The New Wave Of Personal Computers:
An In Depth Look At The New Commodore 64, Sinclair Color Spectrum, Epson Portable Computer, And More

COMPUTE!

$2.50
August
1982
Issue 27
Vol. 4, No. 8
63379 £1.85 in UK

The Journal For Progressive Computing™

Household Budget Manager
Control And Analyze Credit, Expenses, And Income

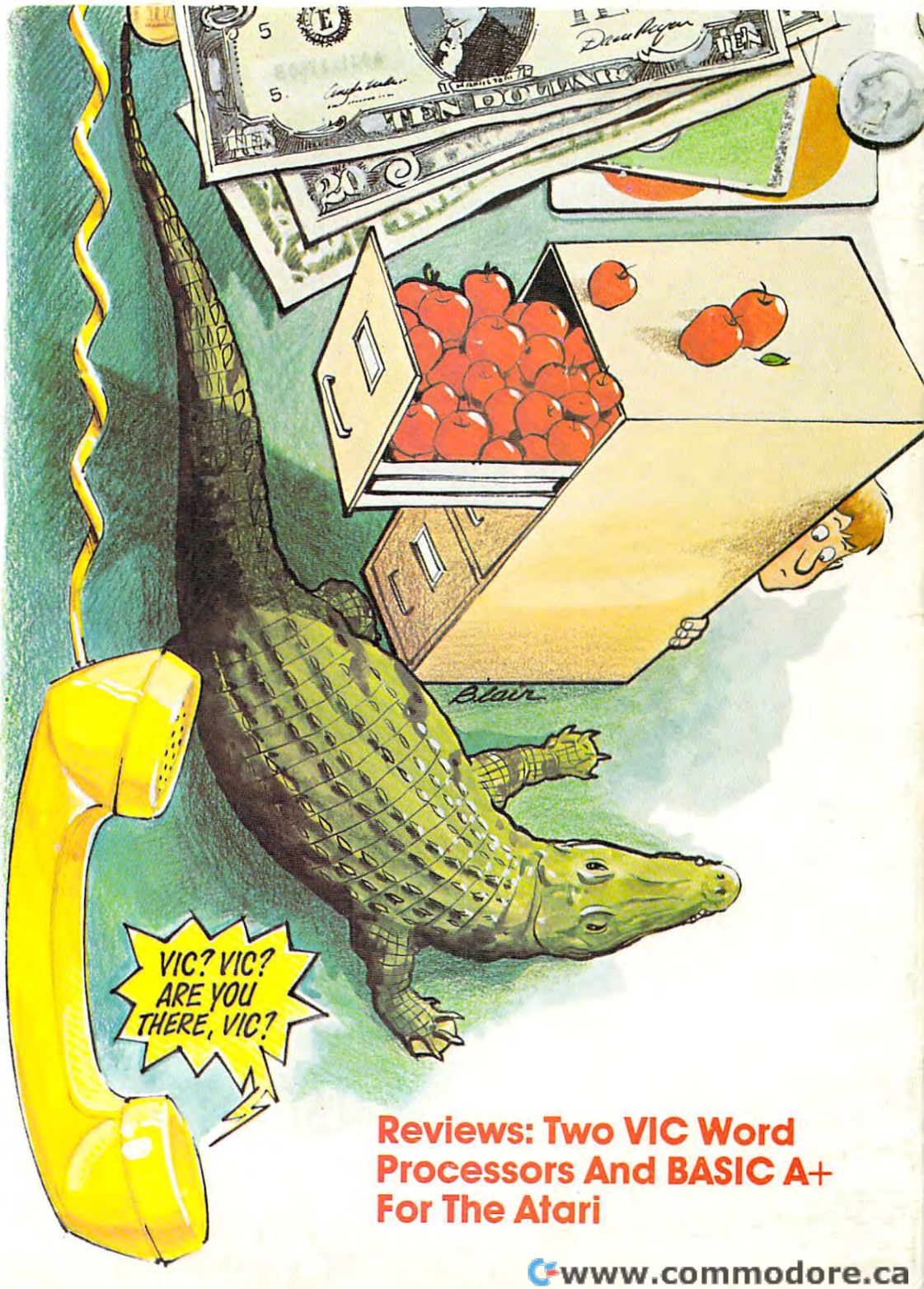
VIC-20 Communications: The RS-232 Interface

Apple Data Manager: An Intelligent Filing Cabinet

Home Energy Monitor For Radio Shack Color Computer

Guess That Animal
An Educational Commodore/Atari Game

Inner BASIC For PET/Commodore



Reviews: Two VIC Word Processors And BASIC A+ For The Atari

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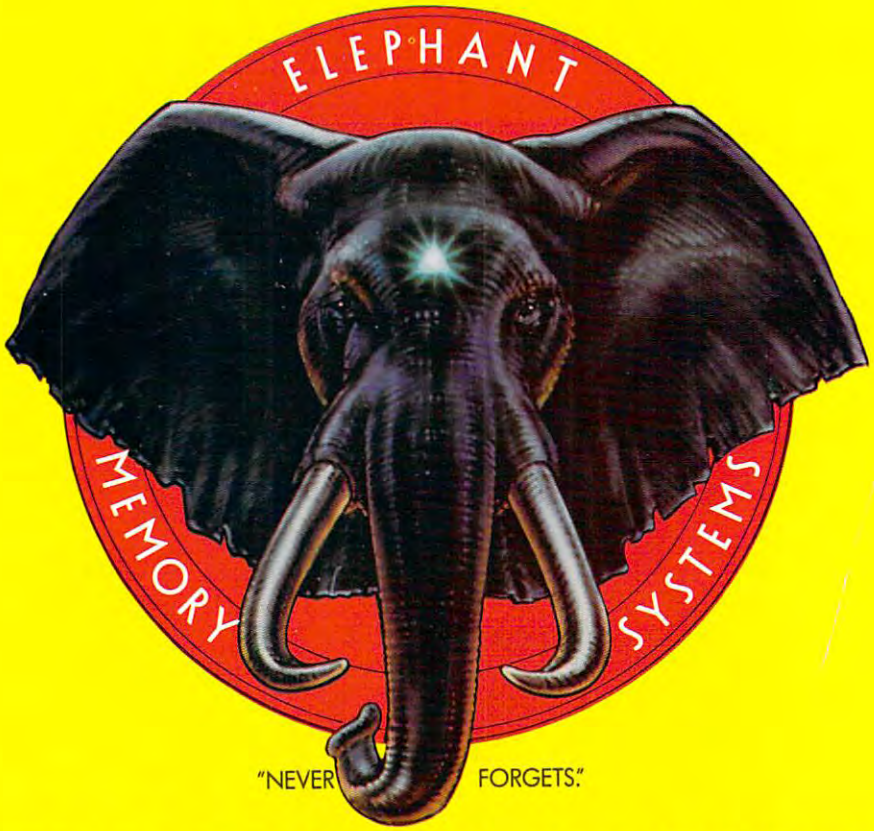

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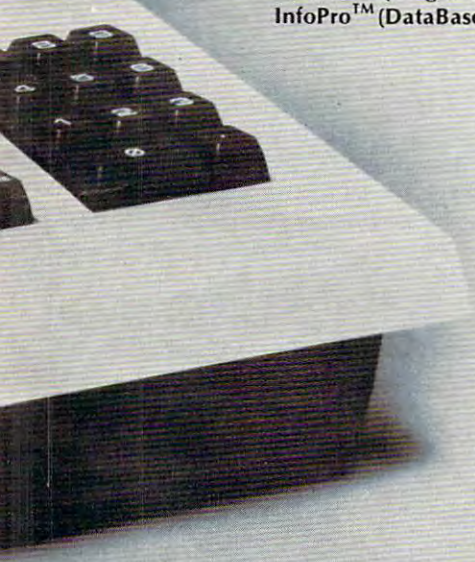

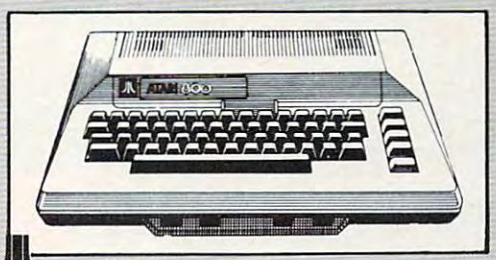

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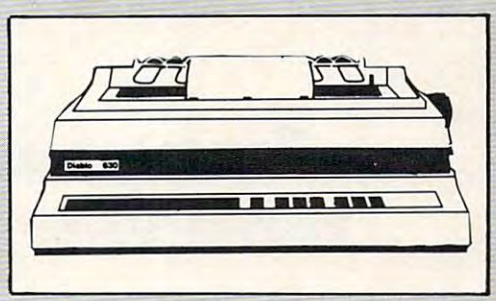

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August 1982 Vol. 4, No. 8

AP = Apple, **AT** = Atari, **P** = PET/CBM, **V** = VIC-20, **O** = OSI, **C** = Radio Shack Color Computer, * = All or several of the above.

COMPUTE! The Journal for Progressive Computing (USPS: 537250) is published 12 times each year by Small System Services, Inc., P.O. Box 5406, Greensboro, NC 27403 USA. Phone: (919)275-9809. Editorial Offices are located at 625 Fulton Street, Greensboro, NC 27403. Domestic Subscriptions: 12 issues, $20.00 Send subscription orders or change of address (P.O. form 3579) to Circulation Dept., **COMPUTE!** Magazine, 515 Abbott Drive, Broomall, PA 19008. Second class postage paid at Greensboro, NC 27403 and additional mailing offices.

ISSN 0194-357X.

The Editor's notes...

Robert Lock, Publisher/Editor

Software Warranties Revisited

In recent editorials we've raised the question of software and product warranties. In February, we quoted an interesting letter written by John Navas II, a concerned subscriber. We're still quite interested in *your* feedback. One note of inquiry we received was from the Federal Trade Commission. They too, it seems, are concerned about the same questions. We would like to keep the forum going, and welcome input from both buyers and sellers. Here's an update from John:

Thank you for quoting my letter on software warranties in your February editorial, and for inviting comment on this important issue. Since then I have learned that some firms justify "as is" warranties as a defense against potentially large product liability damage claims. The following is my rebuttal to that justification:

As a businessman I understand concerns for the potential risks of product liability and consequential damages. Such concerns, however, do not justify a disclaimer of all *warranties. To do so confuses product* warranty *with the separate issue of product* liability. *It is a simple matter to write a product warranty which limits liability to the price paid for the product.*

With such a warranty, a responsible business should have little to fear, particularly when there is not clear negligence or knowing concealment of product defects. Presumably **COMPUTE!** *readers share my lack of sympathy for negligent conduct or failure to disclose known defects to prospective purchasers.*

All I ask of suppliers is that they be diligent in pre-sale quality control, that they promptly remedy without charge all product defects identified within a reasonable post-sale period and that they provide a written warranty to that effect. If a supplier disclaims all warranties, including implied warranties, it forces its customers to rely solely on trust.

Unfortunately, my own experience has shown that such trust can be unwarranted, and that there is no reliable way to anticipate how a supplier will behave. Several programs that I have purchased recently from reputable suppliers proved within the first few weeks of use to have serious defects. In at least one case I discovered that the supplier had previously known about some of the defects. Only once have I been able to get a defect repaired without charge. Sometimes suppliers have advised me that no corrections would ever be made. Sometimes "new" versions would become available, but only at a substantial additional charge. Either way, suppliers explicitly relied upon their "as is" warranty disclaimers.

Some suppliers do provide reasonable software warranties. One example limits liability to the price paid, notes that software is not warranted to be error-free, but entitles the original purchaser to replacement or repair of defects without charge (or to a full refund) within the warranty period. These suppliers deserve our business.

Sincerely,

John Navas II

Personnel Updates

June has been an interesting month for corporate presidents. The presidents of Atari, Inc., and Commodore, Inc., are both leaving their respective positions. Peacefully too, from all we can tell. Atari's president is leaving to establish a personal computer venture... Commodore's to establish an innovative computer retailing plan. We wish them both well in their newest endeavors. We'll keep you posted on their replacements.

Documentation Update: Krell LOGO

It's not our policy to mention specific vendors on this page, but in this case I think it's warranted. A July column panned Krell's LOGO documentation, and it slipped through our editorial review in a fashion that I don't think was quite fair. We have no qualms about describing the realities of a given situation, but we always verify and double check. In this case we didn't. If we had, we would have discovered that Krell has substantially increased their package documentation (prior to our comments, by the way). Our apologies for not pointing this out last month.

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Contributing Editors

Marvin DeJong, Dept. of Mathematics-Physics The School of the Ozarks Pt. Lookout, MO 65726
Bill Wilkinson, Optimized Systems Software 10379-C Lansdale, Ave. Cupertino, CA 95014
Gene Zumchak, 1700 Niagara St. Buffalo, NY 14207

Subscription Information

COMPUTE! Circulation Dept.
515 Abbott Drive
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TOLL FREE Subscription Order Line
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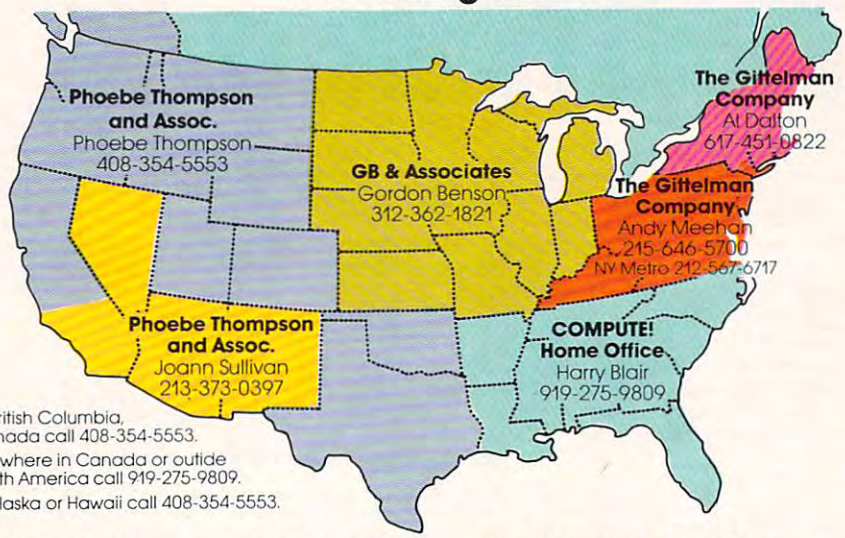

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Small System Services, Inc. publishes:

COMPUTE!
The Journal For Progressive Computing

COMPUTE! Books

Corporate office:
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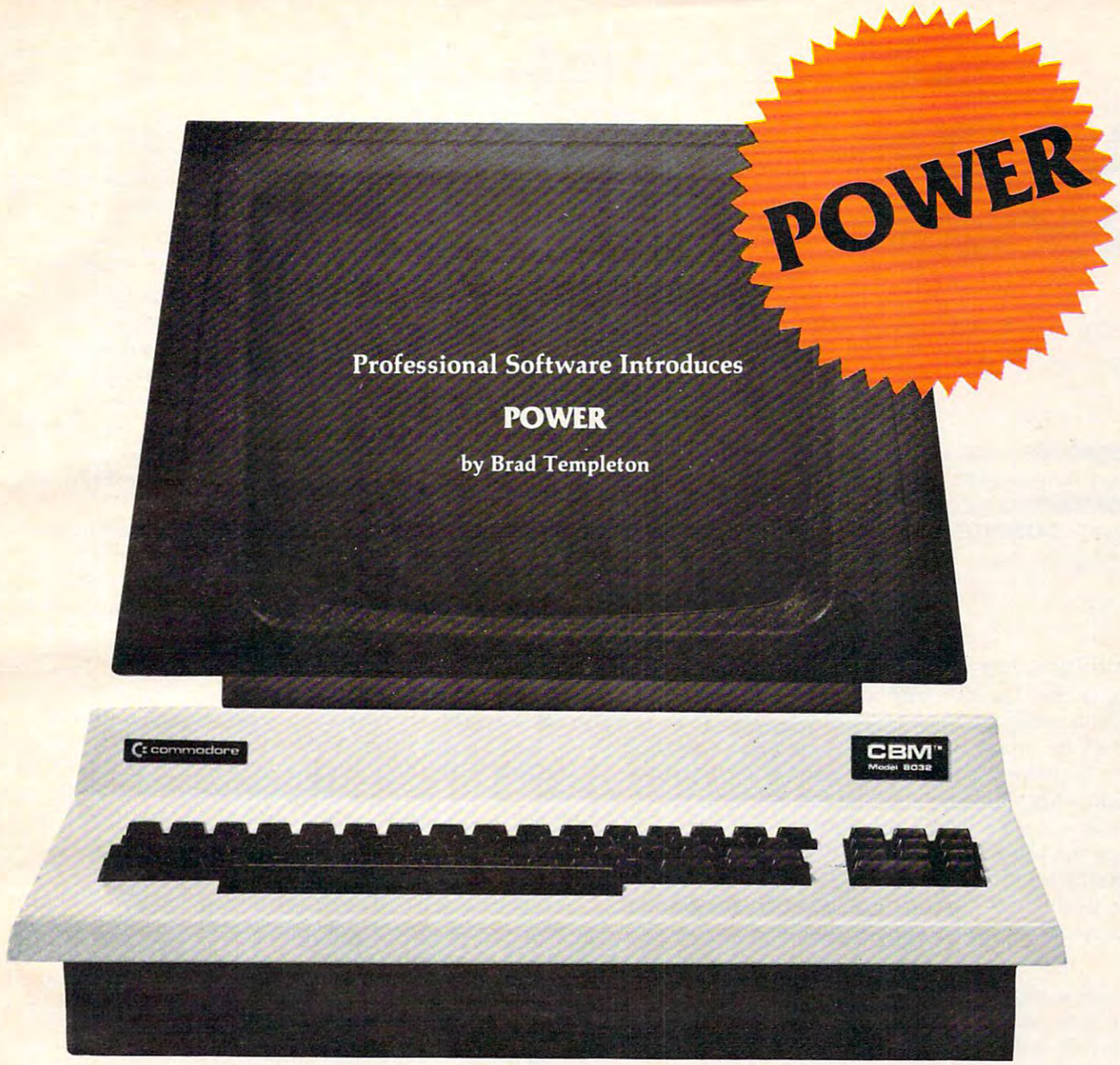

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Ask The Readers

Robert Lock, Richard Mansfield, And Readers

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Atari Tape Suggestions

I have an Atari 800 with a cassette recorder. I have been having one heck of a time getting good CSAVE's on my tapes. I use good tapes and try my best to properly record, but it has gotten to the point where I'm afraid to start on any large program because if the CSAVE is no good, CLOAD will wipe me out when I want to check if the tape is good. I would like to hear of any good solutions to the problem. I have had the recorder checked and I was told it was working normally.

Albert Jacobs

Proper maintenance of a cassette recorder is essential. The heads should be regularly cleaned and demagnetized (solvents and tools for these jobs are available at any electronics supply store). Also, some computers require special recording techniques.

The Atari stores programs as FSK tones. The only direct effect this has on you is that you should not use computer digital tape or chromium dioxide tape. Instead, use a good quality, "low noise" audio cassette. Uniform tape speed is also important. Avoid tapes which rattle or seem to stick. Some people find that it helps to fast-forward and then rewind a tape before using it for the first time.

Another thing that can help is to issue an LPRINT command (even if you don't have a printer) before you CSAVE. This insures that certain operating system flags are set correctly.

For additional information, see "Atari Tape Techniques," **COMPUTE!**, *July 1981, #14.*

VIC Upgrades

Will it ever be possible to upgrade the VIC with any of the new display, sound, and microprocessor chips in the new Max and the Commodore 64? Also, with the Superexpander cartridge in the VIC, it is easy to mix normal (but not reversed) text and graphics characters with high resolution graphics. Is it possible to program these characters? (The bit map for the graphics screen does not use all the available memory.)

D. M. Lane

Transforming the VIC into the new Max and 64 (see "The New Wave of Home Computers" in this issue) would be a major technical undertaking – it is not a simple chip substitution. Highly placed sources at Commodore have hinted, however, that there is a possibility that a special cartridge for the VIC will be manufactured. This would bring to the VIC all the synthesizer effects available on the MAX and the 64. This is, however, only a possibility.

Concerning programming characters, the Superexpander uses up nearly all of the characters, but in theory you could have up to 50 more. To do this, you'd need to see what characters the cartridge was using to bit-map the screen and then see what's left over.

Recover From NEW On VIC

If you type NEW, your program is still in the VIC. "Recovering From NEW On Apple and CBM" (**COMPUTE!**, May 1982, #24, pg. 135) showed how you can restore the program for PETs and Apples. The procedure is exactly the same for VIC except that the POKEs are different locations.

The first POKE should be POKE 4098,16 (instead of POKE 1026,4). The second POKE goes into location 4097. Determine the correct number to POKE by following the article's instructions for the second POKE. Also adjust the variable pointers as the article suggests. The locations are the same as for the Upgrade ROM set (locations 42 and 43). In the program which adjusts the variable pointers, use 4096 instead of 1024.

Minoah Tam

SuperPET Users Group

I am the proud owner of a SuperPET. 4040 disk drive, and a 4022 tractor printer. Would any SuperPET owners out there happen to know of any user group devoted to the SuperPET? If there isn't I would like to organize a SuperPET users group here in the Tri-state are.

P. V. Skipski

P. V. Skipski
4782 Boston Post Rd.
Pelham, NY 10803

VIC Super Expander Hints

This is for other readers who have spent from $65-$80 to acquire the Super Expander for the Commodore VIC, and then found most of their games did not work properly.

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503/655-9574

On the basic 5K VIC, the memory locations (51-52 and 55-56) point to the end of memory when powered on. If you PEEK (51 or 55) you will notice that both of these locations contain zero.

Once the Super Expander is plugged in and the same two locations namely (51 and 55) are PEEKed, you will notice the value has changed from zero to 120.

What this means is that any program which is going to use its own character set must have the following instructions:

```
POKE 52,28 – Set String High Pointer
POKE 56,28 – Set Memory High Pointer
POKE 51,0 – Set String Low Pointer
POKE 55,0 – Set Memory Low Pointer
```

Also there is a major bug when the Super Expander is installed. When the RUN/STOP and RESTORE keys are hit, followed by the direct command ?FRE(X), the amount of free memory shows 3104. Since this is less than the basic 5K VIC without the Super Expander, you feel cheated.

The only way I have found to correct this loss of memory is to do a SYS64802 after the RUN/STOP and RESTORE. I have reported this bug to Commodore, but to date have not received an answer.

I hope these tips will help other people with the VIC Super Expander.

The code to look for in any game which is going to use its own character set which will not work will look like the following:

```
50 POKE 52,28: POKE 56,28
60 POKE 51, PEEK (55): CLR
70 CS=256*PEEK (52) + PEEK (51)
```

To correct this code, add the following instruction:

```
55 POKE 51,0: POKE 55,0
```

William D. Collins

Tape Dents

I would like to warn any readers who experience sudden and unexplained program failures when loading from an Atari 410 program recorder of a potential problem. The same is true of other cassette systems as well.

If you should forget to depress the STOP/EJ. key after loading in a cassette, the flywheel shaft remains in contact with the pinch roller assembly. This contact and pressure will actually put a "dent" in the cassette tape that will remain. When you try to load the tape data into the computer later on, that particular section, where the depression is, will not make contact with the playback head and the program will crash with an -ERROR 143 at line 0 indicator.

Fortunately, rewinding the tape and storing for several days will usually correct the problem. Unfortunately, it doesn't always iron itself out and if there was not an extra CSAVE or backup tape made, all data is lost!

Randy T. Agee

Earlier Atari GTIA Chips?

Thought some Atari users might be interested in learning of my experience. I've been reading reports that say that the GTIA, a more advanced graphics chip, might be in machines "purchased after January 1982." False!

The date must go back further than that. My 400 was purchased in November 1981 and, using the following test, I proved the GTIA was in my machine. Try it!

```
10 GRAPHICS 11: REM OR 9 OR 10
20 GOTO 20
```

Ed Pomelear

If you get a black screen, you've got the GTIA chip in your machine. If it's blue, you've got the older CTIA chip. For in-depth information on the GTIA, see "Atari Video Graphics And The New GTIA" in this issue.

VIC Zenith Jitters

I just recently purchased a VIC and own a Zenith TV set. The computer does not work on the Zenith because of vertical hold problems. There is a single POKE command (POKE 36864,133) which corrects this problem. Some preprogrammed tapes and some cartridges prevent this command from being entered. I would appreciate it if someone could come up with a permanent fix for this. Is Commodore working out a solution?

David St. Romain

Several readers have mentioned this problem. It appears that some recent Zeniths (and reportedly some Sylvania sets, too) get a bad case of the "flutters" when attached to computers. The culprit is evidently a new circuit in some televisions which are "auto-setting." And the problem isn't limited to VIC – any computer can create these unpleasant effects with these models. Aside of the POKE solution you mention, Zenith has sent a technical notice out to its service centers with instructions on curing the problem. It involves a simple disconnection of a yellow wire and your local authorized Zenith center should be able to perform the modification.

The most recent VIC cartridge games and other recent programs released by Commodore have an "interlace mode toggle" built in. Pressing the F8 key will switch back and forth between the two screen modes and you can see which setting produces the best results on your set. Programs with model numbers between 1901 and 1908 do not have this toggle feature, but most of the later programs do. ©

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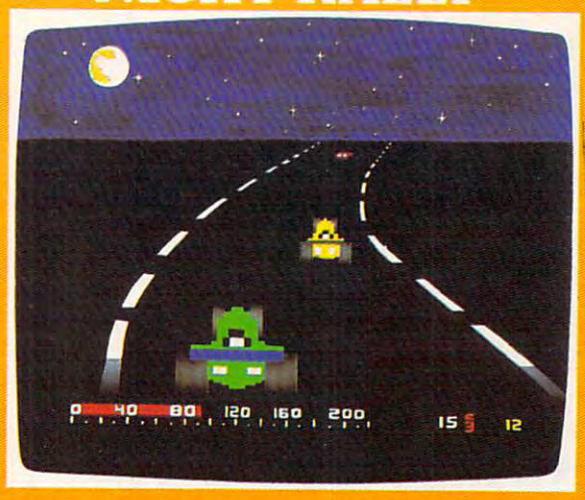

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A Monthly Column

Computers And Society

David D. Thornburg
Associate Editor

Stranger Than Fiction ...

I once read that the reason truth is stranger than fiction is because fiction has to make sense.

I guess that's so, because no fiction writer could ever come up with some of the developments we have seen in the personal computer industry in the past few months. As the computer market continues to expand into mass merchandising outlets, we will be getting used to some pretty strange things.

For example, where can you find the three B's under one roof (bytes, baud, and Barbie dolls)? If you said Toys "R" Us, move to the head of the class. While this nationwide discount toy store has been selling video games for quite some time, I had once said that the beginning of the true mass market could be pinned to the date TRU decided to carry personal computers.

Nestled away among the video games and cartridges, one can find the Commodore VIC, the TI 99/4A and soon(I'm told), the Atari computers. Remember a year or so ago when I said that the TI computer was dead?

I was wrong. (Boy, was I wrong!)

Shipments of the 99/4A are up there with Apple. At a retail price (including modulator) of under $300, Toys "R" Us will probably do a brisk business in this product.

But how does a discount toy store handle esoteric products such as disk drives, expansion RAM, etc.? And, especially, how does this type of store sell these products when the sales staff doesn't know that a parallel port doesn't have parking spaces for boats?

Good question.

It is unrealistic to expect rapid turnover sales personnel to become conversant with computers overnight. As one sales person told me, "This is different from selling video games. All people ask then is whether a certain game lets them play Pac Man, or whether the game will hurt their TV. With computers we've had people in the store asking about "expandability."

To tell the truth, I'm not worried about the folks who know enough to ask about expandability. Anyone who knows that much is well on the way to making a careful purchase decision. But what about the true neophyte – the person who sees the computer as a mass merchandised electronic appliance to grace the den next to the VCR and projection TV? How is this person to make an intelligent decision on selecting a computer that retails for under $500? The traditional computer stores seem to be dropping these products, especially in areas serviced by discount houses. After all, why should someone in a MicroAge or Computerland store, for example, spend an hour making a sale, only to have the customer end up buying the machine at the local discount house?

For the first time since the revolution began, we are starting to see true product differentiation. The Apple-priced systems continue to be the mainstay of the traditional computer stores, and the low end products are being pitched to a broader audience from the traditional consumer outlets. The sad part is that the broad audience is the one that needs the most help in the purchase decision.

One solution I can think of is for the manufacturers to combine efforts and publish a "generic personal computer purchase guide" that lets people know what the personal computer is all about. Tons of these books should be shipped to all the mass outlets and handed free to anyone thinking about buying one of these machines.

If the manufacturers would also adopt a uniform format for listing specifications (similar to that of the stereo or automotive manufacturers), even the most nontechnical among us would be able to do effective product comparisons without taxing the skills or patience of a sales person who knows no more than the customer.

The manufacturers have an even greater obligation to make their system setup easy for the neophyte. When I opened my TI 99/4A, the "Read This First" manual was at the very bottom of the stack. While the setup manual was very well written, it should have been taped over the keyboard so it couldn't be missed.

I am excited about computers being bought by millions of people. I am excited to see these products in the mass market outlets. But I am afraid that the manufacturers of these micros don't realize how much help their customers really need.

Notes On Education ...

Sterling Swift Publishing Co. (1600 Fortview Rd., Austin, TX 78704) has just published a new edition

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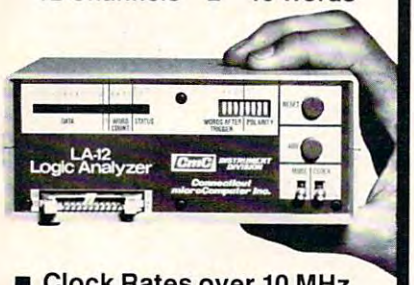

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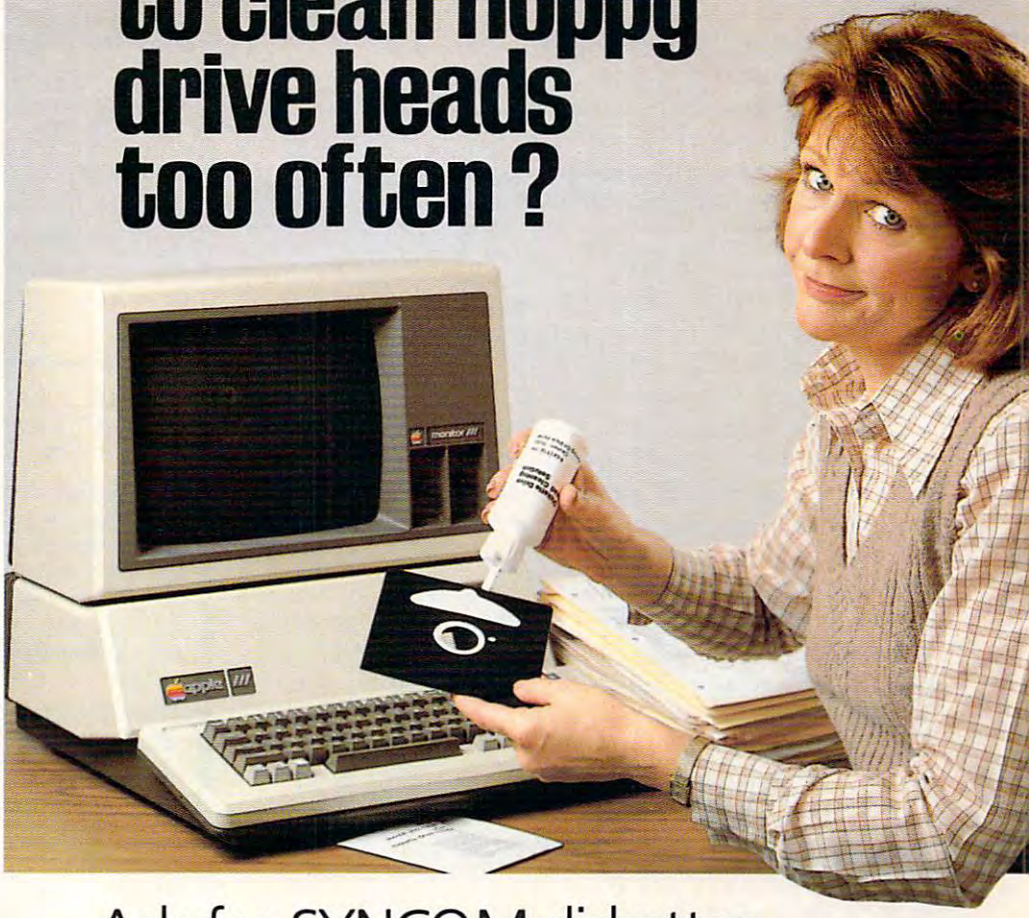

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of their Apple II educational software directory ($14.95). This is a delightful replacement for their first edition, for it covers educational software offerings from 128 sources. The spectrum of software spans elementary to college education, and covers every topic from drill and practice to games. Vendor listings are divided into chapters covering traditional educational publishers, non-commercial vendors, etc. With 350 pages devoted to this important field, the Swift directory is a valuable investment for Apple using educators. I was sorry to see that the Mind Toys games from Automated Simulations were not listed, but no software directory can be expected to be perfect.

On another topic, this column has presented my views on the uses of computers in education. This view is limited by my personal bias and is, thus, incomplete. In particular, I am not a strong proponent of the use of computers as teacher replacements. It seems to me that computers can be more effectively used for other tasks. However, when one considers the use of computers with older students (those in college, for example), the idea of testing "book knowledge" with computer simulations seems quite valuable. This is especially true in the physical sciences where the computer simulation might be seen as an intermediate step from the lecture to the laboratory.

Just as Seymour Papert is well known for his view of the computer as a learning tool for the child, so Alfred Bork is known for his view of the computer as a medium of instruction. Bork's perspectives on computers as instructional tools are presented in *Learning with Computers* (Digital Press, Bedford, MA), a book-length collection of papers he published over a ten year period. Since each paper in this book is self-contained, there is a certain amount of unavoidable repetition. Much of the work by Bork and his colleagues was carried out using large computers, but he is also very interested in the use of personal computers as well as incorporating "intelligent" video disk technology into the classroom.

I have often classed Bork's view of computers in education as being quite conservative. This may be a bum rap. In fact, he believes that, once computer-based instructional materials are in widespread use, there will be radical changes in traditional educational institutions. With all courses individualized, there is no need for traditional semester boundaries, etc.

But what about teachers? If students are being taught by computers, what are the teachers going to be doing? According to Bork, their role may shift from being the deliverers of courses to the designers and developers of courses, with some time devoted to working with students who have individual learning problems. While this scenario might become reality, I find it flawed. Teachers cannot develop effective course materials in a vacuum. I know of no way to replicate the wealth of information one gains by teaching something to a class full of students.

Disagreements aside, I think that Al Bork is an articulate spokesman for his brand of classroom computer use, and that his book deserves a broad audience among educators who are using computers in any capacity. ©

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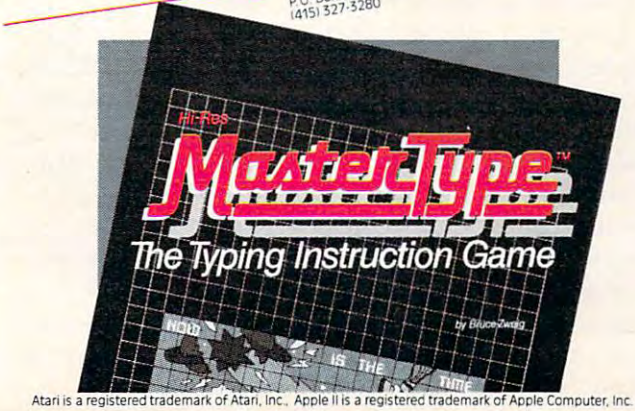

Computers with more power and lower price tags than ever before will be coming on the market soon. These are the highlights of two important trade shows held recently in Chicago and Houston.

The New Wave Of Home Computers

Tom R. Halfhill, Features Editor

Back in the late 1940's, when a computer weighed several tons, cost millions of dollars, and had to be air conditioned to keep its thousands of vacuum tubes from melting, somebody estimated that by the end of this century in America there might be as many as 100 computers.

In the last two years, Sinclair Research alone claims to have sold more than 300,000 of its tiny computers in the U.S. And if that's not enough to demonstrate how fast things are changing, you should have spent a week in June visiting the Summer Consumer Electronics Show (CES) in Chicago and the National Computer Conference (NCC) in Houston.

It was new microcomputer hardware that stole the show – both of them. Even IBM, the mainframe grand-daddy itself, leaned heavily toward microcomputers at its NCC booth – which, incidentally, was plopped right next to Apple Computer's. Judging just from the size and extravagance of both booths, it was impossible to tell which company was the establishment giant and which was the cocky upstart. The home/personal computer firms, banished to back aisles at the NCC until just a couple of years ago, finally have achieved their place in the sun.

Expanding Power In Ever Smaller Packages

The big news at both shows was the latest developments in a trend that started in the late 1940's: packing more power into smaller computers that cost less. Like a science fiction fantasy run wild, the Incredible Shrinking Computer is reaching almost ridiculous proportions, beyond belief even ten years ago. New computers and peripherals from Commodore, Sinclair, Epson and others will put startling amounts of computer power at the fingertips of consumers for less money than ever before. Very soon consumers shopping for home computers not only will face the question: How much power can I afford?, but also: How much power do I really need?

The Commodore Challenge

Commodore, which displayed no less than five new machines that drew "Ooohs!" and "Aaahs!" at both shows, seems to be addressing the question by offering the industry's most complete vertical selection. In prices ranging from $179.95 to $2,995, Commodore can sell you anything from a game machine with marginal BASIC programmability to a full-blown business system with built-in dual disk drives, 256K RAM, and 16-bit CP/M capability (and a wide assortment of computers in between). More importantly, each computer is among the most advanced and least expensive in its class. Commodore can do this more easily than others because it is among the microcomputer industry's few "vertically integrated" companies – that is, it does everything from designing and manufacturing its own chips to assembling the computers and writing the software.

"We want to cover the entire market," says Kit Spencer, Commodore's marketing vice president. "We're the microcomputer specialists." Some believe a hazard of this approach is that the lower-end game machines might "tarnish" the button-down image of the upper-end business computers. In other words, *Gorf* and *VisiCalc* don't mix. Atari, for example, has struggled to convince people that its computers are more than just sophisticated game machines. Commodore, though, unlike Atari, did not establish itself by selling several million video game machines, and already has a solid toe-hold in the small business marketplace, especially abroad.

What Commodore most definitely has started with its new line is a real dogfight in the under-$1,000 home computer market, not to mention the under-$500 market. Prices of competing machines suddenly dropped, though of course spokesmen denied the changes were a response to Commodore's salvos. Atari, for instance, announced at CES a $50 cut in the list price of its 400, from $399 to $349. Rumors of a new Atari computer, perhaps to be called the model 600 and falling between the 400 and 800 in terms of both features and price, turned out again to be just rumors.

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Color Computer Upgrades

Radio Shack is fighting to stay in the pack, too. The TRS-80 Color Computer went on sale for $299 from its regular $399 in early summer, and a Tandy spokesman at NCC said that, although the sale was not advertised as such, it was sort of a "close-out." He said the new Color Computers being sold for the usual $399 will come with 16K RAM instead of the previous 4K (but still will lack the Extended BASIC).

The new Sinclair ZX Spectrum, a 16K color-and-sound computer selling for around $200, but not yet available outside Great Britain, will cloud the under-$500 picture even further. Meanwhile, peripherals manufacturers, hampered by the mechanical rather than solid-state nature of their devices, are battling to bring the prices of their products down to something that looks more reasonable alongside the prices of the new computers. Word is they're succeeding, and that we'll soon see disk drives and letter-quality printers at unheard-of prices. Software development isn't standing still, either, with Atari announcing a partnership with one of the entertainment industry's most admired clusters of creative geniuses for the purpose of developing new computer-based games. Here, then, is a rundown of the most exciting news from the CES and NCC shows:

Computers: Commodore

We have to start with Commodore. With five new computers scheduled to hit the market by the end of the year, it's certainly the most active company. Starting at the bottom of the line, Commodore showed its Max Machine (pre-production versions were called "Ultimax"). For $179.95, the Max is a cartridge- and cassette-driven game machine targeted at the Atari VCS, the new, more sophisticated Atari 5200, the Mattel Intellivision and the Odyssey. But Commodore also is billing Max as an entry-level computer and a music synthesizer. A plug-in BASIC cartridge will give game players a taste of computing, although only about 1K of RAM is available. Still, it's possible to save programs on cassette, and Max has an integral 66-key bubble membrane keyboard identical in layout to the popular VIC-20.

The electronics are not at all like the VIC-20's, however. While the VIC, like earlier Commodores, has a 6502 microprocessor chip for its CPU (Central Processing Unit), Max has a 6510. The 6510 is a new chip designed by MOS Technology, a subsidiary of Commodore. It is nearly identical to the 6502, but has additional input/output lines to handle the processing required by the new system. Max also boasts two more new chips: a display chip that puts 40 columns by 25 lines on the screen in text mode with 16 colors and high-resolution graphics, and a sound synthesizer chip known as SID (Sound Interface Device). SID supports three voices with a nine-octave range, and must be heard to be believed. Demo programs playing classical music sounded remarkably close to Yamaha keyboard synthesizers costing several times as much as Max.

None of the new Commodore computers replaces the VIC-20, which at $299 neatly fills the gap in the low-end market.

These same three chips – the 6510 CPU, the display chip, and SID – also are the central configuration of the new Commodore 64 (see part one of "Commodore 64: A First Look" elsewhere in this issue). Naturally, this is no coincidence. The Commodore 64 is designed to be upward compatible with Max. That is, once game-players get their initial taste of computing on the Max and exhaust its possibilities, they can upgrade to the $595 Commodore 64 and keep using all their game cartridges, joysticks, and the cassette tape drive: all will work on the 64! This means a family can buy a very sophisticated yet reasonably priced video game machine, freely invest in game cartridges, get a crack at simple programming, and later move up to a full-blown 64K RAM computer if they wish, without obsoleting their software and other accessories. In addition to its capabilities, this feature should give Max a strong edge in the video game market.

Commodore promises that both Max and the 64 should be available by the time you are reading this. Similar promises when the VIC-20 was introduced took several months to come to pass, so we'll have to wait and see.

None of the new Commodore computers replaces the VIC-20, which at $299 neatly fills the gap in the low-end market between the $179 Max and the $595 Commodore 64. VIC owners wishing to upgrade to a 64 will find that most of their peripherals will work as is, and that their programs will convert with little difficulty.

Commodore is rounding out its home computer line with the new P series, the third-generation PETs. The P128 offers 128K RAM, the same color graphics and sound capabilities as the 64, and will sell for $995. At the higher end are the B and BX series, 80-column professional computers which offer everything from built-in dual disk drives and monitors to multiprocessing, and which will sell for

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In tune with Commodore's new corporate alignment and marketing philosophy, the Max and VIC-20 will be sold through "mass merchants" – catalog showrooms, department stores and other non-specialty retailers – while the 64 and higher machines will be sold exclusively through established Commodore dealers. However, Commodore spokesmen left open the possibility that the 64 eventually may be available through mass merchants also.

Peripherals makers are working hard to produce add-ons that don't cost twice as much as the new computers they'll be plugged into.

Other Entries

Don't get the idea that Commodore was the only company at CES and NCC with exciting new computers to show off. Sinclair offered a tantalizing glimpse of its ZX Spectrum, and Epson had plenty of its HX-20 battery-powered portables for people to fiddle with (see sidebars). Timex also debuted its $99.95 Timex Sinclair 1000, a Sinclair ZX-81 which Timex is licensed to market in the U.S. under a joint name. The Timex is identical to the ZX-81 except for its 2K of RAM, twice as much as the standard Sinclair. It is, of course, fully compatible with all Sinclair add-ons, including the plug-in 16K RAM module, also sold by Timex. According to a Sinclair representative at CES, if Timex sells a certain volume of the computers by a deadline several months hence, it wins the right to market the ZX Spectrum in this country. Otherwise, Sinclair will market the Spectrum mail-order, just as it has been selling the ZX-81s. Sinclair hopes to export the Spectrum to the U.S. by the end of this year.

Peripherals...

There should be big news in this area in coming months, with reports of upcoming Tandon disk drives for under $300 and possibly a letter-quality printer from Epson for around $400. As mentioned, peripherals makers are working hard to produce add-ons that don't cost twice as much as the new computers they'll be plugged into. However, nothing of the sort was shown at CES or NCC. What was seen from various manufacturers were prototypes of new micro-floppy disk drives,

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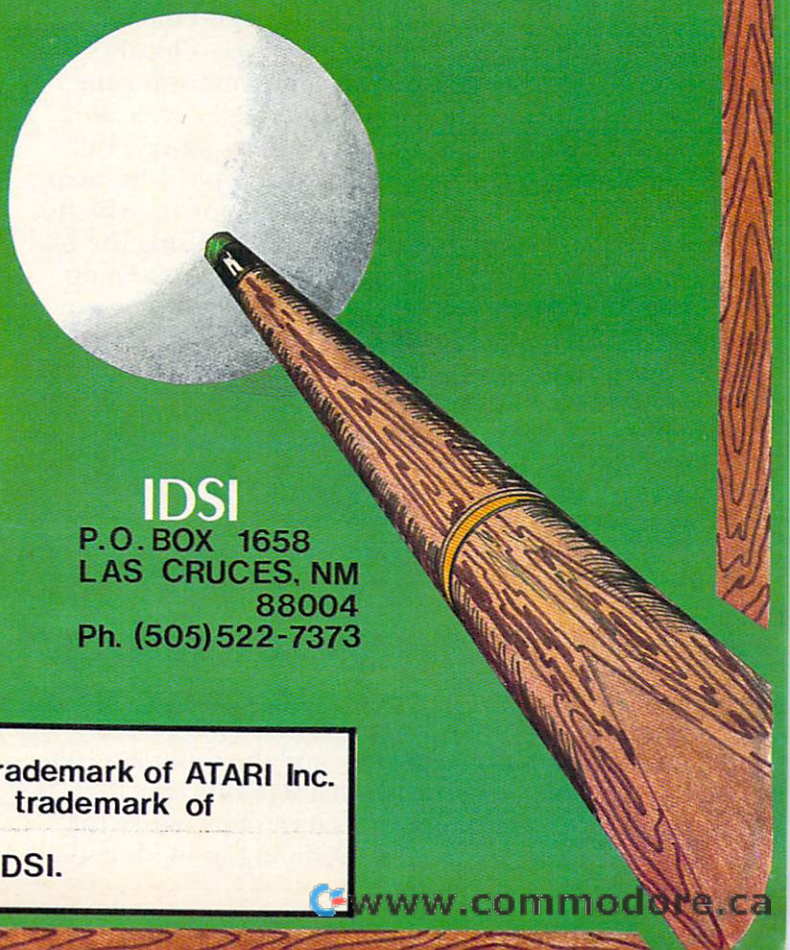

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both in 3-inch and 3-1/2 inch versions. A compatibility conflict already is arising, with Sony and other Japanese companies favoring the 3-1/2 inch size. Several domestic firms are trying to standardize among themselves on the smaller disks, some say as an effort to beat out the Japanese. It might be too late, since Sony has solidified its position by signing a $300 million contract to supply Hewlett Packard with the larger micro-floppies. Regardless, either size has potential advantages for home users.

For one thing, they may be cheaper than the 5-1/4 inch drives now standard for home computers. Sony is selling the 3-1/2 inch drives for $400 each in small quantities, and for significantly less in large quantities. Computer manufacturers buying several thousand of the micro-floppies for private labeling might eventually get them on the market for less than the $500 to $700 that current 5-1/4 inch drives cost. And despite their smaller size, the micro-floppies are much faster and actually store more data than larger disks. The Sony model, for example, crams 218K single density on one side of a disk, and 437.5K double density. That's more than even 8-inch disks. A double-sided, double density version could remember close to a megabyte!

Because the micro-floppies spin at 600 r.p.m. – twice the speed of 5-1/4 inch drives – and have much less area for the read/write head to cover, access time is better than existing drives, too. Media cost is the same as 5-1/4 inch disks, and the micro-floppies are encased in more foolproof hard plastic cases. They sound like ideal companions for the new, inexpensive home computers. So when will we see them for sale? Nobody knows. Sorry. But Clive Sinclair, the brains behind the price-breaking ZX-80/81 computers, already has come up with his own answer – again. Brochures advertising the ZX Spectrum in Great Britain promise that "coming soon" is a ZX Microdrive, apparently Sinclair's own version of the micro-floppy. The Microdrive, if it lives up to the ads, will be revolutionary: palm-sized, it will store 100K per disk and transfer data at 16K bytes per second! (See sidebar on the ZX Spectrum for more details.)

More Add-Ons

Speaking of Sinclair peripherals, a British firm called HSW & S, Inc. (with offices in Oxford, PA under the name Data-Assette) was at CES showing some unusual add-ons for the ZX-80/81. Two are keyboards: one is a nifty little affair that clamps neatly on the Sinclair's membrane keyboard to provide partial-stroke keys, and the other is a full-size, full-stroke keyboard in a separate case that plugs into the computer. You can buy either for $75. There's also the ZX 99, a plug-in module that adds an RS-232C interface so the Sinclair can drive any serial printer using standard ASCII character codes (the exhibitors at CES were running a Radio Shack Line Printer VII). The module also allows software control of up to four tape drives on the Sinclair, and includes a 2K ROM tape operating system. This sells for $150. A plug-in 64K RAM board also will be available.

Commodore VICMODEM

Commodore, besides its storm of new computers, also was showing off its VICMODEM. This is a very un-modem-looking modem, a cartridge that plugs into the VIC-20 and connects it directly to modular telephones (without the familiar acoustic coupler cups). This allows the VIC, among other things, to communicate with distant computers – yes, even mainframes – and to access computing services such as CompuServe, The Source, General Videotex, and the Dow Jones News/Retrieval Service. In fact, purchase of the VICMODEM includes free membership with CompuServe and free sample access time to all these services, including the Commodore Information Network, part of CompuServe. The VICMODEM also comes with its own terminal software (necessary for running a modem), called VICTERM I. Best of all, the whole package will sell for $109.95.

Atari also introduced a telecommunications package, the Communicator II. This includes a new direct-connect modem, called the Atari 835, the terminal software on a cartridge, dubbed *Telelink II,* and a free hour of sample access time on CompuServe, The Source and the Dow Jones Service. The list price is $279.95, and Atari predicts availability in the last quarter of 1982. *Telelink II,* which allows users to store and automatically dial two frequently called information service numbers and access codes, will be sold separately for $79.95, though the direct-connect modem will not be sold separately. The Atari 830 acoustic modem still will be available.

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Sinclair ZX Spectrum

Like its predecessors, the ZX-80/81 microcomputers, the new ZX Spectrum appears to be yet another price breakthrough for Sinclair Research and founder Clive Sinclair. It offers features and memory capacity heretofore unavailable in machines costing up to $1,000 – yet it is selling for the equivalent of only about $200!

Available only in Britain for the past few months, and not due for export until the end of the year, the Spectrum reportedly has been selling like hotcakes. And no wonder. The basic Spectrum offers 16K RAM, a powerful 16K BASIC language in ROM, eight colors each for the foreground, background and border (with flashing and intensity control), a tone generator programmable from BASIC with variable pitch and duration, a partial-stroke keyboard (unlike the ZX-80/81 flat membrane keyboard) with auto-repeat on all keys and one-touch BASIC keyword entry, upper and lower case, full ASCII character set, high-resolution 256 by 192 dot-addressable graphics, instant syntax checking, and high-speed LOAD and SAVE with cassette (16K in 100 seconds).

For the equivalent of less than $300, the Spectrum is available with 48K RAM. Those who buy the 16K model can upgrade to 48K for only slightly more than a 48K Spectrum would cost outright.

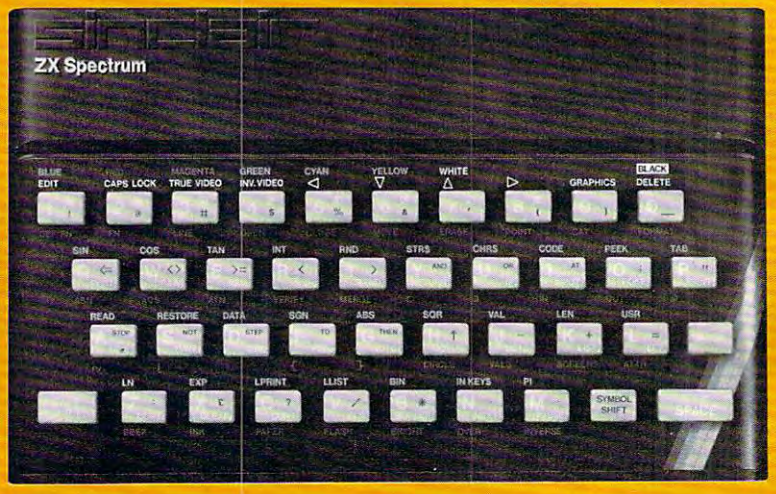
Even more amazing is the line of peripherals for the Spectrum. In Britain, Sinclair is now selling the ZX Printer, a thermal paper dot-matrix device, for around $100. It has a full ASCII character set (including lower case), prints 32 columns wide at 50 characters per second, connects to the Spectrum with no additional interface, and automatically prints out any screen – including graphics – with the single command COPY. Then there's the RS-232C interface soon to be available which will allow the Spectrum to hook up to a wide range of printers, terminals, modems and other devices – for under $50. And finally, Sinclair is promising a ZX Microdrive: a palm-sized disk drive that stores 100K per disk and transfers data at 16K per second. The Spectrum can handle up to eight Microdrives, totaling close to a megabyte of storage. Sinclair says it will sell for around $100.

This means that for the first time, consumers will be able to assemble a full-blown computer system – with 48K computer, hi-res color graphics and sound, printer and disk drive – for around $500!

The secret, claims Sinclair, is a new master chip combining the functions of many chips in other computers. The Spectrum has only 14 chips. At its heart is a Z-80A microprocessor running at 3.5 MHz.

This master chip, by the way, partly accounts for the delay in exporting the Spectrum to the U.S., says a Sinclair representative. The chip is being redesigned to meet Federal Communications Commission standards, probably for radio frequency interference.

Like the ZX-80/81 (which it will not replace, incidentally), the Spectrum connects to any ordinary TV and cassette recorder. It has a 32-column by 24-row screen display and redefinable character set. The keys, although similar in appearance to the calculator-style keys on the TRS-80 Color Computer, are made of a soft rubber that feels spongy to the touch. Most of the 40 keys have at least four functions, and some have six.



The Spectrum's sound consists of a single tone generator controlled by the keyword BEEP – which is an accurate description. Don't expect the kind of sound you hear from Ataris or the new Commodores, but even a beep is better than silence.

The Spectrum's extensive BASIC is an enhanced version of the current Sinclair BASIC and corrects many deficiencies. Besides graphics commands such as BASIC INK, PAPER, BRIGHT, FLASH, INVERSE, BORDER and CIRCLE, there are also a READ, DATA and RESTORE, unlike the ZX-80/81 dialect.

If the master chip is redesigned on schedule, we might see ZX Spectrums in America by the end of 1982. Depending on Timex's sales of ZX-81s, the watch company may be marketing the Spectrum also (see text). All we can do is wait.

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Epson HX-20

It was a pleasant surprise – dropping by the Epson booth at NCC in Houston to look for new printers and finding a startling new computer instead. What visitors found was the recently announced HX-20, the first computer from a company known for its economical and dependable printers. And it is definitely not a "me-too" computer. Epson's new machine is destined to redefine the term "portable."

The first thing that attracts people is the HX-20's looks: it is extremely compact, yet very complete. Less than a foot wide by 8-1/2 inches deep and 1-3/4 inches thick, and weighing less than four pounds, the HX-20 manages to pack in a 24-column dot-matrix printer with upper and lower case, a 20-column by 4-row liquid crystal display screen, a microcassette drive (optional), and a full-size, full-stroke keyboard. It's not a sparse keyboard, either. Its 68 keys include such extras as upper and lower case, five programmable function keys, BREAK, one-touch MENU, PAUSE, INS/DEL, HOME/CLR, NUM, CAPS LOCK, GRPH, screen scroll, and four-way cursor movement.

Although not much larger than a TRS-80 or Sharp Pocket Computer, its full-feature design – including 16K RAM expandable to 32K RAM – puts it in a league with much larger computers tied down to wall outlets. But the most amazing thing of all about the HX-20 is its portability: powered by four nickel-cadmium batteries, the HX-20 can run up to 50 hours on a charge, and be recharged in eight hours. Naturally, this performance depends on how often the printer and microcassette drive are used – such mechanical devices really eat up power.

The HX-20 also has a built-in RS-232C interface, and Epson was demonstrating a nifty little battery-powered modem that just happens to plug into the interface and make the perfect traveling companion for the machine.

And oh, yes, the latest word from Epson is that the HX-20 should be available by September for $795.

At the center of the computer are two Central Processing Units, both eight-bit 6301 microprocessors running at 614 KHz in a master-slave configuration. It comes with 32K of ROM expandable to 40K internally, and 64K with an expansion unit that was not shown. The liquid crystal display supports upper and lower case and a full-screen editor. Although only 20 characters wide, it scrolls another 20 characters sideways before wrapping down to the next line.

More HX-20 features: Microsoft BASIC is standard, there's a built-in clock and calendar with an alarm and interval timer, a programmable tone generator covering four octaves, interfaces for a bar code reader and a standard cassette recorder (the computer is available without the on-board microcassette), an internal DIP switch for selecting international character sets, 32 special graphic characters, a numeric keypad as part of the regular keyboard, and optional programs on ROM cartridges.

Other nice touches include a low-voltage power system that maintains data in RAM even when the computer is turned off, a knob that adjusts the liquid crystal display for straight-on or angled viewing, and even dot-addressable graphics for drawing charts on the small screen and printer. Epson is promising a floppy disk drive, too.

All in all, Epson has done a stunning job in packing so many features into a box about the size and weight of a hardback book. The keyboard – where skimping usually is done on small computers – is as luxurious as those on much larger, fixed-base machines. Although the HX-20 probably will not find its niche as a home computer, mainly because its display format limits game use, it seems to be ideal for traveling businessmen or engineers who need a portable, yet powerful computer that can hook up to any telephone for communicating with the home office. Its main drawback is the small display. It's a shame that a keyboard which lends itself so nicely to word processing is tied to a screen limited to only a few words at a time. An Epson representative says it may be possible to attach a monitor or TV, but there is no mention of this in the specifications.

At any rate, Epson's debut in computers is a groundbreaking – in more ways than one.

Software...

Although the most exciting news at the CES and NCC shows was the hardware, all was not quiet on the software front. Two major creative forces in the entertainment industry were married when Atari announced a partnership with Lucasfilm Ltd. to develop new video games for arcade coin-ops, home game machines and computers. Lucasfilm produced *Star Wars, The Empire Strikes Back,* and *Raiders of the Lost Ark,* and did the special effects for this summer's *Star Trek II, Poltergeist* and *E.T., the Extra-Terrestrial.* As anyone who has seen any of those movies knows, Lucasfilm obviously is a coven of creative talent. But aside from its sparse statement on developing new games, Atari was deliberately vague about what other paths might be explored by the joint venture. "We'll be developing new forms of electronic entertainment," said an Atari spokesman, "and the term 'electronic entertainment' is quite carefully chosen." In other words, just wait and see what we come up with, folks. As far as games, Atari did suggest that video game

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Commodore P, B, BX Series

With so many new computers to see at the recent trade shows, including five from Commodore alone, it was almost easy to lose a few in the shuffle. Luckily, nearly every machine was a significant advance in either technology or pricing – and often both. This was particularly true of the new Commodores.

Although the Commodore 64, an amazing value at $595, stole lots of thunder, the new P, B, and BX Series Commodores drew their fair share of interest from computer hobbyists and business users. They, too, offer unprecedented features for the money.

With their sleek, white Porsche-designed cases, these three new series look very much alike, but there are important differences separating the P from the more expensive B and BX machines.

The P128 is the home computer of the trio. It is the third-generation PET and shares many features with the Commodore 64: 40-column by 25-row screen display on normal TV sets, 16 colors, high-resolution 320- by 200-pixel graphics, the industry's most advanced synthesizer chip for programmable sound effects and music, redefinable character set, and animation with independently movable graphics blocks called "sprites" (also known as player/missiles in Atari parlance).

But that's where the similarities between the 64 and P128 end. The P128 comes with 128K of RAM – more than twice as much as most home computers can hold – and is expandable internally to 256K RAM and externally to 640K (896K total). And it will sell for just $995!

On top of that, there will be a plug-in Z-80 microprocessor board that will add CP/M, opening up a huge world of professional software, and even an 8088 16-bit microprocessor board for CP/M-86 capability. There's a built-in RS-232C interface for hooking up modems and printers, Commodore's traditional IEEE-488 interface to support the full range of Commodore CBM peripherals, a real-time clock, an enhanced Microsoft BASIC upward compatible with BASIC 4.0, audio system output, monitor output, and a cartridge slot for plug-in games and other software.

High-level languages such as U.C.S.D. Pascal will be supported, and the CP/M makes possible languages such as FORTRAN, COBOL and APL.

Commodore also pulled out all the stops on the P128's keyboard. It's the most complete we've ever seen on a home computer. Its 94 keys include 10 programmable function keys, a separate numeric keypad with CE, 00, ENTER and math operators, a key for each cursor arrow to support the full-screen editor, a large and easy to find RETURN, Pi, ESC, CTRL, INS/DEL, RUN/STOP, NORM/GRPH, CLR/HOME, OFF/RVS, and the full CBM business character set with PET graphics symbols.

Internally, the P128 has an eight-bit 6509 microprocessor for its Central Processing Unit (CPU). Commodore says this new chip is "functionally identical" to the 6502 found in previous Commodores, using the same instruction set. This means machine language programmers will adjust easily to the new chip, so new software for the computer should be available quickly. RAM expansion will come in 64K steps. Separate chips handle the color video, sound, and input/output, allowing the 6509 CPU to work undistracted. Also, the plug-in Z-80 and 8088 chips will work "concurrently" with the 6509 for what amounts to multiprocessing.

Game players weren't forgotten, either. The P128 supports two joysticks or four paddles. As on the Commodore 64, the sprites are totally independent of the background graphics, include collision detection and foreground/background priority, and can be three colors each. Eight of these can be moved anywhere on the screen at once. There's also a medium-resolution 200- by 160-pixel graphics mode, in addition to the hi-res and text modes.

The sound chip is the same Sound Interface Device (SID) found in the Commodore 64 and Max Machine. SID has three voices, programmable waveforms, filters, and 16-bit resolution over a

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nine-octave range. (For a fuller explanation, see Part I of "First Look at the Commodore 64" elsewhere in this issue.)

In practically every category, then, the P128 is the machine that will set the pace for state of the art home computers – including price.

The B and BX Series computers are aimed more toward the business/professional users. Both are 80-column machines with built-in green phosphor monitors, dual 5-1/4 inch disk drives and detachable keyboards. The layouts of the keyboards, incidentally, are identical to the P128's.

The B128, like the P128, comes with 128K RAM and is expandable to 256K internally and 640K externally (896K total). It starts at $1,695 (including both disk drives). It also shares the P128's 6509 CPU, the SID chip, the optional Z-80 and 16-bit 8088 multiprocessor boards for CP/M and CP/M-86 capability, the RS-232C and IEEE-488 interfaces compatible with CBM peripherals, audio output, the cartridge slot, standard Microsoft BASIC upward compatible with BASIC 4.0, and the real-time clock. It does not have hi-res color graphics or joystick ports.

The BX256 computer offers all the B128 features above, except it comes with 256K RAM and the 16-bit 8088 microprocessor for CP/M-86. It will retail for $2,995.

The B and BX Series computers, then, with their built-in dual disks, tilt-and-swivel monitors, 80-column by 25-line displays, detachable keyboards, and higher prices, will compete in a different market than the P Series. The B and BX will be stiff competition in the low-end business/professional market against machines such as the IBM Personal Computer, the Apple II and III, the TRS-80 Models II and III and the new 16-bit TRS-80 Model 16. Meanwhile, the P128 will be equally strong in the high-end home computer market against the Apple II, the Atari 800, and the TRS-80 Model III.

If the P, B and BX Series Commodores hit the dealers by this fall as promised, expect to see topsy-turvy changes as the other manufacturers scramble to stay competitive. It should be quite a show.

versions of Lucasfilm movies probably could be expected. *Raiders* was mentioned specifically. But Atari also cautioned that nothing would come to fruition until at least next summer. That should leave plenty of time to fuel wild rumors.

Atari also announced three new pieces of educational software, price cuts of about 22 percent for *Asteroids, Computer Chess, Missile Command, Space Invaders,* and *Super Breakout,* and cuts of 33 percent for *Star Raiders* and *Music Composer.*

TI Unleashes Software

Texas Instruments announced a flood of new software for its TI-99/4A Home Computer – no less than 45 titles, including 30 cartridges. Many of these are interactive learning tools, all with color graphics and optional synthesized speech. Of particular interest to computerists is an Editor/Assembler package so hackers can get at the 16-bit TMS 9900 microprocessor that is the TI-99/4A's heart. A memory expansion unit and disk drive are required, and the assembler lists for $99.95. For the same price, TI also introduced the Mini Memory Module, a plug-in 14K RAM cartridge with a built-in battery that retains the memory even when the computer is shut down and the module removed. A full-featured word processor, *TI-Writer,* also was announced for $99.95. And for $129.95, you can get TI-LOGO II, an extended version of the respected educational language that adds music, sound effects and printer interface to the original TI-LOGO. Expect all these products by the fourth quarter of this year.

Commodore introduced a line of software to accompany its new machines, including games and versions of popular business programs. An educational program for the Commodore 64, *Visible Solar System,* used fascinating high-resolution color graphics to show the relationships between planets, their orbits and the sun. The business programs are *EasyCalc, EasyPlot, EasyTools* and *EasyScan. EasyCalc* is advertised as the largest spreadsheet-type program available on a micro, with a matrix of 65 columns by 999 rows. Versions for the SuperPET at $149.95 and the Commodore 64 at $99.95 will be available this summer, with conversions for the P, B and BX series to follow later. The Commodore booths also were crowded with people playing some of the 13 new cartridge games for the VIC-20, such as *Gorf, Omega Race, Wizard of Wor* and *Mole Attack.* Five Scott Adams adventure games also were shown for the VIC.

What's Next?

There you have it ... the highlights of both shows. But the real interesting part is yet to come. It will be intriguing to watch how the various computer manufacturers juggle their line-ups and prices to compete in the rapidly changing home market, especially for the under-$500 machines. This is where the manufacturers are trying to reach the vast consumer population, those who are unfamiliar with computers and are buying them as they would any other home appliance. Expect rapid changes there for the next couple years. We'll keep you posted. ©

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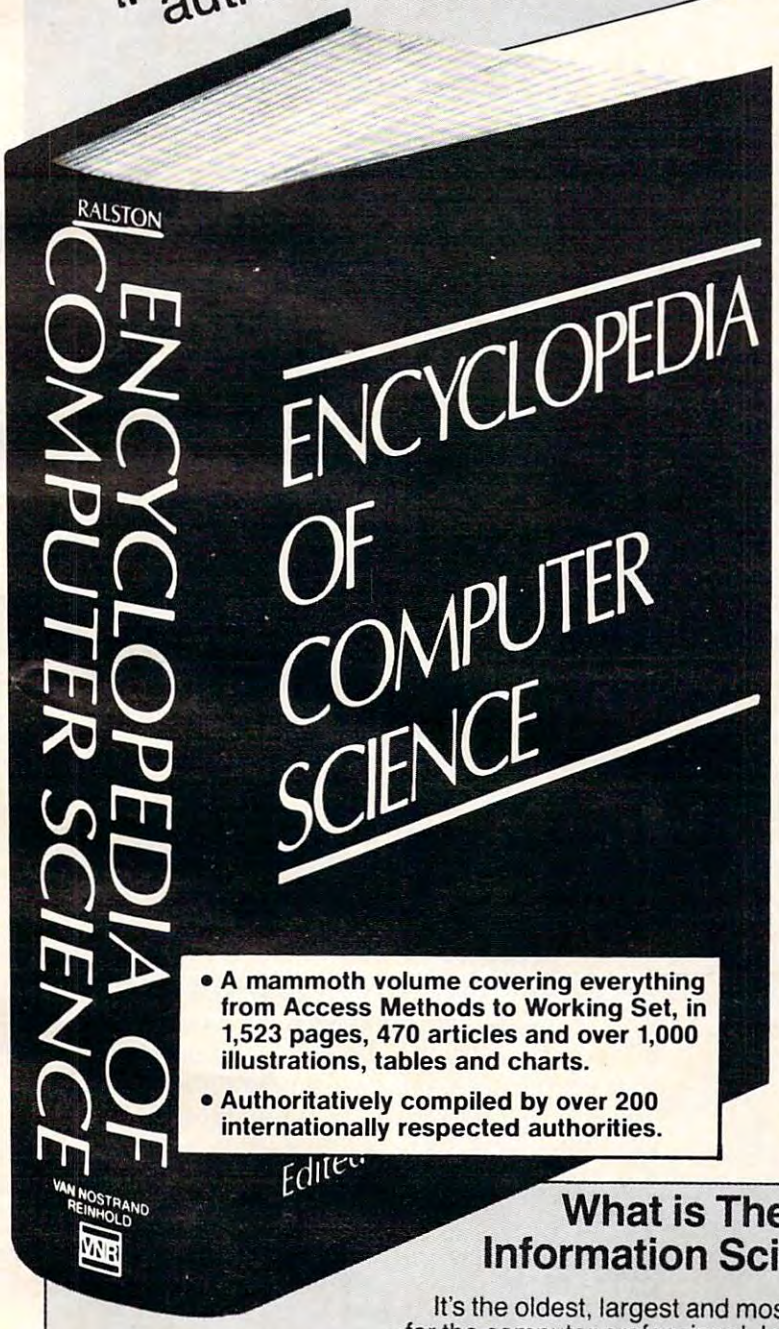

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A Monthly Column

The Beginner's Page

Structured Programming

Richard Mansfield
Assistant Editor

From time to time you'll hear about *structured* programming. It's not a single idea or technique, but rather a cluster of suggestions about the best way to go about programming. A "perfect" programming method will probably never be developed, but the various suggested "rules" associated with "structured programming" are worth looking into to see if there's anything there that you might find helpful.

Never Use GOTO

Advocates of structured programming suggest a variety of guidelines which programmers should follow to achieve easily written, easily modified, easily understood, and efficient programs. Some structured programming enthusiasts say you should never use GOTO in a program. GOTO jumps out of the normal "flow" of execution; it makes things unclear because its purpose within a program cannot be quickly understood. Other structured programming theorists suggest that a program should be "flowcharted" before the actual programming starts. A flowchart is to a program what an outline is to an essay: it illustrates the main ideas and shows the path of execution which the computer will follow when the program RUNs.

Related to flowcharting is a third idea associated with structured programming called "top-down" programming. In brief, this means that you make a general outline or flowchart of the main parts of your program before getting down to writing its individual subroutines and specific parts. This could mean that you first program a "main loop" which is a series of GOSUBs to subroutines written later. (With the opposite approach, "bottom-up" programming, you write the subroutines first and then tie them together at the end with a main, governing, "top" routine.)

"Modular" programming (breaking a program into smaller parts and solving each separately, using many subroutines); organizing DATA lines or files so that they are clearer and structured in a way that reflects the structure of the program which uses them; indenting program lines so that you can *see* a loop in a LISTing – all of these can be found under the umbrella idea: structured programming.

```
10 FOR I = 1 TO 10
20 PRINT I
30 PRINT I * I
40 FOR J = 1 TO 500
50 NEXT J
60 NEXT I
```

An "unstructured" listing.

```
10 FOR I = 1 TO 10
20     PRINT I: REM PRINT NUMBER
30     PRINT I * I: REM NUMBER SQUARED
40         FOR J = 1 TO 500: REM DELAY LOOP
50         NEXT J
60 NEXT I
```

One aspect of structured programming is indenting loops so that they are easily seen.

How you program is up to you. There are two general approaches, and each has its passionate advocates:

1. Improvise as you go.
2. Plan everything first.

The recreational programmer tends toward the first style. Type it in, RUN it, "how did *that* happen?" try something else, fix up problems, RUN again, and eventually it works.

The Special Requirements Of Group Programming

Professional programmers work under entirely different conditions. They must communicate with the computer, of course, but they also must communicate with each other. Their programs must meet standards. *Documentation* (explanations of what's going on in a program) must be thorough and clear. Often they work in groups, as part of a programming team. A job is broken down into pieces so that each programmer is writing a subroutine of what will later be linked together to become the main program. Unless things are well coordinated, group programming will be unsuccessful. It would be like an auto factory where each worker made a personal decision about where to drill bolt holes on his piece of a car. When the time came to put it all together, very little would fit.

For somewhat similar reasons, many teachers would favor structured programming. If you had

It's hard to picture all of DYNACOMP's *software*


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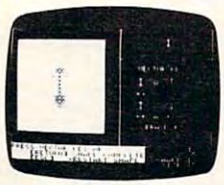
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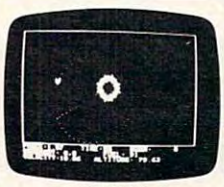
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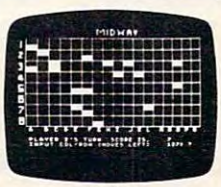

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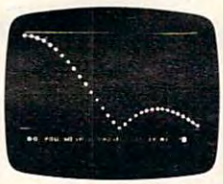
FOURIER ANALYZER


RINGS OF THE EMPIRE


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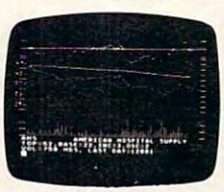
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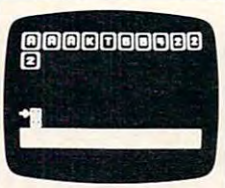
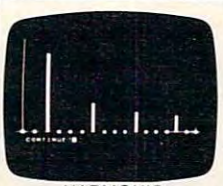
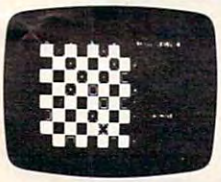
FOREST FIRE


QUINTOMINOES


STARBASE 3.2

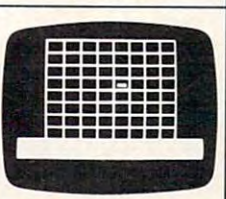

GO FISH


HARMONIC ANALYZER


CHECKERS 3.0


HODGE PODGE


TRIPLE BLOCKARD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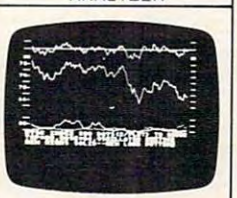
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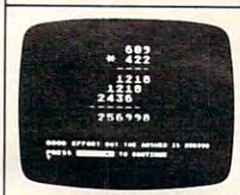
TEACHER'S AIDE


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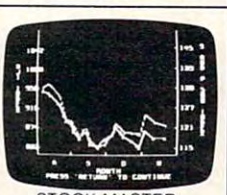
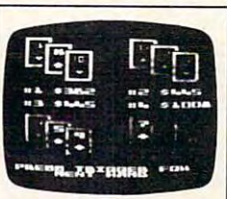

STOCK MASTER STOCK PLOT


BACCARAT


SUPER SUB CHASE


MAIL MASTER


VALDEZ (MAP)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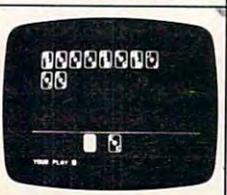
GIN RUMMY

SPACE LANES


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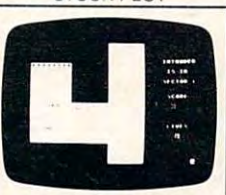
BREAKUP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If you liked DYNACOMP'S BRIDGE 2.0, you will absolutely love BRIDGE MASTER. BRIDGE MASTER is a comprehensive bridge program designed to provide hours of challenging competition. Bidding features include the Blackwood convention, Stayman convention, pre-emptive openings, and recognition of demand bids and jump-shift responses. After playing a specific hand, you may replay the same hand, with the option of switching cards with your computer opponents. This feature allows you to compare your bidding and playing skills to BRIDGE MASTER. Bonuses for game contracts and slams are awarded as in duplicate bridge. Doubled contracts are scored based upon a computer assigned vulnerability. A score card is displayed at the conclusion of each hand. The score card displays a summary of total hands played, total points scored, number of contracts made and set, and % bids made. BRIDGE MASTER is clearly the best computer bridge program available.

DYNACOMP'S previous BRIDGE 2.0 customers may upgrade to BRIDGE MASTER for a nominal charge of $5.00 plus postage and handling (see ordering information box).

NEW NEW

BACCARAT (Atari only) — Price $18.95 Cassette/$22.95 Diskette

This is the European card game which is the favorite of the Monte Carlo jet set. Imagine yourself at the gaming table with 007 to your left and Goldfinger to your right. Learn and play BACCARAT at your leisure on the Atari. Contains full high resolution color graphics and matching sound. Runs in 16K. Requires one joystick.

NEW

GIN RUMMY (Apple diskette only) — Price: $22.95 Diskette

This is the best micro computer implementation of GIN RUMMY existing. The computer plays exceptionally well, and the HIRES graphics are superb. What else can be said?

NEW

POKER PARTY (Available for all computers) — Price: $19.95 Cassette/$23.95 Diskette

POKER PARTY is a draw poker simulation based on the book, POKER, by Oswald Jacoby. This is the most comprehensive version available for microcomputers. The party consists of yourself and six other (computer) players. Each of these players (you will get to know them) has a different personality in the form of a varying propensity to bluff or fold under pressure. Practice with POKER PARTY before going to that expensive game tonight! Apple cassette and diskette versions require a 32 K (or larger) Apple II.

NEW NEW

GO FISH (Available for all computers) — Price: $14.95 Cassette/$18.95 Diskette

GO FISH is a classic children's card game. The opponent is a friendly computer with user inputs that are simple enough for small children to easily master. The Apple and Atari versions employ high resolution graphics for the display of hands. A must for children! Runs in 16K.

NEW NEW

BLACKJACK COACH (32K TRS-80 only) — Price: $29.95 Cassette/$33.95 Diskette

BLACKJACK COACH is both a game and an educational tool. With this program you may quantitatively test standard and special playing and betting methods, including the several card count schemes. You can simply play, play with the computer as a coach, or statistically test your method under long run automatic play. All the standard player choices are included: insurance, splitting pairs, double downs and surrender (optional). The computer analyzes the technique and provides detailed summary reports which statistically pinpoint the strengths and weaknesses of your play. Don't risk your money at the tables until you have practiced with BLACKJACK COACH!

THOUGHT PROVOKERS

NEW

MANAGEMENT SIMULATOR (Available for all computers) — Price: $25.95 Cassette $29.95 Diskette

This program is both an excellent teaching tool as well as a stimulating intellectual game. Based upon similar games played at graduate business schools, each player or team controls a company which manufacturers three products. Each player attempts to outperform his competitors by setting selling prices, production volumes, marketing and design expenditures etc. The most successful firm is the one with the highest stock price when the simulation ends.

FLIGHT SIMULATOR (Available for all computers) — Price: $19.95 Cassette/$23.95 Diskette

A realistic and extensive mathematical simulation of take-off, flight and landing. The program utilizes aerodynamic equations and the characteristics of a real airfoil. You can practice instrument approaches and navigation using radials and compass headings. The more advanced flyer can also perform loops, half-rolls and similar aerobatic maneuvers. Although this program does not employ graphics, it is exciting and very addictive. See the software review in COMPUTRONICS. Runs in 16K Atari.

VALDEZ (Available for all computers) — Price: $17.95 Cassette/$21.95 Diskette

VALDEZ is a computer simulation of supertanker navigation in the Prince William Sound/Valdez Narrows region of Alaska. Included in this simulation is a realistic and extensive 256 × 256 element map, portions of which may be viewed using the ship's alphanumeric radar display. The motion of the ship itself is accurately modelled mathematically. The simulation also contains a model for the tidal patterns in the region, as well as other traffic (outgoing tankers and drifting icebergs). Chart your course from the Gulf of Alaska to Valdez Harbor! See the software reviews in 80 Software Critique and Personal Computing.

NEW

BACKGAMMON 2.0 (Available for all computers) — Price: $19.95 Cassette/$23.95 Diskette

This program tests your backgammon skills and will also improve your game. A human can compete against a computer or against another human. The computer can even play against itself. Either the human or the computer can double or generate dice rolls. Board positions can be created or saved for replay. BACKGAMMON 2.0 plays in accordance with the official rules of backgammon and is sure to provide many fascinating sessions of backgammon play.

CHESS MASTER (North Star and TRS-80 only) — Price: $19.95 Cassette/$23.95 Diskette

This complete and very powerful program provides five levels of play. It includes castling, en passant captures and the promotion of pawns. Additionally, the board may be preset before the start of play, permitting the examination of "book" plays. To maximize execution speed, the program is written in assembly language (by SOFTWARE SPECIALISTS of California). Full graphics are employed in the TRS-80 version, and two widths of alphanumeric display are provided to accommodate North Star users. See review in onComputing.

FOREST FIRE! (Atari only) — Price: $14.95 Cassette/$18.95 Diskette

Using excellent graphics and sound effects, this simulation puts you in the middle of a forest fire. Your job is to direct operations to put out the fire while compensating for changes in wind, weather and terrain. Not protecting valuable structures can result in startling penalties. Life-like variables are provided to make FOREST FIRE! very suspenseful and challenging. No two games have the same setting and there are 3 levels of difficulty.

BLACK HOLE (Apple only) — Price: $15.95 Cassette/$19.95 Diskette

This is an exciting graphical simulation of the problems involved in closely observing a black hole with a space probe. The object is to enter and maintain, for a prescribed time, an orbit close to a small black hole. This is to be achieved without coming so near the anomaly that the tidal stress destroys the probe. Control of the craft is realistically simulated using side jets for rotation and main thrusters for acceleration. This program employs Hi-Res graphics and is educational as well as challenging.

NEW

SPACE EVACUATION! (Available for all computers) — Price: $15.95 Cassette/$19.95 Diskette

Can you colonize the galaxy and evacuate the Earth before the sun explodes? Your computer becomes the ship's computer as you explore the universe to relocate millions of people. This simulation is particularly interesting as it combines many of the exciting elements of classic space games with the mystery challenge of ADVENTURE.

MONARCH (Atari only) — Price: $14.95 Cassette/$18.95 Diskette

MONARCH is a fascinating economic simulation requiring you to survive an 8-year term as your nation's leader. You determine the amount of acreage devoted to industrial and agricultural use, how much food to distribute to the populace and how much should be spent on pollution control. You will find that all decisions involve a compromise and that it is not easy to make everyone happy. Runs in 16K Atari.

CHOMPELO (Atari only) — Price: $14.95 Cassette/$18.95 Diskette

CHOMPELO is really two challenging games in one. One is similar to NIM; you must bite off part of a cookie, but avoid taking the poisoned portion. The other game is the popular board game REVERSI. It fully uses the Atari's graphics capability, and is hard to beat. This package will run on a 16K system.

AVAILABILITY

DYNACOMP software is supplied with complete documentation containing clear explanations and examples. Unless otherwise specified, all programs will run within 16K program memory space (ATARI requies 24K). Except where noted, programs are available on ATARI, PET, TRS-80 (Level II), NEC and Apple (Applesoft) cassette and diskette as well as North Star single density (double density compatible) diskette. Additionally, most programs can be obtained on standard (IBM 3740 single density/double density compatible format) 8" CP/M floppy disks for systems running under MBASIC or CBASIC (for example, Altos, Xerox 820, Heath/Zenith and many others). 5¼" CP/M diskettes are available for the North Star, SuperBrain and Osborne computer systems.

**ATARI, PET/CBM, NORTH STAR, CP/M, IBM, OSBORNE, SUPERBRAIN, NEC PC-8000 and XEROX are registered tradenames and/or trademarks.*

***Except where noted, all TRS-80 Model I software is available on cassette (only) for the TRS-80 Model III. Exceptions: VALDEZ, CRIBBAGE, GRAFIX, CHESSMASTER, TRS-80 diskettes are not supplied with either DOS or BASIC.*

****For most North Star disk-based systems.*

*****For Altair systems having Microsoft BASIC.*

******For SUPERBRAIN systems running under MBASIC or CBASIC (state which).*

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NEW

STARBASE 3.2 (Available for all computers) — Price: $13.95 Cassette/$17.95 Diskette

This is the classic space simulation, but with several new features. For example, the Croylins now shoot at the Invincible without warning while also attacking starbases in other quadrants. The Croylins also attack with both light and heavy cruisers and move when shot at! The situation is hectic when the Invincible is besieged by three heavy cruisers and a starbase S O.S. is received! The Croylins get even! See the software reviews in A.N.A.L.O.G., 80 Software Critique and Game Merchandising.

NEW

LIL' MEN FROM MARS (Atari only) — Price: $19.95 Cassette/$23.95 Diskette

Defend yourself! The little men from Mars are out to get you if you don't get them first. This is a hilarious high resolution animated graphics (arcade) game which exercises much of the Atari's power. Requires one joystick.

SPACE TILT (Apple and Atari only) — Price: $14.95 Cassette/$18.95 Diskette

Use the game paddles to tilt the plane of the TV screen to "roll" a ball into a hole in the screen. Sound simple? Not when the hole gets smaller and smaller! A built-in timer allows you to measure your skill against others in this habit-forming action game.

NEW

ESCAPE FROM VOLANTIUM (Atari only) — Price: $15.95 Cassette/$19.95 Diskette

Bring the action and excitement of an arcade into your home with ESCAPE FROM VOLANTIUM! To escape you must maneuver your space ship around obstacles and laser blast the guardian (without being eaten). If he is killed with a direct shot (not just a leg lopped off), a door opens to the outside. However, the door does not stay open indefinitely. If you fail to escape in time, the door closes and a new guardian appears. Sometimes you can smash through the door by repeatedly chipping away at it. Other times it is impervious. At the higher levels of play more obstacles and guardians appear, adding to the excitement. Uses high resolution graphics and sound. Runs in 16K.

ALPHA FIGHTER (Atari only) — Price: $13.95 Cassette/$17.95 Diskette

Two excellent graphics and action programs in one! ALPHA FIGHTER requires you to destroy the alien starships passing through your sector of the galaxy. ALPHA BASE is in the path of an alien UFO invasion; let five UFO's get by and the game ends. Both games require the joystick and get progressively more difficult the higher you score! ALPHA FIGHTER will run on 16K systems.

THE RINGS OF THE EMPIRE (Atari only) — Price: $14.95 Cassette/$18.95 Diskette

The empire has developed a new battle station protected by rotating rings of energy. Each time you blast through the rings and destroy the station, the empire develops a new station with more protective rings. This exciting game runs on 16K systems, employs extensive graphics and sound and can be played by one or two players.

INTRUDER ALERT (Atari only) — Price: $15.95 Cassette/$19.95 Diskette

This is a fast paced graphics game which places you in the middle of the "Dreadstar" having just stolen its plans. The droids have been alerted and are directed to destroy you at all costs. You must find and enter your ship to escape with the plans. Five levels of difficulty are provided. INTRUDER ALERT requires a joystick and will run on 16K systems.

NEW

MIDWAY (Atari 32K only) — Price: $14.95 Cassette/$18.95 Diskette

MIDWAY is an exciting extension of the game of Battleship. It mixes the challenges of strategy and chance. Your opponent can be another human or the computer. Color graphics and sound are both included. Runs in 16K.

NEW

TRIPLE BLOCKADE (Atari only) — Price: $14.95 Cassette/$18.95 Diskette

TRIPLE BLOCKADE is a two-to-three player graphics and sound action game. It is based on the classic video arcade game which millions have enjoyed. Using the Atari joysticks, the object is to direct your blockading line around the screen without running into your opponent(s). Although the concept is simple, the combined graphics and sound effect lead to "high anxiety".

GAMES PACK I (Available for all computers) — Price: $14.95 Cassette/$18.95 Diskette

GAMES PACK I contains the classic computer games of BLACKJACK, LUNAR LANDER, CRAPS, HORSERACE, SWITCH and more. These games have been combined into one large program for ease in loading. They are individually accessed by a convenient menu. This collection is worth the price just for the DYNACOMP version of BLACKJACK.

GAMES PACK II (Available for all computers) — Price: $14.95 Cassette/$18.95 Diskette

GAMES PACK II includes the games CRAZY EIGHTS, JOTTO, ACEY-DUCEY, LIFE, WUMPUS and others. As with GAMES PACK I, all the games are loaded as one program and are called from a menu. You will particularly enjoy DYNACOMP's version of CRAZY EIGHTS.

Why pay $7.95 or more per program when you can buy a DYNACOMP collection for just $10.95?

NEW

MOON PROBE (Available for all computers) — Price: $12.95 Cassette/$16.95 Diskette

This is an extremely challenging "lunar lander" program. The user must drop from orbit to land at a predetermined target on the moon's surface. You control the thrust and orientation of your craft plus direct the rate of descent and approach angle. Runs in 16K Atari.

SPACE TRAP (Atari only, 16K) — Price: $14.95 Cassette/$18.95 Diskette

This galactic "shoot'em up" arcade game places you near a black hole. You control your spacecraft using the joystick and attempt to blast as many of the alien ships as possible before the black hole closes about you.

CHIRP INVADERS (PET/CBM only) — Price: $14.95 Cassette/$18.95 Diskette

CHIRP INVADERS is an addictive game using action graphics. A Federation space station must be reached before the Chirps conquer the Earth. Stationary obstacles, moving meteors, and the attacking Chirps must all be avoided for a successful journey. Good luck. 40 column PET/CBM only.

NEW

SUPER SUB CHASE (Atari only) — Price: $19.95 Cassette/$23.95 Diskette

SUPER SUB CHASE simulates a search and destroy mission. Set your course and keep an eye on the sonar readings as you hunt for the hidden submarine. Set the depth charge explosion depth and watch them sink towards the sub. This is an addictive game which takes advantage of the Atari's graphics and sound capabilities. One or two players. Joystick(s) required.

ADVENTURE

CRANSTON MANOR ADVENTURE (North Star, SuperBrain and CP/M only) — Price: $19.95 Diskette

At last! A comprehensive Adventure game for North Star and CP/M systems. CRANSTON MANOR ADVENTURE takes you into mysterious CRANSTON MANOR where you attempt to gather fabulous treasures. Lurking in the manor are wild animals and robots who will not give up the treasures without a fight. The number of rooms is greater and the associated descriptions are much more elaborate than the current popular series of Adventure programs, making this game the top in its class. Play can be stopped at any time and the status stored on diskette. Not available in 5¼" CP/M format.

GUMBALL RALLY ADVENTURE (North Star only, 48K) — Price: $21.95 Diskette

Take part in this outlaw race from the east coast to the west coast. The goal is to find your way to the finish line while maintaining the highest possible speed. You may choose one of five cars available at the garage. The choice will affect your speed and range. Remember to take spare parts and don't get caught speeding!

UNCLE HARRY'S WILL (North Star only, 40K) — Price: $24.95 Diskette

Uncle Harry has died and has left you everything. However, he has neglected to mention where everything is! Instead, his will consists of a poem which contains clues. You will have to travel all over the United States both by car and on foot to solve the puzzle, and there are over 300 locations to probe. Be careful and watch out for red herrings!

TYPE 'N' TALK

DYNACOMP is now distributing the new and revolutionary TYPE-'N-TALK™ (TNT) speech synthesizer from Votrax. Simply connect TNT to your computer's serial interface, enter text from the keyboard and hear the words spoken. TNT is the easiest-to-program speech synthesizer on the market. It uses the least amount of memory and provides the most flexible vocabulary available anywhere!

TYPE-'N'-TALK List price $375. DYNACOMP'S price $319.95 plus $5.00 for shipping and handling.

TALK TO ME (T'N'T Atari only, 24K) — Price: $14.95 Cassette/$18.95 Diskette

This program presents a superb tutorial on speech synthesis using the Atari 800 and TYPE 'N TALK™. TALK TO ME will illustrate normal word generation as well as phoneme generation. The documentation includes many helpful programming tips. TALK TO ME has been demonstrated on network (CBS) TV!

OTHER T'N'T PROGRAMS: MOON PROBE, TNT, CHOMPELO, TNT

MISCELLANEOUS

CRYSTALS (Atari only) — Price: $14.95 Cassette/$18.95 Diskette

A unique algorithm randomly produces fascinating graphics displays accompanied with tones which vary as the patterns are built. No two patterns are the same, and the combined effect of the sound and graphics are mesmerizing. CRYSTALS has been used in local stores to demonstrate the sound and color features of the Atari. Runs in 16K Atari.

NORTH STAR SOFTWARE EXCHANGE (NSSE) LIBRARY

DYNACOMP now distributes the 23 volume NSSE library. These diskettes each contain many programs and offer an outstanding value for the purchase price. They should be part of every North Star user's collection. Call or write DYNACOMP for details regarding the contents of the NSSE collection.

Price: $9.95 each/$8.95 each (4 or more)

The complete collection may be purchased for $159.95

NEW

5¼" DISKETTES (soft sectored/ten sectored) — Price: $39.95/20 Diskettes

As you might imagine, DYNACOMP purchases diskettes in large quantities and at wholesale prices. We want to pass the savings along to you!

BUSINESS and UTILITIES

NEW **MAILMASTER (Atari diskette only)** Price: $39.95 Diskette
MAILMASTER is a very versatile software package for managing and manipulating mail lists and mini data bases. Each disk can hold over 600 customer entries containing name, address, 38 letter key words and a phone number. The display is marked so that entries may be made and edited with ease. The status (e.g., disk space left, options, etc.) is shown at all times. Labels may be printed 1,2 or 3 up, and all sorting (zip code and alphabetic) is performed by a fast machine language program.

NEW **PERSONAL FINANCE SYSTEM (Available for all computers)** Price: $39.95 Diskette
PFS is a single diskette, menu-oriented system composed of ten different programs. Besides recording your expenses and tax deductible items, PFS will sort and summarize expenses by payee, and display information on expenditures by any of 26 user defined codes by month or by payee. PFS will even produce monthly bar graphs of your expenses by category! This powerful package requires only one disk drive, minimal memory (24K Atari, 32K North Star) and will store up to 600 records per disk (and over 1000 records per disk by making a few simple changes to the programs). You can record checks plus cash expenses so that you can finally see where your money goes and eliminate guesswork and tedious hand calculations. Contains high speed machine language sort. PFS has been demonstrated on network (CBS) TV!

FAMILY BUDGET (Apple and Atari only) Price: $34.95 Diskette
FAMILY BUDGET is a very convenient financial record-keeping program. You will be able to keep track of cash and credit expenditures as well as income on a daily basis. You can record tax deductible items and charitable donations. FAMILY BUDGET also provides a continuous record of all credit transactions. You can make daily cash and charge entries to any of 21 different expense accounts as well as to 5 payroll and tax accounts. Data are easily retrieved giving the user complete control over an otherwise complicated (and unorganized!) subject.

INTELINK (Atari only) Price: $49.95 Diskette
This software package contains a menu-driven collection of programs for facilitating efficient two-way communications through a full duplex modem (required for use). In one mode of operation you may connect to a data service (e.g., The SOURCE or MicroNet) and quickly load data such as stock quotations onto your diskette for later viewing. This greatly reduces "connect time" and thus the service charge. You may also record the complete contents of a communications session. Additionally, programs written in BASIC, FORTRAN, etc. may be built off-line using the support text editor and later "uploaded" to another computer, making the Atari a *very* smart terminal. Even Atari BASIC programs may be uploaded. Further, a command file may be built off-line and used later as controlling input for a time-share system. That is, you can set up your sequence of time-share commands and programs, and the Atari will transmit them as needed; batch processing. All this adds up to saving both connect time and your time.

NEW **PAYFIVE (Apple II plus diskette, two drives required)** Price: $149.95
This is an enormously flexible employee payroll system with extraordinarily good human engineering features. PAYFIVE prints checks and compiles the required federal, state and local forms for up to 148 employees! The pay methods may be hourly, salary, commission or any combination. There are multiple options for pay periods, and they also can be used in any combination. PAYFIVE includes many other features and comes extremely well documented with a 200 page manual. The manual may be purchased separately for $30, and that payment later applied to the software purchase.

SHOPPING LIST (Atari only) Price: $12.95 Cassette/$16.95 Diskette
SHOPPING LIST stores information on items you purchase at the supermarket. Before going shopping, it will remind you of all the things you might need, and then display (or optionally print) your shopping list and the total cost. Adding, deleting, changing and storing data is very easy. Runs with 16K.

NEW **TAX OPTIMIZER (Available for all computers)** Price: $59.95 Diskette
The TAX OPTIMIZER is an easy-to-use, menu oriented software package which provides a convenient means for analyzing various income tax strategies. The program is designed to provide a quick and easy data entry. Income tax is computed by all tax methods (regular, income averaging, maximum and alternate minimum tax). The user may immediately observe the tax effect of critical financial decisions. TAX OPTIMIZER has been thoroughly field tested in CPA offices and comes complete with the current tax tables in its data files. TAX OPTIMIZER is tax deductible!

NEW **UTIL (Apple only, 48K)** Price: $19.95 Diskette
UTIL is a disk-oriented utility system which permits examining and changing of the contents of DOS 3.2 and 3.3 diskettes at the bit (nibble or byte) level. With UTIL you can easily examine the contents of a diskette sector by sector, restructure the sector pointers, reallocate sectors (e.g. bad sectors may be "hidden"), and perform many other sophisticated operations. For the experienced programmer.

NEW **TURNKEY AND MENU (Atari only)** Price: $17.95 Diskette
TURNKEY is a utility program which allows you to create autoboot/autorun diskettes easily. Simply load and run TURNKEY, load the program diskette to be modified, and answer the questions! The TURNKEY diskette also comes with DOS 2.0 and includes another program, MENU. MENU lists the contents of your diskette alphabetically, and permits the running of any BASIC program on the diskette by typing a single key. TURNKEY and MENU provide you with the ability to run any program on your diskette by simply turning on the computer and pressing a single key.

NEW **STOCKAID (Atari only)** Price: $29.95 Diskette
STOCKAID provides a powerful set of tools for stock market analysis. With STOCKAID you can display point and figure charts, as well as bar charts with oscillators. You can also examine long term moving averages and on-balance volume features. STOCKAID allows you to input daily data with a single diskette storage capability of 239 days × 16 stocks. Included are stock dividend and split adjustment capabilities. A very professional package!

NEW **SHAPE MAGICIAN (Apple II, 48K, diskette only)** Price: $29.95
At last! An utility for painlessly creating graphics shapes for the Apple. Create, edit and save up to 30 shapes which can then be used to develop arcade games or to simply enhance your programs. Add that professional touch!

EDUCATION

HODGE PODGE (Apple 48K and Atari diskette only) Price: $14.95 Cassette/$18.95 Diskette
Let HODGE PODGE be your child's teacher. Pressing any key on your Apple will result in a different and intriguing "happening" related to the letter or number of the chosen key. The program's graphics, color and sound are a delight for children from ages 1½ to 7. HODGE PODGE is a non-intimidating teaching device which brings a new dimension to the use of computers in education. See the excellent reviews of this very popular program in INFOWORLD and SOFTALK.

NEW **TEACHERS' AIDE (Atari only)** Price: $13.95 Cassette/$17.95 Diskette
TEACHERS' AIDE consists of three basic modules contained in one program. The first module provides addition and subtraction exercises of varying levels of difficulty. The second module consists of multiplication problems in which the student may be tested both on the final answer and/or on the subtotal answers in the long hand procedure. Several levels of complexity are provided here as well. The third module consists of division problems; one particularly nice feature of the division module is that the long hand division steps can be displayed along with the remainder in order to clearly demonstrate the procedure by which the remainder is derived. Using TEACHER'S AIDE is not merely a drill, but rather a learning experience.

NEW **PHARMACOLOGY UPDATE (PET only)** Price: $169.95 Cassette/$149.95 Diskette
This is DYNACOMP's first educational software entry for the medical profession (more are coming!). PHARMACOLOGY UPDATE was written by a R.N. as a masters project, with the aid of a practicing pharmacologist and an electronics instructor. This package comes in two parts. The first part is a 200 page manual which is divided into 11 sections. Each of these sections provides both concise information and probing questions. The second part consists of 11 programs that are keyed to the text and which test the degree of your understanding of the text material. This package has great educational value for the beginning student as well as the professional interested in an efficient way to review and update his or her knowledge. Available on cassettes (11) or diskette.

NEW **TEACHER'S GRADEBOOK (Apple 48K dual/single drive)** Price: $49.95 Diskette
TEACHER'S GRADEBOOK is a *complete* password protected record-keeping system for the classroom. It supports up to nine users, and each user may have data for up to nine classes on one disk (with up to 90 students per class). Typical information which can be entered, edited and processed includes rosters, absences and grades. Summary reports may be displayed (on the screen) or printed in various ways, with automatic weighted averaging and conversion to letter grades. This system has been tested ("goof-proofed") in the class environment and is both well-written and well-documented.

ORDERING INFORMATION

All orders are processed and shipped within 48 hours. Please enclose payment with order and include the appropriate computer information. If paying by VISA or Master Card, include all numbers on card. Purchase orders accepted.

Shipping and Handling Charges
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8" CP/M Disks
Add $2.50 to the listed diskette price for each 8" floppy disk (IBM soft sectored CP/M format). Programs run under Microsoft MBASIC or BASIC-80.

5¼" CP/M Disks
All software available on 8" CP/M disks is also available on 5¼" disks, North Star and Osborne format.

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STATISTICS and ENGINEERING

DIGITAL FILTER (Available for all computers) Price: $39.95 Cassette/$43.95 Diskette
DIGITAL FILTER is a comprehensive data processing program which permits the user to design his own filter function or choose from a menu of filter forms. In the explicit design mode the shape of the frequency transfer function is specified by directly entering points along the desired filter curve. In the menu mode, ideal low pass, high pass and bandpass filters may be approximated to varying degrees according to the number of points used in the calculation. These filters may optionally also be smoothed with a Hanning function. In addition, multi-stage Butterworth filters may be selected. Features of DIGITAL FILTER include plotting of the data before and after filtering, as well as display of the chosen filter functions. Also included are convenient data storage, retrieval and editing procedures.

DATA SMOOTHER (Not available for Atari) Price: $19.95 Cassette/$23.95 Diskette
This special data smoothing program may be used to rapidly derive useful information from noisy business and engineering data which are equally spaced. The software features choice in degree and range of fit, as well as smoothed first and second derivative calculation. Also included is automatic plotting of the input data and smoothed results.

FOURIER ANALYZER (Available for all computers) Price: $19.95 Cassette/$23.95 Diskette
Use this program to examine the frequency spectra of limited duration signals. The program features automatic scaling and plotting of the input data and results. Practical applications include the analysis of complicated patterns in such fields as electronics, communications and business.

TFA (Transfer Function Analyzer) Price: $19.95 Cassette/$23.95 Diskette
This is a special software package which may be used to evaluate the transfer functions of systems such as hi-fi amplifiers and filters by examining their response to pulsed inputs. TFA is a major modification of FOURIER ANALYZER and contains an engineering-oriented decibel versus log-frequency plot as well as data editing features. Whereas FOURIER ANALYZER is designed for educational and scientific use, TFA is an engineering tool. Available for all computers.

HARMONIC ANALYZER (Available for all computers) Price: $24.95 Cassette/$28.95 Diskette
HARMONIC ANALYZER was designed for the spectrum analysis of repetitive waveforms. Features include data file generation, editing and storage/retrieval as well as data and spectrum plotting. One particularly unique facility is that the input data need not be equally spaced or in order. The original data is sorted and a cubic spline interpolation is used to create the data file required by the FFT algorithm.

FOURIER ANALYZER, TFA and HARMONIC ANALYZER may be purchased together for a combined price of $51.95 (three cassettes) and $63.95 (three diskettes).

REGRESSION I (Available for all computers) Price: $19.95 Cassette/$23.95 Diskette
REGRESSION I is a unique and exceptionally versatile one-dimensional least squares "polynomial" curve fitting program. Features include very high accuracy; an automatic degree determination option; an extensive internal library of fitting functions; data editing; automatic data, curve and residual plotting; a statistical analysis (eg: standard deviation, correlation coefficient, etc.) and much more. In addition, new fits may be tried without reentering the data. REGRESSION I is certainly the cornerstone program in any data analysis software library.

REGRESSION II (Available for all computers) Price: $19.95 Cassette/$23.95 Diskette
PARAFIT is designed to handle those cases in which the parameters are imbedded (possibly nonlinearly) in the fitting function. The user simply inserts the functional form, including the parameters (A(1), A(2), etc.) as one or more BASIC statement lines. Data, results and residuals may be manipulated and plotted as with REGRESSION 1. Use REGRESSION I for polynomial fitting, and PARAFIT for those complicated functions.

MULTILINEAR REGRESSION (MLR) (Available for all computers) Price: $24.95 Cassette/$28.95 Diskette
MLR is a professional software package for analyzing data sets containing two or more linearly independent variables. Besides performing the basic regression calculation, this program also provides easy to use data entry, storage, retrieval and editing functions. In addition, the user may interrogate the solution by supplying values for the independent variables. The number of variables and data size is limited only by the available memory.

REGRESSION I, II and MULTILINEAR REGRESSION may be purchased together for $51.95 (three cassettes) or $63.95 (three diskettes).

ANOVA (Not available on Atari cassette or for PET/CBM) Price: $39.95 Cassette/$43.95 Diskette
In the past the ANOVA (analysis of variance) procedure has been limited to the large mainframe computers. Now DYNACOMP has brought the power of this method to small systems. For those conversant with ANOVA, the DYNACOMP software package includes the 1-way, 2-way and N-way procedures. Also provided are the Yates 2^{K-P} factorial designs. For those unfamiliar with ANOVA, do not worry. The accompanying documentation was written in a tutorial fashion (by a professor in the subject) and serves as an excellent introduction to the subject. Accompanying ANOVA is a support program for building the data base. Included are several convenient features including data editing, deleting and appending.

BASIC SCIENTIFIC SUBROUTINES, Volumes 1 and 2 (Not available for Atari)
DYNACOMP is the exclusive distributor for the software keyed to the popular texts *BASIC SCIENTIFIC SUBROUTINES, Volumes 1 and 2* by F. Ruckdeschel (see advertisements in BYTE magazine). These subroutines have been assembled according to chapter. Included with each collection is a menu program which selects and demonstrates each subroutine.

Volume 1
Collection #1: Chapters 2 and 3 - Data and function plotting; complex variables and functions.
Collection #2: Chapter 4 - Extended matrix and vector operations.
Collection #3: Chapters 5 and 6 - Random number generators (Poisson, Gaussian, etc.); series approximations.
Price per collection: $16.95 Cassette/$20.95 Diskette
All three collections are available for $44.95 (three cassettes) and $53.95 (three diskettes).

Volume 2
Collection #1: Chapter 1 - Linear, polynomial, multidimensional, parametric least squares.
Collection #2: Chapter 2 - Series approximation techniques (economization, inversion, reversion, shifting, etc.).
Collection #3: Chapter 3 - Functional approximations by iteration and recursion.
Collection #4: Chapter 4 - CORDIC approximations to trigonometric, hyperbolic, exponential and logarithmic functions.
Collection #5: Chapter 5 - Table interpolation, differentiation and integration (Newton, LaGrange, splines).
Collection #6: Chapter 6 - Methods for finding the real roots of functions.
Collection #7: Chapter 7 - Methods for finding the complex roots of functions.
Collection #8: Chapter 8 - Optimization by steepest descent.
Price per collection: $14.95 Cassette/$18.95 Diskette.
All eight collections are available for $99.95 (eight cassettes) and $129.95 (eight diskettes).
Because the texts are a vital part of the documentation, *BASIC SCIENTIFIC SUBROUTINES, Volumes 1 and 2* are available from DYNACOMP:

BASIC SCIENTIFIC SUBROUTINES, Vol 1 (319 pages): $19.95 + 75¢ postage
BASIC SCIENTIFIC SUBROUTINES, Vol 2 (790 pages): $23.95 + $1.50 postage

See reviews in KILOBAUD and Dr. Dobbs.

NEW **SOFTNET (Apple II, 48K, diskette only)** Price: $129.95
SOFTNET may be used to create models of liquid pipeline systems to evaluate their flow performance. Up to 150 nodes with up to 150 connecting elements may be simulated, and models may be combined to form yet larger models. If you are involved in water distribution systems, chemical fluid flow problems, building plumbing, or similar situations, this is an ideal analysis tool.

NEW **MATCHNET (TRS-80 only)** Price: $19.95 Cassette/$23.95 Diskette
It often takes days to iteratively optimize an L, Pi or T matching network for a particular application. Take a few minutes with MATCHNET and you will have the Q, frequency response and reflection coefficients for any of twelve matching networks. You input the source and load impedance and MATCHNET calculates the R, C, (and L) values and plots (and/or prints) the frequency response and reflection coefficients for each configuration. The reviewer of this program remembers when he use to do this by hand and loves MATCHNET!

ACTIVE CIRCUIT ANALYSIS (ACAP) (48K Apple only) Price: $35.95 Cassette/$39.95 Diskette
With ACAP you may analyze the response of an active or passive component circuit. The circuit may be probed at equal steps in frequency, and the resulting complex voltages at each component juncture examined; the frequency response of a filter or amplifier may be completely determined with respect to both amplitude and phase. In addition, ACAP prints a statistical analysis of the range of voltage responses which result from tolerance variations in the components. ACAP is easy to learn and use. Circuit descriptions may be saved onto cassette or diskette to be recalled at a later time for execution or editing. ACAP should be part of every circuit designer's program library.

LOGIC SIMULATOR (Apple only; 48K RAM) Price: $35.95 Cassette/$39.95 Diskette
Test your complicated digital logic design with respect to given set of inputs to determine how well the circuit will operate. The elements which may be simulated include multiple input AND, OR, NOR, EXOR, EXNOR and NAND gates, as well as inverters, J-K and D flip-flops, and one-shots. Inputs may be clocked in with varying clock cycle lengths/displacements and delays may be introduced to probe for glitches and race conditions. A timing diagram for any given set of nodes may be plotted using HIRES graphics. Save your breadboarding until the circuit is checked by LOGIC SIMULATOR.

NEW **NUMBERKRUNCHER (TRS-80 only)** Price:69.95 Cassette/$73.95 Diskette
This program is the most complete numerical analysis system available for the TRS-80. It can handle up to 255 data sets, each set having a six character name. It includes complete data editing facilities and convenient data input/output capability. The analyses available are multiple linear regression and correlation determination of residuals, data transformations and extensive graphics generation, including axis naming, and more. The supporting documentation is extremely well written and well organized, and includes appendices which describe the numerical procedures used in the program.

NEW **STATSORT (TRS-80 only)** Price: $39.95 Cassette/$43.95 Diskette
STATSORT consists of several menu selected programs which allow the user to create (build, edit, merge), format and print files, (machine) sort them on any field, and numerically analyze (maximum, minimum, average, variance, standard deviation) tabulated data. STATSORT is well documented and easy to use. The cassette version can also be employed to create a data type which can be read by the Radio Shack Advanced Statistical Package.

NEW **STATTEST (Not available on Atari cassette or for PET/CBM)** Price: $19.95 Cassette/$23.95 Diskette
This is a statistical inference package which helps you make wise decisions in the face of uncertainty. In an interactive fashion you can build and edit data files and test the differences in means, variances and proportions. STATTEST will also perform data analysis as well as do linear correlation and regression. This menu-directed statistical workhorse is rounded out with a chi-square contingency test and a (uniform and normal) random sample generator. The documentation is written by a college professor who guides you through the various tests.

ABOUT DYNACOMP

DYNACOMP is a leading distributor of small system software with sales spanning the world (currently in excess of 50 countries). During the past three years we have greatly enlarged the DYNACOMP product line, but have maintained and improved our high level of quality and customer support. The achievement in quality is apparent from our many repeat customers and the software reviews in such publications as COMPUTRONICS, 80 Software Critique, A.N.A.L.O.G., Softalk, Creative Computing and Kilobaud. DYNACOMP software has also been chosen for demonstration on network television. Our customer support is as close as your phone. It is always friendly. The staff is highly trained and always willing to discuss products or give advice.

to grade twenty programming solutions, your task would be easier if all the students' programs were following general rules and were easy to understand. If a student program is extensively commented with REM statements, if all the subroutines are clearly identified, if the "flow" (the path of execution) of the program is straightforward and obvious – the program can be more easily analyzed and evaluated.

Also, students who are first learning to program might find that the additional, formal rules of structured programming aid them in grasping the elements of programming. On the other hand, other students might find the same rules cumbersome, an unnecessary burden. Because programming is both a science and an art – it could be taught either way. Some students might profit from comprehensive "laws" which must be followed; others might need the creative freedom of the artist with "rules" kept to a minimum.

It's Your Decision

Clearly, this distinction between the improvisational and pre-planned programming styles is somewhat artificial. All programming involves *some* rules which must be followed if the program is to work correctly. The heart of this issue is deciding how many rules, how much formality is useful. Certainly, those special situations involving group programming, such as the classroom or professional programming teams, are operating under special constraints which require special rules.

For the rest of us, the benefits, if any, of the various structured programming notions must be determined on a personal basis. If indenting your loops helps you in some way, by all means do it. If you need heavy REMarking, REM liberally. If you think using GOTO is perilous, avoid it. Your personal style will evolve, and you will naturally use what you find useful and discard what you find unnecessary.

But be wary of the idea that structured programming (or any other "solution" to programming tasks) is a cure-all. As Raeto West points out in his book, *Programming the PET/CBM*, "...the sad fact is that any complex program will remain complex in whatever way it is written down." ©

This personal budget program is designed for the Atari with 16K and a cassette recorder or Commodore PET. To adapt the program to Apple or VIC, see the accompanying notes.

Household Budget Manager

Richard Kalagher
Vienna, VA

This program will allow you to enter and store all of your household check and credit card expenditures. You can allocate these expenditures to budget categories that you define, review selected portions of your expenditures, perform searches, and calculate sales tax. And you don't need a disk drive to save the data! All data automatically becomes part of your program, which you save on cassette at the end of each session.

When I first tried to write a cassette based data storage system, I found that storing and reading data from the tape was not only somewhat unreliable, but painfully slow. However, Bruce Frumker's article in **COMPUTE!**, August, 1981, #15, solved the problem. By using the "dynamic keyboard" technique, this program stores any data you enter as part of the program. You just need to SAVE the program on cassette after each use. And you will find that the program will run faster than a disk based system.

In order to save memory for data, there are not many REM statements in the program. Lines 8-113 initialize the program variables and fill the array P with the values in the DATA statements on lines 200-230. (You could put thirty zeros separated by commas on line 200 to save typing, the first time you run the program.)

Array P contains all of the saved balances. P(0) is the line number (minus 10000) where the next set of data will be written. P(1) through P(26) contains the balances in your budget categories. The index corresponds to the letter of the alphabet. For example, if you have a category called "Insurance," its balance is contained in P(9) since I is the 9th letter of the alphabet. You could, for example, increase the balance by $100.00 (if you made a mistake) by hitting BREAK after the main menu is displayed, typing in P(9) = P(9) + 100.00, hitting RETURN, typing CONT, and hitting RETURN again to start the program running. P(27) is your checkbook balance, P(28) the last month, P(29) the last day, and P(30) the Unallocated Deposits (explained later). Line 232 contains the current year which you should change each year.

Lines 999-1999 contain the main menu. Line 1155 sends the program to a given subroutine. You should be able to determine how each subroutine works by studying the code and the descriptions below of what each option is used for. Just remember that most decisions are based on the ATASCII code of the first character of a given string.

The budget system is simple and straightforward. First you decide on the budget categories you would like (e.g., Household, Automobiles, Savings, etc.) When you write a check, the computer will subtract the amount from the budget category and from your checkbook balance. When you make a purchase with a credit card, the computer will again subtract the amount from the budget category, but it will add the same amount to a credit card escrow category. When you pay your credit card bill, the amount will be subtracted from the credit card escrow category. In addition, you can search for and display the information in many different ways.

Setting Up Your Budget Categories

You must select your budget categories and the names of your credit card escrow accounts. There are two restrictions:

1. You can have a total of 26 categories.
2. The names of each category must start with a different uppercase letter.

For example, you cannot have "Mastercard" and "Medical" but you could have "Doctors and Dentists" and "Mastercard." I recommend that you use a small number of budget categories (i.e., 8-15). For example, I include my mortgage payment, utilities, and major house repairs in one category called "Utilities" – but the choice is yours.

Similarly, you can have a separate escrow account for each credit card or you could lump them all into one category called "Credit Card Escrow." Again, the choice is yours.

The DATA statements in lines 9000-9500 contain the names of the budget categories. You can use these or make up your own using the above restrictions (remember to begin with an uppercase letter). The order of the categories is not important (unless you want them in a particular order). Be sure the last statement is

```
9500 DATA END
```

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NAUTILUS

From Synapse by Mike Potter

Two-player interaction combat game: the underwater cities and their destroyers against the helicopters and submarines. The helicopters bomb the ships; the subs fire torpedoes at the cities and surface to fire at the destroyers. The destroyers fire at the helicopters and drop depth charges on the subs. They can also lower men into the ocean to rebuild cities hit by torpedoes. Top and bottom halves of screen scroll separately for maximum field of play. Great graphics.

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Allocating Money

As you write checks and make charge purchases, the amounts will be subtracted from the budget categories. You could just let these amounts accumulate (they would show as negative balances in the budget categories) or you can add money each month (or week) to the categories. One procedure would be to decide how much money each month you want to allocate to each category. As you allocate money to categories (the procedure is described in the next section), the money is subtracted from a special category called "Unallocated Deposits."

When you make deposits, they can be used to cover the money in this special category. At the end of the month, any additional money in "Unallocated Deposits" could be allocated to a "Savings" or "Miscellaneous" category or could just be left for you to balance out at the end of the year.

Menus

The following sections describe the function of each of the nine main menus.

1. *Enter Checks and Charges*

This is the basic input for the program. The computer will prompt you with questions which you answer, and then press RETURN. First you are asked for a check number or charge card. If you are entering a check, you must input as the first character a number (0-9). You can enter up to four digits. If you have a billpayer account or automatic checks to which you do not assign a number, you can use any of the following symbols as the first character of the check number: !, #, $, %, *, ., /, ?, etc. (Any symbol with an ATASCII decimal code less than 64 will work except the + sign.)

For deposits, the first character of the check number must be the + sign. For example, you could use +, +PAY, +DEP, +12, etc. You can also enter interest by using the + sign, or service charges by entering a + sign and then a negative amount when the computer asks for the amount.

For credit card purchases, enter the name of the credit card. The first letter must correspond to the budget category you have set up for that credit card. For example, if your category is "Visa Escrow" then enter Visa or V for the entry. If you are using just one credit card escrow for all credit cards, the first letter of this entry should be the same as the name of the category. For example, if the category was named "Credit Card Escrow" you could enter C-V for Visa, C-M for Mastercard, etc.

You will now be asked for the date. Enter a two digit month, a backslash, and a two digit day (i.e., 03/21, 05/01, 12/25, etc.).

You will now be asked for the amount. Enter the number with two decimal places. For example 10.00 not 10 if the amount was $10.00. This will give you a nice right-justified column on the screen. For amounts over $10,000.00 the balances will be correct although you will get some truncation on the screen. All numbers are entered as positive although you can enter negative numbers if you want (i.e., a service charge entered as a deposit).

You will now be asked if you paid sales tax on the item (answer Y or N). This information can be used at the end of the year to determine how much sales tax you have paid during the year for income tax purposes.

You will be asked to enter a budget category. You need only enter the first letter of the budget category, but you can enter the whole word if you like. If the entry was a deposit (i.e. first character of the check number was a + sign) the computer will ask if you want to allocate the deposit to a budget category. If you say "no," the deposit will be allocated to the special "Unallocated Deposit" category (see previous section). If you say "yes," it will ask which category.

The computer will now ask if the data is okay. If you say "no," you will be asked to re-enter all of the data. If you say "yes," you will see a brief flash of letters on the screen. What happens is the program momentarily stops executing and adds a line of data (to itself) containing the information you have just entered.

You will now be asked for a check number or credit card again. You now repeat the above process. If you are through making entries, hit RETURN and you will return to the main menu.

2. *Print Check Register*

When you select this option you will get a listing on the screen of all checks and deposits for the period you select. If you just want to see one month, enter that month for both starting and ending month. If you want the whole year then enter 1, 12. The "BALANCE" will be your current checking account balance. "TOTAL FOR ABOVE" will be the sum of the checks less deposits for the time period you have selected. You will be prompted to hit RETURN when the screen is full or when you want to return to the main menu.

3. *Print Charge Register*

This works just like the check register except you will be asked which charge card. If you have only one charge escrow, enter the first letter of its name.

4. *Update Balances in Budget Categories*

This is the routine you use to allocate money to the budget categories. You need only enter the first letter of the budget category. Note that you can enter a negative amount. For example if you had $-35.67 of unallocated deposits at the end of

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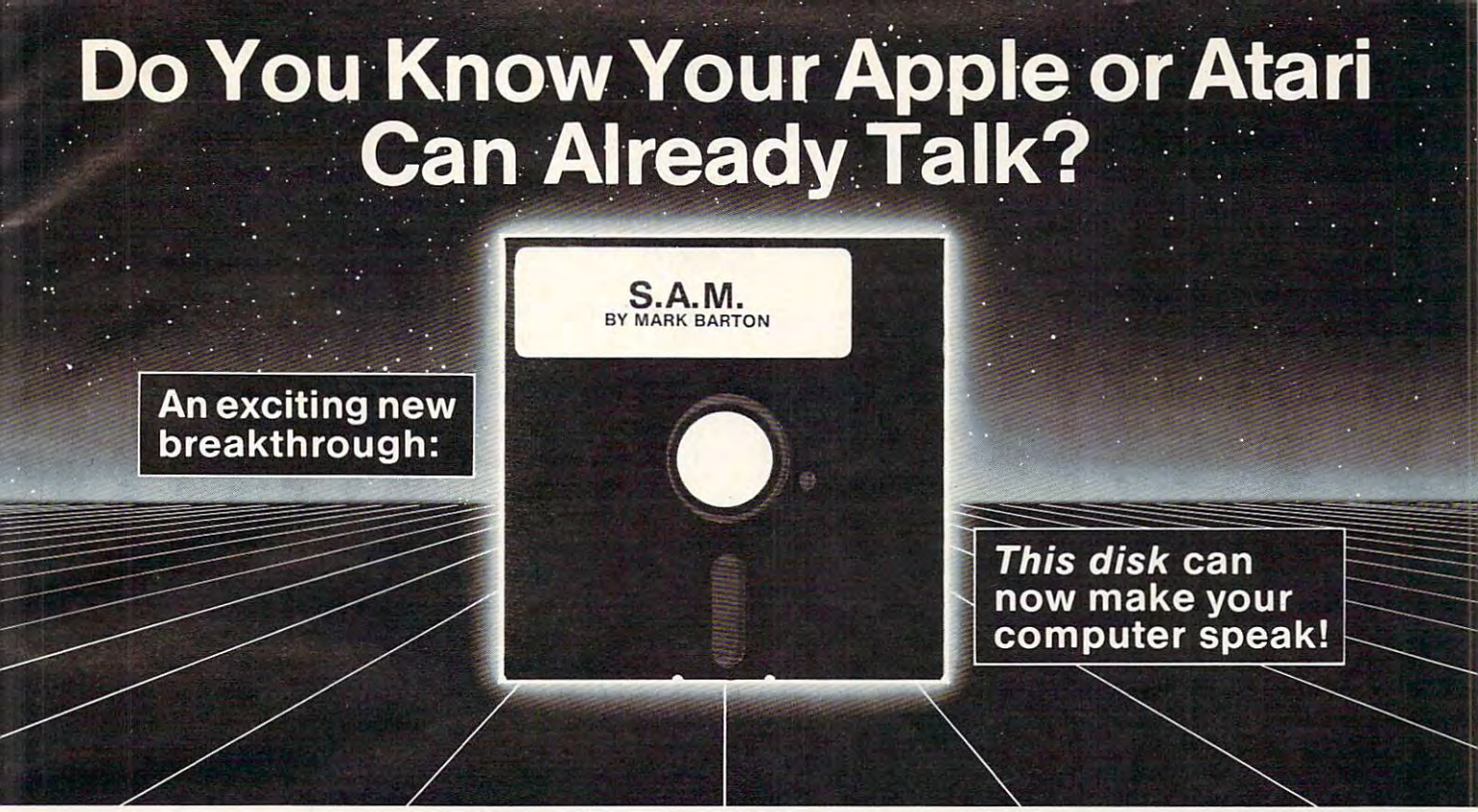

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the month, you could allocate this amount to "Savings" or "Miscellaneous" to balance the "Unallocated Deposits" to zero.

Hit RETURN to return to the main menu.

5. *Calculate Sales Tax*

If you use the sales tax tables to calculate this deduction on your income tax, you may be losing money. At the end of the year, this routine will tell you how much you have actually spent. Just enter your state's sales tax in percent (i.e., enter 4 not .04 for a 4% rate) and you will get the correct result.

6. *Print Balances in All Categories*

This routine will tell you the balance in all budget categories, your checkbook balance and the amount of Unallocated deposits.

7. *Perform Search for Charge or Check*

This is one of the most useful and most entertaining routines to use. Just enter from 1 to 16 characters and the computer will find and total all charges and checks that contain those characters in the Payee field. Want to know how much you spent on electricity? Just enter the name of your electric company. When was the last time you went to the dentist? Just enter the dentist's name and you will know. If there are items you might want to find and total, you can enter your own special characters in the Payee field at the time you enter data and then find and total them using this routine.

8. *Examine an Individual Category*

This routine works like menu items two and three above except you can look at any budget category.

9. *Store Data and End Session*

When you are finished for the evening, enter nine at the main menu to end this session. First the screen will blink for about ten seconds while the new balances become part of your program. You will then be instructed to turn over the tape, rewind, and hit RETURN with PLAY and RECORD pressed. Your program will be saved on tape (with all your data) for the next session. Note that you have the previous version of your program on the other side of the tape in case you have any difficulties loading the most current version next time.

Operational Concerns

If you make a mistake when entering data, the computer will ask you to re-enter the data after reminding you of the correct format. If the computer does stop, it will display a message stating what line it stopped at and give you an ATARI BASIC error code. You can almost always recover from an error by typing CONT and hitting RETURN. This way you will not lose any of the data you have entered during the session.

Since the data is being stored as part of your program, the program will require more memory as you use it. On a 16K system you have about 6500 bytes of available memory. Each entry takes 30-60 bytes depending on its length. To find out how much memory you have remaining you can type ?PRINT FRE(0) when your program is loaded, but not yet running. You will also be warned with a red screen and a message if you have less than 1000 bytes remaining when you run the program.

When you have little memory left you can store the data by itself on a separate tape. Use the following procedure:

1. Put a new tape in the Program Recorder, rewind, and press PLAY and RECORD (label the tape since you will want to file it).

2. Type LIST "C", 10000, 30000

3. Hit RETURN twice

4. After the tape stops you will have a tape of just your data.

5. Put in a scratch tape, rewind, and press PLAY and RECORD.

6. Type LIST "C", 0, 10000.

7. When you get the READY prompt, type NEW and hit RETURN.

8. Rewind the tape and press PLAY.

9. Type ENTER "C" and hit RETURN twice.

10. When you get the READY prompt you will now have your program in memory with all of the current balances, but without the check and credit card data. You will also again have about 6500 free memory bytes (with a 16K system) so you can continue your record keeping.

Any time you want to put your old data back, just follow the above procedure, then put in the data tape you want and use ENTER "C" to load the data as part of your program. How often you have to do this will depend on how many checks and charges you use, but you might want to choose a standard time such as yearly or quarterly.

I have deliberately left out several possible features in order to conserve as much memory as possible. You could, if you have a larger memory capacity, add routines to balance your checkbook, automatically format dollar amounts, search fields other than the payee field, use logical searches, print to a printer, etc.

If you would like a copy of this program, [*the Atari version only*] please send a blank disk or cassette and a stamped, self-addressed mailer, and $3.00, to me at 1841 Nigel Ct., Vienna, VA 22180.

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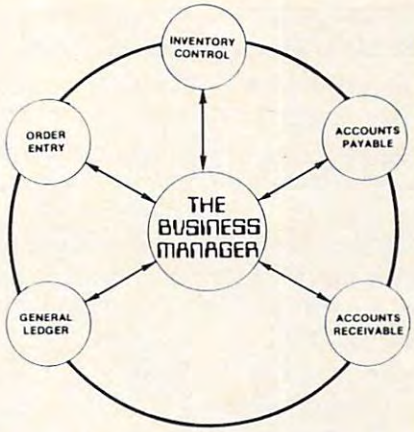

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Multi User System

Notes To VIC, Apple, And PET Owners

This program makes use of a very unusual feature of the Atari, "forced read." When activated, the Atari will start generating carriage returns automatically, entering whatever appears on the screen as if a user had entered it. It can be used for line deletion, auto-numbering when entering programs, or the update of a program line: in effect, the machine can program itself. In Mr. Kalagher's program, this technique is used to update a series of DATA statements used to hold budget information, and add other information such as checks and charges to the end of the program. This keeps the program and its data together, eliminating the need to use a cumbersome cassette file. When the changes are complete, the program is re-SAVEd onto cassette.

Obviously, converting this program to run on another computer would be no easy task. Few computers share "special features," such as this one. However, a similar technique commonly known as the "dynamic keyboard" can be used on the PET/CBM and VIC-20.

On these computers a "keyboard queue" is used to remember the last ten keystrokes typed. This provides a feature known as "typeahead," which lets you enter keystrokes faster than the computer can process them, preventing any loss of data.

Normally the operating system of the computer manages the keyboard queue, but it can be "fooled" into thinking up to ten characters need to be typed by POKEing the desired characters into the "keyboard buffer." The number of characters POKEd is stored in an "index." The most common use of this technique is to place up to ten carriage returns as if the user had typed them. This is different than PRINTing a carriage return, which merely moves the cursor to the left edge of the next line.

Any information on the screen that is "RETURNed over" in this fashion will be entered as data or program lines. One serious complication is that the PET/CBM and VIC clear out all variables and arrays when a new program line is entered. This makes it necessary to list all the essential variables on the screen, and then RETURN over them too. In this program, the entire P(0-30) array must be listed out in DATA statements any time a line is changed.

The subroutine at 9700 is then called to read the array back in and initialize program constants, since they were lost when the lines were updated. GOSUBs and FOR/NEXT loops are also cancelled, so you can't RETURN from such a routine or use it in a FOR/NEXT loop. The last line of the list should be a "GOTO xxx" statement that transfers control back to the program, usually the line following the line that calls the subroutine (to simulate a RETURN).

Screen positioning is important: see the subroutine at 9600. To convert it to run on Original ROM PETs, change POKE 158,9 to POKE 525,9 and POKE 622+I,13 TO POKE 527+I,13. For the VIC, change them to POKE 198,9 and POKE 631+I,13 respectively.

VIC owners will also want to tailor the menu and prompts to conform to the 23 character line length or even add some color! You will not have very much memory for your budget information with the 5K VIC, so you may want to use several copies of the program, maybe one for every three months.

Owners of other machines will have to research into their machine's "special features" and see if there is any way to implement the "dynamic keyboard." If you do, write it up and share it with the rest of us. Apple owners who have disk drives could SAVE the data on disk rather than in the program.

Program 1: Atari Version

```
1 REM HOUSEHOLD CHECK, CREDIT CARD,
2 REM AND BUDGET PROGRAM
8 SETCOLOR 2,2,6:SETCOLOR 1,2,0:SETCOLOR
 4,10,4
10 DIM P(30)
20 FOR I=0 TO 30
30 READ X:P(I)=X
40 NEXT I
45 PRINT CHR$(125)
50 IF FRE(0)<1000 THEN PRINT CHR$(125):S
ETCOLOR 2,4,4:? "WARNING!  ROOM FOR ABOU
T ";INT(FRE(0)/50);" MORE ENTRIES"
70 ? "PROGRAM WAS LAST RUN ON ";P(28);"/
";P(29)
75 TRAP 83
80 ? :? :? "ENTER TODAY'S DATE (MM,DD)"
81 INPUT X,B
82 GOTO 90
```

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```
83 ? :? "TRY AGAIN. REMEMBER TO PUT A CO
MMA BETWEEN DAY AND MONTH"
84 GOTO 80
90 P(28)=X:P(29)=B
100 DIM S$(38):S$="
                  "
101 DIM N$(5):N$=S$
102 DIM D$(9):D$=S$
103 DIM I$(16):I$=S$
104 DIM A$(7):A$=S$
105 DIM W$(1):W$=S$
106 DIM C$(1):C$=","
107 DIM Z$(38):Z$=S$
108 DIM T$(1):T$=S$
110 DIM B$(10):B$="BALANCE = "
111 DIM SE$(16):SE$=S$
112 DIM Q$(1):Q$=S$
113 DIM Y$(3):READ Y$
200 DATA 0
201 DATA 0
202 DATA 0
203 DATA 0
204 DATA 0
205 DATA 0
206 DATA 0
207 DATA 0
208 DATA 0
209 DATA 0
210 DATA 0
211 DATA 0
212 DATA 0
213 DATA 0
214 DATA 0
215 DATA 0
216 DATA 0
217 DATA 0
218 DATA 0
219 DATA 0
220 DATA 0
221 DATA 0
222 DATA 0
223 DATA 0
224 DATA 0
225 DATA 0
226 DATA 0
227 DATA 0
228 DATA 0
229 DATA 0
230 DATA 0
231 REM CHANGE YEAR
232 DATA /82
999 PRINT CHR$(125)
1000 PRINT "WHAT DO YOU WANT TO DO?":? :
?
1010 PRINT "1. Enter Checks and Charges"
:?
1020 PRINT "2. Print Check Register":?
1030 PRINT "3. Print Charge Register":?

1040 PRINT "4. Update Balance in Budget
Categories"
1050 PRINT "5. Calculate Sales Tax":?
1060 PRINT "6. Print Balances in all Cat
egories":?
1070 PRINT "7. Perform Search for Charge
 or Check":?
1080 PRINT "8. Examine an Individual Cat
egory":?
1095 PRINT "9. Store Data and End Sessio
n"
1140 PRINT :PRINT :PRINT "ENTER NUMBER";

1145 TRAP 1998
1150 INPUT WHICH
1151 PRINT CHR$(125)
1155 ON WHICH GOSUB 3000,4000,4000,2500,
7000,2000,6000,4000,5000
1998 T$=" "
1999 GOTO 999
2000 REM PRINTS BALANCES IN ALL CATEGORI
ES
2020 ? "     BALANCES IN ALL CATEGORIES"
:?
2030 RESTORE 9000
2040 FOR I=1 TO 26
2050 READ Z$
2060 IF Z$="END" THEN GOTO 2100
2070 PRINT Z$;" = $ ";P(ASC(Z$)-64)
2080 NEXT I
2100 POP
2110 PRINT "Unallocated Deposits = $ ";P
(30)
2120 PRINT "Checking Account Balance = $
 ";P(27)
2450 ? :? "HIT [RETURN] WHEN THROUGH":IN
PUT T$
2460 RETURN
2460 RETURN
2500 REM SUBROUTINE TO UPDATA BALANCESIN
 BUDGET CATEGORIES
2510 PRINT "YOU CAN ADD OR SUBTRACT FROM
 ANY      BUDGET CATEGORY. HIT [RETURN]
WHEN DONE":?
2515 ? :? "YOU HAVE ";P(30);" UNALLOCATE
D DOLLARS"
2520 PRINT :PRINT "WHICH BUDGET CATEGORY
":INPUT T$
2525 IF T$="" THEN RETURN
2530 PRINT "ENTER AMOUNT":INPUT X
2535 I=ASC(T$)-64
2540 P(I)=P(I)+X
2545 P(30)=P(30)-X
2550 GOTO 2515
3000 REM SUBROUTINE TO PUT IN DATA
3010 LINE=P(0)+10000+1
3020 ? CHR$(125)
3022 ? "CHECKING ACCOUNT BALANCE = $";P(
27):?
3025 IF T$="N" THEN ? "REENTER DATA":?
3030 ? "ENTER CHECK NO. OR CREDIT CARD
```

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```
      OR [RETURN] WHEN THROUGH ":INPUT N
$
3035 IF N$="" THEN RETURN
3036 N=ASC(N$)
3040 ? "ENTER DATE MM/DD":INPUT D$
3041 IF LEN(D$)<>5 THEN ? "REENTER DATE.
 REMEMBER FORMAT MM/DD":GOTO 3040
3042 D$(6,8)=Y$
3050 ? "ENTER PAYEE":INPUT I$
3060 ? "ENTER AMOUNT":INPUT A$
3062 IF N<>43 THEN ? "SALES TAX ON THIS
(Y OR N)":INPUT Q$
3065 IF N=43 THEN ? "DO YOU WANT THIS DE
POSIT ALLOCATED TO A CATEGORY":INPUT T$:
IF T$="N" THEN I=30:GOTO 3073
3070 ? "ENTER CATEGORY":INPUT W$
3071 I=ASC(W$)-64
3072 IF I<1 OR I>26 THEN ? "ILLEGAL CATE
GORY,TRY AGAIN":GOTO 3030
3073 ? "IS DATA OK? (Y OR N)":INPUT T$
3074 IF T$="N" THEN GOTO 3010
3076 IF I=30 THEN W$=" "
3080 P(0)=P(0)+1
3085 X=VAL(A$)
3087 IF N=43 THEN X=-X:Q$="N"
3100 P(I)=P(I)-X
3110 IF N<65 THEN P(27)=P(27)-X
3120 IF N>64 THEN P(N-64)=P(N-64)+X
3400 GOSUB 3500
3450 GOTO 3010
3500 REM SUBROUTINE TO PUT DATA STATEMEN
TS IN PROGRAM
3510 ? CHR$(125)
3520 ? "{DOWN}";LINE;" DATA ";N$;C$;D$;C
$;I$;C$;A$;C$;W$;C$;Q$
3530 ? :? :? "CONT"
3540 POKE 0,0
3550 POKE 842,13:STOP
3560 POKE 842,12
3570 RETURN
4000 REM SUBROUTINE TO PRINT CHECK REGIS
TER, CHARGE REGISTER OR A CATEGORY
4004 B=0
4005 TRAP 4064
4010 RESTORE 10000
4025 IF WHICH=8 THEN ? "WHICH BUDGET CAT
EGORY":INPUT T$
4026 IF WHICH=3 THEN ? "WHICH CHARGE CAR
D":INPUT T$
4027 ? "ENTER STARTING MONTH AND ENDING
MONTH (M1,M2)"
4028 INPUT M1,M2
4029 I=0:? CHR$(125)
4030 ? "NUM. DATE     PAYEE              A
MOUNT"
4032 ? "-------------------------------
------"
4040 SOUND 0,INT(RND(0)*255),10,10:READ
N$,D$,I$,A$,W$,Q$
4041 IF VAL(D$(1,2))<M1 THEN GOTO 4040
4042 IF VAL(D$(1,2))>M2 THEN GOTO 4040
4044 IF WHICH=8 AND T$<>W$ THEN GOTO 404
0
4046 IF WHICH=2 AND ASC(N$)>64 THEN GOTO
 4040
4048 IF WHICH=3 AND N$(1,1)<>T$ THEN GOT
O 4040
4050 Z$=S$
4052 Z$(1,4)=N$:Z$(6,13)=D$:Z$(15,30)=I$
4053 Z$(39-LEN(A$),38)=A$
4054 IF ASC(N$)=43 THEN B=B-VAL(A$):GOTO
 4056
4055 B=B+VAL(A$)
4056 PRINT Z$;
4057 I=I+1:IF I=15 THEN ? :? "THERE'S MO
RE. HIT [RETURN] TO CONTINUE":INPUT W$:G
OTO 4029
4060 GOTO 4040
4064 ? :SOUND 0,0,0,0
4065 IF WHICH=2 THEN ? B$;P(27)
4067 IF WHICH=8 OR WHICH=3 THEN ? B$;P(A
SC(T$)-64)
4068 ? :? "TOTAL FOR ABOVE = ";B
4070 ? :? :? "HIT [RETURN] WHEN THROUGH"
:INPUT W$
4080 RETURN
5000 REM SUBROUTINE TO PUT P ARRAY IN DA
TA STATEMENTS 200-230
5005 FOR I=0 TO 30
5007 SOUND 0,INT(RND(0)*255),10,10
5010 ? CHR$(125)
5015 X=P(I)
5020 ? "{DOWN}";200+I;" DATA ";X
5030 ? :? :? "CONT"
5040 POKE 0,0
5050 POKE 842,13:STOP
5060 POKE 842,12
5065 SOUND 0,0,0,0
5070 NEXT I
5080 ? CHR$(125)
5090 ? "SAVE PROGRAM AND DATA FOR NEXT S
ESSION"
5100 ? :? :? "    1. TURN OVER TAPE AND
REWIND."
5110 ? :? "    2. PRESS [RECORD] AND [PL
AY]."
5120 ? :? "    3. PRESS [RETURN] AFTER B
UZZER RINGS       TWICE."
5130 TRAP 5150
5140 LPRINT
5150 CSAVE
5160 END
6000 REM SUBROUTINE TO PERFORM SEARCH
6005 TRAP 6150
6020 PRINT "ENTER CHARACTERS TO BE SEARC
HED"
6030 INPUT SE$
6032 PRINT CHR$(125)
6034 ? "NUM. DATA     PAYEE              A
```

```
MOUNT"
6036 ? "------------------------------
------"
6040 X=LEN(SE$)
6045 B=0
6050 RESTORE 10000
6060 READ N$,D$,I$,A$,W$,Q$
6065 IF LEN(I$)<X THEN GOTO 6060
6070 FOR I=1 TO LEN(I$)-X+1
6080 IF I$(I,I+X-1)=SE$ THEN GOTO 6100
6090 NEXT I
6095 GOTO 6060
6100 POP
6110 Z$=S$
6112 Z$(1,4)=N$:Z$(6,13)=D$:Z$(15,30)=I$
6114 Z$(39-LEN(A$),38)=A$
6116 PRINT Z$;
6118 B=B+VAL(A$)
6120 GOTO 6060
6150 ? :? "TOTAL FOR ABOVE = ";B
6200 ? :? "HIT [RETURN] WHEN DONE":INPUT
 T$
6210 RETURN
7000 REM SUBROUTINE TO CALCULATE SALES T
AX
7010 ? "ENTER TAX RATE IN PERCENT"
7020 INPUT X
7022 X=X/100
7025 ? :? :? "CALCULATING... PLEASE WAIT
 "
7030 TRAP 7100
7040 B=0
7050 RESTORE 10000
7060 READ N$,D$,I$,A$,W$,Q$
7070 IF Q$<>"Y" THEN GOTO 7060
7080 B=B+VAL(A$)
7090 GOTO 7060
7100 TAX=B%(1-X)%X
7105 TAX=INT(TAX%100)/100
7110 ? :? :PRINT "TOTAL TAXABLE PURCHASE
S = ";B
7120 PRINT :PRINT "SALES TAX PAID = ";TA
X;" DOLLARS"
7130 ? :? :PRINT "HIT [RETURN] WHEN THRO
UGH":INPUT T$
7140 RETURN
9000 DATA Automobile
9010 DATA Contributions
9020 DATA Household
9030 DATA Utilities
9040 DATA Insurance
9050 DATA Doctors and Dentists
9060 DATA Food
9070 DATA Kid's Clothes
9080 DATA Large Purchases
9090 DATA Tuition
9100 DATA Savings
9110 DATA Mastercard Escrow
9120 DATA Visa Escrow
9500 DATA END
```

Program 2: Commodore Version

```
1 REM HOUSEHOLD CHECK, CREDIT CARD,
2 REM AND BUDGET PROGRAM
3 REM PET/CBM VERSION
10 GOSUB9700
45 PRINTCHR$(147)
50 IF FRE(0)>1000 THEN 70
60 PRINT"{CLEAR}{REV} W A R N I N G {OFF}"
    :PRINT"ROOM FOR ABOUT";INT(FRE(0)/
    50);"MORE ENTRIES."
70 PRINT"PROGRAM LAST RUN ON";P(28);"/";P(
    29)
80 PRINT:PRINT:INPUT"ENTER TODAY'S  DATE
    (MM,DD)";X,B
90 P(28)=X:P(29)=B
200 DATA 0,0,0,0,0
201 DATA 0,0,0,0,0
202 DATA 0,0,0,0,0
203 DATA 0,0,0,0,0
204 DATA 0,0,0,0,0
205 DATA 0,0,0,0,0,0
231 REM CHANGE YEAR
232 DATA /82
999 PRINTCHR$(147)
1000 PRINT"WHAT DO YOU WANT TO DO?":PRINT:PR
    INT
1010 PRINT"1. ENTER CHECKS AND CHARGES":PRIN
    T
1020 PRINT"2. PRINT CHECK REGISTER":PRINT
1030 PRINT"3. PRINT CHARGE REGISTER":PRINT
1040 PRINT"4. UPDATE BALANCE IN BUDGET CATEG
    ORIES":PRINT
1050 PRINT"5. CALCULATE SALES TAX":PRINT
1060 PRINT"6. PRINT BALANCES IN ALL CATEGORI
    ES":PRINT
1070 PRINT"7. PERFORM SEARCH FOR CHARGE OR C
    HECK":PRINT
1080 PRINT"8. EXAMINE AN INDIVIDUAL CATEGORY
    ":PRINT
1090 PRINT"9. STORE DATA AND END SESSION"
1140 PRINT:PRINT:INPUT "ENTER NUMBER";WHICH
1155 ON WHICH GOSUB 3000,4000,4000,2500,7000
    ,2000,6000,4000,5000
1998 GOTO999
2000 REM PRINTS BALANCES IN ALL CATEGORIES
2020 PRINT"{CLEAR}{REV}BALANCES IN ALL CATEG
    ORIES":PRINT:PRINT
2030 RESTORE:FORI=1TO32:READZ9$:NEXT
2040 FORI=1TO26:READZ$:IFZ$="END"THEN2100
2070 PRINTZ$;TAB(25);" = $";P(ASC(Z$)-64)
2080 NEXTI
2100 PRINT"UNALLOCATED DEPOSITS";TAB(25);" =
     $";P(30)
2120 PRINT"CHECKING ACCOUNT BALANCE";TAB(25)
    ;" = $";P(27)
2450 PRINT"{DOWN}HIT {REV}RETURN{OFF} WHEN T
    HROUGH"
2455 GETT$:IFT$=""THEN2455
2460 RETURN
2500 REM SUBROUTINE TO UPDATE BALANCES IN BU
    DGET CATEGORIES
2510 PRINT "{CLEAR}YOU CAN ADD OR SUBTRACT F
    ROM ANY":PRINT"BUDGET CATEGORY."
2511 PRINT"{DOWN}HIT {REV}RETURN{OFF} WHEN D
    ONE:":PRINT
2515 PRINT:PRINT"YOU HAVE";P(30);"UNALLOCATE
    D DOLLARS"
2520 PRINT:INPUT"WHICH BUDGET CATEGORY?_*{03
     LEFT}";T$
2525 IF T$="*"THEN RETURN
2530 INPUT"ENTER AMOUNT";X
2535 I=ASC(T$)-64:IFI<1ORI>26THENRETURN
```

```
2540 P(I)=P(I)+X
2545 P(30)=P(30)-X
2550 GOTO 2515
3000 REM SUBROUTINE TO PUT IN DATA
3010 LINE=P(0)+10000+1
3020 PRINTCHR$(147)
3022 PRINT"CHECKING ACCOUNT BALANCE =$";P(27
    ):PRINT
3025 IFT$="N"THENPRINT"REENTER DATA":PRINT
3030 PRINT"{DOWN}ENTER CHECK NO. OR CREDIT C
    ARD":PRINT"{DOWN}OR {REV}RETURN{OF
    OFF} WHEN THROUGH"
3031 INPUT"{DOWN}?_*{03 LEFT}";N$
3035 IFN$="*"THENRETURN
3036 N=ASC(N$)
3040 INPUT"ENTER DATE MM/DD";D$
3041 IFLEN(D$)<5THENPRINT"REENTER DATE. REME
    MBER FORMAT MM/DD":GOTO3040
3042 D$=D$+Y$
3050 INPUT"ENTER PAYEE";I$
3060 INPUT"AMOUNT";A$
3062 IFN<>43THENINPUT"SALES TAX ON THIS (Y O
    R N)";Q$
3065 IFN=43THENINPUT"DO YOU WANT THIS DEPOSI
    T ALLOCATED TO A CATEGORY";T$
3066 IFN=43ANDT$="N"THENI=30:GOTO3073
3070 INPUT"ENTER CATEGORY";W$
3071 I=ASC(W$)-64
3072 IFI<1ORI>26THENPRINT"ILLEGAL CATEGORY, ~
    TRY AGAIN":GOTO3030
3073 INPUT"IS DATA OK (Y/N)";T$
3074 IFT$="N"THEN3010
3076 IFI=30THENW$=" "
3080 P(0)=P(0)+1
3085 X=VAL(A$)
3087 IFN=43THENX=-X:Q$="N"
3100 P(I)=P(I)-X
3110 IFN<65THENP(27)=P(27)-X
3120 IFN>64THENP(N-64)=P(N-64)+X
3400 GOSUB3500
3450 GOTO3010
3500 REM SUBROUTINE TO PUT DATA STATEMENTS I
    N PROGRAM
3510 OTHER$=STR$(LINE)+" DATA "+N$+C$+D$+C$+
    I$+C$+A$+C$+W$+C$+Q$
3515 O2$=STR$(LINE+1)+"DATA XXXX,X,X,X,X,X"
3520 RL=3530:GOTO9600
3530 GOSUB9700:GOTO1998
4000 REM SUBROUTINE TO PRINT CHECK REGISTER,
     CHARGE REGISTER, OR A CATEGORY
4010 RESTORE:B=0:PRINT"{CLEAR}"
4011 READZ9$:IFZ9$<>"END"THEN4011
4020 IFWHICH=8THENPRINT"WHICH BUDGET CATEGOR
    Y":INPUTT$
4025 IFWHICH=3THENPRINT"WHICH CHARGE CARD":I
    NPUTT$
4027 PRINT"ENTER STARTING MONTH AND ENDING":
    PRINT"MONTH  (M1,M2)";
4028 INPUTM1,M2
4029 I=0:PRINTCHR$(147)
4030 PRINT"NUM.   DATE       PAYEE          A
    MOUNT"
4032 PRINT"----------------------------------
    -----"
4040 READ N$,D$,I$,A$,W$,Q$
4041 IFN$="XXXX"THEN4064
4042 IFVAL(LEFT$(D$,2))<M1THEN4040
4043 IFVAL(LEFT$(D$,2))>M2THEN4040
4044 IFWHICH=8ANDT$<>W$THEN4040
4046 IFWHICH=2ANDASC(N$)>64THEN4040
4048 IFWHICH=3ANDLEFT$(N$,1)<>T$THEN4040
4050 PRINTN$;TAB(6);D$;TAB(17);I$;TAB(32);A$
4054 IFASC(N$)=43THENB=B-2*VAL(A$)
4055 B=B+VAL(A$):I=I+1:IFI<15THEN4060
4056 PRINT:PRINT"THERE'S MORE":PRINT"HIT RET
    URN TO CONTINUE"
4057 GETZ9$:IFZ9$=""THEN4057
4058 GOTO4029
4059 GETA$:IFA$=""THEN4059
4060 GOTO4040
4064 PRINT
4065 IFWHICH=2THENPRINTB$;P(27)
4067 IFWHICH=8ORWHICH=3THENPRINTB$;P(ASC(T$)
    -64)
4068 PRINT:PRINT"TOTAL FOR ABOVE=";B
4070 PRINT:PRINT:PRINT"HIT {REV}RETURN{OFF} ~
    WHEN THROUGH"
4075 GETZ9$:IFZ9$=""THEN4075
4080 RETURN
5000 REM SUBROUTINE TO PUT P ARRAY INTO DATA
     STMTS
5010 RL=5020:GOTO9600
5020 GOSUB9700
5030 PRINT"{CLEAR}SAVE PROGRAM AND DATA FOR ~
    NEXT SESSION
5040 PRINT"{02 DOWN}1. TURN OVER TAPE AND RE
    WIND.
5045 PRINT"{02 DOWN}PRESS {REV}RETURN{OFF} W
    HEN YOU'VE DONE THIS"
5047 GETZ9$:IFZ9$=""THEN5047
5050 PRINT"{02 DOWN}2. PRESS PLAY & RECORD"
5060 PRINT:PRINT
5150 SAVE"BUDGET":REM OR WHATEVER NAME YOU W
    ANT
5160 END
6000 REM SUBROUTINE TO PERFORM SEARCH
6010 PRINT"{CLEAR}ENTER CHARACTERS TO BE SEA
    RCHED"
6030 INPUTSE$
6032 PRINT"{CLEAR}"
6034 PRINT"NUM.   DATE       PAYEE          A
    MOUNT"
6036 PRINT"----------------------------------
    -----"
6040 X=LEN(SE$)
6045 B=0:RESTORE
6050 READZ9$:IFZ9$<>"END"THEN6050
6060 READ N$,D$,I$,A$,W$,Q$
6065 IFN$="XXXX"THEN6150
6070 IFLEFT$(I$,X)<>SE$THEN6060
6115 PRINTN$;TAB(6);D$;TAB(17);I$;TAB(32);A$
6118 B=B+VAL(A$)
6120 GOTO6060
6150 PRINT:PRINT"TOTAL FOR ABOVE =";B
6200 PRINT:PRINT"HIT {REV}RETURN{OFF} WHEN D
    ONE"
6205 GETZ9$:IFZ9$=""THEN6205
6210 RETURN
7000 REM SUBROUTINE TO CALCULATE SALES TAX
7010 PRINT"ENTER TAX RATE IN PERCENT"
7020 INPUTX
7022 X=X/100
7028 PRINT:PRINT:PRINT"CALCULATING...PLEASE ~
    WAIT"
7040 B=0:RESTORE
7050 READZ9$:IFZ9$<>"END"THEN7050
7060 READ N$,D$,I$,A$,W$,Q$
7070 IFQ$<>"Y"THEN7090
7080 B=B+VAL(A$)
7090 IFN$<>"XXXX"THEN7060
7100 TAX=B*(1-X)*X
7105 TAX=INT(TAX*100)/100
7110 PRINT:PRINT:PRINT"TOTAL TAXABLE PURCHAS
    ES = ";B
```

```
7120 PRINT:PRINT:PRINT"SALES TAX PAID=";TAX;
    "DOLLARS"
7130 PRINT:PRINT"HIT {REV}RETURN{OFF} WHEN D
    ONE"
7140 GETZ9$:IFZ9$=""THEN7140
7150 RETURN
9000 DATA AUTOMOBILE
9010 DATA CONTRIBUTIONS
9020 DATA HOUSEHOLD
9030 DATA UTILITIES
9040 DATA INSURANCE
9050 DATA DOCTORS AND DENTISTS
9060 DATA FOOD
9070 DATA KID'S CLOTHES
9080 DATA LARGE PURCHASES
9090 DATA TUITION
9100 DATA SAVINGS
9110 DATA MASTERCARD ESCROW
9120 DATA VISA ESCROW
9130 DATA END
9600 REM SUBROUTINE TO PUT INFO INTO DATA ST
    ATEMENTS
9610 PRINT"{CLEAR}{02 DOWN}":FORI=0TO5:PRINT
    200+I;"DATA ";
9615 FORJ=0TO4-(I=5)
9617 A=P(I*5+J):A=INT(A*1000+.5)/1000
9620 PRINTMID$(STR$(A),2);",";:NEXT:PRINTCHR
    $(20):NEXT
9630 PRINTOTHER$:PRINTO2$
9640 PRINT"GOTO";RL:PRINT"{HOME}"
9650 REM DYNAMIC KEYBOARD
9660 POKE 158,9
9670 FORI=0TO8:POKE623+I,13:NEXT
9680 END
9700 S$="
     "
9710 N$=S$:D$=S$:I$=S$:A$=S$:W$=S$:C$=",":Z$
    =S$:T$=S$:B$="BALANCE ="
9720 SE$=S$:Q$=S$
9730 DIMP(30)
9740 RESTORE:FORI=0TO30:READP(I):NEXT:READY$

9750 RETURN                                    ©
```

How can a teacher use one computer to teach spelling to an entire class? One solution is to print out individualized study sheets. This program (versions for Microsoft – Apple, Commodore, OSI, and Radio Shack – and Atari BASICs) creates several different word games. They are good for spelling practice, but they're enjoyable games, too. If you don't have a printer, you can redirect the output to the screen by making a few adjustments such as substituting PRINT for PRINT#, ignoring PRINT#3 (special PET printer formatting commands), and by not OPENing to the printer. See the special Atari instructions under "Atari Notes."

Word Games

August Schau
Buckfield, ME

Teachers wishing to use microcomputers to individualize instruction can easily be frustrated because they lack the hardware necessary for students to interact with a microcomputer on a regular basis.

I doubt that our local situation is unique. The local school district is contemplating the purchase of three Commodore 4016's on Commodore's three-for-two offer. This hardware will serve 500 students and 40 staff members located in three buildings. Future hardware acquisitions will probably be modest, and the prospect of multiple stations for student use in the near future is not realistic.

While waiting for the administration to consider an investment in microcomputers, I have purchased a CBM 8032 with 8050 disk drive and model 4022 printer and have begun to explore its application as a behind-the-scenes resource.

Having a computer-supported teacher might be a cost-effective way to maximize benefits from a limited amount of hardware.

One Computer Can Serve Many Students

Teachers can share a computer/printer combination to assist with the record keeping associated with classroom management and to prepare individualized instructional materials. Materials for individual students can be used as printed, and satisfactory copies for group use can be made from a printout using a thermofax master and spirit duplicator.

The program will generate individual spelling activities.

Lines 90-115 – ten words are INPUT and stored in A$ array. Each word is scrambled in subroutine 225, returned and stored in B$ array.

Lines 120-145 – each word is sent to subroutine 300 to have "_" substituted for vowels, is returned and stored in C$ array.

Line 200 prints A$ array in order 1-10, B$ array in random order, and C$ array in random order following the format on line 55.

Subroutine 660 fills the puzzle matrix with random letters and the answer matrix with "#".

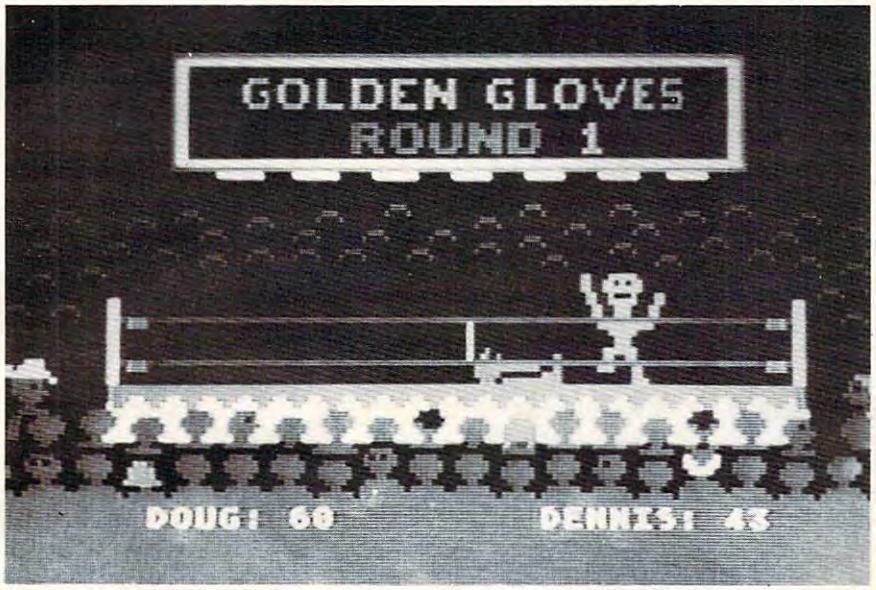
Lines 420 and 425 select a starting point. Words are presented left to right and top to bottom to reinforce patterns common to written language. The starting point is shifted in lines 450 and 520 if the word does not fit. If there is a letter already occupying one of the spaces needed, a new starting point is selected and tested.

Lines 600-645 print the two matrixes side by side following the format on line 385.

Program 1. Microsoft Version

```
20 GOSUB 710
25 PRINT "PRESS RETURN AFTER EACH ENTRY":P
   RINT
30 INPUT "STUDENT'S NAME";Q$
35 OPEN 1,4
40 SP$=CHR$(29)
45 OPEN 4,4,1
50 OPEN 3,4,2
55 PRINT#3,"        AAAAAAAAAA
   AAAAAAAAA          AAAAAAAAAA"
60 FOR I=1 TO 10
65 PRINT "WORD ";I;" IS ";
70 INPUT A$(I)
75 NEXT I
80 PRINT:PRINT
85 PRINT"JUST A MINUTE!"
90 FOR I=1 TO 10
95 LET X$=A$(I)
100 GOSUB 225
105 LET B$(I)=E$
110 LET E$=""
115 NEXT I
120 FOR J= 1 TO 10
125 LET X$=A$(J)
130 GOSUB 300
135 LET C$(J)=Z$
140 LET Z$=""
145 NEXT J
150 PRINT#1,"__"CHR$(1)Q$
155 PRINT#1:PRINT#1
160 PRINT#4,"WORD LIST"SP$"SCRAMBLE"SP$"FIL
   L IN"
165 PRINT#4:PRINT#4
170 REM PRINT OUT RESULTS
175 FOR I=1 TO 10
180 LET R=INT(RND(1)*10)+1
185 IF B$(R)="0"THEN 180
190 LET S=INT(RND(1)*10)+1
195 IF C$(S)="0" THEN 190
200 PRINT#4,A$(I)SP$B$(R)SP$C$(S)
205 LET B$(R)="0":LET C$(S)="0"
210 PRINT#4
```

ARTWORX SCORES ANOTHER TECHNICAL KNOCKOUT.



Scene from GOLDEN GLOVES

HODGE PODGE: by Marsha Meredith (Atari and Apple)
NOW AVAILABLE FOR ATARI!!! This captivating program is a marvelous learning device for children from 18 months to 6 years. HODGE PODGE consists of many cartoons, animation and songs which appear when any key on the computer is depressed. A must for any family containing young children.
PRICE . . . . . **$19.95** diskette

BETA FIGHTER: by Douglas McFarland (Atari, 16K)
See who will be the ace gunner in this action game set on a spectacular Martian landscape. BETA FIGHTER can be played with one or two players and uses player/missile graphics and delightful sound effects.
PRICE . . . . . **$16.95** cassette **$20.95** diskette

DRAWPIC: by Dennis Zander (Atari 16K)
DRAWPIC provides the user with an unbelievably easy way to create screens in graphics modes 3-7. Just sit back with your joystick and use POINT PLOT, DRAW LINE, RUBBER BAND fill and COLOR SET to create beautiful images on your Atari. Full or partial screen images are saved as string data in the program and can be instantly recalled and combined into new images using machine language subroutines. These graphic images can be easily incorporated into your own programs. The images of HODGE PODGE and the landscape of BETA FIGHTER were made using DRAWPIC.
PRICE . . . . . **$29.95** cassette **$33.95** diskette

☐ **ROCKET RAIDERS** by Richard Petersen (Atari 24K)
Defend your asteroid base against pulsar bombs, rockets, lasers, and the dreaded "stealth saucer" as aliens attempt to penetrate your protective force field. Precise target sighting allows you to fire at the enemy using magnetic impulse missiles to help protect your colony and its vital structures.
PRICE **$19.95** cassette **$23.95** diskette

☐ **FOREST FIRE TWO:** by Richard Petersen (Atari 24K)
FOREST FIRE has been enhanced and now offers a two player mode for head to head competition to see who can survive, suffer the least damage and put their fire out first. User input now determines landscape, wind and weather conditions, offering limitless game variation. FOREST FIRE's excellent color graphics have been made even better, turning your computer into a super-detailed fire scanner.
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☐ **FORM LETTER SYSTEM:** (Atari, North Star and Apple)
This is the ideal program for creating personalized form letters! FLS employs a simple to use text editor for producing fully justified letters. Addresses are stored in a separate file and are automatically inserted into your form letter along with a personalized salutation. Both letter files and address files are compatible with **ARTWORX** MAIL LIST 3.0 and TEXT EDITOR programs.
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☐ **PILOT:** by Michael Piro (Atari, 16K)
Pilot your small airplane to a successful landing using both joysticks to control throttle and attack angle. PILOT produces a true perspective rendition of the runway, which is constantly changing. Select from two levels of pilot proficiency.
PRICE . . . . . **$16.95** cassette **$20.95** diskette

☐ **TEXT EDITOR:** (Atari and North Star)
This program is very "user friendly" yet employs all essential features needed for serious text editing with minimal memory requirements. Features include common sense operation, two different justification techniques, automatic line centering and straightforward text merging and manipulation. TEXT EDITOR files are compatible with **ARTWORX** FORM LETTER SYSTEM.
PRICE . . . . . **$39.95** diskette

☐ **MAIL LIST 3.0:** (Atari, Apple and North Star)
The very popular MAIL LIST 2.2 has now been upgraded. Version 3.0 offers enhanced editing capabilities to complement the many other features which have made this program so popular. MAIL LIST is unique in its ability to store a maximum number of addresses on one diskette (typically between 1200 and 2500 names!). Entries can be retrieved by name, keyword(s) or by zip codes. They can be written to a printer or to another file for complete file management. The program produces 1, 2 or 3-up address labels and will sort by zip code (5 or 9 digits) or alphabetically (by last name). Files are easily merged and MAIL LIST will even find and delete duplicate entries! The address files created with MAIL LIST are completely compatible with **ARTWORX** FORM LETTER SYSTEM.
PRICE . . . . . **$49.95** diskette

☐ **THE VAULTS OF ZURICH:** by Felix and Greg Herlihy (Atari, 24K, PET)
Zurich is the banking capital of the world. The rich and powerful deposit their wealth in its famed impregnable vaults. But you, as a master thief, have dared to undertake the boldest heist of the century. You will journey down a maze of corridors and vaults, eluding the most sophisticated security system in the world. Your goal is to reach the Chairman's Chamber to steal the most treasured possession of all: THE OPEC OIL DEEDS!
PRICE **$21.95** cassette **$25.95** diskette

☐ **BRIDGE 2.0** by Arthur Walsh (Atari (24K), Apple TRS-80, PET, North Star and CP/M (MBASIC) systems)
Rated #1 by Creative Computing, BRIDGE 2.0 is the only program that allows you to both bid for the contract and play out the hand (on defense or offense!). Interesting hands may be replayed using the "duplicate" bridge feature. This is certainly an ideal way to finally learn to play bridge or to get into a game when no other (human) players are available.
PRICE **$17.95** cassette **$21.95** diskette

☐ **ENCOUNTER AT QUESTAR IV:** by Douglas McFarland (Atari, 24K)
As helmsman of Rikar starship, you must defend Questar Sector IV from the dreaded Zentarians. Using your plasma beam, hyperspace engines and wits to avoid Zentarian mines and death phasers, you struggle to stay alive. This BASIC/Assembly level program has super sound, full player missile graphics and real time action.
PRICE **$21.95** cassette **$25.95** diskette

NEW PROGRAMS!

GOLDEN GLOVES: by Douglas Evans (Atari 24K)
Use your joystick to jab, block and duck as each player attempts to land the knockout punch. This unique real-time program brings all of the excitement of ringside to your Atari. GOLDEN GLOVES is a one or two-player game, or you can be a spectator as the computer controls both fighters.
PRICE . . . . . **$22.95** cassette **$26.95** diskette

CRAZITACK: by Peter Adams (Atari 16K)
The Crazies are attacking us and the only defenses are three MX bases. Missiles can be launched singly or in a salvo, but it is doomsday when you run out of missiles.
PRICE . . . . . **$17.95** cassette **$21.95** diskette

DOMINATION: by Alan Newman (Atari 24K)
Between one and six players compete for power via economic, diplomatic and military means in this award-winning game. You must make decisions quickly, exercise skillful hand-eye coordination, outguess your opponents and cope with random events.
PRICE . . . . . **$17.95** cassette **$21.95** diskette

POKER TOURNEY: by Edward Grau (Atari 32K, Northstar)
You are entered in a high stakes Draw Poker Tournament facing six opponents including Lakewood Louie, Shifty Pete and Dapper Dan. Each has his own style of play and of bluffing. POKER TOURNEY utilizes the Joker, has true table stakes play and each hand is played based on pot odds. The Atari version's graphics and sound are superb of course (programmed by Jerry White) making POKER TOURNEY the class program of its type.
PRICE . . . . . **$18.95** cassette **$22.95** diskette

HAZARD RUN: by Dennis Zander (Atari, 16K)
The sheriff has spotted you and you must make the treacherous run through Crooked Canyon past Bryan's Pond to the jump at Hazard Creek and safety. You can even put the joystick-controlled GEE LEE car up on two wheels to make it through some tight spots. A lead foot is not always the answer as you dodge trees, rocks and chickens in this nerve-racking game. HAZARD RUN employs full use of player/missile graphics, re-defined characters and fine scrolling techniques to provide loads of fast action and visual excitement.
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```
215 NEXT I
220 GOTO 360
225 REM WORD SCRAMBLER
230 N=LEN(X$)
235 FOR J=1 TO N
240 LET Q(J)=J
245 NEXT J
250 LET C=0
255 LET Y=INT(RND(1)*N)+1
260 IF C=0 AND Y=1 THEN 255:REM WORD CANNOT
    START WITH FIRST LETTER
265 IF Q(Y)=0 THEN 255
270 IF Y=Q(Y) THEN Q(Y)=0
275 LET E$=E$+MID$(X$,Y,1)
280 LET C=C+1
285 IF C=N THEN 295
290 GOTO 255
295 RETURN
300 REM VOWELS = BLANKS
305 LET N=LEN(X$)
310 FOR I=1 TO N
315 LET X=ASC(MID$(X$,I,1))
320 REM TO OMIT "Y" FROM FILL IN ADD X=89 T
    O NEXT LINE
325 IF X=65 OR X=69 OR X=73 OR X=79 OR X=85
    THEN 340
330 LET Y$=MID$(X$,I,1)
335 GOTO 345
340 LET Y$=CHR$(164)
345 LET Z$=Z$+Y$
350 NEXT I
355 RETURN
360 CLOSE 3:CLOSE 4:CLOSE 1
365 OPEN 1,4,1
370 OPEN 2,4,2
375 PRINT:PRINT
380 PRINT "STILL WORKING ON IT!"
385 PRINT#2,"          AAAAAAAAAAAAAAAAAAAA
          AAAAAAAAAAAAAAAAAAAA"
390 DIM K$(15,20)
395 DIM P$(15,20)
400 GOSUB 660
405 LET D=D+1
410 F$=A$(D)
415 REM PICK RANDOM STARTING POINT
420 LET A=INT(RND(TI)*20)+1:X=A
425 LET B=INT(RND(TI)*15)+1:Y=B
430 REM PICK HORIZONTAL OR VERTICAL
435 LET S=INT(RND(TI)*2)+1
440 ON S GOTO 445,515
445 REM HORIZONTAL
450 IF A+LEN(F$)>20 THEN A=A-LEN(F$)
455 X=A
460 FOR I=1 TO LEN(F$)
465 IF K$(B,A)<>"#"THEN 420
470 A=A+1
475 NEXT I
480 FOR I=1 TO LEN(F$)
485 P$(Y,X)=MID$(F$,I,1):REM STORE WORD IN ~
    PUZZLE MATRIX
490 K$(Y,X)=MID$(F$,I,1):REM STORE WORD IN ~
    ANSWER MATRIX
495 X=X+1
500 NEXT I
505 IF D<10 THEN 405
510 GOTO 580
515 REM VERTICAL
520 IF B+LEN(F$)>15 THEN B=B-LEN(F$)
525 Y=B
530 FOR I=1 TO LEN(F$)
535 IF K$(B,A)<>"#" THEN 420
540 LET B=B+1
545 NEXT I
550 FOR I=1 TO LEN(F$)
555 LET P$(Y,X)=MID$(F$,I,1):REM STORE WORD
     IN PUZZLE MATRIX
560 LET K$(Y,X)=MID$(F$,I,1):REM STORE WORD
     IN ANSWER MATRIX
565 Y=Y+1
570 NEXT I
575 IF D<10 THEN 405
580 REM PRINT PUZZLE
585 PRINT#1:PRINT#1:PRINT#1:PRINT#1
590 PRINT#1,"WORDSEARCH"SP$Q$
595 PRINT#1
600 FOR Y=1 TO 15
605 FOR X=1 TO 20
610 PRINT#1,P$(Y,X);
615 NEXT X
620 PRINT#1,SP$;
625 FOR X=1 TO 20
630 PRINT#1,K$(Y,X);
635 NEXT X
640 PRINT#1
645 NEXT Y
650 CLOSE 1:CLOSE 2
655 GOTO 705
660 REM FILL P MATRIX WITH RANDOM LETTERS
665 FOR Y=1 TO 15
670 FOR X=1 TO 20
675 L=INT(RND(TI)*26+1)
680 P$(Y,X)=CHR$(L+64)
685 K$(Y,X)="#"
690 NEXT X
695 NEXT Y
700 RETURN
705 GOTO 805
710 POKE 59468,12: PRINT "{CLEAR} WORD DRIL
    L"
715 FOR I= 1 TO 12: PRINT CHR$(163);: NEXT
720 PRINT: PRINT
725 PRINT "BY AUGUST SCHAU"
730 PRINT:PRINT"RFD #1"
735 PRINT:PRINT"BUCKFIELD, ME. 04220"
740 PRINT:PRINT
745 PRINT "INPUT STUDENT'S NAME AND 10 WORD
    S.
750 PRINT:PRINT "PRINTOUT INCLUDES:"
755 PRINT:PRINT "1) THE LIST OF WORDS
760 PRINT "2) A RANDOM LIST OF SCRAMBLED WO
    RDS
765 PRINT "3) A RANDOM LIST OF WORDS WITH B
    LANKS
770 PRINT "   SUBSTITUTED FOR VOWELS
775 PRINT "4) A WORD SEARCH IN A 15X20 GRID

780 PRINT "5) AN ANSWER GRID
785 PRINT:PRINT
790 PRINT "PRESS {REV}SPACE BAR{OFF} TO CON
    TINUE"
795 GET V$:IF V$="" THEN 795
800 PRINT"{CLEAR}":RETURN
```

Program 2. Atari Version

```
10 REM WORD DRILL FOR ATARI
15 DIM Q$(30),T$(20),A$(20*10),AL(10),X$(20)
   ,Z$(20),B$(200),C$(200),E$(20)
16 DIM Q(20)
17 DIM TAB$(80):TAB$=" ":TAB$(80)=" ":TAB$(2
   )=TAB$
20 GOSUB 710
25 ? "Press RETURN after each entry":?
```

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*BASIC and **Joysticks required.

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```
30 ? "Student's name";:INPUT Q$
60 FOR I=1 TO 10
65 ? "WORD ";I;" IS ";
70 INPUT T$:A$(I*20-19,I*20)=T$:AL(I)=LEN(T$
   )
75 NEXT I
80 ? :?
85 ? "Just a minute!"
90 FOR I=1 TO 10
95 X$=A$(I*20-19,I*20-20+AL(I))
100 GOSUB 225
105 B$(I*20-19,I*20-20+AL(I))=E$
110 E$=""
115 NEXT I
120 FOR J=1 TO 10
125 X$=A$(J*20-19,J*20-20+AL(J))
130 GOSUB 300
135 C$(J*20-19,J*20-20+AL(J))=Z$
140 Z$=""
145 NEXT J
150 LPRINT Q$:LPRINT :LPRINT
160 LPRINT "WORD LIST{10 SPACES}SCRAMBLE
   {11 SPACES}FILL IN"
165 LPRINT :LPRINT
170 REM PRINT OUT RESULTS
175 FOR I=1 TO 10
180 R=INT(10*RND(0)+1)
185 X$=B$(R*20-19,R*20-20+AL(R)):IF X$(1,1)=
   "0" THEN 180
190 S=INT(10*RND(0)+1)
195 Z$=C$(S*20-19,S*20-20+AL(S)):IF Z$(1,1)=
   "0" THEN 190
200 T$=A$(I*20-19,I*20-20+AL(I))
201 LPRINT T$;TAB$(1,20-LEN(T$));X$;TAB$(1,2
   0-LEN(X$));Z$
210 LPRINT
215 B$(R*20-19,R*20-18)="0":C$(S*20-19,S*20-
   18)="0"
217 NEXT I
220 GOTO 360
225 REM WORD SCRAMBLER
230 N=LEN(X$)
235 FOR J=1 TO N
240 Q(J)=J
245 NEXT J
250 C=0
255 Y=INT(N*RND(0)+1)
260 IF C=0 AND Y=1 THEN 255:REM WORD CANNOT
   START WITH FIRST LETTER
265 IF Q(Y)=0 THEN 255
270 IF Y=Q(Y) THEN Q(Y)=0
275 E$(LEN(E$)+1)=X$(Y,Y)
280 C=C+1
285 IF C=N THEN RETURN
290 GOTO 255
300 REM VOWELS = BLANKS
305 N=LEN(X$)
310 FOR I=1 TO N
320 X=ASC(X$(I))
325 IF X=65 OR X=69 OR X=73 OR X=79 OR X=85
   THEN 340
330 Y=X
335 GOTO 345
340 Y=ASC("_")
345 Z$(LEN(Z$)+1)=CHR$(Y)
350 NEXT I
355 RETURN
360 LPRINT
370 ? :?
390 END
710 GRAPHICS 0:? "WORD DRILL"
720 ? :? "Enter student's name"
730 ? "and 10 words.  Printout"
740 ? "includes:":?
750 ? "1) The list of words"
760 ? "2) A random list of scrambled"
770 ? "{3 SPACES}words."
780 ? "3) A random list of words with"
790 ? "{3 SPACES}blanks substituted for vowe
   ls."
800 ? :?
810 ? "Press SPACE BAR to continue"
820 IF PEEK(764)<>33 THEN 820
830 POKE 764,255:GRAPHICS 0:RETURN
```

Atari Notes

This program uses an 80-column printer such as the Atari 825 or the Epson MX-80 printer. To re-route output to the screen, change all LPRINT statements to PRINT statements, and decrease the table width, if possible.

There are some limitations to string-array simulation techniques (used here to translate the Microsoft version of Word Drill to Atari BASIC). Unless you're willing to perform a great deal of calculation, two-dimensional string arrays are very hard to emulate. Also, since Atari reserves memory for all strings before the string is even filled, large arrays such as A$(10,20) can easily exceed available memory. For example, with the array A$(10,20), if we want to allow each element of the string 20 characters, the amount of memory used by this "superstring" is:

10 x 20 x 20 = 4000

bytes plus overhead.

A similar situation is encountered with the word search puzzle generator in Word Drill, which uses two 15 x 20 arrays. Memory needed by the arrays alone would be over 12,000 bytes. This plus the 16K for the program would restrict the use of Word Drill to machines with 32K or more memory. To serve the greatest audience (and avoid long, complicated calculations), Word Drill for the Atari only provides the first two functions: fill in the blank and word scramble. Nevertheless, you should find it useful.

You might also want to try "Word Hunt" for the Atari, **COMPUTE!**, March 1982, #22.

Figure 1.

WORD LIST	SCRAMBLE	FILL IN
ARM	GIFNRE	L_G
HAND	OBLWE	_RM
ELBOW	ABCK	F_NG_R
WRIST	RMA	B_CK
LEG	RISTW	CH_ST
ANKLE	NALKE	_NKL_
KNEE	GLE	WR_ST
FINGER	SEHTC	_LB_W
CHEST	DANH	H_ND
BACK	NEEK	KN__

Figure 2.

Word Search

```
IXHEGJBFMFEEFQIARUHG
FWJLJMUFMSMLPUHBARED
MSVBJZRPNUHBLUCANRWS
JINJZKBACKDODQJIYVFD
KNVGLXPIHMPWEUJBGJDP
JYYXJBRGXQLFAIPQXRYT
ATQIBCJGACNGKZFCSPEW
GOWYQVHAMRUHANDKMFHG
BNCQRVQRACFINGERTMYJ
FRYNSWWMDHGANKLERONE
GLXRACSOXEKNEERNBNDB
VSCFFWGFASCLJZAAPAKA
TWRISTRNOTLETPMFYIZP
AKHZACJJPYYGSNWJHVTK
RGTZMZAGKUSHYRJVKUDK
```

Figure 3.

Sally Student

```
##########E########
##########L########
##########B########
######BACK#O########
##########W########
####################
####################
#######A###HAND#####
#######R#CFINGER####
#######M#H#ANKLE####
#########EKNEE######
#########S#L########
#WRIST###T#E########
##########G########
####################
```

©

This first installment of a two-part article reviews the features and capabilities of Commodore's new mid-priced home computer.

A First Look At The Commodore 64

Tom R. Halfhill
Features Editor

Your first look at the new Commodore 64 might cause you to overlook. That is, the 64 looks so much like the familiar VIC-20 that you might miss it altogether.

That's what happened to many visitors to the Commodore booth at the recent Consumer Electronics Show in Chicago, where Commodore was proudly showing off the new machine. People had trouble at first picking it out of rows of VIC-20s on display. The 64 has the same 66-key, full-stroke keyboard and the same compact plastic case. It's a different-colored case, though, and there's a small "64" in the upper-right corner next to the power indicator light. Eagle-eyed observers also notice the slightly different port configuration. Those are the only differences – externally.

Internally, it's another story. The electronics which make the Commodore 64 tick are far removed from the workings of its lesser cousin.

Same Family, Different Branch

First, the basics. The Commodore 64 comes with 64K of Random Access Memory, hooks up to any TV with its built-in RF modulator, and costs $595. This places it midway in price and features between the 5K RAM VIC-20 at $299 and the new 128K P128 at $995 (see "Computers to Come" elsewhere in this issue). In many ways, the 64 is an interesting cross between the VIC and the P128. For example, it shares the P128's 40-column by 25-line screen display, an improvement over the VIC's 22 by 23 format. Other features in common with the P128 include 16-color graphics, the most sophisticated three-voice sound synthesizer chip in the home computer market, an optional plug-in Z-80 microprocessor board for CP/M capability, and three screen modes (the 40 by 25 text mode, 320- by 200-pixel high resolution graphics, and 200- by 160-pixel medium resolution graphics).

In addition, the 64 has another important feature in common with the P128: "sprites" (known as player/missiles to Atari buffs). These are definable graphics figures which can be programmed to move around the screen in any mode, completely independent of the background and of each other.

On the other hand, the 64 has a few things in common with the VIC, too – mainly, its peripherals. The 64 is designed to work with the VIC's disk drives, printers, the new VICMODEM, the Datassette recorder, the light pen, joysticks, and paddles. However, before connecting the VIC-1540 disk drive to the 64, a ROM chip must be changed for full compatibility. Commodore will produce a new disk drive, called the 1541 and identical to the 1540 except for this chip, especially for the 64. Meanwhile, VIC owners switching to a 64 can upgrade their 1540 drives. Up to five of these 170K drives can be daisy-chained to the 64. Up to three more devices, such as the VIC Graphic Printer, can be chained onto the drives. The 64 also will run the wide range of CBM peripherals with an optional plug-in cartridge that provides an IEEE-488 interface.

The 64's compatibility extends to software, too. The 64 has 8K PET BASIC 2.0 (Upgrade ROM). Commodore says the cassette interface allows use of programs and files created on all other Commodore computers, and that most BASIC programs written on 40-column PETs will run without modification. Exceptions are programs which POKE screen memory locations, since these vary on different systems. For even greater software compatibility, Commodore will have a PET emulator that will transform the 64 into a PET in practically every area except machine language.

Besides all that, the 64's compatibility goes still further. It is designed to be the next logical step for owners of Commodore's new Max Machine. This $179.95 game machine with a full-size bubble-membrane keyboard uses the same processor chip, sound chip, video chip, Datassette recorder, joystick, paddles, and game cartridges as the 64. Video game lovers who cut their teeth on simple programming with the Max Machine's optional BASIC cartridge can move up to the 64 without discarding their peripherals and game software.

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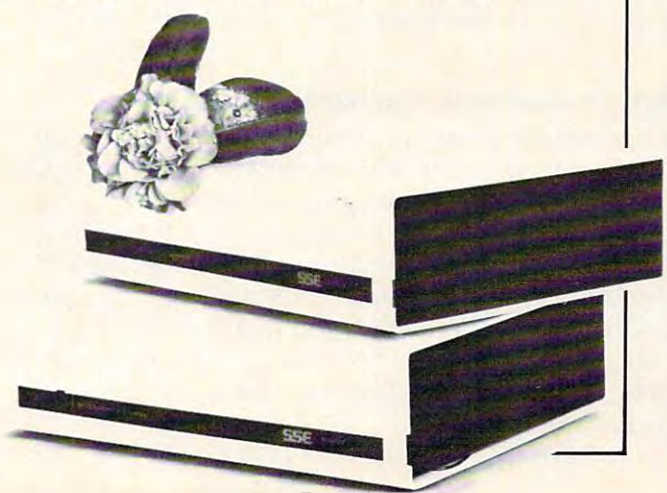

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6502 chip in earlier Commodores, the 64 has a 6510 designed by MOS Technology, the same Commodore subsidiary which designed the 6502. The 6510 has additional input/output lines, but is still, like the 6502, an eight-bit chip. Moreover, it shares the 6502's instruction set. This means machine language programmers will adapt quickly to the new chip.

Computers which rely on one chip, the CPU, for all their processing tend to be rather slow, so Commodore bestowed the 64 with additional chips to handle the time-consuming video and sound processing (a technique used also by Atari). The 6567 Video Interface Chip allows 255 combinations of border and background colors, 16 text colors and all 64 PET graphics characters. It also permits redefining custom character sets and sprites. The sound chip, called the 6581 Sound Interface Device (SID), is an extremely versatile three-voice synthesizer superior to anything found in other home/personal computers. We can say this with abandon because we've watched sound being programmed on the 64 and have heard the results.

The new chips make the Commodore 64 part of one family: the Max Machine uses the same three CPU, video, and sound chips, while the new Commodore P, B, and BX Series computers use the same SID chip for their sound (although they are based on a different, but similar, CPU, the 6509).

Add Sprite To Your Life

The standout feature of the Commodore 64's graphics is the ability to manipulate sprites. Until now, the only home computers capable of displaying sprites were the Atari 400/800 and Texas Instruments TI-99/4A. All you Commodore loyalists who used to flip by articles on Atari player/missile graphics will have to learn what it's like to struggle with this new concept in computer animation. Luckily, you'll probably have it easier than Atari people, since the new Commodores use sprites even more powerfully than the Ataris.

System Overhead: Diminishing RAM...

Theoretically, you can create up to 256 sprites on the Commodore 64. We say "theoretically" because memory limitations play a large factor, even with 64K of RAM. For one thing, not all of that 64K is available for programming; some is consumed by the system for overhead. When powered up under BASIC, a PRINT FRE(0) command to check on free memory yields 38,911 bytes. Commodore says 52K is available for machine language programming.

So how many sprites are possible? While 256 shapes can be defined in memory, one Commodore programmer says 48 is a realistic limit for display purposes. We can live with that! But there is a further limit of eight sprites per *scan line*, the horizontal lines forming the TV picture. That is, if more than eight sprites are displayed at once at the same "latitude," the extra sprites momentarily disappear as they pass by.

However, there are ways around some of these limits. The 64 has a trick similar to Atari display list interrupts. A Commodore programmer referred to it as a "raster scan interrupt." This allows the same eight sprites to be used more than once on the same screen. For example, consider a Space Invaders-type game. Eight sprites can be displayed as the top row of aliens. A split-second after that row is scanned onto the screen, an interrupt is triggered, the sprites are redefined, and finally are redisplayed as the next row of aliens. This process is repeated all the way down the screen. So you can put, say, five rows of eight aliens each (total = 40 aliens) on one screen using only the same eight sprites.

Commodore has also provided collision and priority registers to accompany the sprites. Collision registers detect when sprites bump into each other – to trigger an explosion in a game, for example. Priority registers allow programmers to define each sprite's display priority in relation to the screen background and other sprites. For instance, a sprite defined as an airplane can be moved behind or in front of a cloud on the screen, simulating three dimensions.

Atari programmers accustomed to handling "players" and "missiles" as separate objects will have to adjust their thinking on the Commodore 64. The 64 has only sprites, which are used for both. Actually, the Atari works in a similar way, splitting its fifth player into four missiles to accompany the other four players. Programmers on the 64 will simply construct missiles out of whole sprites, since they have so many on hand anyway.

Sprites on the 64 can be defined up to 21 pixels high by 24 pixels wide, and with up to three colors each. In addition, a single statement will double a sprite in either direction, or both. Best of all, movement is extremely simple and fast: specify an X,Y position on the screen and the sprite is there.

On microcomputers which have them, sprites are proving to be the most powerful – yet underused – graphics feature available. Games ordinarily requiring 48K RAM or more to handle complicated animation can be done in 16K on machines with sprites. The Commodore 64's approach to sprites appears to be the most powerful to date. We can expect some dazzling arcade-style games as pro-

grammers get the hang of working with the 64.

The Sound Of Music

No doubt about it: the new Commodores with the SID chip have the most sophisticated sound capabilities of any home/personal computers on the market. Skeptical? You won't be after you hear them. For one thing, the SID chip is much more than the tone generators found in other computers. It is a true sound synthesizer with an envelope generator for each of its three voices, programmable attack, decay, sustain, and release for each voice, plus a choice of four waveforms, plus programmable high-, low-, band-, and notch-pass filters, plus 16-bit frequency resolution over a nine-octave range from 0-4 KHz, and even variable resonance and a master volume control.

Commodore sales literature does not exaggerate: the 64 truly rivals the capabilities until now found only in dedicated keyboard synthesizers.

The four waveforms allow users to vary the tone of each voice. For example, the variable-pulse waveform produces a sharp, biting sound like the tone generators in other computers. The triangle waveform is much more mellow, simulating organ music. The sawtooth waveform is abrupt, like a harpsichord. And the fourth waveform, "white noise," is handy for sound effects such as explosions.

The programmable attack-decay-sustain-release synthesizes the acoustical properties of notes made by ordinary musical instruments. The "attack" is the rapidity with which the note reaches its peak; a sharp, biting note is represented by a steep attack slope. "Decay" is the slope of the note's decline. "Sustain" is the note's duration. "Release" is the dying of the note to silence. The SID chip allows notes to be sustained up to 24 seconds.

Further processing of the note is possible with the programmable filters. These are often found as slide controls on keyboard synthesizers, and are available through BASIC on the Commodore 64. The 16-bit resolution means notes can be extremely fine-tuned – in increments of 0.059 KHz, in fact.

All these features might seem to make sound on the 64 difficult to program, but a Commodore representative managed to transform a row of keys into a primitive organ with less than a screenful of BASIC.

Not only does the 64 have an audio output port to feed all those fantastic sounds through a stereo system, but one Commodore programmer says it is even possible to feed outside sources *into* the computer. Can you imagine plugging and electric guitar into the 64, processing the sound through the SID chip, and routing it back to the amplifier? The neighbors will love you!

Odds And Ends

The Commodore 64 offers other niceties, too: syntax errors are detected upon entry, before RUN. There's a video monitor output. An assembler for the 6510 CPU is promised soon. The plug-in cartridges allow up to 16K additional ROM and 2K RAM. There are ports for two Atari-type joysticks or four paddles. And there will be a forthcoming version of LOGO, the popular educational language for children.

Next month, Part II will take an even more detailed look at the Commodore 64's advanced features. ©

Drawing on his background as a professional programmer for Interact and Atari, the author offers a solid case for the "other half" of programming – debugging.

Don't Forget Testing

Dave Johnson
Mountain View, CA

Testing is an often overlooked phase of the software development process. But many large software developers have learned to devote as much time and effort to testing as they do to programming. If you plan to sell your programs or to give them to other computer users, you should be fairly confident that the programs work. Not very many of us have given much thought to what we can do to give us this confidence. This article will offer suggestions and methods to help you gain confidence in the reliability of your programs.

The first thing to look at, of course, is the way that you write your programs. Programs that are written in a structured, logically organized manner tend to have fewer problems, to work better in less memory, and to be easier to fix when problems are found. But all of us reading this article use faultless programming methods, so I won't pursue this.

What Should The Program Do?

To start the testing process you need to define exactly what the program must do and not do before you will give it your stamp of approval. This is more complicated than it seems. To demonstrate how complicated, let's look at the questions that arise when trying to test a very simple BASIC program. This hypothetical program will just accept your name as input and display it on the screen.

Obviously, the first visible function of our program is to get your name. (I say "visible" because the program may spend some time dimensioning arrays, etc., internally. The first visible function is to get the name.) In my opinion, if you run any program, but all that is displayed is a question mark, that is a problem. "Human engineering" is very important in programs that you intend to sell. The program should make it clear to the user what it wants the user to do. Our little program should prompt you by displaying a message such as "Please type in your name." To summarize, one question to ask when reviewing a program is "Does the program prompt for input correctly and clearly?"

Now you must type in your name. How many letters can you type that the computer accepts? Are strings big enough for all possibilities? Will the computer let you know if this limit is exceeded? Do the instructions supplied with the program tell you what this limit is? (Naturally you included instructions with your program!) Are control-C's or other keys that cause a program to abort masked out? Is it clear what the allowable range of inputs is? Does the program catch input errors and gracefully recover from them? (And tell you what the error was?)

Now let's look at the display of the name. Does the program display the name on the next line, or does it give breathing room of a couple of lines so that you are not confused by a crowded screen? Does the program display the correct name? Are displays correct, clear and easily understood?

Once the program has run through once, does it simply return to BASIC, ask for another name, or allow options?

This example was intended to give you an idea of the kinds of questions that must be answered when deciding whether or not to approve a program. When we talk about a "bug," we can be talking about anything from a problem that erases everything on your disk to a misspelled word in your instruction manual. If you are putting together a simple program that will be used a few times, you will have different requirements than you will if you have a business reputation to maintain. You see that you have to decide just what you will call a problem that you will spend time fixing, and what you will let go by.

Finding The Bugs

Once you have decided what to say are problems, how do you conduct a test that finds them? The most useful thing I can say, to start with, is that you should WANT to find bugs! If you write a program that runs the first time and doesn't look like it has bugs in it, that does *not* mean you are a good programmer. It only means that you have not looked for the bugs yet! Too often programmers take it personally if bugs are found in their codes and subconsciously design tests that will not find bugs. Not finding bugs doesn't mean that there are no bugs; it means they have not been found!

There are two types of testing to consider. Both types should be used on your product. The first is testing that you set up and conduct. The second is testing that some independent, objective person conducts without interference from you.

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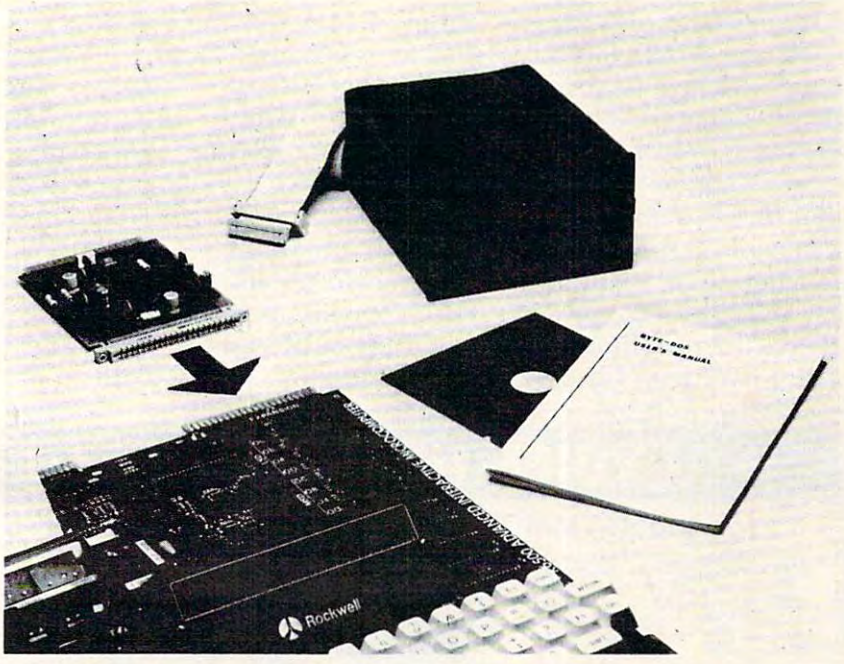

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You have the advantage of knowing the code. This advantage, by the way, is called "white box" logic coverage testing. You know the logic of, for example, a FOR 1 TO 10 loop. You can look at what happens the first time through, one time in the middle, and the tenth time. (Both extremes, and the middle.) Try to cover all the "paths" through your program, as well as conditions outside of the expected. For example, for a subroutine that expects a variable IVAR to be between 1 and 10, test by passing 1, 5, 10, 0, -1, -99, 11, and 99 in IVAR. (Extremes, middle, and outside.)

"Black box" testing methods are designed by someone not familiar with the code. The program is approached as an unknown (a black box), and the tester knows only what the program functionally should and should not do. The tester is not concerned with how the computer does what it does, only with whether it does or not. As the programmer, you may be so involved with a tricky problem in a small segment of code that you overlook a major design consideration.

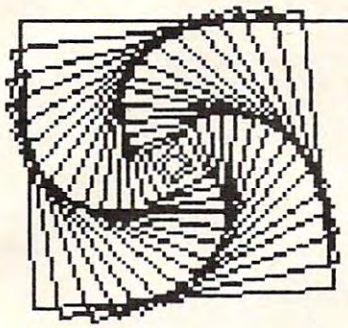
To set up such a test, sit down with the functional definition that was put together earlier and come up with "test cases." Test cases are inputs that will take the program through a variety of possible paths. I have seen very detailed test cases that cover hundreds of pages for relatively simple programs.

There should be a procedure for the tester to verify completing each step of the test case and to comment on the results. This way you will know what led up to any problems you might encounter. Duplicating problems can be the hardest part of the debugging process.

For our demonstration BASIC program that inputs and displays a name, the test cases might look like this:

Input	Expect to see	Comments
BILL	BILL	I saw "BILLL"
Bill	Bill	Still saw "BILLL"
BILLY BOB	BILLY BOB	Still saw "BILLL"
Bob	Bob	Now it says "Bobb"

You should develop a structured, organized testing plan for each testing method that can be generally applied to different programs. You can refine such a plan as you find areas that are lacking. Unfortunately, finding these areas means getting letters from customers saying: "When I type CONTROL SHIFT W followed by a CONTROL BACKSPACE the second time I run the program, the screen turns orange. But I can't make this happen the first or third time." Your *next* program will be tested for this! ©



A Monthly Column

Friends Of The Turtle

David D. Thornburg
Associate Editor

Dear Turtle ...

Dear Turtle,

I have an Apple II and want to buy LOGO for it. Which is the best version to get? My sister in Azuza (who has been chasing my husband since day one) likes the Terrapin version, and my husband (who would probably run off with the bank teller if I didn't have the goods on his father's secretary) favors Krell. I am leaning towards the LCSI version sold by Apple. Should I trust my heart?

Perplexed in Pensacola

Dear Perplexed,

As soon as I add Krell LOGO to my collection, I will write a report on all three. No matter which you choose, you will find LOGO to be a marvelous language. Your sister could be more of a problem if she knew how similar the Krell and Terrapin LOGO's are. I think it's time the three of you shared procedures

Dear Turtle,

Why is it that FOLLLK is now FOLLK (Friends of Lisp/LOGO and Kids) and is now located at 436 Arbalo Dr., San Francisco, CA 94132?

Just Asking

Dear Just Asking,

Beats me. It could be that they felllt that FOLLLK had tooooo many LLLLLLL's in it. Remember that a one-L lama is a priest, a two-L llama is an animal and that a three-L "lama" is a big fire.

Dear Turtle,

My brother-in-law runs a newsstand. Ever since he started selling **COMPUTE!** he has been too busy to see his wife (so he says). Since he is devoting his life to his work, what are the chances he will also be able to sell an all-LOGO magazine soon?

St. Louis Blue

Dear Saint,

My experts tell me that both the Krell people and the FOLLK folk will be publishing LOGO newsletters soon.

If your brother-in-law also sold **COMPUTE! Books**, *he could build an addition to his newsstand to house your sister.*

Dear Turtle,

How come TI didn't go down the drain like Thornburg predicted when the 99/4 first came out?

Disillusioned

Dear Disillusioned,

TI's remarkable turnaround can be linked to the three L's: Low prices, Lots of product, and LOGO. TI is clearly in this business to stay. As for Thornburg ...

Dear Turtle,

Why haven't you told PET users about Spider by Bill Finzer? This "turtle" program is available from both the Softswap Microcomputer Center, San Mateo County Office of Education, 333 Main St., Redwood City, CA 94063, or from San Francisco State University, Center for Mathematical Literacy, 1600 Holloway Ave., San Francisco, CA 94132.

Tulare Fan

Dear Tulare Fan,

I just did.

Dear Turtle,

Talk about dumb. My local computer store salespeople don't know what a Big Trak is.

Amused

Dear Amused,

Tell them to drop into their local toy store to see the Big Trak robot vehicle by Milton Bradley. It is the best (and only) $40 programmable LOGO-like turtle on the market.

Dear Turtle,

I think Turtle Geometry is awful. It lets *anyone* quickly create pictures on a display with a minimum

of training. People should have to *work* for this privilege. As for myself, I think people should use coordinate pairs and have to specify both the *x* and *y* coordinates for each point on the screen. Enough of this nonsense! I think, therefore I am most sincerely yours,

René Descartes

Dear René,

You might want to become a philosopher or something, and leave graphics to the rest of us.

Dear Turtle,

While you were answering those letters, I was trying out an Atari PILOT program written by Dr. R. Bharath, an associate professor at Northern Michigan University. His program simulates the "Drunkard's Walk" problem in which one guesses the number of steps needed to reach a target, given a certain probability of moving toward or away from the target. He hopes that **COMPUTE!** readers find it interesting.

Dr. T.

Dear Dr. T.

Dr. Bharath's program is presented here.

Confidential to Lost in Space,

As Atari PILOT programmer Richard Kline says,

```
GR: PEN RED

GR: 28(DRAW 6; TURN 13)

GR: PEN BLUE

GR: GOTO 12,-19

GR: TURN 14; 5(DRAW 50; TURN 144)
```

```
10 T: DRUNKARDS WALK BY R. BHARATH
20 T:
30 T:A DRUNKARD COMES OUT OF PUB WHICH IS\

40 T:MIDWAY BETWEEN HOME AND A POND <TEN S
    TEPS FROM EACH>.  \
50 T:AT EACH STEP CHANCES ARE THE SAME THA
    T THE NEXT STEP WILL BE TOWARDS HO
    ME.\
60 T:YOU HAVE TO GIVE THIS PROBABILITY\
70 T:AND THE PROGRAM CALCULATES WHERE THE ~
    PERSON ENDS UP AND \
80 T:HOW MANY STEPS IT WILL TAKE TO REACH ~
    THE DESTINATION <HOME OR POND>.
90 T:
100 T:
110 T:
120 T:WHAT ARE THE CHANCES THE NEXT STEP WI
    LL BE TOWARDS HOME?
130 T:<GIVE YOUR RESPONSE ON SCALE 0 TO 10
140 T:10 MEANS CERTAIN TO TAKE EACH STEP TO
    WARDS HOME
150 T:0 MEANS CERTAIN TO TAKE EACH STEP TOW
    ARDS POND >
160 A: #P
170 T:GUESS IF HE WILL REACH HOME<SAY YES O
    R NO>
180 A:$GUESS
190 T:GUESS HOW MANY STEPS HE WILL TAKE BEF
    ORE GETTING TO HIS DESTINATION <HO
    ME\
195 T:OR POND>
200 A:#G
210 GR:TURN 90
220 C:#D=0
230 C:#C=0
240 *BBB
250 GR:PEN YELLOW
260 GR:GOTO -50,0
270 GR:GOTO 50,0
280 GR: PEN RED
290 GR: GOTO #D,0
300 C: #X=?\10
310 C:#Y=1-<2*<#X<#P>>
320 T: STEP NUMBER #C
330 PA:50
340 GR:GO 5*#Y
350 C:#D=#D+<5*#Y>
360 C:#C=#C+1
370 J<#D=-50>: *EEE
380 J<#D=50>: *EEE
390 PA :20
400 GR:CLEAR
410 J: *BBB
420 *EEE
430 PA:100
440 GR:QUIT
450 J<#D=50>:*F
460 T:   REACHES HOME
470 A:=$GUESS
480 M:YES
490 TY:YOU WERE RIGHT
500 TN:YOU GOT IT WRONG
510 J:*X
520 *F T:FALLS IN POND
530 A:=$GUESS
540 M:NO
550 TY:YOU WERE RIGHT
560 TN:YOU WERE WRONG
570 *X
580 T:TAKES #C STEPS IN PROCESS
590 T:<WITH CHANCE #P IN 10 OF TAKING A STE
    P TOWARDS HOME AT EACH STEP>
600 T:
610 T:
620 T:
630 T:<YOUR GUESS WAS #G STEPS>
640 E:
```

Sometimes those beautiful Atari graphics can take a long time to create. This program eases your task by adding to the graphics commands already in BASIC.

Atari Sketchpad

Todd Mowbray
Burlington, Ontario

This program is dedicated to those Atari owners who use the graphics modes on their machines frequently for pictures and graphics displays. This program replaces the need to type out commands such as DRAWTO and PLOT, and it also can correct mistakes. It uses the Graphics modes with a text window (modes 3-8) and can be run on 8K. However, on the 8K machines the high-resolution graphics are unattainable, due to the memory usage for the display. There are seven commands to be used within the program: Plot, Drawto, Erase, Change Modes, Clear Screen, Print Out and Quit.

All of the commands use short forms such as "p" for "plot." The commands and their short forms are reviewed below.

Plot: Short form "p". This is the same as the BASIC PLOT, and as long as the values are within the specified ranges (see below) they will be plotted.

Drawto: Short form "d". This is the same as the BASIC DRAWTO, and the same is true about the values.

Erase: Short form "e". This is a built-in command that is well used once you get a picture or graphics display nearly done. It erases the last line, or PLOT command, that was entered.

Change Modes: Short form "cm". This command display changes the Graphics modes for you, to any desired mode (3-8).

Clear Screen: Short form "cs". This one is self-explanatory.

Print Out: Short form "po". This is another

Table 1. Maximum values for Graphics modes 3 to 8.

Graphics Mode	Horizontal	Vertical
3	40	20
4	80	40
5	80	40
6	160	80
7	160	80
8	320	160

Of course, when you use these values, remember that the upper left hand corner is 0,0. For Graphics mode 8, the x axis or horizontal maximum number is 319. This is because the Atari starts at zero instead of one for addressing to the screen.

Table 2: Variables

Variables

A$,A,B,X(I),Y(I),AA,BB,T

A$ – holds the commands that were entered (p and d)

A,B – present location of "pencil" on screen

X(I), Y(I) – old values of A and B

AA,BB – maximum values for the Graphics mode

T – a counter for the number of commands (p and d), and also helps to keep track of old commands

50 – dimensions A$,C$,X(I),Y(I), and T

100-105 – Title

115-120 – set up Graphics mode

121-123 – read in values for AA and BB

125 – sets Graphics mode

150-195 – wait for command, and if proper one is used, branch to the appropriate subroutine.

500-525 – plotting subroutine. Check values and at line 515 add command to A$, and values to X(I) and Y(I).

750-775 – DRAWTO subroutine. Check values, and, if correct, add the command to A$ and values to X(I) and Y(I).

1000-1015 – erase subroutine; erase last command, take it from A$, and take the values away from X(I) and Y(I).

1025-1080 – print out subroutine; prints out the commands (p and d) and their corresponding values. Will print out 20 of them and then ask for a number. This is only designed as a delay, so that if you are writing them down, you will have time.

5000 – a delay subroutine.

And that's all there is to it. The program will run as is, or it could be changed to have a Change Color command. Happy sketching!

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function that was one of the purposes in creating the Atari Sketchpad – to keep track of the PLOT and DRAWTO commands that were entered, and the values that were with them. This is usually done after the masterpiece is created. The computer will print out the command as either a "d" or a "p" corresponding to PLOT and DRAWTO. Also, when you erase something, the values and the command are also erased, so that you get a printout of the steps it took to generate the picture; you don't get false values.

Quit: Short form "q". This is also self-explanatory.

```
50 DIM A$(250),C$(2),X(250),Y(250):A$="":T=1
100 GRAPHICS 1:SETCOLOR 2,0,0:SETCOLOR 0,4,4
    :? #6;"ATARI SKETCHPAD 1.1"
101 POSITION 0,4:? #6;"BY TODD MOWBRAY"
105 GOSUB 5000
110 REM
115 ? "{CLEAR}ENTER GRAPHICS MODE (3-8)";:IN
    PUT M
120 IF M<3 OR M>8 THEN ? "{UP}":GOTO 115
121 FOR I=1 TO M-2:READ AA,BB:NEXT I
122 DATA 39,19,79,39,79,39,159,79,159,79,319
    ,159
123 RESTORE
125 GRAPHICS M:SETCOLOR 2,0,0:COLOR 1
150 ? "{CLEAR}COMMAND";:INPUT C$
155 IF C$="" THEN 150
160 IF C$="P" THEN 500
165 IF C$="D" THEN 750
170 IF C$="E" THEN 1000
175 IF C$="CS" THEN A$="":T=1:GOTO 125
180 IF C$="CM" THEN A$="":T=1:GOTO 110
185 IF C$="QT" THEN END
190 IF C$="PO" THEN 1025
195 GOTO 150
500 ? "{CLEAR}PLOT WHERE (X,Y)";:INPUT A,B
505 IF A<0 OR B<0 THEN 500
510 IF A>AA OR B>BB THEN ? "ILLEGAL COORDINA
    TES":GOSUB 5000:GOTO 500
515 PLOT A,B:X(T)=A:Y(T)=B:A$(LEN(A$)+1)="P"
    :T=T+1
520 IF T>249 THEN ? "{CLEAR}ALLOWED LIMIT":G
    OTO 1025
525 GOTO 150
750 ? "{CLEAR}DRAWTO WHERE (X,Y)";:INPUT A,B
755 IF A<0 OR B<0 THEN 750
760 IF A>AA OR B>BB THEN ? "ILLEGAL COORDINA
    TES":GOSUB 5000:GOTO 750
765 DRAWTO A,B:A$(LEN(A$)+1)="D":X(T)=A:Y(T)
    =B:T=T+1
770 IF T>199 THEN ? "ALLOWED LIMIT":GOTO 102
    5
775 GOTO 150
1000 REM ERASE
1005 IF T<2 THEN 150
1010 COLOR 0:PLOT A,B:DRAWTO X(T-2),Y(T-2):P
     LOT A,B:DRAWTO X(T-2),Y(T-2):COLOR 1
1015 A$(LEN(A$))=" ":T=T-1:X(T)=0:Y(T)=0:GOT
     O 150
1025 GRAPHICS 0:SETCOLOR 2,0,0:? "P=PLOT  D=
     DRAWTO":? :? :FOR I=1 TO T-1
1050 ? A$(I,I);"(";X(I);",";Y(I);")":NEXT I
1080 ? "WANT TO SKETCH ANOTHER PICTURE";:INP
     UT C$:IF C$="N" THEN END
1090 GOTO 125
5000 FOR I=1 TO 1500:NEXT I:RETURN
```

For the Apple II, this simulates chemistry experiments for elementary students. It includes a list of choices and animated graphics.

Chemistry Lab

Joanne Davis
Kew Gardens, NY

"Chemistry Lab" encourages elementary school students to hypothesize and review concepts by allowing them to duplicate laboratory experiences in chemistry. It uses standard chemical indicators to identify a variety of substances as acids, bases, sugars, or starches.

The program is menu-driven. After choosing a topic, the student is shown instructions, followed by a picture of an eyedropper containing the indicator (in the appropriate color), a beaker (containing the material to be tested), and the material and indicator names. The student predicts the result of the test, as he or she would before conducting a laboratory experiment, and INPUTs the prediction.

When the test is carried out, the eyedropper releases its contents drop-by-drop and the beaker fills with liquid, its color indicating the presence of acid, sugar, etc. Comments then reinforce the material's classification.

This procedure is repeated to test four more substances. More items can easily be added by DIMensioning the arrays and adding more DATA.

Two Special Techniques

Two of the techniques used in this program should be of special interest. The animation is created by alternating between color and black and by time delays caused by empty FOR/NEXT loops. The inside of the dropper is blacked out a line at a time, with the delay making the action visible. The previous position of the drop is blacked out and then redrawn at a new location. Then the beaker is filled up, a line at a time.

Since the sugar and starch test required virtually the same instructions, a way had to be found to make the few alterations needed. The changes are READ in from DATA statements and inserted into the message.

A science curriculum can be made to come alive with animated laboratory experiments. Try it and see.

Table 1. VARIABLES

A$: GET response
AN$: Answer INPUT
B$: Sugar or starch?
BEAK: Color in beaker
C$: Color name of indicator
CH$: Menu choice
DROP: Color in dropper
ID$, IH$, IR$: Correct identity
IN$: Name of indicator
N$: Acid test materials
N1$: Sugar/starch test materials
P: Drop position
S,SO: Sound
TT: Time delay
X: Counter
Y: DATA flag

Table 2. SUBROUTINES

1000 Acid test
2000 Starch test variables
2500 Sugar test variables
3000 Sugar/starch instructions and tests
4000 READ data into array
5000 Graphics outline
6000, 6500 Animation

```
0 REM BY J. DAVIS
10 REM CHEM EXPER
20 TEXT : HOME
30 VTAB 8: HTAB 15: PRINT "**************"
40 HTAB 15:PRINT"WELCOME TO THE":HTAB 15:P
    RINT"CHEMISTRY LAB":HTAB 15:PRINT"
    **************"
50 FOR TT = 1 TO 4500: NEXT
60 HOME : VTAB 5: PRINT "CHOOSE TEST 1, 2,
     OR 3:": PRINT : HTAB 5: PRINT "1.
     ACID":HTAB
65 HTAB 5: PRINT "4. QUIT"
70 GET CH$:CH = VAL (CH$): ON CH GOSUB 100
    0,2000,2500,100
80 TEXT : GOTO 60
100 END
1000 REM ACID/BASE***PHENOL
1020 REM INSTRUC
1025 GOSUB 4000
1030 TEXT : HOME
1040 PRINT:PRINT:PRINT "YOU ARE GOING TO TES
    T SOME MATERIALS TO": PRINT "SEE I
    F THEY ARE ACIDS
1041 OR BASES. THE": ? "INDICATOR WILL TURN ~
    ";: INVERSE : ? "PINK";: NORMAL : ?
```

```
1042 " IN AN ";: INVERSE : PRINT "ACID";: NO
    RMAL : PRINT "."
1045 PRINT : PRINT "TYPE ";: INVERSE : PRINT
     "A";:NORMAL:PRINT"IF YOU THINK TH
    AT THE MATERIAL":
1046 PRINT "IS AN ACIS.": PRINT "TYPE ";: IN
    VERSE : PRINT "B";: NORMAL : PRINT
     "IF YOU THINK
1047 THAT THE MATERIAL": ? "IS A BASE."
1050 PRINT : PRINT "HIT ANY KEY TO BEGIN.": ~
    GET A$
1070 HOME
1150 FOR X = 1 TO 5
1152 DROP = 15: GOSUB 5000
1155 VTAB 21
1160 PRINT "INDICATOR: ";: INVERSE : PRINT "
    PHENOLPHTHALEIN"; NORMAL
1180 PRINT : INVERSE : PRINT "A";: NORMAL : ~
    PRINT "CID OR ";: INVERSE : PRINT ~
    "B";:
1181 NORMAL:PRINT "ASE ?":GET AN$: IF AN$ < ~
    > "A" AND AN$ < >"B" THEN HOME:GOT
    O1155
1190 IF ID$(X) = "A" THEN BEAK = 11: GOTO 12
    10
1200 BEAK = DROP
1210 GOSUB 6000
1220 HOME : IF ID$(X0 = "A" THEN PRINT N$(X)
    ;" IS AN ACID.": GOTO 1240
1230 PRINT N$(X);" IS A BASE."
1240 FOR TT = 1 TO 4000: NEXT TT
1250 NEXT X
1400 FOR TT = 1 TO 1000: NEXT TT
1500 RETURN
2000 Y = 1: GOSUB 4000: GOSUB 3000: RETURN
2500 Y = 2: GOSUB 4000: GOSUB 3000: RETURN
3000 REM STARCH/SUGAR INSTRUCTIONS
3010 TEXT : HOME
3020 PRINT : PRINT : PRINT "YOU ARE GOING TO
     TEST SOME MATERIALS TO": PRINT "S
    EE IF THEY
3021 CONTAIN ":B$(Y);".": ? : ? "THE INDICAT
    OR WILL TURN ";: INVERSE :?C$(Y);:

3022 NORMAL : PRINT " IN A ": INVERSE : PRIN
    T B$(Y);: NORMAL : PRINT "."
3030 PRINT:PRINT "TYPE ";: INVERSE :PRINT "Y
    ";: NORMAL:PRINT " IF YOU THINK TH
    AT THE MATERIAL":
3031 PRINT "CONTAINS ";B$(Y);" ."
3040 PRINT : PRINT "HIT ANY KEY TO BEGIN.": ~
    GET A$
3050 HOME
3060 FOR X = 1 TO 5
3070 DROP = P(Y): GOSUB 5000
3080 VTAB 21
3090 PRINT "INDICATOR: ";: INVERSE : PRINT I
    N$(Y): NORMAL
3092 :
3094 :
3096 :
3100 PRINT "NOW TESTING: ";: INVERSE : PRINT
     N1$(X): NORMAL
3110 PRINT : INVERSE : PRINT B$(Y);: NORMAL ~
    : PRINT " (Y/N) ?": GET AN$
3120 IF AN$ < > "Y" AND AN$ < > "N" THEN HOM
    E : GOTO 3080
3130 ON Y GOSUB 3500,3600
3140 FOR TT = 1 TO 4000: NEXT TT
3150 NEXT X
3200 RETURN
3500 REM STARCH MESSAGE
3510 IF IH$(X) = "S" THEN BEAK = 3: GOTO 353
    0
3520 BEAK = DROP
3530 GOSUB 6000
3535 HOME
3540 IF IH$(X) = "S" THEN PRINT N1$(X);" CON
    TAINS STARCH.": GOTO 3560
3550 PRINT N1$(X);" DOES NOT CONTAIN STARCH.
    "
3560 RETURN
3600 REM SUGAR MESSAGE
3610 IF IR$(X) = "S" THEN BEAK = 9: GOTO 362
    5
3620 BEAK = DROP
3625 GOSUB 6000
3627 HOME
3630 IF IR$(X) = "S" THEN PRINT N1$(X);" CON
    TAINS SUGAR.": GOTO 3660
3650 PRINT N1$(X);" DOES NOT CONTAIN SUGAR."

3660 RETURN
4000 RESTORE
4005 FOR X = 1 TO 5
4010 READ N$(X),ID$(X),N1$(X),IH$(X),IR$(X)
4020 NEXT X
4030 FOR X = 1 TO 2
4040 READ B$(X),C$(X),IN$(X),P(X)
4050 NEXT X
4060 RETURN
5000 REM SCREEN**OUTLINE BEAK AND DROP
5010 GR : COLOR= 10
5020 VLIN 0,20 AT 14: VLIN 0,20 AT 18
5030 HLIN 15,17 AT 0: HLIN 13,19 AT 6
5040 HLIN 15,17 AT 21: VLIN 21,24 AT 16
5050 PLOT 9,28: VLIN 28,38 AT 10
5060 VLIN 28,38 AT 21: HLIN 11,20 AT 38
5065 REM INSIDE DROPPER
5070 COLOR= DROP
5080 VLIN 15,20 AT 15: VLIN 15,20 AT 16: VLI
    N 15,20 AT 17
5500 RETURN
6000 REM ANIMATION
6010 COLOR= 0
6015 P = 31:S = - 16336
6020 FOR G = 15 TO 20
6025 PLOT 16,P
6030 HLIN 15,17 AT G:SO = PEEK <S> - PEEK <S
    > - PEEK <S>
6033 GOSUB 6500
6035 FOR TT = 1 TO 400; NEXT TT
6037 COLOR= 0
6040 NEXT G
6050 FOR TT = 1 TO 400; NEXT TT
6100 COLOR= BEAK
6110 FOR G = 37 TO 32 STEP - 1
6120 HLIN 11,20 AT G: FOR TT = 1 TO 250; NEX
    T
6130 NEXT G
6140 RETURN
6500 COLOR= DROP:P =P + 1: PLOT 16,P
6510 RETURN
7000 DATA SOAP,B,BREAD,S,S,LEMON JUICE,A,CRA
    CKER,S,0,COLA,A,CHOCOLATE,0,S,BAKI
    NG
7001 SODA,B,COLA,0,S,VINEGAR,A,FLOUR,S,0
7010 DATA STARCH,PURPLE,IODINE,13,SUGAR,ORAN
    GE,BENEDICTS SOLUTION,7
30000 REM BY J. DAVIS
```

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CompuServe

A Monthly Column

The World Inside The Computer

Fred D'Ignazio is a computer enthusiast and author of several books on computers for young people. He is presently working on two major projects: he is writing a series of books on how to create graphics-and-sound adventure games. He is also working on a computer mystery-and-adventure series for young people.
As the father of two young children, Fred has become concerned with introducing the computer to children as a wonderful tool rather than as a forbidding electronic device. His column appears monthly in **COMPUTE!**

Build Your Own Computer Friend

Fred D'Ignazio
Associate Editor

Catie hopped down the steps and jumped out of the bright yellow school bus. She rushed home.

She burst into the kitchen, chattered to her father, munched a granola bar, then headed straight for the computer.

She turned the computer on.

A smiling cartoon face appeared on the screen. Under the face, in bright orange, appeared the words "HI! I'M GED! YOU TURNED ME ON! WHO'S OUT THERE?"

Catie searched the keyboard, then, pecking the keys one at a time, she typed "C-a-t-i-e" and pressed the RETURN button.

"CATIE, BABY!" typed the computer. "I WAS GETTING LONELY. HERE'S A KISS FOR TURNING ME ON. SSSMOOOOCH!"

Catie typed "k-i-s-s" and pressed RETURN.

"YUM. THAT WAS NICE," the computer said. "CATIE, IS TODAY A SCHOOL DAY?"

"Yes," typed Catie.

"IS SCHOOL OVER, CATIE?" asked the computer.

"Yes," Catie typed.

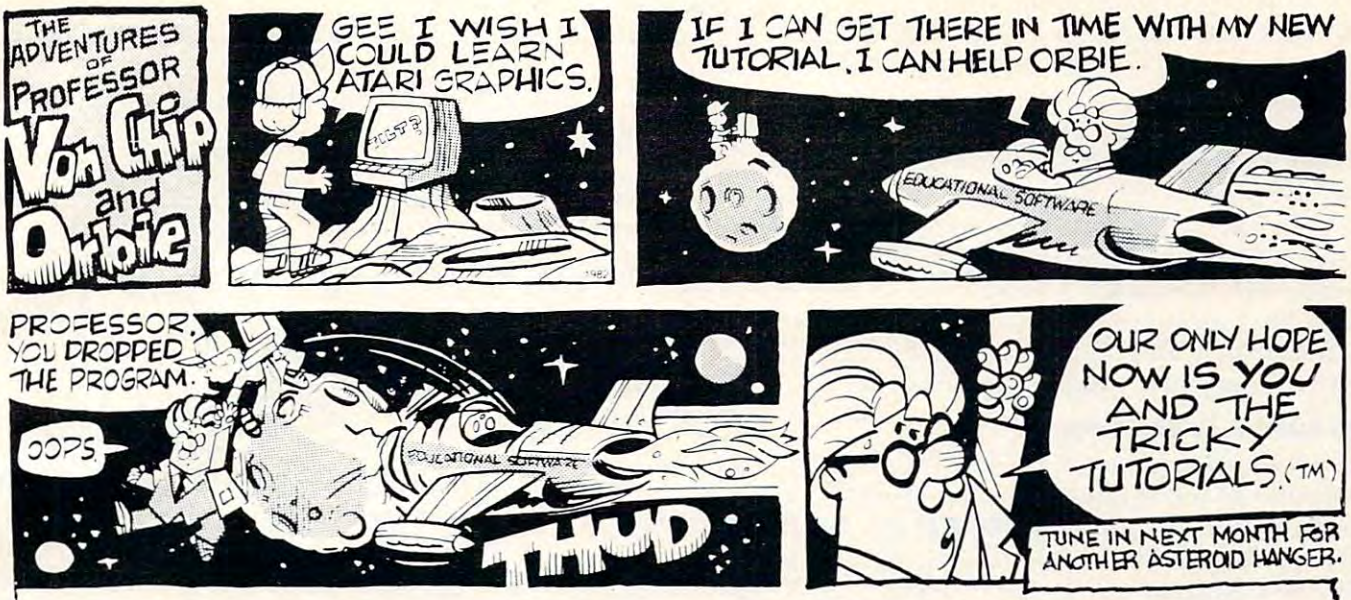
"WHAT DID YOU DO AT SCHOOL TODAY, CATIE?" the computer asked.

Catie told the computer about her field trip to the dairy farm, how she squeezed a cow's udder and milk squirted out, how she got her sneakers muddy in the cow barn, and how the farmer's wife served everyone fresh milk and chocolate chip cookies. "Now I'm home," she concluded.

"I'M GLAD YOU'RE HOME, CATIE. I MISSED YOU," the computer typed. "WANT TO PLAY?"

"Sure," typed Catie. "What game?"

"HOW ABOUT ONE OF THESE," said the computer. A list of Catie's favorite game programs appeared on the screen. Alongside each program was a number. There were word games, number games, storybook games, motor-skill games, and



TRICKY TUTORIALS (tm)

There are many things that the ATARI computers can do either better, or easier than other small computers. The following series of programs is designed for anyone who is at least familiar with BASIC programming. What each tutorial offers is similar to an extensive magazine article with all discussion in as simple language as possible, plus you get MANY examples already typed in and running. The instruction manuals range from 10 to 50 pages, and some tutorials fill up a complete tape or disk. There is little overlap in what is taught, so anyone wanting to know all they can should buy them all (my banker thanks you). ATARI buys these from us to use in training their own people! Rave reviews have been published in ANTIC, ANALOG, CREATIVE COMPUTING, and even INFOWORLD. You trust INFOWORLD, don't you?

TT #1: DISPLAY LISTS—This program teaches you how to alter the program in the ATARI that controls the format of the screen. Normally, when you say "Graphics 8", the machine responds with a large Graphics 8 area at the top of the screen and a small text area at the bottom. Now, you will be able to mix various Graphics modes on the screen at the same time. The program does all of the difficult things (like counting scan lines). You will quickly be able to use the subroutines included in your own programs.
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TT #5: PLAYER/MISSILE GRAPHICS—Learn to write your own games and other animated applications! The tutorial begins with many small examples that compliment the 50 page manual, then gradually builds up to a complete game where everything you need to know is fully explained. Also included are two machine language utilities that you can use to animate Players with from BASIC. Next we include two of the best editors currently available; one for editing playfield shapes (backgrounds); and one to edit your players, and all in glorious Technicolor!! Everything except the two editors run in 16K Tape or 32K Disk. **$29.95**

TT #6: SOUND AND MUSIC—Unless you have spent many years experimenting with the four voice channels, you will learn a lot from this one! Learn to play standard notes, chords, and whole songs using some simple "tricks". One of the nicest parts are the examples of special sound effects that you can refer to whenever you need a sound for a program or to impress a friend. This program will be of interest to all ages and levels of experience!
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adventure games.

Catie chose game number eight – a "junior" adventure game called *The Castle at the Bottom of the Sea*. She pressed the "8" button.

"GOOD IDEA!" the computer typed. "HAVE FUN! AND REMEMBER: DON'T TRY TO BREATHE UNDERWATER!"

The computer's face briefly appeared, winked, then vanished. Disk lights flashed. The screen turned a deep blue, and the game began.

The Build-A-Friend Books

Once upon a time, Catie had only one friendly computer in the D'Ignazio family – Ged. Now, thanks to the support of **COMPUTE!** and its publisher, Robert Lock, I am hard at work teaching all of Catie's computers to be more like people. Then I'm going to write a book about each one.

This fall, **COMPUTE!** will publish the books, each with the title: *Computer Friends: Learn About Computers by Inventing an Electronic Friend.* The books will teach kids how to create computer friends on the Apple, Atari, VIC, and TI computers. The first four friends they can create will be:

A SUPER HERO
A STARSHIP COMMANDER
A MONSTER
A JOKER/STORYTELLER

Each friend will come with a repertoire of abilities, responses, and memories. Each friend will know how to play at least one game with the child. Parents, teachers, and children can add more games, as they go along.

The friends are not totally formed until the child invents them. The child will get to choose many of their attributes and characteristics. Also, near the end of each book, I will indicate the way the child can continue working with his or her computer friend to make him or her (or it!) more complex, more exciting, and more like a real friend.

What Sort of Friend Would *You* Build?

In this column and the next three columns (September, October, and November issues of **COMPUTE!**) I'd like to explore the topic of building a computer friend.

And I'd like very much to hear your views. You can reach me by writing:

Fred D'Ignazio
c/o **COMPUTE!**
P.O. Box 5406
Greensboro, NC 27403

An Imaginary Playmate

Psychologists say that it is healthy for a child to have an imaginary playmate. That playmate might be in the form of a ratty blanket, a favorite doll, or it might be completely invisible – except in the eyes of the child.

If a blanket, a doll, or an imaginary being can become a friend to a child, why not a computer?

On the surface, most computers are dull. A child can learn how to dredge up all sorts of exciting games and programs from the computer's memory. But, in between games, the computer becomes lifeless, cold, and not especially likable or friendly.

Having a "friend" program or operating system would let you replace the computer's heartless mechanical shell with a personality that is warm, sympathetic, and enjoyable for a child to interact with.

How do you get started? First, the child's computer friend must know certain things about the child. It must also know something about itself.

For example, the computer friend must have a name.

Jonathan Long, of Chapel Hill, North Carolina, sent me a "name" program that he wrote for his Atari computer. The program creates random four-letter names by alternating between consonants and vowels. Slightly modified, this is what Jonathan's program looks like:

```
4 DIM A$(1),TITLE$(4),CONSONANT$(20),VOWEL$(
  6),NAME$(20)
5 CONSONANT$="BCDFGHJKLMNPQRSTVWXZ"
6 VOWEL$="AEIOUY"
20 FOR OPER=1 TO 4
50 IF OPER=2 OR OPER=4 THEN LET LETTER=INT(R
   ND(0)*6)+1:NAME$=VOWEL$:GOTO 80
60 LET LETTER=INT(RND(0)*20)+1
70 NAME$=CONSONANT$
80 A$=NAME$(LETTER,LETTER)
90 TITLE$(LEN(TITLE$)+1)=A$
100 NEXT OPER
110 GRAPHICS 2:POKE 752,1:SETCOLOR 4,0,0:SET
    COLOR 2,0,0
114 ? "{CLEAR}"
115 POSITION 2,1
120 ? #6;"hello{A}"
121 POSITION 2,3
122 ? #6;"I AM A COMPUTER."
123 POSITION 2,5
125 ? #6;"[illegible]{3 }"
130 POSITION 2,7
135 ? #6;TITLE$
199 END
```

Jonathan's program could be inserted in a "computer friend" operating system or master program. It would make your computer be a friend with many names. Routinely, Jonathan's program spouts out names that sound ethnic, or normal, or alien, or just plain weird.

In addition to knowing its name, the computer friend should know something about itself. What

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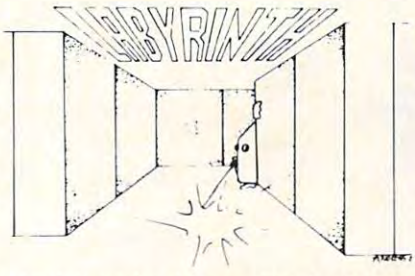

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it "knows" can be either factual or completely made up.

Next, the computer friend should know your child's name. And the names of your child's best friends, his brothers or sisters, his pets, and the names of the child's *other* imaginary friends.

Third, the computer friend must know important details about the child's life. For example: the child's birthday, what grade (if any) he is in at school, who his teachers and babysitters are, what color hair he has, and so on.

Is the child a boy or girl? The computer friend should know.

What is the child's address? What's the name of the town?

What are his likes? What does he think is yucky?

What TV programs does he watch? What are his favorite books? Does he like ice cream cones? Pizza? Broccoli with ketchup?

All these things and more a good computer friend should know.

What Kind Of Friend Am I?

Friends come in all shapes and sizes. Some are silly. Some are serious. Some are smart. Others are not so smart. Some are aggressive, possessive, and bold. Others are soft, gentle, and sympathetic.

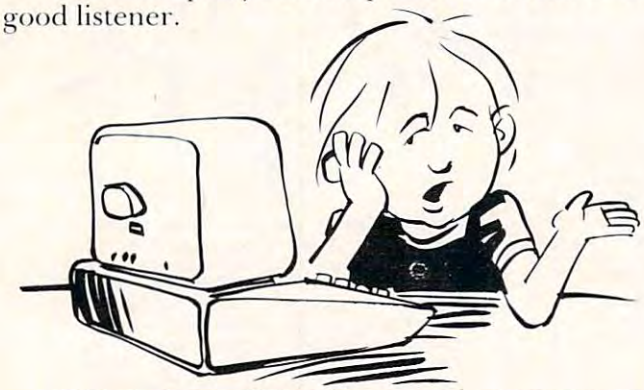
Some friends are all these things at different times.

If a computer tried to mimic human friends, it would have an identity crisis. Its program would become huge, unwieldy, and complex.

Our computer friends need not be super-intelligent. They need not be like human friends at all. Trying to act human is hard for computers.

Let your computer friend act like a computer. Let it do the things that are friendly, yet also are easy for a computer to do, not hard.

For example, your computer friend can be a good listener.



Think about all the times you were anxious to tell someone about something very important. And nobody listened.

Your human friends care about you. But often they are too wrapped up in their own problems and interests to listen to things that are important to you.

And if you talk too long, human friends may interrupt you, or become angry or bored.

But not a computer friend. You can talk to a (properly programmed) computer friend until you run out of things to say – or pull out its plug.

And it's not like pouring all your feelings, your ideas, your joys and your fears down into the Black Hole of Calcutta. (Which is what it's like when you talk to people sometimes.)

The computer *can* remember. You can teach it to remember everything (within its memory limitations). Or just bits and pieces. Or after codewords like "THIS IS VERY IMPORTANT!"

Or you can teach it to spit everything back at you. That way you can see what you sound like.

What other things can *you* think of that are among a computer's strengths and also help make it a good friend?

A Friend, Hero, Teacher, or Pet?

You can program your computer to have one personality – or several. It might be a shrewd sleuth like Sherlock Holmes. It might be brilliant – but absent-minded – like a nutty inventor. It might be stuffy or laid back, happy or moody, gossipy and inquisitive, or secretive and sly. It's up to you.

Or it might not be a friend at all. It might be something more. For example, the computer might be a hero, programmed to act like the child's favorite pro basketball star, or a comic book character, or a rock singer, or a beautiful actress or model.

Or the computer could be a teacher. Not just the types of computers we see today with teaching *programs*. The computer would have some aspects of a good teacher's personality. It would be warm and friendly. It would never lose its patience. It would guide your child toward various learning activities – programs – stored on the machine. It would be a friend with a single goal. And the goal is learning.

Have you ever heard a computer bark? Or meow?

It could, you know. If it were your child's pet.

Computer pets could be a godsend! Especially in cramped, tiny apartments in big cities. Especially where real, live animal pets are not allowed.

Just think: you would never have to potty train or paper train your child's computer pet. You would never have to clean its litter box. Or give it baths. Or take it to the vet.

Yet a computer pet could be very rewarding. Like a computer friend, it could be a companion to your child. And your child could train it herself. She might train it to "fetch," or solve puzzles, talk, do tricks, or tell jokes.

Granted, a computer pet is not soft and cuddly like a warm kitten or a fluffy rabbit or gerbil. But turtles and goldfish aren't cuddly either, and they make popular pets.

And why stick to pets that are common?

A child can create a computer pet unlike any animal on earth. He can fabricate it directly from his imagination or his dreams.

How many legs does the pet have?

How many eyes?

Does the pet have feathers, fur, scales, or skin?

What color?

What does the pet eat?

For answers to all these questions, just ask your child.

What does the pet look like? You and your child can draw the pet on the picture screen.

What does the pet sound like? Use your computer's SOUND command.

Your child's pet can be a monster, a dragon, a dinosaur, or a schmoo. Or a nice brown pony. And your child could learn all about ponies and horses as she created her pet.

In fact, having a computer pet could be a first step toward owning and caring for a real, live pet. Your child could learn all about her computer pet. If it lived, thrived, and was happy, perhaps she could graduate to the real thing.

Or a child might have several computer pets and several real pets.

Or just computer pets.

You and your child decide.

The Creature Inside The Computer

This column is called the "World Inside the Computer." In earlier columns I talked about the shape of that world and the shape of the worlds to come.

There are worlds inside your computer. But there are creatures inside your computer, too. In fact, your computer is swarming with them.

The creatures are really programs. You can write them yourself. Once they are written, your child should be able to call them up just like she'd whistle for her dog when she woke up, or cry "Here, kitty, kitty!"

Your computer is like a puppet theater filled with creatures that aren't real, yet are, nevertheless, very lifelike and entertaining. Your child should be able to put his hands inside the computer "puppets,"

then bring them to life, control them, and interact with them. The more puppets, the richer the child's experience with the computer. Sitting your child in front of the computer could become as exciting as turning him loose in a big-city zoo.

Building The Computer Zoo

In this column, we have looked at a couple of the issues related to giving your computer a personality. In the next three columns we will turn to specific programs that impart a simple personality to your family or school's computer. In the September column we'll build a computer friend. In the October column we'll modify and expand the friend to become a friendly teacher. And, in the November column, we'll create a computer pet. As always, I'm looking forward to hearing your comments, suggestions, and ideas. What kind of pet should we create? A dog? A cat? A dragon? A horse? What do you think?

Write and let me know. ©

This program gets smarter every time you use it. It shows one way a computer could "learn." For Atari and Commodore computers.

Guess That Animal!

Simulating Learning In Computers

Daniel Hastie
Garland, TX

The human mind learns by associating new information in some way with old information. But how should this be modeled in a computer? The answer to this question depends on the type and volume of information. I would like to propose a game where a modest amount of simple information makes a binary tree appropriate. Branches can be labeled so that the ordering of the data is not critical.

The Modeling Approach

Guessing an animal is a game which many children approach on a random basis. Especially when the starting letter is given, the child begins a scan through his "animal vocabulary" looking for a possible match with any entry beginning with that letter. Since there is no evidence that information is filed in their little heads alphabetically, this is usually a very hit-or-miss approach.

A more advanced player immediately begins a binary search by asking a series of Yes or No questions about the animal to distinguish the category to which it belongs. This enables him to search a smaller memory region (assuming associated items are stored closely together) and find the animal's name. We would like to simulate this approach with the computer.

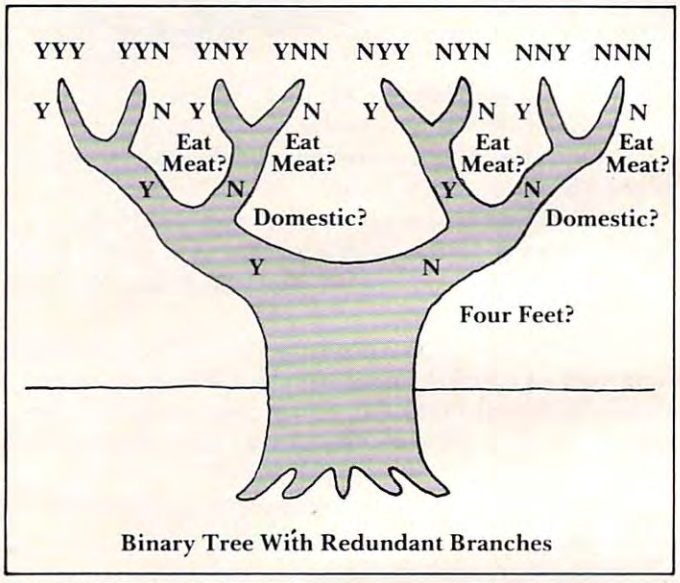
The Program

Some time ago I found a program by Mike Gabrielson in *Recreational Computing* which presented the idea of a computer guessing an animal type, but the listing provided was in Pascal and it wasn't clear to me at the time how to adapt it to my PET. However, that planted the idea which finally sprouted and grew into Program 1.

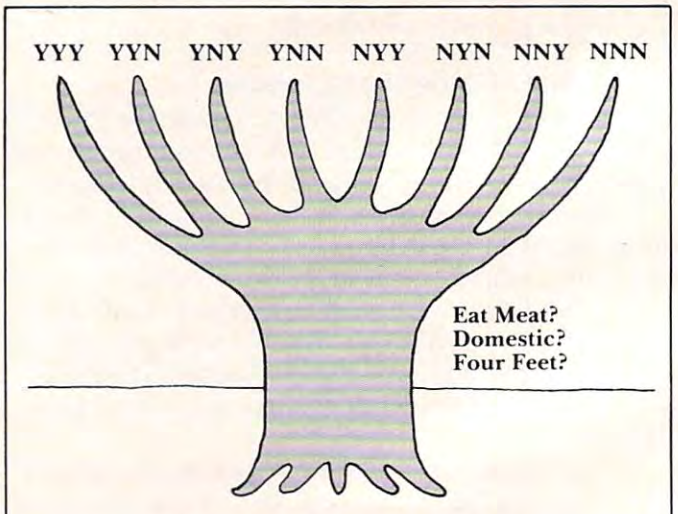
Let's walk our way through the program and hit the key points. After reading the data file (refreshing its "animal memory") and printing a starting message, a set of questions to be used with every game is asked. These starter questions are labeled by an "S" in the T$ array. I chose to use three starter questions producing eight initial entries or tree limbs. This cuts down on redundant questions in the various main branches (see Figure 1). You might experiment with more if you find redundancy increasing.

To these questions, an answer string is formed by concatenating [*chaining together*] the responses into QA$ in line 410. Then a search is started, looking through array T$ for a match to QA$. When found, the corresponding entry in array Q$ is printed. Initially, this will be a branch tip (a final guess), but it is handled the same as any other distinguishing question. Again the answer is concatenated and a new search initiated. If no match is found, then the computer branches down to line 450 in the program. If the last answer was *yes*, the computer was successful in finding the

Figure 1. Comparison of Tree Branching Techniques



Binary Tree With Redundant Branches



Tree With Eight Main Branches

Figure 2. Sample conversation between computer and human. (Human responses between stars.)

```
THINK OF AN ANIMAL AND I
WILL TRY TO GUESS IT.

PRESS SPACE BAR WHEN READY

DOES IT HAVE FOUR FEET?      **Y**
IS IT DOMESTIC?              **Y**
DOES IT EAT MEAT?            **Y**
IS IT A DOG?                 **N**
I GIVE UP, WHAT IS IT?       **A CAT**

WHAT WOULD BE A GOOD QUESTION TO
TELL THAT FROM A DOG?
**DOES IT BARK?**
WHAT WOULD BE THE RIGHT ANSWER
FOR A CAT?                   **N**
WOULD YOU LIKE TO TRY AGAIN?
**Y**

THINK OF AN ANIMAL AND I
WILL TRY TO GUESS IT.

PRESS SPACE BAR WHEN READY

DOES IT HAVE FOUR FEET?      **Y**
IS IT DOMESTIC?              **Y**
DOES IT EAT MEAT?            **Y**
DOES IT BARK?                **N**
IS IT A CAT?                 **Y**
GOOD, I GUESSED IT!
WOULD YOU LIKE TO TRY AGAIN?
```

animal and, after an appropriate message, asks if another game is desired.

The interesting part is the sequence of steps processed if the last answer is *no*. Giving up, the computer asks what the animal is and what question could be asked to help distinguish the animal from what the computer guessed. Then the proper answer for this animal is requested (see Figure 2). The old final guess is cut off from its place in the tree, and the new question fork NQ$ (with the new animal as one of its tips) is grafted in. Then the old final guess is grafted back in as the second tip of the fork. Figure 3 shows the horticultural image. The two tips are also keyed with the appropriate answer string in array T$ and play begins again.

If the human player decides to stop, the computer updates its memory base, erasing the old and saving the new one. The next time someone plays "Guess That Animal!" the computer will be smarter. Watch out! It may do better than you!

For tape-bound systems, use Figure 4 to replace the disk commands with appropriate tape commands.

But where did the original data come from? Not to worry; use Program 2, the Data Starter program.

Figure 3. Branch Grafting Procedure

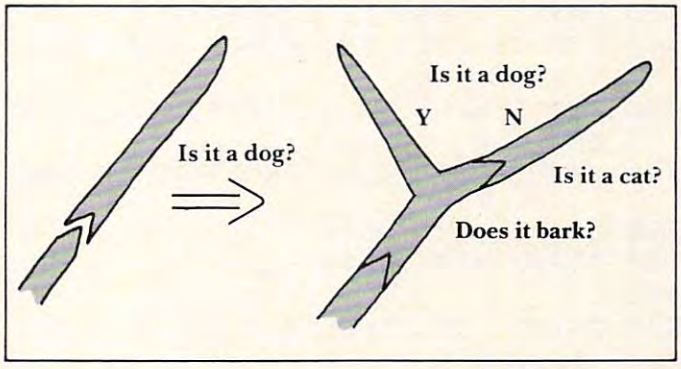


Figure 4. Program Changes for Tape Operation

```
130 PRINT"PUT ON DATA TAPE"
140-170 DELETE
180 OPEN 1,1,0,"ANIMAL DATA"

780 PRINT"REWIND DATA TAPE, PRESS
SPACE BAR WHEN READY"
790 GET A$: IF A$<>" " THEN 790
810 OPEN 1,1,2,"ANIMAL DATA"
```

For DATA STARTER, replace line 120 in Program 2 with the statement shown in 810 above.

Program 1. PET/CBM Version

```
100 REM *** GUESS THAT ANIMAL!
110 DIM T$(100), Q$(100)
120 G$="GOOD, I GUESSED IT!"
130 PRINT"WHAT DRIVE ARE YOU USING?
    "
140 :GET DN$
150 : IF DN$="1" OR DN$="0" THEN 17
    0
160 :GOTO 140
170 REM *** READ STORED DATA ***
180 OPEN 1,8,2,DN$+":ANIMAL DATA,S,
    R"
190 INPUT#1,NS,N
200 FOR I=0 TO N
210 :INPUT#1, T$(I), Q$(I)
220 NEXT : CLOSE1
230 :
240 REM *** START GAME ***
250 PRINT CHR$(147): REM CLR SCREEN

260 PRINT"THINK OF AN ANIMAL AND I"

270 PRINT"WILL TRY TO GUESS IT."
```

```
280 PRINT: PRINT"PRESS SPACE BAR WH
    EN READY"
290 GET A$: IF A$<>" " THEN 290
300 REM SET UP ANSWER STRING AND PO
    INTER
310 QA$="": REM NULL ANSWER STRING
320 FOR ZZ=0 TO NS: GOSUB 370: NEXT

330 FOR I=NS+1 TO N: IF T$(I)=QA$ T
    HEN 350
340 NEXT: GOTO 450:  NO MATCH FOUND

350 ZZ=I: I=N: NEXT
360 GOSUB 370: GOTO 330
365 :
370 PRINT  Q$(ZZ);: REM PRINT & GET
     ANSWER
380 :  GETA$
390 :   IF A$="Y" OR A$="N"THEN 410

400 :  GOTO380
410 QA$=QA$+A$
420 PRINT" ";A$
430 RETURN
440 :
450 REM *** GUESSED IT OR GIVE UP**
    *
460 :  IF A$="Y" THEN PRINT G$: GOT
    O 700
470 PRINT"I GIVE UP, WHAT IS IT";
480 INPUT NA$
490 PRINT: T$=Q$(ZZ): TL=LEN(T$)
500 PRINT"WHAT WOULD BE A GOOD QUES
    TION TO"
510 PRINT"TELL THAT FROM "; RIGHT$(
    T$,TL-6)
520 INPUT NQ$: REM NEW QUESTION
530 IF RIGHT$(NQ$,1)<>"?" THEN NQ$=
    NQ$+"?"
540 PRINT"WHAT WOULD BE THE RIGHT A
    NSWER"
550 PRINT"FOR "NA$;
560 :INPUT A$ :RA$=LEFT$(A$,1)
570 : IF RA$="Y" OR RA$="N" THEN 59
    0
580 :GOTO560
590 N=N+1: PA$=LEFT$(QA$,LEN(QA$)-1
    )
600 :
610 REM *** REPLACE FINAL GUESS WIT
    H NEW QUESTION
620 T$=Q$(ZZ): Q$(ZZ)=NQ$
630 X$="N": Z$="Y"
640 :  IF RA$="N" THEN X$="Y": Z$="
    N"
650 REM *** ADD OLD & NEW FINAL GUE
    SS
660 T$(N)=PA$+X$: Q$(N)=T$: N=N+1
670 T$(N)=PA$+Z$: Q$(N)="IS IT "+NA
    $+"?"
680 :
690 PRINT
700 PRINT"WOULD YOU LIKE TO TRY AGA
    IN?"
710 :GETA$
720 : IF A$="N" THEN 770
730 : IF A$="Y" THEN 250
740 :GOTO710
750 :
760 :
770 REM *** SCRATCH OLD DATA AND SA
    VE NEW
780 OPEN 1,8,15:PRINT#1,"S"DN$":ANI
    MAL DATA"
790 CLOSE1
795 :
800 C$=CHR$(13)
810 OPEN 1,8,2,DN$+":ANIMAL DATA,S,
    W"
820 PRINT#1, NS;C$;N;C$;
830 FOR I=0 TO N
840 : PRINT#1, T$(I);C$;Q$(I);C$;
850 NEXT: CLOSE1
860 END
```

Program 2. PET/CBM Version

```
100 REM DATA STARTER
110 N=10: NS=2: C$=CHR$(13)
120 OPEN1,8,2,"0:ANIMAL DATA,S,W"
130 PRINT#1, NS;C$;N;C$
140 FOR I=0 TO N
150 READ T$, Q$
155 Q$=Q$+"?"
160 PRINT#1, T$;C$;Q$;C$;
170 NEXT: CLOSE1: END
180 DATA   S,DOES IT HAVE FOUR FEET

190 DATA   S,IS IT DOMESTIC
200 DATA   S,DOES IT EAT MEAT
210 DATA NNN,IS IT A WORM
220 DATA NNY,IS IT AN EAGLE
230 DATA NYN,IS IT A CHICKEN
240 DATA NYY,IS IT A MAN
250 DATA YNN,IS IT AN ELEPHANT
260 DATA YNY,IS IT A WOLF
270 DATA YYN,IS IT A COW
280 DATA YYY,IS IT A DOG
```

Program 3. Atari Version

```
100 REM *** GUESS THAT ANIMAL! ***
110 MXA=50:REM MAXIMUM # OF ANIMALS.  ADJUST
    FOR MEMORY SIZE
115 DIM T$(MXA*10),T2$(30),TL(MXA),Q$(MXA*30
```

```
    ),QL(MXA),G$(20),TEMP$(30),NA$(10),NQ$(3
    1),FILE$(12)
117 DIM QA$(30)
120 G$="Good, I guessed it!"
130 OPEN #2,4,0,"K:":GRAPHICS 0
140 PRINT "Tape or Disk? ";
150 GET #2,A:IF A<>ASC("T") AND A<>ASC("D")
    THEN 150
160 IF A=ASC("D") THEN ? "DISK":? :FILE$="D:
    ANIMAL.DAT":GOTO 180
170 ? "TAPE":? :? "Position data tape, press
     PLAY,":? "then press RETURN":FILE$="C":
    ?
180 TRAP 190:OPEN #1,4,0,FILE$:GOTO 200
190 CLOSE #1:? "Error #";PEEK(195);" on read
    ing...":? "Try again.":GOTO 140
200 INPUT #1,NS,N
205 FOR I=0 TO N
210 INPUT #1,TEMP$:T$(I*10+1)=TEMP$:TL(I)=LE
    N(TEMP$)
220 INPUT #1,TEMP$:Q$(I*30+1)=TEMP$:QL(I)=LE
    N(TEMP$)
230 NEXT I:CLOSE #1:TRAP 40000
240 REM *** START GAME ***
250 GRAPHICS 0
260 PRINT "Think of an animal and I"
270 PRINT "will try to guess it."
300 REM SET UP ANSWER STRING AND POINTER
310 QA$="":REM NULL ANSWER STRING
320 FOR ZZ=0 TO NS:GOSUB 370:NEXT ZZ
330 FOR I=NS+1 TO N:IF T$(I*10+1,I*10+TL(I))
    =QA$ THEN 350
340 NEXT I:GOTO 450:REM NO MATCH FOUND
350 ZZ=I:I=N:NEXT I
360 GOSUB 370:GOTO 330
365 REM
370 ? Q$(ZZ*30+1,ZZ*30+QL(ZZ));
380 GOSUB 1000
410 QA$(LEN(QA$)+1)=CHR$(A)
430 RETURN
440 REM
450 REM *** GUESSED IT OR GIVE UP ***
460 IF A=ASC("Y") THEN ? G$:GOTO 700
470 ? "I GIVE UP, WHAT IS IT";
480 INPUT NA$:IF LEN(NA$)>10 THEN ? "** TOO
    LONG **":? "WHAT IS IT";:GOTO 480
490 ? :T2$=Q$(ZZ*30+1,ZZ*30+QL(ZZ)):TL=QL(ZZ
    )
500 ? "What would be a good question to"
510 ? "tell that from ";T2$(7)
520 INPUT NQ$
521 IF LEN(NQ$)>30 THEN ? "** TOO LONG **":G
    OTO 520
530 IF NQ$(LEN(NQ$))<>"?" THEN NQ$(LEN(NQ$)+
    1)="?"
535 IF LEN(NQ$)>30 THEN ? "** TOO LONG **":G
    OTO 520
540 ? "What would be the right answer"
550 ? "for ";NA$;"?";
560 GOSUB 1000
570 IF A<>ASC("Y") AND A<>ASC("N") THEN 560
590 N=N+1:TEMP$=QA$(1,LEN(QA$)-1)
610 REM *** REPLACE FINAL GUESS WITH NEW QUE
    STION
620 T2$=Q$(ZZ*30+1,ZZ*30+QL(ZZ)):Q$(ZZ*30+1,
    ZZ*30+LEN(NQ$))=NQ$:QL(ZZ)=LEN(NQ$)
630 X=ASC("N"):Z=ASC("Y")
640 IF A=X THEN X=Z:Z=A
650 REM *** ADD OLD & NEW FINAL GUESS
660 T$(N*10+1,N*10+LEN(TEMP$))=TEMP$:T$(N*10
    +LEN(TEMP$)+1)=CHR$(X):TL(N)=LEN(TEMP$)+
    1
665 Q$(N*30+1,N*30+LEN(T2$))=T2$:QL(N)=LEN(T
    2$):N=N+1
670 T$(N*10+1,N*10+LEN(TEMP$))=TEMP$:T$(N*10
    +LEN(TEMP$)+1)=CHR$(Z)
675 TL(N)=LEN(TEMP$)+1
680 Q$(N*30+1)="IS IT ":Q$(N*30+7)=NA$:Q$(N*
    30+LEN(NA$)+7)="?":QL(N)=LEN(NA$)+7
690 ?
700 ? "Would you like to try again?";
710 GOSUB 1000
720 IF A=ASC("N") THEN 770
730 IF A=ASC("Y") THEN 250
740 GOTO 710
770 REM *** SCRATCH OLD DATA AND SAVE NEW
780 IF FILE$="C" THEN ? "Rewind data tape, p
    ress PLAY and RECORD,"
790 IF FILE$="C" THEN ? "then press RETURN"
800 TRAP 805:OPEN #1,8,0,FILE$:GOTO 810
805 ? "Error #";PEEK(195);" when writing ani
    mal file!":CLOSE #1:END
810 PRINT #1;NS:PRINT #1;N
820 FOR I=0 TO N
830 PRINT #1;T$(I*10+1,I*10+TL(I))
840 PRINT #1;Q$(I*30+1,I*30+QL(I))
850 NEXT I:CLOSE #1
860 END
1000 REM GET Y/N RESPONSE
1005 POKE 752,1:? " ";:POKE 53279,0
1010 GET #2,A:IF A>96 THEN A=A-32
1020 IF A<>ASC("Y") AND A<>ASC("N") THEN 101
     0
1025 IF A=ASC("N") THEN 1040
1030 FOR R=1 TO 3:? "YES(3 LEFT)";:FOR W=1 T
     O 5:NEXT W:? "YES(3 LEFT)";:FOR W=1 TO
     5:NEXT W:NEXT R:GOTO 1050
1040 FOR R=1 TO 3:? "NO(2 LEFT)";:FOR W=1 TO
      5:NEXT W:? "NO(2 LEFT)";:FOR W=1 TO 5:
     NEXT W:NEXT R
1050 POKE 752,0:? :RETURN
```

Program 4. Atari Version

```
100 REM DATA STARTER (ATARI)
110 NS=2:N=10:DIM Q$(30),T$(10)
120 OPEN #1,8,0,"D:ANIMAL.DAT":REM USE OPEN#
    1,8,0,"C:" FOR TAPE
130 ? #1;NS:? #1;N
140 FOR I=0 TO N
150 READ T$,Q$
160 Q$(LEN(Q$)+1)="?"
170 ? #1;T$:? #1;Q$
175 NEXT I:CLOSE #1:END
180 DATA S,DOES IT HAVE FOUR FEET
190 DATA S,IS IT DOMESTIC
200 DATA S,DOES IT EAT MEAT
210 DATA NNN,IS IT A WORM
220 DATA NNY,IS IT AN EAGLE
230 DATA NYN,IS IT A CHICKEN
240 DATA NYY,IS IT A MAN
250 DATA YNN,IS IT AN ELEPHANT
260 DATA YNY,IS IT A WOLF
270 DATA YYN,IS IT A COW
280 DATA YYY,IS IT A DOG
```

A Monthly Column

Learning With Computers

The PILOT Language

Glenn Kleiman
Teaching Tools: Microcomputer Services
Palo Alto, CA

Last month I compared BASIC and LOGO as languages for teaching computer programming to children. This month's topic is another language useful in education: PILOT. The name PILOT is an acronym for Programmed Instruction, Learning Or Teaching. PILOT is a simple computer language, originally designed for teachers to use in writing their own lesson programs. It is also useful for teaching children about programming.

All adequate versions of PILOT contain a small set of commands for displaying information and questions on the screen, waiting for answers to be typed on the keyboard, checking whether an answer matches any of a list of expected responses, branching to different parts of the program, and performing simple calculations. These commands, generally referred to as Core PILOT commands, can be used to create programs which make the computer converse with a person.

Sample PILOT Dialogues

Here are some dialogues between students and a PILOT program. The students' responses are italicized.

What is your name?
Susan
Hello, Susan.
I'm going to ask you some questions about the United States.
Which is the largest state?
Alasska. It's even bigger than Texas.
That's right, Susan. Alaska is the largest state.
...

What is your name?
Jason
Hello, Jason.
I'm going to ask you some questions about the United States.
Which is the largest state?
I don't know. Maybe its Hawaii.
No, Jason, the correct answer is Alaska.
...

What is your name?
Sam
Hello, Sam.
I'm going to ask you some questions about the United States.
Which is the largest state?
N.Y.
That is a large state with a lot of people, but it is not the largest in size.
Please try again.
How about Texas?
No, Texas is a big state, but it's not the largest of all 50 states. Please try again.
I know, its Alasca!
That's right, Sam. Alaska is the largest state.

The program gives intelligent responses to the students' answers. Susan's dialogue shows the computer can recognize the correct answer, even though she misspelled it and named another state in the same answer. In the next dialogue, Jason gives an incorrect answer and is told the correct one. In the last dialogue, Sam's first two answers are incorrect, but he shows he knows which states are among the largest. The computer gives him hints and additional chances. Notice that the computer recognizes the abbreviation *N.Y.* and another misspelling of Alaska.

The PILOT Program

The three dialogues shown above are all the result of a fairly simple PILOT program. The program starts with:

```
10 T: What is your name?
20 A: $NAME
30 T: Hello, $NAME.
40 T: I'm going to ask you some questions about the
      United States.
```

In PILOT, each command is represented by a letter followed by a colon. (Many versions of PILOT do not require line numbers, but they are included in the example program for ease of reference to specific lines.) T: is the TYPE command. It displays information on the screen, such as the question in line 10. A: is the ACCEPT command. It causes the computer to wait for a response typed on the keyboard. It is used in line 20 to accept the student's name. The name is then stored in the variable $NAME so it can be used later. Line 30 displays a greeting, and line 40 tells the student what the lesson is about.

The program continues with:

```
50 *FIRST-QUESTION
```

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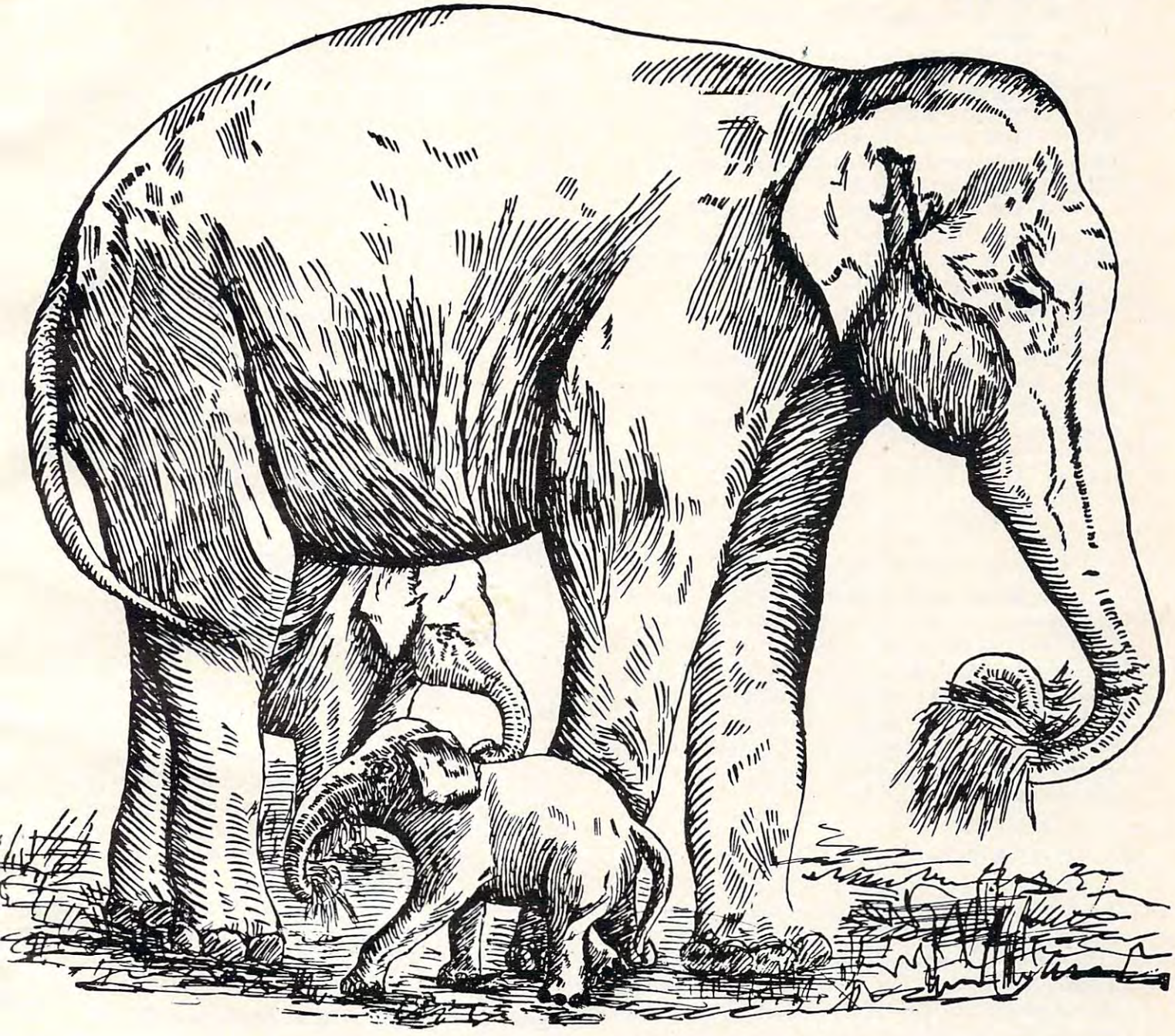

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```
60 T: Which is the largest state?
70 A:
80 M: ALAS
90 TY: That's right, $NAME. Alaska is the largest
   state.
100 JY: *SECOND-QUESTION
```

Line 50 is given the label *FIRST-QUESTION. One advantage of most versions of PILOT over BASIC is that lines and variables can be given names which convey what they do. This makes PILOT programs easy to read.

Line 60 displays a question and line 70 waits for a response. Line 80 is our first example of the MATCH command. M: ALAS tells the computer to search through the last answer entered and check if it contains the string of letters ALAS. Using ALAS means that close spelling errors of ALASKA will also be accepted. Extra words and spaces, and upper-case to lower-case inconsistencies are ignored in matching. All the following answers contain matches to ALAS:

I think it is Alaska
ALASSKA
ALASCA
alaska
The biggest state is the alaskan one

The MATCH command is very powerful for writing question-answer programs. A single M: command can check for more than one possible answer (as in line 140 below) and proper use of this command can lead to accepting a wide variety of responses, including common misspellings. However, you have to be careful with the answers to be accepted. For example, the following answers also contain matches to ALAS:

Calasfornia.
Alas, I wish I knew.

Lines 90 and 100 have Y or YES conditionals. A YES conditional tells the computer to follow the command only if the last M: command found a match. If the student's last answer contained ALAS, a match would be found. The T: command in line 90 would then display the "That's right" message, and the J: or JUMP command in line 100 would cause the program to branch to the line labelled *SECOND-QUESTION. If the student's answer did not contain ALAS, then lines 90 and 100 would not cause any actions and the programs would continue with the next line (110).

The rest of the program for this question handles incorrect answers:

```
110 M: TEXAS
120 TY: No, Texas is a big state, but it's not the largest
    of all 50 states. Please try again.
130 JY: *FIRST-QUESTION
140 M: CALIF,NEW YORK,NY,N.Y.
150 TY: That is a large state with a lot of people, but it
    is not the largest in size. Please try again.
160 JY: *FIRST-QUESTION
170 T: No, the correct answer is Alaska.
180 *SECOND-QUESTION
190 [Program continues ...]
```

Lines 110 to 160 check for expected wrong answers and give corrective feedback and another chance. An important feature of well designed tutorials is checking for children's typical errors and correcting misconceptions before they cause problems in understanding later parts of the lesson. Line 170 is reached only when the student does not give any of the expected answers.

The above example, while not showing all the possibilities of Core PILOT, should give you an idea of the type of program for which Core PILOT is well suited. In addition to the Type, Accept, Match, Jump commands, Yes conditionals, and string variables shown in the example program, Core PILOT also allows simple calculations, numeric variables, other types of conditional decisions, and sub-programs or modules which can be called from any point in the program (like subroutines in BASIC).

PILOT Is Not Just For Teachers

While PILOT was designed for teachers to write tutorial programs, it is also a good language for introducing children to computer programming. PILOT can serve as a vehicle for getting children comfortable with computer programming and for introducing general programming concepts such as variables, conditionals, branching and modules. PILOT programs are easy to understand, and children can easily get started writing their own. Children enjoy creating computerized question-answer dialogues, and working with PILOT can encourage them to further develop language skills. Most versions of PILOT for personal computers add other features desirable in a language for children, such as ways of creating pictures, and good error diagnostics to facilitate debugging programs.

Versions Of PILOT For Atari, Apple And TRS-80 Computers

Many versions of PILOT are available for different computers. Here is some information about PILOTs for the computers most widely used in schools. (I have not found an acceptable PILOT for PET computers. Anyone know of one?) All of these versions contain the Core PILOT commands, so I will focus upon what else has been added.

Atari PILOT is an ideal system for novice computer users. It adds easy-to-use, yet powerful, grahics and sound capabilities to Core PILOT. The graphics component contains turtle graphics commands like those in the LOGO language. Pic-

tures are created by telling a "turtle" which color pen to use and how to turn and move. As I discussed in last month's column, and as is shown every month in David Thornburg's "Friends of the Turtle" column, turtle graphics is an excellent system for children to create pictures and learn about programming. In addition, Atari PILOT contains a sound command which can produce up to four tones at one time, thereby playing chords as well as individual notes. This gives you full access to the sound capability of Atari computers and lets you create turtles which sing as they draw.

Atari PILOT also has other useful features. For example, it checks each line as it is entered into a program, so many errors are caught immediately. There is also a trace command which lets you run a program one command at a time to see how it works. There are two manuals for Atari PILOT, an instruction manual and a reference guide. Both are excellent. The clever illustrations in the reference guide give a sense of how user friendliness was considered in every aspect of this package.

The combination of PILOT, turtle graphics, sound, and excellent manuals in a single user-friendly package makes Atari PILOT my first choice as a language to teach children.

Atari PILOT, for Atari 400 and 800 computers, is available from Atari dealers in two different packages. An educator package, which sells for $129.95, contains the PILOT cartridge, the instruction and reference manuals and two tapes with sample programs, all put together in a nice binder. The home package, which sells for $79.95, contains just the PILOT cartridge and the instruction manual.

Users of Atari PILOT will also want a book by David Thornburg called *Picture This!*, published by Addison-Wesley. It is a tutorial guide to turtle graphics which also teaches a great deal about computer programming in general. As one would expect from David's **COMPUTE!** columns, the book is both informative and fun.

E-Z PILOT is an excellent, inexpensive PILOT which gives you access to the high resolution graphics capability of Apple II computers. E-Z PILOT lets you use upper and lower-case letters in several sizes and colors. These letters can be combined with high resolution pictures. There are commands for drawing lines and for using previously created shape tables and full screen graphic displays. Pictures created with a graphics tablet or many of the available graphics software packages can be used in E-Z PILOT lesson programs. You can also add sound to your lessons.

E-Z PILOT is easy for beginners to use. It provides a simple menu-driven editor for entering and modifying programs. Prompts for acceptable commands are shown, and syntax errors are caught as they are entered. Once a lesson is created and saved, it is automatically added to the menu of lessons the students see each time they start E-Z PILOT.

E-Z PILOT is a bit slow to work with at times, and the documentation needs to be elaborated. However, it is very suitable for creating computerized lessons and could also be used to introduce students to programming. It requires an Apple II with Applesoft and one disk drive. At $34.95 it is a best buy. Available from TECK Associates, Box 8732, White Bear Lake, MN 55110.

APPILOT II allows you to use high and low resolution graphics, mix text and graphics on the screen, add music and even some speech if used in conjunction with the Muse Voice program (sold separately). It also lets you time answers to questions and set maximum times to allow a student to answer. It is easy for novices to use and comes with a good manual and demonstration programs. APPILOT II requires an Apple II with Integer BASIC and one disk drive. It is available for $99.95 from Muse Software, 347 N. Charles St., Baltimore, Maryland 21201.

Apple PILOT is a sophisticated package of tools for creating lesson programs. It contains many commands and options in addition to those of Core PILOT. These include special editors for creating your own graphics and sounds. Apple PILOT is an excellent language for experienced programmers. However, it is not designed for novice computer users and is not suitable for teaching children about programming. Apple PILOT requires a 48K Apple and two disk drives for creating lessons, one disk drive for using lessons. It is available for $150.00 from Apple dealers.

Mark-PILOT is part of the GENIS package from Bell & Howell. This package also includes an authoring system called CDS (Courseware Development System). Mark-PILOT is easy to use, but limited. It does not let you use high resolution graphics, lower-case letters, sound or timing. At $300.00 for Mark-PILOT and CDS, I feel the package is overpriced. No backup copy is provided; a replacement disk costs $100.00.

TRS-80 Micro-PILOT contains the standard PILOT commands plus extensions for using the low resolution graphics and large letter set of the TRS-80 Model I and Model III computers. A special editor lets you design screen displays and store them on disk, to be retrieved when needed in a program. Micro-PILOT is easy to use and comes with a complete manual and a demonstration program which the manual describes in detail. It has several features usually found in BASIC but not in PILOT, such as mathematical functions

(square root, tangent, and so on). Unfortunately, Micro-PILOT has adapted BASIC conventions for variable names when the standard PILOT ones are preferable.

Micro-PILOT is suitable both for teachers writing tutorial programs and for children writing their own programs. Available for Model I and Model III computers with one disk drive, Micro-PILOT is sold by Radio Shack dealers for $79.95.

TRS-80 Color Computer PILOT is an interesting new version. I have received a preliminary copy without complete documentation and I have not explored it in detail, but it clearly contains some excellent features. For example, it lets you combine high resolution graphics with upper and lower-case letters of various colors and sizes. It even lets you design your own letter set and add music to your programs. This version of PILOT, soon available from Radio Shack dealers, requires only 16K and a cassette recorder. ©

Review

Two VIC Word Processing Programs

Harvey B. Herman
Associate Editor

Not Just A Game Machine

Commodore has in its ads made much of the fact that the VIC is not a video game but a real computer. This truthful claim was only academic at first as there was little available VIC software. Today the number of advertised programs appears to be growing exponentially, and the advantages in owning a true computer are quite evident.

As much as I like the VIC, I am aware of its shortcomings. The basic unit has minimal memory (5K read/write memory, RAM) and a display with a short 22 character line. Optional hardware has recently become available to correct these deficiencies. Note, however, that the programs described here will even work with the original unexpanded computer. Pretty good for a machine that retails for less than $300!

Why A Word Processor?

I always felt that it was not practical to type my own letters as I made too many mistakes. Furthermore, sitting at a typewriter, correcting errors with Liquid Paper, and retyping whole pages was not my idea of a good time.

The situation has now changed completely since I started using a word processor (*PaperMate* from AB Computers) on an older, expanded 2001 PET. I still make errors when I type letters, but they can be easily corrected before the final copy is printed.

I did not appreciate the convenience of a word processor until I actually started using one. For example, a draft letter can be run off with a few corrections without having to retype the whole letter. Moreover, a somewhat disorganized person like myself can keep up with his filing. Because I save all correspondence on disk, I always know that I can find a given letter by looking through a limited number of printed disk directories. Nothing gets lost.

Recently, I was given two VIC word processing programs to review, but I was a little dubious. A PET makes an excellent word processor, but it was not clear that a VIC would, particularly a VIC with a limited amount of memory. For program evaluation, I used additional hardware – a 3K RAM expander and a VIC 1515 printer. (The extra RAM allowed longer text files, but was not essential.) If VIC word processing intrigues you, read on to learn more about the good and bad features of each program.

Un-Word Processor

The accompanying eight-page manual describes this program as a simple word processor. I would agree with that description and even add "very." This software may seem strange at first. It consists of two machine language text formatting programs, one for the VIC 1515 printer and the other for an RS-232 printer. The formatting program appropriate for your system is loaded and protected from BASIC with a few POKEs. The instructions are quite explicit even if the rationale might not be clear to a beginner.

The next order of business is the writing of what I would call a pseudo-BASIC program. The first statement is a SYS call to the formatting program, and the subsequent statements, a text file not normal BASIC, are numbered lines of text headed by a double quote. Corrections are made in the text file, using the VIC screen editor, after the line is entered. The file can be saved on cassette or disk the same as any other program.

The text file is printed by simply RUNning the pseudo program. Return and line feed are added automatically to the printout, about every 72 characters. The line length may be adjusted as desired. A second double quote can be used to prematurely terminate a line as at the end of a paragraph or to produce a blank line.

Although this program is admittedly simple, I don't mean to imply that it is not useful. In some cases simple is better. It would be particularly easy for elementary school students, who might be intimidated by a more comprehensive program. The only minor flaw that I found was a few easily recognized errors in the manual.

The VIC Typewriter

The 13-page manual that accompanies this program says, up front, that it is a very simple word processor. However, it is closer to a real one than the program just described. It consists of a combined BASIC driver and a machine language subprogram. Text files, written with the program, can be saved to either cassette or disk, and retrieved later. On command, the text file can be printed on

the one supported printer, the VIC 1515.

The manual is slick and professionally done. A summary of the 18 direct commands and the seven indirect (embedded) commands precedes a detailed description of each. I found myself referring to this summary quite often at first, but I expect that this would not be necessary after extended use.

There are several features of this program that I really like. It continuously displays the maximum number of lines available (185 lines for the 3K expanded VIC) and the current line number. The VIC function keys are used to advantage. For example, one key can be used to delete a line and another to page forward in the text. Enhanced or reversed printed characters are easy to intersperse in the text using special symbols. A tab key (five spaces) is even provided.

Other features were difficult to use or were absent. One function key, corresponding to "delete text," is too easy to use, while another, "delete character," is tricky to get just right as it does not have instantaneous action. There is no page back key, so one must page forward and wrap around to the start through the back door. Support for an RS-232 printer is lacking. It could have been easily added as an option to be separately loaded. I could go on, but we would not expect it to contain all the bells and whistles of much more expensive programs.

In a comparison between the two programs, the *VIC Typewriter* is a clear winner. This program has so many more features that it would be the one to choose if you want a serious program. On the other hand, having more features makes it more difficult to learn. If you are a VIC owner in the market for a simple word processor, check these programs out at your closest VIC emporium. You will get a taste of an important application for personal computers. Choose the one that suits you best.

Please note – problems associated with the early release of Home Calculation Pack are being corrected; be sure you get the updated version.

Un-Word Processor
Midwest Micro Associates
P.O. Box 6148
Kansas City, MO 64110
$12.95

The VIC Typewriter (one of six programs in Home Calculation Pack VT 107A)
Commodore Business Machines
681 Moore Road
King of Prussia, PA 19406
$59.95

Review:

BASIC A+

Charles Brannon
Editorial Assistant

What is your "wish list" for the ultimate BASIC? What statements would you have? How large could the language afford to be? Atari owners can choose from three BASICs: Atari 8K BASIC, Microsoft BASIC, or BASIC A+. The original BASIC was designed to fit into an 8K cartridge, limiting its potential, whereas the latter two languages load as machine language programs from disk, and can be as large as memory permits. These *softloaded* languages, therefore, require a disk drive and at least 32K of RAM. The increased size of these languages means less memory for writing programs, though. With a maximum 48K of memory, you have a bit over 20K remaining.

An Extended BASIC

BASIC A+ is upward compatible with Atari 8K BASIC. That is, programs written in Atari BASIC will run without modification in BASIC A+. Prior programming experience with Atari BASIC transfers to BASIC A+. In effect, BASIC A+ is an extension of Atari BASIC, adding a multitude of commands and improving others.

Most of the minor discrepancies and bugs of Atari BASIC have been corrected. For example, the RUN command did not clear out arrays or strings as it should, and does, in BASIC A+. You can now use a subscripted variable in a READ or INPUT statement, such as READ A(I).

Have Your Cake And Eat It Too...

BASIC A+ narrows the compatibility gap between Atari BASIC and the popular Microsoft BASIC with options such as prompts in INPUT statements. For example,

```
INPUT "What is your name?",NAME$
```

TAB is also supported, as in PRINT TAB(20);X(I). TAB even works with a printer. String concatenation is provided with ",". A$=A$+B$ becomes A$=A$,B$. Since BASIC A+ includes equivalent commands for most Microsoft statements (excluding strings), you get the best of both worlds!

BASIC A+ adds program debugging tools such as TRACE and TRACEOFF, which activate and cancel the display of line numbers during a program's execution, and LVAR, which lists all variables. Error messages are now non-cryptic English phrases, such as NO SUCH LINE # instead of ERROR - 12. BASIC error handling with TRAP is made easier with ERR(0), which returns the error number; ERR(1), which gives the offending line's number; and CONT, which continues execution on the line following the error (RESUME in other BASICs).

Extended I/O

BASIC A+ adds DOS commands to BASIC, making disk handling by a program much easier. Compare these two statements which delete a file from the disk:

```
XIO 33,#1,0,0,"D:TEMP"
ERASE "D:TEMP"
```

Also included are PROTECT and UNPROTECT (a.k.a. LOCK/UNLOCK), RENAME, and DIR. Yes, you can now list the directory without going to DOS!

BASIC A+ can save and load binary files. These files can be any section of memory. For example, a word processor could use BPUT to save a text file at top machine I/O speed or use BGET to recall another. This formerly required many POKEs and a machine language program to call the CIO. RPUT and RGET are useful for fixed-length files produced with NOTE and read with POINT. For example, to PRINT a number to such a file could produce anything from "0" to "10" to "3.1415927" to "1.562 E+42." RPUT will output the number as 7 bytes, using the internal storage format for numbers. RGET will read these bytes and reconstruct the number. This built-in "packing" and "unpacking" capability is vital for efficient record processing.

PRINT USING

BASIC A+ supports deluxe formatting via PRINT. For example, PRINT USING "###.##" would format a three-digit number in dollars and cents format, automatically padding unused digits with spaces (or zeroes to the right of the decimal point). So 33.345 would appear as "b33.35". (The "b" denotes a blank.) Notice that PRINT USING automatically rounds numbers to fit the format field. "Pi" printed in the same format would appear as "bb3.14". Other format characters are "$" (floating dollar sign), "," (comma formatting such as 1,000,000 for one million), "&" (fills unused digits with zeroes), "*" (pads blank digits with asterisks for number protection, such as check printing), and "+" or "-" (which force the appropriate sign to be printed where specified). String formatting is provided with "%" and "!" which perform right or left justification on the string.

An Ideal Language?

BASIC A+ is written by programmers who have both designed Atari BASIC and have used it extensively. Therefore, it reflects the "wish list" of these programmers. If you're a serious programmer, you'll find this wish list comes close to yours – BASIC A+ is a programmer's programming language. Examples of this are seen throughout the language. Most obvious of these are the structured programming constructs of "IF...ELSE...ENDIF" which permit multi-line, multi-clause comparison and evaluation, and "WHILE...ENDWHILE" which allow a structured loop without a GOTO. The SET function enables or disables certain features. For example, SET 0,128 disables the break key; SET 2,ASC(":") changes the INPUT prompt from a question mark to a colon; SET 5,1 will allow program entry in lower case (converts to uppercase). Believe it or not, there is even a SET for the ANSI-standard FOR/NEXT loop. SET 3, 1 will allow a FOR/NEXT loop to execute zero times. This statement:

```
FOR I=30 TO 1:PRINT I:NEXT I
```

would normally print "30" and stop – executing at least once, no matter what the FOR range is. Almost all microcomputer BASICs do this, but the SET statement will permit BASIC to ignore such loops, making the Atari one of the only microcomputers to comply with the ANSI standard.

Programming convenience is enhanced with the DPOKE and DPEEK commands which simulate 16-bit PEEK and POKE commands. For example, to find the start of screen memory with SAVMSC ($58), you would code:

```
SCR=PEEK(88)+256*PEEK(89) in Atari BASIC, or
SCR=DPEEK(88) in BASIC A+.
```

Obtaining the same address from the display list shows the convenience even more dramatically:

```
A=PEEK(560)+256*PEEK(561)+4
SCR=PEEK(A)+256*PEEK(A+1)
vs. SCR=DPEEK(DPEEK(560)+4)
```

DPOKE lets you place sixteen-bit results in memory without breaking the number into two 8-bit parts. For example, DPOKE 12,1536 replaces POKE 12,0:POKE 13,6 and DPOKE 12,A replaces this piece of code:

```
POKE 13,INT(A/256):POKE 12,A-PEEK(13)*256
```

Other memory-manipulation commands are FIND and MOVE. FIND will search a string, even a huge Atari "megastring" of thousands of characters, for any substring. This has instant application for database management programs, and has infinite minor potential, such as menu selection:

```
GOTO FIND("PDCJN",A$,0)*10+1000
```

where P,D,C,J,N are the first letters of a menu. FIND will return from 0-5. MOVE will move a block of memory from one place to another. This can be used to move the character set in ROM into RAM for modification (and BASIC A+ conveniently reserves 1024 bytes for the character set). MOVE can be used for insert/delete functions, and even page-flipping. Imagine how much easier player/missile graphics would be with MOVE, where you could easily move players around in player memory with this machine language-speed command. Ah, but that's another topic...

A User-Friendly Language

One of the most attractive features of BASIC A+ is the ease of access to hardware features. The controller functions STICK, PTRIG, etc., and the SETCOLOR command represent Atari BASIC's user friendliness. These functions could easily be replaced with PEEKs and POKEs, but Atari BASIC makes the machine easy to use without memorizing a memory map. BASIC A+ continues this tradition. PEN(0) will return the horizontal position of the light pen, if present. HSTICK and VSTICK return delta-X and delta-Y offsets for the joystick. HSTICK, for example, returns +1 if the joystick is pushed right, -1 if the joystick is to the left, and 0 if the joystick is "horizontally centered." The two functions can be combined to easily update motion.

Player/Missile Graphics

This ease of use continues with a complete set of commands to control player/missile graphics, one of the Atari's best features. Formerly, programming P/M graphics was a nightmare of PEEKs, POKEs (so many POKEs!), sloowww FOR/NEXT loops for initialization and vertical movements, and machine language routines that were clumsy at best. BASIC A+ makes P/M graphics as easy as PLOT and DRAWTO. Setting player colors is accomplished with SETCOLOR's analog, PMCOLOR. PMCLR clears out a player. PMWIDTH sets the width of a player. The headache of memory allocations and bit selection is replaced with PMGRAPHICS, a statement similar to GRAPHICS. PMGRAPHICS (abbreviated as PMG.) does all the setup for you. Cancelling P/M is done with PMGRAPHICS 0. After the initialization, PMADR will return the memory location of any player, so POKEing or MOVEing bytes into it is easy.

The heart of the P/M graphics commands is PMMOVE, which positions the player anywhere on the screen. The horizontal and vertical positions of the player can be set together or separately.

Horizontal position is an absolute location from 0-255, but vertical positioning is done with a relative *offset*. PMMOVE 0;1 would move the first player up one scan line. PMMOVE 0,100;-4 would move the player to horizontal position 100 and then move it down 4 scan lines. Two other commands are MISSILE and BUMP. MISSILE creates a missile (the "missile" in player/missile graphics) which is moved with PMMOVE. BUMP will read the collision registers. BUMP(0,3) will check for a collision between player 0 and player 3.

Unique Documentation

The manual for BASIC A+ comes as a sheaf of loose-leaf pages to be inserted into the BASIC reference manual. A logical concept – BASIC A+ extends BASIC, so its manual extends BASIC's. It is a little confusing, all the paper-shuffling, but gives you a complete reference. All changes are noted with special pages, and the table of contents is replaced as well. Additional appendices are added, as well as two new chapters, including a tutorial on player/missile graphics and the related commands. The manual is very well written, concise, but complete. It even includes "secret" internal memory locations to permit the user to customize BASIC A+. It is apparently easy to add new commands to BASIC A+. On an included demo/utility disk are two commands, RENUM and "@" which respectively RENUMber your program and permit an Atari load, to let you load Atari programs into BASIC A+.

A Few Notes And Bugs

1. The pre-reserved memory for characters and P/M graphics cannot be used for your BASIC program, although you can store machine language programs there.

2. A GRAPHICS command can apparently wipe out some of the reserved character graphics area.

3. BASIC A+ runs noticeably faster than Atari BASIC. One reason for this is that BASIC A+ only checks for the break key at the end of each line, not after each command. Unfortunately, this can cause a lock-up on single-line commands such as

```
FOR I=0 TO 1E9:PRINT PEEK(764):NEXT I  and
300 GOTO 300 :REM FREEZE FULL-SCREEN
    GRAPHICS UNTIL BREAK
```

SYSTEM RESET will abort such a loop.

4. OSS sells BASIC A+ for the Apple, so software producers can sell software that will run on either machine.

5. OSS has a run-time BASIC A+ which presumably runs faster, uses less memory, and has security features. You must pay a royalty to use it, however (unless OSS distributes your software).

6. OSS apparently has excellent user support, with a newsletter, and inexpensive update disks available.

7. Get OS/A+ with the BASIC. Although space does not permit a complete review here, be assured it's a bargain. For an extra $70 you get a full-power "system" DOS with easy to use commands such as REName. Other commands can be accessed from disk, such as COPY and HELP. BASIC A+ is loaded with "BASIC." OS/A+ is always available – no DUP.SYS or MEM.SAV! Included are numerous system utilities and EASMD, the disk-based upward-compatible Editor Assembler – how's that for a free bonus?

BASIC A+ is a feature-packed, easy-to-use language. The scope and range of BASIC A+ make it a truly professional language, worth the consideration of any serious programmer.

BASIC A+
Optimized Systems Software, Inc.
10379 Lansdale Ave.
Cupertino, CA 95014
$80 (or $150 with OS/A+)

©

VIC Communications: The RS-232 Interface

Jim Butterfield and Jim Law
Toronto

The VIC has very good communications potential built in. It's versatile and sophisticated: you can set transmission speeds and other characteristics. Buffering gives you a nice bonus: after you deliver characters to the interface, you may go about your computing business and the characters will be sent at the proper time. Similarly, input characters can be collected while you are doing other things, allowing you to pick them up at your own convenience.

The interface is called RS-232 (more about that later). Its versatility makes it very useful, but there are a couple of drawbacks. First, you can't use the serial disk/printer port or the cassette tape while the RS-232 is in gear. You could stop the RS-232, fire something out to printer or disk, and then resume communications; but that's sometimes awkward to do. Secondly, the Parallel User Port (PUP) and the RS-232 interface are the same connections, so it's difficult to use them both at the same time. If you are planning to sense a bunch of switches on the PUP and report their status over a communications line, you'll have some headscratching to do.

The RS-232 Connection

RS-232 is a communications standard that defines a whole bunch of wires (25) for connecting a terminal device (that's your VIC) to a communications device (that's your modem). It defines what the wires do. It defines a standard connector (which the VIC doesn't have). It defines standard voltages and currents (which the VIC doesn't observe).

Although all the RS-232 connections are defined, they are rarely all used. The most important connections are:

Signal	Description	Edge Connector	RS-232 Connector
From Modem to VIC:			
Data Rcv	Serial data input	Pins B and C	Pin 2
DSR	Modem OK	Pin L	Pin 21
CTS	Modem ready to transmit	Pin K	Pin 4
From VIC to Modem:			
Data Xmt	Serial data out	Pin M	Pin 3
DTR	VIC OK	Pin E	Pin 5
RTS	VIC is ready to transmit	Pin D	Pin 6
Ground connections:			
Gnd	Signal ground	Pin N	Pin 7
Pro	Chasis ground	Pin A	Pin 1

We should mention that the VIC leaves RTS on all the time just to keep the modem on its toes. Two more connections are fitted to the VIC but not used: RI and DCD connect to pins F and H. But you won't need to worry about them unless you're heavily into communications.

Hardware

We mentioned that the PUP connector is not a standard RS-232 connector, and the voltages furnished by VIC are not standard RS-232 voltages. This means that you'll need an adaptor to hook into your modem. Commodore should make these available soon.

If you're not willing to wait or just want to make your own adapter, two possible circuits are described below. The first uses discrete parts and any well-stocked junk box should harbor the necessary items. The second has minimum parts, but the ICs may be hard to find. If you are not handy with a soldering iron, perhaps a friend or a local electronics buff could assemble the interface for you: it's not a difficult project.

The simplest way to connect the VIC is with just the two data lines and ground. This "three wire" connection will work with most modems and any printer where handshaking is not a problem. If you are using the "junk box" circuit, make only as many circuits as you need: one input and one output should be enough for a modem.

Figure 1. Output Circuits

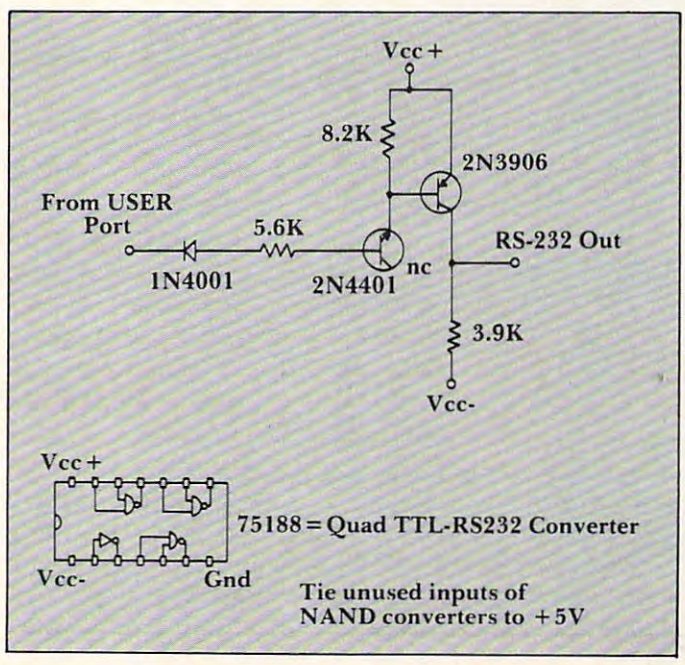


Figure 2. Input Circuits

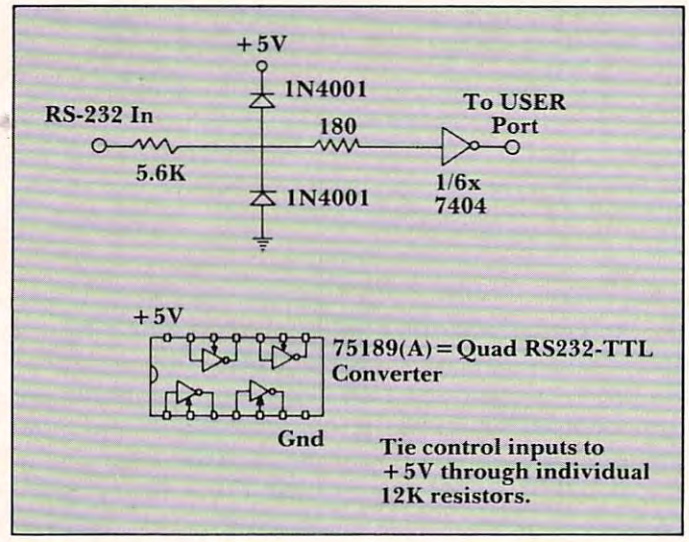


Figure 3. Power Supplies and Connection Diagram

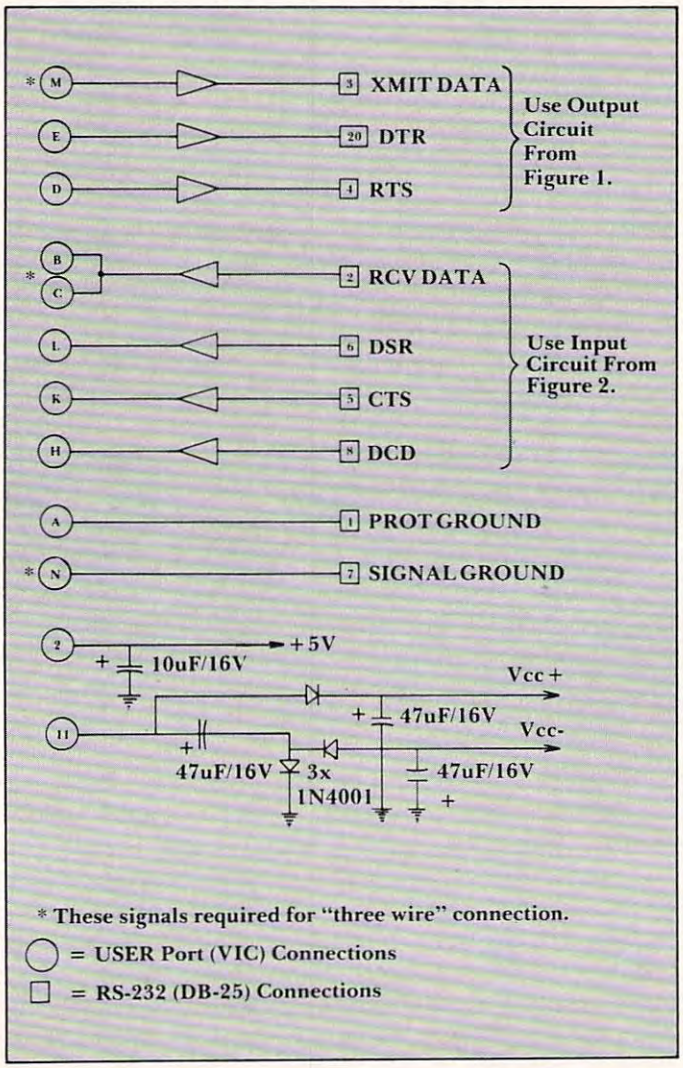
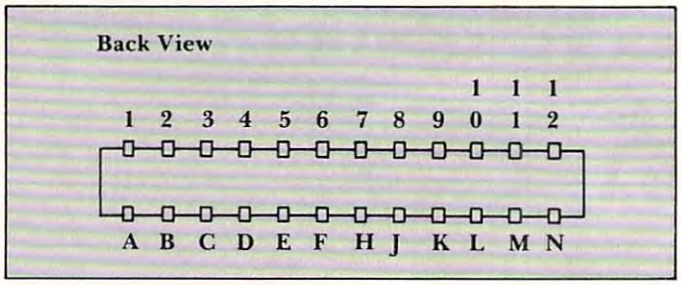


Figure 4. VIC User Port



The RS-232 interface is in place in your VIC as device 2. So all you need to do is to OPEN device 2 (for example, OPEN 1,2) and you may send and receive to your heart's content (PRINT#1,"ANYBODY THERE" : INPUT#1,R$). But you'd better know a few things about how it works before you do that.

Speed And Code And Other Things

The signals you are sending to the modem are serial. That means that a character is not sent all at once – the bits are sent one at a time at a certain speed. You must set that speed, and arrange a few other administrative details.

We need to signal speed, code, parity, and even the type of modem handshake we want. To open a 300 bit per second channel we would code:

```
OPEN 1,2,3,CHR$(6)+CHR$(0)
```

The value of 6 sets the speed to 300 bps; 5 would set 150 bps and 8 would set 1200 bps. We have turned off parity, assumed eight bits, and assumed ordinary ("simple 3-wire") RS-232 interfacing.

At the same time that we do this OPEN, something else happens: the VIC grabs two buffers for input/output use. It takes them from your available BASIC space. Try the above statement followed by a PRINT FRE(0) and watch 512 bytes disappear. The missing bytes will be returned to you when you say CLOSE 1.

There's another snag. These buffers are set up in the top of memory; if you have any strings stored up there you'll be in trouble. If you're going to use the RS-232, your program should OPEN it as its first command. That way there's no chance of confusion. Remember to CLOSE when you're done.

Working The Channel

You send with PRINT# and your program will be able to continue immediately while the data is sent. If you happen to fill up the buffer, the PRINT# will wait; you won't lose anything.

You can receive data with INPUT#, but it's a