLING 1	62- AB 0 228 170 0 207 195 220 175 0 192 0	-METS H 48 49 0 58 51 59 39 0 36 0	5 HR 0 3 0 0 4 5 8 0 0 0 4 0	RRI 0 11 14 0 24 29 35 15 0 23 0	AVE .000 .211 .298 .000 .280 .262 .263 .000 .188 .000	CRAIG HOOK JACKSON MACHENZIE ANDERSON HILLER CISCO IAVIAULT HUMTER	1F 0 0 0 0 0 0	555 0 0 0 0 0 0	332 0 0 0 0 0 0	270 0 0 0 0 0	158 0 0 0 0 0	FR 178 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	W 11 0 0 0 0 0	I. 33 99 00 00 00 00 00 00 00 00 00 00 00 00
NAME  THRONEBERR NEAL 2 CHACON 1 MANTILLA ASHBURN 2 HICKMAN 1 THOMAS 2 CANNIZZARO 1 KANEHL CHRISTOPHE 1 WOOULING TAYLOR 2	62- AB 0 228 170 0 207 195 220 175 0 192 0	-MET: H 0 48 49 0 59 51 59 39 0 36 0	3 HR 0 3 0 0 4 5 8 0 0 4	RRI 0 11 14 0 24 29 35 15 0 23 0	AVE .000 .211 .288 .000 .280 .262 .268 .223 .000 .188 .000 .000	CRAIG HOOK JACKSON MACHENZIE ANDERSON HILLER CISCO IAVIAULT HUMTER	1F 0 0 0 0 0 0	555 0 0 0 0 0 0	332 0 0 0 0 0 0	270 0 0 0 0 0	158 0 0 0 0 0	FR 178 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	W 11 0 0 0 0 0	I. 33 99 00 00 00 00 00 00 00 00 00 00 00 00
NAME  THRONEBERR NEAL 2 CHACON 1 MANTILLA ASHBURN 1 HICKMAN 1 THOMAS 2 CANNIZZARO 1 KANEHL CHRISTOPHE 1 WOOILING TAYLOR COLEMAN COLEMAN 1	62- AB 0 228 170 0 207 195 220 175 0 192 0	-METS -METS -0 -48 -49 -0 -59 -59 -0 -0 -0 -0 -0	3 HR 0 3 0 0 4 5 8 0 0 4 0 0	RBI 0 11 14 0 24 29 35 15 0 23 0 0	AVE .000 .211 .298 .000 .280 .262 .268 .000 .188 .000 .000 .000	CRAIG HOOK JACKSON MACHENZIE ANDERSON HILLER CISCO IAVIAULT HUMTER	1F 0 0 0 0 0 0	555 0 0 0 0 0 0	332 0 0 0 0 0 0	270 0 0 0 0 0	158 0 0 0 0 0	FR 178 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	W 11 0 0 0 0 0	I. 33 99 00 00 00 00 00 00 00 00 00 00 00 00
NAME  THRONEBERR NEAL 2 CHACON 2 HANTILLA 3 HSHBURN 1 HICKMAN 1 HOMAS 2 CANNIZZARO 1 KANEHL CHRISTOPHE 1 WOOILING TAYLOR COLEMAN HONGES 2	62- AB 0 228 170 0 207 175 0 175 0 0 0 0 0	-METS 0 48 49 0 59 51 59 36 0 0 0 59	3 HR 0 3 0 0 4 5 8 0 0 0 4 0 0 0 27	RBI 0 111 14 0 24 29 35 15 0 23 0 0 0 59	AVE .000 .211 .298 .000 .280 .232 .238 .223 .000 .188 .000 .000 .288	CRAIG HOOK JACKSON MACHENZIE ANDERSON HILLER CISCO IAVIAULT HUMTER	1F 0 0 0 0 0 0	555 0 0 0 0 0 0	332 0 0 0 0 0 0	270 0 0 0 0 0	158 0 0 0 0 0	FR 178 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	W 11 0 0 0 0 0	I. 33 99 00 00 00 00 00 00 00 00 00 00 00 00
NAME  THRONEBERR NEAL  CHACON  IMANTILLA  ASHBURN  ITHOMAS  CANNIZZARO  KANEHL  CHRISTOPHE  WOODLING  TAYLOR  COLEMAN  HOUGES  BOUCHEE	62- AR 0 228 170 0 207 195 220 175 0 0 0 0 0 205 0	0 48 49 0 53 51 59 0 33 0 0 0 59	3 HR 0 3 0 0 4 5 8 0 0 0 0 0 27 0	REI  0 11 14 0 24 29 35 15 0 23 0 0 59	AVE .000 .211 .288 .000 .262 .268 .223 .000 .188 .000 .000 .000 .000 .000 .288 .000	CRAIG HOOK JACKSON MACHENZIE ANDERSON HILLER CISCO IAVIAULT HUMTER	1F 0 0 0 0 0 0	555 0 0 0 0 0 0	332 0 0 0 0 0 0	270 0 0 0 0 0	158 0 0 0 0 0	FR 178 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	W 11 0 0 0 0 0	3 9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
NAME  THRONEBERR NEAL 2 CHACON 2 HANTILLA 3 HSHBURN 1 HICKMAN 1 HOMAS 2 CANNIZZARO 1 KANEHL CHRISTOPHE 1 WOOILING TAYLOR COLEMAN HONGES 2	62- AR 0 228 170 0 207 195 220 175 0 0 0 0 0 205 0	-METS 0 48 49 0 59 51 59 36 0 0 0 59	3 HR 0 3 0 0 4 5 8 0 0 0 4 0 0 0 27	0 11 14 0 24 29 35 15 0 23 0 0 0 59 0 18	AVE .000 .211 .298 .000 .280 .232 .238 .223 .000 .188 .000 .000 .288	CRAIG HOOK JACKSON MACHENZIE ANDERSON HILLER CISCO IAVIAULT HUMTER	1F 0 0 0 0 0 0	555 0 0 0 0 0 0	332 0 0 0 0 0 0	270 0 0 0 0 0	158 0 0 0 0 0	FR 178 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	W 11 0 0 0 0 0	l.

**Figure 9:** Individual player statistics derived from the simulated play of fifty baseball games between the 1961 New York Yankees (9a) and the 1962 New York Mets (9b). In this fifty-game series the pitcher-tiring factor was set to 0. In team results, the Yankees won 39 of 50 (78%) of the games, and the Mets won 11 of 50 (or 22%).

1792 471 51 228 .233

in 1962) won the other 15 games for a 30% winning average.

The numbers of hits and runs scored in this simulation were a little bit high, since the designated hitter was used (this did not occur in either 1961 or 1962) and the pitchers were never removed after tiring. Every time 2 runs are scored in an inning and for every scoring occasion in an inning after the 2 runs have been scored, the pitcher's hit rating is worsened by 0.025. This is done in line 6042 of the Game program.

A second test of fifty games was run. However, this test eliminated the tiring factor by changing the equation in line 6042. This line is branched to by other program statements; thus it could not be removed. Instead it became a nonfunctioning line: W(D+4)=W(D+4). The program was again tested.

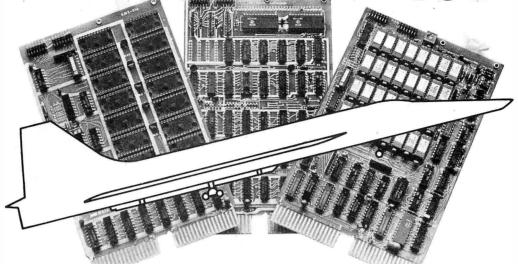
In the second test, the Yankees won 39 (or 78%) of the games, while the Mets won only 11 (or 22%). The individual statistics appeared reasonable and are shown in figure 9. The model was clearly performing accurately with the statistically better team winning the majority of the games. The program Game was modified back to its original form, and the World Series described at the

beginning of this article was run using the model.

455 555 332 270 158 178 11 39 5.34

Due to memory limitations, other enhancements were left out of this baseball-simulation model. For example, the display message for outs could be replaced by regular baseball scoring (6-3 meaning ground-out from shortstop to the first baseman), home run rates could be determined by the size of the field the simulation is assumed to be played in, and prepared lineups for each team could be stored on disk to facilitate play. If you modify these programs, please write to me. I would like to know the details.

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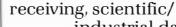
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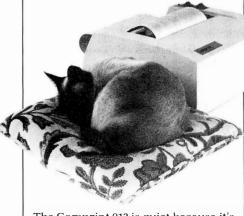
offer a 6 month warranstandard. The key to all this superior perfor-

The superior print quality provided by the Comprint 912 is obvious in this actual size sample.

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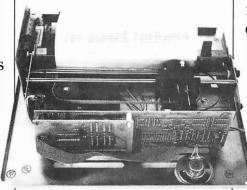


The Comprint 912 is quiet because it's electronic not mechanical.

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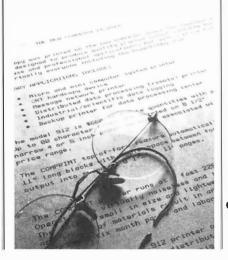


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# Stack It Up

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Most microprocessors currently available employ a stack of some sort. This stack is either a scratch memory in the processor itself or an addressable programmable memory characterized by retrieval of information in the reverse order of storage using a pointer. In the common parlance, a stack is a LIFO (last in first out) mechanism. It is a very useful feature for preserving the proper

Listing 1: PARSE, a translation procedure written in an informal ALGOL.

```
STRING PROCEDURE PARSE(Exp):
STRING Exp;
BEGIN
  EXTERNAL INTEGER PROCEDURE
                                           Intoken
  LOGICAL
                           Endinput,
                                           Errflag
                           Position.
  INTEGER ARRAY S =
                                                 -9,
                             - 3
                                3
                                       4
                                           -4
                                                -9,
                                                _9.
                              5 -5
                                      -6
                                            6
                                       8
                                           -8
                                                 -9
  STACK Q;
  Errflag := Endinput := false;
PARSE := null; Position := 0
  I := Intoken(Exp, Position, Endinput);
     := Intoken(Exp, Position, Endinput);
  COMMENT I is last token, J is current ;
  IF Endinput THEN Errflag := true
  ELSE WHILE NOT Endinput DO BEGIN
     T := S(I,J); IF T < 0 THEN Errflag := true
ELSE CASE T OF BEGIN
        COMMENT valid sequence of tokens ;
        CASE1: BEGIN
                  Q := PARSE; PARSE := null;
                END;
        CASE2: null;
        CASE3: PARSE := PARSE . Q;
        CASE4: PARSE := PARSE . Exp(Position) . '$';
        CASE5: BEGIN
                   Q := PARSE . '$'; PARSE := null;
                END;
        CASE6: PARSE := PARSE . Exp(Position);
        CASE7: PARSE := PARSE . Q;
        CASE8: PARSE := PARSE . Exp(Position) . Exp (Position-1);
  END;
  I := J;
    := Intoken(Exp, Position, Endinput);
  END:
  WHILE NOT Q = empty DO PARSE := PARSE .Q; IF Errflag THEN PARSE := null;
END.
```

order of subroutine call and return points with minimal hassle. Experienced programmers using 8080 type machines quickly discover its other uses; for example, a direct register store instruction is three bytes long on the 8080, whereas a register stack instruction is only one byte. As a result, saving registers used by subroutines and restoring them later is cheaper if the stack is used in preference to some directly addressed memory area. More importantly, perhaps, the availablity of such a mechanism greatly simplifies the writing of reentrant routines, ie: ones which do not modify themselves in the process of execution. Note, however, that all the mechanisms provided in microprocessors to date for stack operations are explicitly fixed mode and singular. There is only one stack, and it operates on entities of the same width, in number of bits, as the accumulator(s). Moreover, these entities have no attribute other than their fixed width, in bits.

In contrast, several large scale computers, such as the Burroughs 5500 processor with which I am familiar, employ a more generalized stack mechanism in which:

- The storage area for the stack(s) is independent of the central processor's memory, ie: not directly addressable.
- The entities being stored and retrieved have attributes of type (integer, logical, real, string, array) and of length (array size).
- Multiple stacks may be processed simultaneously and independently.

To achieve the latter, the stack controller requires a "stack control block" in central processor addressable memory to be uniquely associated with each active stack. Otherwise, such stack controllers bear approximately the same relation to the central processor and its addressable memory as a

high speed data channel, in that the data transfers are generally effected through cycle stealing direct memory addressing, and an unmaskable interrupt to the central processor occurs only when an error condition, stack overflow or underflow, is detected.

I don't seriously propose such a stack controller for the representative homebrew computer system. I do propose, however, to show by example that incremental programming development in that direction can provide correspondingly simpler solutions to a large class of computing problems.

### A Problem

One of the curious properties of calculators using Polish notation techniques is that any expression using the operators provided on the keyboard can be evaluated in an absolute minimum of keystrokes. Moreover, the required number of temporary storage areas, depth of stack, is at most the number of operands for the most complex operator. In an exactly analogous way, a stack of depth two or a second accumulator is sufficient in digital computers for evaluating any size expression using operators corresponding to native instructions, provided that the terms are calculated in the correct order. The price one pays for this admittedly pleasing property is learning to think things from the inside out. The user mentally seeks the interior of the expression, innermost term in parentheses, and works outward in calculation left to right. The pity is that it doesn't come easily to lots of folks since most people use the algebraic method of solving expressions which is the way they were taught in school. [If a larger stack is used the expression can be evaluated from the left to right with the intermediate answers pushed onto the stack. . . RC/

### A Solution

The main problem with Polish notation is really one of representation. One wants to enter an expression in the same way it appears in, for example, a statistics handbook. If that could be done, if a way could be found to rearrange expressions from algebraic form to Polish notation, a mathematical calculator or computer could be constructed having the computational efficiency of Polish notation without sacrificing ease of use. In fact, this process of rearrangement has been intrinsic to most higher level programming language compilers and interpreters for many years. The manner in which the rearrangement is done is most easily explained in terms of a program

Input string: 1 + (((A+B)/C) - (D\*(E-F)/G)) / H

•	•			15 15 17 17 17	
Position	i	j	t	PARSE	Q
1 2 3 4	4 4 3	3	8 5	null +1 null	empty +1\$
4	1	1	1	null	null, +1\$
5	1	1	1	null	null, null, +1\$
6 7 8 9	1 4 3 4	4 3 4 2	2 8 6 7	+A +AB	null,
10 11 12	2 3 4	3 4 2	4 6 7	+AB/\$ +AB/\$C	+1\$
13 14	2	2 3 1	4 5	+AB/\$C-\$ null	+AB/\$C-\$\$, +1\$
15 16 17	1 4 3	4 3 1	2 8 5	*D null	*D\$, +AB/\$C-\$\$,
18 19 20 21	1 4 3 4	4 3 4 2	2 8 6 7	-E -EF -EF*D\$	+1\$ +AB/\$C-\$\$,
22 23 24 25 26 27	2 3 4 2 2 3	3 4 2 2 3 4	4 6 7 3 4 6	-EF*D\$/\$ -EF*D\$/\$G -EF*D\$/\$G+AB/\$C-\$\$ -EF*D\$/\$G+AB/\$C-\$\$+1\$ -EF*D\$/\$G+AB/\$C-\$\$+1\$/\$ -EF*D\$/\$G+AB/\$C-\$\$+1\$/\$	+1\$ +1\$ empty

Figure 1: Sample parsing process resulting from use of program PARSE.

which does just that by use of a stack only slightly more general than the native stack in microprocessors.

### Explanation

Listing 1 is a procedure for parsing, computer jargon for rearranging, generalized binary operator expressions. In somewhat less prosaic language: PARSE is a program which takes an algebraic form expression and rearranges it to produce a sub-Polish notation form expression containing references, where needed, to the runtime stack. Its output presumes that the result of each calculation is immediately placed on the stack.

Note that PARSE does not count parentheses. In fact, it does not even use them directly. Instead, it uses an external procedure called INTOKEN to scan the input expression, EXP, and produce encoded tokens depending on the current input:

- 1 for a left parenthesis.
- 2 for a right parenthesis.
- 3 for an operator.
- 4 for a constant or symbol.
- 5 if none of these.

Text continued on page 144



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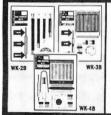
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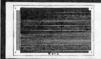
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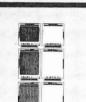
A- PC-03	PRINTED CIRCUIT BOARD	\$5.95
1 0 00	The second second	03.33



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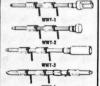
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30-R-50-040	30 AWG Red Wire 4" Long	\$1.23
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30 W 50 050	30 AWG White Wire, 5" Long	\$1.30
30-R-50-050	30 AWG Red Wire 5" Long	\$1.30
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### mos, cmos-safe

GROUND STRAP NOT INCLUDED

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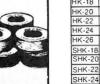
	GROUND STRAP NOT INCLUDED	
MOS-40	36-40 PIN CMOS SAFE	\$7.95



#### DIP IC EXTRACTOR TOOL

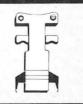
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------	----------------	--------



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SHK-20	20 AWG	25 FT	STRANDED CONDUCTOR	\$ .98
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SHK-26	26 AWG	50 FT.	STRANDED CONDUCTOR	\$1.35



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Removes 24-40 pin IC's, .600" centers. C-MOS safe. Includes terminal lug for attachment of ground strap.

GROUND STRAP NOT INCLUDED

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Listing 2: INTOKEN encodes the current character in the input expression, Exp. As before, an informal ALGOL type notation is used.

```
INTEGER PROCEDURE INTOKEN (Exp., Position, Endinput):
LOGICAL Endinput;
INTEGER Position
                Exp;
STRING
BEGIN INTOKEN := 0
   IF Position = SIZE(Exp) THEN Endinput := true
     Position := Position + 1;

WHILE Exp(Position) = ' ' DO Position := Position + 1;

IF Exp(Position) = '(' THEN INTOKEN := 1
     ELSE IF Exp(Position) = ') 'THEN INTOKEN := 2
     ELSE IF Exp(Position) = ANY('+', '-', '*', '/') THEN INTOKEN = 3
     ELSE BEGIN
        INTOKEN -= 5:
        COMMENT Presume error first, determine otherwise later:
        IF NOT (0 > Exp(Position) OR '9' < Exp(Position))
        THEN BEGIN
           INTOKEN := 4
           WHILE NOT (0 > Exp(Position) OR '9' < Exp(Position))
           DO Position
                         := Position + 1; Position := Position -1;
        IF NOT ('A' > Exp(Position) OR 'Z' < Exp (Position))
        THEN BEGIN
           INTOKEN := 4:
           WHILE NOT ('A' > Exp(Position) OR 'Z' < Exp(Position))
           DO Position := Position + 1; Position := Position -1;
        END;
     END:
  END;
END.
```

Listing 3: Single stack control routines written for the 8080 processor. STACK places a string of characters on a LIFO list, followed by the length of the string. POPSD removes the length of the last entered string, if any, from the list. POPUP removes the last entered string, if any, from the list. (Note: These routines are not debugged; in fact, the symbol STACK is multiply defined, so that it won't assemble correctly. They are included here only to suggest an appropriate technique.)

```
STACK:
          PUSH
                     PSW
                                    COMMENT The following presumes
                                    external procedures ABUF and
          PUSH
                     В
                     D
                                    RBUF whose functions are.
          PUSH
          PUSH
                     Н
                                    respectively,
                                       acquire a buffer of byte size
          XCHG
                     STACK
          I.HI.D
                                        specified by A, returning
          PUSH
                     Н
                                        address in H.L or zero if
          POP
                     R
                                        none available
          ADI
                     3
                                       release a buffer addressed by
          CALL
                     ABUF
                                        H,L to the buffer pool
          MOV
                     A,H
          ORA
                                    STACK: SAVE(H,L);
                                    ABUF (A+3); IF 0
                     STKOF
          JΖ
                                     THEN SET (Carry)
          SHLD
                     STACK
          MOV
                                     ELSE BEGIN
                     A,C
          STAX
                     Η
                                       COMMENT Stack entry contents:
          INX
                     Н
                                       +0
                                            addr of previous entry
          MOV
                                       +2
                     A,B
                                            size of current item
          STAX
                     Н
                                       +3
                                            current item
          INX
                     Н
          POP
                     PSW
                                       caller provides size in A,
          VOM
                     B,A
                                       item data address in H,L;
          STAX
                     Н
                                       RESET (Carry);
          ORA
                                       MEMORY(H,L)
                     STKCX
                                       Stack := (H,L);
          JΖ
          INX
                                       (H,L) := (H,L)
                                                          + 2;
                     Н
                                       MEMORY(H,L) :=
STKCY:
          LDAX
                                                           Α:
          STAX
                     Н
                                       (H,L) := (H,L)
          INX
                     Н
                                       RESTORE(D,E); SAVE(D,E);
                                       WHILE NOT A = 0 DO
          INX
                     D
          DCR
                     В
                                       BEGIN
          JNZ
                     STKCY
                                          MEMORY (H,L) := MEMORY (D,E);
                                          (H,L):= (H,L)+1;
(D,E):= (D,E)+1;
STKCX:
          POP
                     Н
          POP
                     D
          POP
                                          A := A - 1:
                                                 Listing 3 continued on page 146
```

Text continued:

Another peculiar property of PARSE, presuming you haven't figured out how it works yet, is that only one complete INTOKEN scan of the input expression is required because of the use of a stack, Q, for retaining the symbols for intermediate expressions. INTOKEN recognition of parentheses (output codes 1 and 2) effectively controls stacking and popping up symbols for intermediate expressions in the required order.

The operation of PARSE depends critically on the array S. In use, its row subscript is presumed the value of the last INTOKEN output, its column subscript the value of the current INTOKEN output. Specifically, if the last input token was a left parenthesis and the current input token was 'E' (a symbol or constant) then INTOKEN's last and current outputs would be 1 and 4; the matching element in S (row 1 column 4) has value 2, so that the statement CASE2 would be performed. Subsequently, J replaces I and INTOKEN is again invoked to evaluate J anew; a new element of S is fetched using the new values of I and J as subscripts; and the element of the CASE statement list matching the new value taken from S is performed. This process is repeated until INTOKEN sets Endinput true, indicating the end of the input string Exp has been detected. Since the last two tokens might be right parentheses, and PARSE does not in fact process the last token since tokens are used only in pairs, the stack Q is always flushed before PARSE finishes.

PARSE is presented in informal ALGOL only in the hope the process per se of suitably rearranging algebraic form expressions can be made more easily understood than via an equivalent 8080 assembly language program which might prove to be a transliteration nightmare for the novice LSI-11 or PPS-8 programmer. Contrarily, the step by step listing of PARSE and the associated control indices in figure 1 should aid in understanding what PARSE is really doing. with respect to the hypothetical expression. The function of INTOKEN, recognizing and encoding the elements of an expression, is sufficiently straightforward that an explicit statement of it is hardly necessary, but listing 2 is included nonetheless in informal ALGOL. The remaining question, perhaps, is one of making the stack Q of PARSE operable on a microcomputer. To that end, listing 3 shows a hypothetical implementation of single stack control routines STACK, POPUP, and POPSD using 8080 assembler format.

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Name (Please Print) Street City/State/Zin Accredited by the Accrediting Commission of the National Home Study Council 170-119 Now what? Well, for a start let's observe that PARSE will work only with binary operator expressions. Right? Well, not quite. Note that PARSE passes the buck for recognition. If INTOKEN can recognize unary

### Listing 3, continued:

```
STC
                                       END:
CMC
                                    END:
                                    RESTORE(H,L);
RET
STKOF:
          POP
                     Н
POPUF:
                     D
          POP
          POP
                     R
                     PSW
          POP
          STC
          RET
POPSD:
          PUSH
                                    POPSD: IF Stack = 0
                                    THEN SET(Carry)
          STC
          LHLD
                     STACK
                                    ELSE BEGIN
          MOV
                     A,H
                                       COMMENT Give caller size
          ORA
                                       of next entry to pop, for
                     POPZD
                                       buffering as needed
          .17.
          INX
                     Н
                                       RESET(Carry):
                                       SAVE(H,L);
          INX
                     Н
          CMC
                                       (H,L) := Stack + 2
                                       A := MEMORY(H,L);
          LDAX
                     Н
                                       RESTORE(H,L);
          JMP
                     POPXD
POPZD
          SUB
                                    END:
POPXD:
          POP
          The following must be in R/W
          memory, since Stack is the
          list-origin address, and L.H.J.
          is externally modified to
          effect an indirect LHLD
LHLI:
          LHLD
                     0
          RET
STACK
          PUSH
                     PSW
POPUP.
                                    POPUP: IF Stack = 0
          PUSH
                     В
                                     THEN SET(Carry)
          PUSH
                     D
                                    ELSE BEGIN
          PUSH
                                       COMMENT Target area is
          LHLD
                     STACK
                                       specified by caller H,L;
          XCHG
                                       RESET(Carry);
          POP
                     Н
                                       SAVE(D,E,H,L);
          VOM
                     A,D
                                       (D,E) := Stack;
          ORA
                                         = MEMORY (D,E + 2);
                                       SAVE(D,E,H,L);
                     POPUF
          .17.
          PUSH
                                                = (D,E) + 3;
                     Н
                                       (D.E)
          PUSH
                     D
                                       WHILE NOT B = 0 DO
          INX
                     D
                                       BEGIN
                                          COMMENT Zero-length entries
          INX
                     D
          LDAX
                     D
                                          are removed but not copied
          ORA
                                          MEMORY(H,L) := MEMORY(D,E);
                                          (D,E) := (D,E) + 1;

(H,L) := (H,L) + 1;
                     POPCX
          JZ
          INX
                     D
          MOV
                     B,A
                                          B := B - 1;
POPCY:
          LDAX
                     D
                                    END;
                                    RESTORE(D,E,H,L);
          STAX
                     Н
                                             := MEMORY(D,E);
                                    Stack
          INX
                     Η
                                    RBUF(D,E);
          INX
                     D
          DCR
                     В
                                     RESTORE(D,E,H,L);
                     POPCY
          JNZ
                                    END:
POPC x
          POP
          XCHG
                     LHLI+1
          SHLD
          CALL
                     LHL
          SHLD
                     STACK
          LHLD
                     LHLI+1
          CALL
                     RBUF
          POP
                     Н
          POP
                     D
          POP
                     R
          POP
                     PSW
          STC
          CMC
```

operators, it can also stuff in a dummy operand on the fly, since PARSE initializes Position, and thereafter leaves it alone. That is, the common unary operators are special cases of a binary and either zeroes or ones: NOT FRED is equivalent to ones exclusive-OR FRED; NEGATIVE VIBES is equivalent to 0 — VIBES; and INVERSE HYPOTHESIS is equivalent to 1/HYPOTHESIS.

How about the results? PARSE can easily be modified to directly generate machine language code if INTOKEN is modified to create or at least have access to a symbol table; or its output can be used, as is, by an interpretive calculator program. Obviously, 8080 machines and, for that matter, most microprocessors lack multiply and divide instructions, but nonnative operations can easily be interpreted as operator subprogram calls. PARSE makes no presumption about the computer on which it's run except the availability of a stack to use with its output referenced by '\$'. The operators, for example, for which PARSE was developed in the form shown were character string operators of combination and proximity. The PARSE output was interpreted by a program for searching large textual files on an IBM System 360 disk unit. The point is that the results are what you make of them, PARSE being no more than a procedure for rearrangement of expressions.

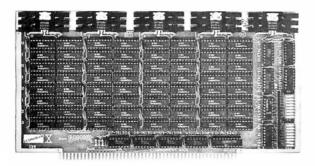
A final apology before getting under way. FORTRAN freaks may by now have noticed an "error" in that although the tokens 1 and H in the example of figure 1 are at the same parenthesis level, the add-1 parse precedes the divide-H in the final step. Why? I prefer to ask why one bothers anyway with operator priorities so long as the desired order of computation can be explicitly specified by using parentheses. The example of figure 1, in fact, was contrived in part to illustrate that PARSE as shown here presumes a strict left to right evaluation at any parentheses level. Operators are not "ranked" as in FORTRAN and several other higher level programming languages.

### One More Time

If the available stack mechanism is only once more generalized, to provide multiple stacks simultaneously, some conceptual simplification of a large class of problems occurs. As a near trivial example, we illustrate in listing 4 a 2 stack sorting procedure. In essence, it removes records (strings) from a file one at a time and manipulates the two stacks, Highside and Lowside, back and forth until the new record fits in the inclusive interval of values bounded by the top

RET

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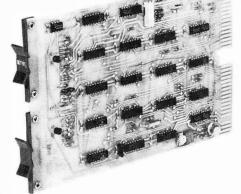
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Listing 4: A SORT procedure expressed in informal ALGOL type notation demonstrates use of two stacks.

```
STRING ARRAY PROCEDURE SORT(File):
STRING ARRAY File;
BEGIN
  INTEGER
  STRING
                       This;
  STACK Highside, Lowside;
  Lowside := File (1);
Highside := File (2);
  COMMENT top function references item
  on the top of some stack;
   IF TOP(Lowside) > TOP(Highside)
  THEN BEGIN
     This
               := Highside;
                := Lowside;
     Highside
               := This;
     Lowside
   END;
  COMMENT size function produces the
  current number of elements in array;
  WHILE K ≤ SIZE(File) DO
  BEGIN
     This
                := File(K);
                = K + 1;
     WHILE This < TOP(Lowside) DO Highside
                                               := Lowside;
     WHILE This > TOP(Highside) DO Lowside
     Highside
   WHILE NOT(Lowside = empty) DO Highside := Lowside;
   WHILE K ≤ SIZE(File) DO
   BEGIN
     SORT(K) := Highside;
                := K + 1:
   END:
END.
```

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elements of the two stacks. The procedure has two virtues:

- It's easy to describe and understand.
- It requires an absolute minimum of workspace.

The price one pays is speed. It's probably one of the two or three slowest sorting algorithms around.

The program examples which appear in this article are written in an informal ALGOL type notation. The basic unit of ALGOL is the statement. It can be either a simple statement such as:

```
Position :=0;
```

which is read "position is evaluated as 0," or a compound statement defined by BEGIN . . . END such as:

```
BEGIN
Q := PARSE; PARSE := null;
END
```

which is read ''Q is evaluated parse, PARSE is evaluated null."

The statements defined between the BEGIN and END statements are not restricted to type. A preceding conditional such as (IF . . . THEN . . ELSE) will affect the entire command statement. One of the constituents of the statement may well be another compound statement. For example, to add an array of samples having subscripts 1 through Limit which is specified elsewhere we could write:

```
BEGIN
Subscript :=1; Sum :=0;
WHILE Subscript < Limit DO
BEGIN
Sum := Sum + Sample(Subscript);
Subscript := Subscript + 1;
END;
END:
```

The WHILE statement's operand (the statements after the DO) rather intuitively is in execution so long as the conditional part (Subscript < Limit) is true.

The CASE statement is simpler in effect. It acts approximately like an indexed jump. It has two operands. The first of these (T in the PARSE procedure) is an integer, and the second is a list of statements bracketed by BEGIN and END. The first operand selects for execution the statement from the list whose position matches the value of the index specifier.

Following are the informal extensions that have been made to ALGOL and used in the programs:

- The period indicates concatenation of character strings. Presuming values of 'WHAT' and 'STUFF' for symbols A and B, A . B will have a value of 'WHATSTUFF.'
- Q is declared to be of type STACK which, however implicit in most implementations of ALGOL-60, was not construed to be explicitly available. It is, in effect, a LIFO indexed character string array.
- Null and empty are used for assigning values, respectively, of a character string of length zero and a stack having zero entries.

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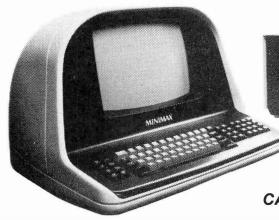
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   System does not utilize IEEE or USER Port, system functions directly from memory port
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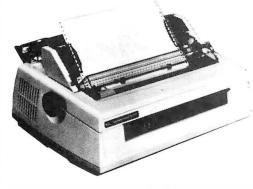
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\*The CMS Software (G/L, A/R, A/P) are based on Osborne & Associates trial tested business basic software. Software is complete with full documentation and user instructions. All packages require a printer for output. Commodore recommends the NEC Spinwriter (available from NEECO) as the output printer for WORDPRO.

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Listing 1: 8080 assembly-language program to create an animated computer game.

0100 0100 0100 0100		OGRAM I	LLUSTRATING SOME PRINCIPLES OF AN ANIMATED CAME
U100		RIGHT 1	979 'IONY ESTEP
0100	0030 *		
0100	0035 VIXIBAS	_	OCC00H
0100	0040 HIDL	DQU	OCELEH; ALL THESE RELATE TO THE SOL/20 &
0100	0045 CLSO1	ĐQU	OCODSH ; ITS VDA AND SCREEN CLEAR ROUTINE
0100	0047 SCBOT	DQU	OCFCOH ; MIDDLE OF LOVEST LINE
0100	0050 RAR	ĐQU	9311 ; THESE ARE ARRENS ON KEYBOARD
0100	0055 LAR	DQU	81H
0100	0060 UAR	Đ <b>Đ</b> U	9711
0100 0100	0065 DAR 0070	DRG ORG	9AH
0100 31 OC 06	0075	LXI	100H ;SO IT WILL RUN WITH CPN SP.STWCK+46
0100 31 0C 00 0103 CD D5 C0	0800	CALL	CLSCN : FOR NOW-SOL, WRITE SIMPLE ROUTINE TO CLEAR
0106 21 00 CC	0085	LXI	H, VIA-BAS
0109 36 20	0090	IVI	M,' '
010B CD 79 02	0095 BEGIN		TIAW
010E AF	0100 GO	XRA	A ; INITIALIZE FLAGS
010F 32 A3 03	0105	STA	CI
0112 32 9E 03	0110	STA	FLG1
0115 32 88 04	0115	STA	NSCR
0118 32 89 04	0120	STA	PSCR
011B 3E 01	0125	IV1	٨,1
011D 32 47 04	0130	STA	BFIGl
0120 32 30 05	0135	STA	RAFL
0123 32 EA 04	0140	STA	STRIF
0126 CD D5 C0	0145	CVIT	CLSQ1
0129 21 00 CC	0150	LXI	H, VIMBAS
012C 36 20	0155	IVI	M, 1 1
012E 21 1E CE	0160	LXI	H,MIDL
0131 22 F6 02	0165	SHLD	CORNIR
0134 CD 89 01 0137 CD 6A 02	0170	CALL	SHIP
013A CD 6A 02	0175 0180	CALL	DELAY
013D CD 6A 02	0185	CALL	DETVA
0140 CD 6A 02	0100	CVLL	DELAY
0143 CD 6A 02	0195	CVLL	DETVA
0146 CD 6A 02	0200	CVLL	DELAY
0149 CD 6A 02	0205	CVLL	DELAY
014C	0210 *****		********
014C	0215 *MAIN	LOOP ST	MRTS HERE
014C CD Cl 01		CVLL	TAKOF : PUT BLANKS IN SHIP HVAGE
014F CD 69 01	0225	CVTT	SHIP ; PUT IT ON SCREEN
			Listing 1 continued on page 154

Listing 1 continued on page 154

It has been quite some time since the arrival of memory-mapped I/O (input/output) boards upon the amateur computer scene, but the voluminous home computer literature rarely contains any listings of animated video games. Since it seems to me that there breathes not a hobbyist with soul so dead that he would not play one of these devilish little time wasters if he had one. I concluded that perhaps the lack of video games was due to some lack of information about how to get one up and going. This was certainly the case with me; I just started with a blank piece of paper and began scratching. But as the reader will see, there really is no mystery to it, and the results are well worth the effort.

A video game works just the same as an animated cartoon; there are a series of frames, each of which shows one or more of the objects in the picture in a slightly different position. Since the viewer's visual system has a certain persistence, the effect is one of continuous motion. In the case of a television picture, each frame is a single rewriting of the raster. This is very fast, and the flicker is seldom noticeable. A computer can pop information in and out of screen memory much faster than the monitor can

Text continued on page 158

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Shurgart SA450	51/4"	Northstar	Single/Double	C, D	CP/M
Persci 277	8"	Micromation	Single/Double	A, B	CP/M
Miropolis MODII	514"	Micropolis	Quad	C. D	CP/M
Persci 277	8"	Micromation	Single/Double	A. B	CP/M
Shugart SA450	51,"	North Star	Singe/Double	A.B	CP/M
Micropolis MODII	51 4"	Micropolis	Quad	A.B	CP/M
Micropolis MODII	514"	Micropolis	Quad	0.1	MDOS
Micropolis MODII	514"	Micropolis	Quad	1. 2	MZOS
Micropolis MODII	514"	Micropolis	Quad	A, B	OASIS
Shugart SA450	514"	North Star	Single/Double	1, 2	DOS
Persci 277	8"	Alpha Micro*	Single	1. 2	AMOS*



Those configurations using two types of drives permit file copy from one type to another with the facilities of 'PIP'. MUFS includes Vector Graphics complete System B, all the above mentioned disks/controllers with operating systems fully configured and operational on the System B. OASIS, AMÓS and the ALPHA MICRO CPU/Disk Controller are extra. MUFS also includes UNIVID (Universal Video, which allows the mindless terminal which comes with the System B to emulate the Hazeltine 1500 and Adam-3A). Additionally, MUFS also includes the communications software (IC) described below (IC is available separately). With MUFS, computer/software dealers can develop/copy/demo most all of their software on a single system with the snap of a disk drive door! Since MUFS supports multiple terminals, the 'Mime' terminal is available as an option. If purchased, this allows MUFS to run software designed specifically for either memory mapped or serial I/O (most software works on either).

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- When sending data, IC is programmed to automatically wait for the receiving computer if it cannot keep up with a steady
- Throughly tested with 7 different computer systems, full and half duplex.
- Software available on diskette only, or diskette/prom (prom version boots faster)
- Does not require an interrupt capability

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- Prints formated program listings with user selected spacing, titling, dating, and paging
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\*Amos is not menu selectable, and does require removal and insertion of some board's in the S-100 Bus

<sup>\*\*</sup>CP/M is a trademark of Digital Research

#### Listing 1 continued: 0152 2A F2 02 0230 Lk 0155 ES 0235 PUSH П 0150 2n F4 00 11720 DITE (JD 11 0159 15 (124) PUSh 0157, 27, FG 02 0250 LLLD COM III U255 ROP 015D C1 015E 09 U200 Lill 015F D1 0265 PUP Ulou 19 0270 ibid CORR ; HE LOCATION FOR CHIP MUNICE; HAT GENERA IN SHIP HAGE SHIP ; PUR IT ON SCHEMA 0161 22 Po 02 0275 SHILL 0164 ch //C 01 0.280 CAL 0167 CD 65 U1 0285 CVIT 0167, CD D9 01 0296 CLIT KYCHK ; CHECK KEYLOARD TOPE ; CHECK TO SEE IF THE ME MY YOP OR DOMON OF SCR. 016D CD D5 UZ 0255 CLII BLICHE ; IS A LALLOW DROPPING? 0170 CD 55 02 いさいし بليلات 0173 (1) 6/- 02 0305 CLLL. DELAY U176 CD (IU (I3 0310 PEGI CHL PEACER ; IS THERE A SHOUTER OF SCREEN? 0179 cD C9 03 017C CD 36 05 0315 CJI Ú32(1 CLL PETOF THAT IT OFF IN YEE 017F AF 0325 XRA 0180 32 Er. 04 0330 STRIF 0183 CD 8A 04 0186 C3 4C 01 0335 SCORTS CALL SCORE ; UPDATE SCORE **Ú340** Ji iP RUMTT 0345 0189 0189 2A F6 02 CORNE ; MOVES LETICRY TILEGE OF SHIP 0350 SHIP UIIID 018C CD 48 04 0355 HIT; CMIO SCREET! CALL 018F 3A FA 02 0366 LLV. LEID 0192 77 0365 IKN 11,0 U193 23 0370 THY 0194 CD 48 04 0375 CIII HTT 0197 3A FS 62 0380 HV. BLEK 019a 77 0365 LW 0.7. 0198 23 0390 INX: HIT 019C CD 48 0-7 0395 CALL 019F 3A FE 02 0400 LIV. WHE 01/2 77 0405 IXJV P. A U1A3 23 0410 II!X HI. 0174 CD 46 04 0415 CUIT 01A7 3A FB 02 0426 LUV EE!U 01AA 77 0425 IKN H.A ULAD C9 RET 0430 01AC 3E 10 A, 10H THE GIVPHICS WHICH MAKE UP THE SHIP 0435 140500 11/1 01AE 32 F6 02 51% ; ARE INDE IMO A PICTURE IN METORY

0/340

0445

0450

0455

0460

0465

0470

0475

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0490

0495

0500

0505

0510 0515

0520

0480 TAKOF

i-VI

CTPA

INT

STA

17/1

STA

RL'I

NVI

57% SIV

STA

STA

RET

CA

ANT

STATUS IN

A.90H

BLAK

A. 3CH

LUID

1,311

RHID

WHILL

DIAK

LED

RET ID

1

Listing 1 continued on page 156

REPLACES SHIP CHAPPICS WITH BLANKS

OFAH ; THESE INPUT BOUTINES ARE FOR SOL

;SO THAT 'SHIP' ROUTINE WILL BLACK ;OUT PICTURE OF SHIP

### WILD & CRAZY **ASSEMBLY** PROGRAMMERS

01B1 3E 90

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01BB 3E 3E

01C1 3E 20

01C0 C9

01CF C9

01D2 2F

0100 DB FA

U1D3 E% 01

01B3 32 FS U2

01B8 32 FA 02

01BD 32 FB 02

01C3 32 F8 02 01C6 32 F9 02

01C9 32 F/. 02

01CC 32 FB 02

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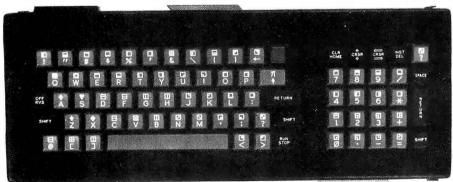
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Listing 1 continued:			
01D5 C9	0525	RET'	
01D6 DB FC	94/1 0620	IN	OFCII
01D6 C3	0535	RET'	
01D9 CD D0 01	0540 KY <b>Q</b> IK	CYTT	STATUS
OIDC Cu	0545	RZ	
01DD CD D6 01	0550	CVIT	IMP
01E0 FE 93	0555	CPI	RAR ; RIGHT ARRON
01E2 CA FA 01	0560	JZ	RIGH.
01E5 FE 81	0565	CPI	LAR ; LEFT ANROL
01E7 CA 05 02	0570	JZ	LEFT'
01EA FE 97	0575	CPI	UNR ; UP ARON
01EC CA 10 02	0580	JZ	UP
01EF FE 9A 01F1 CA 1B 02	0565	CPI	DAR ; DOWN ARROW
01F4 FE 20	0590 0595	JZ CPI	DUM - L - CDACE HAD INDEED DATICES
01F6 CA 53 02	0600	JZ	1 ;SPACE BAR DROPS BALLOON BLASET
01F9 C9	0605	RET	DENOLI
Ulfa 2A F2 02	0610 RIGHT	TIIT)	LK ;THESE ROUTINES UPDATE THE OFFSETS TO
01FD 11 01 00	0615	LXI	D,1 THE SHIP POSITIONS
0200 19	0620	DAD	D
0201 22 F2 02	0625	SHLD	LP
0204 C9	0630	RET	
0205 2/A F2 02	0635 LEFT	I'IITI)	LR
0208 11 FF FF	0640	LXI	D,-1
020B 19	0645	D\T)	D
020C 22 F2 02	0650	21 LTD	LR
020F C9	0655	RET	
0210 2A F4 02	0660 UP	THTD	UD
0213 11 C0 FF	0665	LXI	D,-64 ;64 CHARACTER WIDE SCREEN SO YOU GO U/D 1 LINE
0216 19	0670	DV.D	D
0217 22 F4 02	0675	SII.D	UD
021A C9	0680	RET	UD
021B 2A F4 02 021E 11 40 00	0665 DOM1 0690	LXI	1),64
0221 19	0695	DVD	D D
0222 22 F4 02	0700	SliLD	UD
0225 C9	0705	RET	
0226 3E: 01	0710 B/LN	IVI:1	Λ,1
0228 32 FD 02	0715	STY	BLNF
022B 2A F6 02	0720	TIIT	CORNIR
022E 11 41 00	0725	LXI	D,41E
0231 19	0730	DV7D	D
0232 22 FE 02	0735	SHLD	BLIE
0235 2/ FE 02	0740 BLil	TITD	BLUK BLUK OUT BALLOON
0238 36 20	0745	IVI	E, 1 1
023A 11 40 00	0750	DAD DAD	D,64 ; NOVE IT DOWN A LINE
023D 19 023E 22 FE 02	0755 0760	EUR'D DATE	DIAIR
0241 36 EC	0765	MI	N,ECI
0243 7C	0770	VXII	V'H
0244 FE DC	0775	CPI	ODOH
0246 Ch 41. 02	0780	JZ	BDWN ; HIT BOTTON
0249 C9	0785	RET	
024A 3E 00	0790 BUAN	I Vi	Λ,0
024C 32 FC 02	0795	STA	ELND
024F 32 FD 02	0800	STA	BLNF
0252 C9	0805	RET	
0253 3E 01	0810 BLUSET		۸,1
0255 32 FC 02	0815	SIV	BLND

Listing 1 continued on page 158

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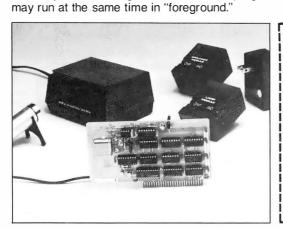
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Listing 1 continued:			
0258 C9 0259 3A FD 02 025C FE 01 025E CA 35 02 0261 3A FC 02 0264 FE 01 0266 C0 0267 CD 26 02 0264 ES	0820 0825 BLNCH 0830 0835 0840 0845 0850 0655 0860 DELAY	REI' LDA CPI LDA CPI RMZ CALL PUSI	BLNF 1 BLN1 ELND 1 BALN H; A USEFUL ALLPURPOSE TIMING ROUTINE
026B 2A 6E 05 026E EB	0865 0870	LHLD	SPEED
026F 15	0875 DELA1	DCR	D
0270 C2 6F 02 0273 lD 0274 C2 6F 02 0277 EL 0278 C9	0880 0885 0890 0895 0900	JNZ DCR JNZ POP RET	DELAL E DELAL H
0279 21 DA CD	0905 WAIT	LXI	H, VDNBAS+474
027C 11 94 05 027F CD 64 05	0910 0915	CALL	D,MSG PRINT
0282 21 14 CE	0920	LXI	H, VD/BAS+532
0285 11 A2 05	0925	LXI	D, M9C2
0288 CD 64 05 028B 21 DO CF	0930 0935	CVLT	PRINT H,VDNBAS+976
028E 11 70 05	0940	LXI	D,MSG1
0291 CD 64 05	0945	CALL	PRIM
0294 CD D0 01	0950 IN1	CALL JZ	STATUS INI
0297 CA 94 02 029A CD D6 01	0955 0960	CVLL	INP
029D FE 30	0965	CPI	101
029F CA 00 00	0970	JZ	OH ; REBOOT CP/N
02A2 FE 31 02A4 CA B9 02	0975 0980	CPI JZ	'l' FAST
02AA CA B9 02 02A7 FE 32	0985	CPI	121
02A9 CA CO 02	0990	JZ	MED
02AC FE 33	0995	CPI	731
02AE CA C7 02 02B1 FE 34	1000 1005	JZ CPI	SLON '4'
02B3 CA CE 02	1010	JZ	SPASTIC
02B6 C3 79 02	1015	JMP	WAIT ; GOT A BAD CHAR
02B9 21 19 00 02BC 22 6E 05	1020 FAST 1025	LXI SHLD	H,19H SPEED ; HERE VIE SET PARAMETERS FOR DELAY LOOP
02BF C9	1030	RET	STEED THE THE SET PROPERTIES TON BOOM DOOR
02C0 21 24 00	1035 MED	LXI	II,24H
02C3 22 6E 05	1040	SHLD RET	SPEED
02C6 C9 02C7 21 32 00	1045 1050 SLOW	LXI	н, 32н
02CA 22 6E 05	1055	SHLD	SPEED
0200 09	1060	RET	2011
02CE 21 38 00 02D1 22 6E 05	1065 SPASTI 1070	SHLD	H,38H SPEED
02D1 22 0E 05	1070 1075	RET	OI WAS
02D5 2A F6 02 02D8 7C	1080 TOPB 1085	HOV	CDRNR A,H
02D9 FE OC	1090	ŒI	OCCH :TOP 2 DIGITS OF VOMBAS
02DB CA E4 02 02DE FE CF	1095 1100	JZ CPI	TOP OCPH ;BOTTON OF SCREEN

Listing 1 continued on page 160

BEGIN

PUT DESIRED CHARACTERS
IN MEMORY

MOVE THEM TO SCREEN AT LOCATION L

DISPLAY GAME (1, n)

ADD DESIRED OFFSET TO L (UP, DOWN, RIGHT, LEFT)

WRITE BLANKS INTO PRESENT LOCATION OF CHARACTERS

FND

TIME DELAY

**Figure 1:** A Warnier-Orr diagram describing the steps involved in simulating motion.

Text continued:

rewrite its screen, so the programmer might think that computer games could represent extremely smooth movement.

However, the movement has to be represented in finite increments, which will be determined by the minimum distance between the characters or points that can be written on the screen. In the case of a typical video display board which can put 1024 characters on the screen, the user must move in increments of 1/16th the height of the screen when moving vertically and 1/64th the width of the screen when moving horizontally. This means that the movement will necessarily be a little jerky, but smooth enough for games.

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TRS-80 power increases with Level III's seven Disk BASIC features. Ten user-defined subroutines can be used in a program. Error messages are spelled out, LINE INPUT instruction accepts punctuation marks within a string and eliminates the automatic ``?'' from the INPUT

prompt. A more flexible MID\$ increases string manipulation power. INSTR function searches a string for a specified substring. And Level III performs hex and octal conversion.

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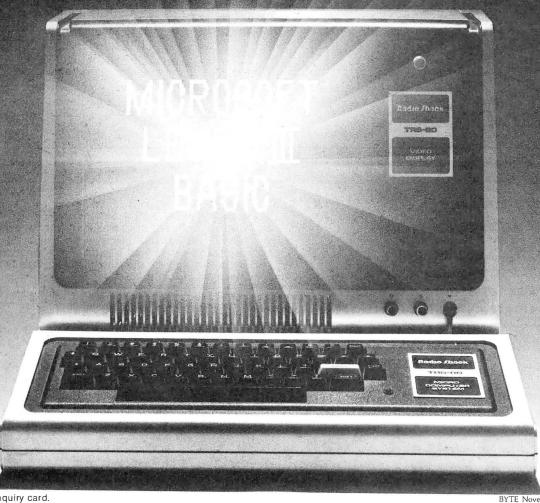
Level III occupies only 5.2K RAM with something for every TRS-80 from the 16K Level II minimum system requirement and up. It can be stored on disk as a file, but it only works in conjunction with Level II; it will not operate with Disk BASIC. Programs written in Level III BASIC are stored on cassette tape.

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Microsoft Level III BASIC is sold at Computer retailers nationwide. If your local computer store doesn't have Level III, ask them to call us. You can call us, too, for the name of your nearest Microsoft dealer. Phone (206) 454-1315. Or write Microsoft Consumer Products, 10800 Northeast Eighth, Suite 819, Bellevue, WA 98004



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Listing 1 continued:			##,64 UD  ##,-64 UD  0 0 0 0 0CELINI ; STARTS AT MIDDLE OF SCRN 10
02E4 21 40 00	1115 GOP	T.X.T	1!.64
02E7 22 F4 02	1120	SHLD	UD
02EA C9	1125	RET'	
02EB 21 CO FF	1130 COT	LXI	H64
02EE 22 F4 02	1135	SILD	UĎ
02F1 C9	1140	RET'	
02F2 00 00	1145 LR	DI:1	0
02F4 00 00	1150 UD	DM	0
02F6 1E CL	1155 CORNE	DW	OCCIUM ; STARTS AT MIDDLE OF SCRI
02F8 10	1160 VAIIT	DB	10H ;SHIP CPAPHICS
02F9 90	1165 EI <b>.</b> ⁄K	DB	9011
02FA 3C	1170 LEAD	DB	3CH
O2FB 3E	1175 REND	DB	35):
02FC 00	1180 BIAD	DC	0
0200 00	1100 BLAR	ממ	0
021 0 0 00	1190 DEM	LDC.	Cl
0300 3A 7B 03	1200	CDI	1
0305 CA 3m 03	1205	.12	SHOP
0308 CD 84 03	1210	CALL	PLD
0300 Q5 N4 05	1215	SILI	OFGE
030D D8	1220	RC	0.1
030F 87	1225	ΛDD	Λ
030E 87	1223	ADD	<i>I</i> .
0310 5F	1235	VOV	E.A
0311 16 00	1240	IVI	D-0
0313 21 C0 CF	1245	LXI	H. SCBOT : HIDDLE OF BOTTOL OF SCRIL
0316 19	1250	DAD	D
0317 22 45 04	1255	SHLD	PLOC1
031A 36 18	1260	I <b>V</b> I	M, 18H
031C 23	1265	INX	H
031D 36 18	1270	IVI	11,1811
031F 23	1275	IMX.	II
0320 36 18	1280	IIVI	M, 1811
0322 10 BF FF	1205	IXI	D,-05
0325 19	1290	TAIT)	74 OC U
0320 30 90 0328 11 CO FF	1200	LAL	D
0326 19	1305	DAD	D D
0326 19	1310	DVD	D
032D 22 A1 U3	1315	SILD	PYI
0330 3E 01	132ü	IVI	A.1
0332 32 A3 03	1325	STA	Gi
0335 AF	1330	XRA	A
0336 32 47 04	1335	STA	EFIGI
0339 CD 98 03	1340	CMT	OPF1
033C C9	1345	RET	
033D CD OF 05	1350 SHOTI	CVTT	JETON
0340 CD 8E 03	1355	CALL	CVII
0343 (1) B6 03	1360	CVTY	19104
0340 Ct. LTD 04	1370	CP1	1 1790
0340 C/LEE 04	1375	CDT	J DIII
034D CA FB 04	1380	.17	יופון)
0350 2A Al 03	1385 TEMP	ITIT()	PYI
0353 22 C7 03	1390	SILD	BI.1
0356 3E 01	1395	IVI	Λ,1
0358 32 9E 03	1400	STA	FIGI
035B CD D6 03	1405	CVTT	RID4

Listing 1 continued on page 164

the screen, leave it there for a short length of time, then write blanks over the parts wanted to be moved and rewrite them in the next space of the motion sequence. After another delay, the process is repeated. It does not take much thinking to realize that the main body of the game will be a loop with these essential elements, plus whatever keyboard checking, score updating, message displaying, and the like are wanted as the game progresses.

This lends itself to a fairly modular program structure (see figure 1). The program I am going to use to illustrate this process is quite simple; elaborate discussion of program logic. Let us start with a description of the program from the point of view of a player.

Let us write a program in which the player flies a motorized delta-wing over his friend's backyard computer-controlled peashooter. The peashooter fires a pea and a water jet at you as you cruise past. When you are hit the peashooter receives 100 points. You try to position yourself directly over your friend's backyard and drop a water balloon on the peashooter. If you hit him with the balloon, you receive 100 points. To make it interesting, we will have the gunner appear and disappear at random times and places.

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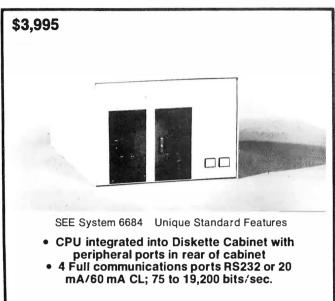
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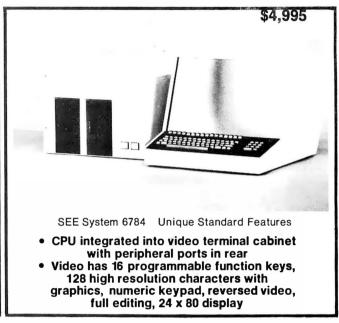
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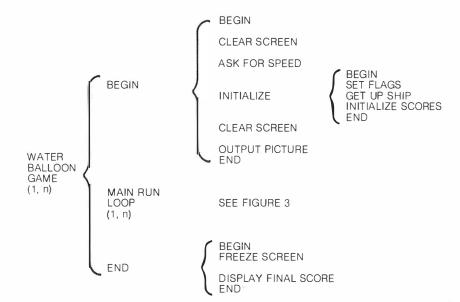
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**Figure 2:** The modular components of the balloon game.

assembler, consider what functions must be added to those in figure 1 to round out the whole game. To get everything ready to play, an initialization routine is needed to clear the screen, set the scores to 0, and so on. After waiting for the player to set the speed, put the delta-wing on the screen, give him a chance to get his fingers on the buttons and survey the situation, and then we will enter the main loop.

The main loop, figure 2, will contain the functions described before; it will put the peashooter and ship on, leave them there for a short time, then write blanks over them and rewrite them, in a new location if required. In addition, there will be keyboard checks to see if the player has fired his acceleration rockets to change the movement of the deltawing, and update the score. Check for hits by a water balloon or peashooter and see if a water balloon is being dropped. Move the peas and water jet which are being fired, and put on impact marks if any hits have been scored.

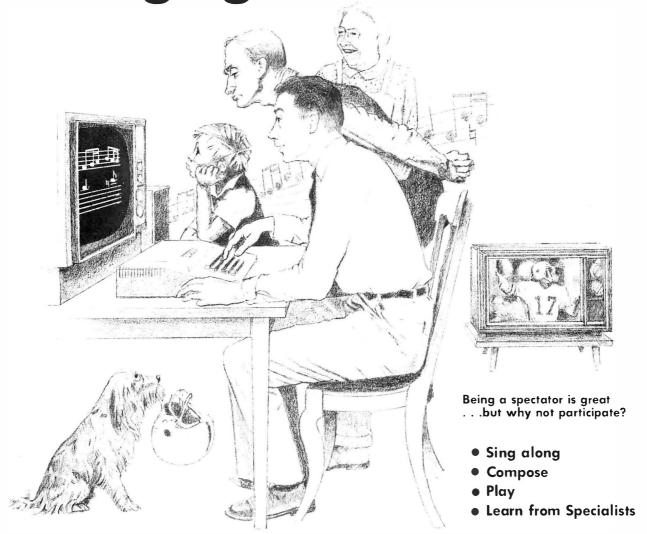
Figure 3 summarizes the functions performed in the main loop, and names the subroutines which perform those functions. There are a number of possible changes that could be made in this program to tailor the program to the user's personal taste. The programmer should be able to figure out where to put the wrench by reference to the diagrams and the comments in the listing.

Most of the housekeeping functions of this program are no different from those found in any assembly-language program, so it will be assumed that the user can find the way through those, but a few more comments about the animation techniques might be worthwhile. For an illustration, follow the progress of a pea fired from the peashooter.

Starting at line 1195 the program checks to see if a peashooter is on the screen, since you want peas to come only from a real peashooter. If one is there, jump to SHOT1, where you check to see if a water jet is already on the screen (water jets last for two

Text continued on page 168

# **Bringing Music Home**



### LET MICRO MUSIC TURN YOUR APPLE JI ® INTO A FAMILY MUSIC CENTER!

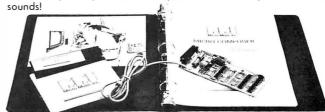
VISIT THE APPLE DEALER NEAREST YOU AND ASK FOR A DEMONSTRATION OF MMI'S MICRO COMPOSER TM

The MICRO COMPOSER LETS YOU—

- Play up to 4 simultaneous voices
   See all 4 voices at the same time you're hearing the music—a must for music editing!
- Enter music notes by a fast, simple and well-tested coding system.
- Program the pitch, rhythm, and timbre of the music. Tempo is
- varied by the Apple paddle.Choose 7 different tone colors for each voice or create your
- own tone color.
   Compose, edit, display, and play music through an interactive, command-driven language that's easy to learn.
- Save your music on disk or cassette.
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   DAC card. No amplifier needed! Designed for MMI by Hal
   Chamberlin and Micro Technology Unlimited.
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Micro Music Inc 309 W. Beaufort, University Plaza, Normal, Illinois 61761 (309) 452-6991

APPLE II is a trademark of Apple Computer Inc.

Listing I continued:			
035E 5F	1410	FOV	E, A
035F 16 00	1415	l-ïVI	D,0
0361 21 BB FF	1420	LXI	11,-69
0364 19	1425	DVD	D
0365 22 9F 03	1430	SHLD	INOT
0368 2A 9F 03	1435 SHB1	LILD	INGS]
036B E5	1440	PUSH	11
036C D1	1445	POP	D
036D 2A C7 03	1450	LILD	BL1
0370 36 20	1455	MVI	M, '
0372 01 40 00	1460	LXI	B,64
0375 09	1465	DVD	В
0376 36 20	1470	IVI	M,' ' BL1
0378 2A C7 03	1475	DAD FIETD	D
037B 19 037C 7C	1480 1485	NOV	A <sub>t</sub> 11
037D FE CE	1490	CPI	OCBH ; MISSILE IS OFF TOP OF SCREEN
037F CA 98 03	1495	JZ	OFF1
0382 36 07	1500	IVI	11,0711
0384 22 C7 03	1505	SILD	BL1
0387 11 40 00	1510	LXI	D,64
03EA 19	1515	DVD	D
038B 36 07,	1520	I-IVI	M,OAH
038D C9	1525	RET	
038E 3V 0E 03	1530 ONI	TDV	FLG1
0391 FE 01	1535	CPI	1
0393 C0	1540	IU.	71/7
0394 F1	1545	POP	PS/
0395 C3 6E 03	1550	JUP	SIEL .
0398 3E 00 039A 32 9E 03	1555 JFF1	INI	N,0
039D C9	1560 1565	STA RET	FIGI
039E 00	1570 FIG1	DB	0
039F 00 00	1575 EXEL	DI:	Ö
03ለ1 00 00	1580 PY1	Dk:	U
03A3 00	1585 G1	DB	Ō
03M 21 C0 03	1590 RIJD	LXI	H, RODE ; A RANDON NUM ROUTINE WHICH DOESN'T
03A7 EB	1595	XCIIC	REPENT FOR 40,000 TRIES
03A8 21 C2 03	1600	LXI	H, RIDI
03AB 7E	1605	VCIII	A,H
03AC 3C	1610	INR	Is .
03AD OF	1615	RRC	
03 <b>AE</b> 47	1620	VOV	Ε,Λ
03AF 1A	1625	LDAX	D
03B0 07	1630	RLC	ä
03B1 80 03B2 77	1635	INDD MOV	
03B3 78	16 <b>4</b> 0 1645	HOV	H, A A, B
03B4 12	1650	STAX	D
03B5 C9	1655	RET	D
03B6 CD //4 03	1660 Rt ID4	CATT	RID
03B9 1F	1665	RIR	
03BA 1F	1670	RAR	
03BB B6 07	1675	WII	7
03BD C6 01	1680	ADI	1
03BF C9	1685	RET	
03C <b>0</b> 00 00	1690 RNIM	Diri	0.
03C2 00 00	1695 RMD1	DW	0
03C4 C3 50 03	1700 SHEL1	JMP	TEMP

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03C7 C0 CF 03C9 3A 47 0		1705 i		ELDY.	SCECT BFLC1
03CC FE 01 03CE C8		1715 1720		LX Cb1	1
03CF 3A EA 0		1725		LDA CPI	STRIF
03D4 C8		1730 1735		PZ	1
03D5 2A 45 0 03D8 7E	4	1740 1745		TRITO IXON	PLCC1 A,II
03D9 FE 20 03D8 CA ED 0	13	1750 1755		CPI JZ	XPLD1
03DE 23 03DF 7E		1760 1765		IIIX XIII	H A,li
03E0 FE 20		1770		CPI J2	
03E5 23		1775 17ช0		MIN	XPLD1
03E6 7E 03E7 FE 20		1785 1790		IXX CPI	V.14
03EO CA ED 0		1795 1800		JZ RET	Xh[D]
03ED 22 24 0 03F0 3E 01		1805 1 1810	XPLDl	SIID I <b>I</b> VI	BLQ; A,1
03F2 32 47 0 03F5 3E 2B	14	1815		STA	LFLGI
03F7 CD 26 0	4	1820 1825		CVTT	A, '+' ELOP
03FA CD 6A 0 03FD 3E 23		1830 1835		VI VI	DEL/Y
03FF CD 26 0 0402 CD 6A 0		1840 1845		CVTT	DETVA
0405 3E 20 0407 CD 26 0	)4	1850 1855		VVI	A,' 'BLOP
	)3	1860 1865		HILD	DL1
040E 01 40 0	00	1870		LXI	B,64
0411 09 0412 77		18 <b>7</b> 5 1880		DA'D DA'D	B E,A
0413 3E 00 0415 32 A3 0	13	1885 1890		IVM STA	Λ,0 Gl
		1895		VDI LDV	PSCI(
041D 32 89 0		1900 1905		STA	PSCR
0420 32 9E 0 0423 C9	13	1910 1915		STA REI	FIGI
0424 00 00 0426 06 05		1920 1925	BLOP	NVI IVI	0 B <b>,</b> 5
	)4 FF	1930 1935		LXI	DLOvi D,-4
042E 19 042F 77	-	1940 1945	BLPl	NON DATE	D M,A
0430 23		1950		IMX	H
0431 77 0432 23		1955 1960		IIIX	M,A H
0433 77 0434 23		1965 1970		INX	Η,Α Η
0435 77 0436 77		1975 1980		NOV NOV	A,M
0437 23 0438 77		1985 1990		INX VOVI	H HA
0439 23		1995		$\mathbb{D}^{2}X$	H
043A 77 043B 23		2000 2005		INX	Н, А Н
043C 77 043D 11 BA F	FF	2010 2015		LXI	H,A D,-70
0440 05 0441 <b>C</b> 8		2020 2025		DCR RZ	B
0442 C3 2E 0 0445 C0 CF	04	2030	PLCC1	JNIP DW	BLP1 SCBOT
0447 00 0448 7E			BFLG1	DE	0 A, E
0449 FE 20		2050	1111	CPI	1 1
044B C8 044C FE 10		2055 2060		RZ CPI	1011
044E C8 044F FE 90		20G5 2070		RZ CPI	90li
0451 C8 0452 FE 3C		2075 2080		RZ CPI	3Cli
0454 Cช		20წ5		RZ CPI	
0455 FE 3E 0457 CU	0.4	2090		RZ	3141
0458 22 24 0 045B 3E 2/\		2100		SILD	A, IXI
045D CD 26 0 0460 CD 6i 0		2110 2115		CVTI' CVTT	DETVA ETCE
0463 3E 4F 0465 CD 26 0	04	2120 2125		CVII	A, 'C'
0468 CD 6A 0 046B 3E 20	02	2130 2135		I:IVI	DEL/Y
046D CD 26 ( 0470 31 88 (		2140 2145		CATT	BLOP
0473 CG 01		2150		ICE	1 FSCR
0475 32 88 0 0478 21 00 0		2155 2160		LXI	11,0

Listing 1 continued on page 166

; A VERY DUMB-LOOKING EXPLOSION

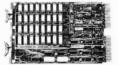
THESE ARE CHARACTERS WHICH INDICATE A HIT

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- S-100 \$750.00
- LSI \$750.00
- SBC 80/10 \$750.00
- 6800 \$750.00



CI-S100 64K x 8



CI-1103 32K x 16



CI-6800 64K x 8



CI-8080 64K x 8

CI-S100 — 64K x 8 on a single board. Plugs directly into the IMSAI, MITS, TDL. SOL and most other S-100 Bus computers. No wait states even with Z80 at 4Mhz. Addressable in 4K increments. Power requirement 6 watts. Price \$750.00.

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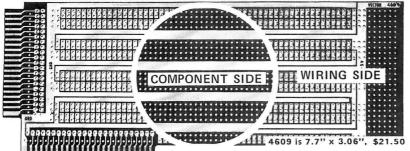
Computer Products Division

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7	-		
Listing	1	continued	:

047B 22 F4 02	2165	SHLD	UD
047E 22 P2 02	2170	SHLD	LR
0481 21 1E CE	2175	LXI	H,MIDL
0484 22 F6 02	2180	SHLD	CORNR
0487 C9	2185	RET	
0488 00	2190 MSCR	DB	0
0489 00	2195 PSCR	DB	0
048A 21 04 OC	2200 SCORE	LXI	II, VD: IBAS+4
048D 11 BC 05	2205	LXI	D,BLMSG
0490 CD 64 05	2210	CVLL	PRIM'
0493 23	2215	INX	H
0494 3A 89 04	2220	LDA	PSCR
0497 CD AB 04	2225	CATT	SCOUT
049∧ 21 30 X	2230	LXI	H, VD:BAS+48
049D 11 C4 U5	2235	LXI	D, TRUEG
04A0 CD 64 05	2240	CALL	PRINT
04A3 23	2245	INX	H
04A4 3A 88 04	2250	LDV	NSCR
04A7 CD AB 04	2255	CALL	SCOUT
04AA C9	2260	RET	
04AB FE OA	2265 SCUT	CPI	ONH ; A VERY DUMB HEX-TO-DECIMAL CONVEXTOR
04AD D2 BA 04	2270	JNC	LTR
04B0 C6 30	2275	ΛDΙ	3011
04B2 77	2280	FOV	M, A
04B3 23	2285	INX	II
04B4 36 30	2290	MVI	M, 30H
04B6 23	2295	INX	H
04B7 36 30	2300	INI	M,30H
04B9 C9	2305	RET	
04BA FE 14	2310 LTR	CPI	20
04BC D2 CC 04	2315	JNC	Tr/Et
04BF 36 31	2320	IVM	M, 31H
04C1 23	2325	INX	H
04C2 O6 26	2330	ADI	38
04C4 77	2335	NOV	M,A
0405 23	2340	IJ:IX	II
0406 36 30	2345	IV1	M, 30II





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22 16-pin DIPs or 2 40-pin plus 18 sixteen-pin DIPs.	<ul> <li>Wrap wire or solder.</li> </ul>
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04C8 23		2350		INX MVI	H M,30H H M,30H H H 28 M,30H H M,30H H M,30H H M,30H H M,30H 35H OVER H,VLHLVS+408 D,FINEXG PRHITE BEGIN O A,3 RAFL RIDM E,A D,0 H,-66 D H,-60 D H,-66
04C9 36 30	0	2350 2355 2360		MVI	11,3011
040E 36 3	2	2365	TWEN	MVI	м,32Н
04CE 23	C	2370		INX	H 28
04D1 77	C	2380		NOV	И,А
04D2 23	0	2385		INX	H
04D5 23	U	2390		DVX VIAT	M, 30H H
04D6 36 3	0	2400		MVI	м,30н
04DB FE 3	E 04	2410		JZ	OVER
04DD C9		2415		RET	
04DE 21 9 04Fl 11 O	6 CD C 05	2420 2425	OVER	LXI LXI	D.FINNEX
04E4 CD 6	4 05	2430		CVTT	PRIM
04E7 C3 0	B 01	2435	CTI T MITC	JI:IP	BECIN
04EB 3E 0	3	2445	JETI	ŀīV I	A,3
04ED 32 3	0 05	2450		STA	RAFL
04F0 CD B 04F3 5F	6 03	2455		NOV	E.V
04F4 16 0	0	2465		MVI	D,0
04F6 21 B 04F9 19	E FF	2470		DVD	H,-66 D
04FA 22 9	F 03	2480		SILD	INCPL
04FD 2/\ 9. 0500 FS	F 03	2485		THTD	ukag
0501 D1		2495		POP	D
0502 2A A	1 03	2500		LPLD	PYl
0507 19	C	2510	RX2	DV/D	D D
0508 36 0	4	2515		₩I IVI	14,4
050B C2 0	7 05	2525		Z71L	RX2
050E C9	0.05	2530		RET	
050F 3A 3	U US 1	2535	JETON	CEL	RAFL 1
0514 C8	-	2545		RZ	•
0515 3D 0516 32 3	0.05	2550		DCR	A RAFI.
0519 FE 0	1	2560		CPI	1
051B C2 3 051E 2A 9	1 05 F 03	2565		JNZ LLTD	RXS
0521 ES	. 05	2575		PUSII	II
0522 D] 0523 24 A	1 02	2580		POP	D pv1
0526 06 0	C 03	2590		i-iVI	B,12
0528 19	0	2595	EX3	D/\D	D 2011
0529 36 2 052B 05	U	2605		DCI:	B
052C C2 2	8 05	2610		JNZ	RX3
0521 09		2615	RAFL	DB	1
0531 F1		2625	RXS	POP	PSV
0532 F1 0533 C3 4	C 01	2635		JHP	RUBETT
0536 CD A	4 03	2640	PENOP	CVTT	RID
0539 D6 D 053B D8	12	2645		RC	OD21!
053C D6 0	3	2655		SUI	3
053E D0 053F 21, 4	5 04	2660 2665		RIAC LIII.D	PLOCI
0542 06 2		2670		IVI	B, 20II
0544 70 0545 23		2675 2680		NOV Tik	M, B
0546 70		2685		IXN	H,E
0547 23 0548 70		2695 2695		IIIX	H M,B
0549 11 B	F FF	2700		LXI	D,-65
054C 19 054D 70		2705 2710		DAD	D
054E AF		2715		XRA	N,B
	3 03	2720		STA	Gl
0552 32 9 0555 3E 0		2725 2730		STA	FLG1 A,1
	17 04	2735		STA	EFLG1
055A 2A C	.7 03	2745 2745		IIOV LIILD	BL1 N,B
055E 11 4	10 00	2750		LXI	D,64
0561 19 0562 70		2755 2760		DY.TO	D !! <b>,</b> D
0563 C9		2765		RET'	
0564 LA 0565 FE 0	)(;	2770 2775	PKIM'	LDAX CPI	D
0567 C8		2780		RZ	
0568 77 0569 23		2785 2790		NOV INX	H,A 11
056A 13		2795		DD:	D
056B C3 6		2800 2805	SPEED	JMP DV!	PRIMP 0
	7	1 ctina	7 cont	inuod o	n nage 168

Listing 1 continued on page 168

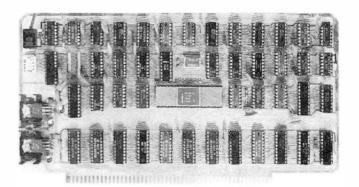
### Now! For the S-100 bus

# 8086 Power

### WITH 16-BIT WORD LENGTH

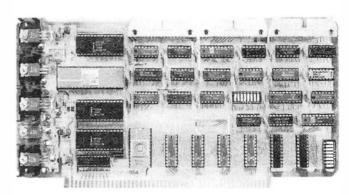
### 8086 CPU

This card brings state-of-the-art performance to the S-100 bus. It may be used to upgrade existing 8-bit systems by "swapping" the CPUs or it may form the foundation for a high performance 16-bit system. It will operate with 8-bit, 16-bit, or mixed memory and peripherals. It has a 1-megabyte addressing range. It can be factory upgraded at nominal cost from 4 Mhz. to 8 Mhz. when the faster CPU chip is available. Price — \$895.



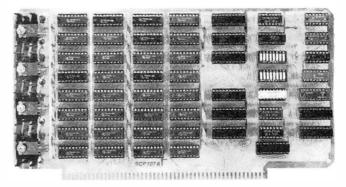
### **CPU Support Card**

This is a companion to our 8086 CPU. It includes a 2K monitor with machine language debugger and disk bootstrap loader, serial port with software-selected baud rate, time-ofday clock with battery backup capability, two general purpose timers/counters, and a vectored interrupt controller with 7 interrupts generated on board and 8 accepted from the bus. Price — \$395.



### 8/16 Memory Card

Through the use of the sXTRQ line of the proposed IEEE Standard, this memory board will appear to be 8K by 16 bits to our 8086 CPU or 16K by 8 bits to 8-bit CPUs. It is offered with 250 nsec. memory chips only and will perform without wait states with our 8086 CPU using an 8 Mhz. clock. It has 24-bit extended addressing. Price — \$595.



### (Prototypes shown)

167

### Z80/8086 Cross Assembler

This cross assembler runs under CP/M and its derivatives. Its mnemonics are the same as or similar to Intel's ASM-86. It is available in 5" soft-sectored, 5" North Star, or 8" softsectored (IBM) formats. Price - \$250.

### Microsoft BASIC-86

Microsoft's BASIC interpreter for the 8086 is essentially identical in features to their 5.0 release for the 8080 and is ANSI compatible. It is a "stand-alone" version and includes all disk and terminal I/O drivers. Programs written for any earlier version of Microsoft BASIC will run under BASIC-86 with little or no modification. Price - \$350.

### MCS-86 User's Manual

By Intel — Feb., 1979, edition. This is the primary hardware and software reference manual for the 8086 CPU. Price \$6.25. (Includes shipping)

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(206) 575-1830

Circle 330 on inquiry card. BYTF November 1979

Listing 1	cont	inue	d:						
0570 2A 54 45 20 48 34 3D 54	27, 53 20, 53 45, 44 31, 20 52, 55 2C, 20 46, 41 45, 53	45 50 2C 54 20 31 53		2510	IEGI	ASC	***SET SPE	ED, 1 T	NRU 4, 1=F/STEST ***
0593 00	2A 2/	4		2815		DL:	()		
0594 2 <i>P.</i> 41	2A 20 4C 40 4E 20	4F		2820		ASC	*** BVLIVO	/; ** <sup>1</sup>	
05 <i>h</i> 1 00				2825		DB	0		
74 37 6F	6F 70 69 67 20 31 39 20 6E 79 73 74	7 68 1 39 0 54 1 20		2830	11902	ASC	'Copyrigi:t	. 1979 T	Cony Estep'
05BB 00				2835		DB	0		
058C 44 50	52 4F 45 52			2840	DELISC	ASC.	DROPPER'		
05C3 00	45 54	2		2845		DB	0		
05C4 53	48 41 45 52			2850	THI-EC	VCC	'SHOOTER'		
20 52	2A 20 4E 41 53 43 45 20	4C 4F		2855 2860	FIN-EC	DB ASC	0 *** FINAL	SCORE *	k* T
2A 05DD 00 05DE				2865	STACK	DC DS	0 50		
BALN	0226		BOWN		241	BEGIN	010B	BFLG1	0447
BLi	03C7		BLAK	C	2F9	LITVIC	05I3C	DLM	0235
BLNCH	0259 0253		BLOP		)2FC )426	BLAF BLOW	02FD 0424	BLNR BLP1	02FE 042E
BOI,	0253 02EB		CLEC		COD5	CORNR	02F6	DVK	0097
DELAI	026F		DELA		26/	DOWI!	021E	F/ST	02B9
FINAS HIT	05CC 0448		FLG1		)39E )294	Gl INCR1	03V3 03VF	IMP CO	010E 01D6
JETI	04EB		JETO	1 0	50F	KYCIK	0109	$\Gamma V T S$	0081
LEFT MED	0205 02C0		MIDL		OZFA CELE	LR MSCT:	02F2 0488	LTR NSG	04B <b>∧</b> 0594
MSGl	0570		MSG2		0514	OFFI	0398	ora	038E
OVER	04DE		DEAT]		300	PEAGI	03C9	PEVOF	0536
PLOC1 PY1	0445 03Λ1		PRIN RAFL		0564 0530	PSCR RAR	0489 0093	PU'I'ON REND	01AC 02Fb
RIGHT	01FA		H4D		03/4	RND1	0302	MU21	03136
RNIOM RXS	03C0 0531		RUNI		014C CFC0	RX2 SCORE	0507 0487	IXX3 SCORI	0528 0183
SCOUT	04AB		SHUL	(	368	SHELl	03C4	SHIP	0189
STACK	033D 05DE		SLOW		)2C7 )1D0	SPAST STRIF	02CE 04EA	SPEED	056E 01C1
TEMP	0350		THAS		05C4	TOP	02 E4	TOPB	02D5
CT./CS:	0 400		* ** **			150	00=4		0.01

Text continued:

cycles, as you will see when you play). If there is no water jet there, then a random number test decides whether to shoot a pea or water jet. If it is a pea, control falls through to TEMP. This locates the starting point for the pea line and then sets the flag that tells the program that a pea is being fired. The program keeps track of that, since it will be on for several program cycles, until it makes a hit or goes off the screen.

Next, we determine the random direction of fire, and at last the program is ready to start the pea in motion. An increment is computed and stored at lines 1425 thru 1450.

Note at SHB1 that the user should reload the HL register pair with the same values that are already in it. This is a practice I always follow when I will be coming to an entry point from a number of different places. The idea is to eliminate parameter passing, or rather to pass the parameters through a named storage location, which makes it much easier to debug. Be that as it may, you can readily see how in the ensuing instructions, the heart of the matter is reached. Write hexadecimal 20 into the area occupied by the pea and its trail (hexadecimal 07 and 0A respectively in the Processor Technology video display module (VDM) character set), then add the increment. Check to see if it is off the screen, and if not put the characters into the new

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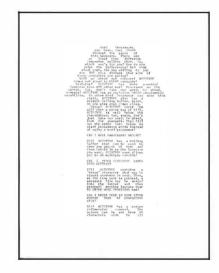
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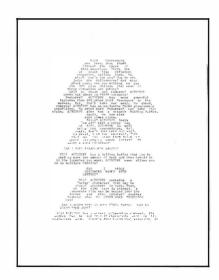
WHIT

02F4

02F8







Word Processors are here. Just thumb through the pages of this magazine. There are at least five different companies selling them. So, which one's for you? How do you judge the differences? And what about cost. Are you willing to pay the 300 plus dollars that some of the companies are asking?

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PUT BLANKS INTO **TAKOF** LOCATION FROM WHICH MOTORIZED DELTA-WING IS MOVED ONTO SCREEN END **BFGIN** SHIP MOVE MOTORIZED DELTA-WING LOCATION IN MEMORY TO SCREEN **END** ADD OFFSETS LR, UD PUT MOTORIZED DELTA-WING CHARACTERS **PUTON** INTO MEMORY WHERE **BLANKS NOW ARE** FND **BEGIN** MOVE DELTA-WING TO SCREEN SHIP MAIN END RUN **BEGIN** LOOP **KYCHK** UPDATE UD AND LR FROM KEYBOARD (1, n)END **BEGIN** DID WE HIT TOP OR **TOPB** BOTTOM OF SCREEN? FND **BEGIN** IS WATER BALLOON CALLED FOR OR ALREADY ON **BLNCHK** ITS WAY? UPDATE WATER BALLOON CHARACTER LOCATION **BEGIN DELAY** LEAVE SCREEN AS IT IS FOR A MOMENT END **BEGIN PEACHK** UPDATE PEASHOOTER AND PEA FND **BEGIN SCORIT** CALCULATE SCORES PUT THEM ON SCREEN

Figure 3: A summary of the functions performed in the main loop, along with a definition of the individual tasks executed by each subroutine.

locations, and return. Checking for a hit is done when the ship is displayed.

I hope that playing around with this program will prove to be as much fun for you as it was for me. In order to adapt it to your system, you may need to change the control keys, the clear routine, and the display location, but if you have a SOL-20 it will work as is. If you tackle the development of an animated game, you will find the simple principles embodied in this program will work in much more elaborate games. One final note: when you first play this, you will be positive that it is impossible to win. The "random" peashooter seems to have an incredible sixth sense about where to aim his pea. However, it can be done . . . in fact, my seven-yearold can beat it on speed 1, so hang in there! Good luck, and have fun.

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04 = \*ENTER A/C RECEIVABLES 05 = \*ENTER A/C PAYABLES

05 = "ENTER A/C PAYABLES 06 = ENTER/UPDATE INVENTORY 07 = ENTER/UPDATE ORDERS

08 = ENTER/UPDATE BANKS

09 = EXAMINE/MONITOR SALES LEDGER 10 = EXAMINE/MONITOR PURCHASE LEDGER 11 = EXAMINE/PRINT INCOMPLETE RECORDS

12 = EXAMINE PRODUCT SALES

### SELECT FUNCTION BY NUMBER

13 = PRINT CUSTOMER STATEMENT 14 = PRINT SUPPLIER STATEMENTS 15 = PRINT AGENT STATEMENTS

16 = PRINT TAX STATEMENTS 17 = PRINT WEEK/MONTH SALES

18 = PRINT WEEK/MONTH PURCHASES 19 = PRINT YEAR AUDIT

20 = PRINT PROFIT/LOSS ACCOUNT

21 = UPDATE END MONTH FILES 22 = PRINT CASH FLOW FORECAST

23 = ENTER/UPDATE PAYROLL (NOT YET AVAILABLE)

24=RETURN TO BASIC

#### WHICH ONE? (ENTER 1-24)

Each program goes to sub menu, e.g.:
(9) allows: A. LIST ALL SALES; B. MONTOR SALES BY STOCK CODES,
C. RETRIEVE INVOICE DETAILS; D. AMEND LEDGER FILES;

E. LIST TOTAL ALL SALES.

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### Five Useful Programs for the SC/MP

Associate Professor Charles A Kapps Temple University School of Business Administration Philadelphia PA 19122

Now that you are the proud owner of one of the least expensive microprocessor kits, what can be done with it? Before that question is answered, why do you own the SC/MP to begin with? You may be someone interested in learning about microprocessors or computers, and since you are a cautious person of modest means, you have chosen to begin slowly.

No computer is useful unless it has a means of communicating with the outside world. The SC/MP is no exception. The SC/MP kit by itself provides no such capability. Thus, some sort of I/O (input/output) hardware must be obtained, such as a teletypewriter. This article assumes that you have the minimum of I/O hardware, probably a video display, which is likely to cost three times as much as the computer. (This is an important thing to know about computers. They are worse than automobiles because the accessories really account for most of the cost. This is even true with the big number-crunching computers).

The main limitation of such a system is it is not feasible to attempt to write very large programs. This is not only because of the SC/MP's rather meager amount of memory (256 bytes). It is also due to the fact that, without any means of assembling, editing, and backing up programs, it becomes humanly impossible to do any serious programming endeavors. For this reason, the programs in this article have been kept short and simple. For more ambitious readers, these programs can be combined or added to in order to accomplish more sophisticated tasks.

### Input and Output on the SC/MP

A thorough search of the manuals provided with the SC/MP kit provides little information about programming input and output functions. Clearly, input and output are possible, because the KITBUG monitor program provided in read only memory is able to perform those functions. The assembly listing of KITBUG, which is provided in the SC/MP Kit User's Manual, shows how input and output are accomplished. The input and output portions of the monitor are located at the end of the listing, and occupy hexadecimal locations 186 thru 1FB of the read only memory (over 100 bytes).

The main reason those functions require so much coding is that the SC/MP has neither a parallel I/O port nor an internal universal asynchronous receiver/transmitter (UART), as a more sophisticated processor might. Instead, it is necessary to have a program which simulates the primary functions of a universal asynchronous receiver/transmitter, namely converting between parallel-byte data and asynchronous serial data (ANSI). For example, the output program transmits a 0 (note that the actual bits are inverted). This is the start bit. The program must then idle for 1/110 second because the transmission rate is 110 baud. The least significant bit (LSB) of the data byte is then transmitted, and the program again idles for 1/110 second. This is repeated until all data bits are transmitted. Finally, the program outputs a 1 and idles for 1/55 second for the 2 stop bits needed by a teletypewriter. For input, a similar procedure is operated in reverse.

After study of these programs, it should be possible to imitate these processes and incorporate them into our own programs. Although studying other people's programs is often a good way to learn how to program, copying these programs is not the best thing to do here.

As every good programmer knows, basic processes should be written in the form of subroutines which can be called from various places in the main program. This rule was followed by the writers of KITBUG, and all the various areas of the program assume the form of subroutines. These subroutines can be called from anywhere, including your own program area. In particular, there are 4 subroutines which are useful for all kinds of programs:

PUTC	This subroutine prints a single ASCII
	character on the output device.
GECO	This program reads 1 character typed in
	at the keyboard, and returns the ASCII
	code.
PHEX1	Here are 2 different entry points to a
and	subroutine which converts a byte into a
PHEX2	2-digit hexadecimal number and prints it.
GHEX	This program reads a hexadecimal

16-bit value as 2 bytes.

number of up to 4 digits, and returns the

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### **Using System Subroutines**

Before these subroutines can be used, or any subroutines written by someone else, you must be familiar with all of the usage conventions of the subroutines. These conventions include:

- how to call and return from the subroutine
- how to pass information back and forth
- special conventions, such as the saving and restoring of registers, temporary storage used, etc

The standard method for calling subroutines in KITBUG is to use pointer register 3 to contain the return address. This is done by loading pointer register 3 with the address of the subroutine. Then execute the instruction XPPC P3; this exchanges pointer register 3 and the program counter. This leads to the subroutine, and since the program counter value at the time of the call is saved in pointer register 3, the subroutine returns the same way it was called, with XPPC P3.

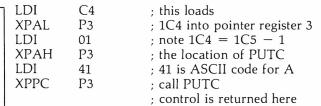
Of special note here is a peculiarity of the SC/MP processor. Most computers increment their program counters between the fetch and execute cycles. In the SC/MP, the program counter is incremented after the execute cycle. This is, in effect, the same as incrementing it just before the next fetch. The result is that whenever a jump is executed (such as the XPPC instruction), the effective address must be one less than the actual address where you want to jump. For example, the PUTC sub-

routine is located at hexadecimal 01C5, so when you call PUTC, you must load 1C4 into pointer register 3.

Note that after control has been returned from the subroutine, pointer register 3 no longer has its initial value. In fact, it has the last value that the program counter had in the subroutine, and thus points to the end of the subroutine. Normally this would mean that pointer register 3 would have to be reloaded in order to call the subroutine a second time. Actually, the writers of KITBUG foresaw this problem, and were kind enough to make life simple. Every return instruction (XPPC P3) is followed by a jump back to the beginning of the subroutine. This allows a subroutine to be called several times, merely by executing XPPC P3 instructions.

The second matter pertaining to subroutine calling conventions is concerned with how data is passed back and forth between the calling program and the subroutine. The first 3 of the subroutines, PUTC, GECO, and PHEX, deal only with a single byte of information. For these subroutines, the byte is simply passed by means of the accumulator. For example, PUTC prints a single character. When PUTC is called, the ASCII code of the character to be printed must be loaded into the accumulator, then the subroutine is called by executing XPPC P3. (It is assumed that pointer register 3 has already been set up.)

For example, the following program segment would cause an A to be displayed:



Subroutine GHEX is not quite as simple, because the data being transferred is a 16-bit quantity, and therefore will not fit in the accumulator. The answer to what GHEX does with its results lies in the third category of subroutine conventions: special conventions.

All of the subroutines in KITBUG use a special convention for dealing with temporary data, saving registers, etc. Note that KITBUG cannot use its own program area for storing data. KITBUG resides in read only memory. KITBUG must then be able to use some of the 256 bytes of programmable memory for its storage needs. It does this through a common storage area known as the *stack*. The stack is an array which holds data in a last-in-first-out fashion. The stack resides in the higher addresses of programmable memory, and advances downward as data is added. Pointer register 2 is used to point to the most recently added piece of information on the stack. Since all of the KITBUG subroutines use the stack, pointer register 2 may not be used except in carefully prescribed and compatible ways.

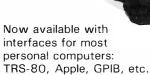
When the program is started, KITBUG loads pointer register 2 from locations OFFB and OFFC. (Note that because of the addressing overlap, these locations are the same as O2FB and O2FC.) Unless these locations are

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modified, they will contain 0. Thus, pointer register 2 will initially be 0. When an item is stored on the stack, it is done with the instruction ST @ -1(P2). Negative autoindexing is performed before the effective address is computed. Therefore, the effective address is 0FFF. (Note that borrows and carries do not propagate into the most significant 4 bits during effective address computation.) Since the address 0FFF is the same as 02FF on the SC/MP, the stack will effectively start at the high end of the programmable memory and proceed downward. This is probably the best place for the stack anyway, so the best thing to do about initializing the stack is nothing.

### Program 1: Output

The first program, listing 1, is a simple program which can be used for checking out the machine. It also illustrates how to use subroutine PUTC.

The program is written in an infinite loop and repeatedly prints a message. The message is stored in the form of an ASCII character string starting at location hexadecimal 0220. An ASCII code for 0 is used to terminate the message. Control characters such as carriage return and line feed must be included in the message. In

the example, the message is simply "HELLO." However, any message could be put in its place. If the I/O (input/output) device is a video display, rather than a teletypewriter, some interesting geometric patterns can often be formed by typing messages with random characters and control characters mixed together.

The functioning of the program is quite simple: locations 200 thru 205 set pointer register 1 equal to 0220, the beginning of the message string. Hexadecimal locations 0206 thru 020B set pointer register 3 to point to PUTC, the printout subroutine. At 020C a character is loaded into the accumulator. Auto-indexing is used, so that repeated executions of this instruction will cause successive characters to be fetched. At 020E there is a jump back to the beginning if the zero end code is reached; otherwise, PUTC is called at location 0210, which causes the character in the accumulator to be printed. Then jump back to 0206 to print the next character. (Note that as stated above, it is not necessary to reload pointer register 3 every time the subroutines are called. Therefore, there could be a jump to location 020C and the program would work just as well. This can be done by changing location 0212 to F9.)

Text continued on page 178

Listing 1: The program will print an ASCII message over and over. The message is a string of ASCII character codes followed by a 0.

```
TTM
                                   .NLIST
3
                                            PROGRAM #1
                                   . TITLE
                                   ; THIS PROGRAM PRINTS OUT A MESSAGE
4
                                   ; OVER AND OVER FOREVER.
5
                                   ; THE MESSAGE TAKES THE FORM OF
                                   ; ANY STRING OF ASCII CHARACTER CODES
6
7
                                   ; FOLLOWED BY A TERMINATION CODE OF ZERO
8
              0200
                          = 200
9
     0200
                C4
                     20
                          START:
                                             ^L < STRING>
                                                               ; PIIS USED AS A
                                   LDI
                                                               ; POINTER TO THE
10
     0202
                31
                                   XPAL
                                             P 1
                                             ^U<STRING>
11
     0203
                C4
                     02
                                   LD I
                                                                ; MESSAGE STRING
12
     0205
                35
                                   XPAH
                                             P 1
                          LOOP:
                                                               ; P3 MUST BE ONE LESS
13
     3206
                     C4
                                             ^L< PUTC> - 1
                C4
                                   LDI
14
     0208
                33
                                   XPAL
                                             P3
                                                                ; THAN THE ADDRESS
                                             ^U< PUTC>
                                                                : OF PUTC = 1C5
15
     0209
                C4
                     01
                                   LDI
16
     020B
                37
                                   XPAH
                                             P3
17
     020C
                C5
                     01
                                             @1(P1)
                                                                GET NEXT CHARACTER
                                   LD
18
     020E
                98
                     F0
                                   JZ
                                             START
                                                                ; ZERO IS END CODE
                                   XPPC
                                                                ; OTHERWISE PRINT CHARACTER
19
     0210
                3F
                                             P3
                                             LOOP
                     F3
                                                                ; AND LOOP
20
     0211
                90
                                   JMP
21
              0220
                          .=0220
22
                                             /HELLO/(CR)(LF)(0)
     0220
                          STRING: .ASCII
                48
                     45
     0222
                4C
                     4C
     0224
                4F
                     ØD
     0226
                0 A
                     00
23
              0001
                          P1=%1
24
              0002
                          P2=%2
25
              0003
                          P3=%3
26
              01C5
                          PUTC=01C5
27
              000D
                          CR=0D
28
              000A
                          LF=0A
                                    . END
              0200
                                             START
SYMBOL TABLE
                   LF
                           000A
                                      L<sub>0</sub>0P
                                               0206
CR
       = 000D
                   P 1
                          = 20001
                                             = %0002
PUTC
       = 01C5
                                      P2
                   START
                            0200
                                      STRING
                                               0220
P3
       = 30003
```

ERRORS DETECTED: 0

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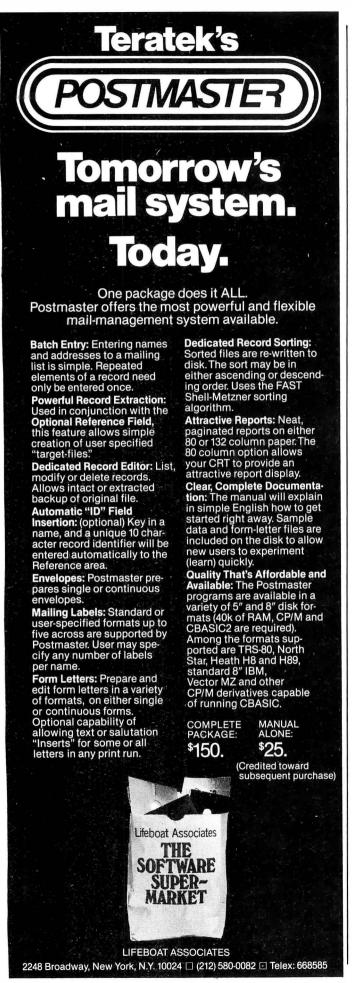
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Text continued:

In order to run this, or any program in this article, it is necessary to initialize the register save locations of KITBUG. These are 0FF7 thru 0FFF. (In the kit setup these are equivalent to 02F7 thru 02FF.) Locations 0FF7 and 0FF8 should contain 0200 (02 in 0FF7, 00 in 0FF8). The remaining locations, especially 0FFB and 0FFC (the stack initialization), should contain 0. Typing G to KITBUG then causes the program to run.

### Program 2: Output and Input

The second program, listing 2, is much longer than the first, but is not conceptually more complex. This program combines some message printout with some input.

The program is designed to do the following: first, it prints out HELLO, I'M A COMPUTER, WHO ARE YOU? The computer than waits for a name to be typed, such as JOHN DOE. It responds HI, JOHN DOE, I'M PLEASED TO MEET YOU, and jumps back to the monitor. The initialization registers are saved, so that the program can be rerun by simply typing G.

The input is managed by subroutine GECO. GECO is called by executing XPPC P3, as usual. Routine GECO waits until something is typed at the keyboard. It then returns to the program with the ASCII code for the

character typed in the accumulator.

Printout for program 2 is handled by a subroutine of my own called PRINT. This is found starting at line 49 of the listing. PRINT is basically the same as program 1, but modified to have the form of a subroutine. Instead of looping endlessly, when done printing a message, it returns from where it was called. Note that PRINT calls PUTC. Whenever a subroutine calls another subroutine, pointer register 3 must be saved for the return. PRINT uses the stack for this purpose. Note the basic rules for using the stack. Whatever is added to the stack by a subroutine must be removed before exiting. PRINT uses pointer register 1 to point to the message it is printing. Pointer register 1 must be set by the main program before PRINT is called.

The first thing program 2 does is to save pointer register 3. The reason is that KITBUG treats the program as if it were a subroutine. Saving pointer register 3 makes it possible to return to KITBUG when it is done. There is a catch, however. Because of the peculiarity of how the SC/MP treats the program counter, KITBUG must subtract 1 from the number in memory locations OFF7 and OFF8 before using it as a jump address. Unfortunately, this will get you into a loop if you try to get subsequent entries to the program by typing G a second time. The problem is that KITBUG does not add 1 back on to the program counter value when you return. To get around this, put 200 into pointer register 3, and then return using an XPPC P1. This fools KITBUG into working properly. The rest of the program is straightforward, and consists of calls to PRINT and GECO.

To keep this program as short as possible, advantage was often taken of the fact that registers (particularly the high-order parts of pointer registers) already contain the right value. Thus, these registers are not reloaded. This saves 2 or 3 bytes of program here and there, and since the programs are being entered into the computer by

Listing 2: This program outputs a prompt, accepts some input, and then outputs another message which has your input embedded.

```
. NLIST
                                              TTM
2
                                    . TITLE
                                              PROGRAM #2
3
                                    THIS PROGRAM TYPES A MESSAGE
4
                                    PROMPTING YOU TO TYPE SOMETHING.
5
                                    ; IT THEN ANSWERS WITH A MESSAGE
6
                                    WHICH HAS YOUR TYPEIN IMBEDDED.
7
              0200
                           .=200
8
      0200
                 C4
                     3E
                          START:
                                    LDI
                                              ^L<PRINT>-1
                                                                 ; SET UP TO ; CALL THE
9
      0202
                 33
                                    XPAL
                                              P3
10
      0203
                     FF
                 \mathbf{CE}
                                    ST
                                              @-1(P2)
                                                                 ; PRINT SUBROUTINE
11
                                                                 ; BUT SAVE THE OLD
; VALUE OF P3 ON
      0205
                 C4
                     02
                                    LDI
                                              ^U<PRINT>
12
      0207
                 37
                                    XPAH
                                              P3
13
      0208
                 CE
                     FF
                                    ST
                                              @-1(P2)
                                                                 THE STACK
14
      020A
                 C4
                     60
                                              ^L< MSG1>
                                    LDI
                                                                 ; SET P1
15
      020C
                 31
                                    XPAL
                                                                 ; TO POINT
                                              P 1
16
      020D
                 C4
                     02
                                    LDI
                                              ^U< MSG1>
                                                                 ; TO
17
      020F
                 35
                                    XPAH
                                              P1
                                                                 FIRST MESSAGE
18
      0210
                 3F
                                    XPPC
                                              P3
                                                                 ; CALL PRINT
19
      0211
                 C4
                     85
                                    LDI
                                              ^L< GECO> - 1
                                                                 ;SET UP
20
      0213
                 33
                                    XPAL
                                              P3
                                                                 ; TO CALL
21
      0214
                 C4
                      01
                                    LDI
                                              ^U< GECO>
                                                                 ; INPUT ROUTINE
22
      0216
                 37
                                                                 ; IN KITBUG
                                    XPAH
                                              P3
23
      0217
                 C4
                      90
                                    LDI
                                              ^L < MSG2>
                                                                 PI POINTS TO INPUT
24
      0219
                 31
                                    XPAL
                                              P 1
                                                                 BUFFER (HIGH PART OF P1 OK)
25
      021A
                 3F
                          LOOP:
                                    XPPC
                                              P3
                                                                 ; CALL GECO
26
                     01
      021B
                 CD
                                    ST
                                              @1(P1)
                                                                 SAVE CHARACTER IN BUFFER
27
      021D
                 E4
                      ØD
                                    XRI
                                                                 COMPARE WITH CR
                                              CR
28
      021F
                 9C
                     F9
                                    JNZ
                                              L<sub>0</sub>0P
                                                                 ; LOOP UNTIL CR TYPED
29
                 CD
                     FF
                                              @-1(P1)
      0221
                                    ST
                                                                 ; CHANGE CR TO ZERO
30
      0223
                 C4
                      3E
                                    LDI
                                              ^L < PRINT > -1
                                                                 :SET UP CALL
                                                                 TO PRINT AGAIN
31
      0225
                 33
                                    XPAL
                                              P3
32
                     02
      0226
                 C4
                                    LDI
                                              ^U< PRINT>
33
      0228
                 37
                                    XPAH
                                              P3
34
      0229
                 C4
                     B0
                                    LD I
                                              ^L < MSG3>
                                                                 ; P1POINTS TO MESSAGE 3
35
      022B
                 31
                                    XPAL
                                              P 1
                                                                 (HIGH PART OF P1 OK)
36
      022C
                3F
                                    XPPC
                                              P3
                                                                 ; CALL PRINT
37
      022D
                 C4
                     90
                                              ^L<MSG2>
                                                                 ;P1 POINTS TO BUFFER
                                    LDI
38
      022F
                 31
                                              P1
                                    XPAL
                                                                 ; (HIGH PART STILL OK)
39
      0230
                 3F
                                    XPPC
                                                                 ; CALL PRINT
                                              P3
40
                 C4
      0231
                     Cô
                                              ^L< MSC4>
                                    LD I
                                                                 ; P1 POINTS TO MESSAGE 4
41
      0233
                 31
                                    XPAL
                                              P1
                                                                 ; (HICH PART STILL OK)
42
      0234
                 3F
                                    XPPC
                                              P3
                                                                 ; CALL PRINT
      0235
43
                 C<sub>6</sub>
                     01
                                    LD
                                              @1(P2)
                                                                 GET ORIGINAL P3 OFF
44
      0237
                 35
                                    XPAH
                                                                 STACK AND PUT IN PI
                                              P 1
45
      0238
                 C6
                     01
                                    LD
                                              @1(P2)
                                                                 ; WE HAVE TO DO FUNNY
46
      023A
                 31
                                    XPAL
                                                                 BUSINESS WITH P3 SO THAT
                                              P 1
47
      023B
                 C4
                     00
                                    LDI
                                              a
                                                                 ; IT WILL EQUAL 200
48
      023D
                 33
                                    XPAL
                                              P3
                                                                 FOR RESTART (HIGH ORDER PART OK)
49
      023E
                 3D
                                    XPPC
                                              P 1
                                                                 ; RETURN TO KITBUG
                                                                 ; PRINT SUBROUTINE
50
      023F
                 C4
                     C4
                          PRINT:
                                              ^L< PUTC>-1
                                    LDI
51
      0241
                33
                                    XPAL
                                              P3
                                                                 ; P3 IS SET TO PUTC
52
      0242
                CE
                     FF
                                    ST
                                              @-1(P2)
                                                                 ; BUT IS ALSO SAVED
53
      0244
                                              ^U< PUTC>
                 C4
                     01
                                    LDI
                                                                 ON STACK FOR
54
      0246
                 37
                                    XPAH
                                              P3
                                                                 ; RETURN
55
      0247
                 CE
                     FF
                                    ST
                                              @-1(P2)
56
     0249
                          PLOOP:
                 C5
                     01
                                    LD
                                              @1(P1)
                                                                 ; GET CHARACTER
57
      024B
                 98
                     03
                                                                 DONE IF ZERO
                                    JZ
                                              POUT
                                    XPPC
58
      024D
                 3F
                                              P3
                                                                 ; OTHERWISE CALL PUTC
59
      024E
                 90
                     F9
                                    JMP
                                              PL00P
                                                                 ; AND LOOP
60
      0250
                 C6
                          POUT:
                     01
                                    LD
                                                                 ; RESTORE
                                              @1(P2)
61
      0252
                 37
                                    XPAH
                                                                 ; P3
                                              P3
      0253
                 C<sub>6</sub>
62
                     01
                                    LD
                                              @1(P2)
                                                                 ; FROM
63
      0255
                 33
                                    XPAL
                                              P3
                                                                 ; STACK
64
      0256
                 3F
                                    XPPC
                                              P3
65
      0257
                 90
                     E6
                                    JMP
                                              PRINT
      0259
                 90
66
                     E4
                                    JMP
                                                                 JUMP BACK IF RECALLED
                                              PRINT
67
              0260
                           .=260
68
      0260
                 48
                     45
                          MSG1:
                                    . ASCII
                                              /HELLO, I'M A COMPUTER./CR>CLF>
      0262
                 4C
                     4C
                     2C
      0264
                 4F
      9266
                 20
                     49
      0268
                 27
                     4D
      026A
                 20
                     41
      026C
                 20
                     43
      026E
                 4F
                      4D
      0270
                 50
                     55
```

0272

54

45

Listing	2 continued	<i>l:</i>				
	0274	52	2E			
69	0276 0278	0D 57	0 A 48		. ASCIZ	/WHO ARE YOU?/(CR)(LF)
09	027A	4F	20		· ASCIZ	WHO ARE TOUTS CREATER
	027C	41	52			
	027E	45	20			
	0280	59	4F			
	0282	55	3F			
	0284	ØD	Ø A			
	0286	00				
70		0290		MSG2=290		
71		02B0		.=02B0		
72	02B0	0A	<b>0</b> A	MSG3:	. ASCIZ	<lf><lf><lf><lf><hi! <="" td=""></hi!></lf></lf></lf></lf>
	02B2	0A	ØA			
	02B4	48	49			
	02B6	21	20			
73	<b>02B8</b>	00 02C0		.=02C0		
74	02C0	2C	ØD.		ASCIZ	/,/CR>Clf>/I'M PLEASED TO MEET YOU./
• •	02C2	0A	49	noor.	· ACCIZ	,, CHO ET // I II I LEASED TO THEI TOO!
	02C4	27	4D			
	02C6	20	50			
	02C8	4C	45			
	<b>02CA</b>	41	53			
	02CC	45	44			
	02CE	20	<b>54</b>			
	02D0	4F	20			
	02D2	4D	45			
	02D4	45	54			
	02D6 02D8	20 4F	59 5 <b>5</b>			
	92DA	2E	00			
75	9 <b>2</b> BH	0001	00	P1=%1		
76		0002		P2=72		
77		0003		P3=%3		
<b>78</b>		000D		CR=0D		
79		000A		LF = 0A		
80		0186		GECO=018		
81		01C5		PUTC=01C		
82		0200			. END	START
SYMB	OL TABL	E				
CR	= 000	D C	ECO	= 0186	LF	= 000A
LOOP			ISG1	0260	MSG2	= 0290
MSG3			ISG4	02C0	PLOOP	0249
POUT			RINT		PUTC	= 01C5
P 1	= 7000		2	=%0002	P3	=%0003
STAR	T 020	0				

hand, it is worth it. However, in the broader sense of programming, taking advantage of these kinds of savings is

not a good practice because it destroys the possibility of incorporating programs into a larger system.

Program 3: Time

ERRORS DETECTED: 0

The third program, listing 3, has some practical utility. It is a digital clock. The logic of the program is simple, consisting of one major loop containing a counter and a delay loop. The delay loop is adjusted so that the time around the entire loop is exactly 1 minute. The count is displayed each time through the loop.

This program was designed to produce output for a video display, so each line overwrites the previous line. The program could be modified to produce output on a teletypewriter, by adding a line feed to the output.

Output for this program uses the routine PHEX, which prints out the 2-digit hexadecimal numbers contained in the accumulator. In this case we are dealing with decimal, not hexadecimal, but since the SC/MP has decimal

instructions this only means that neither digit will be greater than 9.

PHEX has two entry points, PHEX1 and PHEX2, the difference being PHEX1 follows its output with a space, and PHEX2 does not. PHEX2 is generally used when a multi-byte number is to be printed. Here two 2-digit numbers for hours and minutes are being printed, so PHEX1 is used. This occurs in lines 8 thru 15 of the program.

The minutes are then incremented. When 60 is reached, go back to 0 and increment the hours. Thirteen hours gets reset to 1.

The program then delays for the remaining part of a minute, and then loops, printing out the next minute's time.

The delay is controlled by the numbers at locations 0228, 022C, and 022E. The numbers shown in the listing worked for the author's own setup, and kept time within a few seconds a day. The timing is controlled by the actual crystal frequency on the SC/MP board. Other

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Listing 3: Looping through several time delays is used to keep track of time. This program displays the time accurate to the minute.

1 2 3 4 5					;TIME C	TTM PROGRAM #3 PROGRAM DISPLAYS OF DAY ON A CRT IME IS RE-WRITTEN MINUTE	
7		0200		.=200	,		
8	0200	C4	3D	START:	LDI	^L< PHEX1>-1	GET ADDRESS
9	0202	33	O.D		XPAL	P3	OF NUMERIC
10	0203	C4	01		LDI	^U< PHEX1>	PRINT ROUTINE
11	0205	37	•		XPAH	Р3	; IN P3
12	0206	C0	39		LD	HOUR	GET HOUR
13	0208	3F	0,		XPPC	P3	; CALL PHEX1
14	0209	C0	37		LD	MINUTE	GET MINUTE
15	020B	3F	-		XPPC	P3	; CALL PHEX1
16	020C	C0	34		LD	MINUTE	GET MINUTE
17	020E	02			CCL		CLEAR LINK
18	020F	EC	01		ĐAI	1	; ADD ONE
19	0211	C8	2F		ST	MINUTE	STORE NEW VALUE
20	0213	EC	40		DAI	40	DOES MINUTE = 60?
21	0215	9C	10		JNZ	DELAY	NO SO DELAY ONE MINUTE
22	0217	<b>C8</b>	29		ST	MINUTE	MINUTE = 0
23	0219	C0	26		LD	HOUR	GET HOUR
24	<b>021B</b>	EC	00		DAI	0	; ADD 1 (LINK = 1)
<b>25</b>	<b>021D</b>	<b>C8</b>	22		ST	HOUR	; HOUR = HOUR + 1
26	<b>021F</b>	EC	87		DAI	87	; IS HOUR = 13?
27	<b>022</b> 1	9C	04		JNZ	DELAY	; NO SO DELAY
28	0223	C4	01		LDI	1	; OTHERWISE
29	0225	<b>C8</b>	1 A		ST	HOUR	; HOUR = 1
30	0227	C4	1 <b>E</b>	DELAY:	LDI	01E	; WE WILL DELAY
31	0229	<b>C8</b>	18		ST	COUNT	;225 = (FF-1E) TIMES
32	<b>022</b> B	C4	22	DL:	LDI	22	; THEN DELAY
33	<b>022</b> D	8F	$\mathbf{F}\mathbf{F}$		DLY	0FF	; 131070 MICRO CYCLES
34	022F	A8	12		ILD	COUNT	; INCREMENT COUNT
35	0231	9C	F8		JNZ	DL	; LOOP UNTIL OVERFLOW
36	0233	C4	C4		LDI	^L< PUTC> - 1	GET CHARACTER PRINT
37	0235	33			XPAL	P3	; IN P3
38	0236	C4	ØD		LDI	CR	; LOAD CARRIAGE RETURN
39	0238	3F	-		XPPC	P3	; CALL PUTC
40	0239	90	<b>C5</b>	HOUD O	JMP	START	GO BACK TO THE BEGINNING
41		0240		HOUR=24			
42		0241		MINUTE=			
43 44		0242 000D		COUNT=2 CR=0D	42		
45		0001		P1=%1			*
46		0001		P2=%2			
47		0002		P3=%3			
48		013E		PHEX1=0	13F		
49		01C5		PUTC=01			
50		0200		1010 01	.END ST	ΓART	¥
SYME	OL TABI	LE					
COUT	m - AC	10 1	מי	- 0000	DEI A	V 4007	
	T = 024		CR	= 000D	DELA		
DL	022		HOUR	= 0240		ΓE= 0241 =%0001	
PHEX1 = 013E PUTC P2 = 70002 P3				= 01C5 =%0003	P1 STAR		

COUNT	= 0242	CR	= 000D	DELAY	0227
DL	<b>022</b> B	HOUR	= 0240	MINUTE=	0241
PHEX1	= 013E	PUTC	= 01C5	P1 =	70001
P2	= 70002	P3	= %0003	START	0200

ERRORS DETECTED: 0

crystals might require different settings. Location 022C has the fine setting; the other values give a coarser setting.

#### Programs 4 and 5: Calculation

Programs 4 and 5, listings 4 and 5, are designed to perform calculator-like arithmetic functions. Program 4 is an adder, and program 5 is a multiplier. The functions were kept separate in order to make the programs simple; however, an enterprising reader could easily combine the functions into a single program, and even include subtraction and division.

Both programs use the decimal addition instruction, as did program 3. Multiplication is performed in a very sim-

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Listing 4: Calculator functions can be easily programmed into the SC/MP. This routine inputs 2 numbers and outputs the sum.

1 2 3 4 5 6 7		0000		-000	;TWO NU ;"253+7 ;INPUT	TTM PROGRAM #4 ROGRAM ADDS MBERS, WHEN TYPE 92= " HAS FOUR DIGIT M IS FIVE DIGITS	
8	0200	0200 C4	DF	.=200 START:	LDI	^L< GHEX> - 1	:SET P3
-		33	Dr	START	XPAL	P3	; TO ADDRESS
10	0202	C4	00		LD I	^U< GHEX>	OF
11 12	0203 0205	37	00		XPAH	P3	; GHEX
13	0205	3F			XPPC	P3	; CALL GHEX TWICE
14	0207	3F			XPPC	P3	TO GET TWO NUMBERS
15	6208	02			CCL	10	; CLEAR OLD CARRY
16	0209	C2	01		LD	1(P2)	GET LOW HALF 2D NO
17	0209 020B	EA	03		DAD	3(P2)	; ADD TO LOW HALF 1ST NO
18	020B 020D	CA	03		ST	3(P2)	STORE AT BOTTOM OF STACK
19	020D 020F	CA C6	03 02		LD	@2(P2)	GET HIGH HALF 2D NO
20	020r	CO	02		LD	62(12)	; AND BUMP STACK POINTER
21	0211	EA	00		DAD	0(P2)	; ADD HIGH HALF 1ST NO
22	0211	CA	00		ST	0(12) 0(P2)	STORE ON TOP OF STACK
23	0213	C4	C4		LDI	^L< PUTC> - 1	; P3 SET FOR CHARACTER PRINT
23 24	0217	33	C-T		XPAL	P3	HIGH P3 IS OK (REALLY)
2 <del>4</del> 25	0218	C4	30		LDI	30	GET ASCII 0
26 26	021A	F4	99		ADI	0	; ADD CARRY FOR FIFTH DIGIT
20 27	021A 021C	3F	00		XPPC	P3	; PRINT 0 OR 1
28	021C	C4	43		LDI	^L< PHEX2> - 1	:P3 SET FOR BYTE PRINT
29	021B	33	70		XPAL	P3	, TO SET FOR BITE TRIM
30	021r 0220	C6	01		LD	@1(P2)	; POP HIGH BYTE OFF STACK
31	0220	3F	01		XPPC	P3	; AND PRINT
32	9223	C6	01		LD	@1(P2)	; POP LOW BYTE
33	0225	3F	611		XPPC	P3	; AND PRINT
34	0225	C4	C4		LDI	^L< PUTC> - 1	; P3 SET AGAIN FOR CHARACTERS
35	0228	33	U.T		XPAL	P3	HIGH P3 STILL OK
36	0229	C4	ØD		LDI	CR	GET CARRIAGE RETURN
37	022B	3F	ОD		XPPC	P3	PRINT
38	022C	C4	ØA		LDI	LF	GET LINE FEED
39	022E	3F	U.A.		XPPC	P3	PRINT
40	022F	90	CF		JMP	START	;LOOP TO BEGINNING
41	0221	0001	CI.	P1=%1	OTH	STAC	, Eddi To BESTANTING
42		0001		P2=%2			
43		0003		P3=%3			
44		000D		CR=0D			
45		000A		LF=ØA			
46		00E0		GHEX=00	E0		
47		01C5		PUTC= 01			
48		0144		PHEX2=0	144		
49		0200			.END ST	ART	
SYME	OL TABL	Æ					
CP	- 000	ND.	CHEV	- 0050	1 15	- 0004	
CR	= 000	_	GHEX	= 00E0	LF	= 000A	
PHEX P2	2 = 014 = 7000		PUTC P3	= 01C5 =%0003	P1 START	=%0001   0200	
F 2	- 1.000	14	1 0	-700003	SIANI	0200	

ERRORS DETECTED: 0

ple way by repeated addition. Thus  $573 \times 426$  is computed by adding 426 to itself 573 times. This may seem like a very slow procedure, but in fact, the SC/MP is fast enough that computation time does not become noticeable until the multiplier is in the 1000s. The computational delay is then about 1.2 seconds per 1000.

Input to the program is performed using GHEX. This program reads a 4-digit hexadecimal number from the keyboard. Since these numbers are decimal, not hexa-

decimal, this means only that digits greater than 9 must be avoided. Since a 4-digit number cannot fit in 1 byte, GHEX cannot return its answer in the accumulator, as did the other subroutines. GHEX returns the 2-byte result on the stack. (The least significant byte is first, or at the higher address.)

The first 6 lines of both programs cause the data to be read in. Notice that lines 5 and 6 simply call GHEX twice.

Text continued on page 188

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Listing 5: As an extension of the addition routine, the multiplication routine inputs 2 numbers and multiplies them.

1					.NLIST	TTM	
2					. TITLE	PROGRAM #5	
3					:THIS I	PROCRAM MULTIPLIE	ES
4					TWO NU	UMBERS WHEN TYPEL	) IN AS
5					: "357X9	942= "	
6					; INPUT	HAS FOUR DIGIT N	'IAX
7					; OUTPU	Γ 18 EIGHT DICITS	3
8		0200		.=200			
9	9200	C4	DF	START:	LDI	^L< GHEX> = 1	;SET P3
10	0202	33			XPAL	P3	TO ADDRESS
11	0203	C4	00		LDI	^U< GHEX>	; OF
12	0205	37			XPAH	P3	; CHEX
13	0206	3F			XPPC	Р3	CALL GHEX TWICE
14	0207	3F			XPPC	P3	TO GET TWO NUMBERS
15	0208	C4	06		LD1	6	SET UP LOOP
16	020A	68	65		ST	TEMP	TO PUT SIX ZEROS
17	020C	C4	00	L1:	1.D I	0	ON STACK
18	020E	CE	$\mathbf{F}\mathbf{F}$		$\mathbf{ST}$	(n-1(P2)	LAST FOUR ZEROS ARE
19	0210	B8	5F		DLD	TEMP	: INITIAL PRODUCT
20	0212	9 C	F'8		JNZ	Lt	FIRST TWO EXTEND MULTIPLICAND
21							TO EIGHT DIGITS
22	0214	02		L2:	CCL		; CLEAR OLD CARRY
23	0215	C2	09		'LD	9(P2)	: AND SUBTRACT
24	0217	EC	99		DΛI	99 ~	; ONE FROM
25	0219	CA	69		ST 9(P2	2)	; MULTIPLIER
26	021B	C2	08		LD	8(P2)	; BOTH HALVES
27	021i)	EC	99		DA1	99	; IN TENS COMPLIMENT
28	021F	CA	083		ST	8(P2)	THERE IS NO CARRY ON
29	0221	96			CSA		; LAST ADD 0-1 = 9999
30	0222	94	13		11,	OUT	; SO GET OUT
31	9224	02			CCL		OTHERWISE CLEAR CARRY
32	0225	C6	()4		LD	@4(P2)	TEMPORARILY BUMP STACK BY 4
33	0227	C4	04		LUI	4	; COUNT = 4 DIGITS
34	0229	C8	46		ST	TEMP	FOR LOOP
35	022B	C6	$\mathbf{F}\mathbf{F}$	L3:	LD	@-1(P2)	; NOW ADD
36	022D	EΛ	04		DAD	4(P2)	; MULTIPLICAND TO

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SYMBOL TABLE

= 000D

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023B

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37	022F	CA	60		ST	0(P2)
38	0231	B8	3E		DLD	TEMP
39	0233	9C	F6		JNZ	L3
40	0235	90	DD		JMP	L2
41	0237	C4	94	OUT:	LD I	4
42	0239	C8	36		$\mathbf{ST}$	TEMP
43	023B	C4.	4:3	L4:	LDI	^L< PHEX2>-1
44	0231	33			XPAL	P3
45	023E	C6	01		LD	(a1(P2)
46	0240	3F			XPPC	P3
47	0241	B9	2E		DLD	TEMP
48	0243	9C	F6		JNZ	1.4
49						
50	0245	C6	06		LD	@6(P2)
5.1	0247	C4	C4		LDI	^L< PUTC> - 1
52	0249	33			XPAL	P3
53	024A	€4	(II)		LDI	CR
54	024C	3F			XPPC	P3
55	024D	C4	OA		LDI	LF
56	024F	3F			XPPC	P3
57	0250	90	$\Delta \mathbf{E}$		JMP	START
58		0270		TEMP=2	70	
59		<b>00E●</b>		GHEX= 0	0E0	
60		0144		PHEX2=	0144	
61		01C5		PUTC=0	1C5	
62		0001		P1=%1		
63		0002		P2=%2		
64		0003		P3=%3		
65		000D		CR=01)		
66		000A		LF=0A		
67		0200			.END	START

**CHEX** 

L2

OUT

= 00E0

0214

0237

LF

L3

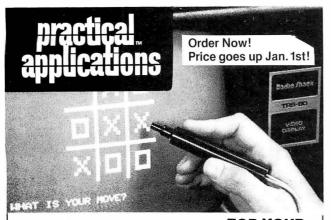
000A

PHEX2 = 0144

022B

PRODUCT AS EIGHT DIGIT
OR FOUR BYTE ADD
; LOOP UNTIL DONE, THEN
; DECREMENT MULTIPLIER AGAIN
: WHEN DONE
PRINT OUT FOUR BYTES
:SET P3 TO PHEX2
: HIGH P3 IS OK
,
POP PRODUCT OFF STACK
; PRINT
; DECREMENT AND LOOP
; NOTE INSTRUCTIONS AFTER L4
; CANNOT BE SKIPPED
; BUMP GARBAGE OFF STACK
SET P3 TO PUTC
; HIGH P3 IS OK
; PRINT CARRIAGE RETURN
; THEN
:LINE FEED
: AND
: GO BACK TO BEGINNING
, co man to brothing

Listing 5 continued on page 188



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Listing 5 continued:

PUTC = 01C5 P1 = 70001 P2 = 70002 P3 = 70003 START '0200 TEMP = 0270

ERRORS DETECTED: 0

FREE CORE: 17525. WORDS

, PROG5 = PROG5

Text continued:

This causes 2 numbers to reside in the top 4 locations on the stack. GHEX "knows" a number has been typed when a nonhexadecimal character, such as W, is typed. Thus, to add 2 to 2 with program 4, the programmer could type 2W2W. "2+2 =" could also be typed, which is much more impressive when demonstrating the program. (Note that GHEX always gives a 2-byte result, even though fewer than 4 digits are typed.)

Lines 14 thru 21 add the 2 numbers, leaving the result on the stack. Note that there may be overflow indicating a fifth digit of 1. Lines 22 thru 26 create this fifth digit of 0 or 1 and print it. (Note the comment on line 23. Originally, the high part of pointer register 3 was 00, but GHEX will leave it as 01. *nb* earlier comments on this programming practice.)

Lines 27 thru 32 pop the rest of the sum off the stack and print it. Lines 33 thru 39 type a carriage return and line feed and loop back to the beginning to solve another problem.

Program 5 is designed to produce an 8-digit or 4-byte result, because the product of two 4-digit numbers can have 8 digits. Steps 14 thru 19 form a loop which places 6 0s on the stack. The lower 4 0s form an accumulator for the product. The 2 other 0s combine with the 2-byte multiplicand to extend its precision to 4 bytes or 8 digits. This simplifies addition of the multiplicand to the product accumulation.

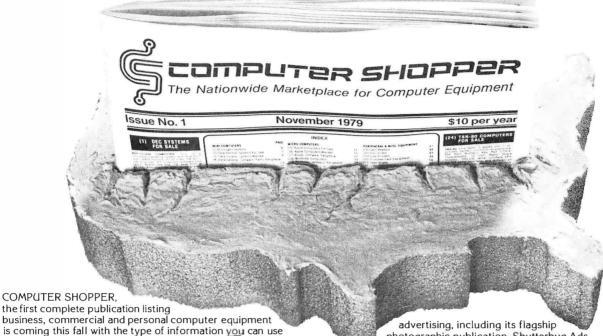
Lines 20 thru 39 form a loop for adding the multiplicand to the product accumulator. The multiplier is decremented each time through the loop. Decrementing is accomplished by adding 9999, which is a 10's complement negative 1.

Finally, steps 40 thru 56 print the result and loop back to the beginning. Note that in the loop beginning at line 42, pointer register 3 is reloaded each time through the loop. If this were not done, subsequent calls would end up at PHEX1 rather than PHEX2, and blank spaces would be interspersed in the result.

#### Conclusion

The 5 programs described in this article are intended to be simple demonstration programs that can be easily hand loaded into a minimal system. They are also designed to illustrate some of the basic concepts involved in programming the SC/MP. I hope that these programs will give the reader some ideas which can be used to design the applications for the SC/MP. The reader may also be able to apply the concepts of this article to other microcomputer kits, since many of them, such as the KIM-1, have useable system subroutines in read only memory.

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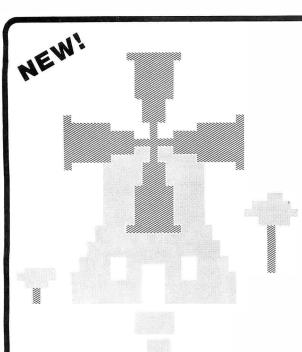
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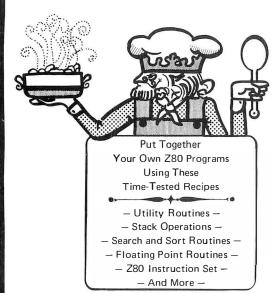
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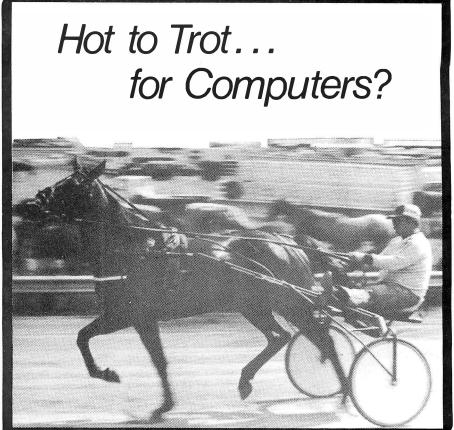


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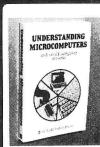




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## **Programming Ovickies**

## Keyboard Input Software for the Z80

Kerry W Newcom, 10 Evergreen Ave, Burlington MA 01803

Every program that uses terminal or keyboard input must scan the incoming data to determine its validity. The order of keyboard entries is unpredictable, and interactive programs will often fail because all input sequences are not tested. In some cases, testing all input combinations may be impractical or impossible as the number of valid input strings increases.

These problems usually force a choice between two unpleasant alternatives. One alternative is to rely on complex error checking and error messages. The other is to guarantee operation for only a small set of rigidly defined inputs. Error checking sometimes takes more lines of code than the routine that will eventually process the data, while rigidly defined input specifications result in an unfriendly and unforgiving user interface.

The routine KEYIN, shown in listing 1, circumvents these problems by checking as narrow or wide a range of data inputs as desired by the calling routine. KEYIN will not return an invalid input to the calling routine, and bad data can be rejected by a single error message. KEYIN will also convert hexadecimal, decimal, or octal digits to binary while it is doing the error checking. KEYIN may be called by routines with vastly different requirements for alphanumeric data checking.

Knowledge of two variables and the table on which they operate is central to understanding how KEYIN works. The variables are stored in locations TBLPNT and TBLCNT. TBLPNT holds the address pointer for the table, and TBLCNT holds the number of entries in the table. The table these variables operate on may be placed in read-only or programmable memory. If the table is in read-only memory, TBLPNT can move up or down the table as subroutines require larger or smaller sets of input characters. If the table is in programmable memory, one may put its contents under program control in addition to moving TBLPNT.

For example, a subroutine may want to allow entry of one or more hexadecimal digits followed by an alphabetic command such as G for go or R for run. The table for this example would be constructed as shown in listing 2. The routine that calls KEYIN should place the address of TABLE in the location TBLPNT and the number of entries in the table (18 in this example) in location TBLCNT. The variable BASE should be set to 16 for hexadecimal decoding.

When KEYIN is called, routine KEYIN2 will load reg-

**Listing 1:** Z80 assembler code for the KEYIN routine. The program uses a table, as shown in listing 2, to determine acceptable input.

LINE	ADDR R	OBJECT			
17 18	F200 F202 F204 0007		TBLPNT TBLCNT BASE BELL	EQU 0F200H EQU 0F202N EQU 0F204H EQU 07H	
21 22 23	F000 F000 F001 F002	DS	KEYIN:	CODE OFOOOH PUSH DE PUSH RC PUSH AF	
28 29 30 31 32	F003 F006 F007 F00A F00E F011 F013 F015	210000 ES 2A00F2 ED4B02F2 CD4AF0 EDB1 2807 3E07	KEAIN5: KEAIN7:	LD HL, U PUSH HL LD HL, (TBLPNT) LD BC, (TBLCNT) CALL CHARNE CPIR JR Z, KEYIN3 LD A, BELL	; INTITALIZE HL; SAVE NUMERIC INPUT   LOAD THE TABLE POINTER   LOAD # OF ENTRIES IN TABLE   ACCEPT INPUT WITHOUT ECHO   SEARCH THE TABLE   IF VALID ENTRY NOT FOUND   THEN BEEP
34 35 36 37 38 39 40	F017 F01A F01C F01F F020 F021 F022	CD38F0 18ER CD38F0 E1 47 79 ED5B04F2 BB	KEYIN3:	CALL CHAROUT JR KEYIN2 CALL CHAROUT POP HL LD B,A LD A,C LD DE, (BASE)	; INITIALIZE HL ; SAVE NUMERIC INPUT ; LOAD THE TABLE POINTER ; LOAD & OF ENTRIES IN TABLE ; ACCEPT INPUT WITHOUT ECHO ; SEARCH THE TABLE ; IF VALID ENTRY NOT FOUND ; THEN BEEP ; OR WRITE AN ERROR MESSAGE ; GO BACK AND GET MEXT ENTRY ; ELSE ECHO CHARACTER ; RESTORE NUMERIC INPUT ; SAVE CURRENT INPUT IN REG. R ; LOAD COUNT REMAINDER INTO A ; LOAD HASE INTO DE
42 43 44 45 46 47	F027 F029 F02B F02C F02D F02E	2808 29 29 29 29 29		JR NC, KEYINA JR Z, KEYINA ADD HL, HL ADD HL, HL ADD HL, HL ADD HL, HL	OR EQUAL TO EASE THEN EXIT
50 51 52 53 54 55 56 58	F031 F033 F034 F035 F036 F037	18D3 F1 78 C1 D1 C9	KEYIN4:	JR KEYIN1 POP AF LD A,B POP &C POP DE RET	;AND GET THE NEXT ENTRY ;RESTORE AF ;PLACE THE COMMAND IN REG A ;RESTORE &C ;RESTORE &C ;RESTORE DE ;EXIT KEYIN
59 60	EEFE			EQU DEEFEH	
62 63		CS FS			
65 66 67 68	F03A F03D F03F F04i F043	01FEEE ED78 CB6F 28FA	CHARO1:	LD BC, DECODE IN A,(C) BIT 5, A JR Z, CHAROI LD C. DEEH	;I/O ADDRESS DECODING ;CHECK STATUS OF OUTPUT DEVICE ;IF NOT READY ;THEN LOOP ;ELSE SET DECODE FOR DATA OUT
70 71 72 73 74 75	F045 F046 F048 F049	Fi ED79 Ci C9		POP AF OUT (C),A POP BC RET	WRITE TO OUTPUT DEVICE
77 28 79 80 81 82	F04B F04E F050 F052 F054	01FEEE ED78 CB77 28FA 0EFF	CHAR 1:	E DEPENDENT CODE- LD EC, DECODE IN A,(C) BIT 6, A JR Z, CHAR1 LD C, UFFH	; I/O ADDRESS DECODING ; CHECK STATUS OF INPUT DEVICE; ; IF NOT READY ; THEN LOOP ; ELSE SET DECODE FOR DATA IN
83 84 85 86 87	F056 F058 F059	ED78 C1 C9		IN A, (C) POP BC	;EXIT

ERROR COUNT II

CPU (SEC)=7

ASSEMBLY COMPLETE - NO ERRORS

**Listing 2:** Table setup to allow KEYIN to recognize the commands G and R for go and run, along with a hexadecimal number.

TABLE: DEFM 'GR'

DEFM 'FEDCBA9876543210'

**Listing 3:** Multiple tables allow KEYIN to search for one of several different valid commands. Here tables are set up to search for RUN, RES (reset) and REG (register).

TABLE: DEFM 'R'
TABLE1: DEFM 'EU'
TABLE2: DEFM 'SG'

ister pair HL with the table pointer and load register pair BC with the number of entries in the table. The routine CHARNE is called and it will accept one character from the keyboard without echoing the character. The routines CHAROUT and CHARNE are hardware dependent and are shown here only to illustrate how KEYIN interacts with the user. CHAROUT can be any routine that sends one character to an output device, and CHARNE can be any routine that accepts one character from an input device. The keyboard entry is passed back from CHARNE to KEYIN in register A.

After CHARNE accepts an entry, the CPIR instruction in KEYIN2 begins searching TABLE for a valid entry. If a valid entry is found, the input character is echoed back to the terminal. If a valid entry is not found, an error message may be returned or the input may simply be ignored or rejected with an audible signal as it is here. Routine KEYIN2 will be reexecuted until it recognizes a valid entry.

The CPIR instruction decrements the BC register pair as it compares the input character against the characters in the table. This is important since the value that is left in the BC register pair will be the binary value of the hexadecimal input when the CPIR instruction terminates. When a valid entry is found, KEYIN checks register C against the variable BASE. If the value in register C is greater than or equal to BASE, KEYIN will return to the calling routine with hexadecimal input in register pair HL and the nonhexadecimal character in register A. If the value in register C was less than BASE, its binary value will be placed in the register pair HL and KEYIN will reset the table pointer and counter and wait for another character.

Another use of KEYIN is searching a tree for valid input. As an example, assume that a program would like to evaluate three similar commands and reject all others. For this example, valid command strings are RESET, REGISTER, and RUN. TABLE would be set up with R as the root letter followed by branches EU and SG, as shown in listing 3. Before KEYIN is called, TBLPNT is set to address TABLE, TBLCNT is set to one and BASE is set to zero. On the first call to KEYIN, all inputs will be rejected except R. Once R is input, the calling routine sets TBLPNT to TABLE1 and TBLCNT to two. Now only the letters E and U will be accepted by KEYIN. If a U is input, a valid command has been found and the appropriate action can be taken. If the input was an E, the calling routine sets TBLPNT to TABLE2 and KEYIN is called again. KEYIN will now only accept the letters S and G, and the appropriate action may be taken once a valid input is accepted.

In general, KEYIN will allow n-way branching from the root or any branch of a tree by setting TBLCNT to n, TBLPNT to the first of the n acceptable inputs, and BASE to zero for character input. ■

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## Technical Forum

## A Proposed Graphics Software Standard, Part 1

Vincent C Jones, 1913 Sheely Dr, Ft Collins CO 80526

A major stumbling block to making good software available in the personal computer market is the lack of standardization. Each manufacturer and software developer establishes internal standards for software and hardware interfaces, and they are usually incompatible with one another. Reasons for this vary from the experimenter's attempts to save 1 byte of memory in a 14 K byte program, to the mainframe manufacturer seeking to protect a development investment. The net result is the same. Extensive modifications are typically required to run software on any machine that differs from the original development's hardware and software configuration.

In an effort to prevent this fragmenting effect from overwhelming graphics applications programming, the following graphics interface software protocol is proposed as a standard.

This two-part article presents a complete microcomputer-oriented graphics software protocol and the algorithms required to implement it on typical raster scan graphics displays. The functions of hardware initialization, screen erase, point display, line generation, character generation, and animation are defined, and their implementation is demonstrated with a sample 8080/Z80 assembly language version for the Cromemco Dazzler. The power of a standard protocol is illustrated by a diagnostic demonstration program using the proposed 1 K byte 8080 assembly language protocol standard.

The standard actually proposes two separate but dependent protocols. The top-level protocol is machine independent. It defines a standard display coordinate system, several standard display modes, the available functions, and what these functions do. For example, a request for a red line from the center of the screen to the bottom right corner would always require the following command sequence:

CHAR (RED)

Set the current color to RED

CURSOR

Move to the center of the screen

LINE (255,0)

Set the current color to RED

Move to the center of the screen

Draw the line

Obviously, not all displays are capable of color; a black and white display would draw a white line instead. To compensate for any deficiencies in the hardware that is being used, a feedback path is included to inform the

user program of the available capabilities. General-purpose programs can check to verify that the display being used is suitable and, if necessary, display an error (or warning) message, or use a different algorithm to accomplish the task at hand. For example, a TV tennis game could check to see if full color was available. If so, it could use red paddles, a yellow ball, a green court, and white boundaries. If only three colors were available, the paddles and ball could be the same color. If only a black and white display was available, all markings could be in white with a black court and background.

The lower-level protocol defines the calling sequences used in a particular programming language. When necessary, it also defines where the routines are loaded in memory, and the addresses of their calling vectors. Returning to the example of drawing a red line, an 8080 (or Z80) assembly language program would use the instruction sequence:

MVI A.11H ;Code for Red CALL 0113H ;Vector for CHAR X = 128, Y = 128LXI H,8080H ;Vector for CURSOR CALL 010AH LXI H,FF00H X = 255, Y = 0CALL 0110H ; Vector for LINE.

Similarly, a BASIC program would read:

REM — Set the current color to RED

CHA 17

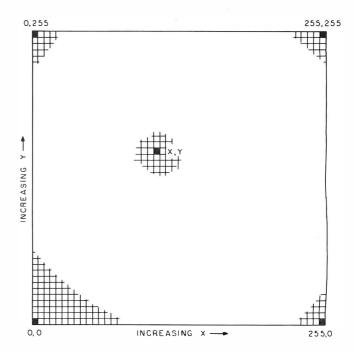
REM — Move to the center of the screen

CUR 128,128

REM — Draw the line down to corner

LIN 255,0.

Suitable standards for other languages remain to be developed. Reader suggestions are welcome.



**Figure 1:** Standard coordinate system used in the proposed graphics software standard.

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#### The Standard Display

The protocol defines a standard display device to circumvent hardware differences. The standard device displays 256 lines with 256 points on each line. As shown in figure 1, the origin (X = 0, Y = 0) is defined as the bottom leftmost point on the display. X increases to a maximum value of 255 as you move to the right, Y increases to 255 as you rise to the top. This defines the first quadrant of the standard Cartesian coordinate system. Each picture element (pixel) may be black, white, red, green, blue, yellow, cyan, or magenta (any combination of the three primary colors).

The display to be used is programmed to imitate the standard. To facilitate this procedure, four standard display modes are defined. Mode 0 requests the maximum possible resolution while mode 1 requests the maximum choice of colors. This allows for displays, such as the Cromemco Dazzler, which offer a trade-off between resolution and color. Two additional modes provide the ability to deliberately select larger pixels. Mode 2 is 128 by 128 resolution and mode 3 is 64 by 64 resolution. Regardless of the resolution actually used, the coordinate system remains at 256 by 256, as defined above. Generalpurpose applications programs can check to determine the available resolution and range of colors, whether the display is black and white or color, whether or not individual points can be erased, and if dual-buffered animation is available.

#### The Standard Functions

A five command repertoire is generally considered to be the bare minimum for a general-purpose graphics display. These commands provide all the output capabilities normally found on commercial nonintelligent graphics terminals, such as the Tektronics 4010. The routines are:

PAGE: Next page, ie,

erase the entire

CURSOR (X,Y): Position the cur-

sor at the point

X,Y.

DOT: Set the pixel

> defined by the cursor position to the currently

selected color.

LINE (X,Y): Set the pixels

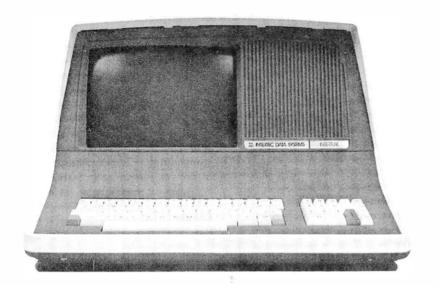
> along the line connecting the current cursor position to the point X,Y to the currently selected

color.

CHAR (VAL): Display the

> character whose ASCII value is VAL at the current cursor position using the currently selected

color.



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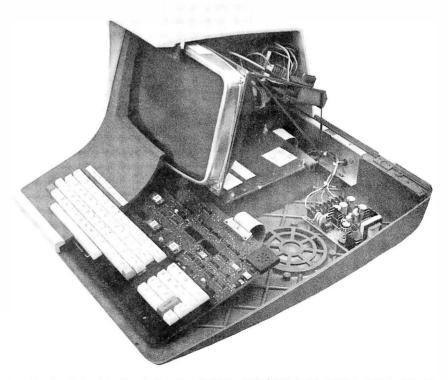
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To facilitate matching the hardware requirements of many displays, an initialization command is also required:

INITG: Initialize the graphics

subsystem.

Finally, a 2-buffer animation command is included for interactive graphics and game playing:

ANIMAT: Display the refresh buffer currently being filled and open a second refresh buffer for filling.

Display mode and current color selection are provided by the routine CHAR through ASCII control characters. Standard carriage control characters are also recognized. Display description parameters are returned by the routine INITG.

Let us now examine the function of each of the seven routines in detail.

#### **INITG**

The INITG function serves three primary functions. As an aid to the user, the display software is initialized to a standard configuration; the cursor is positioned at X = 0, Y = 0, the current color is set to white, the display is cleared, animation is disabled, and the display mode is set for maximum resolution (mode 0). Special options peculiar to the particular display are also disabled so that general-purpose programs do not have to be aware of them to function correctly. Secondly, this routine performs any initialization functions required by the display hardware. For those displays which refresh from program memory, the routine establishes the refresh buffers. If the display is under program control, it is turned on. Finally, INITG sets the display description variables to the appropriate values. Failure to initialize the display before using any of the other functions may lead to unpredictable and potentially disastrous results.

#### PAGE

The PAGE function clears the display screen. No other changes are made to the state of the display: the cursor is not moved, the current color is not changed, and the display mode is unaffected.

#### **CURSOR**

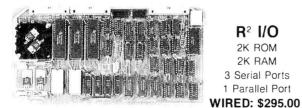
The CURSOR function sets the display cursor to a particular pixel on the screen. This establishes the initial location for the display functions which affect individual pixels on the screen. Coordinates are always interpreted on the 256 by 256 pixel matrix regardless of the actual resolution of the display. This is true even when the display mode is deliberately set to a lower resolution mode.

When in a lower resolution mode, the low-order bits of the position requested are ignored. For example, when in 128 by 128 resolution mode (mode 2), the points (8,4), (8,5), (9,4), and (9,5) will all be interpreted as the same pixel (the low-order bit in each coordinate has no effect).

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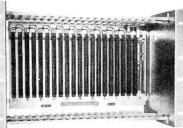
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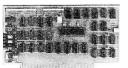
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Mnemonic	ASCII	Hexadecimal	Standard Function
MAXR MAXC R128 R64 RXXX	NUL SOH STX ETX EOT	00 01 02 03 04	Display Mode Selection Maximum resolution Maximum colors 128 by 128 64 by 64 Undefined
BS HT LF VT FF CR	BS HT LF VT FF CR	08 09 0A 0B 0C 0D	Carriage Control Backspace (optional) Horizontal tab (optional) Line feed Vertical tab (optional) Form feed Carriage return
SO SI	SO SI	OE OF	Character Style Undefined Undefined
BLK RED BLU MAG GRN YEL CYN WHI N O N E	DLE DC1 DC2 DC3 DC4 NAK SYN ETB ETX to GS	10 11 12 13 14 15 16 17 18 to	Current Color Selection Black Red Blue Magenta Green Yellow Cyan White Eight optional colors

Table 1: Standard control character functions.

When changing between display modes, cursor position is not required to be maintained by the interface software. To avoid erroneous results, all changes to display mode should be followed by a cursor positioning command.

#### DOT

The DOT function sets the display pixel indicated by the cursor to the currently selected color. With some displays in low-resolution mode, several physical pixels may be affected. For example, the Matrox ALT-256\*\*2 turns on (or off, as selected) sixteen hardware pixels for every "dot" when in a 64 by 64 resolution mode.

#### LINE

The LINE function generates the line connecting the pixel defined by the cursor to the pixel requested. Both endpoints are included in the line. Therefore, a line of zero length is logically equivalent to a call to DOT. Care must be exercised when erasing or otherwise changing the color of a line, since the pixels in a line from pixel A to pixel B may differ from those used when the line is drawn from pixel B to pixel A. When lines are drawn in lower resolution modes, the pixels used are the size made by the DOT function at that resolution.

#### CHAR

The CHAR function provides the capability to display alphanumeric as well as graphical data. In addition, control characters provide limited cursor positioning and control over display mode and current color as shown in table 1. Control characters that are not recognized are ignored. Note that form feed positions the cursor only—it does not erase the screen.

Characters are positioned so that the cursor defines the

lower left corner of a normal character (characters with descenders will extend below the cursor position). The cursor is left at the next character position. No check is made to detect characters off the edge of the screen. Parity is ignored. Lowercase characters, if not supported, are converted to uppercase.

#### **ANIMAT**

The function ANIMAT provides for flicker-free changes in the display by permitting the user to load one refresh buffer while displaying another. Each call to ANIMAT displays the buffer which is being filled, and opens another buffer for filling. This buffer exchange is performed at the start of the next vertical blanking period. Those displays without the ability to utilize multiple buffers but which do allow the erasing of individual pixels (such as the Matrox ALT-256\*\*2) will just delay until the start of the next vertical blanking period. In either case, no changes are made to either buffer, and the cursor position is maintained. The ANIMAT function does nothing on those displays which support neither double buffering nor selective erase. To return to normal mode where updates are displayed in real time, it is necessary to reinitialize with INITG.

#### Standard Calling Sequences

To encourage maximum software interchange, two standard programming language protocols are currently defined. The first protocol is for 8080 and Z80 assembly language users, the second is for BASIC programs. By following one of these protocols, a program written for one display will work with any other display of sufficient resolution and color flexibility. The standard display and function definitions described previously are common to both protocols.

#### 8080 Assembler Protocol

The 8080 assembly language interface is loaded into hexadecimal memory locations 0104 to 04FF. This provides a standard location for the package, regardless of memory size. To avoid conflict with programs requiring use of the restart (RST) instruction and most popular 8080 monitors, a lower starting address is not used. The first 21 bytes (hexadecimal 0104 to 0118) are the entry points to the different routines, as indicated in table 2. All arguments are passed to the called routine in register pair HL, except for the CHAR routine, which uses register A. The contents of all registers and flags are preserved, except for the INITG routine.

Routine INITG is called with the address of the first unused memory location above the program, to indicate

Routine	Vector A (hexaded		Parameters
INITG PAGE CURSOR DOT LINE CHAR	104 107 10A 10D 110	None H = X coord None H = X end coord A = ASCII value	ee address ay description in HL linate; L = Y coordinate oordinate; L = Y end coordinate alue of character
ANIMAT	116	None	

Table 2: 8080 assembly language standard vector addresses.

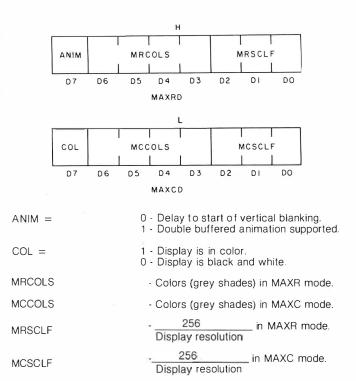


Figure 2: 8080 assembly language standard display parameter fields.

available space for refresh buffers. While some displays do not require this information, it should always be included for compatibility. The address in HL is replaced by INITG with a 2-byte description of the display being used (all other registers and flags are left undisturbed). The format for these bytes is given in figure 2. The colors and scale factor fields which are available in register H describe the display when maximum resolution is selected; the same fields in register L describe the maximum color selection mode.

The available colors field gives the number of colors, other than white, to which a point can be written. If the field is zero, it means that the way to erase what has been written is to page the display. The scale factor field indicates the physical size of display points in standard coordinates. If the X and Y scale factors differ, the larger of the two is used. For example, if the display had 64 lines with 100 points on each, the scale factor would be four, based on the Y axis resolution.

The animation and color fields apply to all display modes. If the animation field is one, the display supports double buffered animation. If this field is zero, it is impossible to build one display scene while another is displaying. In this case the ANIMAT routine is a delay until the start of vertical blanking. The color/black and white field is self-explanatory: if it is one, the display is in color; otherwise it is black, grey, and white. Note that this field has no real meaning if the number of available colors is zero or one.

#### **BASIC Protocol**

For maximum flexibility and machine independence, a BASIC language usage protocol is also defined. Table 3 summarizes the commands and their arguments. Display initialization (IGR command) sets the variables A1



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Mnemonic	Function	Arguments
IGR PAG CUR DOT LIN CHA ANM TXT	INITG PAGE CURSOR DOT LINE CHAR ANIMAT PRINT	None None <x>, <y> None <x>, <y> None <x>, <y> <numeric ascii="" value=""> None Equivalent to print except on display</numeric></y></x></y></x></y></x>
Variable Name	Display Parameter	
A1 A2 A3 A4 A5 A6 A7 A8	Y scale factor Available coll X scale factor Y scale factor	or, high-resolution mode or, high-resolution mode ors, high-resolution mode or, maximum color mode or, maximum color mode ors, maximum color mode ors, maximum color mode

**Table 3:** BASIC standard protocols.

through A8 to reflect the display parameters. The scale factors A1, A2, A4, and A5, normally given exactly, are permitted to be rounded off to the nearest integer. These variables are ordinary BASIC variables and may be used and set as desired by the program.

The additional command TXT provides the user with the full flexibility of the BASIC PRINT command. Text and variables are displayed using the formats requested in the TXT statement starting at any location on the screen by using CUR to position the cursor. All characters are displayed using the current color.

#### **Function Algorithms**

To facilitate development of this standard, the algorithms used to produce the Matrox ALT-256\*\*2 and the Cromemco Dazzler implementations of the 8080 assembly language standard are provided here. Of particular interest to most readers will be the line and character generation algorithms, which are independent of the hardware configuration of the display used.

For those readers not familiar with Nassi-Schneiderman design charts, a brief explanation is in order. More detailed information can be found in the original article published in the SIGPLAN Notices (August 1973). The Nassi-Schneiderman chart is a stylized flowchart for structured programming. By supporting only standard structured programming constructs (see figure 3) and not GOTOs and off page connectors, the chart forces the software designer to avoid the convolutions and obscurities in logic which make programs excruciating to debug and impossible to maintain.

The INITG and DOT routines are the only routines which normally require extensive adaptation to suit different displays. Since the Matrox ALT-256\*\*2 is the only currently available low-cost display which is not direct memory access (DMA) refreshed from program memory and an enhanced 8080 assembly language package that is compatible with this standard is available from Matrox, the special considerations required to program I/O port driven displays are not included in this article. For direct memory access displays, the only other adaptations normally required are the refresh memory size parameter in

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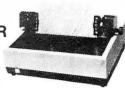
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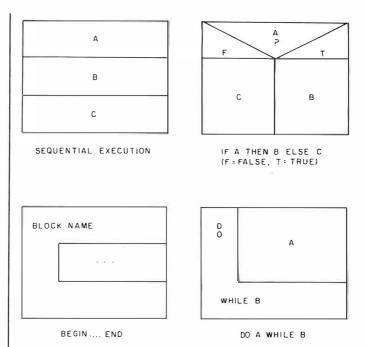
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**Figure 3:** Nassi-Schneiderman charts, a system of stylized flowcharts which are designed for use with structured programming techniques. Each of the charts physically resembles the program section it emulates. The charts are read from top to bottom.

PAGE, the color and mode select controls in CHAR, and the scale factors used by the internal subroutine SCALE.

#### **INITG Logic**

Initialization is normally required for both hardware and software (see figure 4). The first step is to establish the refresh buffer. This requires taking the address which defines the top of the user program and moving up to the first address legal for refresh buffers. This address is needed by other routines, as well as for starting the display hardware. The different variables and flags are then set to the required values, and the page routine is called to clear the screen. The appropriate display

#### INITE

Legal Refres F ?	sh Address
Move up to next legal address	OK
Save refresh buffer address	
Set Animation Inactive flag	
Set Cursor to $X = \emptyset$ , $Y = \emptyset$	
Set Current Color to White	
Set Mode to MAXR	
Turn off all nonstandard options	
Call PAGE to clear the screen	
Start the display hardware	

**Figure 4:** The INITG function. INITG serves three purposes as an aid to the user: it initializes the system, performs any initialization functions required by the display software, and sets the display description variables to the appropriate values.

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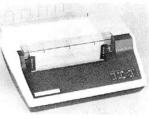
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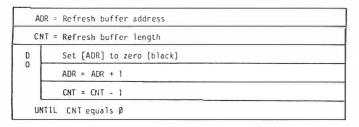
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**Figure 5:** The PAGE function. PAGE is used to clear the display screen.

CURSOR

Call SCALE to interpret coordinates

Set the software cursor to the scaled values.

**Figure 6:** The CURSOR function which sets the display cursor to a particular pixel on the screen.

description is generated, and control is returned to the calling program.

#### **PAGE Logic**

The PAGE command clears all the memory used for display refresh (see figure 5). The most general algorithm, and the one that is charted, is clear byte, increment address, decrement byte count, and test for done. In machines with indexed addressing, the byte count can

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double as an index register. In machines with a memoryto-memory block transfer instruction, it is usually possible to clear one byte and transfer it to all of the display refresh memory.

#### **CURSOR** Logic

The CURSOR routine must convert from standard coordinates to software coordinates (see figure 6). Software coordinates are required by the LINE and CHAR algorithms to have a one-to-one correspondence with the actual display pixels being used. CHAR further requires X coordinates to increase to the right and Y coordinates to increase to the top. Since LINE must also scale its arguments, CURSOR and LINE can usually share the same internal scaling routine for efficiency.

#### **DOT** Logic

DOT is the only routine (other than PAGE) which actually modifies the refresh memory (see figure 7). Both LINE and CHAR use it to modify the desired pixels in the display. This routine is extremely hardware-dependent. Indeed, one of the primary reasons for defining this protocol was protection from differing display idiosyncracies. The DOT routine must translate the coordinates in the software cursor to the actual corresponding bits in memory. Remember that the software cursor is scaled so that a unit change in a coordinate is equivalent to the adjacent pixel. The logic presented here assumes a linear scan through refresh memory to generate the entire display, a line at a time, with the top line displayed first. Note that this algorithm is not adequate for the Dazzler, nor is it suitable for self-refreshed displays like the

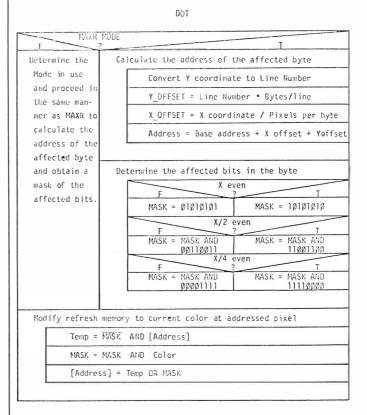


Figure 7: The DOT function which sets the display pixel indicated by the cursor to the currently selected color.



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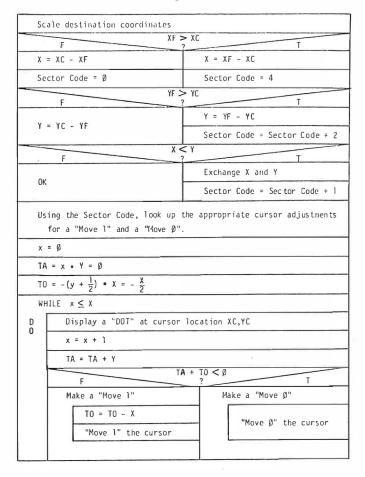
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**Figure 8:** The LINE function which generates the line connecting the pixel defined by the cursor to the pixel requested.

Matrox ALT-256\*\*2. The former divides the display into four quadrants, each in its own block of memory with every byte describing points on more than one line. The modifications to the algorithm are explained in the sample implementation, and need not concern the non-Dazzler owner. The Matrox's refresh memory is directly addressed by X,Y coordinates and no conversion is required.

The first step is to determine the address of the byte which contains the requested point. The cursor Y coordinate is converted to a display line number which, when multiplied by the number of bytes per line, gives the offset into the refresh buffer of the first byte on the line. The X coordinate corresponds directly to the desired point along the line. Dividing the X coordinate by the number of points in each byte gives the offset from the first byte in the line. Taking the base address of the refresh buffer (set up by INITG) and adding the offsets to the desired line in the buffer and the desired point on the line yields the address of the byte which requires modification.

The second step is to determine which bits in the byte correspond to the desired pixel. The hypothetical display depicted by the Nassi-Schneiderman chart has eight pixels in each byte. The selected bits are then changed to match the current color, and the refresh memory is updated to reflect the revised point. An effective procedure is to generate a mask which contains ones at bit positions

corresponding to the addressed point, and zeros elsewhere in the byte. The byte of refresh memory is ANDed with the complement of the mask to delete the old contents. The mask itself is then ANDed with the bit pattern for a byte with every pixel. The current color and the result are ORed into the cleaned up byte of refresh memory.

#### LINE Logic

Perhaps the most crucial facet of any graphics system is its line generator (see figure 8). Before introducing the actual algorithm used, it may prove beneficial to discuss its theoretical development.

We wish to generate an arbitrary line from a point (XC, YC) to a point (XF, YF) (see figure 9). The goal is to determine those discrete points  $(x_n, y_n)$  which best approximate the desired line.

To simplify the derivation, we will only consider generating a line from point (0,0) to point (X,Y), where X is greater than or equal to Y and both are greater than or equal to 0 (figure 10). (This situation is general because any arbitrary line may be rotated and translated to match the proposed conditions.) Under these conditions, there is a point along the line for every value of x ( $0 \le x \le X$ ), and for every value of x there is only one value of y. Closer examination reveals that for any value of x, the y value for the following point (x + 1) will either remain unchanged or increase by 1. No other value of y is possible. Furthermore, it can be shown that the decision to increment y for the next x is based solely on whether the point (x + 1, y) $+ \frac{1}{2}$ ) lies above or below the line. If it lies above the line, y remains unchanged. If it lies below the line, y is incremented. In the event  $(x + 1, y + \frac{1}{2})$  is exactly on the line, either option is correct. For convenience, "on the line" is arbitrarily treated as equivalent to "above the

Assuming that we have a method to determine the position of the point  $(x + 1, y + \frac{1}{2})$  relative to the desired line, we can generate an optimal approximation of the line from (0,0) to (X,Y), where  $X \ge Y \ge 0$ , using the following algorithm:

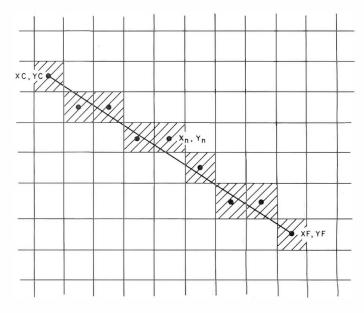


Figure 9: Generating an arbitrary line.

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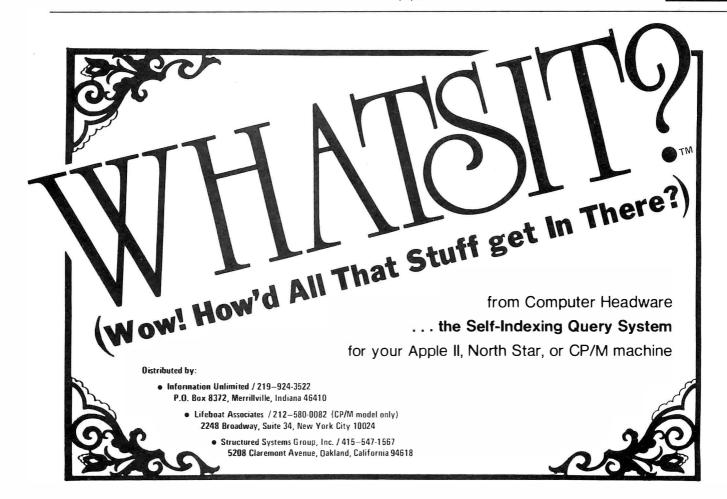
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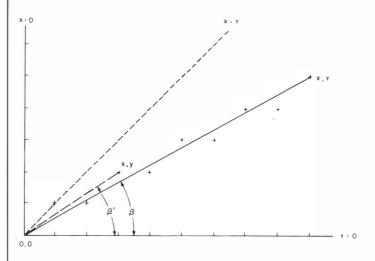
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**Figure 10:** Simplified line generation.

- 1)Initialize  $x \leftarrow 0$ ,  $y \leftarrow 0$ .
- 2) Display the point (x,y).
- 3) Test for done: x = X?
- 4) Calculate the position of the point  $(x + 1, y + \frac{1}{2})$ relative to the desired line.
- 5)Set dy to 1 if below the line; 0 if on or above.
- 6) Calculate the next point:

$$x \leftarrow x + 1$$

$$y \leftarrow y + dy$$
  
7)Go to step 2.

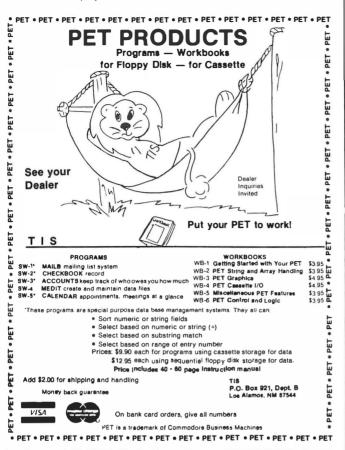
There are only two obstacles to overcome before implementing this algorithm: step 4 and the restrictive initial conditions. Let us examine each in turn.

A brief excursion into trigonometry is required to evaluate step 4. Referring to figure 10, if we call the angle between the desired line and the X axis  $\theta$ , and the angle formed by the current point (x,y) the origin and the X axis  $\theta'$ , then if (x,y) lies above the desired line,  $\theta < \theta'$ . Conversely, if (x,y) lies below the desired line,  $\theta > \theta'$ . Of course, if the two coincide,  $\theta = \theta'$ . We know from trigonometry that for angles in the first quadrant, the greater the angle, the greater its tangent. We also know that the tangent of  $\theta$  is  $\frac{Y}{X}$ , while that of  $\theta'$  is  $\frac{y}{x}$ . Therefore, we can easily determine the position of any point relative to the desired line by comparing the quotients  $\frac{Y}{x}$  and  $\frac{y}{x}$ .

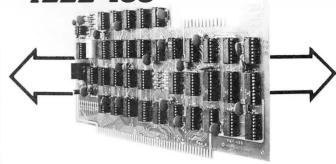
Unfortunately, performing division on microcomputers is a time-consuming process. Using the properties of inequalities to eliminate the divisions, we can build a decision table (see table 4) which requires only multiplication. Returning to our original algorithm, we set dy to 1 if:

$$(x + 1) \times Y > X \times (y + \frac{1}{2})$$

and to 0 if it is not. Further advantage can be gained by realizing that at each iteration the product on the left side of the inequality increases by Y, while the right either remains the same or increases by X. By remembering the Circle 376 on inquiry card.



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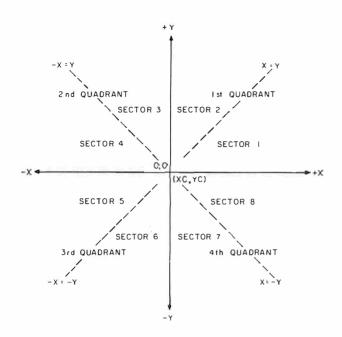


Figure 11: Quadrant and sector definition.

products from the previous iteration, and whether or not y is incremented, the multiplication can be reduced to addition. For maximum efficiency, the right-hand product can be maintained negated so that the comparison can be made with a single addition.

The restriction that the line runs from (0,0) to a point (X,Y) with  $X \ge Y \ge 0$  requires the use of coordinate translations, rotations, and reflections. The first step is to translate the line so that it starts at (0,0). Since the line originates at the cursor, we would traditionally subtract the cursor from the other endpoint to obtain its relative position. However, because a 256 by 256 display does not give us room for a sign-bit in an 8-bit byte, it is first necessary to rotate the line to the first quadrant and then calculate the magnitude of the endpoint displacements from the cursor.

While all these coordinate transformations may seem complicated, the actual implementation is quite simple. Consider the command to generate the line from the current cursor position (XC,YC) to a final point (XF,YF). The first step is to compare XF to XC. If  $XF \ge XC$  then we are in the first or fourth quadrant (see figure 11); otherwise, we are in the second or third. Similarly, if YF  $\ge$  YC, we are in the first or second quadrant; otherwise, the third or fourth quadrant. By combining the two results, the quadrant is uniquely determined, and we can proceed to determine the magnitude of the X and Y displacements, XM and YM, as shown in table 5. Finally XM and YM are compared to determine the exact sector.

The easiest technique for remembering this multiple logical decision is to weight the results of each decision and check the sum. Each sector is then assigned an equivalent weight, and the sector parameter table is reordered accordingly. Column 2 of table 6 applies a weight of 4 to (XF > XC),2 to (YF > YC) and 1 to (YP > XP)

Once the sector is determined, we have all the information required to construct any arbitrary line. Referring to

	Above On		Below
Angle Relationship	$\theta < \theta'$	$\theta = \theta'$	$\theta > \theta'$
Tangent Relationship	$\frac{Y}{X} < \frac{y}{x}$	$\frac{Y}{X} = \frac{y}{x}$	$\frac{Y}{X} > \frac{y}{x}$
Relationship after Multiplying through by x.X	xY < Xy	xY = Xy	xY > Xy
Result of xY - Xy	Negative	Zero	Positive

**Table 4:** Point position relative to a line.

Quadrant	XM	YM
1	XF - XC	YF - YC
2	XC - XF	YF - YC
3	XC - XF	YC - YF
4	XF - XC	YC - YF

Table 5: Component magnitudes in the four quadrants.

Sector	Sector	X Y		Move 0		Move 1	
	Weight			x incr	y incr	x incr	y incr
1	6	XM	ΥM	+ 1	0	+ 1	+ 1
2	7	ΥM	XM	0	+ 1	+ 1	+ 1
3	3	ΥM	XM	0	+ 1	- 1	+ 1
4	2	XM	YM	- 1	0	<b>–</b> 1	+ 1
5	0	XM	YM	- 1	0	- 1	- 1
6	1	ΥM	XM	0	<b>- 1</b>	- 1	- 1
7	5	ΥM	XM	0	- 1	+ 1	- 1
8	4	XM	ΥM	+ 1	0	+ 1	- 1

Table 6: Coordinate equivalents for each sector.

step 5 of the fundamental sector 1 algorithm, we call setting dy to 0 "move 0," setting dy to 1 "move 1," and generate the equivalence chart in table 6. As the algorithm steps along in transformed coordinates, it uses the "move 0" and "move 1" to modify the cursor position using X and Y increments appropriate for the sector the line is actually in.

#### **CHAR Logic**

One of the most common formats for displaying characters is the 5 by 7 matrix of points (see figure 12). However, not many people realize why 5 by 7 is the smallest common size. The limiting width is, of course, the minimum number of points capable of displaying the three separate parallel lines required for the letters M and W. This sets the minimum possible width to 5, but why must 7 be the minimum height? The answer is, it need not be! However, human engineering studies have indicated that the average person finds it easier to read characters which are proportioned the same as in standard printing. Ratios of width to height far removed from the "normal" 0.75 increase fatigue and error rates.

To generate easily read lowercase characters, even larger matrices are required. This is a result of the greater complexity and finer detail of the lowercase characters. The full ASCII character set can be generated with a 7 by 9 matrix if provision is made for characters with descenders (g, j, p, etc). This requires the use of an extra

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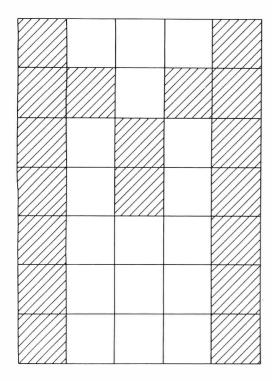
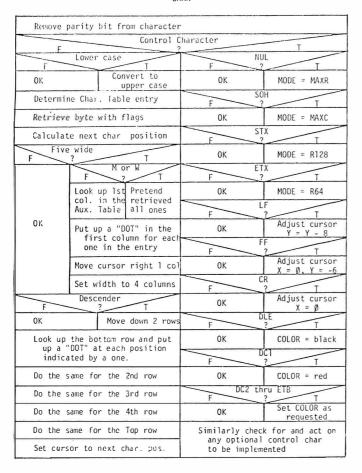


Figure 12: Typical character generation.

CHAR



**Figure 13:** The CHAR function which provides the capability to display alphanumeric as well as graphical data.

Char Size	LC	Char/Line (256 by 256)	Lines/Page (256 by 256)	Memory For Tables (bytes)
9 x 11 7 x 9 5 x 7 4 x 5*	Y	25 32 42 64	18 21 32 32	1200 864 320 192

\*See text

**Table 7:** Effects of differently sized character matrices.

bit to determine if the matrix is displayed normally or shifted down two positions. As far as the display is concerned, the character uses a 7 by 11 matrix of display points. Larger display matrices can be used for greater legibility and varying character fonts, but even a 7 by 11 character matrix severely restricts the total number of characters that will fit on the low-resolution displays for which this standard is designed. If even one row of blank points is left between adjacent characters, then only sixteen 7 by 9 characters will fit across a 128-wide display. Memory requirements for large matrix character pattern storage are also severe. The table space required is directly proportional to the area of the matrix (see table 7).

A character matrix size less than the "absolute minimum" 5 by 7 was desirable, since even 5 by 7 characters require 320 bytes for their lookup table. Readable versions of 58 of the 64 uppercase printing ASCII characters can be generated within a 4 by 5 matrix. The remaining 6 characters (#, \$, &, %, M, and W) fit in a 5 by 5 matrix. Since these are normally considered wide characters, their unity width-to-height ratio is not objectionable.

To simplify table lookups and the special handling of 5 wide characters, 3 bytes are used for each character. Twenty bits are used for the 4 by 5 display matrix; the four extra bits are used as flags to define the specific parameters for each character. Two flag-bits are used to indicate the width of the character. Proportional spacing also fits the maximum number of characters into any given space. The third flag-bit is used by 5 wide characters to indicate whether the first column is all ones (M and W), or must be retrieved from an auxiliary lookup table (#, \$, %, and &). The remaining flag is used to indicate descending characters (, ; and \_\_). These characters are displayed two positions lower than their matrices indicate. Each character is therefore displayed in an n by 7 display area, where n ranges from 2 to 5.

The basic character generation algorithm (figure 13) is applicable to any size character matrix, whether the character is stored by column (more efficient for 5 by 7 and 6 by 8 matrix characters), or by row (more efficient for variable 4 by 5, 7 by 9, and 8 by 11). If the character set being used does not include lowercase, it is necessary to shift lowercase characters to their uppercase equivalents. Comparing the ASCII value of the character to 32 separates control characters for special handling.

The character table is ordered by ASCII value and lookup is done by indexing on the ASCII value requested. Since the first 32 ASCII characters are control characters,

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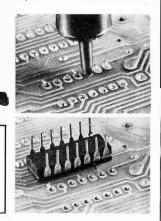
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[		next Vertical Blanking period			
	WHILE Vertical Blanking	in progress			
	D Kill time				
	UNTIL Vertical Blanking in progress				
	D Kill time				
D	Display buffer currently being	g filled			
	Filling	g buffer Ø			
S	hift to filling buffer Ø	Shift to filling buffer 1			

**Figure 14:** The ANIMAT function which provides for flicker-free changes in the display by permitting the user to load one refresh buffer while displaying another.

the physical contents of the table start with character 32 (blank). To index into the table, the ASCII value of the first table entry is subtracted from the value requested. This index value is then multiplied by the number of bytes per character, and the product is added to the address of the first character in the table in order to obtain the address of the first byte of the character desired. The cursor is then sequenced through the character matrix, turning on the points indicated. Only the points actually making up the character are affected, so background data is not erased and an overprint results.

Control characters are handled separately. Mode and color changes will depend on the DOT routine. Since these will be overly hardware-dependent, their implementation is left as an exercise to the reader. Carriage control characters modify the cursor position without otherwise affecting the display. Any unrecognized characters should be ignored.

# ANIMAT Logic

The first requirement of the ANIMAT logic is to wait for vertical blanking to start (see figure 14). Most displays provide an input port with a status-bit which indicates when vertical blanking is in progress. By delaying until the status-bit indicates normal scan, then delaying until it indicates vertical blanking in progress, we are assured of a full vertical blanking period being available. If the display being programmed does not support changing the location of the refresh buffer by software controls, the routine is finished.

Displays in which refresh buffer locations can be changed are programmed to provide double buffering. After waiting for the vertical blanking period, the refresh buffer currently being filled is put on display. The alternate buffer is then opened for filling. Note that this algorithm is valid whether the buffer being filled is displayed (first call to ANIMAT after an INITG) or is being filled while another buffer is being displayed (all subsequent calls to ANIMAT).

In part 2 we will present an implementation of the 8080 assembly language protocol for the proposed graphics software standard, plus a series of demonstration programs. ■

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# **Book Reviews**

# 8080/8085: Assembly Language Programming

Lance R Leventhal Osbome and Associates Inc Berkeley, California 1978 467 pages softcover \$9.50

8080/8085: Assembly Language Programming is another in the series of Osborne and Associates' books on microcomputers. Those who are familiar with earlier works published by this company know that, in its contents, the entire series is comprehensive. Unfortunately, these books have been extremely difficult to read due to the use of bold

and regular type and the appearance of obscure abbreviations in their diagrams. I am pleased to say that this new book upholds the reputation for completeness, and it is also quite readable.

Chapter 1 defines and justifies assembly language programming. I doubt that anyone who purchases this book needs this chapter, but it is reassuring to us assembly language enthusiasts

Chapter 2 describes how an assembler works and gives a very complete view of all the available features. As with all this publisher's books, it is not merely an overview. This chapter will greatly assist you in choosing among the available assemblers. Chapter 3 is technical writing at its finest. Each assembly language instruction given is elaborated upon with diagrams the reader has become acquainted with in the earlier books—minus the incomprehensible abbreviations. Bold type is used only where it should be—for titles.

Chapters 4 thru 13 give sample programs ranging from very simple to extraordinarily complex. The early examples are slightly beyond the information given in chapter 3, but they progress through arithmetic and tables to I/O (input/output) routines and interrupts. Each chapter ends with self-testing examples where the answers, but not

the methods, are given. These self-tests are well-thought-out variations of earlier examples and, therefore, double the learning experience.

The final chapters give detailed advice on programming. These are mandatory if one expects his programs to be useful to anyone else. Leventhal repeatedly emphasizes that commercial programs must be written for the program buyer, not the writer.

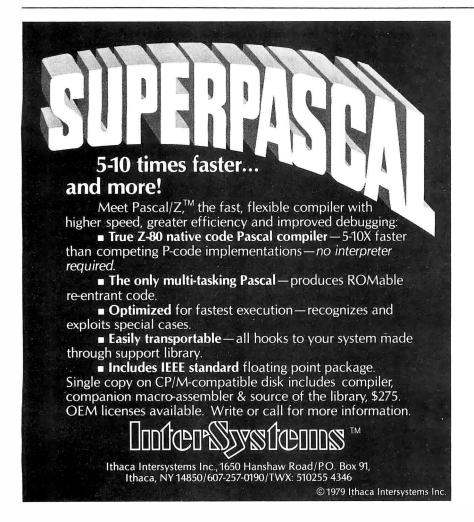
In summary, this is an excellent encyclopedia of assembly language programming. If you understand all of this book and have it for reference, you will have few problems.

Bruce R Evans MD 16 Marwin Rd Pickering Ontario CANADA L1V 2N7

# Technical Aspects of Data Communication

John E McNamara
Digital Press
Digital Equipment Corp,
Educational Services Dept
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Technical Aspects of Data Communication by John E McNamara is the book I was looking for five years ago. It could have saved me hundreds of hours of searching and reading. The last paragraph of the introduction states why: "This book will not teach anyone every thing about data communication. Knowledge of data communication is acquired by a bootstrapping process in which one learns enough to read the next book or explore the next problem, from which one learns enough to go on further. This book is intended to fill



a place in that process."

This book deals with the real nitty-gritty of data communications from "what is a stop bit?" all the way through an explanation of packet switching. All the information is presented in practical terms rather than through math and theory. A glossary in the back of the book defines all the terms used. Various accompanying tables list character codes, pin connections, and usable line lengths. If you need to know what a UART is and how it works, there is an appendix devoted entirely to UARTs.

If you need to know about asynchronous or synchronous communication, common protocols and what they are suited for, how telephones work, the characteristics of different modems, and what types of automatic-calling units are available and how to write a program to talk to them, you can find it in this book. If you only need to know what pin 8 on the 25-pin connector on your terminal is used for, you can also find that information in this book.

There are about 400 pages of good reference information with readable explanations for anyone who must deal with data communications hardware or software. Technical Aspects of Data Communication is well worth the price. ■

Phil Hughes POB 2847 Olympia WA 98507



# Broken Text

Several readers have brought to our attention that line 1790 of the Quest program on page 181 of the July 1979 BYTE is difficult to read. The line should read 1790 ON A1 GOTO 1000, 9999, 1760. ■

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with room for RAM/ROM/PROM/EPROM and S-100 expansion, plus generous prototyping space.
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# Build a Simple Digital Oscilloscope

Frank DeCaro 103 Spit Brook Rd, Apt C-2 Nashua NH 03060

A digital-logic probe is a convenient device for examining signals. A typical probe has one or more light emitting diodes (LEDs) to indicate logic states. The LED lights to indicate a high (1) logic state, and turns off to indicate a low (0) logic state. It is not possible, however, to compare these signals with the state of the system clock. The system clock is the square wave source from which all other signals are derived.

The digital oscilloscope presented here allows comparison of selected signals with the system clock. The schematic diagram is given in figure 1. The digital oscilloscope converts a serial digital signal into a visible display on 16 LEDs. Each LED corresponds to 1/2 of a clock cycle. Figure 2 shows some typical waveform traces and their corresponding displays on the digital oscilloscope. Figure 3 shows a typical method of connection for displaying serial waveforms. One limitation of the 16 LED display is that it cannot completely show a signal which is derived from the clock signal by dividing by more than 8.

A block diagram of the digital oscilloscope is shown in figure 4. The major sections are:

- data and enable sequencer
- enable strobe
- data strobe
- latch
- display

The clock is fed into a circuit which divides the frequency by 8. These 2 signals comprise the data and enable sequencer. Eight clock cycles are required for the sequencer to complete 16 transitions. The 16 address inputs

Text continued on page 226

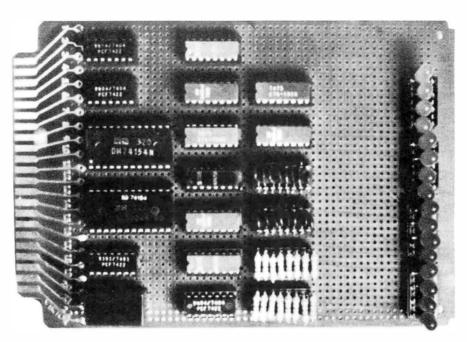


Photo 1: Digital oscilloscope as constructed on a project board. The photo shows the original design (the schematic diagram in figure 1 shows an updated version which eliminates all capacitors on the output lines).

Device	Туре	+ 5 V	GND
IC1 IC2 IC3 IC4 IC5 IC6 IC7 IC8 IC9 IC10 IC11 IC12 IC13 IC14	74154 7404 7404 7404 7474 7474 7474 7474 74	24 14 14 14 14 14 14 14 14 14 14 24	12 7 7 7 7 7 7 7 7 7 7 12

Table 1: Power and ground connections for integrated circuits in figure 1 schematic diagram.

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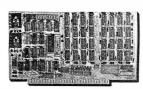
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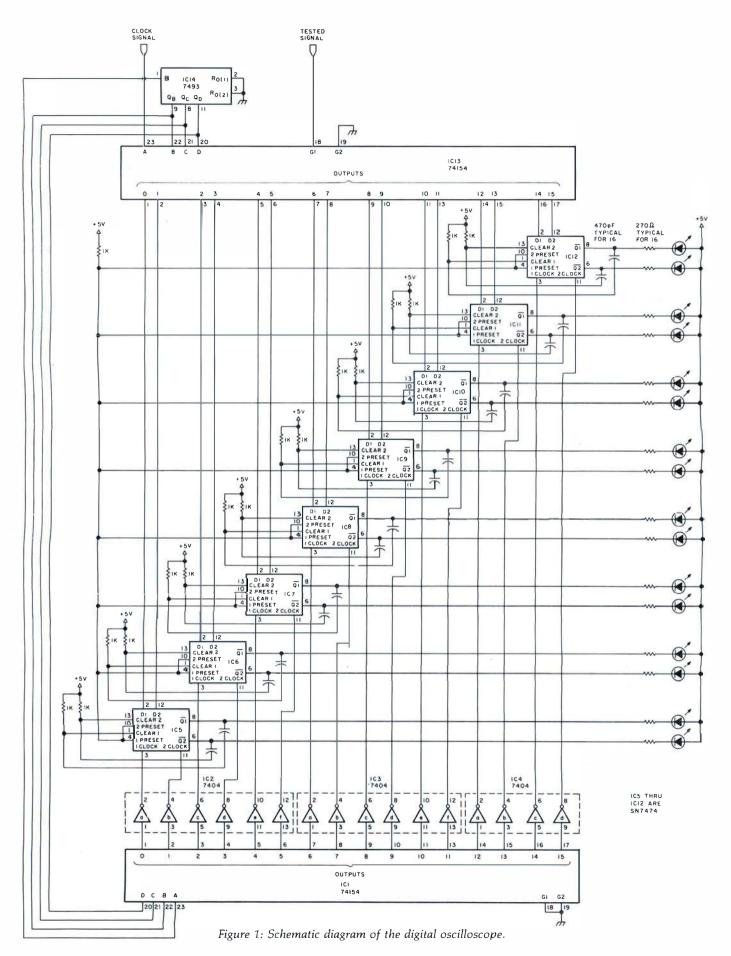
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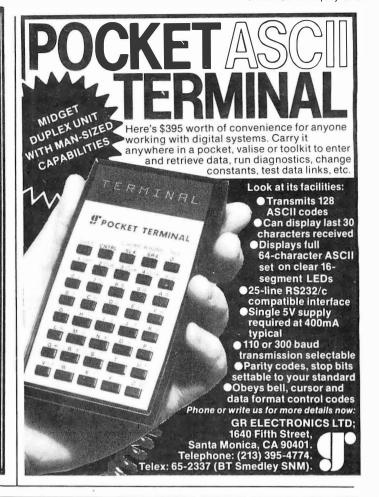
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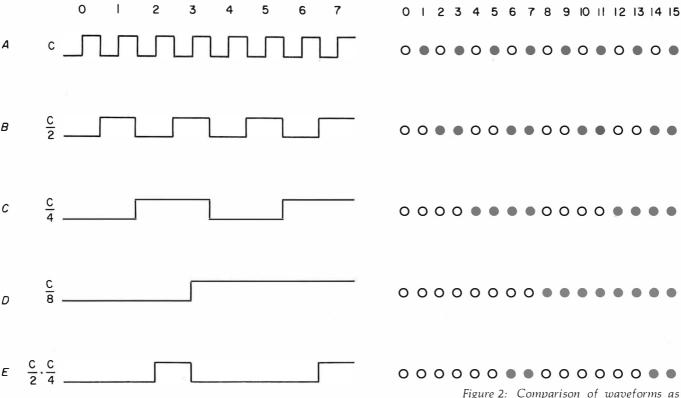


Figure 2: Comparison of waveforms as they might be displayed on an analog oscilloscope, and as they are displayed on the digital oscilloscope. The dark circles You Don't Have indicate lighted light emitting diodes To Be A Genius (LEDs). The open circles show unlighted To Own The TI Home Computer LEDs. Text continued: of the enable and data strobes are

sequentially scanned.

The data and enable strobe signals are sent to latches. The data strobe provides the information to be stored when the enable strobe of the same latch goes low. The latches are updated every 8 clock cycles. The output of each latch is used to drive an LED. The LED will glow if the output of the latch is low (a 0 state). In this manner, the serial digital signal is mapped onto the array of 16 LEDs.

The digital oscilloscope is also useful as a logic design and analysis aid. It can generate a truth table for a combinational logic network of up to 4 inputs. To accomplish this, simply connect the clock signal, the clock divided by 2, the clock divided by 4, and the clock divided by 8 to the inputs of the logic network (pins 23, 22, 21, and 20 of IC1.) Connect the output of the logic network to the signal input of the digital oscilloscope. Figure 5 illustrates how to make these connections to a logic network.
■



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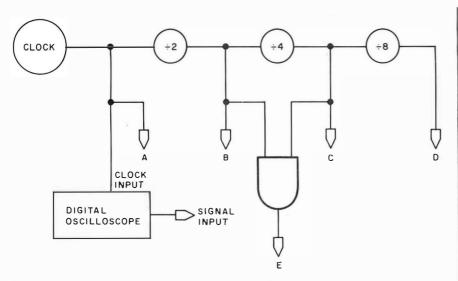


Figure 3: Typical method of connection for displaying serial waveforms.

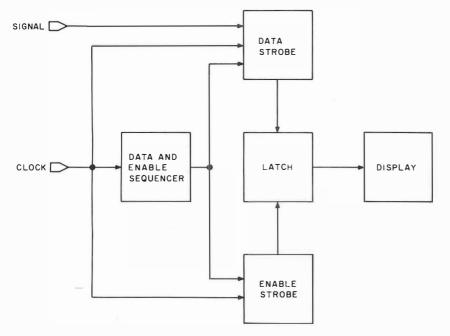


Figure 4: Block diagram of digital oscilloscope function.

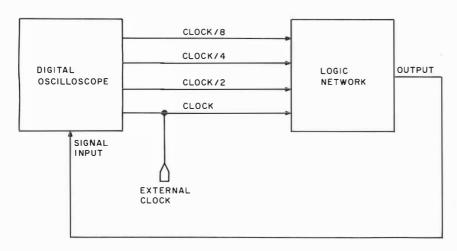
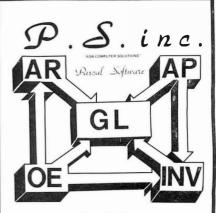


Figure 5: Connections to determine truth table for a logic network.



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#### **NOVEMBER 1979**

November 1

Invitational Computer Conference, Cherry Hill NJ. This conference is directed to the quantity buyer and will feature the newest developments in computer and peripheral technology. Contact B J Johnson and Associates, 2503 Eastbluff Dr, Suite 203, Newport Beach CA 92660.

November 5-7

Thirteenth Asilomar Conference on Circuits, Systems and Computers, Asilomar Hotel and Conference Grounds, Pacific Grove CA. Contact Roger C Wood,

Electrical and Computer Engineering Dept, University of California, Santa Barbara CA 93106.

November 5-8
Electronics Production
Engineering Show, Kosami
Exhibition Center, Seoul
Korea. This international industrial exposition will be devoted to the needs of manufacturers of electronic products in Korea. Contact Expoconsul, Clapp and Poliak International Sales
Division, 420 Lexington

November 6-8

Ave, New York NY 10017.

IEEE Third International Conference on Computer Software and Applications, The Palmer House, Chicago IL. Contact IEEE Computer Society, POB 639, Silver Spring MD 20901. November 6-8
Midcon/79 Show and Convention. O'Hare Exposition
Center and Hyatt Regency
O'Hare, Chicago IL. Contact
Electronic Conventions Inc,
999 N Sepulveda Blvd, El
Segundo CA 90245.

November 6-8

New England Printed Circuits and Micro-Electronics Exposition, Northeast Trade Center, Woburn MA. This show is devoted to the equipment, materials, tools, supplies, and test instruments needed to manufacture electronic and microelectronic circuits, components, and systems. The show is sponsored by the International Electronics Packaging Society. Contact Industrial and Scientific Conference Management Inc, 222 W Adams St, Chicago IL 60606

November 6-8

Third Digital Avionics Systems Conference, Ft Worth TX. This conference will probe the expectations and challenges of the digital revolution in avionics systems. Contact John C Ruth, Technical Program Chairman, POB 12628, Ft Worth TX 76116.

November 8-10

Entering a Decade of Experience - Where Are We and Where Are We Going?, Atlanta Hilton, Atlanta GA. Sponsored by the Society for Computer Medicine, this conference will cover microprocessing in medicine, computers and medical records, automated illpatient monitoring and other related topics. Contact the Society for Computer Medicine, Suite 602, 1901 N Ft Myer Dr, Arlington VA 22209.

November 12-14

Computer Cryptography,
The George Washington
University, Washington DC.
The objective of this course
is to provide each participant with a working
knowledge of the use of



cryptography in computer applications. Contact Continuing Education, George Washington University, Washington DC 20052.

November 12-16

Communications Satellite Antenna Technology, University of Southern California, Los Angeles CA. This course is for engineers engaged in the design of military or commercial satellite communication systems, spacecraft antenna and ground stations. Multiple beams, frequency reuse,

polarization control, the new generation of satellites, and other topics will be discussed. For more information, call (213) 741-2410.

November 13-15

DPMA Education Foundation Sponsors Systems Conversion Symposium, Washington DC. The theme of the three-day meeting is "Converting Today's Systems to Tommorow's Technology." Hardware and software aspects of computer conversion, strategies and techniques, and transition to a distributed data base system will be discussed. Contact Ken Burroughs, DBD Systems Inc, 1500 N Beauregard St, Alexandria VA 22311.

November 14-16

Advanced Programming Techniques Using Pascal, Allentown PA. This class will teach Pascal programmers how to build a comprehensive and effective Pascal-based software development environment. Emphasis will be on programming exercises with

group and individual instruction. Contact Software Consulting Services, 901 Whittier Dr, Allentown PA 18103

November 14-16

1979 International Micro and Minicomputer Conference, Astro Village, Houston TX. This conference concerns micro and minicomputer systems, a survey of the range of current applications, and exploration of potential areas for future development. Emphasis will be

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placed on technical papers and exhibits. Contact Dr S C Lee. School of Electrical Engineering and Computer Sciences, University of Oklahoma, Norman OK 73019.

November 15

Invitational Computer Conference, Southfield MI. See November 1 for details.

November 15-19

White House Conference on Library and Information Services, Washington DC. This conference has been called to help shape policies on public access and dissemination of information in this country. Two issues to be covered are the libraries' ability to help stop functional illiteracy and the use of computers, cable television, audio and video systems as alternative routes of information delivery. Contact Susanne

Roschwalb, (202) 466-7800 or Vera Hirschberg, (202) 653-6252.

November 27-29

Sixth Datacommn, Pacific Grove CA. This symposium is sponsered by the IEEE Computer Society, the IEEE Communications Society, and the Association for Computing Machinery. Some of the subjects of the eleven sessions are electronic fund transfer, protocols, routing and flow control, new data network services in Europe, and local networks.

For more information, contact Sixth Datacomm, POB 639, Silver Spring MD 20901.

Marganhar 28-30

Business and Personal Computer Sales Expo '80, Philadelphia Civic Center, Philadelphia PA. Contact

Produx 2000 Inc. Roosevelt Blvd and Mascher St. Philadelphia PA 19120.

November 29-30

Metric Management Workshop, Dallas North Park Inn. Dallas TX. The workshop is designed to help personnel at all levels plan and implement a costeffective transition to metric in their company. The sessions will cover establishing a metric plan and strategy, assigning responsibility for the transition within the existing organizational structure, and developing a sensible apporach to controlling conversion costs. Contact Len Boselovic, ANMC, 1625 Massachusetts Ave NW, Washington DC 20036.

#### DECEMBER 1979

December 2-6

MUSE North American Annual Meeting, Bahia Mar Hotel and Yachting Center, Ft Lauderdale FL. This conference of Modcomp Users Exchange (MUSE) will feature technical sessions. workshops and user/ manufacturer interface sessions on the use of Modcomp computers and their Felated software. Contact Kathy Black, MUSE, 4620 W Commercial Blvd. Suite 6C, Tamarac FL 33319.

December 3-5

The Application of Computer Technology to Accounting Systems, Washington DC. The theme of the conference is "Information Systems as a Management Tool for the Financial Executive." It is sponsored by the Association of Government Accountants (AGA). Contact Ken Burroughs, DBD Systems Inc, 1500 N Beauregard St, Alexandria VA 22311.

December 3-5 COMDEX '79, MGM Grand Hotel, Las Vegas NV. This conference and exposition

for third party sellers of computer systems, word processing systems. peripherals and software packages and media will focus on solutions to business problems normally encountered in structuring a successful dealership and the operational aspects of the dealership from both the supplier and the customer side. Contact The Interface Group, 160 Speen St, Framingham MA 01701.

December 3-5

Implementing Cryptography in Data Processing and Communications Systems, New York NY. Going beyond an introduction to cryptographic systems, the seminar will stress implementation of the DES and address public key implementation considerations. Contact Ms Jansen, Cryptotech, 12 State Rd, Bellport NY 11713.

December 3-5

Winter Simulation Conference, Holiday Inn, Embarcadero, San Diego CA. This conference will feature papers and panel discussions on discrete and combined (discrete and continuous) simulations. Contact Professor Robert E Shannon, University of Alabama in Huntsville. School of Science and Engineering, POB 1247, Huntsville AL 35807.

December 8-9

Data Processing for Businesspeople, Cherry Hill Inn, Cherry Hill NJ. Management Information Corporation presents this seminar to meet the needs of company management in understanding computers. The seminar includes basic concepts of data processing alternatives (service bureaus, timesharing), small business computer systems, program packages availability and selection, managing the computer system, and the future of data processing. Contact Management Information Corporation,

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140 Barclay Ctr, Cherry Hill NI 08034.

December 10-11

Mini and Microcomputers in Control, Galt Ocean Mile Hotel. Ft Lauderdale FL. This symposium will cover computer architecture and hardware for control, languages for control, algorithms for control, hierarchical control, methodology, and other topics. Contact The Secretary, Computers in Control Symposium, POB 2481, Anaheim CA 92804.

December 10-12

Project Managment for Computer Systems, Chicago II.. This seminar will illustrate techniques for planning, implementing, installing, and controlling projects. Contact The University of Chicago, 1307 E 60th St, Chicago IL 60637.

December 10-13 1979 Fall DECUS US Mini/Midi Symposium, San Diego CA. This symposium is an opportunity for Digital Equipment Computer users to participate in a technical exchange. Contact DECUS, One Iron Way, MR2-3, Marlboro MA 01752.

December 10-14

IEEE Computer Society's Tutorial Week 79, Hotel Del Coronado, San Diego CA. Fifteen different one-day seminars will be offered throughout the week, Contact IEEE Computer Society, POB 639, Silver Spring MD 20901.

JANUARY 1980

January 3-4

Hawaii International Conference on System Sciences, Honolulu HI. The conference will cover developments in theory or practice in software and hardware, and advanced computer systems applications in selected areas with emphasis on medical information processing and computer-based decision support systems for upperlevel managers in organizations. For more information, contact Perry G Patteson, Office of Management Programs, University of Hawaii, 2404 Maile Way, Honolulu HI 96822.

January 23-26

International Microcomputers Minicomputers Microprocessors (IMMM), Harumi Exhibition Centre, Tokyo Japan. This is a show for manufacturers, commercial and financial establishments, service industries and institutions. and design engineers interested in buying computer systems, components and services. For more information, contact Industrial and Scientific Conference Management Inc, 222 W Adams St, Chicago IL 60606.

January 28-30

Principles of Programming Languages, Las Vegas NV. This symposium concerns practical and theoretical aspects of principles and innovations in the design, definition, and implementation of programming languages. Some topics are algorithms and complexity bounds for language processing tasks, specification languages, error detection and recovery, and unusual or special-purpose languages that raise issues of principle. Contact Professor John Werth, Department of Mathematical Sciences. University of Nevada, Las Vegas NV 89154.

January 30-February 1 MIMI '80 Asilomar, Asilomar Conference Grounds, Pacific Grove, CA. This symposium covers all aspects of mini and microcomputers including technology, hardware, software engineering, languages, education and more. Contact The Secretary, MIMI '80 Asilomar, POB 2481, Anaheim CA 92804. ■

# BYTE's Bits

The Formation of a New Personal Computer Society

Do personal computer owners need a national organization? A personal computer user named Abby Gelles would answer in the affirmative. She was interacting with a number of the attendees of the National Computer Conference Personal Computer Festival last June when the usual pro and con arguments were raised in her conversations. She is convinced there is a need.

So, with some kindred spirits in New York City, Abby has formed the Personal Computer Society. You can find out about what she is proposing by writing her at: Ms Abby Gelles, Executive Director,

Personal Computer Society, POB 147, Village Sta, New York NY 10014.

> ICS Announces New Courses

Integrated Computer Systems Inc (ICS), 3304 Pico Blvd, POB 5339, Santa Monica CA 90405, has announced the fall and winter schedule for their Short Course series. Courses on computer graphics, digital signal processing, troubleshooting microprocessor systems, and other topics, will be covered. The courses will be held in cities around the United States from November through February. These courses are structured for technical and managerial personnel.



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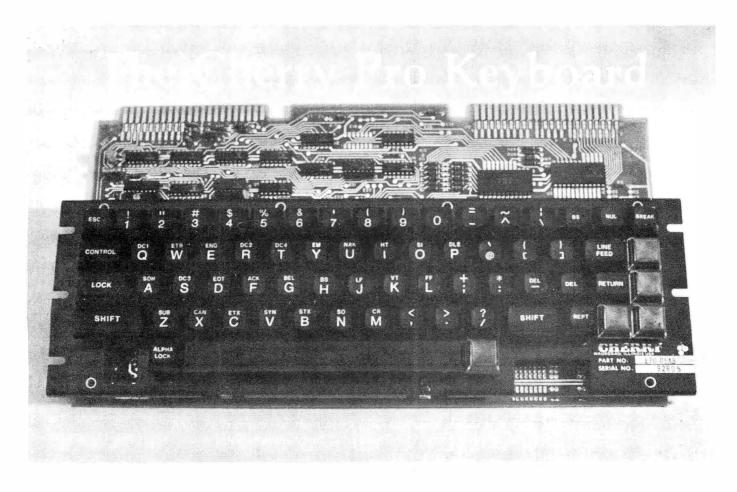
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Dan S Parker 1007 Third St #3 Davis CA 95616

In the few short years since the birth of the personal computer, the list of peripheral devices has grown tremendously: printers, video displays, mass storage devices, and keyboards. At first, many of these items were overruns from original manufacturers, or were removed from used business or military systems. Documentation was scarce and complete schematics were often nonexistent. Keyboards were available in a myriad of styles, but not with all the features of a professional unit. If they were encoded at all, it was often in half ASCII (upper case ASCII only, as available on the Teletype Model 33).

## About the Author

Dan S Parker is presently completing work on a PhD degree in Physics at the University of California at Davis. His area of research is magnetic properties of rare earth crystals in solid state, low temperature physics. He is also actively developing a data acquisition and cryogenic control microcomputer for his research equipment.

No more! Enter the PRO, Cherry's new entry into the personal computer keyboard market (Cherry model B70-05AB). Aptly named, it is indeed a professional keyboard that comes fully assembled, tested, and ready for installation in your computer system. Its features rival those of keyboards found in expensive terminals.

# General Features

The PRO features the full 128 ASCII character set of upper case, lower case, and control characters. A total of 67 gold contact keys, engraved in white on durable matte black injection molded plastic, are easy on the eyes. The shift, shift lock, control, linefeed, and return keys are oversize for easier operation (see photo 1). Cherry lists the operating force of the keys at 2.5 ounces. They feel solid, positive, and very smooth. The keys are wave soldered to 1/16 inch glass epoxy circuit board material and anchored to a 1/16 inch black anodized aluminum cover subplate. No wobble in those keys or flexing of the circuit board when a key is pressed.

Five of the keys are unassigned and

available for user defined functions. They can be relabeled (clear plastic covers to put labels under) and are all momentary contact. The operation and customizing manual is easy to read and has the full set of diagrams including schematics.

# **Electrical Specifications**

The PRO operates from a single +5 V power supply and draws 325 mA maximum current as listed in the operator's manual. I measured it and found that it draws considerably less: 200 mA nominal. Outputs are via one of two 22 pin edge connectors and are TTL and DTL (transistor-transistor logic and diode-transistor logic) compatible. Pinouts include the seven ASCII bits, optional parity, +5 V, ground, strobe and inverted strobe, shift, break, repeat, control, and keyboard lockout. Cherry has conveniently placed these contacts so that only one side of a 22 pin edge connector (not supplied) is needed. Thus a single readout 22 pin connector may be used. The other pins are available with solder pads for customizing.

A second 22 pin edge connector (the one in the upper right of photo 1) is designed for piggybacking a numeric keypad onto the PRO. The matrix scanning technique employed makes it easy to modify key assignments and generate custom output codes.

The strobe pulse is generated 2.5 µs after a key is pressed to insure data stability and is nominally 100  $\mu$ s wide. This seems to be ideal for both the Dajen SCI and Processor Technology 3P+S that I've used the keyboard with. The manual describes how to modify this timing.

# Customizing

The keyboard is truly designed for the experimenter; Cherry is to be commended for making the keyboard user adaptable with a minimum of effort. As shipped, the keyboard is ready to use for most applications. As an example of the ease of modification, two of the integrated circuits are provided in sockets. Changing these two circuits to other integrated circuits (not provided but standard parts) and making no other changes converts the board to negative logic. Yet a different exchange of these two circuits results in a positive logic 3 state output so that two or more PRO keyboards can be wired in parallel. Still a fourth choice of circuits gives high voltage CMOS drive compatibility.



All schematic reference points, integrated circuit designations, and modification points are marked on the circuit board. All of the keys are equipped with dual plated-through holes so that the link connecting them can be cut to isolate the keyswitch. This makes it easy to add custom features. A large number of solder pads and a spare integrated circuit pad have also been provided.

A provision has been made for the addition of an automatic repeat key by installing a 74123 monostable multivibrator in a provided integrated circuit pad along with appropriate timing capacitors and resistors. The manual's suggested timing components made this very easy to implement. My only complaint is that the holes on the empty pad are filled with solder which has to be removed (eg: the board is wave soldered).

The repeat function has two modes. In the first mode, holding down any key for more than 1/2 second causes that character to repeat at about nine characters per second. In the second mode, simultaneously holding down the repeat and character keys causes the automatic repeat.

A few of the other documented changes that can be made include the generation of odd or even parity, latched output, and a shift control mode in which, by depressing both the shift and control keys, additional 8 bit codes can be generated.

# Alpha Lock versus Shift Lock

Shift lock and alpha lock are not the same thing, and a lot of confusion among experimenters and dealers seems to exist about this point. Put simply, alpha lock (often called caps lock or teletypewriter lock) simply locks out the lower case characters so that the keyboard generates only numbers and upper case letters. In this mode the shift key still operates and gives the shifted mode characters above the numbers such as ") (\*&%\$#. The advantage of this mode is that much software, like most BASICs and assemblers, accepts only upper case letters and numbers.

In the second mode, with the alpha lock not engaged, the keyboard generates upper and lower case just like a typewriter, such as might be needed for text editing. In both modes the shift and shift lock keys are active. The alpha lock key is shown in photo 1 just to the left of the space bar and is an alternate action key, as is the shift lock key. My preference would have been to position the alpha lock key a bit further from the main section of the keyboard.

#### Enclosures

The PRO comes without an enclosure but is provided with mounting wings. A recommended panel cutout diagram is included with the manual for custom cutting if you so desire. Fortunately, the cutout is simplified by a minimum of contour "stair step" cuts. Dimensions of the keyboard are 14 by 7\% by 7/8 inches (34.6 by 18.4 by 0.9 cm). The thickness is measured from bottom of the printed circuit board to top of aluminum cover plate. Hence the keyboard can be mounted extremely low profile either flat or tilted. At present, the only custom precut keyboard enclosures available commercially, I believe, are offered by Electrolabs (POB 6721, Stanford CA 94305) and Ironman (POB 1260D, Southgate CA 90280). A number of firms offer blank enclosures which also appear to be suitable for use with the PRO. Better yet, make your own.

# Concluding Remarks

The PRO is priced at \$135 in single quantities. For two to four pieces, the price is \$107 each, directly from Cherry. The price plummets to \$94.50 for five or more keyboards. Delivery takes two or three weeks.

For more information, contact Cherry Electrical Products Corp, 3600 Sunset Av, Waukegan IL 60085.



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BYTE November 1979

# Clubs and Newsletters

ACM Special Interest Group Publishes Newsletters

The Special Interest Group on Language Analysis and Studies in the Humanities' SIGLASH Newsletter is published in March, June, September and December by the Association for Computing Machinery (ACM). The newsletter contains unrefereed papers, reviews of books and articles, abstracts of members' work, a "rap" section for short communications, announcements of general interest, and letters to the editor. Membership in this special interest group, which includes the newsletter, is \$4 a year for ACM members and \$10 for non-ACM members. Contact

ACM Inc, POB 12105, Church St Station, New York NY 10249.

> Tri-State Computer Club

The Tri-State Computer Club is a newly established hobbyist group serving the river cities in the Ohio, West Virginia and Kentucky areas. They have over 40 members representing 6800s. TRS-80s, Digital Equipment Corporation (DEC) and Heath equipment. The meetings are held on the second Saturday of the month at 3:30 PM in the Lawrence County OH public library. Meetings are open and the public is invited to attend. Contact Douglas

Troughton, 508 Colony Dr, Wheelersburg OH 45694.

Apple Computer Users Group in Honolulu HI

Honolulu HI now has its own Apple Computer Users Group. The Honolulu Apple Users Society (HAUS) supports a newsletter containing the latest up-to-date information concerning the Apple, including program tips and techniques, listings, reviews, etc. Meetings are held the first Monday of each month at the Computerland store in Honolulu. The president is Bob McDowell, and Randy Brumback is vice-president. The club holds weekly sessions on programming, BASIC, hi-res graphics, etc. Annual dues are \$10 which include a newsletter. Additionally, the group is interested in exchanging information and software with other clubs. Contact Bill Mark, 98-1451-A Kaahumanu St, Aiea HI 96701 or phone (808) 488-2026.

> PPC Journal for Hewlett-Packard Programmable Calculator Users

The PPC Journal is the monthly publication of the Personal Programmers Club (PPC) which is a volunteer, nonprofit, loosely organized, world-wide group of Hewlett-Packard programmable calculator users. The purpose of the publication is to disseminate user information related to the selection, evaluation, care and application of all Hewlett-Packard programmable calculators. The journal is available through membership in PPC. Interested individuals should write to PPC, 2541 W Camden Pl, Santa Ana CA 92704. A sample issue of the PPC Journal and other information materials may be obtained by sending a self-addressed 9 by 12 inch envelope with 2 ounces of first class US postage attached.

Non-Mikbug 6800 Series System User Group

According to a letter received from Mark Siebart, he is attempting to set up a users group and newsletter for non-MIKBUG 6800 series systems with emphasis on the Capitol Radio Engineering Institute (CREI) and National Radio Institute (NRI) machines. These are based on a J-Bug compatible monitor using the MEK format. Anyone interested in such a group should write to Mark at 2599 Caulfield, San Diego CA 92154.

> Bulletin for TRS-80 tiny-c and Assembler

The TRS-80 tiny-c and Assembler Programming Bulletin specializes in programs and techniques for Radio Shack's editor and assembler and tiny-c associates' tiny-c interpreter for the TRS-80. An annual subscription (4 issues) costs \$8.50 and a single issue is priced at \$2.50. Contact Rob Varty, 2193 Haygate Cr, Mississauga, Ontario CANADA L5K 1L7.

Wake is the Word for Washington Area KIM Enthusiasts

WAKE, Washington Area KIM Enthusiasts, meets each month at the McGraw-Hill Continuing Education Center in Wasington DC to study operation, expansion and applications of KIM-1 microcomputers. The

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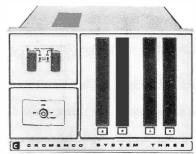
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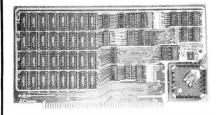
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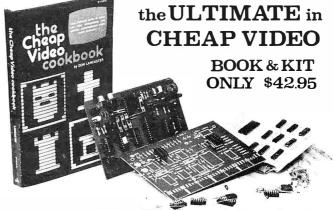
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meetings are at 7:30 PM on the third Wednesday of every month. For a copy of the current WAKE newsletter, send a stamped, selfaddressed envelope to WAKE, c/o Ted Beach, 5112 Williamsburg Blvd, Arlington VA 22207 or phone (703) 538-2303.

> Microcomputer Investors Association

The most recent issue of the MicroComputer Investors Association journal contains 200 pages with 20 articles that deal with utilizing microcomputers to make and manage investments. Practical computer programs accompany half of the articles. The Association is a nonprofit group which was formed 3 years ago to enable members to share data and information. An information packet is

available for \$1. Contact lack Williams, MCIA, 902 Anderson Dr. Fredericksburg VA 22401.

> Free Newsletter for Science and Technology Educators

Hands On! is a free newsletter published 3 times a year by the Technical Education Research Centers (TERC), 575 Technology Sq, Cambridge MA 02139. TERC is a nonprofit curriculum research and development corporation. Billed as a forum for science and technology educators, the latest issue of the newsletter contains articles such as A Biased Introduction to the World of the 6502 Microprocessor: Toward Affordable Computers: Networking and Graphics; Microcomputers in Instrument and Control and much more. To be added to TERC's mailing list, contact the company at the above address.

# Computer Club in Venezuela

The Cuatro Computer Club, Los Pinos Ave, EDF Airosa 5, La Florida, Caracas VENEZUELA, has a monthly newsletter entitled Micronews. The newsletter includes short programs on computer graphic art and game programs, as well as future conferences and events, and anecdotes.

> The Delmarva Computer Club

The Delmarva Computer Club has been formed to create a community awareness of microcomputer uses for business and pleasure. The club meets at

Arcadia High School in Oak Hill VA at 7:30 PM on the first and third Wednesday of each month. Beginners are able to get hands-on programming instruction in BASIC, and advanced members work on community projects and software development and exchange. Contact Jean Trafford. POB 36, Wallops Island VA 23337.

> Albany-Schenectady NY Microcomputer Society

Capital Area Microcomputer Soceity (CAMS) is a newly organized group interested in information exchange among members, solving software and hardware problems, and presentation of programs of general interest. Presently there are about 30 members and meetings are held at various locations around the Capital District on the second Wednesday of each month. Contact Stanley L Mathes, Box 348 Ridge Rd, RD#1, Scotia NY 12302, (518) 372-3767.

# Electronotes for Musicians

Electronotes 99 is a newsletter for knowledgeable designers, technicians and hobbyists in the music synthesizer field. There are projects, diagrams, items for sale and articles of general interest to sound engineers and designers. For more information, contact Electronotes 99, 1 Pheasant Ln, Ithaca NY 14850.

# Utah Computer Association

The Utah Computer Association (UCA) meets every second Thursday of the month at 7 PM at Murrav High School, 5440 S State St, Salt Lake City UT. The club also has special interest groups that meet at different times to review new products and exchange

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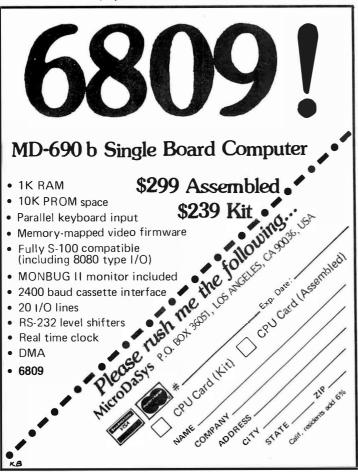
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information on programs. Their newsletter, Bits, is published monthly and includes articles concerning club meetings, programs and instructions for microcomputers, advertisements, and general information for computer users. Membership in the club is \$7.50 per year which includes subscription to UCA Bits. For more information, contact UCA, 378 E 9800 S, Sandy UT 84070.

> Chicago Area Computer Hobbyist Exchange

The Chicago Area Computer Hobbyist Exchange (CACHE) meets at 1 PM on the third Sunday of the month at the Northern Illinois Gas Building, Golf and Shermer, Glenview IL. Annual dues are \$10 which includes the monthly newsletter, the CACHE Register. For further information, call the club's hotline at (312) 849-1132 or write to CACHE, POB 52, S Holland IL 60473.

# Computer Club in Tucson

The Pima Community College Computer Club has been formed at the East Side campus at 7830 E Broadway and meets the second Friday of each month at 7:30 PM. Most of the members have already purchased systems, but those still searching for the best buy are welcome, as are nonstudents. Contact Mike Blicharz (602) 749-9157 or Saul Levy (602) 793-0670.

Institute for Computers in Jewish Life (ICJL)

The ICJL recently sponsored a conference on the use of the microprocessor in Jewish education. The conference was open to all educators interested in the application of computers in education. The Use of Microprocessors in Jewish Education newsletter covers programs used for teaching

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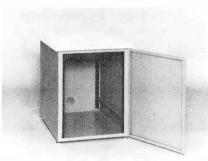
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# The Eastern Iowa Computer Club

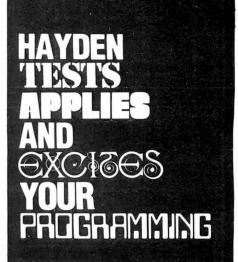
This group meets on the last Sunday of each month. Their newsletter deals with the events of the meeting and future activities of the club. They have printed game programs in the report and are currently working on a software contest. The club invites inquiries from other computer groups and users. For more information. contact the Eastern Iowa Computer Club, POB 164, Hiawatha IA 52233.

# The Homebrew Computer Club

The Homebrew Computer Club. POB 626. Mountain View CA 94042, meets at the Fairchild Auditorium in the Stanford Medical Center on the third Wednesday of each month from 7 to 10 PM. The group exchanges programs, works out bugs and tries out new microcomputer systems. Their newsletter covers new products, conferences, and has a section of used computers for sale.

# The Popular Computing Newsletter

This is a newsletter for TRS-80 users. It includes programming tips, various programs for home and business, reviews of books and programs, and one edition has programs for two games and a program for add-on interest comparison. It is available from Popular Computing Inc, POB 16875, FT Lauderdale FL 33318, at \$24 for one year, \$36 for two years, and \$48 for three years.



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# **Extended Multiplication** with the TI-58

Michael E Manwaring, 3608 73rd Ave N, Minneapolis MN 55429

Most calculators have 8 to 10 digits of display. A few have as many as 14 digits. For most applications, we have very little interest in any more than 8 significant digits; there are, however, a few fields, such as cryptology, in which someone might want many more digits of answer. The Number Cruncher is a mathematical program that will enable the user to multiply two numbers with a total of up to 90 digits, using a TI-58. The TI-59 can handle a total of 300 digits using this program.

After entering the program (see listing 1), press E. Subroutine E clears the memories, sets the program pointers, and repartitions the memory space to give the

**Listing 1:** TI-58 program for multiplying two numbers with an answer totaling up to 90 digits long.

TI 58 NUMBER CRUNCHING	017 018 019	11 A 72 ST* 01 01	048 049 050	13 97 06	C DSZ 06
LABEL LIST	020 021	69 OF 21 21	051 052	01 31	01 31
001 15 E 017 11 A 026 12 B 048 13 C 122 14 B	02345 02345 0226 0238	69 OP 22 22 92 RTN 76 LBL 12 B 72 ST* 01 01	13456789 95555555 90000000	370553344 37067057	RC* 05 X RC* 03 SM*
PROGRAM LIST	029	97 DSZ	060	01	01
000 76 LBL 001 15 E 002 47 CMS 003 01 1 004 00 0 005 42 STD 006 01 01 007 02 2 008 42 STD 009 00 00 010 42 STD 011 06 06 012 04 4 013 69 DP 014 17 17 015 92 RTN	030 031 032 033 034 035 036 037 038 040 041 042 044 045	00 00 00 00 38 38 69 DP 21 21 69 DP 24 24 92 RTN 43 RCL 42 STD 03 03 69 DP 33 GTD 00 00 33 33	061 062 063 064 065 066 067 068 070 071 072 073 074 075 076	731935126499141512 550556270605	RC* 01 0P 33 1 EE 6) INT 0P 21 SM* 01 × 1 EE
010 72 KIN 016 76 LBL	047	33 33 76 LBL	078	06	6
		Listing continu	ed on on	nosito	11000

Listing continued on opposite page

Listing 1 continued:		129` 61 GTO
Disting 1 continued:	104 29 29 105 43 RCL 106 09 09 107 42 STD 108 01 01 109 97 BSZ 110 04 04 111 49 49 113 43 RCL 114 02 02 115 75 - 116 01 1 117 54 ) 118 44 SUM 119 01 01 120 92 RTN 121 76 LBL 122 14 D 123 73 RC* 124 01 01 125 99 PRT	129 61 GTD 130 14 D 131 43 RCL 132 02 02 133 42 STD 134 07 07 135 43 RCL 136 04 04 137 42 STD 138 43 RCL 140 01 01 141 42 STD 142 05 05 143 42 STD 144 09 09 145 69 DP 146 35 35 147 43 RCL 148 03 03 149 42 STD 150 08 08 151 61 GTD
101 42 STO 102 03 03	126 69 DP 127 31 31	153 53 53 154 00 0
103 69 <b>D</b> P	128 91 R/S	155 00 0

greatest possible capacity. The partition will be displayed. Now you can enter the multiplications, 6 digits at a time, pressing A after each 6 digits of the first multiplicand, reading from left to right.

Each multiplicand is divided into groups of 6 digits from right to left, then the numbers are entered from left to right. If the number of digits in a multiplicand is not exactly divisible by 6, the first group of digits of that multiplicand will have less than 6 digits. When the first multiplicand has been entered, the second multiplicand may be entered in the same manner by pressing B after each group of 6 digits.

For example, 6,853,233,214,307,635,533,673. 5,822,756,618,783,644,505,626,130. must be entered in the following manner:

6853 233214	A A
307635	Α
533673	Α
5	В
822756	В
618783	В
644505	В
626130	В

When the multiplicands have been entered, press C to calculate the result and enter it into computer memory. It may take 5 seconds for each 6 digits of the multiplicands entered to perform this step. When the calculation is completed, a meaningless number is displayed. The result can be extracted from memory by pressing D several times. Pressing D causes the result to be read from left to right. In this case, the result is on the order of  $4 \times 10^{46}$ , so it will be necessary to press D 8 times to recall the entire result. If D is pressed one too many times, the last entered group of digits from the second multiplicand will be displayed. Each time D is pressed 6 more digits of the result are displayed.

D	0
D	39904
D	709058
D	677695
D	645793
D	103475
D	894028
D	753563
D	675490

It appears at first that the TI-58 uses the 10-digit display value in its calculations. In reality, all calculations are done using a 13-digit internal register or accumulator which allows it to multiply two 6-digit numbers and retain all eleven or twelve digits.

The algorithm used in this program is very similar to the old method of pencil and paper multiplication, where you multiplied one digit of one multiplicand by one digit of the other multiplicand at a time, carrying the tens digit to be added to the next multiplication. The main difference is that instead of multiplying and carrying one digit at a time, the computer does 6 digits at a time, greatly speeding up the calculation.

# Calculator Airborne **Navigation**

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Signature	:(Required if using cred	lit card)	
M	(nequired it using cred	iii card)	
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LINE	CODE	ENTRY	COMMENTS	
00			0.1° ADDED TO	
01	2401	RCL 1	WIND DIRECTION	
02	2400	RCL 0	TAKES CARE OF	
03	41	T - 1	TAIL AND HEAD	
04	2407	RCL 7	WINDS	
05	41	_		
06	2304	STO 4		
07	2407	RCL 7		
08	51	+		
09	1551	8 ≥ 0		
10	1313	GTO 13		
11	1312	GTO 12		
12	2304	STO 4		
13	2404	RCL 4		
14	1541	8 × < 0		
15	1320	GTO 20		
16	09	9		
17	00	0		
18	51	+		
19	2304	STO 4		
20	1404	f SIN		
21	2403	RCL 3		
22	61	×	-	
23	2402	RCL 2		
24	71	+	3	
25	1504	8 SI <b>N</b> -1		
26	2305	STO 5		
27	2404	RCL 4		
28	2406	RCL 6		
29	51	+		
30	1551	8 ≥ 0		
31	32	CHS		
32	2405	RCL 5		
33	1551	8 ≥ 0		
34	32	CHS		
35	51	+		
36	2406	RCL 6		
37	51	+		
38	1404	f SIN		
39	2403	RCL 3		
40	61 2405	X RCL 5		
41	1404	f SIN		
42	71	1 51IN		
43	1541	8 × < 0		
45	32	CHS		
46	74	RS	GROUND SPEED	
47	2400	RCL 0		
48	2405	RCL 5		
49	51	+	TRUE	
			HEADING ■	

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NEWDOS "PLUS" by Apparat+

NEWDOS plus the following functions: enhanced DIRCHECK command, improved EDITOR, ASSEMBLER, DISASSEMBLER. SUPERZAP. Machine language RELOCATOR, LEVEL I on disk.

DOS 3.0 by the original author of 2.1

No key bounce. Check EOF, write EOF, SEEK, REREAD, REWRITE, LOC, variable length records, SKIP, disk logging of messages, BOOT, CHAIN, PAUSE, PURGE, SET, RESET, ROUTE. RUN and LOAD for 1 drive system. XFER, FORMAT w/o ERASE. DIR from BASIC, PATCH, LINK, user defined keys, key auto repeat, upper and lower case driver, shift lock, RS-232 drivers, MULTI PROTOCOL COMMUNICATIONS.

# TRS-80\*COMPATIBLE HARDWARE

# **DISK DRIVES**

More capacity than Radio Shack 35 track (80K Bytes) drives. Fully assembled and tested. Ready to plug-in and run the moment you receive it. Can be intermixed with each other and Radio Shack drive on same cable. TRS-80\* compatible silver enclosure, 90 DAY WARRANTY

CCI-100	40 Track (102K Bytes)	\$324.00
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2 Drive Ca	able	\$25.00
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# **PRINTERS**

779 CENTRONICS TRACTOR FEED PRINTER \$1050.00

Same as Radio Shack line printer

701 CENTRONICS TRACTOR FEED PRINTER \$1499.00

21/2 times faster than line printer, full 132 characters, carriage bell tone.

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CENTRONICS CABLE for TRS-80\* For use with above printers.

PAPER TIGER (IP440) Up to 198 cps \$ 994.00 With 2K Buffer and Graphics \$1189.00

**HIPLOT DIGITAL PLOTTER** by Houston Instrument \$ 995.00 X-Y Plotter, RS-232-C or Parallel Interface.

7" x 10" plot size. Multi-colored pens included.

# **DISKETTE TRS-80\*** BUSINESS SOFTWARE BY SBSG

Free enhancements and upgrades to registered owners for the cost of media and mailing. 30 day free telephone support from vendor. User references supplied upon request.

Fully Interactive Accounting Package: Requires 2,3, or 4 drives. Includes General Ledger, Accounts Payable, Accounts Receivable, and Payroll. Report generating. Well documented and fully tested by accountants.

Complete package (Requires 3 or 4 drives) \$389.00 Individual Modules (Require 2 or 3 drives) \$99.00

Inventory II: Requires 2 or 3 drives. Handles up to 1000 items per disk drive. Reports include complete activity, inventory, listing, and minimum quantity search.

Mailing List Name & Address II System: Requires 2 drives. Use with Electric Pencil files for automatic insertion of name, address and greetings in letters. Has ability to print envelopes. Menu driven. Includes enter, delete, update, search, extract, merge and print. Up to 1250 names per diskette. Will sort up to 600 names in 7 minutes. 40 page manual. Zip code sort is excellent for bulk mail applications.

Intelligent Terminal System ST-80 III: Enables a TRS-80\* to act as a dial up terminal on any standard time sharing network. Provides a TRS-80\* with control key, ESC Key, Repeat Key, Rub Out Key, Break Key, full upper and lower case support, selectable printer output and program selectable transmission

Note: SBSG maintains a time-sharing computer where you can dial-up and leave your problems, 24 hours, 7 days a week.

Word Processing System: The Electric Pencil from Michael Shrayer. Diskette \$150.00 Cassette \$99.00

File Management System: For specialized storage needs. Sorts files in ascending or descending order on 3 separate fields. Scanable. Some applications have been fixed assets, phone numbers, names, slides, albums. Selectively totals numeric and dollar fields. Display and print capability. \$49.00

MMSFORTH System Diskette: A complete professional FORTH system. Requires 16K TRS-80\* and 1 drive. \$45.00 \$45.00 Book on FORTH. Contains documentation. \$15.00

# TRS-80\* COMPLETE SYSTEMS

\$494.00 TRS-80\* LEVEL II-4K reg. \$540.00 TRS-80\* LEVEL II-16K with 10 key keypad reg. \$799.00 \$764.00 TRS-80\* Expansion Interface \$254.00 TRS-80\* RS-232-C Interface \$84.00

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# Languages Forum

# **SNOBOL Commentary**

Jonathan Sachs, 6713 Richmond Ave, Richmond View CA 94805

As a long-time SNOBOL addict, I enjoyed Bruce Burns' "SNOBOL Conquers All?" (June 1979 BYTE, page 220), but I want to protest two things he said.

First, that "opponents to the language say they feel that the language's power invites unstructured programming..." I think we are basically in agreement on this one, but uncareful readers may get the idea that if you understand what you are doing, unstructured programming in SNOBOL is OK. Make no mistake: when the full power of SNOBOL4 is applied to a problem, it is beyond the power of a human to understand the resulting program without extensive documentation and thorough study. It is wise to use the language below its capabilities 99% of the time, and end up with readable code.

While I am on the subject of structure, I will add that SNOBOL's lack of strong structure (WHILE/DO, IF/THEN/ELSE) is its single intolerable vice. I object, not because it allows fools to write bad code, but because it

prevents *me* from writing *good* code unless I sweat blood. Because of this, I am planning to modify my SNOBOL compiler (FASBOL II on the DECsystem-10) to support the above constructs. I would like to hear from anyone else who has tried this.

Now, for my second objection. It concerns the one-line code segment to put the characters of a string in lexical order. The one-liner works, but it is horribly inefficient for long strings. When it finds characters N and N+1 are out of order it transposes them, then *returns* to the beginning of the string, even though we know characters 0 through N-1 are ordered.

Gross inefficiency is not a sin, but there is no justification for it unless it buys some overbalancing benefit such as storage economy or generality. Here, the only benefit we get is a one-liner. I think that is a poor demonstration of elegance. I wish Mr Burns had come up with a one-liner (if he had to use one at all) that someone might want to use in a real program.

Incidentally, the following "3-liner" benchmarks almost 4 times faster on my system, for the string 'THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG':

But these are minor complaints. Mr Burns' crusade to implement SNOBOL on microcomputers is a worthy one, and if there is anything I can do to support it, I will.





# What's New?



# Portable Electronic Chess Game

The Boris Diplomat is a compact, portable, battery-operated electronic chess computer. Designed with various operational strengths, the Diplomat will play at a level that will teach a child or will keep the attention of a master. As a

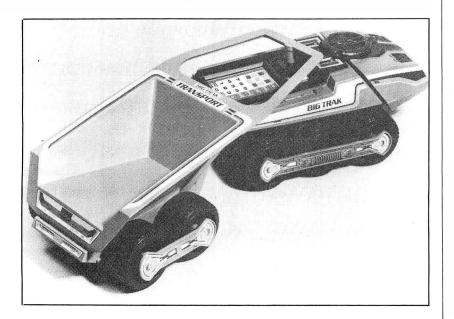
teacher, the Diplomat suggests moves for the unsure beginner. The Position Programmer allows more advanced players to set up special board positions to practice specific strategies. Beginners use the Position Programmer to remove pieces for handicapping or for practice of specific positions. The Diplomat has a built-in chess board with pieces, is 8 by

7 by 1½ inches (20.32 by 17.78 by 3.81 cm), and operates several hours on six AA battery cells or on the AC adapter which is included.

The price of the Boris Diplomat is \$119.95. For further information, contact Chafitz Inc, 1055 First St, Rockville MD 20850.

Circle 624 on inquiry card.

# Programmable High-Performance Toy Vehicle



Milton Bradley's Big Trak is a toy vehicle which is programmed to follow an extremely complex route. Big Trak advances for as many as 99 units, each unit being the measure of its own 13-inch length. By pushing the Repeat button, it travels twice as far. It gives the same performance in reverse. The vehicle pivots either right or left in a full circle or more. It also pivots in tiny fractions of a circle, for Big Trak possesses 60 swiveling positions. It can make a turn, proceed in a straight line,

turn again, and continue traveling on whatever course has been set.

Big Trak has a total of 16 programming steps which direct its functions. By estimating the distances and punching in commands, the user may send it around tables, chairs, and other obstacles, and have it return. The user may input a command which will call up its arsenal of weaponry, firing a single shot, or short or long bursts of sound and light laser-cannon fire. It may be strategically deployed, firing at some target as it

# Voice Controlled Toy Van



George, the toy van controlled by voice, is available from Beneficial Marketing, Suite 1920, Wall St Plz, New York NY 10005. George will go where you tell him only to the extent that you control him with your voice. The number of words used, the length of the words, and the combination of words are all controls. George is priced at \$24.95.

Circle 625 on inquiry card.

maneuvers, or lurk silently in ambush. Big Trak has a companion item called Big Trak Transport. The Transport attaches to Big Trak and hauls and dumps loads on a preprogrammed command. The approximate retail price of Big Trak is \$43 and the Big Trak Transport is priced at \$13. For further information, contact Milton Bradley Co, Springfield MA 01101.

Circle 626 on inquiry card.

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So simple a child can operate, the new CompuCruise combines latest computer technology with state-of-the-art reliability in a package which will not likely be available on new cars for years to come • Cruise Control • Time. E.T., Lap Timer, Alarm • Time, Distance, Fuel to Arrival . Time. Distance. Fuel to Empty • Time, Distance and Fuel on Trip • Current or Average MPG, GPH • Fuel Used, Distance since Fillup • Current and Average-Vehicle Speed . Inside, Outside or Coolant Temperature Battery Voltage English or Mo Display. \$199.95 Metric



# FLOPPY DISK STORAGE BINDER

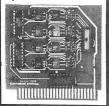
This black vinvl three-ring binder comes with ten transparent plastic sleeves which commodate either twenty, five-inch or ten, eight-inch floppy disks. The plastic sleeves may be ordered separately and added as needed. A contents file is included with each sleeve for easy identification and organiz-ing. Binder & 10 hol-ders \$14.95 Part No. B800; Extra holders 95¢ each. Part No.



#### **OPTO-ISOLATED PARALLEL INPUT BOARD FOR APPLE II**

There are 8 inputs that can be driven from TTL logic or any 5 volt source. The circuit board can be plugged into any of the 8 sockets of your Apple II. It has a 16 pin socket for standard din ribbon cable connection.

Board only \$15.00. Part No. 120, with parts \$69.95. Part No. 120A



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• Tape Interface Direct Memory Access . Record and play programs without bootstrap loader (no prom) has FSK encoder/decoder for direct connections to low cost recorder at 1200 baud rate, and direct connections for inputs and outputs to a digital recorder at any baud rate . S-100 bus compatible . Board only \$35.00 Part No. 112, with parts \$110 Part No. 112A



#### SYSTEM MONITOR

8080, 8085, or Z-80 System monitor for use with the TIDMA board. There is no need for the front panel. Complete with documentation \$12.95

#### **16K EPROM**

Uses 2708 EPROMS. memory speed selection provided, addressable anywhere in 65K of memory, can be shadowed in 4K increments. Board only \$24.95 part no. 7902, with parts less no. EPROMs \$49.95 part no. 7902A



# **ASCII KEYBOARD**

TTL & DTL compatible • Full 67 key array • Full 128 character ASCII output • Positive logic with outputs resting low • Data Strobe Five user-definable spare keys
 Standard 22 pin dual card edge connector • Requires +5VDC, 325 mA. Assembled & Teste Cherry Pro Part No. P70-05AB. \$135.00.



### **ASCII KEYBOARD**

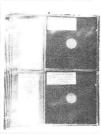
53 Keys popular ASR-33 format • Rugged G-10 P.C. Board • Tri-mode MDS encoding • Two-Key Rollover • MOS/DTL/TTL Compat-ible • Upper Case lockout • Data and Strobe inversion option • Three User Definable Keys • Low contact bounce • Selectable Parity • Custom Keycaps • George Risk Model 753. Requires +5, -12 volts. \$59.95 Kit.

#### **ASCII TO CORRESPONDENCE CODE CONVERTER**

This bidirectional board is a direct replacement for the board inside the Trendata 1000 terminal. The on board connector provides RS-232 serial in and out. Sold only as an assembled and tested unit for \$229.95. Part No. TA 1000C

# DISK JACKET™

Made from heavy duty .0095 matte plastic reinforced grommets. The minidiskette version holds two 5-1/4 inch diskettes and will fit any standard three ring binder. The pockets to the left of the diskette can be used for listing the contents of the disk. Please order only in multitudes of ten. \$9.95/10 Pack.



#### INTERNATIONAL MICROPROCESSOR DICTIONARY

English, French, Danish, German, Italian, Hungarian, Norwe-gian, Polish, Spanish, Swedish. 10 Ianguages, 28 pp. SYBEX. Ref. IMD.

# **VIDEO TERMINAL**

16 lines, 64 columns Upper and lower case . 5x7 dot matrix • RS-232 in • RS-232 out with TTL parallel keyboard input • On board baud rate generator 75, 110, 150, 300, 600, & 1200 jumper selectable • Memory 1024 characters (7-21LO2) Video processor chip SFF96364 by Necu-Ionic . Control characters (CR, LF, →, ← non destructive cursor, CS, home, CL . White characters on black background or vice-versa . With the addition of a keyboard video monitor or TV set with TV interface (part no. 107A) and power supply this is a complete stand alone terminal • also S-100 compatible • requires +16, & -16 VDC at 100mA, and 8VDC at Part no. 1000A \$199.95 kit.



#### RS-232/20mA INTERFACE

This hoard has two passive, opto-isolated circuits. One converts RS-232 to 20mA, the other converts 20mA to RS-232. All connections go to a 10 pin edge connector. Requires +12 and -12 volts. Board only \$9.95, part no. 7901, with parts \$14.95 Part No. 7901A.



#### **COMPUCOLOR II**

Model 3, BK \$13 95, Model 4, 16K \$15 95, Model 5, 32K \$1B 95 Prices include color monitor. computer and one disk drive.



#### PET COMPUTER

With 32K & monitor -\$1195. Dual Drive - \$1195.





16K - \$995, 32K \$1059, 48K - \$1123. Disk & cont. \$589



# T.V. INTERFACE

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This book will teach

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**Z80 APPLICATIONS** 

APPLICATIONS

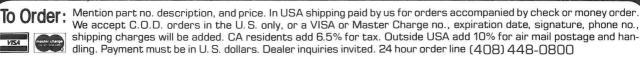
Converts video to AM modulated RF, Channels 2 or 3. So powerful almost no tuning is required. On board regulated power supply makes this extremely stable. Rated very highly in Doctor Dobbs' Journal. Recommended by Apple Power required is 12 volts AC C.T., or +5 volts DC ● Board only \$7.60 part No. 107 with parts \$13.50 Part No. 107A





# **PARALLEL TRIAC OUTPUT BOARD FOR APPLE II**

This board has B triacs canable of switching 110 volt 6 amp loads (660 watts per channel) or a total of 5280 watts. Board only \$15.00 Part No. 210, with parts \$119.95 Part No. 210A.



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# TRS-80 E.S. SERIAL I/O

Can input into basic Can use LLIST and LPRINT to output, or output continuously • RS-232 compatible • Can be used with or without the expansion bus • On board switch selectable baud rates of 110,150,300,600, 1200, 2400, parity or no parity odd or even, 5 to B data bits, and 1 or 2 stop bits. D.T.R. line • Requires +5, -12 VDC • Board only \$19.95 Part No. BO10, with parts \$59.95 Part No. BO1OA, assembled \$79.95 Part No. B010 C. No connectors provided, see below



EIA/R5-232 con 0825P\$6.00, with 9', 8 conductor cable \$10.95 Part

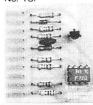




nectors to fit TRS-80 and our serial board \$19.95 Part No. 3CAB40.

# **RS-232/TTL** INTERFACE

Converts TTL to RS-232, and converts RS-232 to TTL • Two separate circuits • Requires -12 and +12 volts • All connections go to a 10 pin gold plated edge connector
• Board only \$4.50
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#### **RS-232/TTY** INTERFACE

This board has two active circuits, one converts RS-232 to 20mA, and the other converts 20mA to RS-232. Requires +12 and -12 volts. Board only \$4.50 Part No. 600, with parts \$7.00 Part No. 600A.



# S-100 BUS **ACTIVE TERMINATOR**

Board only \$14.95 Part No. 900, with parts \$24.95 Part No. 900A



# MODEM

● Type 103 ● Full or half dunlex . Works up to 300 baud • Originate or Answer • No coils, only low cost components • TTL input and output-serial Connect B Ω speaker and crystal mic. directly to board ● Uses XR FSK demodulator ● Requires +5 volts ● Board only \$7.60 Part No. 109, with parts \$27.50 Part No. 109A



# DISKETTES



Box of 10, 5" \$29.95, B" \$39.95 Plastic box, holds 10 diskettes, 5" - \$4.50, 8" - \$6.50

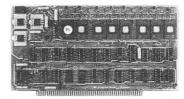
# APPLE II\* SERIAL I/O INTERFACE



Baud rate is continuously adjustable from O to 30,000 ● Plugs into any peripheral connector ● Low current drain. RS-232 input and output • On board switch selectable 5 to B data bits, 1 or 2 stop bits, and parity or no parity either odd or even • Jumper selectable address • SOFTWARE • Input and Output routine from monitor or BASIC to teletype or other serial printer • Program for using an Apple II for a video or an intelligent terminal. Also can output in correspondence code to interface with some selectrics. . Also watches DTR • Board only \$15.00 Part No. 2. with parts \$42.00 Part No. 2A, assembled \$62.00 Part No. 2C

# 8K EPROM PIICEON

Saves programs on PROM permanently (until erased via UV light) up to BK bytes. Programs may be directly run from the program saver such as fixed routines or assemblers. • S-100 bus compatible • Room for BK bytes of EPROM non-volatile memory (270B's). • Onboard PROM programming ● Address relocation of each 4K of memory to any 4K boundary within 64K • Power on jump and reset jump option for "turnkey" systems and computers without a front panel • Program saver software available • Solder mask both sides • Full silkscreen for easy assembly. Program saver software in 1 270B EPROM \$25. Bare board \$35 including custom coil, board with parts but no EPROMS \$139, with 4 EPROMS \$179, with B EPROMS \$219.



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displays Byte or instruction single step. MEM-1A BKxB fully buffered, S-100, uses 2102 type RAMS.

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# **TYPEWRITER**

Stand alone TVT 32 char/line, 16 lines, modifications for 64 char/line included ● Parallel ASCII (TTL) input ● Video output 1K on board memory Output for computer controlled curser Auto scroll ● Nondestructive curser • Curser inputs: up down left, right, home, EOL, EOS • Scroll up, down Requires +5 volts
 at 1.5 amps, and -12

volts at 30 mA ● All 7400, TTL chips ● Char. gen. 2513 ● Upper case only Board only \$39.00 Part No. 106, with parts \$145.00 Part No. 106A



## UART & **BAUD RATE** GENERATOR

 Converts serial to parallel and parallel to serial • Low cost on board baud rate generator ● Baud rates: 110, 150, 300, 600, 1200, and 2400 • Low power drain +5 volts and -12 volts required ● TTL compatible • All characters contain a start bit, 5 to B data bits, 1 or 2 stop bits, and either odd or even parity. • All connections go to a 44 pin gold plated edge connector ● Board only \$12.00 Part No. 101, with parts \$35.00 Part No. 101A, 44 pin edge connector \$4.00 Part No. 44P



# **TAPE** INTERFACE

 Play and record Kansas City Standard tapes Converts a low cost tape recorder to a digital recorder • Works up to 1200 baud ● Digital in and out are TTLserial • Output of board connects to mic. in of recorder • Earphone of recorder connects to input on board No coils • Requires +5 volts, low power drain ● Board only \$7.60 Part No. 111, with parts \$27.50 Part Nn 111A



# **HEX ENCODED KEYBOARD**

This HEX keyboard has 19 keys 16 encoded with 3 user definable. The encoded TTL outputs. B-4-2-1 and STROBE are debounced and available in true and complement form. Four onboard LEOs indicate the HEX code generated for each key depression. The board requires a single +5 volt supply. Board only \$15.00 Part No. HEX-3, with parts \$49.95 Part No. HEX-3A. 44 pin edge connector \$4.00 Part No.



# DC POWER SUPPLY

• Board supplies a regulated +5 volts at 3 amps., +12, -12, and -5 volts at 1 amp. • Power required is B volts AC at 3 amps., and 24 volts AC C.T. at 1.5 amps. • Board only \$12.50 Part No. 6085, with parts excluding transformers \$42.50 Part No. 6085A



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# What's New?

# FUN and GAMES

# Game Playing Device Is Also a Teaching Calculator

Mathemagician is a teaching calculator and game-playing device for adults and children of all ages. It can teach children arithmetic operations: multiplication tables, division tables, addition and subtraction. Children and adults can play any of six different games, which are: Number Machine, Counting On, Walk the Plank, Gooey Gumdrop, Football, and Lunar Lander. Mathemagician's games can be played by one or two people. All functions let the user know at the end of each problem if he or she has given the correct answer, and if not, will then display the correct answer.

Mathemagician sells for \$29.95. For



further information, contact APF Electronics Inc, 444 Madison Ave, New York NY 10022.

Circle 627 on inquiry card.

# Microvision Features Seven Different Game Cartridges

Milton Bradley's Microvision is a hand-held mini "video" game with its own screen. The electronically operated Microvision comes equipped with the game Blockbuster; moreover, six additional game cartridges may be purchased, including Bowling, Pinball, Connect 4, Star Trek Phaser Strike, Vegas Slots, and Mindbuster. Microvision is priced at \$51.25. Game cartridges



# Game Software for the TRS-80

The Software Association has announced a new line of entertainment programs for the TRS-80. All programs are written in machine language and provide fast response times. The initial offerings include:

Z-Chess — a full-featured chess opponent providing seven levels of difficulty, from Blitz to Expert. Six moves of look-ahead are possible, and Z-Chess can solve mate-in-two problems quickly. Numbered squares and a board setup mode are provided for ease of play.

Back-40 — a backgammon challenger with an unrivaled graphic board display. Doubling is permitted, and every feature of a regulation backgammon match is provided including the score.

Dr Chips — a fascinating program based on Doctor and Eliza programs. Machine language allows Dr Chips to analyze sentences and talk back instantly.

All programs require a 16 K byte Level II machine. Z-Chess is priced at \$17.95, Back-40 and Dr Chips are \$14.95 each. For further information, contact The Software Association, POB 58365 Houston TX 77058.

Circle 628 on inquiry card.

range in price from \$16.50 to \$18. Contact Milton Bradley Co, Springfield MA 01101.

Circle 629 on inquiry card.

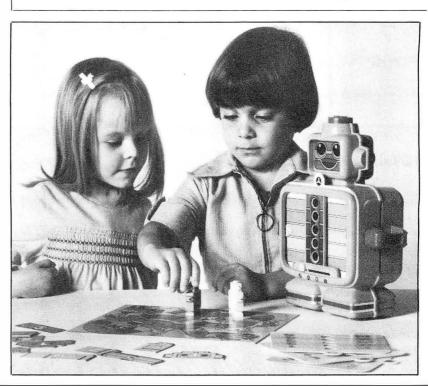
# Electronic Robot Promises Preschool Fun

Alphie is an electronic toy robot offering action, lights, sounds, music and games for children 3 to 8 years old. Preschoolers will enjoy Alphie's Question and Answer games. Once the child makes a decision, Alphie lights up the correct answer. If the child has made the right selection, Alphie plays a rendition of Sousa's "Stars and Stripes Forever." If the child's answer does not match, Alphie gives a good-natured "razzberry." Alphie also plays other tunes, and there is a choice of five popular children's songs.

Slightly older children will enjoy playing Robot Land. In this color matching game, the child tries to beat Alphie or a friend by being the first to move a miniature Alphie piece along the path from the Robot Factory to Spaceship XK-3. In the Lunar Landing game, children count the tones Alphie makes in order to be first to assemble an Alphie puzzle on the lunar game board.

Alphie is priced at approximately \$28. For further information, contact Playskool Inc, 4501 W Augusta Blvd, Chicago IL 60651.

Circle 630 on inquiry card.



# The DATA-TRANS 100

A completely refurbished **IBM** Selectric Terminal with built-in **ASCII** Interface.

\$1395



- 300 Baud
- 14.9 characters per second printout Reliable heavy duty Selectric
- mechanism
- **RS-232C** Interface
- Documentation included
- 60 day warranty-parts and
- High quality Selectric printing Off-line use as typewriter
- Optional tractor feed available
- 15 inch carriage width



1. We accept Visa, Master Charge. Make cashiers checks or personal check payable to:

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3. Deliveries are immediate

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Microprocessor in-terfacing is no longer an art. It is a set of techniques, and in some cases just a set of components. This comprehensive book introduces the basic interfacing concepts and techniques, then presents in detail the implementation de tails, from hardware to software. It covers all the essential peripherals, from key-board to floppy disk, as well as the stan-dard buses (\$100 to IEEE 488) and introduces the basic troubleshooting tech-niques. (2nd Expanded Edition). By Austin Lesea and R. Zaks. Ref. C207 SYBEX. \$11.95

#### **PROGRAMMING** THE 6502 PROGRAMMING THE Z80 PROGRAMMING THE 8080

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# **44 BUS MOTHER BOARD**

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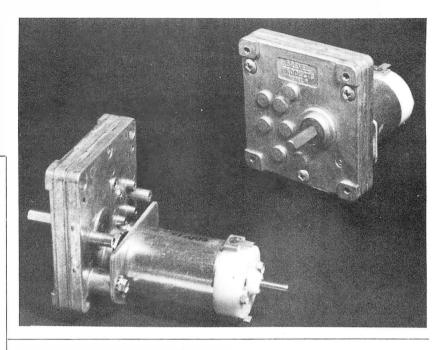
# Pascal Processor for the S-100 Bus

The Pascal-100 processor is a 16-bit central processor board for the S-100 bus, especially designed for use with the Pascal programming language. The processor directly executes p-code instructions generated by the Pascal compiler written at the University of California, San Diego (UCSD Pascal). It runs the latest version of the entire UCSD Pascal operating system, including the Pascal compiler, screen editor, filing system, BASIC compiler, graphics package, games library, computer-based learning system, and utilities and crossassemblers for other micro and minicomputers.

Other features of the Pascal-100 processor include support of up to 128 K bytes of directly addressed main memory, 16-bit data bus transfers, vectored interrupts and floating point operations. The processor complies with the Institute of Electrical and Electronic Engineers standard for the S-100 bus, and will also operate with most peripheral and memory boards designed prior to the standard.

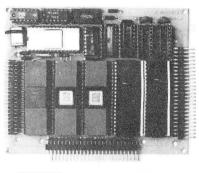
The Pascal-100 processor is priced at \$995. For further information, contact David Lewis, Digicomp Research Corp, Terrace Hill, Ithaca NY 14850.

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# Microprocessor Controller Card

The System A process control board utilizes an 8085 microprocessor and can interface to 76 1/O (input/output) lines. The board contains 4 K bytes of erasable read-only memory and up to 4.6 K bytes of programmable memory. It also has RS-232 teletypewriter control and 14-bit binary counter and timers. The board can be purchased with a resident program that allows the user to program interface requirements and data rates from an external source. Minimal configuration boards may also be purchased. The board dimensions are 4 by 5 inches (10.16 by 12.20 cm). The System A board starts at \$295. For further information, contact FH and M

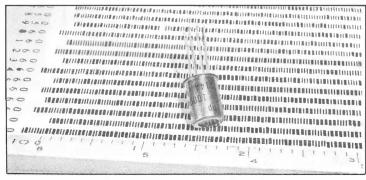


Enterprises Inc, 1850 Gravers Rd, Norristown PA 19401.

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# Hewlett-Packard Introduces High-Resolution Optical Reflective Sensor

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include pattern recognition, object sizing, optical limit switching, tachometry, defect detection, dimensional monitoring, line locating, mark and bar code scanning, and paper edge detection.

For further information, contact Hewlett-Packard, Optoelectronics Division, 640 Page Mill Rd, Palo Alto CA 94304.

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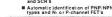
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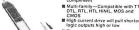
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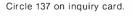
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BYTE November 1979



# What's New?

# MASS STORAGE

# Intelligent Disk System for S-100 Computers

A 10 M byte intelligent rigid disk system has been introduced by Corvus Systems, 900 S Winchester Blvd, San Jose CA 95128. Plug compatible with the Radio Shack TRS-80, Apple and all S-100 bus-type computers, the system adds cost-effective mass storage to these computers, while maintaining total compatibility with existing hardware and software. The disk system

consists of a compact IMI 7710 disk drive employing Winchester technology with two 8-inch rigid disks; a Corvus Z80 intelligent disk controller with comprehensive disk diagnostics;

and an intelligent personality module and associated software for each form

software for each form of computer. Each drive has a capacity of 10 M bytes of formatted storage. Up to four drives can be supported in a simple daisy chain.

of the system is \$5350, including disk drive, controller, and personality module. Add-on disk drives are priced at \$2900.

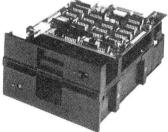
The price

Circle 631 on inquiry card.

# Where Do New Products Items Come From?

The information printed in the new products pages of BYTE is obtained from "new product" or "press release" copy sent by the promoters of new products. If in our judgement the information might be of interest to the personal computing experimenters and homebrewers who read BYTE, we print it in some form. We openly solicit releases and photos from manufacturers and suppliers to this marketplace. The information is printed more or less as a first in first out queue, subject to occasional priority modifications. While we would not knowingly print untrue or inaccurate data, or data from unreliable companies, our capacity to evaluate the products and companies appearing in the "What's New?" feature is necessarily limited. We therefore cannot be responsible for product quality or company performance.

# 5-Inch Disk Drive Is Compatible with Shugart SA-400



The Teac FD-50A 5-inch disk drive moves its data-transfer head directly to the selected track, giving the drive a track-to-track access time of 25 ms and an average access time of 298 ms. A precision built stepper motor ensures accurate head positioning while an improved head configuration is used for precise erasing. In its basic 35-track configuration, the capacity of the FD-50A is 109.4 K bytes (unformatted). This may be extended if desired by addressing an additional 5 tracks. Recording on a total of 40 tracks expands the capacity to 125 K bytes. Up to four FD-50A 5-inch disk drives can be daisy-chained to a single controller. The FD-50A is fully plug-to-plug and disk-compatible with the Shugart SA-400.

For further information, contact Teac Corp, 3-7-3, Naka-cho, Musashino, Tokyo, JAPAN.

Circle 632 on inquiry card.



# 5-Inch Double Density Disk Drive for TRS-80

Percom Data Company has expanded its TFD line of add-on 5-inch disk systems for the Radio Shack TRS-80 computer to include a dual drive unit featuring double-density storage. Designated the TFD-1000, the unit provides 800 K bytes of on-line storage. Two systems (four drives) may be used with a TRS-80 to provide 1.6 M bytes on line.

The TFD-1000 is supplied complete with an interconnecting cable (which accommodates either one or two units), a Peripheral Adapter Module (PAM) printed circuit card, Percom's MICRODOS operating system, and support documentation. The PAM card replaces the RS-232C card in the TRS-80

expansion interface and includes RS-232C circuitry so that serial interfacing capability is retained. The MICRODOS operating system, which replaces TRSDOS, was developed especially for business and professional applications. It provides full random-access capability, is faster than TRSDOS and requires less than 7 K bytes of programmable memory. It is supplied on a system disk that includes BASIC program examples and a menu of the programs. The menu is activated on power-up or reset.

The TFD-1000 complete with cable, operating system, PAM card and documentation costs \$2495. Two TFD-1000 units (four drives) cost \$4950. For further information contact the company at 211 N Kirby, Garland TX 75042.

Circle 633 on inquiry card.

# ProComp/New England Super Christmas Sale

Prices marked with \* good thru Dec 31. Mail and phone orders welcome. Prices FOB Boston, MA. Shipping costs billed COD, Mass residents add 5% sales tax.

# TRS-80 MEGABYTES

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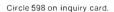


# What's New?

# **PUBLICATIONS**

# Predict Object Motion With Your Programmable Calculator

Countdown, a book by Robert Eisberg and Wendell Hyde, will show the reader how to use a programmable calculator to accurately predict the motion of a variety of interesting objects. Using only basic math and physics, the book explains how to calculate the motion of skydivers, single and multistage rockets, Earth satellites, planets, and alpha particles. The book is written without the assumption that the reader has any familiarity with a programmable calculator. This 114 page paperback book is priced at \$6.95. For further information contact Dilithium Press, POB 92, Forest Grove OR 91776.





# TM990 Series Microcomputer Module Selection Guide Available from Texas Instruments



A 20-page product selection guide and catalog covering the TM990 Series of 16-bit microcomputer modules is available free from Texas Instruments Inc, POB 1443, MS-6404, Houston TX 77001. It provides engineers with a con-

venient reference to TI's line of TM990 Series microcomputer modules and other TM990 Series software, firmware, and hardware products. The publication, CL 377A, covers TM990 Series microcomputer modules; memory expansion modules; I/O (inut/output) expansion modules; industrial AC and DC I/O modules; analog-to-digital and digital-to-analog interface modules; university educational module; and software development module. Product descriptions include key specifications and features

Also included in CL 377A are descriptions, key features and specifications for TI's data entry and display Microterminal; firmware support, including TIBUG Monitor and line-by-line assembler; software, including Power BASIC high-level language and TIPMX Executive Library, a collection of assembly language programs available for users of TI's TMS9900 family of microprocessors; TM990 transportable cross support; Advanced Microprocessor Prototyping Lab (AMPL); and TM990 Series accessories.

Circle 600 on inquiry card.

# Free Technical Catalog

The 1979 edition of Engineering Guide: AC/DC and DC/DC Power Sources contains 44 pages and includes 10 pages of design, applications, and selection information for both linear and switch mode regulated power sources. Designed to help the engineer select the most cost effective power source for an application, this reference includes complete specifications, dimension drawings

and extended pricing information for 23 product families ranging from dual-inline packaged single and dual output DC/DC converters to high-efficiency 76 W multioutput open frame power supplies. The Guide presents a variety of new products and lists price reductions for certain existing product groups. For further information, contact Semiconductor Circuits Inc, 218 River St, Haverhill MA 01830.

Circle 601 on inquiry card.

# Publications on Business Computing

BusinessComputing Press has announced a series of publications informing businessmen and professionals about the effective utilization of low-cost microcomputers in business. The bimonthly journal, BusinessComputing Review, provides research reporting on business computers and applications software. The information is presented in a concise review format that simplifies the selection of systems based on business requirements. Related articles and commentary compliment the reviews.

The report, Evaluating Small Business Software, details the characteristics that any quality software package must possess in order to be used successfully. Specific evaluation criteria are provided for General Ledger, Accounts Receivable, Accounts Payable, Payroll, and Inventory Control packages.

BusinessComputing Newsletter, published 6 times annually, presents newsworthy information about the use of microcomputers in business. The newsletter contains tutorials on business computing and abstracts of new products. The newsletter is sent to subscribers of BusinessComputing Review.

BusinessComputing Review is available for an annual subscription rate of \$25. The report, Evaluating Small Business Software, is \$15 per copy. Contact Business Computing Press, POB 55056, Valencia CA 91355.

Circle 599 on inquiry card.

# Computers for Business People

DDC Publications has announced the publication of a new book for people planning to buy a business computer system. The book, entitled Winning the Computer Game by Chris Kloek, presents a business computer guide to the layman or professional. The book recommends when a company should computerize, when it should not, how to buy systems and services, and how to live happily with them. Winning the Computer Game goes into detail on such subjects as custom versus packaged software, contract negotiation, installation management, and financing alternatives. Appropriate cautions are also provided.

The 178 page guide costs \$12.95 and is available from DDC Publications, 5386 Hollister Ave, Santa Barbara CA 93111.

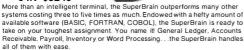
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**DATA GENERAL** 

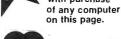
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# What's New?

# SOFTWARF

# Add-on Graphics for Apple II Software

Superchip is a 16 K bit read-only memory designed to be plugged into the Apple II computer. The device provides an alternate set of I/O (input/output) service routines. The output routine can display, within the window concept, the full American Standard Code for Information Interchange (ASCII) character set (lowercase included), along with 32 new characters. User defined characters and character sets are also supported. Text is available in reverse video and may be freely mixed with high-resolution graphics. Characters can be rotated in 90 degree steps to achieve vertical and upside down printing. The new input routine permits the generation of all the new characters from the standard keyboard. An enhanced full screen editor is also provided with full cursor motion, character insertion and deletion. and several other features to increase the speed of editing. The Character Edit Program, which is available on cassette, permits one to construct or modify a character pattern by working with a magnified grid. Superchip was designed to be transparent to existing Apple software, and most programs run under it with no modification.

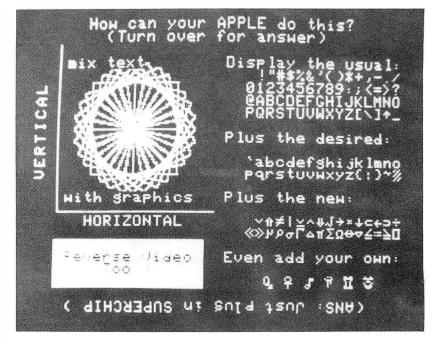
Superchip supports printing through either the communications or printer

# Full Standard PILOT on PET

Commodore PET owners can get full standard PILOT on a minimum size PET with the PETPILOT language processor and editor which is suitable for preparing long programs of up to 80,000 characters. The product features full BASIC in compute statements as well as two new keywords designed to make PILOT programming easier and faster. All language features of the most recent PILOT standard are implemented. Only the tape drive supplied with the PET is required to run any PILOT program. While simple PILOT programs can be created on a single drive PET, authors writing long programs will need the second cassette drive offered by Commodore.

The package offered by the PET-PILOT project contains both programs, a sample PILOT program, a teacher's manual, a quick reference card, and licenses to run the programs on a single PET. The basic package costs \$25. Specify the PET serial number to be licensed when ordering. Contact Dave Gomberg, 7 Gateview Ct, San Francisco CA 94116.

Circle 640 on inquiry card.



interface board and requires a 16 K byte system to operate. The Applesoft board is also supported. Superchip is priced at \$99.95, and the Character Edit Program is \$19.95. A disk interface is available

for \$19.95, and a word processing package costs \$19.95. For further information, contact Eclectic Rentals Inc, 2830 Walnut Hill Ln, Dallas TX 75229.

# User-Oriented Database Management System

Global is a comprehensive and versatile user-oriented database management system for database creation and list maintenance. Global runs under CP/M and CBASIC2 on a microcomputer system in 40 K bytes of programmable memory. This general-purpose tool can be used for diverse applications such as inventory systems, mail lists, indexing collections, history reports, payroll files, accounting files, price lists, client lists, etc.

Some features include completely user-defined file structure with sequential, random, and linked file maintenance; user-defined number of fields; data transfer between records;

automatic high-speed search algorithms with global search function, built-in indexed sequential-access method, etc; fast sort and merge utility; record-selectable output that can be formatted and printed on various forms; links to CP/M commands or programs with automatic return to Global; status reports on disk, data file and hardware environment; and disk used as extended memory.

Global is supplied on standard 8-inch IBM-compatible disks and comes complete with a BASIC subroutine library supplied in source code, and a comprehensive manual for \$295. The manual alone is \$35. For further information, contact Global Parameters, 1505 Ocean Ave, Brooklyn NY 11230.

Circle 639 on inquiry card.

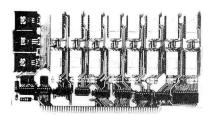
# Educational Software for Apple and TRS-80

Mind-Memory Improvement (Course Steps 1 and 2) has been designed for the Apple and the TRS-80 (Level I and II). It combines the advantages of the home computer with a teaching manual and audio cassettes. The Mind course teaches a system for memorizing lists of items easily. In addition, the course

develops memorizing skills for more difficult material as well as teaching a system for listening and remembering. Emphasis is placed on remembering people's names and faces. The price for Mind-Step 1 is \$24.95 and Mind-Step 2 is priced at \$29.95. Both courses are available for \$49.90. For further information, contact TYC Software, 40 Stuyvesant Manor, Geneseo NY 14454.

Circle 641 on inquiry card.

## 16K EPROM CARD-S 100 BUSS



KIT

OUR BEST SELLING KIT!

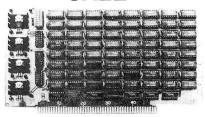
USES 2708's!

Thousands of personal and business systems around the world use this board with complete satisfaction. Puts 16K of software on line at ALL TIMES! Kit features a top quality soldermasked and silk-screened PC board and first run parts and sockets. All parts (except 2708's) are included. Any number of EPROM locations may be disabled to avoid any memory conflicts. Fully buffered and has WAIT STATE capabilities.

**OUR 450NS 2708'S** ARE \$8.95 EA. WITH **PURCHASE OF KIT** 

**ASSEMBLED** AND FULLY TESTED **ADD \$25** 

# **8K LOW POWER RAM KIT-S 100 BUSS**



(450 NS RAMS!)

Thousands of computer systems rely on this rugged, work horse, RAM board. Designed for error-free, NO HASSLE, systems use.

#### KIT FEATURES:

- 1. Doubled sided PC Board with solder mask and silk screen layout. Gold plated contact fingers.
- All sockets included.
- Fully buffered on all address and data
- Phantom is jumper selectable to pin
- FOUR 7805 regulators are provided 5. on card.

Blank PC Board w/Documentation \$29.95

Low Profile Socket Set...13.50 Support IC's (TTL & Regulators) \$9.75

Bypass CAP's (Disc & Tantalums) \$4.50

ASSEMBLED AND FULLY **BURNED IN ADD \$30** 

# **16K STATIC RAM KIT-S 100 BUSS**

\$**279** кіт

FOR 250NS ADD \$10

**FULLY** STATIC, AT DYNAMIC PRICES

WHY THE 2114 RAM CHIP?

WHY THE 2114 RAM CHIP?
We feel the 2114 will be the next industry standard
RAM chip (like the 2102 was). This means price,
availability, and quality will all be good' Next, the
2114 is FULLY STATIC! We feel this is the ONLY
way to go on the 5-100 Buss! We've all heard the
HORROR stories about some Dynamic Ram
Boards having trouble with DMA and FLOPPY
DISC DRIVES. Who needs these kinds of
problems? And finally, even among other 4K
Static RAM's the 2114 stands out! Not all 4K static
Rams are created equal! Some of the other 4K's
have clocked chip enable lines and various timing
windows just as critical as Dynamic RAM's Some windows just as critical as Dynamic RAM's. Some of our competitor's 16K boards use these "tricky" devices. But not us! The 2114 is the ONLY logical choice for a trouble-free, straightforward design.

KIT FEATURES:

Addressable as four separate 4K Blocks. 2. ON BOARD BANK SELECT circui (Cromemco Standard!). Allows up to 512K

- 3. Uses 2114 (450NS) 4K Static Ram ON BOARD SELECTABLE WAIT STATES.
- Double sided PC Board, with solder mask and silk screened layout. Gold plated contact fingers.
   All address and data lines fully buffered.
   Kit includes ALL parts and sockets.
- PHANTOM is jumpered to PIN 67. LOW POWER: under 2 amps TYPICAL from the
- +8 Volt Buss.

  10. Blank PC Board can be populated as any multiple of 4K

BLANK PC BOARD W/DATA-\$33

LOW PROFILE SOCKET SET-\$12 SUPPORT IC'S & CAPS-\$19.95

ASSEMBLED & TESTED-ADD \$30

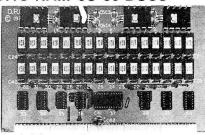
Perfect For

OEM's

# 16K STATIC RAM SS-50 BUSS

PRICE CUT!

**FULLY STATIC** AT DYNAMIC PRICES



- KIT FEATURES: 1. Addressable on 16K Boundaries
  - 2. Uses 2114 Static Ram
  - 3. Runs at Full Speed

FOR SWTPC 6800 BUSS!

mask and silk screened layout. Gold fingers.

4. Double sided PC Board. Solder

ASSEMBLED AND TESTED - \$30

5. All Parts and Sockets included 6. Low Power: Under 2 Amps

Typical

BLANK PC BOARD-\$33

COMPLETE SUCKET SET-\$12

SUPPORT IC'S AND CAPS-\$19.95

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ASSEMBLED AND TESTED! READY TO USE! Over 3 years of design efforts were required to produce a TRUE S-100 Z80 CPU at a genuinely bargain price! 4 MHZ! FFATIIRES:

- 2 or 4 MHZ Operation.
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- Jump on reset capability
- 8080 Signals emulated for S-100 compatability.
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16K S-100 Dynamic Ram Board - \$149.95

ORIGINALLY PRICED AT \$429 each!

We purchased the remaining inventory of PT's popular 16K Ram Board when they recently closed their plant. Don't miss the boat! These are brand new, fully tested. ASSEMBLED and ready to go. All are sold with our standard 90 day limited warranty!!

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#### Model 2500A S-100 Wire Wrap Board

- S-100 BUS compatible Double sided PC hoard
- Plated thru holes
- Perimeter ground
   All S-100 BUS signals labeled
- and numbered
  Accommodates standard size
  IC sockets
- 4 to-220 regulator positions available
- Allows either positive or negative regulators
   Dense hole configuration
  Cat No. 1600 \$ 27.00

#### Model 2501A S-100 **Solder Board**

- S-100 BUS compatible Double sided PC board
- Plated thru holes
- Perimeter ground All S-100 BUS signals labeled and numbered
- Accommodates standard size
- 4 to-220 regulator positions available
   Allows either positive or neg-
- ative regulators

   Dense hole configuration

  Cat No. 1604 \$ 27.00

# Model 2501A S-100 **Mother Board**

- 12 slot capability All 12 S-100 bus connectors in-cluded Low inductance inner-connect to reduce signal noise and Active termination of all bus
- lines to further reduce signal noise and line reflections Distributed bypassing of all
- power lines Solder mask both sides of
- Silkscreen of reference desig-

nations
Simple strong board mounting
Criss-cross BUS lines both
sides of board
All holes plated thru
Solder plated circuit area
Cat No. 1616 Kit \$ 90.00
Cat No. 1615 A&T \$105.00

#### Model 252OA S-100 Extender/ **Terminator**

- ination All power lines fused for pro-
- All S-100 lines labeled and
- Can be used as an extender d/or terminato
- and/or terminator Solder mask both sides of
- Silkscreened reference desig-
- Gold plated fingers

#### Model 7811A Apple II Arithmetic **Processor**

- Based on AMD AM9511 de-
- Fixed point 16 and 32 bit op

- eration Floating point 32 bit operation Binary data formats Add, subtract, multiply, and divide Trigonometric and inverse tri-
- nometric functions gonometric functions Square roots, logarithms, ex-
- ponentiation Float to fixed and fixed to float
- Stack oriented operand stor-

- age
  Programmed IIO data transfer
  End signal selectable interrupt
  Supports interrupt daisy chain
  Allows DMA daisy chain
  Power down ROM
  256 bytes firmware (ROM) or
  software (RAM) space available.
- \$375.00 Cat No. 1635

# Model 7114A Apple II **Prom Module**

The 7114A PROM MODULE permits the addition or replacement of the Apple II firmware without the physical removal of the Apple II ROMS. This allows software/firmware replacement, change, and/or patch to be made on a ROM or BYTE BASIS. An on-board enable/disable toggle switch is also available.

- BYTE oriented program over-
- Selectable prom overlay

- Selectable prom overlay
  Power down of PROMS

  14K PROM space available
  Uses +5 volt 2716 type proms
  Allows use of DMA/interrupt daisy chains
  Cat No. 1631

  A&T

  \$ 72.00

Model 2016B

# **16K Static** Memory

- Fully static operation Uses 2114 type static rams +8 VDC input at less than 2
- Bank select available by hank port and bank byte
  Phantom line capability
  Addressable in 4K blocks in 4K
- Addressable in 4K blocks in 4K increments
   4K blocks can be located anywhere within 64K bank
   May be used as a 4K, 8K, 12K or 16K memory board
   Led indicators for board/bank active indication both sides of
- mask on both sides of
- Silk screen with part and refer-
- ence designation Available fully assembled and tested, as a kit, or as a bare

hoard
Cat No.1601A Kit 450ns \$285.00
Cat No.1601B Kit 200ns \$340.00
Cat No.1602A A&T 450ns \$330.00
Cat No.1602B A&T 200ns \$385.00

# Model 7470A Apple II

# 3¾ Digit BCD A/D Converter

The 7470 allows conversion of a DC voltage to a BCD number for computer monitoring and analy-sis. Typical inputs would be DC inputs from temperature or pressure transducers.

- Selectable interrupt on end of
- conversion

  200,LS per conversion

  -4 to +4 VDC full scale

  Plus or minus .05% nonlinear-
- ity
   Plus or minus 1 count quanti-
- zation Correctible offset error
- Temperature coefficient ad-
- Calibration adjustment
- Input offset adjustment
  Floating inputs
  Overange and sign indicators
  Input filter
- Power down ROM
- Supports interrupt daisy chain Allows DMA daisy chain 256 byte firmware (ROM) or software (RAM) space avail-

anie Cat No. 1621 Kit \$115.00 Cat No. 1622 A&T \$135.00

# Model 2200A

- Mainframe

  5-100 compatible
  Industrial/commercial quality
  construction
  Flip-top cover
  Excellent cooling capability
  12 slot capability tuses model
  2501A)
  Input 105, 115, or 125 VAC
  Output +8 VDC, 20A + 16
  VDC 4A
  Active termination of all bus

- Active termination of all hus
- Fan and circuit breaker includ-Rugged construction
- All parts available separately Cat No. 1612 Kit \$330.00 Cat No. 1614 A&T \$375.00

# Model 7440A Apple II

- **Programmable** Timer Module Flexible external interface patch area for custom inter-
- face applications
  Selectable prescaler on timer
  3 capable of 4mhz input
  Programmable interrupts
  Readable down counter indic-
- ates counts to go to time-out
   Selectable gating for frequency or pulse width comparison
   Three asynchronous external
- clock and gate/trigger inputs internally synchronized
- mernally synchronized

  Three maskable outputs to
  patch area

  Power down ROM

  Supports interrupt daisy chain
  Allows DMA daisy chain
  256 byte firmware (ROM) or
  software (RAM) space available

#### Apple II Model 7712A Synchronous

# Serial Interface

- operation

   DTE type configuration

   Failsafe RS-232C operation

  14 STD CLK rates 50-19.2K

  BAUD plus EXT CLK

  BAUD plus EXT CLK BAUD rates dip switch select
- able All BAUD rates crystal con-
- Programmable interrupts from transmitter, receiver, and error
- detection logic Character SYNC by one or two SYNC codes
- Programmable SYNC code register
- Standard synchronous signaling rate per RS-269/ANSI X3.1-1976
- Peripheral/modem control Three bytes of fifo buffering on both transmit and receive

- on both transmit and receive date 7.8, or 9 bit transmission Optional odd, even, or no par-ity hit Parity, overrun, and overflow status checks Power down prom 256 bytes firmware (ROM) or software (RAM) space awail-able
- Supports interrupt daisy chain
  Allows DMA daisy chain

Cat No. 1627 Kit

#### Apple II Model 7710A Asynchronous Serial Interface

- Parity, overrun, and framing error check
  Optional divide by 16 clock
- False start bit detection
- Data double buffered
- Data double buttered
  One or two stop bit operation
  Power down PROM
  256 bytes firmware (ROM) or
  software (RAM) space available
- able
  Supports interrupt daisy chain
  Allows DMA daisy chain
  134.5 BAUD available for selectric interface
  Conforms to RS-232C (configuration A thru E)
  Supports half or full duplex
  operation
- operation DCR type interface
   Failsafe R5-232C operation
   14 STD CLK rates 50-19.2K
  BAUD plus EXT CLK
- BAUD rates dip switch selec-
- table
  All BAUD rates crystal controlled except EXT
  8 and 9 bit transmission
- · Optional even, odd, and no parity bit Programmable control regis-

Cat No. 1624 A&T \$145.00 Cat No. 1623 Kit \$ 90.00

### Model 772OA II elaaA **Parallel**

# Interface

- Two bi-directional 8 bit buses for interface to peripherals Tow programmable
- registers Two programmable data dir-ection registers
- Four individually controlled interrupt input lines; two use-able as peripheral control out-
- Handshake control logic for input and output peripheral operation
- High impedance 3 state and direct transistor drive pheri-

- direct transistor drive pheripheral lines
  Programmable interrupts
  CMOS drive capability on side
  A peripheral lines
  2 TTL drive capability on all A
  and B side buffers
  Power down ROM
  Supports interrupt daisy chain
  Allows DMA daisy chain
  Allows DMA daisy chain
  some capability of the composition of th

# Model 7500A Apple II

Wire Wrap **Board** The 7500A is used for the prototyping or building of unique circuits for the Apple II

- · All bus signals labeled on
- Perimeter ground
   Size: 7 inch long x 2.75 inch high
   All holes plated thru

• Gold plated conector fingers Cat No. 1606 \$ 19.00 Model 7510A

#### Apple II Solder Board

The 7510A is the same as the 7500A except it is designed for soldering of circuits.

#### Cat No. 1607 Model 7590A Apple II

**Etch Board** The 7590A is a two sided copper board which allows the actual etching of circuits for use in the Apple II computer. Cat No. 1608

> Model 752OA Apple II **Extender**

**Board** The 7520A is a handy tool when debugging or testing modules in the Apple II.

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Features cost/value summary, reports, recorder search, index, detailed report, read and write file, data base change. Cat No. 1038 TRS-80 L2, 16K

\$19.95

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Better than TRSDOS! Allows DIR while in basic, and then returning to basic, DIRCHECK, DISASSEM, EDTASM, and SUPERZAP! A must for disk owners! Cat No. 1549TRS-80, L2+ disk\$99

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A pet version of Star Trek, with optional sound effects. Superb graphics! Exciting! PET, 8K. Cat No. 1564 \$7.95

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Software driven RS232 output port for printers. Installs in seconds.

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RSM-2. Monitor and disassembler, interract directly with the Z80.

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An arcade-type real time game of target practice. Excellent Graphics TRS-80 | 1/12 4K Cat No. 1186 \$14.95

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Organizes and protects your data files! 5 4" disks fit two per insert, 8" fit one per insert. Binders in-cludes 10 inserts.

Cat No. Description 1450 5¼" binder 1651 8" binder 1653 extra 8" inserts 1652 extra 5"4" inserts

# 8K PET \$750

With huilt-in cassette

16K PET \$965 Large keyboard, plus numeric keypad. Cat No. 1824

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Standard keyboard, no graphics keys. Cat No. 1825

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Cat No.1773 S-100 Expansion S329
Cat No.1903 Pac 90
Cat No.1775 Word processing pac 90
Cat No.1776 Dual Disk 1825

## COMPUCOLOR 8K RAM 72KEY

\$1485 16K RAM, 72 KEY

#### \$1680 Cat No. 1866

**32K RAM, 72 KEY** S2280 Cat No.1867

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Cat No.1992 8232 addres \$147

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Certified specifically for personal computers such as the TRS-80, Apple, Pet, etc. Splice-free, leaderless, with folding recording tabs. Cat No. 1945

# TIL305

# DOT MATRIX **READOUTS**

\$5.50 4 for \$20

Pin-for-pin equal to MAN2A. Red LED, 5 x 7 matrix, plus decimal. 3" char. Cat No. 1931

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Allows level 2 tapes to he converted to disk, and executed directly from TRSDOS. TRS-80, L2, 16-48K w/disk.

## 8080/TRS-80

# **EDITOR ASSEMBLER**

Lets you create, assemble, execute, and debug using 8080 mnemonics. TRS-80, L2, 16K 8080 Cat No. 1188

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The famous word processor for the TRS-80 L1/L2 16K Cat No. 1338 \$95 L2 diskette version Cat No. 1338D \$145

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You and dummy play against the computer in regular contract bridge. Either you or comp sets

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Graphic Chessboard with 3 levels of play. TRS-80 L1/L2, 4K Cat No. 1182 \$19.95

Apple II Cat No. 1183 \$19.95

#### TPS-80 LITH ITY I

Duplik, duplicates basic, assembly, and machine language programs, copies level 1 onto level 2. Renum, for renumbering hasic programs. Cat No. 1983 TRS-80 L2, 16K \$7.95

#### TRS-80 UTILITY 2

CFETCH searches tapes for file manes, merges programs with consecutive line numbers. CWRITE combines subroutines, basic or machine language. Cat No. 1984 TRS-80 L2, 16K \$7.95

#### MICRO TEXT EDITOR

Full text editing, economical, features non-destructable cursor. Machine language, uses 3K ram. TRS-80, L2, 4K w/printer. Cat No. 1049 \$9.95

#### TRS-80 CP/M

Allows software interchange with all other CP/M programs. 6 com-mands plus utilities. TRS-40, L2, 16K w/disk. Cat No. 1679 \$149.95

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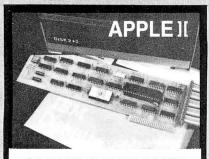
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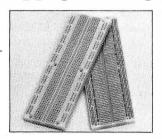
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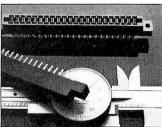
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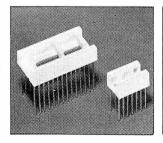
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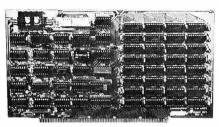
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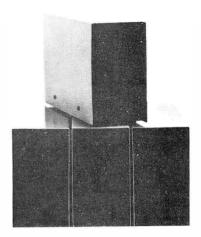
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The analyzer comprises a single circuit board, which installs in about 5 minutes inside the PET. It has 31 one-third octave filters, detectors, an analog-todigital converter, a 1 K byte read-only memory which contains machine language routines, and the necessary peripheral circuitry for transferring data into the PET memory. The board draws its power from the PET transformer.

The cost of the analyzer is \$595. For further information, contact Eventide Clockworks Inc, 265 W 54th St, New York NY 10019

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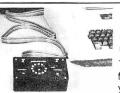
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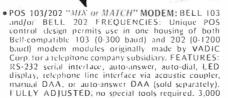
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LM339N 99 LM340K-5 1.35 LM340K-6 1.35	NE565N/H 1.25 NE566CN 1.75 NE567V/H .99	75493N 89 75494CN 89 RC4135 1.25	ASST. 2 5 ea 180 0HM 220 0HM 270 0H -170 0HM 500 0HM 880 0H ASST. 3 5 ea 1.2k 1.5k 1.8k	M 820 0 M 18 4 75	220 pf 05 .04 470 of .05 .04 180 VOL	.03 .047µF .06 .05 .04 .035 .1µF .12 .09 .075 T MYLAR FILM CAPACITORS
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74LS00 29 74LS01 29 74LS02 29	74LS00TTL 74LS47 89	74LS138 89 74LS139 89 74LS151 89	ASST. 5 5 ea 56n 66 82k	39K 47K 100K 1/49K <b>50 PCS 1.75</b>	+20% DIPPED .1/35V .28 .23 .15/35V .28 .23	FANTALUMS (SOLID) CAPACITORS
74LS03 29 74LS04 35 74LS05 35	74LS51 29 74LS54 28 74LS55 29	74LS155 89 74LS157 89 74LS160 1.15	ASST. 6 5 ea 39(* :70*, 560).  1M 1,2M 1.5M	270k 336k 680k 820k 50 PCS 1.75 1.8M 2.2M	22/35V 28 23 .33/35V .28 .23 .47/35V .28 .23 .68/35V .28 .23	17 4.7/25V .33 .28 .23 17 6.8/25V .49 .45 .35
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# **Transistor Checker**



- Completely Assembled -- Battery Operated -

Battery Operated —

Battery Operated —

The ASI Transistor Checker is capable of checking a wide range of transistor types, either "in circuit" or out of circuit. To operate, simply plug the transistor to be checked into the front panel socket, or connect it with the alligator clip test leads provided. The unit safely and automatically identifies low, medium and high-power PNP and NPN transistors. Size: 3% x 6% x 2" "C" cell battery not included.

C" Cell battery not included.

Son SALE!

Trans-Check \$19.95 ea.

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# HEW NEW **DB 25 Series Cables**

Part No.	Cable Length	Connectors	Price
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	Dip J	umpers	
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DJ16-1	1 ft.	1-16 Pin	1.79 ea.
DJ24-1	1 ft.	1-24 Pin	2.79 ea.
DJ14-1-14	1 ft.	2-14 Pin	2.79 ea.
DJ16-1-16	1 ft.	2-16 Pin	3.19 ea.
DJ24-1-24	1 ft.	2-24 Pin	4.95 ea.
For Custom Ca	ables & Jumpers, S	ee JAMECO 1979	Catalog for Pricin



### CONNECTORS 25 Pin-D Subminiature

DB25P (as pictured) PLUG (Meets RS232) DR255 SOCKET (Meets BS232) DB51226-1 Cable Cover for DB25P or DB25S

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# 4-Digit Clock Kit \* Bright .357" ht. red display \* Sequential flashing colon

- Jequential flashing colon
  12 or 24 hour operation
  Extruded aluminum case (black)
  Pressure switches for hours, minutes & hold functions
  Includes all components, case and wall transformer
  Size: 34 x 14 x 14

JE730 ..... \$14.95

### Jumbo 6-Digit Clock Kit

- \* Four .630"ht, and two .300"ht.
- Four .630"ht, and two .300"ht, common anode displays
  Uses MM5314 clock chip
  Switches for hours, minutes and hold functions
  Hours easily viewable to 30 feet
  Simulated walnut case
- 115VAC operation
- 12 or 24 hour operation
- Includes all components, case and wall transformer Size: 6¾ x 3¼ x 1¾

# JE747 ..... \$29.95



- •Bright .300 ht. comm. cath-ode display
  Uses MM5314 clock chip
  •Switches for hours, minutes
  and hold modes
  •Hrs. easily viewable to 20 ft.
  •Simulated walnut case
  •115 VAC operation
  •12 or 24 hr. operation
- •115 VAC operation •12 or 24 hr, operation •Incl. all components, case & wall transformer •Size: 6%" x 3-1/8" x 1%"

# **JE701**

# 6-Digit Clock Kit \$19.95

### REMOTE CONTROL TRANSMITTER & RECEIVER



#### Digital Stopwatch Kit

- Use Intersit 7205 Chip
- Plated thru double-sided P.C. Board
- Times to 59 min. 59.59 sec, with auto reset
  @uartz crystal controlled
  Three stopwatches in one: single event, split
  (cumulative) & taylor (sequential timing)
  Uses 3 penlite batteries
  Size: 4.5" x 2.15" x .30"

JE900 \$39.95

Jamesa

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#### JE600 HEXADECIMAL ENCODER KIT



# FEATURES:

- Full 8 bit latched output for micro-processor use
   3 User Define keys with one being bi-stable Operation
   Oebounce circuit provided for all 19
- keys LED readout to verify entries Easy interfacing with standard 16 pin

10 connector

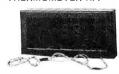
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FULL 8 BIT LATCHED OUTPUT—19 KEYBOARD

ne JERODEncoder Keyboard provides two separate headecima
gits produced from sequential key entires to allow direct prog
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Jaditional keys are provided for user operations with nonenaving able outputavailable. The outputsare latched and monitored LEO leadouts. Also included is a key entry strobe.

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\*Dual sensors—switching control for in-door/outdoor or dual monitoring sensors of the sensors of the sensors 'Anape: -40°F to 199°F / -40°C to 100°C 'Accuracy: ±1° nominal 'Set for Fahrenheit or Celsius reading 'Sim. wahut case -AC wall adapter incl. 'Size: 3.14°H xhc5/8° Wx1-3/8°D

JE300 ......\$39.95

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## FEATURES:

- 60 Keys generate the full 128 characters, upper and lower case ASCII set
- Fully buffered
- Fully buffered
  2 user-define keys provided for custom applications
  Caps lock for upper case only alpha characters
  Utilizes a 2376 (40 pin) encoder read only memory chip
  Outputs directly compatible with TTL/DTL or MOS logic arrays
  Easy interfacing with a 16-pin dip or 18-pin edge connector

JE610 .... \$79.95

62-Key Keyboard only . . \$34.95

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# 5V-1 AMP



- \*Heat sink provided \*PC Board construction
- \*Provides a solid 1 amp @5 volts \*Can supply up to ±5V, ±9V and ±12V with JE205 Adapter \*Includes components, hardware & instructions

JE200 \$14.95 \*Size: 3%"x5"x2"H

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selectable).
Maximum Data Rate300 Baud.
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Receive Channel Frequencles 2025 Hz for space; 2225 Hz for mark
Transmit Channel Frequencies Switch selectable: Low (normal) = 1070 space, 1270 mark; High = 025 space, 2225 mark.
Receive Sensilivity 46 dbm accoustically coupled.
Transmit Level
Receive Frequency ToleranceFrequency reference automatically adjusts to allowfor operation between 1800 Hz and 2400 Hz.
Olgilai Data InlerfaceEIA RS-232C or 20 mA current loop (receiver is optoisolated and non-polar).
Power Requirements120 VAC. single phase, 10 Watts
Physical
Requires a VOM, Audio Oscillator, Frequency Counter and/or Oscilloscope to align.

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Expand your 4K TRS-80 System to 16K. Kit comes complete with:

- 8 each UPD416-1 (16K Dynamic Rams) 250NS
- \* Documentation for conversion

TRS-16K

\$75.00

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\$14.95 (Case and 6 Cassettes)

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UHF Channel 33 TV Interface Unit Kit



Wide Band B/W or Color System
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(UHF).
★ Includes coaxial cable and antenna transformer.

**MOD II** \$29.95 Kit



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   Compete with holding tray for 4 chips

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- 2 each 100K pots (Linear Taper)
- Printed Circuit Board Mount
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BYTE November 1979



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Huntsville	Tucker Bros. Industrial Electronic Supply Lafayette Radio Electronics
Mobile	Lafayette Radio Electronics
ALASKA	
Anchorage	The Electronic Company
Anchorage	TV Mart
ARIZONA Flagstaff	lim's Audio & Steren Renair
Sierra Vista	Jim's Audio & Stereo Repair B & S Electronics
Yuma	Yuma Electronics
CALIFORNIA	
Ana heim	Heathkit Electronic Center Radio Mart
Antioch Azusa	Aman Floatsonias
Bellflower	Farl's Hobby Shop
Berkeley	Al Lasher Electronics
Brea	Century Electronics
Buena Park Chula Vista	Earl's Hobby Shop Al Lasher Electronics Century Electronics Ford Electronics Lion Electronics SCR Electronics
Chula Vista	Lion Electronics
Cypress Davis	Odvesev
El Monte	Odyssey Kimball & Stark
Fontana	Fontana Electronics
Fresno	Fontana Electronics Sparky Electronics
Fullerton	Orvac Electronics Inc. Eagle Electronics
Glendale	Eagle Electronics
Harbor City Hawaiian Gardens	Buff's Electronics Carson Electronics
Lancaster	Consumer Electronics Scott Radio Supply Inc. Tower Electronics Corp. Computer Magic
Long Beach Mission Viejo	Scott Radio Supply Inc.
Mission Viejo	Tower Electronics Corp.
Modesto	Computer Magic
Modesto	Pacific Radio Zackit
Monteréy Morro Bay	Morro Ray Flectronics
National City	Willy's Electronics
Oceanside	Morro Bay Electronics Willy's Electronic Center Radio Shack A.S. C. Palmdale U.S. Electronics Zack Electronics
Palmdale	Radio Shack A.S. C. Palmdale
Palo Alto	U.S. Electronics
Palo Alto	Zack Electronics
Pasadena Paso Robles	Mission Flactronics
Poway	Dow Radio Inc. Mission Electronics Conway Electronics Radio Mart
Redding	Radio Mart
Riverside	Computer Center Heathkit Electronic Center
Sacramento	Heathkit Electronic Center
Sacramento Sacramento	The Radio Place Zackit
Salinas	Salinas Radio
San Carlos	J & H Outlet Store
San Carlos San Diego	J & H Outlet Store Radio Shack A.S. C. Mira Mesa
San Diego San Fernando San Francisco	Byte Shop
San Fernando	San Fernando Electronics Zack Electronics
San Jose Pe	ninsula Electronic Supply Inc
San Jose	ninsula Electronic Supply Inc. Ouement Electronics United Radio & TV Supply Mid State Electronic Supply
San Jose	United Radio & TV Supply
San Luis Obispo	Mid-State Electronic Supply
San maraer	Electronics Plus Quality Electronics Lombard Electronics
Santa Ana Santa Barbara	Quality Electronics
Santa Clara	Olson Flectronics
Santa Cruz	Olson Electronics Santa Cruz Electronics
Santa Cruz Santa Maria	Cap's Communications Mission Control
Santa Monica	Mission Control
Santa Rosa South Lake Taho	Electronics Inc.
Suisun City	e CalPine Electronics Byte Shop
Sunnyvale	Sunnyvale Electronics
Torrance	Sunnyvale Electronics SE Electronics Torrance Electronics
Torrance	Torrance Electronics
Vacaville	D.C. Electronics Zackit
Vallejo Van <b>N</b> uys	Zackit
Van Nuys Ventura	Thrifty Electronics Supply Inc. Lombard's Electronics Inc. MicroSun Computer Center
Walnut Creek	MicroSun Computer Center
West Sacramento	Lane Enterprises  JK Electronics  D & S Electronics
Westminster	JK Electronics
Whittier	D & S Electronics
Whittier	Whittier Electronics Company
COLORADO	A 51
Aurora Colorado Springs	Aurora Electronics Centennial Electronics Inc. Amptec Inc.
Denver	Amptec Inc
Denver	Mt. Coin Distributing Co. The Computer Shop
Durango	The Computer Shop
Steamboat Spring	s Norm's TV & Electronics

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GEORGIA	microcompoter Systems
Atlanta	Atlanta ComputerMart
Atlanta	CompuShop
Columbus Stone Mountain	Radio Wholesale Coleman's Electronics
HAWAII	
Aiea	Detcoms Hawaii
Honolulu IDAHO	Integrated Circuit Supply
Boise	Custom Electronics
Caldwell	Custom Electronics A-Gem Supply Inc.
ILLINOIS Carbondale	17-7-117-11
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Groveland	Moyer Electronics
Morton Grove	CompuShop
Mount Prospect Niles	Tri-State Electronic Corp. Computer Land B-N Computer Works
Normal	B-N Computer Works
Oak Park	Spectronics Inc.
Peoria Peoria	Computer Land of Peoria Warren Radio Co.
Robinson	Radio Shack
Rockford	Computer Store of Rockford
Schaumberg	Computer Store of Rockford Data Domain of Schaumberg
Skokie Villa Park	Lilipute Computer Melvin Electronics
INDIANA	WEIVIN Electronics
East Chicago	Acro Electronics Corp.
Evansville	Hutch & Son Inc.
Gary	Calumet Electronic Supply Meade Electronics
Munster IOWA	
Clinton Bridg	ge Electronics Computer Center
Davenport Dos Mairos	Memory Bank Gifford Brown Incorporated
Des Moines Des Moines	Radio Trade Supply Co
Indianola	Radio Trade Supply Co. Electronix Limited
KANSAS	
Kansas City Salina	Electronic Surplus Sales Electronics Inc.
Wichita	Amateur Radio Equipment Co.
KENTUCKY	
Lexington	Radio Electronic Supply Co.
Louisville Pee	erless Electronic Equipment Co.
Baton Rouge	Davis Electronics Supply Co.
Baton Rouge Baton Rouge Baton Rouge	Menard Electronics Inc. Pelican Electronics
Houma	Polican Electronics
Lake Charles	Wholesale Radio & Equipment
Metairie	rencan Electronics
New Orleans MA RY LAND	Wm. B. Allen Supply Co.
Annapolis	J & M Electronics Inc.
Baltimore Co	omputer Workshop of Baltimore Everything Electronic
Baltimore	Everything Electronic
Baltimore Baltimore	Harco Electronics Tritronics Inc.
Churchville	Churchville Electronics
Damascus	Damascus CB
Frederick Frederick Frederick	ederick Computer Products Inc.
La Vale	J & M Electronics
Rockville	Computer Workshop
Rockville	Heathkit Electronic Center
Silver Spring Towson	Computers Etc. Baynesville Electronic Inc.
Towson	Computers, Etc.
Towson MACCACHUCE	Heathkit Electronic Center
Fitchburg	RM Electronics Inc.  Tuf ts Electronics; Electronics Supply Center
Medford	Tuf ts Electronics:
North Adams	
Peabody Pit tsfield	Heathkit Electronic Center Pittsfield Radio Co. Inc.
Waltham	Computer Mart Inc.
Wellesley	Heathkit Electronic Center
Worcester	RM Electronics Inc.
MICHIGAN Adrian	E & B Electronics Inc.
	vay Electronic Communications
Ann Arbor	Eric Electronics
Ann Arbor Canton	Wedemeyer Electronic Supply The Electronic Connection
	Radio Supply & Engineering Co.
	Heathkit Electronic Center
Clawson I Detroit	Healinkit Electronic Center
Clawson I Detroit	Heathkit Electronic Center
Clawson I Detroit East Detroit East Lansing	Heathkit Electronic Center Eric Electronics
Clawson I Detroit	Heathkit Electronic Center Eric Electronics Hobby Electronic Center
Clawson Detroit East Detroit East Lansing Flint Garden City Grand Rapids	Heathkit Electronic Center Eric Electronics Hobby Electronic Center Computer Center Micro Computer World
Clawson Detroit East Detroit East Lansing Flint Garden City Grand Rapids Grand Rapids	Heathkit Electronic Center Eric Electronics Hobby Electronic Center Computer Center Micro Computer World Radio Parts Inc.
Clawson Detroit East Detroit East Lansing Flint Garden City Grand Rapids Grand Rapids Jackson	Heathkit Electronic Center Eric Electronics Hobby Electronic Center Computer Center Micro Computer World Radio Parts Inc.
Clawson Detroit East Detroit East Lansing Flint Garden City Grand Rapids Grand Rapids Jackson Lansing Livonia	Heathkit Electronic Center Eric Electronics Hobby Electronic Center Computer Center Micro Computer World

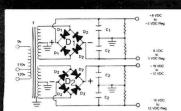
MICHIGAN (Co	ntinued)
Muskegon	H. R. Electronics
Niles Oak Park	Niles Radio Supply Eric Electronics
Pontiac	Electronic Supply
Port Huron	Main TV Radio Electronics Inc.
Saginaw Sterling Heights	Electronic Mart Eric Electronics
Traverse City	Traverse City Electronic Supply
Duluth 1	Northwest Radio of Duluth Inc.
Hopkins	Heathkit Electronic Center
Minneapolis	Pal Electronics
St. Paul Winona	Heathkit Electronic Center Hiawatha Electronics Inc.
MISSOURI	HE I
Bridgeton El Dorado Spring	Forsythe Computers Beckman Electronics
Florissant	Computer Country
Kansas City	Computer Workshop Computer Country
St. Louis MONTANA	Compoter Country
Billings	Conley Radio Supply lectronic Service & Distributing
Bozeman E Great Falls	Arts Electronics
NEBRASKA	And Electronics
Lincoln	Altair Computer Center Scott Electronic Supply
Lincoln North Platte	Scott Electronic Supply
Omaha	Scott Electronic Supply Heathkit Electronic Center
Omahe NEVADA	Omaha Computer Store
Las Vegas	Century 23
NEW JERSEY	Outlin Charle Assessing Course
Bricktown Cherry Hill	Radio Shack Associate Store The Computer Emporium
Fair Lawn	The Computer Emporium Heathkit Electronic Center
Ocean Patterson	Heathkit Electronic Center All-Tronics
Pennsauken	Lafayette Radio
Pompton Lakes Ramsey	Computer Corner
Vineland	Typetronic Computer Store Lafayette Radio Electronics
NEW MEXICO	
Farmington Las Cruces	Micro-Computer Service Mannie's Electronic
NEW YORK	1-
Albany	Fort Orange Electronics Greylock Electronics Radio Equipment Corp.
Albuny Buffalo	Radio Equipment Corp.
Endwell	Computer I ree Inc.
Jericho Kingston	Heathkit Electronic Center Greylock Electronics
Jamestown New York	Warren Radio
New York Poughkeepsie	Manhattan Electronics Corp. Greylock Electronics
North White Pla	ins Heathkit Electronic Center
Rensselaer	Com Tech Electronics
Rochester Troy	Heathkit Electronic Center Trojan Electronics
Utica	Am-Com Electronics
Vestal White Plains	Harvey Electronics The Computer Corner
NORTH CARO	
Boone	Alpha Digital Systems
Durham Greensboro	Futureworld By te Shop
Greenville	Pair Electronics
Releigh NORTH DAKO	Byte Shop of Raleigh
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Cincinnati Columbus	Heathkit Electronic Center Heathkit Electronic Center
Reynoldsburg	Universal Amateur Radio Amateur Electronic Supply
Wickliffe Youngstown	Amateur Electronic Supply Ross Radio Company
OKLAHOMA	
Oklahoma City Oklahoma City	Bits, Bytes & Micros Heathkit Electronic Center
Oklahoma City	Trice Wholesale Electronics
Tulsa	Trice Wholesale Electronics High Technology
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Medford	Portland Radio Supply
Ontario Portland	Miller Electronics Portland Radio Supply
Salem	Computer Pathways
PENNSYLVAN Braddock	Leff Electronics
Chembersburg	Sunrise Electronic Distributing Kass Electronics Distributors
Drexel Hill	Kass Electronics Distributors
Drums Erie	Mr. D's Digital Electronics Warren Radio
Hershey	Microcomputer Systems Inc.
Murrysville (	Computer Workshop of Pittsburg

		VIA (Continued)
cs	Philadelphia	Heathkit Electronic Center
ly cs	Philadelphia Phoenixville	Resco Electronics Stevens Electronics
ly	Pittsburgh	Heathkit Electronic Center
c.	Pittsburgh	Tydings Company
rt	Wilkes Barre	Hamline Electronics
cs Iy	York RHODE ISLA	G. Y.C. Company
,,	Cranston	Jabbour Electronics City
c.	Pawtucket	Jabbour Electronics City
er	Warwick	Heathkit Electronic Center
er	TENNESSEE Clarksville	Masstronics
c.	Chattanooga	William's Data Comp Division
	Coo ke ville	Wagnon's Stereo Center
rs cs	Nashville Knoxville	Electra Distributing Co. Shields Electronics Supply Inc.
ry	Memphis	Bluff City Electronics
p	Memphis	Sere-Rose & Spencer Electronics
ry	Memphis Nashville	Warren Radio Company Eddie Warner's Parts Company
ly	Oakridge	National Electronics
ng	TEXAS	
cs	Beaumont	Electro-Hut
er	Dallas Dallas	CompuShop Heathkit Electronic Center
ly	Dallas	Ram Micro Systems
ly	Houston	CompuShop
er	Houston	Interactive Computers
re	McAllen McAllen	Broadway Electronics Carlos Franco Electronics
23	San Antonio	Appliance & Equipment Co.
	San Antonio	Sherman Electronics Supply Inc.
re m	UTAH Midvale	Heathkit Electronic Center
er	Provo	Alpine Electronic Supply Co.
er	Salt Lake City	Best Distributing
cs	Salt Lake City	Computerland of Salt Lake
io er	VERMONT Essex Junction	Lafayette Radio
re	VIRGINIA	20.0,0110.1100.10
cs	Alexandria	Computer Hardware Store
ce	Alexandria Alexandria	Computers Plus Inc. Heathkit Electronic Center
ic	Arlington	Arlington Electronic Wholesalers
	Blacksburg	Scotty's Radio & TV Inc.
cs	Charlottesville	Graves Electronics
cs p.	Colonial Heigh Falls Church	nts Southside Radio Comm. Crossroad Electronics
C.	Hampton	Electronic Sales Inc.
er	McLean	Tyson's Computer Emporium
io	Norfolk Norfolk	Avec Electronics Corp. Priest Electronics
р.	Portsmouth	Electronics Unlimited
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er	Richmond Roanoke	Computers-To-Go The Computer Place Inc.
er	Springfield C	omputer Workshop of N. Virginia
CS	Virginia Beach	Heathkit Electronic Center
cs	WASHINGTO	N ABC Communications
er	Everett	ABC Communications
	Kennewick	C & J Electronics Inc.
ns	Longview	Progress Electronics
ld op	Moses Lake Pasco	Ron's Electronics Riverview Electronics
cs	Richland	C & J Electronics
gh	Seattle	ABC Communications
-14	Seattle	Amateur Radio Supply
cs	Seattle Seattle	C-Com Empire Electronics
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er	Morgantown	The Computer Corner
io	Morgantown	Electro Distributing Co. Inc.
ny	Wheeling WISCONSIN	Lafayette Radio Assoc. Store
· Y	West Allis	Olson Electronics
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ter	Alberta:	C
cs gy	(Calgary) (Calgary)	CompuShop Alberta Ltd. The Computer Shop
	British Columi	bia:
es	(Prince George	) Elwest Technical Services Ltd.
cs	(Vancouver)	CompuShop
iks	Ontario (Toro Ontario (Willo	nto) House of Computers wdale) Home Computer Centre
ly	Ouebec (Mont	real) Wang's Microcenter
ly	ENGLAND	
cs	Berkshire	NewBear Computing Store
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	Panama City	Redigetec, S.A.
ics	Panama City	Sonitel, S.A.
ng	Panama City	Tropelco, S.A. Applied Digital System
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T <sub>1</sub> T <sub>2</sub>	1 2	0V, 110V, 120V 0V, 110V, 120V	2×7.5A 2×12.5A	2×2.5A 2×3.5A		3¾"×3½"×3½" 3¾"×4¾"×3½"	19.95 25.95
T3 T4	3 4	0V, 110V, 120V 0V, 110V, 120V	2×9A 2×4.5A	2×2.5A	2×2.5A 2×4.5A	3¾"×4¾"×3½" 3¾"×3½"×3½"	27.95 19.95

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ITEM	USED FOR	@+8 Vdc	@-8 Vdc	@+16 Vdc	@-16 Vdc	@+28 Vdc	SIZE $W \times D \times H$	UNIT PRICE	
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KIT 2	SYSTEM SOURCE	25A		3A	3A	()	12"×6"×4¾"	54.95	
KIT 3	DISC SYSTEM	18A	1A	2A	2A	4A	14"×6"×41/8"	62.95	
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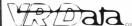
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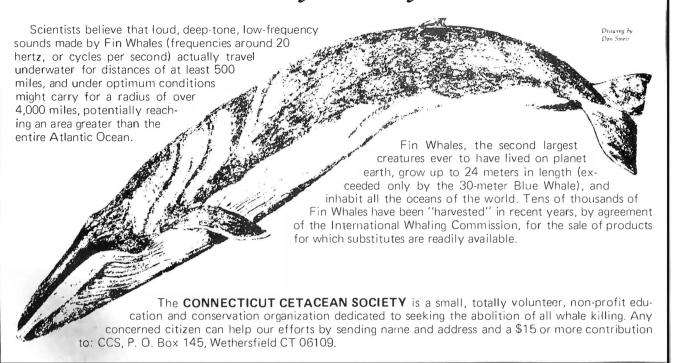
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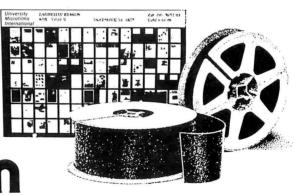
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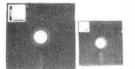
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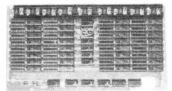
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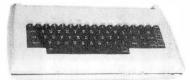
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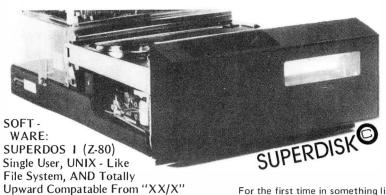


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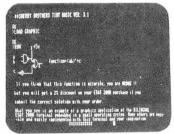
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Electrolabs' new operating system for the Z-80 designed to have exactly the appearance of UNIX\*\*, including virtual I/O, "set TTY", a tree and a shell, filters and pipes PLUS total compatability with CP/M software!

(Because OS-1 is truly a comprehensive "OS", and not merely a file handling
"DOS", we have changed the name
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VIRTUAL I/O - copy with a single command between floppy and hard disk, or from TTY to printer to tape to disk... etc., etc. No messy I/O routines to write, & no awkward transfers. SECURITY - 9 modes of file protection, user and login protection. MULTI-USER - up to 256 passwords. (non-simultaneous users) 16MBy FILE SIZE - but no limit to no. of directories per device, thus allowing EASY implementation of gigantic storage devices. "SET TTY" - for printer or crt: tabs, page width, buffer, cursor, UC/LC, fonts, formfeed, arbitrary control characters etc., etc. "LOGIN" - automatically executes user selected programs and "set TTY". OCCUPIES 12KBy - only 50% larger than CP/M, but 500% more features. CP/M & CDOS COMPATABLE - your library is guaranteed to run!

\*(Naturally, we are not giving away the version of CP/M written by Digital Research, Please pardon our pun, but they might object. What we ARE giving you is a greatly enhanced version of CP/M which resides on OS-1, and allows the user of OS-1 to run any and all of his programs, packages or system utilities which are already running on CP/M. We give you the source code at no charge so that you may modify any part of the CP/M to suit your own system requirements. At no charge, you also receive the enhancement allowing 4MBy files instead of 256K.)

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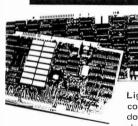
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OPTIONS: 10 MBy hard disk (available now!!!) Extra memory, graphics, etc. Call or write for further details. This is the most advanced microcomputer system available at this time.



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Graphic Presentation - such as computer generated animation & other graphic displays up to 256 colors & up to 256 b&w gray scales, **Image Analysis** — using built-in FRAME GRABBER, for medical image enhancement, contour analysis, & pattern recognition. Commercial TV Tilting & Advertising - using synchronization capability. Interactive graphics - using light pen accessory.

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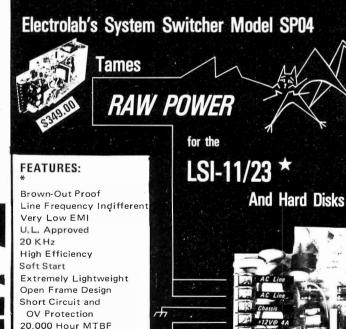
Options - Accessories - Software

Options include: light pen, auxilliary outputs, text mode, memory and much more. Accessories include: b&w and color cameras and monitors, Software: "Plot" 2D or 3D, "Tilting" , "Contour", "Image Enhancement", "Vector Curve Generation".

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74162N 87 74163N 87 74174N 96 74175N 90 74190N 1.15 74192N 87 74193N 85		CD4507 1.00 CD4508 4.25 CD4510 1.02 CD4511 .94 CD4515 2.52 CD4516 1.10	MM5841 MM5865 CT7001 CT7010 CT7015 MM5375AA/N MM5375AG/N	14.45 7.95 5.80 8.95 7.25 4.3.90	18 .57 40 1.23 3 0(gi) Universal Counter Board Kit Operates 5-18 Voti DC to 5 MHz Operates 5-
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6502 based single board with full ASCII keyboard and 20 column thermal printer. 20 char. al-phanumeric display, ROM monitor, fully expandable. \$375.00. 4K version \$450.00. 4K Assembler \$85.00, 8K Basic Interpreter \$100.00 Power supply assy. in case \$60.00. AIM 65 in thin briefcase with power supply \$485.00

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## VISTA V80

**TRS-80** MINI-DISK SYSTEM

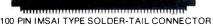


The V80 out-performs standard Radio Shack drives!--23% more storage capacity, 8 times faster access time, more reliable, and much less expensive. Includes disk drive, power supply, regulator board, and case. MSM-358000 \$395.00 Interface cable for V80 WCA-3421 ..... \$24.95

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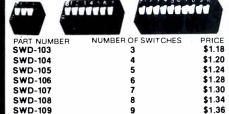


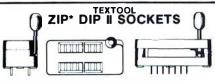
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DB-25S, DB-25P, DB-25 COVER

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10

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CP/M compatible in either single or double density. On-board Z-80 CPU allows universal compatibility. Programmed data transfer. No DMA.

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Our new controller utilizes the IBM standard formats for proven reliability. Data recovery is enhanced through the use of a phase-locked-loop data separation circuit and write precompensation. Single and double density disk drives can

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MANUAL	

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MPI B	51 51/ <sub>4</sub> " [	DRIVE				<b>\$</b> 295.00
Single	or doubl	e dens	ity,	up to 4	0 tracks, t	rack-to-
track	access	time	of	5ms,	Shugart	SA400
compa	atible.					
MOLD	E2 E1/ " I	DDIVE				*450.00

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Double-sided version of MPI B51.	
SHUGART SA400 51/4" DRIVE	\$325.00
Single density, 35 track.	
SIEMENS EDD100 9 9" DDIVE	\$40E 00

Certfied double density Shugart 801R replacement.Runs much cooler and quieter. SIEMENS FDD200-8 8" DRIVE ..... \$575.00

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For a single 51/4" disk drive. PSD-249A	\$52.00
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PSX-030A	\$59.95
For KIM-1 or SYM-1	
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Digital Research has done it again! This new release of their industry standard disk operating system is bound to be an even bigger hit than the original version. All of the fundamental file-size restrictions of release 1 have been eliminated, while maintaining full compatibility with the earlier versions. This new release can be field-configured by the user for a single mini-disk up through a multiple drive hard-disk system with 128 megabyte capacity. Field configuration can be accomplished easily through use of the Macro Library (DISKDEF) provided with CP/M 2.0.

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Up to 198 CPS 1.75 to 9.5 inch adjustable

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Parallel and serial interface.

98 character ASCII set 132 columns- 6 or 8 lines/inch

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Upper and lower case 96 character ASCII set.

5 X 7 dot matrix with software selectable character widths. Ceritronics-type parallel interface.
Interface/cables available for most popular microcomputers.

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## **CENTRONICS 730 PRINTER**

THE ANY-PAPER PRINTER

This printer can use roll paper, fanfold paper, or single sheets because it is equipped with both friction feed and pin feed mechanisms.

RS232 or parallel interface.

96 ASCII character set, upper and lower case. 80 characters per line, 7 X 7 dot matrix.

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SWD-110

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An S 100 single board computer Z 80 CPU with 1024 bytes of RAM 8-32K bytes of PROM Serial I/O port

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#### Solid State Music 1/0 4

2 Serial and 2 Parallel I/O. Ports S 100 with full hand shaking

JADE KIL .											 0		 			\$149.95
Assembled									 							\$199.95
Bare Board																\$29.95

#### PARALLEL/SERIAL INTERFACE

S-100 compatible, 2 serial 1/O ports, 1 parallel I/O

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Everything you need to add 16K of memory to your computer. Your kit comes neatly packaged with easy to follow instructions. In just minutes your computer is ready to tackle more advanced software.

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#### THE NEW Z-80 CPU BOARD FROM JADE

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Expandable to 32K or 64K

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#### SD SYSTEMS

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The ultimate memory-mapped 80 character by 24 line video board, the Vector Graphics FWII has many advanced features: Onboard parallel keyboard port. Power-on jump circuit, 8 X 10 dot character matrix, and the optional ability to program your own characters and/or graphics symbols. this is THE perfect board for text editing systems

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WRAP POST

for .042 dia. holes

A-13 hand installing

T44/C pkg 100 T44/M pkg. 1000

all boards on this page)
44/C pkg 100 \$ 2.34

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5%, 31/2 digit 19 Range DVM. 1/2" LCD displays runs 200 hrs on 1 battery. 10 Meg Ohm Input. 1 yr. guarantee. made in U.S.A., test leads included.

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FREE BATTERY with your meter.

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Spueur 2-de pare 60ceA	MICRO-	

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- 17V pr 15V tr 275win 10°C
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Microcomputer processor

\$17 95 8801-1 Same as 8800V except plain less power

5.9 10.24

#### RS232 & "D" TYPE CONNECTORS

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and

Plun Male S = Socket-Female C = Cover

	S. D. Strade Contractor (St. Company)	P	RICE	
PART NO.	DESCRIPTION	1-4	5.9	10-24
DE-9P	9 Pin Male	1.50	1.30	1.20
DE-9S	9 Pin Female / Illihillihillihillihillih	2.15	2.05	1.95
DE-9C	9 Pin Cover / O HITTITITIO	1.50	1.30	1.15
DA15P	15 Pin Male	2.20	2.00	1.80
DA15S	15 Pin Female MALE	3.20	3.00	2.80
DA15C	15 Pin Cover noodooodningin	1.60	1.45	1.30
DB-25P	25 Pin Male	2.90	2.60	2.50
DB-25S	25 Pin Female	3.75	3.65	3.40
DB51212-1	1 pc. Grey Hood	1.65	1.40	1.20
DB1226-1A	2 pc. Black Hood	1.90	1.60	1.50
DB110963-3	2 pc. Grey Hood	1.80	1.55	1.35
DC37P	37 Pin Male	3.95	3.80	3.60
DC37S	37 Pin Female	5.75	5.50	5.20
DC37C	37 Pin Cover	2.20	1.95	1.75
DD50P	50 Pin Male T FFMALE T	4.95	4.75	4.50
DD50S	50 Pin Female	7.50	7.20	6.90
DD50C	50 Pin Cover	2.50	2.20	2.10
D20418-S	Hardware Set (2 pair)	1.00	.80	.70
0.00	Connector for CENTRONICS 700 SERIES:			

Amphenol 57:30360 for back of Centronics 700 Series printers 1:4 – \$9.00. 5:up – \$7.50



1-4 \$3.50 5-9 \$3.25

S100SE 50/100 Cont 125 ctrs PIERCE 10-24 10-24 \$5.00 5-9 \$4-50

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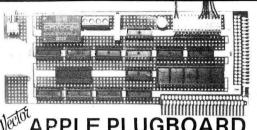
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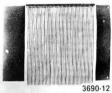
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Card Extender has 100 contacts 50 per side on 125
centers-Attached connector-is compatible with
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ctrs. Extenders \$13.17



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Approx.			
Phenolic		PR	ICE
PART NO.	SIZE	1-9	10.19
64P44XXXP	4.5x6.5"	\$1.56	\$1.40
169P44XXXP	4.5x 17"	\$3.69	\$3.32

LPUXY GIASS			
64P44	4.5x6.5"	\$1.79	\$1.61
84P44	4.5x8.5"	\$2.21	\$1.99
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Add \$3.00 for programming Jumpers

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as used extender and/or

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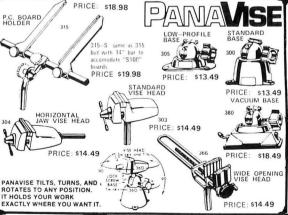
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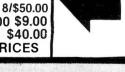
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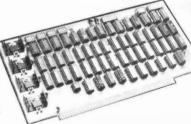
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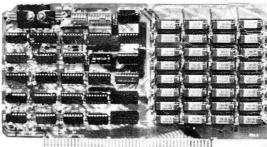
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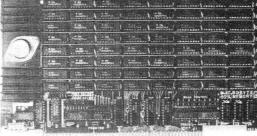
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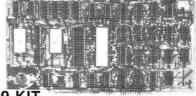
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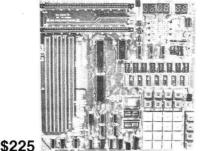
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WANTED: 1802 computer systems and parts. Any condition, any quantity, immediate cash. Prefer RCA systems, but will accept ELF II by Netronics, memory, and support boards. Tom Inskip, 6504 Democracy Blvd, Bethesda MD 20034.

FOR SALE: Teletype ASR33 teletypewriter with papertape reader punch and stand, \$595 and shipping, 32 K slatic programmable memory, four 8 K, S-100 boards factory assembled and tested, \$150 each. I pay postage, Mark Lyon, 6320 Red Prairie Rd, Sheridan OR 97378.

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FOR SALE: TRS-80, 16 K, Level II processor. Perfect working condition. In original carton with cassettes, cables, power pack, manuals, and software. Will include Pixie-Verter to connect to regular TV for \$10 more. Retail price \$690, will sell for \$595 or best offer. I pay freight anywhere in US. Charles Fields, 924 W Washington PI, Broken Arrow OK 74012.

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WANTED: TRS-80 complete and ready to use. Level II with 16 K programmable memory; Level II with 4 K programmable memory; Level I with 16 K programmable memory, or Level I with 4 K programmable memory. I am also interested in Ti-59. Price must be right. S Castiglioni, 2245 Glenwood Rd, Brooklyn NY 11210.

PET OWNERS: Group of three PET owners have 26 game programs. We will trade one for one for other PET programs. Those wishing to trade should send their cassette with programs. Keith Selby, 7205 S Utica Av Apt 1016 Cinnamon Stick Apartments, Tulsa OK 74136.

FOR SALE: Texas Instruments new Ti-59 card programmable calculator with PC-100A printer. Includes aviation library, extra cards, programs, and PPX materials. Almost new. Meticulously maintained. Packed in original cartons. Sent UPS. \$287 total cost. Dave Balmer, POB 325, Union Lake MI 48085, (313) 739-4280 (bus) or 669-9319 (res).

FOR SALE: TRS-80 4 K, Level II 12 inch video display, CTR-41 cassette recorder, twenty program tapes. List price \$900, will sell for \$750. J Kennedy, 5179 Eliot St, Denver CO 80221, (303) 477-4114.

FOR SALE: Centronix printer Model 306. Prints 64 ASCII characters. 5 by 7 dot-matrix impact, 120 cps. up to 80 columns, tractor feed to 9½ inches wide, parallel input. Includes RS-232 interface to 9600 bps, HW vertical form control, auto motor control, stand, and paper tray. Technical manual. Excellent condition. \$800. Tom Jacobs, 100 W University Pky Apt 3G, Baltimore MD 21210, (301) 467-0703.

FOR SALE: Texas Instruments SR-52 handheld programmable calculator. Factory reconditioned on April 13, 1978. In perfect working order. Unit comes with two Ac adapters, three sets of cards, and copies of Statistics, Financial, and EE program libraries. Best offer. Donald L Mitchell. 24466 Mulholland Hwy, Calabasas CA 91302, (213) 347-3617.

FOR SALE: New factory-wired, Meca Alpha-1 dual-cassette. Includes Meca OS Version 3.0. Couldn't figure out how to use it with my system! Take advantage of my mistake. \$600 (or make reasonable offer). Send certified check or money order, I'll pay shipping. W D Wilkens, 24 N 3rd St. Womelsdorf PA 19567.

FOR SALE: Altair 8800A, VDM-11 video, MITS 1 K, S and D Sales 4 K, SwTPC/CT-1024 and seven or eight assorted boards with documentation. Mostly Mini Micro Mart stuff, not working. \$450 or best offer. Dave Johnson. 3054 Roundtree. Ypsilanti MI 48197, (313) 434-3832 after 6 PM EST.

WANTED: Seeking documentation for the Merlin display board. Also seeking super-dense graphics option and documentation. Dick Walter, 2891 Baylis Dr., Ann Arbor MI 48104, (313) 991-7944.

FOR SALE: Three 32 K static programmable-memory boards. S-100, assembled and working perfectly (with 2114's low-power 250 ns), used for 300 hours. \$495 each. Also have 2114s for \$5 each, 4116s at 150 ns for \$15 each, Dynamic N MOS ceramic 8 K by 1 22-pin with specification sheets, \$4 each, eight for \$30 and 4 K by 1 Dynamic 16 pin, \$3 each, eight for \$22. Richard Smith, 3648 Madrid Dr, San Jose CA 95132, (408) 946-0735.

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Please note that it may take three or four months for an ad to appear in the magazine.

FOR SALE: Apple 1 with 8 K programmable memory and 44-pin mother board, power supply, keyboard and 4 K BASIC on cassette plus documentation. \$250. National Multiplex SwTPC 2SIO controller board and CC-8 recorder set up for 4800 bps. Unit is for SWATBUG readonly memory with serial interface in control port. Documentation included. Best offer over \$330. Digital Group Phi-Deck controller card plus Triple I single-deck controller card and remote control box. Included is one Phi-Deck, documentation, and 8080/Z80 program on cassette. Unit used only a few times: guaranteed to work. Best offer over \$290. Items shipped collect. Clinton Cook, 2737 Beachwood Dr, Merced CA 95340, (209) 723-0516.

FOR SALE: SYM-1 in original carton and under warranty. First check for \$230 gets it. COD is ok. Darian Carr, 13709 Peyton, Dallas TX 75240.

WANTED: Jolt computer and Martin Research 8008-based computer. Can also use an Intel SIM-8 board. J Titus, POB 242, Blacksburg VA 24060, (703) 951-9030 or (703) 951-2684.

WANTED: I wish to purchase two random-beam video displays for use as vectored graphic displays. Displays must measure 12 inches or larger. Prefer working units, but can repair or modify if necessary. Will pay top dollar for quality equipment. Send description and price. Edward Rees, 8835 S Oak Park Dr, Apt #20, Oak Creek WI 53154, (414) 764-3093.

FOR SALE: IBM Selectric-based input/output (I/O) writer (Series 731), heavy-duty, all solenoids, 8½ inch platen. Was working, now needs repair. Ideal for talented tinkerer. \$200, including cable and connector. Joe Brennan, 13 W 13th St. New York NY 10011, (212) 691-7939.

FOR SALE: TRS-80 which uses any RS-232 keyboard printer or video display as remote terminal. Performs all keyboard functions, places video-display data on terminal. Run BASIC or disk operating system from terminal. For information send SASE. H S Gentry, Rt 1 POB 39B, Earlysville VA 22936.

FOR SALE: H11 LSI processor with maximum memory. Also contains parallel and serial interface and cables. \$1000. Also, H10 paper-tape reader punch. \$150. H9 video terminal. \$300. Can be bought individually or save \$100 by buying all three. Complete with documentation, tapes, and several programs. Will deliver within a 200 mile radius. Jean P Bonin, 44 Pearl St, Sidney NY 13838.

FOR SALE: Up and running IMSAI 8080 with 22-slot mainframe, MIO board, 8 K Seals memory, 16 K Godbout memory, active terminator, logic-extender board. Poly VDM board, SDS 16 K erasable read-only memory board with 9.1 K IMSAI BASIC, microswitch keyboard. Cost over \$3000, will sell for first certified check for \$900. David Rosenblatt, POB 2600, Tampa FL 33601, (813) 988-3007.

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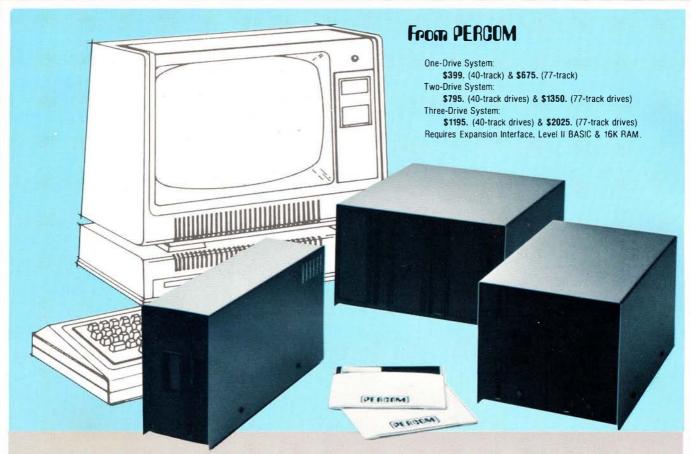
## BOMB— BYTE's Ongoing Monitor Box

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\*Correspond directly with company.

#### **August BOMB Results**

The first and second place winners of the August BOMB were "Anyone Know the Real Time?" by Steve Ciarcia (page 50) and "An Overview of LISP" by John Allen (page 10). These articles placed 1.30 and 1.09 standard deviations above the mean. First and second prizes of \$100 and \$50 will be awarded to the authors. Third place went to "A Preview of the Motorola 68000" by A I Halsema (page 170) followed by "Exploring TRS-80 Graphics" by George H Yeager (page 82).



## Low Cost Add-On Storage for Your TRS-80\*. In the Size You Want.

When you're ready for add-on disk storage, we're ready for you. Ready with six mini-disk storage systems — 102K bytes to 591K bytes of additional on-line storage for your TRS-80\*.

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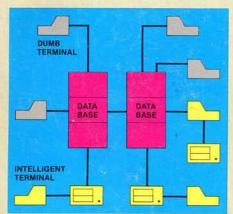
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Percom 'peripherals for personal computing'

## Microcomputing comes of age.

Ohio Scientific's OS-65U
Level 3 operating system
software brings new
networking and distributed
processing capabilities
to microprocessor based
computer systems.



Until now, the only alternative for low cost multiple-user computer applications was time-shared systems. However, a serious drawback of microcomputer or minicomputer multi-user time-share systems is the fact that under heavy work loads they slow down to a crawl since the central processor time in such a system is shared by all of the users.

In a microprocessor based distributed processing system, using floppy based microcomputers as intelligent terminals (local systems) most of the work load is handled locally. Overall system performance does not degrade under heavy job loads. Each local system performs entry, editing and execution while utilizing the central data base for disk storage, printer output, and other shared resources.

For more demanding applications it is desirable to have several data bases, each with its own collection of local systems. Such an inter-connected set of data bases is called a network. Each data base and its local intelligent and dumb terminals is called a cluster.

#### Level III

OS-65U Level 3 now supports this advanced networking and distributed processing capability as well as conventional single user operation and time-sharing. Level 3 now supports local clusters of intelligent microcomputer systems as well as

dumb terminals for the purpose of utilizing a central Winchester disk data base and other shared resources. The system also has full communications capability with other Level 3 data bases providing full network capability.

The system utilizes Ohio Scientific's low cost, ultra high performance computer systems throughout for intelligent terminals as well as data bases. This general systems configuration provides a cost/ performance ratio never before attained in this class of computer power.

Level 3 resides in each network data base. A subset system resides in each intelligent terminal. Each data base supports up to 16 intelligent systems and up to 16 dumb terminals. However, since dumb terminals can heavily load the system, they should be kept to a minimum. Level 3 also supports a real time clock, printer management, and other shared peripherals.

#### **Data Base Requirements**

Minimal requirements for a Level 3 network data base are a C3-C or C3-B computer system with 23 or 74 megabytes respectively, console terminal, 100K bytes RAM and a CA-10X 16 port I/O board for network and cluster communications.

Intelligent Terminal Requirements
Any Ohio Scientific 8" floopy based

Any Ohio Scientific 8" floppy based computer with 56K RAM and one data base communications port.

#### Connections

Intelligent terminals and networked data bases are connected by low-cost cabling. Each link can be up to 10,000 feet long at a transfer rate of 500K bits per second, and will cost typically 30¢ a foot (plus installation).

#### Syntax

Existing OS-65U based software can be directly installed on the network with only one statement change! Level 3 has the most elegantly simple programming syntax ever offered on a computer network.

File syntax is as follows:

DEV A, B, C.D. Local Floppies

DEV E Local hard disks

DEV K-Z Specific network

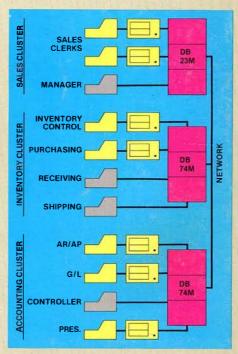
unchanged from single user and timeshare systems

DEV K-Z Specific network
Data Bases

Each of up to 8 open files per user can
be from 8 separate origins. Specific
file and shared peripheral contentions
are handled by 256 network
semaphores
with the syntax Waite N

Waite N, close

The network automatically prioritizes multiple resource requests and each user can specify a time out on resource requests. Semaphores are automatically reset on errors and program completion providing the system with a high degree of automatic recovery.



#### A Typical System

A typical system with two network data bases will have 148 megabytes of disk, four intelligent subsystems equipped with dual floppies, two dumb terminals, a word processing printer, a fast line printer, network data base manager software and 1000 ft. of interconnecting cable. Utlizing .7 MIPS processors throughout it will cost less than \$50,000 plus installation. GT option computers (1.2 MIPS) can be utilized at a slightly higher cost.

#### One Step at a Time

Best of all, Ohio Scientific users can develop distributed processing systems economically one step at a time. A user can start with a single user floppy system, add a hard disk, then time-sharing, then a second Winchester data base for backup and finally cluster intelligent terminals to achieve a full network configuration.

## **OHIO SCIENTIFIC**

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