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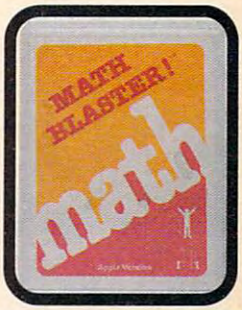

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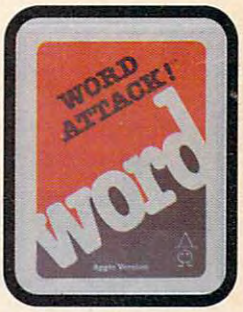

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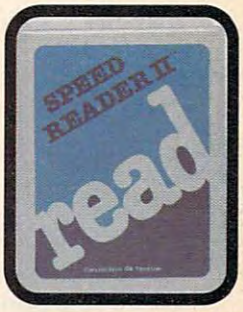

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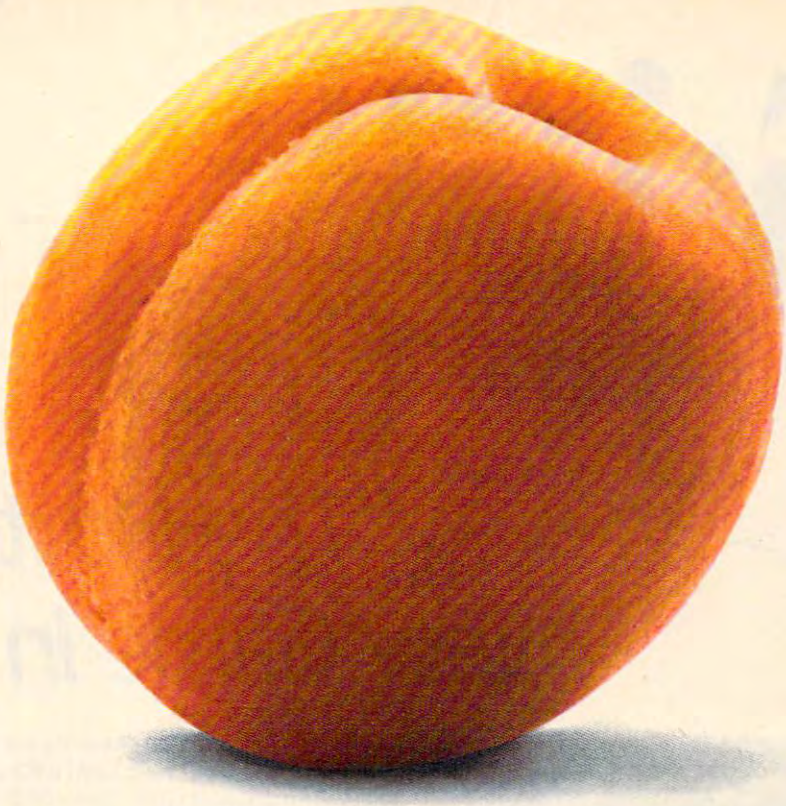

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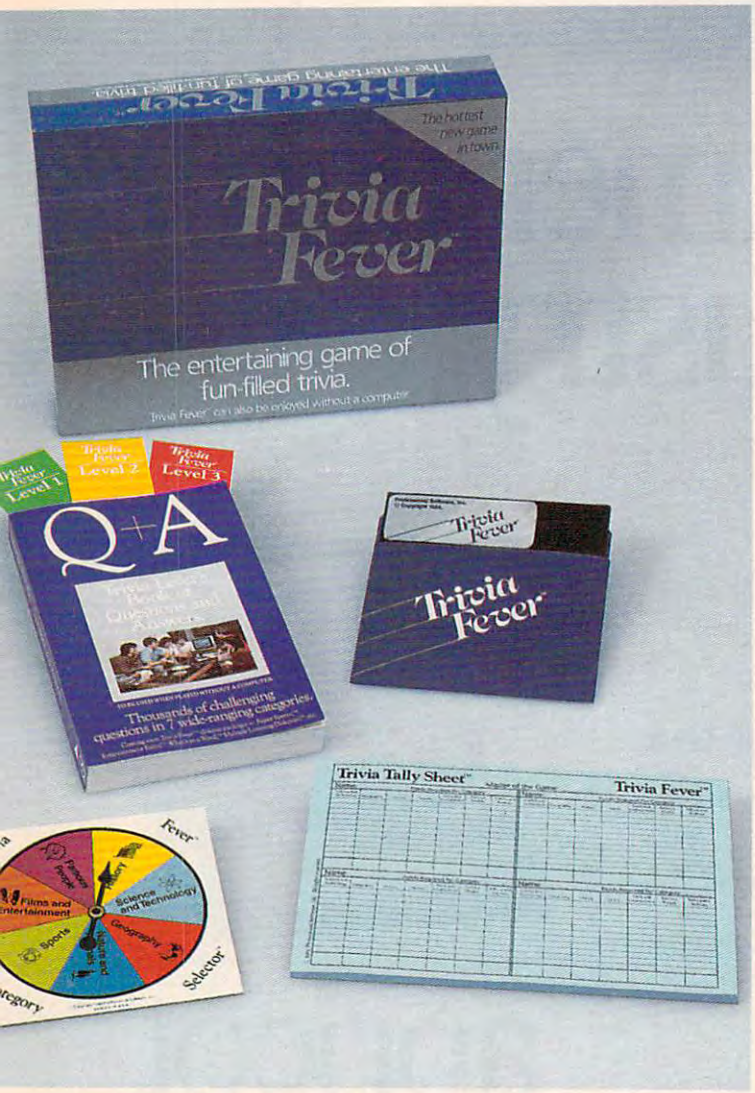

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EDITOR'S NOTES

"It's not writing, it's just typing" was the way the late Truman Capote described the books of Jack Kerouac.

There's more wit than truth in this devastating comment—Mr. Capote was not one to praise rival authors—but it expresses an intriguing and very American ethic: If something is automated it has less value.

There are newspaper reporters who insist on retaining their heavy black typewriters. They will not, cannot, write on a word processor. They feel that the very term *processor* demeans the creative act of writing. It's not writing, it's word processing.

So processed things, robotized things, things made with machine assistance are derided as mass-produced and likely therefore to represent the lowest common denominator in quality or taste.

But clearly this is one case where the medium, the tool, isn't the message. After all, few would question the excellence of much of the typing done by Tennessee Williams. And few would doubt that Shakespeare would have chosen a word processor over of a pot of ink and a feather, given the opportunity.

If writing of the finest quality can come out of a typewriter—and most great twentieth century writing has—why do some people resist new tools? Why are technological advances criticized variously as impersonal, too automatic, too easy? When is the process more important than the product? Is there a clue in the ways we tell the difference between human- and machine-made artifacts?

Oddly enough, one answer seems to be *texture*. Handmade things generally feel and look rougher than automated things. Rugs, furniture, bricks, cloth, even typed manuscripts all look irregular and somewhat mottled when they are hand done.

By contrast, looms, high-speed lathes, assembly-line molds, and computer printers operate smoothly, with more controlled rhythms, than do human hands. The result is more polished and regular. This is where the accusation that something "doesn't look human" comes in: Automation results in replication rather than what we call creation. Automated things are not one-of-a-kind. They don't evidence the struggle that went into something handmade.

Certainly part of the value of hand-hewn beams in a house is our collective awe that something so large was finished at so great a price in human effort. We identify with the craftsman. We may feel envy of his skills, or feel pity or admiration. The point is that we *feel* something. We are rarely jealous or sorry or emotional about machines.

And even with everyday products, things like shirts and food, we tend to prefer the handmade over the mass-produced. Given a choice, most people would favor grandma's real apple pie over Grandma's Home Style Apple Pie Treat.* After all, the human grandma cuts each apple and carefully arranges the wedges and lovingly rolls and crimps the crust.

Over at the factory where the Pie Treats are made, five tons of apples are blown apart in a steel vat, then scraped off the walls, forced through some extremes of temperature, and finally dropped five feet as a congealed mass onto a textureless crust.

The case for human-crafted objects is a strong one. But we should also consider the craftsmen. There is a serious and permanent split between the producer and the consumer here. You might like to be able to own or buy hand-hewn beams, but would you want to hew them? It's nice to eat homemade pies, but would you want to bake them?

Ultimately, we've got to learn to accept and value texture-free goods. The day of the handmade consumer product is gone because, when everything is handmade, only the rich few can live well. It simply takes too much time and effort to do things the old way. Mass-production brings products to the masses, us, and the general standard of living is greatly improved even if we are surrounded by smooth, uninspired objects that show no evidence of grandma's love or a woodworker's sweat.

Lately, the process of learning to love the machine has started in interior-decorating circles. It's called High Tech design and it takes the cold symmetries of industrial and Bauhaus architecture and invites them indoors so we can adjust to our new, smoother world.

Automation is to our age what industrialization was to the nineteenth century. Automation won't go away just because we feel nostalgia for products costing an enormous price in human labor, for unpredictable irregularities in the texture of the things around us.

Richard Mansfield

Senior Editor

* *Pie Treat, and the manufacturing description that follows, are Mr. Mansfield's fictional (we hope) creations, and are not intended to bear any resemblance, accurate or otherwise, to any products out there in the real world that might also share the name "Pie Treat."* —RCL

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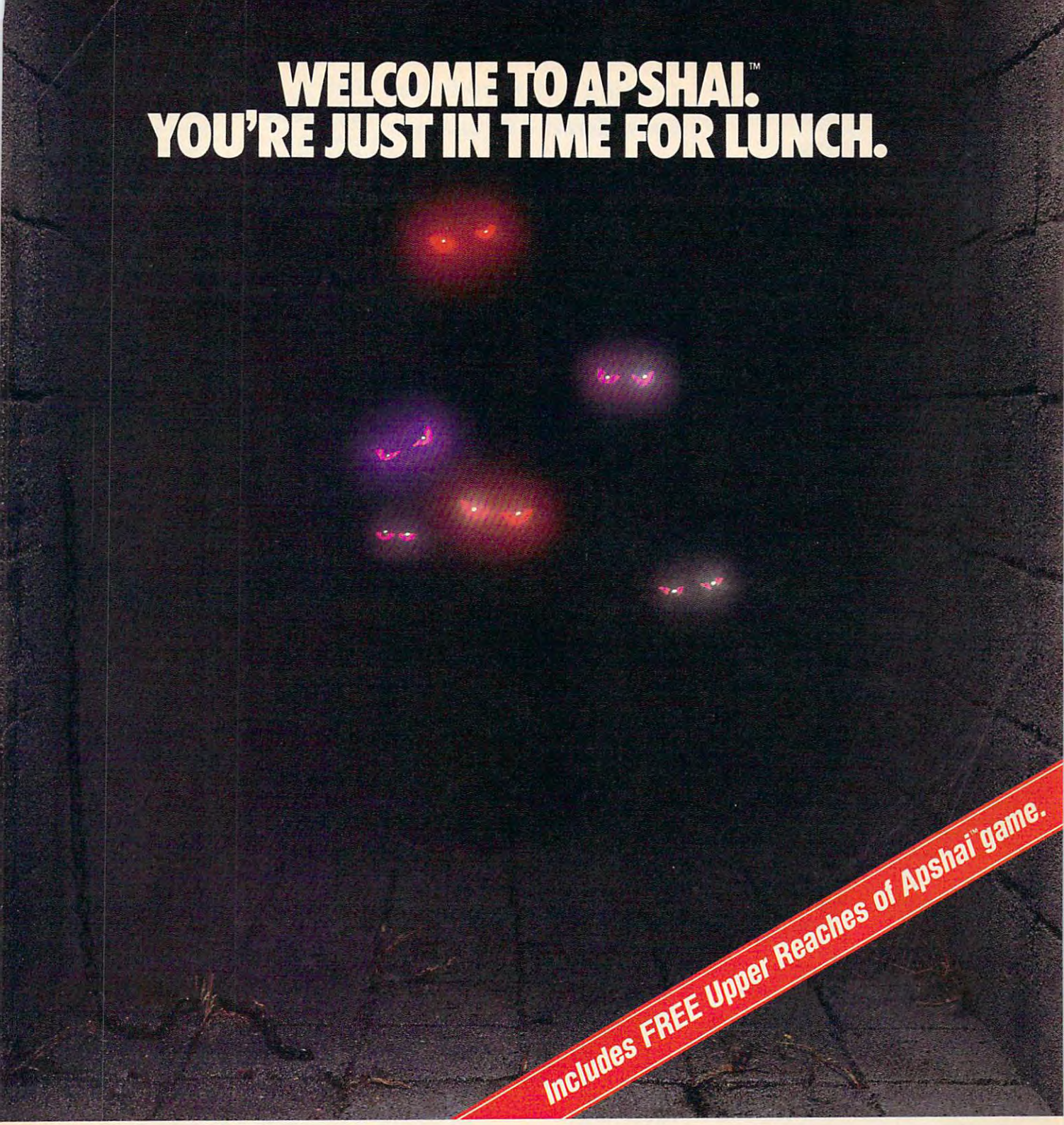

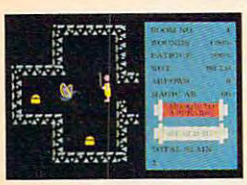

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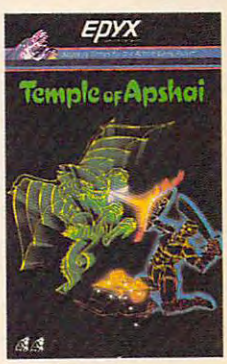

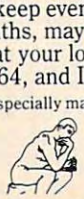

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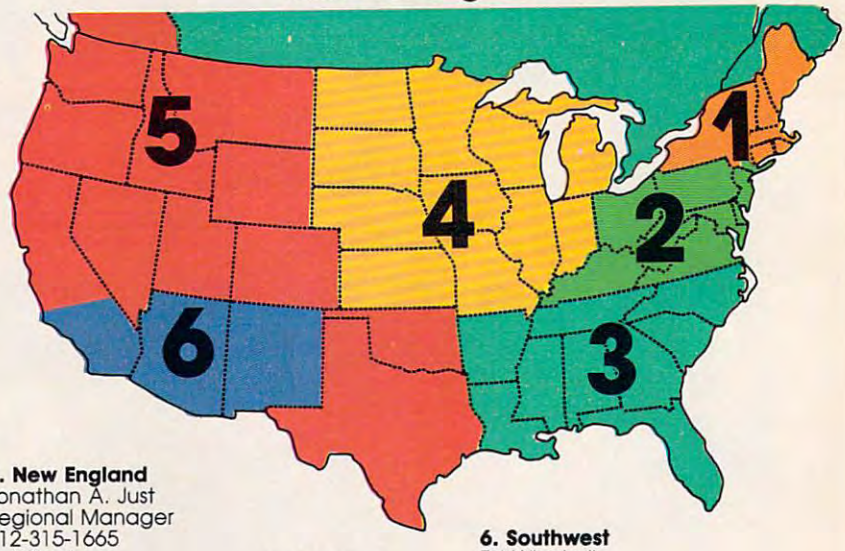

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The True Meaning Of Baud

What's the difference between 300 baud and 1200 baud?

Karl Stephens, Jr.

Most people use the term baud *when referring to telecommunications transmission speed. In popular usage, the higher the baud rate, the faster the modem can transmit characters over the phone lines. You'll hear people referring to 300 baud, 1200 baud, and 2400 baud modems. However, this is technically incorrect. The more correct term is bits per second, abbreviated bps. A 1200 bps modem can transmit characters four times as fast as a 300 bps unit.*

Baud is used to reference the division of each second into tiny, discrete pieces (a process known as signal modulation*) by the modem's electronic circuitry. A 300 bps modem's signal is indeed modulated at 300 baud. Since each tiny division holds one bit of data, the effective transmission rate is 300 baud per second times 1 bit per baud, or 300 bps.*

But 1200 bps modems are another story. A 1200 bps modem divides each second into 600 pieces. Using a technique called four-level phase shift keying, each piece can represent two bits. Multiply 600 baud per second by 2 bits per baud and you end up with 1200 bits of information per second (1200 bps).

High-speed 2400 bps modems also use a modulation rate of 600 baud. What's different is the method of phase shift keying. They use 16-level phase shift keying, so each piece or baud can represent four bits. Multiply 600 baud per second by 4 bits per baud and you have 2400 bits of information per second.

That's why it is technically inaccurate to say medium- and high-speed modems transmit at 1200 baud and 2400 baud. Both devices are actually 600 baud modems.

With most of today's transmission schemes, it actually takes ten bits to send one character of data. Therefore, the approximate character-transmission speeds of 300, 1200, and 2400 bps modems are 30, 120, and 240 characters per second, respectively. If you want to calculate how long it would take to transfer a certain file, divide the transmission speed in characters per second into the length of the file, remembering that 1K equals 1024 characters. For instance, at 300 bps, it would take about 546 seconds or 9 minutes to transfer a 16K file.

For a fuller discussion of modem transmission speeds and whether it's worth investing in a faster modem, see Arlan R. Levitan's "Telecomputing Today" column in the January 1985 issue of COMPUTE!.

The VIC-20 version of *SpeedScript 3.0*—and all other programs for the VIC and Commodore 64 in the April 1985 issue—may be ordered on disk directly from COMPUTE! Publications. Call **TOLL FREE 1-800-334-0868** (in NC 1-919-275-9809) to charge your order 8:30 a.m. to 7:00 p.m. Eastern Time, Monday through Friday. Or send check or money order ($12.95 + $2.00 shipping and handling) to:

COMPUTE! Publications
P.O. Box 5058
Greensboro, NC 27403 USA

Readers outside the US and Canada add $3.00 shipping and handling. All orders must be prepaid in US funds.

64 Classroom Computing

I am interested in contacting other science teachers and students who use the Commodore 64 in the science classroom in order to share science programs written by the teacher and/or student, evaluate commercial software, and publicize science software available for the 64 from vendors.

Besides the obvious educational benefits, there are many other advantages to a coming together of science teachers, 64s, and students. We can expose more students to the world of computing, allow the students a practical application for their programming skills, and form a network of interested buyers of science software.

Jeff Simpson
Science Department
Paradise Valley High School
3950 E. Bell Road
Phoenix, AZ 85032

Scanning The IBM Keyboard

I have an IBM PC and have encountered a dilemma in a BASICA program. My program sends one character at a time from the keyboard to a letter-quality printer (that is, it makes the PC and printer act like a typewriter). The program works fine, but I would like to display on the screen a constant monitoring of the Caps Lock key. So far, I have been unable to determine how to scan the keyboard for that key. Can you help?

Thomas Bigos

Location &H17 at segment &H40 on the IBM PC and PCjr contains the status of the Caps Lock key and other important keys. Each of the eight bits in this location corresponds to one of eight special keys as follows:

	Bit#	Value
Right Shift	0	1
Left Shift	1	2
Ctrl	2	4
Alt	3	8
Scroll Lock	4	16
Num Lock	5	32
Caps Lock	6	64
Ins Lock	7	128

If a bit is on, the key is active. The following program prints the contents of this location:

```
10 DEF SEG=&H40
20 PRINT PEEK(&H17)
30 GOTO 20
```


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Cable Controller Plus

Get all the cable channels on any TV or video recorder with this all new wireless infrared remote control cable tuning system. And at just $88, we're sure to break the cable market wide open.

If you've got cable, we've got it all. Now you can tune in up to 60 cable channels from your easy chair.

The Universal Cable Controller receives all VHF Low Band channels 2-13 and VHF Midband 14(A)-22(I).

Plus it tunes the Super Band VHF channels 23(J)-36(W) and Hyper Band channels from 37-58. It even captures the A1 and A2 Sub Band.

MOVIE CHANNELS

If there are movie channels on your cable and they're not scrambled, the Controller is all you need. If they're scrambled, you'll need the cable company's box.

Note: Check with your cable company before viewing anything at all, to see if they require you to pay a fee.

SPORTS PLUS

There are lots of 'Super Channels' broadcast on cable. On the all sports channel you'll watch 'World Class Sports' whenever you wish. All Movie Channels give you entertainment at all hours.

And 'Super Stations' from New York and Atlanta give you major city TV for cities other than your own. Plus, there's Cable News Network for a world wide perspective on the news and much more. Why not see what's on your cable?

ONLY FOR CABLE

If you don't have cable, the Cable Controller isn't for you. It only finds you extra channels when you are connected to a cable. And, it doesn't tune in UHF.

But, if you're on cable, your cable company is rebroadcasting UHF over unused VHF channels. So with the Cable Controller tuner, you'll get it all.

TOTAL RANDOM ACCESS TUNING

The wireless infrared remote hand controller does it all. It switches both the TV and the Controller on and off and selects your channels. **And, look at this.** You can select your favorite channels (up to 6) and store them in a special section.

Then just touch the special 'RCL' Recall Button and you'll be able to sequence through only your favorite channels. This is especially convenient if you like to flip through movie channels during commercials on regular TV.

For the other channels, you'll enjoy total random access tuning. You can go directly from channel 2 to 28. Or you can step tune one channel at a time.

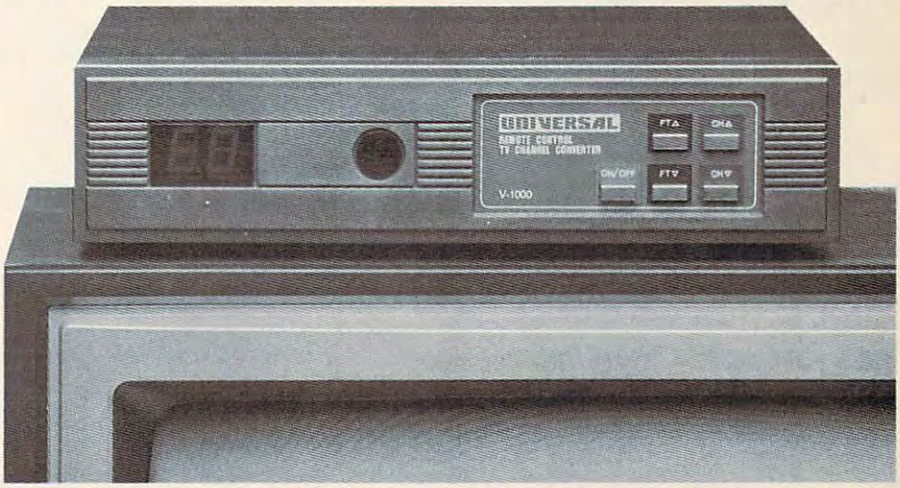
Once you've set your own TV to channel 3, you can just forget it. Any fine tuning is handled from the wireless infrared remote handset. And you'll have crystal controlled frequency phase lock loop synthesizer tuning for the finest picture.

You'll see the number of the station that you have selected displayed on the command base. And, you can tune channels either from the remote or the base.

Color tints, volume, brightness and contrast are all controlled by whatever method you now use.

INSTALLATION

Nothing to it. All cable systems use 75 ohm round cable. Simply unscrew the end from your TV and screw it into the Controller base input.



Then screw in an identical cable (included) between the Cable Controller and your TV. Finally, plug your TV's AC plug into the Controller and the Controller's AC plug into the wall.

WHAT IT IS

The Cable Controller is actually a very sophisticated, all electronic VHF TV tuner/receiver. It's really like a TV set without a picture tube.

Since it's all electronic, you won't be getting snow from dirty tuning contacts and loss of fine tuning as the set ages.

The Controller tunes all the possible stations that your cable can broadcast, something that would be very expensive to build into standard TVs, because not all TVs are going to be used on cable.

GREAT FOR VIDEO RECORDERS

Now you can record off cable. With the Cable Controller hooked to your video recorder you can open the world of cable to your video recorder too.

Cable ready video recorders that don't even tune in 60 channels can cost hundreds of dollars extra. You can feed both your TV and video recorder. Or, you can separate them so that you can easily watch one thing and record another.

WHAT IT ISN'T

It isn't one of the infamous 'black boxes' you might have read about that illegally decode various 'Pay TV' channels. On cable, most of the programming isn't scrambled, it's just found outside the tuning range of the average TV.

So, if there is a Pay TV channel that is scrambled, or is only unscrambled on one TV in your house, the Controller is not made and should not be used to tune it in without paying.

Actually 'Cable Ready' TVs and video recorders do basically the same thing as the Cable Controller, but cable tuning is usually an added on feature that often doesn't cover as many channels.

The Cable Controller is made and backed by a standard limited warranty from Universal Security Instruments Inc.

TRY THE WORLD OF CABLE RISK FREE

Relax up to 20 feet away. Change channels, adjust the fine tuning or turn your set on or off. Explore the vast number of cable channels available to you.

Try it risk free. If you aren't 100% satisfied, simply return it in its original box within 30 days for a refund.

To order your Universal 60 Channel Cable Controller with Wireless Infrared Remote Control, risk free with your credit card, call toll free or send your check for DAK's market breaking price of just **$88** plus **$5** for postage and handling. Order Number 4147. CA res add tax.

There's a whole new world of entertainment waiting for you just off your normal TV tuning range. With the Cable Controller, you can sit back in your favorite easy chair and tune in the world.

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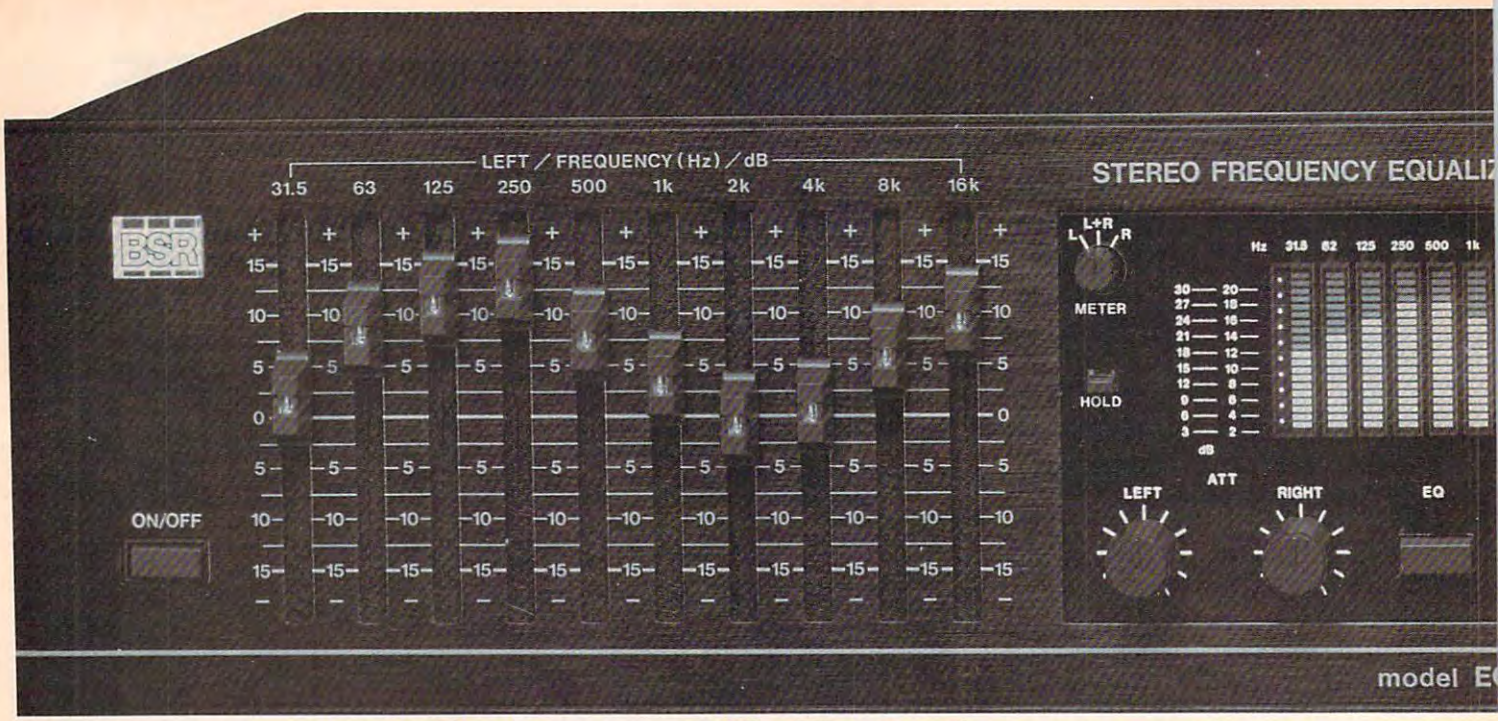

Smart Sound Detonator

Obliterate the wall between you and the individual instruments in your music. Infuse your own stereo system's sound with a breathtakingly vibrant 30 to 50% improvement in sound quality that you can measure with this superb BSR Equalizer/Spectrum Analyzer limited $149 close-out.

By Drew Kaplan

Close your eyes. Touch a button. And you'll hear your stereo system literally explode with life.

You'll hear the gentle brushes on a snare drum, the startling bone-jarring realism of a thunder clap, or the excitement of a full cymbal crash.

You'll hear string basses and other deep low instruments emerge from bass (that will sound murky by comparison), with such clarity and such definition that you'll feel you can almost touch each instrument.

This astoundingly distinct yet powerful bass adds such a full bodied warm feeling to your music, you'll feel as if you've been lovingly wrraped in a warm soft blanket on a cold winter's night.

But don't take my word for the sound quality improvement. With the Pink Noise Generator, Calibrated Electret Condenser Mike and the 220 Element Spectrum Analyzer, **you can** instantly measure each and every improvement you make.

Plus, there's more. A subsonic filter effectively adds the equivalent of many watts onto the power of your amplifier.

Plus, with its provision for two separate tape decks including two way dubbing, you'll have much more than just greatly improved sound.

You can count on great sound from this top of the line Equalizer/Analyzer. It has a frequency response from 5hz to 100,000hz ±1db. And, it has an incredible 100db signal to noise ratio.

BSR, the ADC equalizer people, make this super Equalizer/Analyzer and back it with a 2 year standard limited warranty. Our $149 close-out price is just a fraction of its true $379 retail value.

FIRST THE EQUALIZER
YOUR STEREO'S HIDDEN SOUNDS

Your stereo can sound incredibly better. Just a 5db roll-off at the high end, up around 14,000hz to 16,000hz, can just decimate the harmonics that give you the open feeling you'd experience at a live concert. A similar roll-off at 60hz, causes the fundamental bass notes to just fade away into the 'murk'.

An equalizer isn't some magical device that manufactures sounds that don't exist. Most of the frequencies that will make your music really vibrant, are actually already recorded in your music.

You'll be able to prove this with a few simple tests we'll try when we discuss the Spectrum Analyzer.

You see, certain frequencies are simply not reproduced with as much volume as are the mid-range frequencies which stretch from about 800hz to 2,000hz.

An equalizer simply lets you establish accurate control of all frequencies to fit your equipment, your recordings, your taste, and your listening environment.

TOTAL MUSICAL CONTROL

And, what a job it can do. It's totally unlike bass and treble controls which simply boost everything from the mid-range down for bass, or everything up for treble. You can boost the low-bass at 31.5hz, 63hz and/or 125hz to animate specific areas or instruments.

And, when you boost the part of the bass you like, you don't disturb the mid-range frequencies and make your favorite singer sound like he has a sore throat.

The high frequencies really determine the clarity and brilliance of your music. The problem is that highs are very directional. Wherever you move in your listening room, you'll find a big difference in high end response, as you'll see when we test the Analyzer.

No recording engineer or equipment manufacturer can even begin to control your listening environment.

You can control the highs at 4,000hz, 8,000hz and/or 16,000hz, to bring crashing cymbals to life at 16,000hz while at the same time you can cut tape hiss or annoying record scratches at 8,000hz.

But there's more. Don't leave out the mid-range. You can boost trumpets at 300 to 500hz or a clarinet at 1000hz. You can boost or cut any part of the frequency spectrum a full ±15db.

TAPE DECK HEAVEN

You can push a button and transfer all the equalization power to the inputs of two tape decks. Now you can pre-equalize your cassettes as you record them and get all the dramatically enhanced sound recorded right on your cassettes.

This is an especially great feature when you play your cassettes on bass-starved portables or high-end starved car stereos.

SIMPLY PLUG IT IN

Use your tape monitor circuit, but don't lose it. Now your one tape monitor circuit lets you connect two tape decks.

Just plug the equalizer into the tape 'in' and 'out' jacks on your receiver or preamp. We even supply the cables.

As you listen to your records, FM or any 'Aux', any time you push the tape monitor switch on your receiver you'll hear your music jump to life.

The output from your receiver is always fed directly to your tape deck(s) for recording, and with the touch of a button, you can choose to send equalized or non-equalized signal to your deck(s).

When you want to listen to a tape deck, just select which tape deck you want, turn the switch on the equalizer

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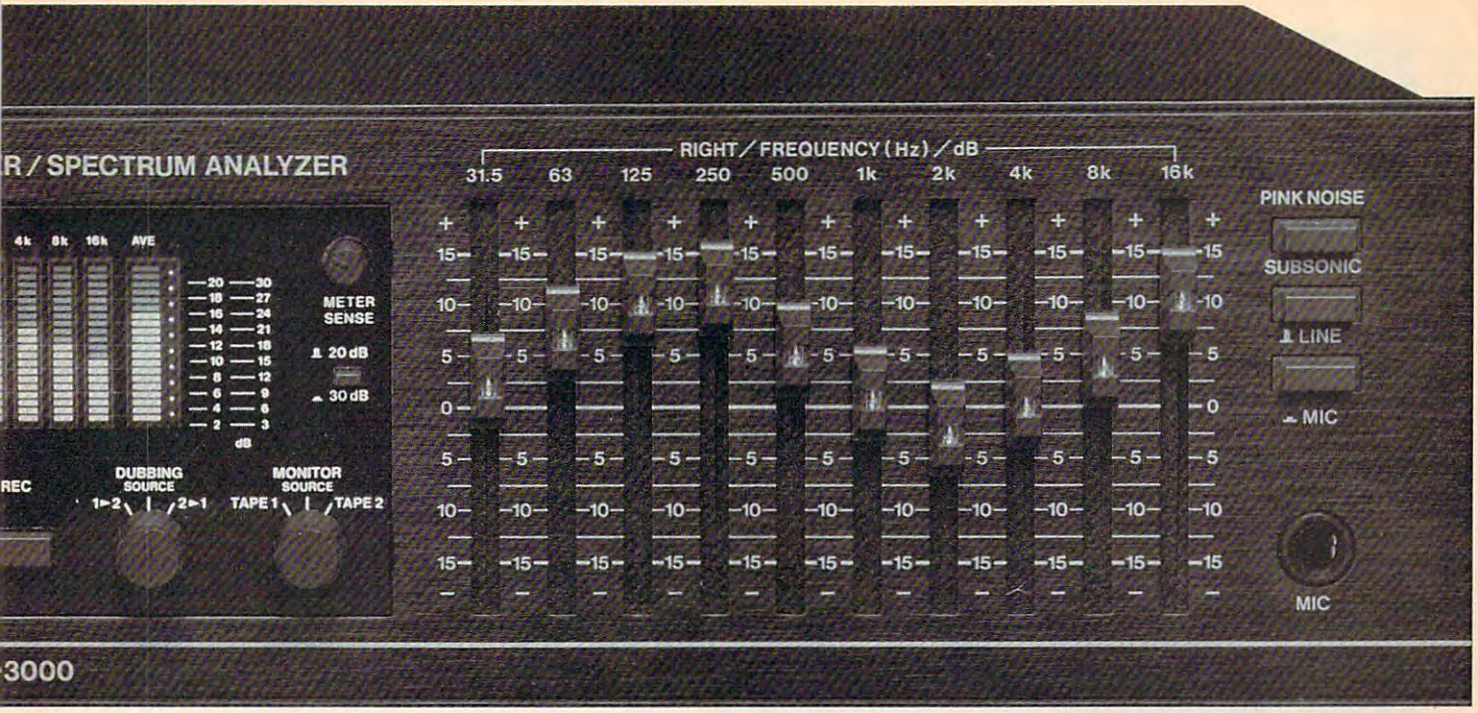

and your tape deck will work **exactly** as it did before. Except, now you can listen with or without equalization.

Look at this. You can dub tapes from deck 1 to deck 2, or from deck 2 to deck 1 with or without equalization.

THE SUBSONIC FILTER

Much of the power drawn from your amplifer is used to drive your woofers. When you drive the amplifier too hard, it clips and you end up with distortion.

A subsonic filter removes a lot of non-musical material **you can't hear** that exists below 20hz. So, it relieves your amplifier of a lot of work. It doesn't actually create more watts (Please, no letters from my 'technical' friends) for your amplifier.

But, it's like turning off the air conditioning in your car. It saves you using about 7hp of what you have. And therefore, you'll have more watts for clean powerful sounding music.

THE SPECTRUM ANALYZER

Now you can scientifically analyze your stereo listening room and test your equipment by using BSR's Real Time Frequency Spectrum Analyzer.

Plus, you'll see your music not as a single level on a VU meter, but as a kaleidoscopic parade of 10 individual 20 element VU meters.

Each is tuned to a specific octave of the sound spectrum. An eleventh 20 element meter averages all levels.

The effect is awesome. You can visually isolate a string bass or cymbal, and actually see each individual instrument almost as a wave moving across the 220 individual florescent elements.

THE MOUTH AND EARS

It talks. The Analyzer speaks with a voice of pure calibrated Pink Noise. Pink Noise is the standard composite 'sound' of **all** frequencies used for testing in labs around the world. All frequencies from 20hz to 20,000hz are generated at the exact same level at the exact same time.

It listens too. If you are testing a cassette or a component in your system, use the 'Line Button'. If you're testing your whole system with speakers, use the matched calibrated electret condenser microphone (included). Either way, you'll have a quick, easy and accurate way to evaluate the total sound of your system.

HOW TO TEST SPEAKERS, EQUIPMENT AND TAPE

Testing your speakers in your listening room is the really crucial test. Simply place the calibrated microphone where you normally sit to listen to your stereo.

At the end of an 18 foot cord is the ear of the system. Just clip the mike wherever you sit and test your room.

Turn on the Pink Noise. You can switch to Left Channel, Right Channel or both. There's a meter range button, a sensitivity control, and even a switch that lets you freeze the meter.

Just sit down at the equalizer. Start with one channel. You'll see all 10 octave bands on the meter. Just slide the corresponding controls to increase or decrease any area that needs help.

You have now set up your system to its maximum capability. But as you'll see, location is very important. Move the microphone 5 feet to the left or right.

Then turn on the Pink Noise and check the Spectrum Analyzer. Now you can see why the specifications that come with your system are only a starting point.

Here's a way to test your tape deck and tape. First record Pink Noise for 3 minutes at -20VU. Then play it back and note the readings on the meters.

Now, record the Pink Noise again at 0VU or +3. Wait till you see how much the high end falls off. Now you'll see why all specifications are listed at -20VU.

With the Equalizer/Analyzer you can enjoy the finest stereo sound from your system and be a test lab too.

WHY SO CHEAP

BSR now only sells equalizers under their ADC name. Well, as Detroit comes out with new cars each year, ADC comes out with new equalizers. We got them to supply us with just 30,000 of last year's ADC model before they shut it down.

They had already paid for all the tooling, all the research and design, so we were able to buy these for less than half the normal price, for cold hard cash.

THE FINAL FACTS

There are 20 slide controls, each with a bright LED to clearly show its position. Each control will add or subtract up to 15db. (That's a 30db range!)

There are separate sound detonation slide controls for each channel at 31.5hz, 63hz, 125hz, 250hz, 500hz, 1,000hz, 2000hz, 4000hz, 8000hz, and 16,000hz.

BSR backs this top of the line Graphic Equalizer/Spectrum Analyzer with a 2 year standard limited warranty. It is 17⅛" wide, 3½" tall and 8¾" deep.

MAKE YOUR MUSIC EXPLODE RISK FREE

It's startling. Music so vibrant with life you'll swear it's 3 dimensional. Sculpture your music any way you want it. If you're not 100% satisfied for any reason, simply return it to DAK within 30 days in its original box for a courteous refund.

To order your BSR EQ3000 Smart Sound Detonator 10 Band Graphic Equalizer with Real Time Spectrum Analyzer and Calibrated Mike, with Subsonic Filter and Two Way Tape Dubbing risk free with your credit card, call toll free, or send your check, not for the $379 retail value. Don't even send the $227.97 dealer cost. Send just **$149** plus **$8** for postage and handling. Order No. 4100. CA res add sales tax.

The sound of your stereo will explode with life as you detonate each frequency band with new musical life. And, you can see and measure exactly what you've done.

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Dept. CP03

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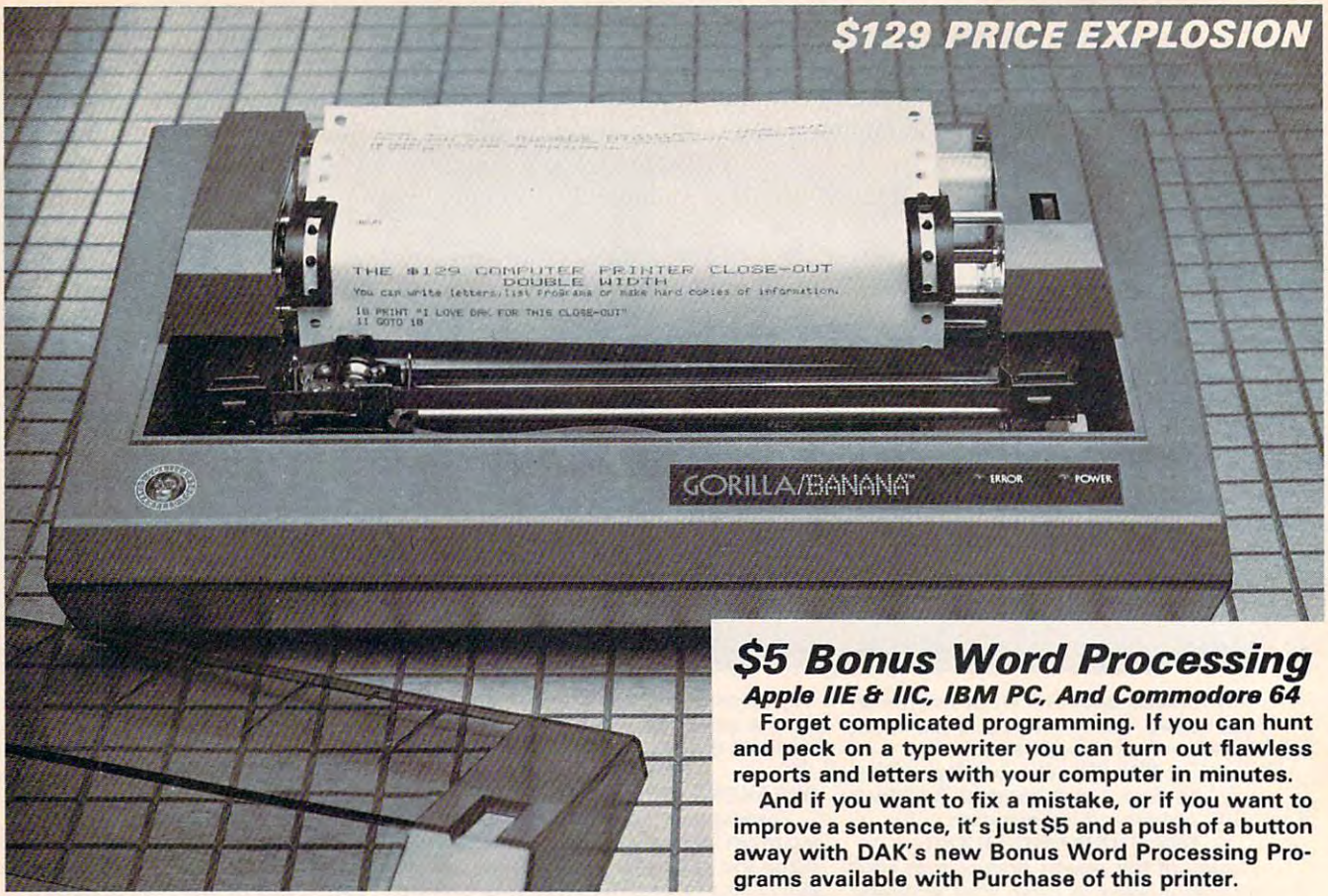

$5 Bonus Word Processing

Apple IIE & IIC, IBM PC, And Commodore 64

Forget complicated programming. If you can hunt and peck on a typewriter you can turn out flawless reports and letters with your computer in minutes.

And if you want to fix a mistake, or if you want to improve a sentence, it's just $5 and a push of a button away with DAK's new Bonus Word Processing Programs available with Purchase of this printer.

The Complete Computer

Let your computer print letters or reports for you on plain paper at 50 characters per second. You can use this dot matrix printer with virtually any home or office computer. It's incredibly easy to use. And, it's built tough. Plus, it even prints graphics. Price Slashed to $129.

By Drew Kaplan

Energize your computer. From writing letters to listing programs, your computer can be phenomenally more useful when you use this printer.

It uses **plain paper** and it's super reliable. It prints both upper and lower case characters. And, if you aren't using a printer with your computer, read on.

LISTING/INDEXES/LETTERS AND MORE

Experience the thrill of actually writing your letters and reports on your computer. Now you'll be able to use all of your computer's word processing and **correcting** capabilities to really explore your creative talents.

I can't overemphasize the convenience of never having to retype a letter or a report because you find a misspelled word or a sentence you'd like to change. Or, think of how easy it will be to sort out a problem in a program when it's on paper.

And, DAK's new $5 Bonus Word Processing Programs are so 'user friendly' that you can learn to use them in just about 10 minutes.

You can change a line, move a line or save a file. It's all just a push of a button away. This printer and **any** word processing program can release the real power of your computer.

Programming is fascinating, games are fun. But, a risk free 30 day in-home trial of this computer printer should really show you just how much your computer can really do for you.

PERMANENT RECORD

If you have a modem, you're in for a treat. You can access encyclopedias, stock market reports, and much more.

With a printer, you can get a 'hard copy' of all the incoming information. You can get everything from SAT test simulations and IQ tests to loan amortization schedules and Airline flights.

And, you won't have to load a bunch of disks to find a program when you print out a menu for each of your disks.

AFRAID OF PROGRAMMING?

You don't need to know the first thing about programming to use this printer. Now, using a computer word processer is an easy as typing on a typewriter.

LOOK AT ALL IT DOES

An ad in several computer magazines listed a $149 thermal printer (that needs expensive thermal paper) as the lowest priced printer in the U.S.

Imagine a 50 character per second dot matrix printer that prints a full 80 column (80 characters) wide line. Plus, it has a built-in standard Centronics Parallel Interface.

This printer handles plain old cheap standard fanfold pin feed computer paper from 4.5" to 9.5" wide, with its built-in adjustable tractor pin feed drive.

It's so powerful you can even use two-part forms for a carbon copy. Plus, there's an impact control for print darkness.

It understands and prints 116 upper and lower case characters, numerals and symbols. And that's not all.

You can even print Double Width characters. **And, look at this.** This printer has full graphic capabilities with 480 dot horizontal resolution and 63 dot per inch vertical resolution. So, you can print out your pictures, pie charts or graphs.

Just like a typewriter, it prints 10 characters to the inch across the page and six lines to the inch down the page.

When hooked to your computer, you'll never have to retype anything again. Just make the correction and let the computer retype your work for you.

The printer is made by C.ITOH/Leading Edge in Japan. It's built to really take heavy use. And it's backed by Leading Edge's standard limited warranty.

It takes standard long life inked ribbon cassettes that are readily available nation-wide. This is a printer that will give you many years of continuous reliable service and enjoyment.

AND NOW THE BAD NEWS

If you're the president of a large corporation, sending important business letters, you may want a $1000 daisy wheel printer. But for most uses, dot matrix printers are incredibly faster, and there isn't any way to print out a graph or picture on a daisy wheel printer.

But, there are two things you need to

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know about this printer. First, it has about the dumbest name I've ever seen. It's built tough and rugged. So, they named it The Gorilla Banana Printer.

Second, like many dot matrix printers, the letters g, j, p, q, and y are level with the other letters. Each letter is completely and perfectly formed, but each sits level with the rest of the alphabet.

Upper case letters and symbols are unaffected. So, if you don't want letters that look like they were printed by a computer, this printer isn't for you.

But for most letters, term papers, reports, or programming it's perfect.

COMPATIBLE COMPUTERS

Any Computer with a standard Centronics parallel port, such as: **Apple, Franklin, IBM PC, TRS80, Osborn, Atari, Commodore VIC 20, Commodore 64, Kaypro, and virtually any other personal computer. Plus, most briefcase portables.**

FEAR OF INTERFACES?

Your computer is smart. But, it doesn't know how to 'talk' to other devices. That's why you need an interface.

An interface isn't just a cable. It's actually an intelligent translator that lets your computer talk to other equipment.

Usually, the computer manufacturers don't include the various interfaces when you buy your computer because they don't know if you'll ever add peripherals, such as disk drives, printers or modems.

So, rather than sell you something you don't need, you don't buy an interface until you add onto your computer.

There are two types of printer interfaces. The first allows you to do text word processing. For 99% of computer use, this is all that is needed. It translates all the possible letters and punctuation known as ASCII.

A second type of interface **also** allows you to dump pictures or graphics from your screen or memory. This is more complicated because each individual dot must be told where to go. This interface, or 'driver program' as it is called, is available in two forms: built into an interface, or as a program on a disk which you use with any standard interface.

Either way, you'll have the printer operating in just a few minutes. And if you already have a printer, the same Centronics parallel interface and cable (about 85% of all printers are compatible) should work with this printer.

WHY SO CHEAP

A new model will emerge soon with a different name. Leading Edge had just 28,000 of these remarkable printers which have been selling at discount for as little as $199, left in stock.

DAK bought them all for cold hard cash. And now we're offering them to you for less than the original price we were quoted as wholesale.

The printer is approximately 16½" wide, 9" deep and 7" tall. It's backed by Leading Edge's standard limited warranty.

ADD PRINTING POWER TO YOUR COMPUTER RISK FREE

Now you can really make your computer work for you. Now you can print out your programs, your reports, your notes and your letters.

If you're not 100% satisfied, simply return the printer, and any accessories and bonuses in their original boxes to DAK within 30 days for a refund.

To order your 50 Character Per Second Dot Matrix, Plain Paper Printer with a built-in Centronics Parallel Interface, risk free with your credit card, call toll free, or send your check for the breakthrough close-out price of just **$129** plus **$8** for postage and handling to DAK. Order No. 4101. CA res add 6% sales tax.

Note: If you need a serial printer for a computer, such as the TRS80 Color Computer or Apple IIC, order the identical printer with a built-in Serial Interface for the same price. Use Order No. 4102.

With this printer you can alter your graphics as you desire. You can print normal or reversed (both shown above, greatly reduced to fit in this catalog) and you can even print **double size.**

The Printer comes packaged with a long life ribbon. Extra ribbons are available at computer stores. DAK has them for **$4** each ($1 P&H) Order No. 4103.

Standard Centronics Interfaces for your computer are available at any computer store. This Printer has its receiving interface built in. You simply need one, complete with its cable, to plug into your computer 'to send' information. Below are our favorites for 5 of the most popular computers.

FREE FREE FREE FREE

No big deal, but we're adding 10 sheets of standard 8½" X 11" continuous form paper to your order. It's worth less than 10 cents, it's available everywhere, and it's yours to keep but it will let you try out your new printer the moment it arrives.

SUPER BONUS $5 WORD PROCESSING

We have powerful bonus word processing programs for $5 with editing, including changing a line, moving a line and saving a file.

While you can choose just about any word processing program to energize this computer printer, DAK has developed incredibly easy to use programs for several popular computers.

If you own an IBM PC, an Apple IIE, an Apple II or II Plus with an 80 column card, the new Apple IIC or a Commodore 64, $5 will bring phenomenal power to your computer. Just use the Order Numbers below.

If you own any other type of computer, standard word processing programs are available at any local computer store.

For your Apple II, II Plus or IIE. We have Practical Peripherals' text interface for just **$49** ($2 P&H) Order No. 9877. We have their graphics capable interface for just **$79** ($2 P&H) Order No. 4104. If you already have a Centronics Parallel Interface, we have a graphics driver program on disk for just **$7** ($1 P&H) Order No. 4105. **Just add $5 ($1 P&H) Order No. 4217 for the Bonus Word Processing Program on disk.**

For your Apple IIC, you have two choices. It has a serial output, so all you need is a cable for just **$18** ($2 P&H) Order No. 4224 for text word processing. (Order the Serial Printer No. 4102.) If you wish to produce graphics as well as text, we have a special interface that converts the IIC to Centronics Parallel. Use it with its included graphics driver disk and you can produce text or graphics for just **$69** ($3 P&H) Order No. 4225. (Order the Parallel Printer No. 4101.) **Our Bonus Word Processing Program is a perfect companion to either printer for just $5 ($1 P&H) Order No. 4217.**

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Run the program and press one of the special keys. The corresponding value is printed. Notice that Ctrl, Alt, and the Shift keys are active only while they are pressed. But the Lock keys act as a toggle; pressing them once activates them, and pressing them again turns them off. If you press more than one key, their values are added. For example, holding down Ctrl and Alt displays 4 + 8 = 12.

To check for the Caps Lock key, you need to read bit 6. To test a particular bit, you must AND with the bit's value. Bit 6 can be checked by ANDing with 64. Change line 20 as follows:

```
20 PRINT PEEK(&H17) AND 64
```

Now the program will check only for Caps Lock. A 64 is displayed when Caps Lock is pressed, and a 0 is displayed when it's not, regardless of the status of the other keys.

Commodore Chained Programs

The "64 Paintbox Loader" on page 128 of the December 1984 issue of COMPUTE! is simple and clean, but it seems to be backwards. How does it work?

J. Quinn

This is an example of a chained program—*a program which loads and runs another program. Chaining programs with Commodore BASIC isn't too difficult, but it does involve a few tricks.*

When you use the LOAD command from direct mode, the loaded program goes into memory without running. But if you use the LOAD command inside a program, whatever BASIC program (if any) is in memory after the loading is complete will run automatically. If the loaded program was BASIC, then that new program will begin executing. However, if a machine language program was loaded (with a final ,1 added to the LOAD command), then the BASIC program which requested the LOAD will start again from the beginning. This explains the peculiar construction of the 64 Paintbox Loader.

Something unexpected would happen if you used a seemingly more logical construction like this:

```
10 LOAD "MLGAME",8,1
20 SYS 49152
```

When this loader program runs, the machine language program MLGAME loads into its proper location, but then the computer tries to restart the BASIC program currently in memory, which is still the loader program. So it loads the MLGAME program again (and again and again and again). The loader program never reaches line 20.

Since the variables established by the running BASIC program are kept intact while the new program is loading (unless overwritten by the program being loaded), you can make a small change:

```
10 IF L=0 THEN L=1:LOAD
   "MLGAME",8,1
20 SYS 49152
```

When the loader (or any other BASIC program) is first run, all variables are erased, so L equals 0 and the game is loaded. After the LOAD, the program starts again from the beginning, but with variable values retained, so this time L is 1 and the program skips to line 20, which activates the ML program.

It is also possible to load one BASIC program from another. With careful planning, you can even run programs that are too large to fit into memory by breaking them into smaller parts and loading each part from the preceding portion. Since BASIC programs always load into the beginning of memory, the second program will overwrite the first. Variables may be erased, depending on how long the programs are. If the original program is larger, all numeric variables will be available for use in the second program.

String variables are passed to the second program only if they are dynamic. (Dynamic strings are those that involve some type of operation beyond simple string definition.) To be sure they make it, add a null string to the end of each string variable. Instead of A$="HELLO", use A$="HELLO" + "" to force the computer to store the string in high memory.

If the second program is larger, all variables will be lost when it is called by the first, so you must always pay close attention to program length when chaining BASIC programs.

Help For Adventurers

I am in need of assistance with the adventure game *Deadline* by Infocom. Do you know where I could write for help?

Rita Miller

You can try writing to Infocom about any Infocom games. You might also want to contact Shay Addams, publisher and editor of Questbusters, The Adventure Newsletter, at The Addams Expedition, 202 Elgin Court, Wayne, PA 19087. *Also, you might try writing* Wizards "R" Us, 308 Arrowood, Lake Jackson, TX 77566, *a new club dealing with games.*

Analog Vs. Directional Joysticks

I was recently dismayed to find that I cannot connect the Wico controllers from our Atari 2600 to our IBM PCjr. The local computer store advised that I need analog controllers. I am confused. What is the difference between controllers, other than planned obsolescence?

David A. Baxter

It's not planned obsolescence, just two different ways of designing a joystick controller. The joysticks used on the Atari 2600, Atari home computers, Commodore home computers, and Coleco Adam are directional. *When the stick is deflected, one or two switches are closed, and the joystick returns a value to the computer which corresponds to one of eight directions (up, down, left, right, and the four diagonals). Computer programs check this value to determine the stick's direction, and then move a marker or player accordingly.*

There is another way of designing a joystick which has been used with the IBM PC, PCjr, Apple II series, and TRS-80 Color Computer. These are analog joysticks. When the stick is deflected, they return a value which corresponds not only to the direction, but also to how far the stick was moved. They are more like paddle controllers on Atari and Commodore machines, with one paddle for the horizontal axis, and one for the vertical. (In fact, you could build an analog joystick for an Atari or Commodore by combining two paddle controllers.)

When you move a paddle controller from left to right, it returns a number, say from 0 to 255. That means there are 256 possible horizontal positions. The same type of value is used for the vertical axis. So analog joysticks tell the computer an absolute position—to which spot the joystick is pointing—instead of in which direction the joystick is pointing.

Which joystick is best depends upon the application. For a game requiring simple directional information—such as Pac-Man—*directional sticks are superior, because the action is more positive. On the other hand, analog sticks are preferable for games in which you want to rapidly move an object to a new position on the screen without moving across all the intervening positions (for example, the aiming crosshair in* Missile Command, *although most versions of this game use directional joysticks or trackballs).*

Because analog joysticks are a little more complicated to manufacture, they cost more. Another drawback is their thumbwheels for adjusting the range of values returned. There are usually two thumbwheels somewhere on the joystick, one for adjusting the vertical values and another for the horizontal values. If either thumbwheel is out of adjustment, the joystick can return wild values that the program can't interpret. A perfectly healthy program can crash with an "Illegal function call" or similar error message, and you might never suspect that it's the fault of the joystick. Some programs circumvent this problem by including routines for calibrating the joystick.

Texas Instruments "Cheater"

In some of the games for the TI-99/4A, you can change the number of lives or the starting level by following this procedure. Insert the cartridge, and turn on your computer. When the title screen appears, after selecting the game, quickly type "*#*".

David L. Whitlock

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Thanks for the tip. This will probably help some frustrated game players.

Apple DOS And Keyboard

I have recently started using an Apple IIe and have several questions. How do you initialize a DOS 3.3 disk? Also, are there ways to disable the following keys from a program: ESC, RESET, CTRL, and RETURN?

Rodney Hesterman

Apple DOS, like all disk operating systems, requires that you format a disk (sometimes called initializing) before any files can be saved on it. The INIT command is used to format an Apple disk and, at the same time, to save a special BASIC program to the disk. The program, called the greeting or hello program, must be in memory when the INIT command is given. Once the disk has been formatted, the greeting program will run automatically whenever you boot the computer (turn the computer on or type PR#6*) if this disk is in the drive.*

The syntax of this command is:

INIT HELLO

Here, the greeting program is named HELLO, the traditional name for a DOS 3.3 greeting program. However, you can use any name you like.

Disabling the keys you mention is virtually impossible without hardware modifications because the Apple lacks a programmable keyboard. Therefore, you cannot disable or redefine the keys as you can on other computers. One way to limit user input is to use the GET command instead of INPUT in your BASIC programs and ignore the characters that you don't want to allow. You could also write your program to use a joystick as a menu-selection pointing device, avoiding the keyboard whenever possible.

Commodore INPUT

I would like to get rid of the question mark which appears when my Commodore 64 executes the INPUT command. Is there any easy way?

Scott Mefferd

The INPUT question mark is built into BASIC. There's no easy way to suppress it. As an alternative, you can use the GET command to read individual keypresses, then combine the characters into the string the program is trying to read. Here's a short example:

```
10 GET A$:IF A$=""THEN10
20 IF A$=CHR$(13)THEN40
30 B$=B$+A$:GOTO10
40 PRINT B$
```

This routine waits at line 10 for any input from the keyboard. When you press a key, line 20 immediately checks to see if you pressed RETURN, CHR$(13). If so, control passes to line 40, which prints out every character you entered (or no characters, if RETURN was the first key pressed). If you pressed a key other than RETURN, line 30 stores the character in the string variable B$. Then it loops back to line 10 to wait for another keypress. Additional keypresses are added to B$ by line 30 until line 20 detects RETURN.

Keep in mind that this routine will also add any editing keys you pressed to the string. When the string is printed, the exact keys pressed are "played back." The DEL key won't delete a character from the screen, but just appears to when the string is printed.

This routine can be modified much further. You can add a cursor and true editing. Customized input routines can really enhance the power of a program.

Mattel Aquarius Translations

I have an Aquarius computer, which uses a version of Microsoft BASIC. I have been unable to translate the Commodore 64 programs to my version of BASIC. The Aquarius people advised me that the Commodore 64 programs were closest to what the Aquarius would accept.

Marion H. Myers

Translating programs written for one computer so that they'll run on a different computer is about the most difficult type of programming you can do. In fact, it can be more difficult than rewriting the program from scratch.

To do a translation, you must have a working familiarity with both computers. It helps to obtain the manuals for the computer you're trying to translate from. If the program PEEKs or POKEs any addresses, you must know the comparable addresses on your system. Your computer must also be able to duplicate the functions of the operating system of the original computer.

Although Commodore does use a version of Microsoft BASIC, the 64 has many unique features, such as the SID (Sound Interface Device) chip and multicolor sprites. Most programs using graphics and sound will contain many PEEKs and POKEs necessary to program these features.

When attempting to translate any program, first examine the listing carefully. Determine what any PEEKs, POKEs, and extended BASIC commands are doing. Make notes on how you plan to duplicate these functions on your computer.

Of course, you must be sure that your computer has the ability to duplicate the original program. If your computer can't duplicate the 64's sprites, for example, any game using sprites will be extremely difficult to translate because you'll probably have to use a high-resolution screen with bitmapped graphics. The resulting program may not be able to run fast enough unless it is written completely in machine language. Some top-level commercial game programmers have stated that when they write a new game, they first program it on the Apple, which lacks most of the graphics and sound capabilities found on Commodore and Atari computers. Once the game is operating on the Apple, it's fairly easy to translate to the 64 and Atari. But again, a thorough knowledge of all the computers is required.

If you stick with programs which contain no PEEKs or POKEs, you'll probably be able to translate without much difficulty. Unfortunately, not many useful programs are devoid of machine-specific PEEKs, POKEs, or CALLs.

VIC Chip Replacement

I've noticed the VIC chip is removable in my VIC-20. The chip in my *ExBASIC* cartridge is also removable. If I replace the VIC chip with the *ExBASIC* chip, will *ExBASIC* be running when I turn on my VIC?

Also, what's that window-like thing on the *ExBASIC* chip?

Jeremy Faden

The VIC chip is responsible for generating and maintaining the computer screen display. It's an input/output chip. The ExBASIC *chip is merely an EPROM (Erasable Programmable Read Only Memory), an erasable form of permanent memory used to store the* ExBASIC *program. Substituting this chip for your VIC chip simply wouldn't work, and might result in damage to your computer.*

Your computer also contains ROM chips, similar to the EPROM used in the ExBASIC *cartridge. Although it is electronically possible to plug the* ExBASIC *chip in place of one of your ROMs, the swap would never work. All programs depend upon the operating system built into these ROMs. If you replaced the ROMs with the* ExBASIC*, you'd be left with a useless operating system.*

The window on your ExBASIC *chip allows the chip to be erased so that it can be reprogrammed using a special device called an EPROM burner. Erasing is accomplished by exposing the the circuitry beneath the window on the chip to ultraviolet light, which resets all the memory locations in the EPROM. If you peel off the sticker and expose the window, you can actually look at the inside of the chip. Notice how the actual chip is a tiny square. What we usually refer to as a chip is just a plastic and wire carrier.*

Don't leave the cover off the window, though. There's a chance that bright sunlight could alter some of the bits in the chip. Prolonged exposure will definitely erase the chip. Some experimenters erase EPROM chips simply by leaving the windows exposed to sunlight for a number of hours. Special high-energy ultraviolet bulbs are used in commercial EPROM erasers.

EPROMs are often used because they are easy and inexpensive to program, but when a manufacturer wants to turn them out by the thousands, it's cheaper to build the pattern into the chip when it's made, hence the nonerasable ROMs inside production models of computers.

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Atari Disk Directories

I have an Atari 800XL and an Atari 1050 disk drive. I would like to know if you could get a disk directory without using DOS. It is very inconvenient to load DOS every time I want to see my programs.

Anthony Bonhomme

Try the following direct-statement line. It lists the directory in BASIC without erasing the program in memory. It always returns an ERROR 136. To keep things clean, type CLOSE#1 or END after you see the error message.

```
OPEN#1,6,0,"D:*.*":FOR X=1 TO
1E9:GET#1,A:PRINT CHR$(A);:NEXT X
```

You might also want to consider obtaining a different DOS for your computer. There are several good DOS packages available from independent companies which offer disk directories in BASIC and many other features. Usually these DOS programs are compatible with Atari DOS disks as well.

Sending Output To A Commodore Printer

How can I get a printout of the results of a program that doesn't have a command to send the results of the program to the printer?

Tom Holloway

Assuming you're asking about a BASIC program which you can modify, simply add the following short subroutine (renumber the lines if necessary to keep them from conflicting with existing lines in the program). Call the routine with a GOSUB command before executing the PRINT statements you'd like sent to your printer.

```
1000 OPEN 4,4,0
1010 CMD4
1020 RETURN
```

This sets up a Commodore printer for uppercase and graphics characters. To print upper- and lowercase characters, change line 1000 to:

```
1000 OPEN 4,4,7
```

In line 1010, the command CMD4 directs the computer to send all output to the device opened as file number 4, in this case the printer. Remember, your monitor is simply an output device, and the output device can be changed.

After your program reaches the end of the section you would like sent to the printer, another subroutine is necessary to restore output to the screen:

```
2000 PRINT#4
2010 CLOSE 4
2020 RETURN
```

If you'd like to change the output of a machine language program from the screen to a printer, it will be necessary to find the points in the program where display is sent to the screen, usually through the CHROUT routine at $FFD2, and divert that to your ML routine to open output to the printer.

To add a routine to send output to non-Commodore printers, refer to your printer manual for the necessary commands.

More On Named Subroutines

A recent letter ("Readers Feedback," COMPUTE!, January 1985) suggested that certain home computers support named subroutines to a limited extent. I should like to add that the Timex/Sinclair does so to a greater extent than do the machines mentioned.

This is due to the fact that the Timex/Sinclair will evaluate anything which follows a GOTO or GOSUB. If one has a subroutine called HEADPRINT and that subroutine has an entry point at line 2700, all that is necessary is to use GOSUB HEADPRINT, provided that the statement LET HEADPRINT=2700 has been executed before the call.

Numeric variable names on the Timex/Sinclair may be of any length and all characters are significant.

Samuel G. Allen

Thanks for reminding us. The Timex/Sinclair computers contain an impressive version of BASIC. By the way, the features you mention also are available in Atari BASIC.

ASCII *WordStar* Files On The IBM

"IBM Personalized Form Letters" in the December 1984 issue of COMPUTE! implied that *WordStar* is not capable of generating the necessary ASCII files required by the program. *WordStar* can easily generate ASCII files in the nondocument mode.

William R. Smith

You're right; although conventional WordStar *files are not saved in ASCII form, as stated in the article, you can create ASCII files in the nondocument mode. These files will be compatible with the "IBM Personalized Form Letters" program.*

Single-Sided Cassettes

I have a Commodore 64 with a Datassette and have been experiencing LOAD errors when trying to load data from a cassette that has data stored on both sides. Can't data be saved to both sides of a cassette?

Clifford R. Mires

It sounds as if the record head on your Datassette could be out of alignment. This would cause it to read part of the "other side" (actually a second track running in the opposite direction) instead of the proper track. Sometimes this happens with audio cassette units, too—especially eight-track players—and can be heard as phantom music in the background.

One solution is to have your Datassette checked by a repair technician at your local computer dealer or audio equipment shop. However, be aware that once the head is properly aligned, it may not be able to read the tapes you made while it was misaligned, especially if the alignment error was great.

Another solution is to keep recording only on one side of each cassette.

Numeric Keyboard For Atari MLX

If you've been having a problem entering numbers into MLX with one hand while marking your place in COMPUTE! with the other, try adding these lines to MLX to change the keys below the 7-8-9 keys to a numeric keyboard:

```
HA 110 POSITION 8,0:? "MLX2"
       :POSITION 23,0:? "fai
       lsafe entry":POSITION
        10,1:? "with Numeric
        Keypad":POKE 710,0:?
        :REM - MLX2
PG 630 REM - Lines 630 thru
       638 added or changed
       to provide numeric ke
       ypad for MLX2
HF 631 IF A=77 THEN A=48:REM
        - "M" = "0" IN MLX2
HC 632 IF A=74 THEN A=49:REM
        - "J" = "1" IN MLX2
GO 633 IF A=75 THEN A=50:REM
        - "K" = "2" IN MLX2
HD 634 IF A=76 THEN A=51:REM
        - "L" = "3" IN MLX2
HP 635 IF A=85 THEN A=52:REM
        - "U" = "4" IN MLX2
HD 636 IF A=73 THEN A=53:REM
        - "I" = "5" IN MLX2
IC 637 IF A=79 THEN A=54:REM
        - "O" = "6" IN MLX2
LP 638 IF A<48 OR A>57 THEN
       580:REM - Renumbered
       in MLX2
```

MLX will now accept U-I-O for 4-5-6, J-K-L for 1-2-3, and M for zero. You can even attach stick-on numbers to the front of the redefined keys.

Larry N. Watkins

Thanks for the modification. It can make machine language programs much easier to enter for those who are accustomed to numeric keypads. ©

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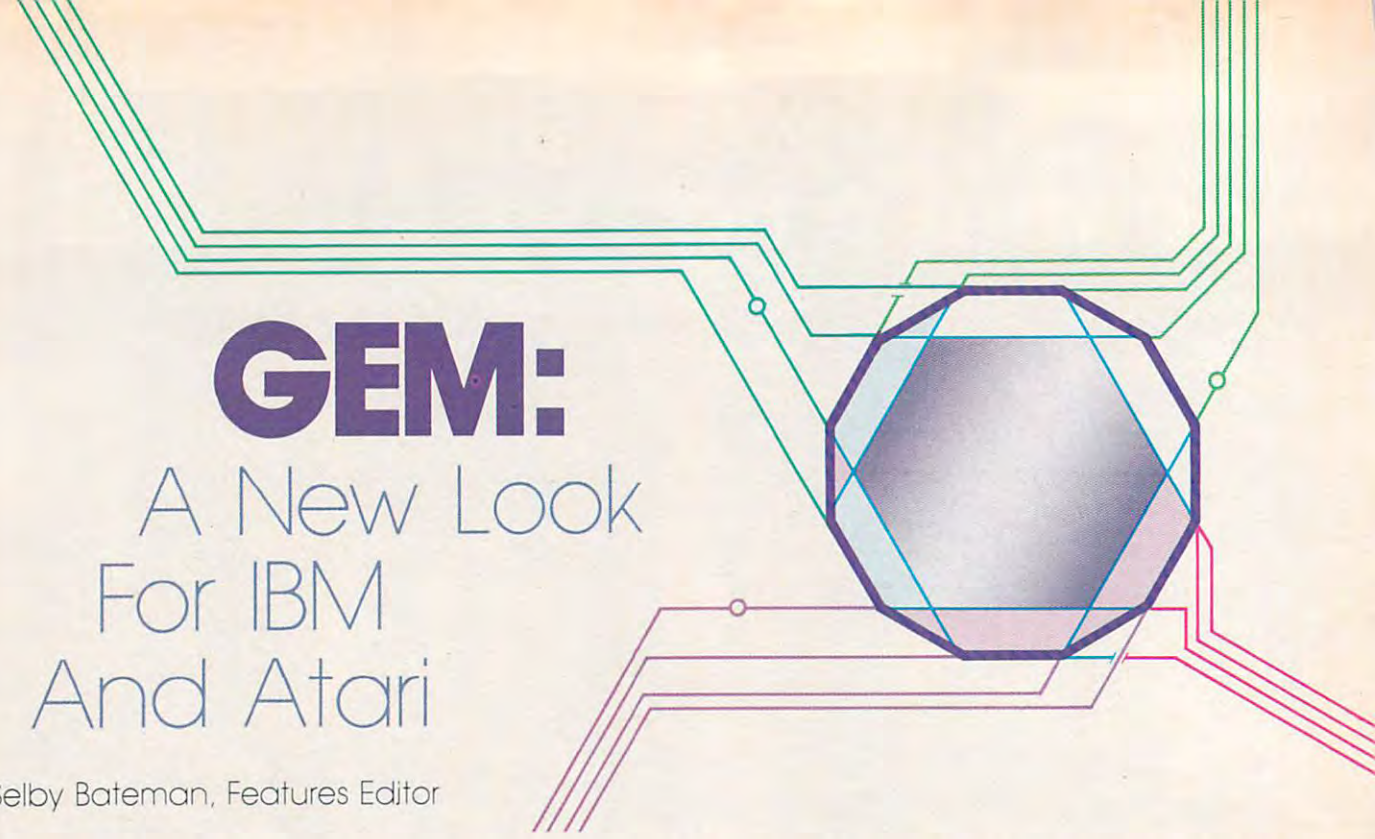
GEM: A New Look For IBM And Atari

Selby Bateman, Features Editor



What looks and acts like an Apple Macintosh, runs on IBM and Atari ST computers, and may help alter the face of computing? The answer is an operating system interface called GEM, the Graphics Environment Manager, which Digital Research hopes will foster a new standard for the way we work with computers.

The great computer facelift is under way. It began with Apple's Lisa computer in early 1983 and the Macintosh in January 1984. The onscreen pull-down menus, icons, windows, and the desktop mouse controllers they popularized are now spreading to other computers via a new operating system extension called GEM (Graphics Environment Manager) from Digital Research, Inc.

Not only does GEM closely reproduce the look and feel of Macintosh technology, but it also represents a similar underlying philosophy toward computing. The goal is to protect users from the complex command codes and special function keys that must be learned to operate most computers. Cryptic commands are replaced with easily recognized graphic symbols manipulated by a hand-directed controller, the mouse.

Digital Research (DRI) is just one company offering or planning a graphics-based operating system interface. But there are good reasons to believe that GEM may succeed in attracting the critical support required from hardware and software manufacturers.

GEM is flexible, fast, compatible with different computers, and takes up a minimum of memory. Its resemblance to the Macintosh environment is uncanny. DRI President John Rowley predicts that by 1986, GEM will be in use on more than a million computers.

Most system software is limited to working with a certain hardware configuration or microprocessor chip. For example, MS-DOS (*MicroSoft Disk Operating System*) works only on computers whose microprocessors are compatible with the 8/16-bit Intel 8088/8086 chips, such as the IBM PC line and compatibles. Likewise, CP/M (*Control Program for Microcomputers*), the dominant operating system before MS-DOS, was designed around the 8-bit Zilog Z80 family of microprocessors.

But GEM is different. GEM is not an operating system; it is an operating system interface. Loaded from disk or built into Read Only Memory (ROM), it wedges itself between the existing operating system and the user, providing Macintosh-like screens and controls without altering the way the computer actually works. Therefore, although GEM was developed for MS-DOS machines, it also works with faster computers based on the powerful 16/32-bit Motorola 68000 chip, such as the new Atari 130ST and 520ST. Because GEM software works independently of any programming language or operating system, it is compatible with MS-DOS, PC-DOS (version 2.0 or above), Atari TOS (Tramiel Operating System), and DRI's Concurrent DOS.

DRI designed GEM to be compatible with different machines for a purpose: By licensing GEM to anyone who wants it, DRI hopes to establish GEM as a new standard. Already, GEM is built into the Atari ST's ROM and also is making its debut on the entire line of Apricot business computers.

For software developers, this means that application programs can be adapted for a potential market of millions of computers without major rewriting. What's more, existing MS-DOS programs can still run without modification, even if those programs haven't been changed to take advantage of GEM.

"The point is that we've finally reached the place where [a program's] source code can be transportable not only within the Intel-architectured machines—the IBM PC and all the flavors of MS-DOS

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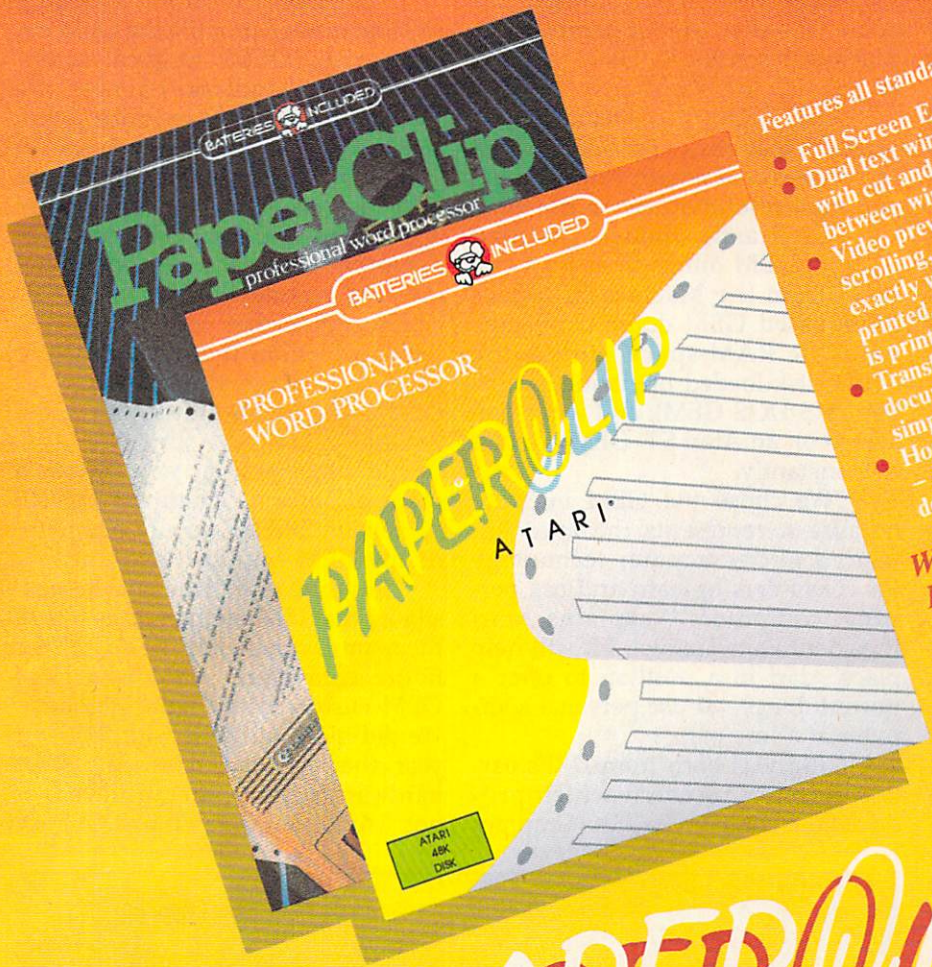

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computers—but a software developer can take the same source code and recompile it on the Atari," says DRI's Thomas Byers, marketing director for GEM. "And let me say that the Atari is the tip of the iceberg. There are a lot of other 68000 manufacturers who are interested in this."

In addition to licensing GEM to hardware and software developers, DRI also is producing its own *GEM Desktop* application and a series of presentation-graphics programs—*GEM Draw*, *GEM Wordchart*, and *GEM Presentation Master*. All are based on the Macintosh-style format.

In other words, you won't have to buy GEM from your favorite software store and write your own application programs. DRI hopes that enough developers will license GEM to provide that service. You're most likely to encounter GEM for the first time in a new computer with GEM, in a new or adapted application program, or in the *GEM Desktop* and DRI graphics programs.

GEM attracted plenty of attention at the Atari exhibit during January's Winter Consumer Electronics Show in Las Vegas. Early versions were up and running on the Atari 130ST, a 128K RAM computer to be priced at about $399, and the 520ST, a 512K RAM machine priced at about $599. Both computers can display a 640 × 400-pixel high-resolution screen in monochrome, plus a 640 × 200-pixel screen in four colors. By comparison, the Macintosh offers a 512 × 342-pixel display in monochrome only.

Atari GEM is controlled with a two-button mouse, very similar to the Macintosh's one-button mouse. As on the Macintosh, you roll the mouse across a desktop to move a screen pointer or cursor. By pointing at small descriptive pictures or *icons*, you can pull menus down over existing screens, select options, roll the menus up again, open overlapping screen windows, move the windows around, and change window sizes. The windows let you call up another application without clearing out the current one. For instance, you could open a window for a calculator to solve a math problem while working with a spreadsheet or a word processor.

If you've ever used a Macintosh, you'll recognize some of the GEM icons. Tiny disks let you select between floppy disk drives and hard disks. Little manila folders denote disk files, and you can delete a file by picking it up with the mouse pointer, carrying it across the screen, and dropping it into an icon of a trash can. During lengthy floppy disk accesses, a small hourglass appears while you wait—a variation on the Macintosh's stopwatch. Indeed, the Atari ST with GEM resembles the Macintosh so closely that it has been nicknamed the "Jackintosh."

Atari GEM also includes such graphics features as *bit block transfer* (a sprite-like animation technique) and high-resolution vector drawing.

Significantly, though, an Atari ST with GEM differs in at least two ways from the Macintosh. Atari's ROM-based GEM doesn't consume valuable RAM space, unlike the Mac's disk-loaded operating system (and MS-DOS GEM); and when you switch on an Atari ST, GEM is available instantly.

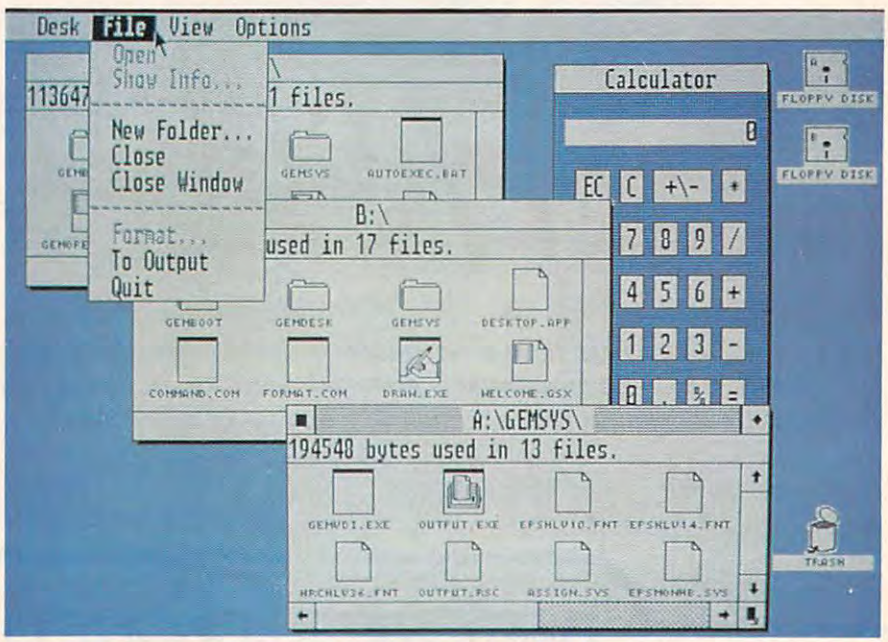
"We chose the GEM interface because it represents the most advanced microcomputer technology for consumers to learn and use personal computers," explains Atari President Sam Tramiel. "It will help place Atari in a position to offer a powerful, easy-to-use personal computer at a low cost."

GEM was born from DRI's earlier graphics research which produced the company's GSX (Graphics System Extended) environment in 1982. After the Macintosh made its debut, DRI used the GSX graphics tools to create a user interface similar in simplicity and style to that on the Macintosh. DRI's marketing plan was to make the system as easy to use and as compatible with different computers as possible.

"Essentially what we've done is say that we will provide the GEM engine to the OEMs (original equipment manufacturers) across the world—Atari, Commodore, even Apple if they want it," says Byers. "It will be on their machines when you buy the computer, and your GEM application will run. The software developer who is concerned about the IBM channel will be able to include a disk that has GEM on it which will allow their application to run on any of the IBM PC family, including the Junior all the way up to the AT."

In other words, says Byers, a piece of software might be labeled "For your IBM PC-family computer or any GEM-equipped machine.

Buyers doesn't rule out the possibility that IBM could become one of the manufacturers licensing GEM for future computers. "IBM is a large OEM customer of Digital Research. We did more business with IBM last year than we did with any other hardware manufacturer, believe it or not. That is not to say it was GEM or



GEM on an MS-DOS computer. A pull-down menu, showing the file options available, overlaps three disk directory windows and an application program (the calculator). Notice the trash can icon at lower right for deleting disk files.

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it wasn't GEM; I couldn't say that even if I wanted to. They do their own announcements."

A growing number of software developers have already announced plans to market GEM-based products, including Hayden, Spinnaker, Blue Chip, Thorn/EMI, Chang Laboratories, and others. Lifetree Software is adapting its *Volkswriter* word processor and naming it *Gem Write*. "With GEM, I can turn my IBM PC into a Macintosh. That's essentially what we see in it," says Peter Pirner, executive vice president of Lifetree. "Even though Apple is making a full-scale onslaught on corporate America, there are a lot of corporations which do not want to support another machine."

But, Pirner notes, a sizeable percentage of a company's workforce might benefit from working in a Macintosh-like environment by using GEM on the existing PCs. That is GEM's real strength, he says.

To be truly successful with GEM, DRI must motivate enough software and hardware manufacturers to develop GEM-based applications and computers. Over the past four years, DRI watched as its first major success, CP/M, was overrun by Microsoft's rival MS-DOS. With GEM, DRI hopes in a way to defeat its competitors by joining them: Create a new standard which will unite users of many different computers and operating systems, from MS-DOS to TOS.

"What we have achieved here is the write-it-once theory that has been around for so long," says Byers. "As I look to the future, we'll be continuing to approach third-party developers, getting them signed on to write applications to GEM, and then to the hardware manufacturers—which are really our bread-and-butter as far as revenue is concerned. You create hardware manufacturer demand by having lots of applications. And you have lots of applications by developing hardware demand. It goes back and forth."

For software developers, DRI is offering a $500 programmer's tool kit which includes copies of GEM; *GEM Desktop*; instructions for all IBM PC and compatible peripheral drivers (such as printers, plotters, graphics cards, mouse controllers, etc.); and several sample applications. It also contains a symbolic debugger and what DRI calls a Resource Construction Set. With these tools, programmers don't even have to write the code which creates menus and places icons. Someone unfamiliar with GEM can design those features with the construction set and a mouse.

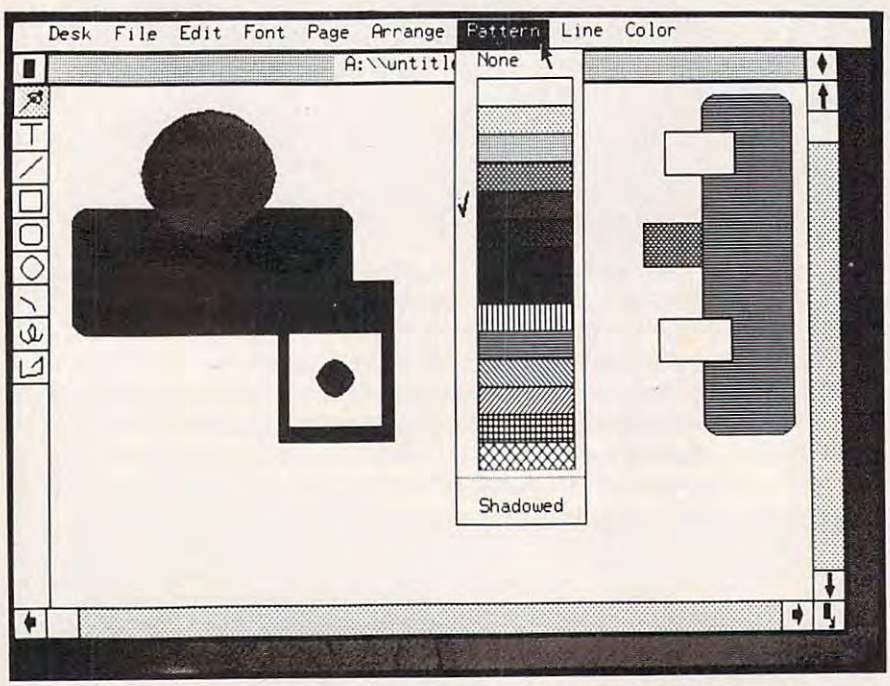
"You don't even have to be a programmer," says Byers. "It's all done by form handling, that is, of the dialogues and the menus. It's a phenomenal tool, really the unsung hero of this whole business."

Not everyone, however, wants to turn their computer into a Macintosh. Critics have attacked the Mac as being easy to learn, but often cumbersome to use. Some simple functions that could be accomplished with a few keystrokes on a conventional computer can require a dozen or more steps with a mouse and pull-down menus. As with any extension that sandwiches another layer between the operating system and the user, the graphics-based interface further isolates people from the power of the computer, say critics. The mouse can seem awkward to those who are familiar and comfortable with keyboard commands, especially in keyboard-dependent applications like word processing.

Furthermore, they point out, the Macintosh's fancy operating system is so memory-hungry and disk-intensive that it drastically slows down the machine, especially if you're using a standard Mac with 128K RAM and a single floppy disk drive. Yet, the Macintosh is driven by the powerful 68000 microprocessor. How much slower will GEM run on the less speedy MS-DOS computers, and how much extra memory will be required?

DRI defends GEM by arguing that the graphics-oriented approach is the wave of the future, and not just in computing. Byers says society is adopting this approach for everything from rock videos to newspapers (witness *USA Today*) to the international icons which identify controls on both foreign and domestic cars. Increasingly, computer users will be occasional users in offices and homes, and they won't want to memorize lists of commands and control codes. Proponents of graphics-oriented systems argue that the icons and ever-ready menus are easier for occasional users to handle than mysterious-looking DOS prompts and commands like A>, REN, DEL, CHKDSK, and EDLIN.

To ease the transition away from the keyboard, GEM lets you move the onscreen pointer with cursor



GEM Draw *is a Digital Research graphics program that takes advantage of the Macintosh-like features of GEM. Note the resemblance to the popular* MacPaint.

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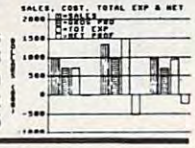

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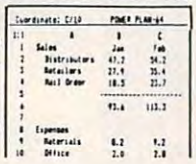

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keys as well as a mouse—something that the Macintosh doesn't allow.

DRI also believes it has solved the speed and memory problems, and not only on the Atari ST with its ROM-based GEM. "Apple essentially said no one could reproduce the Macintosh feel on anything but a 68000," Byers says. "We have demonstrated that on an 8088, a software product could be made which enhances MS-DOS to the extent that its speed is fast enough to break through the psychological barrier, and its size is small enough to make it attractive to people who own computers with only 256K RAM and a floppy drive."

While the debate promises to remain lively, there is no question that the Macintosh user interface has spawned a flock of imitators besides GEM. Some have emerged to lukewarm receptions and others are not yet available. However, programs with windowing capabilities like IBM's *Topview* and Microsoft's long-awaited *Windows* may be stiff competition for GEM. Both come from companies with heavy influence in the marketplace. Earlier programs like *Desq* from Quarterdeck and *VisiOn* from VisiCorp failed to establish a standard because they haven't garnered the software or hardware support that was necessary.

But GEM has a few advantages in its favor. In addition to being flexible and transportable, it requires as little as 128K RAM and a single disk drive to operate (although at least 256K RAM is recommended for major applications). That's much less memory than most of the other windowing systems require. Also, in early 1985 Microsoft was still experiencing problems readying *Windows* for market, and *Topview* is not graphics-based.

In the long run, DRI believes there is room in the market for GEM because permanent divisions will develop within the computer world based on individual preferences. "You'll have a million people using the A> [MS-DOS prompt] forever," predicts Byers. "You'll have five million using [nongraphic] menu systems such as *Topview, Concurrent PC-DOS, Desq*, and those types. But there'll be 50 to 100 million using the iconic-based interfaces." ©

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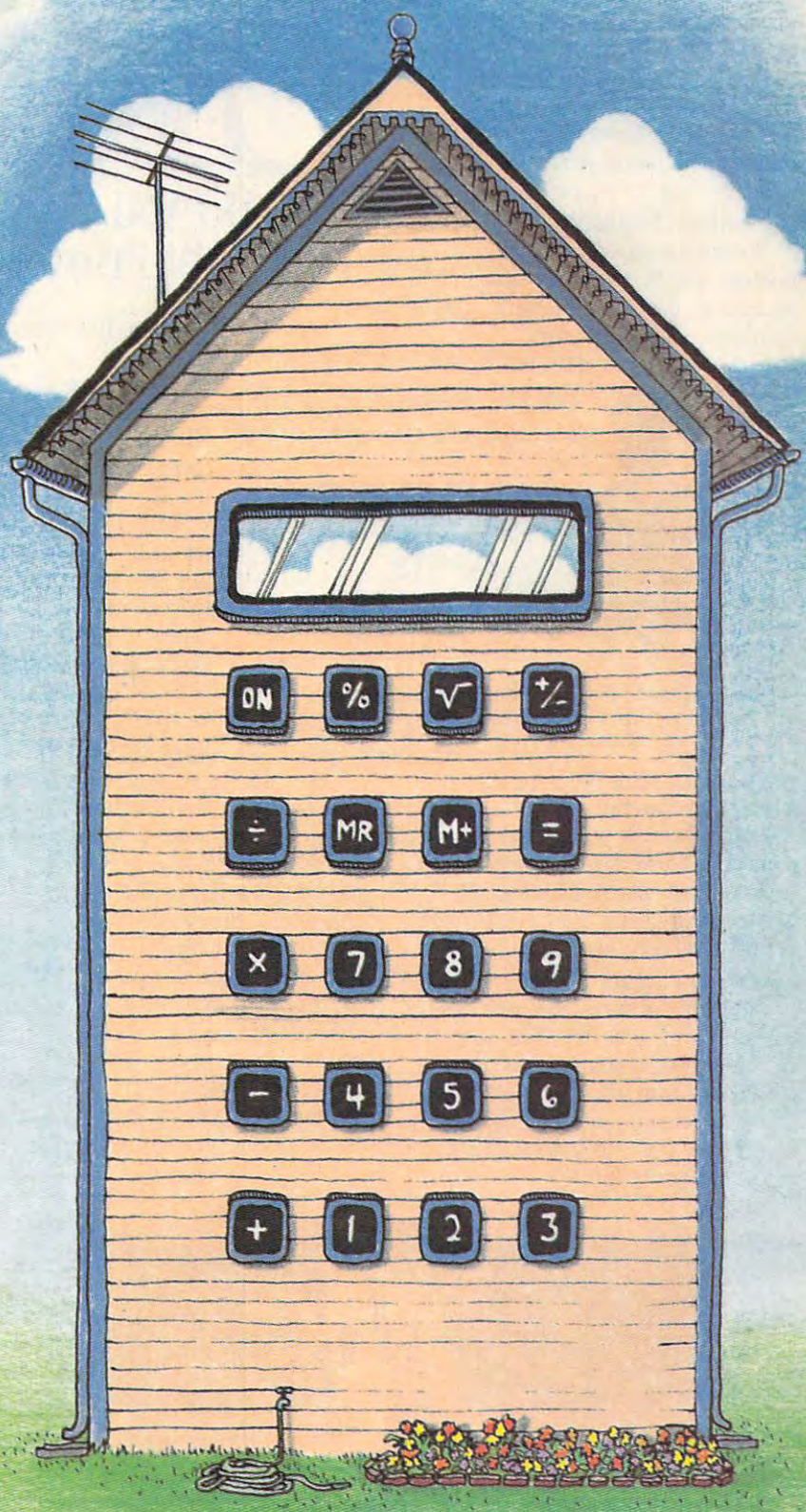
Home Financial Calculator

Patrick Parrish, Programming Supervisor

Many home budget programs have been published in magazines, but rarely has there been a program integrating as wide a variety of loan and investment calculations as "Home Financial Calculator." It is versatile, easy to use, and flexible. Rapid recalculation features make it an ideal tool for "what if" projections. A calculator mode with memory lets you solve problems not directly supported by the program, and you can pass values generated by one calculation to another. It works on the Commodore 64; VIC-20 (with at least 8K memory expansion); Commodore Plus/4 and 16 (using the 64 version); Commodore PET; Atari 400/800 (with at least 16K for tape and 24K for disk) and XL/XE models; Apple II series; IBM PC and PCjr; and TI-99/4A (regular BASIC). Though not tested on other computers, the program is written generally enough to run with trivial modifications on any computer with Microsoft BASIC.



Investment and loan calculations are readily computerized. In fact, many programs have been written which perform these tasks individually. "Home Financial Calculator" goes a step further by integrating several common financial calculations in a menu-driven package. It also features a calculator mode or scratch pad area where program variables can be manipulated using common mathematical operations.

Program 1 is a general BASIC program that runs without modification on Apple II-series computers, and also on a number of other machines with minor changes. No matter what computer you have, type in Program 1. For computers other than the Commodore models you should type a caret (^) for the character shown as an up-arrow (↑). Then add the appropriate lines for your computer from Programs 2–7. As always, save the program before running it for the first time.

Important: Because Program 1 is a general listing for several different

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There are trade offs in buying printers. Simply stated, within a given price range, quality, or legibility, decreases as speed increases.

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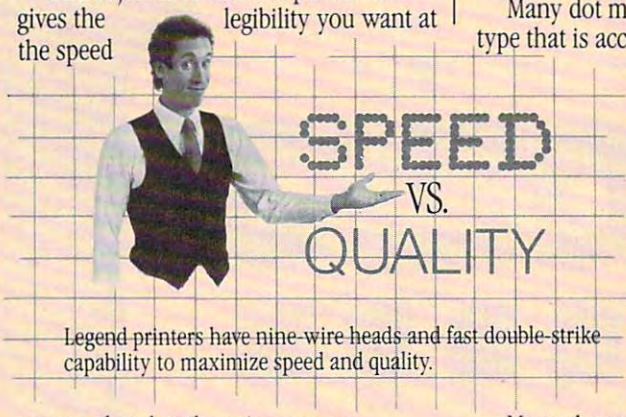


Legend printers have nine-wire heads and fast double-strike capability to maximize speed and quality.

Dot matrix type printers are the most popular and lowest cost printers. Most combine high speed with acceptable quality and legibility. They're extremely versatile and very dependable.

Legendary Head.

Dot matrix printers have print heads containing tiny pins that "fire" against a ribbon to make a series of dots that combine to form letters, numbers and graphics. Generally, the more pins or "wires," the closer together the dots, and the better the legibility.

Legend printers have "full nine wire" heads for better legibility.

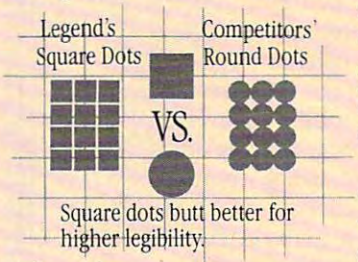
Many dot matrix printers produce type that is acceptable for about 95% of all correspondence—invoices, letters, and the like.

Daisy Wheel or "letter quality" printers run one fifth as fast and cost twice as much as a Legend. So a Legend dot matrix printer makes better sense. Why? Read on.

Easy to Switch.

Many dot matrix printers have a "double strike" capability that reduces the speed, but produces better legibility.

Unfortunately, with most dot matrix printers, changing to the double strike mode is difficult. And, unlike Legend, most other printers only run at 25% of their normal speed.



Square dots butt better for higher legibility.

Legend printers have a special, easily accessible switch on the top of the machine so double strike capability (Legend calls it "damn near letter quality") is at the operator's fingertips. And machine speed stays at a very productive 50% of normal speed.

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Square Vs. Round.

In addition to speed, the shape of the dot affects the legibility of type, too.

Most printers use round dots. Legend printers use square dots because they butt better and fool the eye into thinking that lines are continuous.

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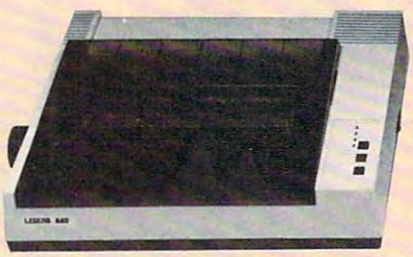
Legend 880—100 cps/80 col.

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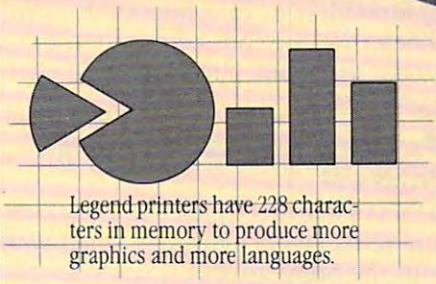
Legend 1385—160 cps/136 col.

Unfortunately, not all printers are capable of running graphics software, including some of the more popular models. If your application includes charts, graphs or other kinds of symbols, it's important that you pick a printer that is compatible with the software and capable of printing graphics, like Legend.

Legend printers are compatible with almost all popular graphics software programs. What's more, you'll get more characters built into memory when you choose a Legend.

More Graphics.

Most comparably priced printers feature 96 to 196 characters (symbols) built into memory. Legend printers have 228,



Legend printers have 228 characters in memory to produce more graphics and more languages.

so you can produce more graphics and more languages (French, German, Greek, Spanish, Italian) so you can be more productive. And isn't that the bottom line, really?

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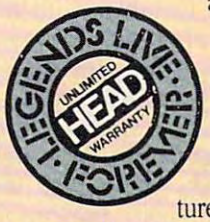

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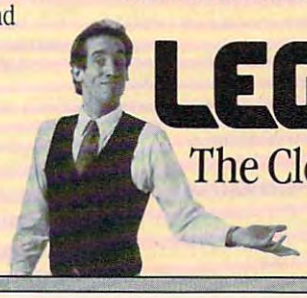

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computers, it has no checksum numbers for use with the "Automatic Proofreader." Be extra careful when typing this program, especially the long lines which contain the financial formulas. A mistyped program may still run, but the results it gives could be inaccurate.

When you run the program, a main menu offers you a choice of Investment or Loan calculations. Type I or L to reach the appropriate submenu.

Common Variables

Before looking at any calculations, let's consider some basics of the program. Home Financial Calculator uses some parameters or variables repeatedly in the calculations. These variables are *Total* (also referred to as Future Value, Total Owed, etc., depending on the calculation); *Present Value* (principal); *Interest Rate; Years; Months; Number of Periods* (of either compounding, deposits, withdrawals, or payments, depending on the application); *Deposits;* and *Withdrawals.* When in the calculator mode (explained below), you'll reference these eight variables with the single letters T, P, I, Y, M, N, D, and W.

As you work with Home Financial Calculator, the values of the eight variables are preserved until you change them. Whenever the program asks you for an input (for example, Interest), the current value of that variable is displayed (zero if no value has been entered yet). If you want to keep the current value, just press RETURN (or ENTER, depending on your keyboard). Otherwise, enter the new value and press RETURN.

With this feature, Home Financial Calculator makes it easy for you to generate "what if" projections. Simply run the same calculation repeatedly, each time changing a previously entered value. Press RETURN to keep a value, and change only one or two values to see the effect on the final result.

You can also store the current value into the calculator mode's Memory Register or recall a value from the Memory Register. To see how all this works, let's take a look at some calculations possible with Home Financial Calculator.

Investment Calculations

Here is the Investment submenu that appears when you type I from the main menu:

1) Future Value with Periodic Interest
2) Future Value with Interest Compounded Continuously
3) Future Value with Regular Deposits
4) Future Value with Cash Flows
5) Withdrawal of Funds
6) Net Present Value
7) Calculator Mode
8) Return to Main Menu.

Determine which option you want and press the appropriate key.

Each option displays screen prompts which ask you to input several values. These values are stored in the eight variables mentioned above: *T* for Total (Future Value), *P* for Present Value (principal), *I* for Interest Rate, *Y* for Years, *M* for Months, *N* for Number of Periods, *D* for Deposits, and *W* for Withdrawals. Of course, not all calculations require you to enter all these values, while others may ask for additional information.

Most calculations can be solved for any *one* of the variables. To solve for a variable, enter an uppercase X at the corresponding input prompt. For example, you could enter values for everything except the Interest Rate, typing X at the Interest Rate prompt. Home Financial Calculator then solves for the Interest Rate.

Remember, however, that the program can solve for only *one* variable during each calculation. If you enter an X at more than one prompt, the program does not have enough information to calculate an answer. Keep this in mind, because the program does not check for potential conflicts.

Future Value With Periodic Interest

Home Financial Calculator's options are fairly self-explanatory when you run the program, but let's try an example. We'll calculate the future value of an investment drawing periodic interest. This kind of investment could be a savings account, interest-bearing checking account, bonds, or a money market account. Choose this option by entering 1 at the Investment submenu.

After the screen clears, the program asks for the first input—Future Value, which appears with an asterisk (*). Below this is a zero (the current value of this variable in memory; all variables start out with a value of zero). Following this is an input prompt.

The asterisk preceding Future Value means that this is one of the variables you can solve for. (A variable *not* preceded by an asterisk means that variable *cannot* be solved for in that particular calculation, so X would be an illegal response.) If you'd like to calculate the Future Value, enter an X here, and answer all the other prompts with the appropriate values.

Let's calculate the future value of a $1,000 investment drawing 8 percent interest for two years and three months, with four compounding periods each year. Enter an X for *Future Value,* since we'll be solving for this total. Answer *Present Value* with 1000 (the principal you're investing); *Annual Int Rate (%)* with 8 (enter the percentage, not a fraction); *For # Of Years* with 2; *For # Of Months* with 3; and *# Of Periods (Compounding)* with 4. After you enter the last value, Home Financial Calculator figures the *Total Future Value* and displays the answer—$1195.09.

Now suppose you wish to know the future value of the same $1,000 investment if you make 9 percent interest. Choose option 1 on the Investment submenu again and rerun the calculation. Notice how Home Financial Calculator automatically prints the current value of each variable at each prompt. The *Future Value* prompt shows a current value of 1195.09 from the previous calculation. Type an X at this prompt, 9 for Interest Rate, and RETURN at all other prompts to preserve their values. The result should be $1221.71.

The versatility of Home Financial Calculator becomes apparent when you realize how many different ways you can run this calculation. Using this same menu option, you can calculate the initial investment (or present value) necessary to accrue a certain future value with periodic interest; the interest rate necessary to accrue a future value from a present value; or the time (in years and months) it would take to accumulate a future amount from an initial investment with periodic interest payments. Just enter an X for the unknown value you're seeking, and fill in all the other prompts.

Future Value With Interest Compounded Continuously

Option 2, a variation of option 1, handles investments paying a con-

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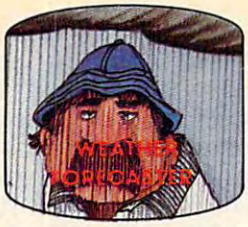

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tinuous interest rate. Like option 1, option 2 can handle a number of calculations—just place an X in the slot you'd like to solve for.

Here, after entering all other parameters, you can calculate the future value of an investment; the initial investment required to reach a certain future value; the interest required to reach a desired future value; or the time required to reach a certain future value at a specified interest rate.

Notice that any variables used in option 1 will be displayed with their current values when running option 2. As mentioned above, the eight major variables in Home Financial Calculator retain their values throughout the program until you change them. This feature is convenient when going from one option to another on the Investment or Loan submenus.

In addition, the values are preserved for use in the calculator mode. For instance, you could compare the effect of continuously compounded interest to periodic interest (option 1) without having to retype the input.

Future Value With Regular Deposits

If you're interested in setting up an annuity, you'd choose option 3 on the Investment submenu. You can determine the future value of an account (such as a savings account, Individual Retirement Account, college or vacation fund, etc.) with regular deposits where interest is compounded with each deposit.

Option 3 can also tell you the amount of each deposit necessary to accrue a future value; the interest rate needed to provide some future value with regular deposits; or the time it would take to amass a future value with regular deposits.

Future Value With Cash Flows

Option 4 does a single calculation—it always solves for *Future Value*, so don't enter an X anywhere. It calculates the future value of an investment with yearly cash flows (either positive or negative). The *Annual Interest Rate* you input here is the growth rate on the money you've invested.

As an example, suppose you wish to determine the value of a vacation fund collected over four years. You're asked for the number of years, then for the deposit or withdrawal each year. You deposit $500 in the fund the first year and $200 the second. The third year you are forced to withdraw $300 (entered as −300), and the fourth year, you put in $400. The fund has a growth rate of 12 percent. Its value after four years will be $1,017.34.

A future value determination can also tell you whether an investment is worthwhile. If the future value of all cash flows is positive or zero, the investment is profitable. A negative future value, on the other hand, represents a losing investment.

Withdrawal Of Funds

If you intend to open an account from which you can regularly withdraw funds, choose option 5. With this option, you can determine the initial deposit required in the account to cover your withdrawals; the amount you can withdraw regularly from this account; the rate of interest you must make on funds in the account; or the period of time over which you can make withdrawals.

Net Present Value

Option 6 lets you determine the feasibility of a prospective investment by calculating its net present value. Net present value is the current value of all future yearly cash flows to an investment along with any initial cash requirement. The interest rate you input here is the rate of return you require on your investment. A positive net present value indicates a profitable investment, while a negative result signifies a losing investment.

As an example, suppose you have the opportunity to make a $2,000 investment which would return $1,500 the first year, cost you $750 the second year, and return $1,900 the third year. You hope to make 13 percent on your money. With option 6, you determine a net present value of $56.87, representing a profitable investment.

The Calculator Mode

Option 7 puts you in the calculator mode (also available from the Loan submenu). Calculator mode works very much like a handheld calculator with a single memory. You can type in a value or recall one from a variable by entering its symbol—T(otal), P(resent Value), I(nterest Rate), Y(ears), M(onths), N(umber of Periods), D(eposits), and W(ithdrawals). You can perform simple math on values stored in the Memory Register using reverse Polish notation. And you can use the results in future calculations.

When you enter calculator mode, the calculator command line appears on the screen:

```
V S H R M+ M− M* M/ MR MC
MEM=0
```

Here are the commands:

V	(View the values of the eight primary variables)
S	(Store Memory Register into a variable)
H	(Help—prints the command line)
R	(Return to main menu, exit calculator mode)
M+	(Add the last input to the Memory Register)
M−	(Subtract the last input from the value in the Memory Register, and store the result in the Register)
M*	(Multiply the last input times the value in the Memory Register, and store the result in the Register)
M/	(Divide the last input into the value in the Memory Register, and store the result in the Register)
MR	(Memory Recall)
MC	(Memory Clear to zero)
MEM=	(Memory Register's current value)

If you've run through a sample investment calculation, you now have some variables in memory. Enter V in the calculator mode to see them. The screen displays the eight values currently in memory for the eight variables.

To work with one of these variables, enter one of their letters (T, P, I, Y, M, N, D, or W) and press RETURN. Then type M+ to add it to the Memory Register (all variables must be stored in the Register before you can perform any operations on them). Suppose you put the current value for T into the Register and now wish to add $229 to this value. Enter 229, press RETURN, then type M+ and press RETURN. The addition is performed and the result displayed. To store this value back into the T variable, enter S for Store. A prompt appears, requesting the variable in which you intend to store the value. Type T to store the value into the variable T.

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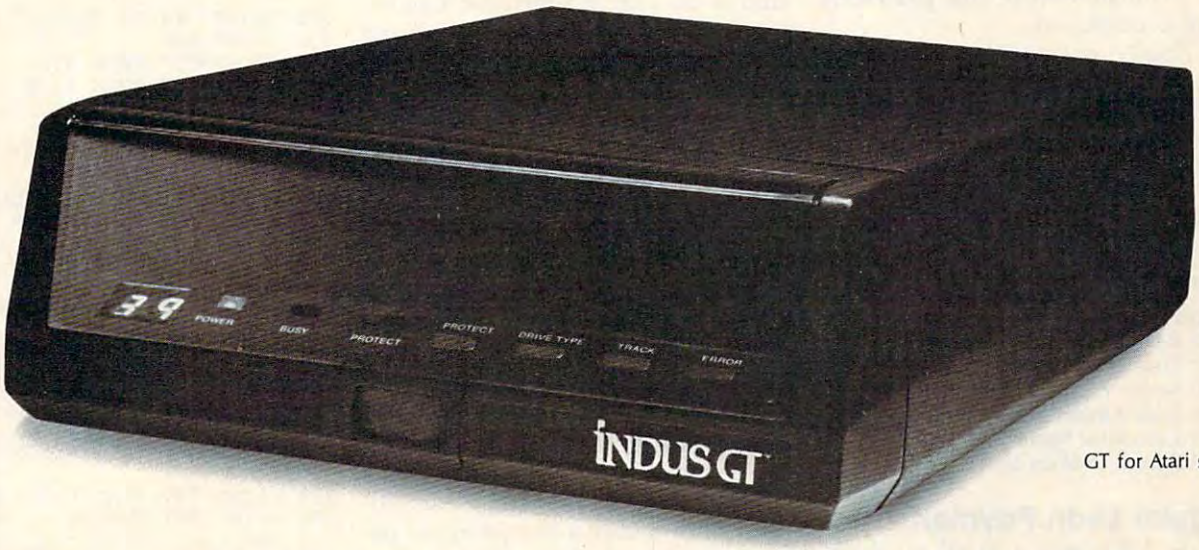

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You can also use the Memory Register to hold a value not represented by any of the eight variables. To do this, determine a value using the calculator mode and store it into the Memory Register with M+. Then, when you're running a calculation elsewhere in the program, you can substitute this value for any of the eight primary variables by typing MR (Memory Recall) at the appropriate prompt. MR can be used both in the calculator mode and at any prompt where the previous value is displayed.

Finally, option 8 on the Investment submenu returns you to the main menu. Once there, you can perform some loan calculations by typing L.

Loan Calculations

Here is the Loan calculations submenu:

1) Regular Loan Payments
2) Remaining Loan Liability
3) Final Loan Payment
4) Single Payment Loan
5) Loan Amortization Schedule
6) Calculator Mode
7) Return to Main Menu

Regular Loan Payments

Option 1 handles a number of calculations for equal payment loans. You can figure the principal of a loan; the amount of each regular payment necessary to repay a loan; the annual interest rate on a loan with regular payments; or the term of the loan.

Remaining Loan Liability

With option 2, you can determine the remaining balance on a loan with regular payments after a number of payments have been made. Enter the principal on the loan, the amount of each payment, the annual interest rate, the number of payments yearly, and the last payment number.

Final Loan Payment

Option 3 calculates the amount of the final payment on a loan. In many cases, the last payment of a loan will vary from the amount of the regular payment. This option handles situations where the final payment is greater than ("balloon payments") or less than the regular payment.

Single Payment Loan

Option 4 calculates the amount owed on a loan that is paid off with a single payment. You must input the principal on the loan, its annual interest rate, its term in years and months, and the number of times a year the interest on the principal is compounded.

Loan Amortization Schedule

Option 5 displays a loan amortization schedule. Enter the principal on the loan, the amount of each payment, the annual interest rate, the term of the loan, and the number of payments yearly. Then enter the period of the year in which the loan began (for instance, 10 for October) and the range in years of the amortization schedule you'd like to examine.

Because of the complexity of these calculations, there may be a delay before the output appears on the screen, especially if you have chosen to look at the latter years in a long-term loan repayment schedule (such as a home mortgage). When the amortization table appears, it displays the payment number, the beginning balance for the period, the amount paid toward the loan principal, the amount paid in interest, and the ending balance. To keep the information from scrolling off the screen, the program shows only a few payment periods at a time. Press RETURN to view another screenful. When the end of a year is reached, the program gives the total amounts paid on the principal and in interest for the year. In addition, when the last period of the loan is reached, the program displays the final payment for the loan.

The last two options on the Loan submenu are the same as those on the Investment submenu.

Modifying The Program

Home Financial Calculator is written in a modular format for easy modification. For many routines, it uses common input labels (lines 4710–5080) and some output labels (lines 5090–5170). If you want to add an investment or loan calculation routine, choose the labels from these lines that fit your application.

Also, you may wish to add a printer option to the loan amortization schedule. Examine lines 3230–3940. Here, variable D5 (defined in line 150) determines the number of loan payments considered on each screen. Variables S1, S2, S3, and S4 (defined in lines 160–190) format the output horizontally on the screen.

Program 1: Home Financial Calculator For Apple (General Version)

```
100 DIM V(8)
110 V$="TPIYMNDW"
120 C$="VSHR"
130 C1$="M+M-M*M/MRMC"
140 Q$=""
150 D5=13
160 S1=5
170 S2=15
180 S3=23
190 S4=31
200 GOSUB 5450
210 PRINT "INVESTMENTS OR LOAN
    S"
220 PRINT "(I/L) ";
230 INPUT A$
240 IF A$="I" THEN 270
250 IF A$="L" THEN 2170
260 GOTO 230
270 GOSUB 5450
280 PRINT "INVESTMENTS:"
290 PRINT
300 PRINT "1) FUTURE VALUE WIT
    H PERIODIC INTEREST"
310 PRINT "2) FUTURE VALUE WIT
    H INTEREST COMPOUNDED CONT
    INUOUSLY"
320 PRINT "3) FUTURE VALUE WIT
    H REGULAR DEPOSITS"
330 PRINT "4) FUTURE VALUE WIT
    H CASH FLOWS"
340 PRINT "5) WITHDRAWAL OF FU
    NDS"
350 PRINT "6) NET PRESENT VALU
    E"
360 PRINT "7) CALCULATOR MODE"
370 PRINT "8) RETURN TO MAIN M
    ENU"
380 PRINT
390 PRINT "CHOICE ";
400 INPUT A$
410 A=VAL(A$)
420 IF A<1 THEN 400
430 IF A>8 THEN 400
440 ON A GOTO 470,730,970,1360
    ,1550,1940,450,200
450 GOSUB 4180
460 GOTO 200
470 GOSUB 5450
480 PRINT "FUTURE VALUE WITH P
    ERIODIC INTEREST"
490 PRINT
500 GOSUB 4710
510 GOSUB 4750
520 PRINT "*";
530 GOSUB 4840
540 PRINT "*";
550 GOSUB 4880
560 IF E=4 THEN 580
570 GOSUB 4920
580 GOSUB 4970
590 IF E<>1 THEN 620
600 V(1)=INT(V(2)*(1+V(3)/V(6)
    )↑(V(6)*Y)*100+.5)/100
610 GOSUB 5090
620 IF E<>2 THEN 650
630 V(2)=INT(V(1)/((1+V(3)/V(6
    ))↑(V(6)*Y))*100+.5)/100
640 GOSUB 5120
650 IF E<>3 THEN 680
660 V(3)=INT((V(6)*(V(1)/V(2))
    ↑(1/(V(6)*Y))-V(6))*10000+
    .5)/10000
670 GOSUB 5150
680 IF E<>4 THEN 710
690 V(4)=LOG(V(1)/V(2))/(V(6)*
    LOG(1+V(3)/V(6)))
700 GOSUB 5180
710 GOSUB 5330
```


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```
720 GOTO 270
730 GOSUB 5450
740 PRINT "FUTURE VALUE WITH I
    NTEREST COMPOUNDED CONTINU
    OUSLY"
750 PRINT
760 GOSUB 4710
770 GOSUB 4750
780 PRINT "*";
790 GOSUB 4840
800 PRINT "*";
810 GOSUB 4880
820 IF E=4 THEN 840
830 GOSUB 4920
840 IF E<>1 THEN 870
850 V(1)=INT(V(2)*EXP(V(3)*Y)*
    100+.5)/100
860 GOSUB 5090
870 IF E<>2 THEN 900
880 V(2)=INT(V(1)/EXP(V(3)*Y)*
    100+.5)/100
890 GOSUB 5120
900 IF E<>3 THEN 930
910 V(3)=INT(LOG(V(1)/V(2))/Y*
    10000+.5)/10000
920 GOSUB 5150
930 IF E<>4 THEN 710
940 V(4)=INT(LOG(V(1)/V(2))/V(
    3)*100+.5)/100
950 GOSUB 5180
960 GOTO 710
970 GOSUB 5450
980 PRINT "FUTURE VALUE WITH R
    EGULAR DEPOSITS"
990 PRINT
1000 GOSUB 4710
1010 PRINT "*REGULAR DEPOSIT $
     "
1020 C=6
1030 GOSUB 3950
1040 PRINT "*";
1050 GOSUB 4840
1060 PRINT "*";
1070 GOSUB 4880
1080 IF E=4 THEN 1100
1090 GOSUB 4920
1100 GOSUB 4970
1110 IF E<>1 THEN 1140
1120 V(1)=INT(V(7)*V(6)*((1+V(
     3)/V(6))↑(V(6)*Y)-1)/V(3)
     *100+.5)/100
1130 GOSUB 5090
1140 IF E<>3 THEN 1280
1150 V(3)=.99
1160 I=0
1170 T=INT(V(7)*(((1+V(3)/V(6)
     )↑(V(6)*Y)-1)/(V(3)/V(6))
     )*100+.5)/100
1180 TE=ABS(V(3)-I)/2
1190 I=V(3)
1200 IF ABS(T-V(1))<.005 THEN
     {SPACE}1260
1210 IF T<V(1) THEN 1240
1220 V(3)=V(3)-TE
1230 GOTO 1170
1240 V(3)=V(3)+TE
1250 GOTO 1170
1260 V(3)=INT(V(3)*10000+.5)/1
     0000
1270 GOSUB 5150
1280 IF E<>4 THEN 1310
1290 V(4)=LOG(V(3)*V(1)/(V(6)*
     V(7))+1)/(V(6)*LOG(1+V(3)
     /V(6)))
1300 GOSUB 5180
1310 IF E<>7 THEN 710
1320 V(7)=INT(V(1)*(V(3)/V(6))
     /((1+V(3)/V(6))↑(V(6)*Y)-
     1)*100+.5)/100
1330 PRINT
1340 PRINT "REGULAR DEPOSITS R
     EQUIRED:$";V(7)
1350 GOTO 710
1360 GOSUB 5450
1370 PRINT "FUTURE VALUE WITH
     {SPACE}CASH FLOWS"
1380 PRINT
1390 GOSUB 4840
1400 GOSUB 4880
1410 PRINT "CASH FLOW (+/-)"
1420 PRINT
1430 V(1)=0
1440 FOR I=1 TO V(4)
1450 PRINT "CASH FLOW - YEAR #
     ";I
1460 INPUT A$
1470 A=VAL(A$)
1480 V(1)=V(1)+A*(1+V(3))↑(V(4
     )-I)
1490 NEXT I
1500 V(1)=INT(V(1)*100+.5)/100
1510 GOSUB 5090
1520 TE=V(1)
1530 GOSUB 5270
1540 GOTO 710
1550 GOSUB 5450
1560 PRINT "WITHDRAWAL OF FUND
     S"
1570 PRINT
1580 GOSUB 4750
1590 PRINT "*REGULAR WITHDRAWA
     L $"
1600 C=7
1610 GOSUB 3950
1620 PRINT "*";
1630 GOSUB 4840
1640 PRINT "*";
1650 GOSUB 4880
1660 IF E=4 THEN 1680
1670 GOSUB 4920
1680 GOSUB 4970
1690 IF E<>2 THEN 1720
1700 V(2)=INT(V(8)*V(6)/V(3)*(
     1-(1+V(3)/V(6))↑(-V(6)*Y)
     )*100+.5)/100
1710 GOSUB 5120
1720 IF E<>3 THEN 1860
1730 V(3)=.99
1740 I=0
1750 R=INT(V(2)*V(3)/V(6)*(1/(
     (1+V(3)/V(6))↑(V(6)*Y)-1)
     +1)*100+.5)/100
1760 TE=ABS(V(3)-I)/2
1770 I=V(3)
1780 IF ABS(R-V(8))<.005 THEN
     {SPACE}1840
1790 IF R<V(8) THEN 1820
1800 V(3)=V(3)-TE
1810 GOTO 1750
1820 V(3)=V(3)+TE
1830 GOTO 1750
1840 V(3)=INT(V(3)*10000+.5)/1
     0000
1850 GOSUB 5150
1860 IF E<>4 THEN 1890
1870 V(4)=LOG(V(6)*V(8)/(V(6)*
     V(8)-V(3)*V(2)))/(V(6)*LO
     G(1+V(3)/V(6)))
1880 GOSUB 5180
1890 IF E<>8 THEN 710
1900 V(8)=INT(V(2)*V(3)/V(6)*(
     1/((1+V(3)/V(6))↑(V(6)*Y)
     -1)+1)*100+.5)/100
1910 PRINT
1920 PRINT "REGULAR WITHDRAWAL
     S:$";V(8)
1930 GOTO 710
1940 GOSUB 5450
1950 PRINT "NET PRESENT VALUE:
     $"
1960 PRINT
1970 PRINT "INITIAL INVESTMENT
     "
1980 C=1
1990 GOSUB 3950
2000 GOSUB 4840
2010 GOSUB 4880
2020 PRINT "CASH FLOW (+/-)"
2030 PRINT
2040 NV=-V(2)
2050 FOR I=1 TO V(4)
2060 PRINT "CASH FLOW - YEAR #
     ";I
2070 INPUT A$
2080 A=VAL(A$)
2090 NV=NV+A/((V(3)+1)↑I)
2100 NEXT I
2110 NV=INT(NV*100+.5)/100
2120 PRINT
2130 PRINT "NET PRESENT VALUE:
     $";NV
2140 TE=NV
2150 GOSUB 5270
2160 GOTO 710
2170 GOSUB 5450
2180 PRINT "LOANS:"
2190 PRINT
2200 PRINT "1) REGULAR LOAN PA
     YMENTS"
2210 PRINT "2) REMAINING LOAN
     {SPACE}LIABILITY"
2220 PRINT "3) FINAL LOAN PAYM
     ENT"
2230 PRINT "4) SINGLE PAYMENT
     {SPACE}LOAN"
2240 PRINT "5) LOAN AMORTIZATI
     ON SCHEDULE"
2250 PRINT "6) CALCULATOR MODE
     "
2260 PRINT "7) RETURN TO MAIN
     {SPACE}MENU"
2270 PRINT
2280 PRINT "CHOICE ";
2290 INPUT A$
2300 A=VAL(A$)
2310 IF A<1 THEN 2290
2320 IF A>7 THEN 2290
2330 ON A GOTO 2360,2780,2960,
     3120,3230,2340,200
2340 GOSUB 4180
2350 GOTO 200
2360 GOSUB 5450
2370 PRINT "REGULAR LOAN PAYME
     NTS"
2380 PRINT
2390 PRINT "*";
2400 GOSUB 4790
2410 PRINT "*";
2420 GOSUB 5010
2430 PRINT "*";
2440 GOSUB 4840
2450 PRINT "*";
2460 GOSUB 4880
2470 IF E=4 THEN 2490
2480 GOSUB 4920
2490 GOSUB 4970
2500 IF E<>2 THEN 2550
2510 V(2)=INT(V(7)*V(6)/V(3)*(
     1-(1+V(3)/V(6))↑(-V(6)*Y)
     )*100+.5)/100
2520 PRINT
2530 PRINT "AMT OF PRINCIPAL:$
     ";V(2)
2540 GOTO 2760
2550 IF E<>3 THEN 2690
2560 V(3)=.99
2570 I=0
2580 P=INT(V(7)*V(6)/V(3)*(1-(
     (1+V(3)/V(6))↑(-V(6)*Y)))
     *100+.5)/100
2590 TE=ABS(V(3)-I)/2
2600 I=V(3)
2610 IF ABS(P-V(2))<.005 THEN
     {SPACE}2670
2620 IF P<V(2) THEN 2650
2630 V(3)=V(3)+TE
```


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```
2640 GOTO 2580
2650 V(3)=V(3)-TE
2660 GOTO 2580
2670 V(3)=INT(V(3)*10000+.5)/1
     0000
2680 GOSUB 5150
2690 IF E<>4 THEN 2720
2700 V(4)=-LOG(1-V(3)*V(2)/(V(
     6)*V(7)))/(V(6)*LOG(V(3)/
     V(6)+1))
2710 GOSUB 5180
2720 IF E<>7 THEN 2760
2730 V(7)=INT(V(3)*V(2)/(V(6)*
     (1-(V(3)/V(6)+1)↑(-V(6)*Y
     )))*100+.5)/100
2740 PRINT
2750 PRINT "REQ PAYMENT:$";V(7
     )
2760 GOSUB 5330
2770 GOTO 2170
2780 GOSUB 5450
2790 PRINT "REMAINING LOAN LIA
     BILITY"
2800 PRINT
2810 GOSUB 4790
2820 GOSUB 5010
2830 GOSUB 4840
2840 GOSUB 4970
2850 PRINT "LAST PAYMENT # WAS
     :"
2860 INPUT A$
2870 A=VAL(A$)
2880 FOR J=1 TO A
2890 I=INT(P*V(3)/V(6)*100+.5)
     /100
2900 P=P+I-V(7)
2910 NEXT J
2920 LI=INT(P*100+.5)/100
2930 PRINT
2940 PRINT "LIABILITY AFTER ";
     A;" PAYMENTS:$";LI
2950 GOTO 2760
2960 GOSUB 5450
2970 PRINT "LAST LOAN PAYMENT"
2980 PRINT
2990 GOSUB 4790
3000 GOSUB 5010
3010 GOSUB 4840
3020 GOSUB 5050
3030 GOSUB 4970
3040 FOR J=1 TO V(6)*Y
3050 I=INT(P*V(3)/V(6)*100+.5)
     /100
3060 P=P+I-V(7)
3070 NEXT J
3080 LP=INT(P*100+.5)/100+V(7)
3090 PRINT
3100 PRINT "LAST PAYMENT:$";LP
3110 GOTO 2760
3120 GOSUB 5450
3130 PRINT "SINGLE PAYMENT LOA
     N"
3140 PRINT
3150 GOSUB 4790
3160 GOSUB 4840
3170 GOSUB 5050
3180 GOSUB 4970
3190 V(1)=INT(V(2)*(1+V(3)/V(6
     ))↑(Y*V(6))*100+.5)/100
3200 PRINT
3210 PRINT "TOTAL OWED:$";V(1)
3220 GOTO 2760
3230 C5=0
3240 N5=0
3250 F=0
3260 P1=0
3270 I1=0
3280 GOSUB 5450
3290 PRINT "LOAN AMORTIZATION
     {SPACE}SCHEDULE"
3300 PRINT
3310 GOSUB 4790
3320 GOSUB 5010
3330 GOSUB 4840
3340 GOSUB 5050
3350 PRINT "# OF PAYMENTS YEAR
     LY"
3360 GOSUB 3950
3370 PRINT "ENTER THE PERIOD O
     F THE YEAR IN WHICH THE L
     OAN BEGAN"
3380 INPUT N
3390 NE=N
3400 NP=(V(4)*12+V(5))/(12/V(6
     ))
3410 NY=INT(((N-1)+NP)/V(6)+.9
     9)
3420 PRINT "ENTER THE RANGE OF
      YEARS YOU'D LIKE TO EXAM
     INE (FIRST, LAST)"
3430 INPUT F1,L1
3440 IF L1<=NY THEN 3460
3450 L1=NY
3460 FOR J1=1 TO L1
3470 IF J1<F1 THEN 3490
3480 GOSUB 5390
3490 FOR J=1 TO V(6)-N+1
3500 I=INT(P*V(3)/V(6)*100+.5)
     /100
3510 N5=N5+1
3520 PP=V(7)-I
3530 IF J1<>NY THEN 3570
3540 IF N5<>NP THEN 3570
3550 PP=P
3560 F=1
3570 IF J1<F1 THEN 3600
3580 PRINT N5;TAB(S1);INT(P*10
     0+.5)/100;
3590 PRINT TAB(S2);INT(PP*100+
     .5)/100;Q$;TAB(S3);
3600 P=P+I-V(7)
3610 IF F=0 THEN 3640
3620 P=0
3630 J=V(6)
3640 IF J1<F1 THEN 3670
3650 PRINT I;TAB(S4);INT(P*100
     +.5)/100;
3660 PRINT
3670 I1=I1+I
3680 P1=P1+PP
3690 C5=C5+1
3700 IF C5<>D5 THEN 3770
3710 IF J1<F1 THEN 3770
3720 GOSUB 5330
3730 GOSUB 5450
3740 C5=0
3750 IF J=V(6)-N+1 THEN 3770
3760 GOSUB 5390
3770 NEXT J
3780 IF J1<F1 THEN 3890
3790 IF F=0 THEN 3820
3800 PRINT
3810 PRINT "FINAL PAYMENT :$";
     INT((PP+I)*100+.5)/100
3820 PRINT
3830 PRINT "TOTAL INT PAID IN
     {SPACE}YR ";J1;":$";INT(I
     1*100+.5)/100
3840 PRINT "TOTAL PRINC PAID I
     N YR ";J1;":$";INT(P1*100
     +.5)/100
3850 IF F=1 THEN 3930
3860 IF J1=L1 THEN 3930
3870 GOSUB 5330
3880 GOSUB 5450
3890 C5=0
3900 P1=0
3910 I1=0
3920 N=1
3930 NEXT J1
3940 GOTO 2760
3950 C=C+1
3960 IF C<>3 THEN 3990
3970 PRINT V(3)*100,
3980 GOTO 4000
3990 PRINT V(C),
4000 A$=""
4010 INPUT A$
4020 IF A$<>"" THEN 4040
4030 RETURN
4040 IF A$<>"MR" THEN 4100
4050 PRINT "MEM=";M;"
     {2 SPACES}USE AS VARIABLE
      HERE (Y/N)"
4060 INPUT A$
4070 IF A$="N" THEN 4000
4080 V(C)=M
4090 RETURN
4100 IF A$<>"X" THEN 4130
4110 E=C
4120 RETURN
4130 V(C)=VAL(A$)
4140 IF C<>3 THEN 4160
4150 V(C)=V(C)/100
4160 RETURN
4170 REM CALCULATOR MODE
4180 GOSUB 5450
4190 M5=0
4200 GOSUB 4530
4210 INPUT A$
4220 IF ASC(A$)>57 THEN 4250
4230 T=VAL(A$)
4240 GOTO 4210
4250 FOR I=1 TO 8
4260 IF A$<>MID$(V$,I,1) THEN
     {SPACE}4290
4270 PRINT V(I)
4280 T=V(I)
4290 NEXT I
4300 FOR J=1 TO 6
4310 IF A$<>MID$(C1$,(J-1)*2+1
     ,2) THEN 4330
4320 ON J GOSUB 4580,4600,4620
     ,4640,4660,4680
4330 NEXT J
4340 FOR K=1 TO 4
4350 IF A$<>MID$(C$,K,1) THEN
     {SPACE}4370
4360 ON K GOSUB 4410,4460,4530
     ,4560
4370 NEXT K
4380 IF M5=0 THEN 4210
4390 M5=0
4400 RETURN
4410 FOR I=1 TO 8
4420 PRINT MID$(V$,I,1);"
     {2 SPACES}";V(I)
4430 NEXT I
4440 PRINT
4450 RETURN
4460 PRINT "IN WHAT VARIABLE "
     ;
4470 INPUT A$
4480 FOR I=1 TO 8
4490 IF A$<>MID$(V$,I,1) THEN
     {SPACE}4510
4500 V(I)=M
4510 NEXT I
4520 RETURN
4530 PRINT C$;" ";C1$;" MEM=";
     M
4540 PRINT
4550 RETURN
4560 M5=1
4570 RETURN
4580 M=M+T
4590 GOTO 4690
4600 M=M-T
4610 GOTO 4690
4620 M=M*T
4630 GOTO 4690
4640 M=M/T
4650 GOTO 4690
4660 T=M
4670 GOTO 4690
4680 M=0
```


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```
4690 PRINT "MEM=";M
4700 RETURN
4710 PRINT "*FUTURE VALUE $"
4720 C=0
4730 GOSUB 3950
4740 RETURN
4750 PRINT "*PRESENT VALUE $"
4760 C=1
4770 GOSUB 3950
4780 RETURN
4790 PRINT "PRINCIPAL $"
4800 C=1
4810 GOSUB 3950
4820 P=V(C)
4830 RETURN
4840 PRINT "ANNUAL INT RATE (%
     )"
4850 C=2
4860 GOSUB 3950
4870 RETURN
4880 PRINT "FOR # OF YEARS"
4890 C=3
4900 GOSUB 3950
4910 RETURN
4920 PRINT "FOR # OF MONTHS"
4930 C=4
4940 GOSUB 3950
4950 Y=V(C-1)+V(C)/12
4960 RETURN
4970 PRINT "# OF PERIODS (COMP
     OUNDING, DEPOSITS, WITHDR
     AWALS, PAYMENTS) YEARLY"
4980 C=5
4990 GOSUB 3950
5000 RETURN
5010 PRINT "PAYMENTS $"
5020 C=6
5030 GOSUB 3950
5040 RETURN
5050 PRINT "TERM OF LOAN:"
5060 GOSUB 4880
5070 GOSUB 4920
5080 RETURN
5090 PRINT
5100 PRINT "FUTURE VALUE:$";V(
     1)
5110 RETURN
5120 PRINT
5130 PRINT "REQUIRED INVESTMEN
     T:$";V(2)
5140 RETURN
5150 PRINT
5160 PRINT "ANNUAL INT RATE (%
     ) REQUIRED:";V(3)*100
5170 RETURN
5180 V(5)=V(4)-INT(V(4))
5190 V(5)=INT(INT(12*V(5)*10+.
     5)/10)
5200 V(4)=INT(V(4))
5210 IF V(5)<>12 THEN 5240
5220 V(4)=V(4)+1
5230 V(5)=0
5240 PRINT
5250 PRINT "# OF YEARS AND MON
     THS:";V(4);",";V(5)
5260 RETURN
5270 PRINT
5280 IF TE>=0 THEN 5310
5290 PRINT "THIS IS A LOSING I
     NVESTMENT."
5300 RETURN
5310 PRINT "THIS IS A PROFITAB
     LE INVESTMENT."
5320 RETURN
5330 PRINT
5340 PRINT "HIT <RETURN> TO CO
     NTINUE"
5350 A$=""
5360 INPUT A$
5370 IF A$<>"" THEN 5350
5380 RETURN
5390 GOSUB 5450
5400 PRINT "LOAN AMORTIZATION
     {SPACE}SCHEDULE FOR YR ";
     J1
5410 PRINT "PRIN $";V(2);"
     {2 SPACES}RATE ";V(3)*100
     ;"%";"{2 SPACES}PAYM $";V
     (7)
5420 PRINT
5430 PRINT "#{3 SPACES}BEG BAL
     {3 SPACES}PRINC{3 SPACES}
     INT{5 SPACES}END BAL"
5440 RETURN
5450 HOME
5460 RETURN
```

Program 2: Modifications For Commodore 64, Plus/4, and 16

Please refer to "COMPUTE!'s Guide to Typing In Programs" before entering this listing.

```
150 D5=6
160 S1=3
170 S2=13
180 S3=21
190 S4=29
3580 PRINT MID$(STR$(N5),2,LEN
     (STR$(N5))-1);TAB(S1);INT
     (P*100+.5)/100;
5450 PRINT CHR$(147)
```

Program 3: Modifications For Commodore PET

For PET/CBM models, make the following modifications in addition to *the changes shown in Program 2.*

```
4010 PRINTCHR$(160);"{3 LEFT}"
     ;:INPUT A$
4020 IF A$<>CHR$(160) THEN 404
     0
5360 GETA$
5370 IF A$<>CHR$(13) THEN 5360
```

Program 4: Modifications For VIC-20

Please refer to "COMPUTE!'s Guide to Typing In Programs" before entering this listing.

```
140 Q$=CHR$(13)
150 D5=3
160 S1=3
170 S2=13
180 S3=S1
190 S4=S2
3580 PRINT MID$(STR$(N5),2,LEN
     (STR$(N5))-1);TAB(S1);INT
     (P*100+.5)/100;
5430 PRINT "#{3 SPACES}BEG BAL
     {3 SPACES}PRINC{7 SPACES}
     INT{7 SPACES}END BAL"
5450 PRINT CHR$(147)
```

Program 5: Modifications For Atari

Please refer to "COMPUTE!'s Guide to Typing In Programs" before entering this listing.

```
105 DIM A$(10),C$(4),C1$(
    12),V$(8),Q$(1):POKE
    82,0:FOR I=1 TO 8:V(I
    )=0:NEXT I
160 S1=4
170 S2=14
180 S3=22
190 S4=30
3580 PRINT N5;:POKE 85,S1
     :PRINT INT(P*100+0.5
     )/100;
3590 POKE 85,S2:PRINT INT
     (PP*100+0.5)/100;:PO
     KE 85,S3
3650 PRINT I;:POKE 85,S4:
     PRINT INT(P*100+0.5)
     /100;
4260 IF A$<>V$(I,I) THEN
     4290
4310 IF A$<>C1$((J-1)*2+1
     ,(J-1)*2+2) THEN 433
     0
4350 IF A$<>C$(K,K) THEN
     4370
4420 PRINT V$(I,I);"  ";V
     (I)
4490 IF A$<>V$(I,I) THEN
     4510
5450 PRINT CHR$(125)
```

Program 6: Modifications For IBM PC/PCjr

Please refer to "COMPUTE!'s Guide to Typing In Programs" before entering this listing.

```
90 WIDTH 40:KEY OFF:DEF SEG=0
   :POKE 1047,PEEK(1047) OR 6
   4
160 S1=4
170 S2=14
180 S3=22
190 S4=30
3500 I=INT(P*V(3)/V(6)*100+.5
     )/100:B=I:GOSUB 5470:I$=
     B$
3580 PRINT MID$(STR$(N5),2,LE
     N(STR$(N5))-1);TAB(S1);:
     B=P:GOSUB 5470:PRINT B$;
3590 PRINT TAB(S2);:B=PP:GOSU
     B 5470:PRINT B$;Q$;TAB(S
     3);
3650 PRINT I$;TAB(S4);:B=P:GO
     SUB 5470:PRINT B$;
5340 PRINT "HIT <ENTER> TO CO
     NTINUE"
5450 CLS
5470 TE=0:B$=STR$(B):FOR K=1
     TO LEN(B$):IF MID$(B$,K,
     1)="." THEN TE=K:K=LEN(B
     $)
5480 NEXT K
5490 IF TE=0 THEN RETURN ELSE
      B$=MID$(B$,1,TE+2):RETU
     RN
```

Program 7: Modifications For TI-99/4A

```
140 Q$=CHR$(13)
150 D5=6
160 S1=9
170 S2=20
180 S3=S1
190 S4=S2
4260 IF A$<>SEG$(V$,I,1)THE
     N 4290
4310 IF A$<>SEG$(C1$,(J-1)*
     2+1,2)THEN 4330
4350 IF A$<>SEG$(C$,K,1)THE
     N 4370
4420 PRINT SEG$(V$,I,1);"
     ";V(I)
4490 IF A$<>SEG$(V$,I,1)THE
     N 4510
5340 PRINT "HIT <ENTER> TO
     CONTINUE"
5430 PRINT " #";TAB(S1+1);"
     BEG BAL";TAB(S2+1);"PR
     INC";Q$;TAB(S3+1);"  I
     NT";TAB(S+1);"END BAL"
5450 CALL CLEAR
```

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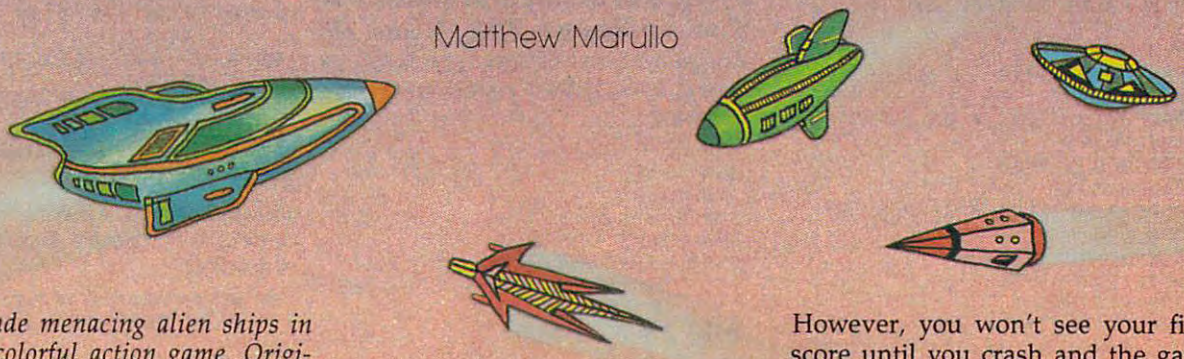
Space Dodger

Matthew Marullo



Try to evade menacing alien ships in this fast, colorful action game. Originally written for the TI-99/4A with Extended BASIC, adaptations have been added for the Commodore 64, unexpanded VIC-20, Apple II series, and Atari. The Commodore, Apple, and Atari versions require a joystick.

Get ready for a game which demands extremely sharp eye-hand coordination and judgment of time and distance. "Space Dodger" is an addictive test of your physical reflexes.

When you type RUN, there's a brief wait while the program initializes. Then the game opens with your spaceship on the left side of the screen, superimposed over a random starfield. On the right side of the screen is a lineup of several colorful alien ships. When the action starts, the aliens begin moving toward your ship at different speeds. Your job is to avoid a disastrous midspace collision that will turn your vessel into a lump of smoking metal.

To dodge the reckless aliens, you'll have to move up or down. But don't move too far and try to escape the screen—the boundaries are guarded by cuboids (cube-shaped asteriods) zipping along at the speed of light. The cuboids are even more dangerous than the alien ships because they travel too fast to dodge.

Moving Up The Ranks

The longer you evade the oncoming aliens, the more points you gain. However, you won't see your final score until you crash and the game ends. At that time you're also ranked according to your value to the Space Service: Space Cadet, Corporal, Sergeant, Captain, or Major.

Every time you advance a rank, the game pauses briefly before it continues to the next level. When it restarts, you'll notice the alien ships fly across the screen even faster. Your score adds up faster, too.

But beware—Space Dodger is not as easy as it looks. Chances are you'll play for quite a while before you even advance beyond Space Cadet.

TI Version

Control your ship with the keyboard: Press the E key to move up, the X key to move down. You can achieve finer control by repeatedly tapping the keys, rather than holding them down.

Space Dodger is one of the fastest BASIC games we've seen for the TI, and it makes good use of the built-in sprite graphics and collision detection.

Commodore 64/VIC-20 Versions

Plug a joystick into port 2 on the Commodore 64. When the game begins, press the joystick forward to move your ship up, and pull it back to move down.

Joystick controls on the VIC are the same as on the 64. Before loading Space Dodger, be sure to unplug any cartridges. VIC Space Dodger is in

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two parts. Program 3 is the loader, which creates the custom characters, then loads and runs Program 4. Type in and save both programs, *using the filename "SD" when saving Program 4.* If you are using tape, save Program 4 on the same tape, immediately after Program 3. Tape users also need to change ,8 to ,1 in line 30 of Program 3.

Both Commodore versions include three additional ranks beyond the lower levels—Lieutenant, General, and Master. The ships are created with multicolor sprites on the 64 and custom multicolor characters on the VIC. Ring modulation and filtering help produce the 64 version's uncanny sound effects.

Apple Version

Written entirely in machine language, Apple Space Dodger works on any Apple II series computer with any version of Apple DOS. The machine language in Program 4 must be entered with the Apple's built-in machine language monitor. You don't need to understand machine language to enter the program.

To type in Program 5, first enter the monitor by typing CALL −151. The Applesoft prompt (normally a]) will be replaced by the monitor's prompt, an asterisk (*). To enter a line from the listing, first type in the four-digit hexadecimal number, then type a colon (:) instead of the hyphen shown in the listing. This is the address where you'll enter the rest of the line. Type in the rest of the line after the colon, leaving a space between each two-digit number. After eight numbers, press RETURN and continue to the next line. If you want to review what you've entered to check for accuracy, you can list a block of data by typing the address of the first location in the range, then a period, then the last address, and then RETURN.

When you're done typing the program, save it on disk with this command:

```
BSAVE SPACE.DODGER,A$7000,
L$8AA
```

Because it's difficult to type a listing this long without making errors, we've included a small checksum program (Program 6) which detects typos. To use it, load the machine language program from disk by entering BLOAD SPACE.DODGER, then run Program 6. If you have made a typo, it will tell you where to look to find the mistake.

When Program 5 is error-free, save a copy on disk. Then run it by typing BRUN SPACE.DODGER. Plug in a joystick, and push forward on the joystick to move your ship up, or pull back on the stick to move down. You have a total of three ships in each game.

Atari Version

Atari Space Dodger works on the 400/800, XL series, and new XE series computers. With a joystick plugged into port 1, you can push the stick forward to move your ship up, and pull back to move the ship down.

The Atari version's multicolored alien ships are created with an unusual implementation of player/missile (P/M) graphics. Ordinarily, the Atari can display a maximum of only four player shapes (or five if you combine the four missiles into an additional player). Each player can be only one color and is limited in width, but can be as tall as the entire screen. But in Space Dodger, one player is used for your ship, and the remaining three players are cleverly combined to make *12 multicolor* alien ships.

The program takes advantage of a technique which allows multiple colors in overlapping players. All three alien players begin at the same horizontal location and are assigned different colors. The P/M shape data is then defined so that visible portions of the underlying alien players can be seen through "holes" in the overlapping players. Thus, each ship is actually a three-colored conglomerate of overlapping shapes. To create the effect of separate ships, the remaining P/M data is filled with zeros to make blank zones between each alien craft.

The result is 12 multicolor ships, but without additional programming tricks, they'd all have to move in unison. Moving one alien player without the others would destroy the carefully arranged multicolor effect.

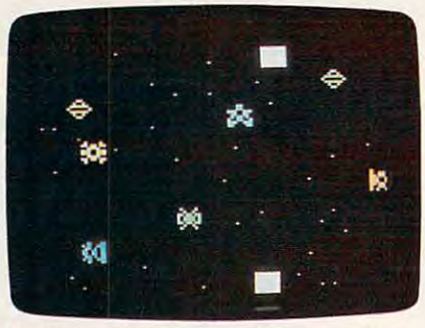
To move the aliens at different speeds and horizontal locations, Space Dodger uses *display list interrupts*. Briefly, the Atari display list is a set of instructions that tells the computer what to display at a given point on the screen as the TV's raster beam sweeps from top to bottom. By manipulating the display list with machine language routines, Space Dodger makes its three overlapped players act like a dozen independently mobile shapes.

The fast, smooth motion of the alien ships is achieved by moving them only during the Atari's *vertical blank interrupt* (the short interval during which the TV's raster beam moves from the bottom of the screen to the top to scan another frame). Naturally, machine language is also needed to make this work.

You can learn more about using both types of interrupts in *De Re Atari*, published by Atari Computers, Inc., as well as *COMPUTE!'s First Book of Atari* and *COMPUTE!'s First Book of Atari Graphics.*

Program 1: TI Space Dodger

```
100 REM EXTENDED BASIC REQU
    IRED
110 FOR I=0 TO 3 :: READ F$
    (I):: NEXT I
120 DATA SPACE CADET,CORPOR
    AL,SERGEANT,CAPTAIN
130 FOR I=97 TO 103 :: READ
     A$ :: CALL CHAR(I,A$):
    : NEXT I
140 CALL CHARPAT(33,D$)
150 DATA 18247E817E241800,1
    818E7665A99E7C3
160 DATA 42DB3CE7E73CDB42,8
    199DBE7E7DB99A5,4224DBB
    DBDDB2442
170 DATA 23A76BDBDB6BA723,F
    FFFFFFFFFFFFFFF
180 A=15 :: B=25 :: C=12 ::
     D=22 :: E=18 :: F=28 :
    : SC=0 :: T=0 :: LEVEL=
    0
190 CALL CHAR(96,"18247E817
    E241800"):: CALL CLEAR
    :: CALL MAGNIFY(2):: CA
    LL SCREEN(2):: CALL CHA
    R(33,"1"):: CALL COLOR(
    1,2,2)
200 RANDOMIZE :: FOR STAR=1
     TO 35 :: CALL HCHAR(IN
    T(24*RND)+1,INT(32*RND)
    +1,33):: NEXT STAR :: C
    ALL COLOR(1,16,2)
```



Reckless alien ships hurtling through space make life hazardous in "Space Dodger" (TI version).

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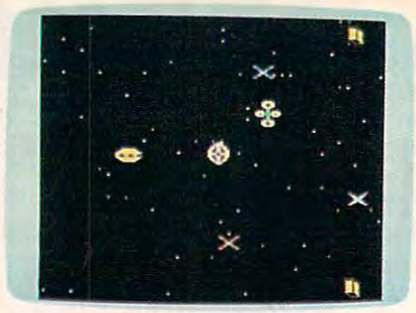
```
210 CALL SPRITE(#1,96,11,75
    ,45,#2,97,INT(6*RND)+3,
    25,180,#3,98,INT(7*RND)
    +3,50,180)
220 CALL SPRITE(#4,99,INT(1
    2*RND)+3,75,180,#5,100,
    INT(10*RND)+3,100,180,#
    6,101,INT(8*RND)+3,125,
    180)
230 CALL SPRITE(#7,102,INT(
    11*RND)+3,150,180,#8,10
    3,16,6,10,#9,103,16,175
    ,10)
240 FOR DELAY=1 TO 650 :: N
    EXT DELAY
250 CALL SOUND(500,110,0,22
    0,0,330,0)
260 CALL MOTION(#8,0,-120,#
    9,0,-120)
270 CALL MOTION(#2,0,-A,#3,
    0,-B,#4,0,-C,#5,0,-D,#6
    ,0,-E,#7,0,-F)
280 CALL KEY(1,K,S):: T=T+1
     :: SC=SC+1+LEVEL*10 ::
     IF T=200 OR T=375 OR T
    =500 THEN 430
290 IF T=550 THEN 460
300 IF S=0 THEN Y=0 :: CALL
     SOUND(1,-7,6)
310 IF K=5 THEN Y=-15 ELSE
    IF K=0 THEN Y=15
320 IF ABS(Y)=15 THEN CALL
    SOUND(-5,1050,3,450,4,-
    6,1)
330 CALL MOTION(#1,Y,0):: C
    ALL COINC(ALL,CC):: CAL
    L POSITION(#1,DR,DC)::
    IF CC=-1 OR DR>192 THEN
     340 ELSE 280
340 CALL DELSPRITE(#2,#3,#4
    ,#5,#6,#7,#8,#9):: CALL
     MOTION(#1,0,0)
350 FOR X=1 TO 10 :: CALL C
    HAR(96,"42008100810081
    42")
360 CALL SOUND(100,-7,X+3)
370 CALL CHAR(96,"000000181
    8000000"):: NEXT X
380 CALL DELSPRITE(#1):: CA
    LL CLEAR :: CALL CHAR(3
    3,D$)
390 FOR V=1 TO 8 :: CALL CO
    LOR(V,16,2):: NEXT V ::
     DISPLAY AT(10,11):"GOO
    D TRY,"
400 DISPLAY AT(12,(29-LEN(F
    $(LEVEL)))/2):F$(LEVEL)
    &"!" :: DISPLAY AT(15,1
    0):"SCORE: "&STR$(SC)::
     DISPLAY AT(18,6):"PLAY
     AGAIN (Y/N) ?"
410 CALL KEY(0,K,S):: IF S=
    0 THEN 410
420 U$=CHR$(K):: IF U$="Y"
    THEN 180 ELSE CALL CLEA
    R :: STOP
430 A=A+10 :: B=B+10 :: C=C
    +10 :: D=D+10 :: E=E+10
     :: F=F+10 :: LEVEL=LEV
    EL+1
440 CALL SOUND(300,440,0,65
    9,0):: CALL DELSPRITE(A
    LL):: CALL SCREEN(10)::
     FOR DELAY=1 TO 300 ::
     NEXT DELAY
450 CALL SCREEN(2):: GOTO 2
    10
460 CALL CLEAR :: FOR U=1 T
    O 8 :: CALL COLOR(U,16,
    1):: NEXT U :: CALL SCR
    EEN(5):: CALL DELSPRITE
    (ALL)
470 CALL CHAR(33,D$):: CALL
     SOUND(2000,131,2,262,2
    ,523,2):: DISPLAY AT(5,
    13):"WOW!" :: DISPLAY A
    T(8,6):"NICE GOING,"&"
    MAJOR!"
480 DISPLAY AT(15,6):"I CON
    GRATULATE YOU" :: DISPL
    AY AT(17,6):"ON YOUR NE
    RVES ---" :: DISPLAY AT
    (19,6):"AND YOUR TALENT
    !"
490 FOR DELAY=1 TO 1000 ::
    NEXT DELAY :: CALL CHAR
    (96,"1818183C243CC3FF")
    :: CALL SPRITE(#1,96,14
    ,95,115)
500 CALL SOUND(1000,440,0,6
    59,0):: FOR DELAY=1 TO
    400 :: NEXT DELAY :: CA
    LL DELSPRITE(#1):: GOTO
     190
```

Program 2: Commodore 64 Space Dodger

Version by Kevin Mykytyn, Editorial Programmer

Please refer to "COMPUTE!'s Guide to Typing In Programs" before entering this listing.

```
20 C=54272:POKE54296,15
                        :rem 235
30 FORA=1TO8:READB$(A):NEXT:DA
   TA SPACE CADET,CORPORAL,SER
   GEANT,CAPTAIN,MAJOR:rem 160
35 DATA LIEUTENANT,GENERAL,MAS
   TER                  :rem 157
40 FORA=16064TO16319:READB:POK
   EA,B:NEXT            :rem 154
50 FORA=16256TO16319:POKEA+64,
   PEEK(A):NEXT:FORA=16347TO16
   352:POKEA,250:NEXT   :rem 62
60 POKE53276,255:POKE2040,13:F
   ORA=2041TO2045       :rem 247
70 POKEA,251:NEXT:POKE2046,13
                        :rem 217
80 FORA=832TO959:READB:POKEA,B
   :NEXT                :rem 221
90 POKE53280,15:POKE53281,0:PO
   KE53251,125:GOSUB880
                        :rem 123
100 PRINT"{CLR}{10 DOWN}
    {14 RIGHT}{BLK}SPACE DODGE
    R"                  :rem 230
110 POKE53269,255:POKE53249,12
    5:FORA=90TO255:POKE53248,A
                        :rem 233
120 POKE53250,345-A:IFA=155THE
    NPOKE53249,120:POKE53251,1
    30                  :rem 38
130 POKE55696+(A-24)/8,7
                        :rem 236
140 NEXT:FORTD=1TO800:NEXT:POK
    E53269,0            :rem 125
150 RA=1:POKE253,5:SC=0:L=200:
    POKE53285,7:POKE53286,2:PO
    KE53287,7           :rem 4
160 B=50:FORA=53249TO53261STEP
    2:POKEA,B:B=B+30:NEXT:PRIN
    T"{CLR}":FORA=1TO65
                        :rem 201
170 Q=1024+RND(1)*999:POKEQ,46
    :POKEQ+C,RND(1)*15:NEXT
                        :rem 102
180 POKE53278,0:POKE2047,255:P
    OKE254,0:SYS49152:POKE5326
    9,255               :rem 3
```



Commodore 64 "Space Dodger."

```
190 SC=SC+(PEEK(253)-4)/2:IFSC
    >=LTHENGOSUB330:L=L*3:RA=R
    A+1:GOTO190         :rem 46
200 IFPEEK(53278)<128THEN190
                        :rem 64
210 POKE254,1:POKE54273,4:POKE
    54277,27:POKE54278,0:POKE5
    4276,128:POKE54276,129
                        :rem 207
220 POKE2047,14:POKE53294,8
                        :rem 245
230 FORTD=1TO200:NEXT:POKE5326
    9,127:FORTD=1TO500:NEXT:PO
    KE53269,0           :rem 14
240 POKE56333,129:POKE53274,0
                        :rem 91
250 PRINT"{CLR}":PRINT"{CYN}
    {7 DOWN}{14 RIGHT}SCORE:"I
    NT(SC)              :rem 58
260 IFSC>HSTHENHS=SC    :rem 51
270 PRINT"{3 DOWN}{12 RIGHT}HI
    GH SCORE:"INT(HS) :rem 166
280 PRINT"{3 DOWN}"SPC(17-LEN(
    B$(RA))/2)"RANK: "B$(RA)
                        :rem 57
290 PRINT"{YEL}{5 DOWN}
    {6 RIGHT}PLAY AGAIN? (UP-Y
    ES DOWN-NO)         :rem 214
300 Q=PEEK(56320):IF(QAND1)=0T
    HEN150              :rem 56
310 IF(QAND2)=0THENSYS832
                         :rem 2
320 GOTO300             :rem 97
330 POKE56333,129:POKE53274,0:
    SYS 65418:POKE53280,2:POKE
    53269,0             :rem 51
340 FORA=53248TO53260STEP2:POK
    EA,40               :rem 77
350 POKEA-52569,40:NEXT:POKE 2
    52,127:POKE53264,127:POKE5
    3269,255:POKE53263,140
                        :rem 171
360 FORTD=1TO180        :rem 194
370 IF(PEEK(56320)AND16)<>16TH
    ENWAIT56320,16,0:WAIT56320
    ,16,16:TD=180       :rem 155
380 NEXTTD:SYS 49152:POKE53280
    ,15:POKE253,PEEK(253)+1
                        :rem 72
390 POKE53278,0:RETURN :rem 74
400 DATA0,0,0,0,0,0,0,0:rem 98
410 DATA0,0,0,0,0,0,0,60
                        :rem 153
420 DATA0,60,59,0,236,14,130,1
    76                  :rem 74
430 DATA2,105,128,0,150,0,0,15
    0                   :rem 4
440 DATA0,2,105,128,14,130,176
    ,59                 :rem 126
450 DATA0,236,60,0,60,0,0,0
                        :rem 62
460 DATA0,0,0,0,0,0,0,0
                        :rem 104
470 DATA0,0,0,0,0,0,0,1
                        :rem 106
```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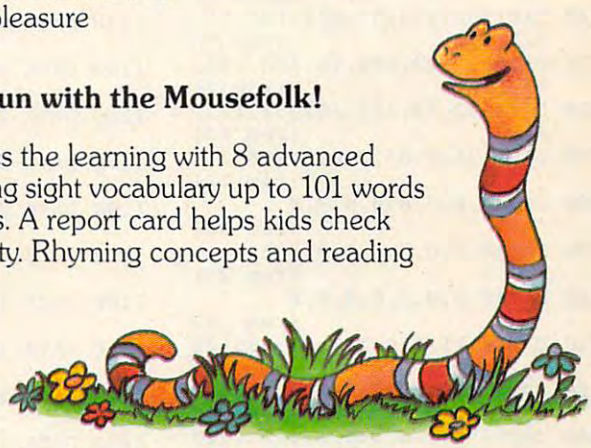

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```
480 DATA0,0,0,0,0,0,0,0
                        :rem 106
490 DATA0,0,0,0,0,20,0,0
                        :rem 157
500 DATA85,0,1,105,64,5,235,80
                        :rem 232
510 DATA5,235,80,23,235,212,23
    ,235                :rem 174
520 DATA212,22,190,148,22,190,
    148,23              :rem 21
530 DATA235,212,23,235,212,5,2
    35,80               :rem 224
540 DATA5,235,80,1,105,64,0,85
                        :rem 236
550 DATA0,0,20,0,0,0,0,255
                         :rem 6
560 DATA0,0,0,0,85,0,1,85
                        :rem 228
570 DATA64,1,125,64,1,125,64,1
                        :rem 235
580 DATA85,64,0,170,0,0,40,0
                        :rem 126
590 DATA21,40,84,85,170,85,93,
    170                 :rem 149
600 DATA117,85,170,85,21,40,84
    ,0                  :rem 82
610 DATA40,0,0,170,0,1,85,64
                        :rem 121
620 DATA1,125,64,1,125,64,1,85
                        :rem 234
630 DATA64,0,85,0,0,0,0,1
                        :rem 223
640 DATA0,0,0,0,0,0,0,0
                        :rem 104
650 DATA0,0,0,0,0,0,0,1
                        :rem 106
660 DATA85,64,5,85,80,21,85,84
                         :rem 7
670 DATA85,85,85,175,175,175,1
    75,175              :rem 67
680 DATA175,85,85,85,21,85,84,
    5                   :rem 65
690 DATA85,80,1,85,64,0,0,0
                        :rem 90
700 DATA0,0,0,0,0,0,0,0
                        :rem 101
710 DATA0,0,0,0,0,0,0,0
                        :rem 102
720 DATA0,0,0,0,0,0,0,255
                        :rem 211
730 DATA192,3,3,192,12,14,192,
    63                  :rem 83
740 DATA250,192,53,122,192,53,
    122,192             :rem 78
750 DATA53,122,192,53,122,192,
    53,122              :rem 25
760 DATA192,53,122,192,53,123,
    0,53                :rem 182
770 DATA124,0,63,240,0,0,0,0
                        :rem 114
780 DATA0,0,0,0,0,0,0,0
                        :rem 109
790 DATA0,0,0,0,0,0,0,195
                        :rem 221
800 DATA0,0,0,0,0,0,0,0
                        :rem 102
810 DATA0,15,252,240,63,255,25
    2,254               :rem 229
820 DATA171,188,250,234,188,25
    0,174,240           :rem 188
830 DATA254,170,240,63,187,240
    ,62,170             :rem 81
840 DATA240,62,150,240,14,150,
    252,14              :rem 13
850 DATA234,188,62,174,188,63,
    170,240             :rem 97
860 DATA63,255,192,15,252,0,0,
    0                   :rem 28
870 DATA0,0,0,0,0,0,0,0
                        :rem 109
880 PRINT"{CLR}{YEL}{12 DOWN}
    {13 SPACES}PLEASE WAIT":I=
    49152               :rem 34
890 READA:IFA=256THENRETURN
                        :rem 241
900 POKE I,A:I=I+1:GOTO890
                        :rem 247
910 DATA 120,169,164,141,20,3
                        :rem 137
920 DATA 169,192,141,21,3,169
                        :rem 153
930 DATA 127,141,13,220,169,12
    9                   :rem 246
940 DATA 141,26,208,169,27,141
                        :rem 202
950 DATA 17,208,88,169,140,141
                        :rem 209
960 DATA 182,2,32,71,192,169
                        :rem 107
970 DATA 10,133,251,169,127,13
    3                   :rem 247
980 DATA 252,169,90,141,14,208
                        :rem 206
990 DATA 160,12,169,70,153,0
                        :rem 98
1000 DATA 208,173,27,212,240,2
    51                  :rem 24
1010 DATA 197,253,176,247,153,
    192                 :rem 99
1020 DATA 3,136,136,16,235,162
                        :rem 186
1030 DATA 0,189,139,192,157,0
                        :rem 146
1040 DATA 212,232,224,25,208,2
    45                  :rem 27
1050 DATA 169,0,141,59,199,141
                        :rem 201
1060 DATA 58,199,96,238,57,199
                        :rem 232
1070 DATA 173,57,199,141,22,21
    2                   :rem 247
1080 DATA 173,58,199,205,59,19
    9                   :rem 18
1090 DATA 176,6,206,59,199,76
                        :rem 170
1100 DATA 119,192,238,59,199,1
    73                  :rem 56
1110 DATA 59,199,41,63,24,105
                        :rem 148
1120 DATA 5,141,1,212,96,238
                        :rem 87
1130 DATA 58,199,96,206,58,199
                        :rem 226
1140 DATA 96,100,7,0,0,0
                        :rem 131
1150 DATA 36,0,100,7,0,0
                        :rem 126
1160 DATA 21,15,240,100,255,0
                        :rem 122
1170 DATA 0,129,36,0,0,0
                        :rem 132
1180 DATA 242,47,169,1,141,25
                        :rem 145
1190 DATA 208,32,93,192,169,7
                        :rem 159
1200 DATA 141,192,3,141,204,3
                        :rem 125
1210 DATA 169,250,141,18,208,1
    62                  :rem 35
1220 DATA 25,172,27,212,173,27
                        :rem 190
1230 DATA 212,41,15,240,249,15
    3                   :rem 234
1240 DATA 0,216,153,0,217,153
                        :rem 130
1250 DATA 0,218,153,200,218,20
    2                   :rem 227
1260 DATA 16,231,160,12,185,16
    7                   :rem 242
1270 DATA 2,56,249,192,3,170
                        :rem 99
1280 DATA 185,167,2,48,72,138
                        :rem 160
1290 DATA 16,70,165,252,57,156
                        :rem 205
1300 DATA 193,240,10,165,252,8
    9                   :rem 244
1310 DATA 156,193,133,252,138,
    208                 :rem 90
1320 DATA 53,165,252,25,156,19
    3                   :rem 249
1330 DATA 133,252,169,70,153,1
    67                   :rem 43
1340 DATA 2,173,27,212,240,251
                        :rem 183
1350 DATA 197,253,176,247,153,
    192                 :rem 106
1360 DATA 3,152,74,170,240,27
                        :rem 141
1370 DATA 201,6,240,23,173,27
                        :rem 137
1380 DATA 212,74,74,74,74,74
                        :rem 110
1390 DATA 74,240,245,24,105,25
    0                   :rem 242
1400 DATA 157,248,7,208,4,138
                        :rem 151
1410 DATA 153,167,2,136,136,16
                        :rem 192
1420 DATA 163,198,251,208,65,1
    69                   :rem 54
1430 DATA 7,133,251,165,254,20
    8                   :rem 245
1440 DATA 57,173,255,7,73,1
                        :rem 52
1450 DATA 141,255,7,173,0,220
                        :rem 136
1460 DATA 74,176,21,32,131,192
                        :rem 195
1470 DATA 173,182,2,201,51,144
                        :rem 188
1480 DATA 33,173,182,2,56,233
                        :rem 148
1490 DATA 30,141,182,2,208,22
                        :rem 136
1500 DATA 74,176,19,32,135,192
                        :rem 201
1510 DATA 173,182,2,201,210,17
    6                   :rem 233
1520 DATA 9,173,182,2,24,105
                         :rem 91
1530 DATA 30,141,182,2,165,252
                        :rem 186
1540 DATA 141,16,208,160,12,18
    5                   :rem 239
1550 DATA 167,2,153,0,208,136
                        :rem 142
1560 DATA 136,16,246,173,182,2
                        :rem 199
1570 DATA 141,15,208,173,13,22
    0                   :rem 236
1580 DATA 41,1,240,3,76,49
                        :rem 253
1590 DATA 234,76,188,254,1,1
                        :rem 105
1600 DATA 2,2,4,4,8,8 :rem 249
1610 DATA 16,16,32,32,64,64,25
    6                   :rem 243
```

Program 3: VIC-20 Space Dodger, Part 1

Version by Kevin Mykytyn, Editorial Programmer

Please refer to "COMPUTE!'s Guide to Typing In Programs" before entering this listing.

```
10 POKE56,28:CLR:PRINT"{CLR}
   {11 DOWN}{6 RIGHT}PLEASE WA
   IT{WHT}"             :rem 167
```


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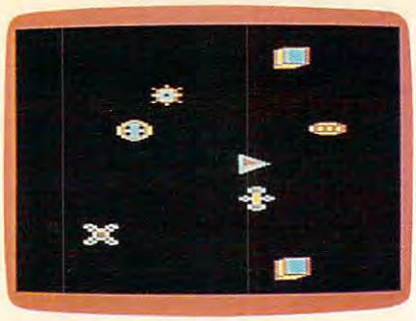

"Space Dodger" for the unexpanded VIC-20.

```
20 FORA=7432TO7673:READB:POKEA
   ,B:NEXT                    :rem 58
30 A$="LO"+CHR$(34)+"SD"+CHR$(
   34)+",8:"+CHR$(131)        :rem 81
35 FORA=1TOLEN(A$):POKE630+A,A
   SC(MID$(A$,A,1)):NEXT:POKE1
   98,A:END                   :rem 120
40 DATA 160,6,32,55,29,240,251
   ,197                       :rem 136
50 DATA 250,144,247,201,15,176
   ,243,153                   :rem 73
60 DATA 247,3,153,240,3,136,16
   ,234                       :rem 128
70 DATA 169,3,133,140,133,139,
   169,0                      :rem 184
80 DATA 133,191,120,169,68,141
   ,20,3                      :rem 180
90 DATA 169,29,141,21,3,88,96,
   165                        :rem 105
100 DATA 247,10,10,56,101,247,
    133,247                   :rem 12
110 DATA 96,76,230,29,169,1,14
    1,240                     :rem 185
120 DATA 3,141,246,3,162,7,202
    ,48                       :rem 73
130 DATA 240,222,240,3,208,248
    ,138,72                   :rem 20
140 DATA 189,247,3,157,240,3,1
    38,10                     :rem 184
150 DATA 168,185,236,29,133,25
    1,24,105                  :rem 82
160 DATA 22,133,253,185,237,29
    ,133,252                  :rem 79
170 DATA 105,0,133,254,162,21,
    160,0                     :rem 161
180 DATA 177,251,133,248,177,2
    53,133,249                :rem 194
190 DATA 136,200,200,177,251,2
    01,8,176                  :rem 70
200 DATA 2,169,32,133,174,177,
    253,201                   :rem 22
210 DATA 8,176,2,169,32,136,13
    3,175                     :rem 188
220 DATA 177,253,201,8,176,8,1
    65,175                    :rem 245
230 DATA 201,32,240,6,230,190,
    165,175                   :rem 15
240 DATA 145,253,177,251,201,8
    ,176,8                    :rem 240
250 DATA 165,174,201,32,240,6,
    230,190                   :rem 16
260 DATA 165,174,145,251,202,2
    08,194,104                :rem 177
270 DATA 170,200,165,248,145,2
    51,165,249                :rem 184
280 DATA 145,253,165,248,201,3
    2,240,19                  :rem 78
290 DATA 32,55,29,240,251,197,
    250,144                   :rem 34
300 DATA 247,201,12,176,243,15
    7,247,3                   :rem 24
310 DATA 157,240,3,76,78,29,32
    ,52                       :rem 91
320 DATA 3,76,191,234,22,30,88
    ,30                       :rem 81
330 DATA 154,30,220,30,30,31,9
    6,31                      :rem 114
340 DATA 162,31               :rem 218
```

Program 4: VIC-20 Space Dodger, Part 2

Version by Kevin Mykytyn, Editorial Programmer

Please refer to "COMPUTE!'s Guide to Typing In Programs" before entering this listing.

```
10 POKE37156,25               :rem 41
20 C=36869:GOSUB260:GOSUB630
                              :rem 151
30 POKEC,255:Q=130:POKE36878,6
   3:SC=0:L=200:RA=1:POKE250,5
                              :rem 53
40 GOSUB230                   :rem 121
50 POKE190,0:SYS7432          :rem 147
60 IFPEEK(190)THEN90          :rem 157
70 SC=SC+(6-PEEK(250))/3:IFSC>
   =LTHENGOSUB170:GOTO40
                              :rem 98
80 GOTO60                     :rem 7
90 SC=INT(SC)                 :rem 14
95 GOSUB200:GOSUB210:POKEC,240
   :SYS982:PRINT"{HOME}
   {6 DOWN}{WHT}"SPC(8-LEN(STR
   $(SC))/2)"SCORE:"SC        :rem 97
100 IFSC>HSTHENHS=SC          :rem 44
110 PRINT"{2 DOWN}"SPC(6-LEN(S
    TR$(HS))/2)"HIGH SCORE:"HS
                              :rem 110
120 PRINT"{4 DOWN}"SPC(8-LEN(P
    $(RA))/2)"RANK: "P$(RA)
                              :rem 47
130 PRINT"{2 DOWN}{2 SPACES}PR
    ESS LEFT TO PLAY":PRINT"
    {8 SPACES}RIGHT TO END"
                              :rem 27
140 IF(PEEK(37137)AND16)=0THEN
    GOSUB280:POKEC,255:GOTO30
                              :rem 42
150 POKE37154,127:IF(PEEK(3715
    2)AND128)=0THENSYS8:rem 98
160 POKE37154,255:GOTO140
                              :rem 154
170 L=L*4:RA=RA-1*(RA<>8):POKE
    250,PEEK(250)+(PEEK(250)>1
    ):GOSUB200:POKE36879,42:SY
    S982                      :rem 235
180 FORA=QTOQ+8:POKE36876,A:FO
    RJ=14TO0STEP-2:POKE36878,J
    :NEXT:NEXT:POKE36876,0
                              :rem 185
190 Q=Q-10*(Q<240):POKE36878,6
    3:RETURN                  :rem 205
200 POKE37150,127:SYS65418:POK
    E37150,130:RETURN         :rem 11
210 POKE36877,128:FORA=15TO0ST
    EP-.7:POKE36878,A         :rem 36
220 POKE36879,8:FORT=1TO50:NEX
    T:POKE36879,10:NEXT:POKE36
    877,0:RETURN              :rem 10
230 B=8:FORA=7722TO8096STEP66:
    POKEA,B:POKEA+1,B+1:POKEA+
    22,B+2:POKEA+23,B+3:B=B+4:
    NEXTA                     :rem 229
240 POKE7903,0:POKE7904,1:POKE
    7925,2:POKE7926,3         :rem 204
250 POKE8118,8:POKE8119,9:POKE
    8140,10:POKE8141,11:POKE36
    879,10:FORT=1TO2000:NEXT:R
    ETURN                     :rem 7
260 FORA=7168TO7431:READB:POKE
    A,B:NEXT:POKE36878,63
                              :rem 124
270 FORA=1TO8:READP$(A):NEXT
                              :rem 223
280 PRINT"{CLR}":FORA=38400TO3
    8905:POKEA,15:NEXT:RETURN
                              :rem 23
290 DATA0,0,0,5,26,85,102,102
                              :rem 169
300 DATA0,0,0,80,164,85,102,10
    2                         :rem 7
310 DATA102,85,26,5,0,0,0,0
                              :rem 63
320 DATA102,85,164,80,0,0,0,0
                              :rem 166
330 DATA0,0,0,5,26,85,153,153
                              :rem 176
340 DATA0,0,0,80,164,85,153,15
    3                         :rem 23
350 DATA153,85,26,5,0,0,0,0
                              :rem 73
360 DATA153,85,164,80,0,0,0,0
                              :rem 176
370 DATA0,1,6,26,85,127,127,12
    7                         :rem 34
380 DATA0,85,169,165,89,217,21
    7,217                     :rem 1
390 DATA127,127,127,127,127,12
    7,127,85                  :rem 141
400 DATA217,217,217,217,217,21
    7,212,80                  :rem 123
410 DATA0,112,216,156,54,39,13
    ,9                        :rem 78
420 DATA0,13,39,54,156,216,112
    ,96                       :rem 133
430 DATA9,13,39,54,156,216,112
    ,0                        :rem 80
440 DATA96,112,216,156,54,39,1
    3,0                       :rem 135
450 DATA3,13,13,13,3,2,50,222
                              :rem 166
460 DATA192,112,112,112,192,12
    8,140,183                 :rem 168
470 DATA222,50,2,3,13,13,13,3
                              :rem 168
480 DATA183,140,128,192,112,11
    2,112,192                 :rem 170
490 DATA0,0,0,0,0,3,14,63
                              :rem 220
500 DATA0,3,15,59,235,175,247,
    87                        :rem 93
510 DATA13,3,0,0,0,0,0,0
                              :rem 155
520 DATA87,87,215,55,15,3,0,0
                              :rem 190
530 DATA2,9,39,39,147,147,159,
    159                       :rem 159
540 DATA128,96,216,216,198,198
    ,246,246                  :rem 159
550 DATA147,147,39,39,9,2,0,0
                              :rem 195
560 DATA198,198,216,216,96,128
    ,0,0                      :rem 201
570 DATA0,0,17,6,6,7,27,27
                              :rem 39
580 DATA64,64,81,228,228,180,5
    7,57                      :rem 209
590 DATA7,6,6,17,0,0,0,0
                              :rem 183
600 DATA180,228,228,81,64,64,0
    ,0                        :rem 82
610 DATA 0,0,0,0,0,0,0,0
                              :rem 101
620 DATA CADET,CORPORAL,SERGEA
    NT,CAPTAIN,MAJOR,COLONEL,G
    ENERAL,MASTER             :rem 81
```


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```
630 FORA=820TO995:READB:POKEA,
    B:NEXT:POKEC,255:RETURN
                          :rem 153
650 DATA 198,139,208,43,165,19
    1,73,4                :rem 254
660 DATA 133,191,169,5,133,139
    ,173,17               :rem 40
670 DATA 145,74,74,74,176,11,1
    65,140                :rem 247
680 DATA 240,21,32,105,3,198,1
    40,16                 :rem 177
690 DATA 14,74,176,11,165,140,
    201,6                 :rem 183
700 DATA 240,5,32,105,3,230,14
    0,165                 :rem 164
710 DATA 140,32,138,3,96,32,12
    5,3                   :rem 78
720 DATA 169,32,160,3,145,251,
    200,145               :rem 20
730 DATA 251,160,25,145,251,20
    0,145,251             :rem 116
740 DATA 96,10,170,189,236,29,
    133,251               :rem 40
750 DATA 189,237,29,133,252,96
    ,32,125               :rem 47
760 DATA 3,32,176,3,166,191,16
    0,3                   :rem 86
770 DATA 189,206,3,145,251,200
    ,232,189              :rem 86
780 DATA 206,3,145,251,160,25,
    232,189               :rem 33
790 DATA 206,3,145,251,200,232
    ,189,206              :rem 78
800 DATA 3,145,251,96,160,3,32
    ,195                  :rem 136
810 DATA 3,200,32,195,3,160,25
    ,32                   :rem 70
820 DATA 195,3,200,32,195,3,96
    ,177                  :rem 145
830 DATA 251,41,31,201,8,144,2
    ,230                  :rem 117
840 DATA 190,96,0,1,2,3,4,5
                          :rem 34
850 DATA 6,7,160,0,169,32,153,
    0                     :rem 237
860 DATA 30,153,0,31,136,208,2
    47,96                 :rem 188
```

Program 5: Apple Space Dodger/Machine Language

Version by Rob Terrell and Tim Victor, Editorial Programmers

```
7000- 4C 14 70 00 21 2E 00 02
7008- 40 40 00 41 00 00 3A 37
7010- 44 03 37 20 20 80 76 A9
7018- 20 8D 42 80 A9 40 8D 43
7020- 80 AD 57 C0 A9 03 8D 11
7028- 70 A9 00 8D 0C 70 8D 0B
7030- 70 A9 03 8D 12 70 A9 05
7038- 8D 13 70 A9 80 8D 0E 70
7040- A9 00 8D 40 80 8D 41 80
7048- 20 C7 71 20 D0 70 20 6A
7050- 70 20 BB 70 20 91 71 B0
7058- E7 20 1B 71 20 E0 75 20
7060- 32 71 20 5D 71 90 E7 4C
7068- F8 71 A2 00 20 1E FB 98
7070- 4A 4A 4A 4A 4A 8D 08
7078- 70 CD 09 70 F0 12 20 A7
7080- 72 8D 09 70 C9 01 F0 08
7088- C9 02 F0 04 90 03 B0 16
7090- 60 A9 00 CD 07 70 D0 01
7098- 60 CE 07 70 AC 07 70 B9
70A0- 77 71 8D 05 70 60 A9 05
70A8- CD 07 70 D0 01 60 EE 07
70B0- 70 AC 07 70 B9 77 71 8D
70B8- 05 70 60 A0 05 38 B9 83
70C0- 71 F9 7D 71 B0 03 20 DF
70C8- 70 99 83 71 88 10 EE 60
70D0- AE 0E 70 A0 05 20 EA 70
70D8- 99 83 71 88 10 F7 60 AE
70E0- 0D 70 E8 D0 02 8A 60 20
70E8- 95 72 8E 0D 70 C0 05 F0
70F0- 21 C0 00 F0 1D AD 0A 70
70F8- 0A 0A 38 6D 0A 70 8D 0A
7100- 70 D0 03 AD 12 70 CD 12
7108- 70 F0 0A 90 08 ED 12 70
7110- B0 F4 AD 13 70 99 7D 71
7118- A9 80 60 AD 43 80 AC 42
7120- 80 8D 42 80 8C 43 80 29
7128- 20 F0 02 A9 01 AA BD 54
7130- C0 60 A0 05 8C 06 70 B9
7138- 77 71 8D 86 74 B9 83 71
7140- 8D 85 74 F0 04 B9 89 71
7148- 2C A9 54 8D 83 74 A9 60
7150- 8D 84 74 20 80 74 AC 06
7158- 70 88 10 D8 60 A9 00 8D
7160- 83 74 A9 60 8D 84 74 AD
7168- 04 70 8D 85 74 AD 05 70
7170- 8D 86 74 20 80 74 60 07
7178- 14 21 30 3B 48 00 03 0A
7180- 05 08 00 80 80 80 80 80
7188- 80 38 0E 1C 2A 0E 38 18
7190- 60 A0 05 B9 83 71 D0 F7
7198- 88 10 F8 AC 0C 70 C0 04
71A0- F0 23 C8 8C 0C 70 AD 12
71A8- 70 4A 6D 12 70 8D 12 70
71B0- AD 13 70 4A 6D 13 70 8D
71B8- 13 70 4E 0E 70 A9 00 8D
71C0- 0B 70 20 B0 72 38 60 AD
71C8- 50 C0 AD 52 C0 AD 42 80
71D0- C9 20 D0 0D 20 EE 71 AD
71D8- 54 C0 20 F3 71 AD 55 C0
71E0- 60 20 F3 71 AD 55 C0 20
71E8- EE 71 AD 54 C0 60 A9 20
71F0- 4C EA F3 A9 40 4C EA F3
71F8- A9 2C 8D FD 74 20 E0 75
7200- 20 32 71 AD 05 70 8D 86
7208- 74 AD 04 70 8D 85 74 A9
7210- 46 8D 83 74 A9 60 8D 84
7218- 74 20 80 74 20 1B 71 A9
7220- 4C 8D FD 74 AD 0D 70 38
7228- ED 0E 70 18 6D 0B 70 8D
7230- 0B 70 CE 11 70 F0 03 4C
7238- 40 70 20 58 FC 20 1F 73
7240- AD 10 C0 AD 00 C0 10 FB
7248- AD 10 C0 29 5F C9 4E F0
7250- 03 4C 24 70 6C FC FF AC
7258- 0C 70 B9 6A 72 A8 B9 6F
7260- 72 F0 06 20 ED FD C8 D0
7268- F5 60 00 06 0C 15 1D C3
7270- C1 C4 C5 D4 00 CD C1 CA
7278- CF D2 00 C3 CF D2 D0 CF
7280- D2 C1 CC 00 C3 C1 D0 D4
7288- C1 C9 CE 00 D3 C5 D2 C7
7290- C5 C1 CE D4 00 2C 30 C0
7298- 8E 06 70 A2 10 CA D0 FD
72A0- 2C 30 C0 AE 06 70 60 A0
72A8- 20 2C 30 C0 88 D0 FA 60
72B0- AD 51 C0 AD 54 C0 20 58
72B8- FC A9 05 85 24 A9 06 85
72C0- 25 20 22 FC A9 73 A0 B2
72C8- 20 9E 73 A9 05 85 24 A9
72D0- 73 A0 CF 20 9E 73 A9 08
72D8- 85 24 A9 73 A0 EA 20 9E
72E0- 73 20 57 72 A9 8D 20 ED
72E8- FD 20 ED FD A9 08 85 24
72F0- A9 73 A0 F7 20 9E 73 A9
72F8- F8 A8 8D 0F 70 8D 10 70
7300- EE 0F 70 D0 FB EE 10 70
7308- D0 F6 C8 D0 F3 60 AD 43
7310- 80 29 40 F0 02 A9 01 A8
7318- B9 54 C0 AD 50 C0 60 AD
7320- 51 C0 AD 54 C0 A9 06 85
7328- 25 20 22 FC A9 0C 85 24
7330- A9 74 A0 08 20 9E 73 A9
7338- 07 85 24 A9 74 A0 14 20
7340- 9E 73 20 57 72 A9 8D 20
7348- ED FD A9 07 85 24 A9 74
7350- A0 22 20 9E 73 AD 0C 70
7358- 18 69 B0 20 ED FD AD 0B
```

The Apple version of "Space Dodger" is written entirely in machine language and has routines to simulate sprite graphics in software.

```
7360- 70 A2 03 A0 00 DD 9A 73
7368- 90 06 FD 9A 73 C8 B0 F5
7370- 48 98 18 69 B0 20 ED FD
7378- 68 CA D0 E7 A9 8D 20 ED
7380- FD 20 ED FD A9 07 85 24
7388- A9 74 A0 31 20 9E 73 A9
7390- 05 85 24 A9 74 A0 47 20
7398- 9E 73 60 01 0A 64 8D A8
73A0- 73 8C A7 73 A0 00 B9 00
73A8- 00 F0 06 20 ED FD C8 D0
73B0- F5 60 CD C5 D3 D3 C1 C7
73B8- C5 A0 C6 D2 CF CD A0 C8
73C0- C5 C1 C4 D1 D5 C1 D2 D4
73C8- C5 D2 D3 BA 8D 8D 00 D9
73D0- CF D5 A0 C8 C1 D6 C5 A0
73D8- C2 C5 C5 CE A0 D0 D2 CF
73E0- CD CF D4 C5 C4 A0 D4 CF
73E8- 8D 00 D4 C8 C5 A0 D2 C1
73F0- CE CB A0 CF C6 A0 00 C3
73F8- CF CE C7 D2 C1 D4 D5 CC
7400- C1 D4 C9 CF CE D3 A1 00
7408- C7 C1 CD C5 A0 CF D6 C5
7410- D2 8D 8D 00 D9 CF D5 D2
7418- A0 D2 C1 CE CB A0 C9 D3
7420- A0 00 D9 CF D5 D2 A0 D3
7428- C3 CF D2 C5 A0 C9 D3 A0
7430- 00 D0 D2 C5 D3 D3 A0 CE
7438- A0 D4 CF A0 D1 D5 C9 D4
7440- AC A0 C1 CE D9 8D 00 CF
7448- D4 C8 C5 D2 A0 CB C5 D9
7450- A0 D4 CF A0 D0 CC C1 D9
7458- A0 C1 C7 C1 C9 CE 00 D9
7460- A0 C1 C7 C1 A0 A0 00 FF
7468- B7 FF 00 FF 00 FF 00 FF
7470- 00 FF 00 FF 00 FF 00 FF
7478- 00 FF 00 FF 00 FF 00 FF
7480- 4C 8C 74 20 50 50 20 20
7488- 20 20 55 20 A9 70 8D 8B
7490- 74 A9 00 8D 89 74 AD 85
7498- 74 CD 8B 74 90 04 ED 8B
74A0- 74 38 2E 89 74 4E 8B 74
74A8- 90 EF C9 04 90 02 69 FB
74B0- 2A 8D 8A 74 4A 2E 89 74
74B8- AD 87 74 0A AD 86 74 2A
74C0- 8D 88 74 85 A1 AD 83 74
74C8- 85 F8 AD 84 74 85 F9 AD
74D0- 8A 74 0A A8 B1 F8 85 9F
74D8- 18 69 02 85 FC C8 B1 F8
74E0- 85 A0 85 FD 90 02 E6 FD
74E8- 20 BB 75 20 55 75 A4 9E
74F0- B1 FE 11 FC 48 51 FE 09
74F8- 80 D1 FC F0 03 4C D5 75
7500- 68 91 FE 88 10 EA 18 A0
7508- 01 B1 9F 65 FC 85 FC 90
7510- 02 E6 FD E6 A1 C6 9D D0
7518- D2 A9 80 85 FF A9 00 2C
7520- 42 80 50 02 A9 20 85 FE
7528- 2C 42 80 50 08 AD 41 80
7530- EE 41 80 10 06 AD 40 80
7538- EE 40 80 0A 0A A8 A5 9F
7540- 91 FE C8 A5 A0 91 FE C8
```


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```
7548- AD 88 74 91 FE C8 AD 89
7550- 74 91 FE 18 60 A5 A1 29
7558- 3F A8 B9 7B 75 0D 42 80
7560- 85 FF A9 08 25 A1 F0 02
7568- A9 80 18 24 A1 10 02 69
7570- 50 50 02 69 28 6D 89 74
7578- 85 FE 60 00 04 08 0C 10
7580- 14 18 1C 00 04 08 0C 10
7588- 14 18 1C 01 05 09 0D 11
7590- 15 19 1D 01 05 09 0D 11
7598- 15 19 1D 02 06 0A 0E 12
75A0- 16 1A 1E 02 06 0A 0E 12
75A8- 16 1A 1E 03 07 0B 0F 13
75B0- 17 1B 1F 03 07 0B 0F 13
75B8- 17 1B 1F A0 00 B1 9F 85
75C0- 9D C8 B1 9F 38 E9 01 85
75C8- 9E A9 27 ED 89 74 C5 9E
75D0- B0 02 85 9E 60 68 38 60
75D8- 00 FF 00 FF 00 FF 00 FF
75E0- 4C E5 75 20 20 A9 00 8D
75E8- E4 75 A9 80 85 F9 A9 00
75F0- 2C 42 80 50 02 A9 20 85
75F8- F8 2C 42 80 50 05 AD 41
7600- 80 10 03 AD 40 80 8D E3
7608- 75 AD E3 75 D0 03 4C 66
7610- 76 AC E4 75 B1 F8 85 9F
7618- 18 69 02 85 FC C8 B1 F8
7620- 85 A0 85 FD 90 02 E6 FD
7628- C8 B1 F8 8D 88 74 85 A1
7630- C8 B1 F8 8D 89 74 C8 8C
7638- E4 75 20 BB 75 20 55 75
7640- A4 9E B1 FC 49 FF 31 FE
7648- 91 FE 88 10 F5 18 A0 01
7650- B1 9F 65 FC 85 FC 90 02
7658- E6 FD E6 A1 C6 9D D0 DD
7660- CE E3 75 4C 09 76 A9 00
7668- 2C 42 80 50 04 8D 41 80
7670- 60 8D 40 80 60 FF 00 FF
7678- 00 FF 00 FF 00 FF 00 FF
7680- 4C 87 76 00 00 00 00 A9
7688- 07 8D 86 76 A9 00 85 FE
7690- A9 60 85 FF A9 FC 85 FC
7698- A9 60 85 FD A9 40 85 F8
76A0- A9 77 85 F9 A0 00 A5 FC
76A8- 91 FE E6 FE A5 FD 91 FE
76B0- E6 FE B1 F8 91 FC 8D 83
76B8- 76 C8 B1 F8 91 FC 8D 84
76C0- 76 C8 AE 84 76 B1 F8 91
76C8- FC C8 CA D0 F8 CE 83 76
76D0- D0 F0 18 98 65 F8 85 F8
76D8- 90 02 E6 F9 A9 06 8D 85
76E0- 76 18 A5 FC 85 FA 98 65
76E8- FC 85 FC A5 FD 85 FB 90
76F0- 02 E6 FD A0 00 A5 FC 91
76F8- FE E6 FE A5 FD 91 FE E6
7700- FE B1 FA 91 FC 8D 83 76
7708- C8 B1 FA 91 FC 8D 84 76
7710- C8 AE 84 76 18 B1 FA 2A
7718- 30 03 18 09 80 91 FC C8
7720- CA D0 F2 CE 83 76 D0 E9
7728- CE 85 76 D0 B4 CE 86 76
7730- F0 0D 18 98 65 FC 85 FC
7738- 90 02 E6 FD 4C A4 76 60
7740- 0B 04 80 88 80 80 80 AA
7748- 80 80 C0 AA 81 80 D0 AA
7750- 85 80 D4 AA 95 80 FE FF
7758- BF 80 A8 D5 8A 80 FE FF
7760- BF 80 D0 AA 85 80 D0 AA
7768- 85 80 80 AA 80 80 15 03
7770- C0 81 80 F0 87 80 98 8C
7778- 80 CC 99 80 CC 99 80 98
7780- 8C 80 F0 87 80 C0 81 80
7788- C0 81 80 C0 81 80 FE 8F
7790- 80 F8 BF 80 C0 81 80 C0
7798- 81 80 F0 87 80 98 8C 80
77A0- CC 99 80 CC 99 80 98 8C
77A8- 80 F0 87 80 C0 81 80 0D
77B0- 04 C0 BF 80 80 E0 FF 80
77B8- 80 B0 D5 81 80 B8 D5 83
77C0- 80 AC D5 86 80 FE FF 87
77C8- 80 D6 AA 87 80 FE FF 87
77D0- 80 AE D5 86 80 AC D5 83
77D8- 80 B8 D5 81 80 F0 FF 80
77E0- 80 E0 BF 80 80 0B 05 80
77E8- 80 80 90 80 80 80 80 95
77F0- 80 80 FF 83 84 80 C0 AA
77F8- AD 91 80 A0 D5 88 84 80
7800- 9E 80 AC 81 80 A0 D5 88
7808- 94 80 C0 AA AD 81 80 80
7810- FF 83 95 80 80 80 80 84
7818- 80 80 80 80 90 80 08 03
7820- F0 9F 80 98 9C 80 8C 9E
7828- 80 FE 99 80 C6 99 80 C6
7830- 8D 80 C6 87 80 FE 81 80
7838- 14 04 80 90 80 80 88 95
7840- 82 80 A8 D5 8A 80 E8 DD
7848- AB 80 A8 F7 AE 80 EA DD
7850- AB 80 BA F7 AE 81 EA FD
7858- BB 81 EA FF AE 81 E8 DD
7860- AB 80 A8 FF AF 81 EA DF
7868- BB 81 BA FF AF 81 EA FD
7870- BB 81 E8 FF AF 81 EA DF
7878- AB 80 BA F7 AE 80 EA DD
7880- AB 80 AA D5 8A 80 A8 D5
7888- 82 80 0A 03 80 80 80 80
7890- 80 80 80 80 80 80 80 80
7898- 80 80 80 80 80 80 80 80
78A0- 80 80 80 80 80 80 80 80
78A8- 80 80
```

Program 6: Apple Space Dodger/Checksum

Tim Victor, Editorial Programmer

```
5 PRINT "CHECK THESE BLOCKS:";
10 FOR I = 30890 TO 30911: POKE
   I,0: NEXT
20 FOR I = 0 TO 33:S = 0
25 PRINT ".";
30 FOR J = 0 TO 63:S = S + PEEK
   (28672 + I * 64 + J): NEXT
40 READ A:S = S - 256 * INT (S
   / 256)
45 AD = 28672 + I * 64: GOSUB 1
   00:A1$ = H$
48 AD = 28672 + I * 64 + 63: GO
   SUB 100:A2$ = H$
50 IF A < > S THEN PRINT : PRIN
   T "$";A1$;" TO $";A2$;
60 NEXT : END
100 H$ = "": FOR K = 0 TO 3:X =
     INT (AD / 16):H$ = MID$
    ("0123456789ABCDEF",AD - X
    * 16 + 1,1) + H$:AD = X: NE
    XT : RETURN
200 DATA 61,59,2,73,94,233,194,
    30
201 DATA 0,88,77,25,18,178,47,1
    55
202 DATA 222,145,106,92,219,136
    ,45,196
203 DATA 74,170,132,67,182,187,
    210,35
204 DATA 113,220
```

Program 7: Atari Space Dodger

Version by Kevin Mykytyn, Editorial Programmer

Please refer to "COMPUTE!'s Guide to Typing In Programs" before entering this listing.

```
PG 10 PRINT "{CLEAR}":GOSUB
      550:GOSUB 530:GOSUB 46
      0:GOSUB 210
IJ 20 SC=0:L=200:LV=1:POKE 7
      04,56:POKE 705,200:POK
      E 706,132:POKE 204,4
HL 30 POKE 1780,0:POKE 1779,
      1:A=USR(15360):POKE 53
      278,0:IF R=0 THEN R=1:
      GOTO 50
LC 40 POKE 559,P
KL 50 IF PEEK(53260)<>0 THEN
       80
EO 60 SC=SC+(PEEK(204)-3)/2:
      IF SC>=L THEN GOSUB 20
      0:R=0:GOTO 30
AF 70 GOTO 50
JM 80 POKE 1780,16:FOR A=15
      TO 0 STEP -1:SOUND 1,1
      40,8,A:FOR T=1 TO 20:N
      EXT T:NEXT A:FOR A=704
       TO 707:POKE A,0:NEXT
      A
MF 90 R=1:P=PEEK(559):A=USR(
      15759):GRAPHICS 0:POKE
      752,1:SETCOLOR 2,0,0
JM 100 POSITION 14,7:PRINT "
      SCORE: ";INT(SC)
CN 110 IF SC>HS THEN HS=SC
OL 120 POSITION 12,10:PRINT
      "HIGH SCORE: ";INT(HS
      )
NH 130 RESTORE 140:FOR A=1 T
      O LV:READ A$:NEXT A
LK 140 DATA SPACE CADET,CORP
      ORAL,SERGEANT,CAPTAIN
      ,MAJOR,COLONEL,GENERA
      L,MASTER
IJ 150 POSITION (16-LEN(A$)/
      2),15:PRINT "RANK: ";
      A$
JE 160 POSITION 3,18:PRINT "
      PRESS LEFT TO PLAY, R
      IGHT TO END"
LB 170 IF PEEK(632)=7 THEN A
      =USR(58484)
NM 180 IF PEEK(632)=11 THEN
      GRAPHICS 0:POKE 559,0
      :POKE 756,4:GOSUB 490
      :GOSUB 290:GOTO 20
GL 190 GOTO 170
DD 200 L=L*4:POKE 204,PEEK(2
      04)+1:A=USR(15759):SE
      TCOLOR 4,3,8:LV=LV+1:
      RETURN
FP 210 REM READ P/M
IP 220 Q=PEEK(106)-8:POKE 54
      279,Q:PMBASE=256*Q+51
      2
OH 230 MB=PMBASE-128:PMBASE4
      =PMBASE+384:POKE 206,
      INT(PMBASE4/256):POKE
       205,PMBASE4-INT(PMBA
      SE4/256)*256
GK 240 POKE 208,INT(MB/256):
      POKE 207,MB-INT(MB/25
      6)*256
JJ 250 FOR A=PMBASE TO PMBAS
      E+384:POKE A,0:NEXT A
BA 260 RESTORE 320:FOR A=0 T
      O 95:READ B:POKE PMBA
      SE+A+16,B:NEXT A
FA 270 FOR A=0 TO 95:READ B:
      POKE PMBASE+144+A,B:N
      EXT A
FF 280 FOR A=0 TO 95:READ B:
      POKE PMBASE+272+A,B:N
      EXT A:POKE 53260,85
NE 290 FOR A=53256 TO 53259:
      POKE A,1:NEXT A:POKE
      54279,Q:POKE 559,46:P
      OKE 53277,3
JK 300 POKE 623,33:POKE 5325
      1,50:POKE 53252,50:PO
      KE 53253,54:POKE 5325
      4,58:POKE 53255,62:PO
      KE 707,30:RETURN
```


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Atari "Space Dodger" uses such programming tricks as multicolor players, display list interrupts, and vertical blank interrupts to create arcade-style graphics and action.

```
CA 310  REM RED PLAYER
CF 320  DATA 0,0,28,2,2,2,0,0
        ,0,0,24,0,0,0,24,0,0,
        66,36,24,24,36,66,0
PC 330  DATA 0,60,66,195,195,
        195,66,60,0,0,0,84,0,
        0,0,0,0,56,68,82,72,7
        2,48,0
LE 340  DATA 0,36,66,36,36,36
        ,66,36,0,0,0,64,224,6
        4,0,0,0,56,68,130,130
        ,130,68,56
MK 350  DATA 0,66,36,24,24,36
        ,66,0,0,0,24,24,24,24
        ,24,0,0,0,28,2,2,2,0,
        0
LL 360  REM GREEN PLAYER
ED 370  DATA 0,0,0,0,56,56,56
        ,0,0,24,36,24,24,24,3
        6,24,0,36,66,0,0,66,3
        6,0
GN 380  DATA 0,0,24,24,24,24,
        24,0,0,0,0,42,0,0,0,0
        ,0,0,0,0,0,0,0,0,0
IJ 390  DATA 0,24,36,24,24,24
        ,36,24,0,0,0,4,14,4,0
        ,0,0,0,0,16,40,16,0,0
FI 400  DATA 0,36,66,0,0,66,3
        6,0,0,0,36,102,102,10
        2,36,0,0,0,0,0,56,56,
        56,0
GD 410  REM BLUE PLAYER
PC 420  DATA 0,31,35,125,69,6
        9,70,124,0,0,0,0,0,0,
        0,0,0,0,24,36,36,24,0
        ,0
GJ 430  DATA 0,0,36,36,36,36,
        36,0,0,1,127,129,127,
        1,0,0,0,0,56,36,50,48
        ,0,0
HG 440  DATA 0,0,24,0,0,0,24,
        0,0,16,56,0,0,0,56,16
        ,0,0,0,0,0,0,0,0,0
BN 450  DATA 0,0,24,36,36,24,
        0,0,0,60,66,129,129,1
        29,66,60,0,31,35,125,
        69,69,70,124
DJ 460  REM DRAW STARS
PL 470  DIM B(4):FOR A=1 TO 3
        :B(A)=A:NEXT A:B(4)=1
        31
BC 480  POKE 756,4:FOR A=1024
         TO 1536:POKE A,0:NEX
        T A:POKE 1032,1:POKE
        1040,2:POKE 1048,3
II 490  DL=PEEK(560)+256*PEEK
        (561)+6:FOR A=DL TO D
        L+22:POKE A,4:NEXT A:
        POKE DL-3,68
NA 500  FOR A=DL TO DL+22 STE
        P 2:POKE A,PEEK(A)+12
        8*(PEEK(A)<128):NEXT
        A
HK 510  SCR=PEEK(88)+PEEK(89)
        *256
NH 520  FOR A=1 TO 50:POKE SC
        R+959*RND(1),B(INT(RN
        D(1)*4+1)):NEXT A:RET
        URN
NL 530  SOUND 0,0,0,0:POKE 53
        761,168:POKE 53763,16
        8
KF 540  DIM A$(20):RETURN
OJ 550  POKE 752,1:PRINT "
        {CLEAR}":POSITION 14,
        12:PRINT "PLEASE WAIT
        "
AN 560  A=15360:RESTORE 610
KM 570  READ B:IF B=256 THEN
        590
NJ 580  POKE A,B:A=A+1:CH=CH+
        B:GOTO 570
JD 590  IF CH=50486 THEN PRIN
        T "{CLEAR}":RETURN
LD 600  PRINT "ERROR IN DATA"
        :END
BI 610  DATA 104,169,004,141,
        240,006
CH 620  DATA 169,006,141,241,
        006,169
BI 630  DATA 074,141,000,002,
        169,060
BM 640  DATA 141,001,002,169,
        255,133
BK 650  DATA 203,160,011,169,
        200,153
AP 660  DATA 110,060,173,010,
        210,240
DG 670  DATA 251,197,204,176,
        247,153
CN 680  DATA 159,061,136,016,
        236,160
CF 690  DATA 122,162,060,169,
        007,032
BJ 700  DATA 092,228,173,011,
        212,201
CN 710  DATA 130,208,249,169,
        192,141
CE 720  DATA 014,212,169,180,
        141,246
CM 730  DATA 006,096,216,072,
        138,072
BC 740  DATA 230,203,165,203,
        201,012
BM 750  DATA 208,004,169,000,
        133,203
BM 760  DATA 170,189,110,060,
        141,010
BA 770  DATA 212,141,000,208,
        141,001
BO 780  DATA 208,141,002,208,
        104,170
BD 790  DATA 104,064,020,030,
        040,050
AP 800  DATA 060,070,080,090,
        100,110
BF 810  DATA 120,130,216,206,
        242,006
CF 820  DATA 208,016,169,024,
        141,242
BB 830  DATA 006,162,002,173,
        010,210
CJ 840  DATA 157,196,002,202,
        016,247
DD 850  DATA 206,246,006,208,
        066,169
BN 860  DATA 001,141,246,006,
        169,000
BM 870  DATA 141,200,002,169,
        007,141
CJ 880  DATA 169,061,141,170,
        061,160
CJ 890  DATA 011,185,110,060,
        056,249
BO 900  DATA 159,061,201,240,
        144,025
CC 910  DATA 169,240,153,110,
        060,173
BO 920  DATA 010,210,074,056,
        229,204
BG 930  DATA 016,252,024,101,
        204,240
DB 940  DATA 242,153,159,061,
        076,208
BM 950  DATA 060,153,110,060,
        136,016
CM 960  DATA 214,169,000,133,
        077,173
CC 970  DATA 243,006,240,007,
        169,000
CF 980  DATA 141,243,006,240,
        038,206
CF 990  DATA 240,006,208,120,
        169,004
EE 1000 DATA 141,240,006,173
        ,244,006
DL 1010 DATA 208,033,173,120
        ,002,201
EL 1020 DATA 015,240,075,074
        ,176,010
EN 1030 DATA 173,241,006,240
        ,067,206
EM 1040 DATA 241,006,016,013
        ,074,176
EH 1050 DATA 059,173,241,006
        ,201,011
EL 1060 DATA 240,052,238,241
        ,006,160
FD 1070 DATA 127,169,000,145
        ,205,145
FJ 1080 DATA 207,136,016,249
        ,172,241
GM 1090 DATA 006,185,099,061
        ,168,169
EH 1100 DATA 007,024,109,244
        ,006,170
FJ 1110 DATA 169,007,141,245
        ,006,189
FC 1120 DATA 111,061,145,205
        ,189,119
ED 1130 DATA 061,145,207,200
        ,202,206
FI 1140 DATA 245,006,016,239
        ,048,028
FL 1150 DATA 172,241,006,185
        ,099,061
EG 1160 DATA 024,105,003,168
        ,162,001
FM 1170 DATA 177,205,073,255
        ,145,205
GB 1180 DATA 177,207,073,255
        ,145,207
FC 1190 DATA 200,202,016,240
        ,076,098
EH 1200 DATA 228,016,024,032
        ,040,048
FP 1210 DATA 056,064,072,080
        ,088,096
EK 1220 DATA 104,060,066,255
        ,051,051
EA 1230 DATA 255,066,060,000
        ,060,000
DF 1240 DATA 204,204,000,060
        ,000,024
FP 1250 DATA 036,066,154,162
        ,098,017
DM 1260 DATA 014,000,024,060
        ,100,092
EM 1270 DATA 028,014,000,104
        ,160,098
FN 1280 DATA 162,228,169,007
        ,032,092
FI 1290 DATA 228,169,064,141
        ,014,212
EG 1300 DATA 096,256
```

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Relax
Stress Reduction System

Arthur Leyenberger

Requirements: Commodore 64 (disk or cassette); Atari computer with at least 48K RAM (disk or cassette); Apple II-series computer with at least 48K RAM and a disk drive; IBM PC with at least 64K RAM, a disk drive, color/graphics adapter, game controller adapter, and color monitor; or an Enhanced Model IBM PCjr.

Relax is an interesting and unusual product for personal computers—it combines biofeedback and computer-generated graphics to help you learn how to reduce stress. It's the first in a new line of products from Synapse designed to use the capabilities of your computer to help monitor and improve your health.

Relax lets you monitor your stress levels by graphically depicting muscle tension on your computer screen. Tiny sensors inside a headband continuously measure this tension. The headband connects to a control unit that converts the readings into signals the computer can understand. This biofeedback technique is known as an electromyogram (EMG) because it measures the electrical activity in muscles.

When you're tense, electrical activity increases. When you relax, it decreases. The control unit lets you vary the rate at which readings are taken. For example, a fast sample rate is supposed to reveal your unconscious reactions to stressful stimuli. A slow rate gives a more general index of reactions. In either case, the results are seen immediately on the screen.

Solid Documentation

Relax comes with a workbook and manual to help you understand and interpret your reactions to stress. The workbook includes documentation on the *Relax* system and forms for producing your stress profile. This profile helps you set up a plan to reduce stress and evaluate your progress. The documentation and tutorial were written by Dr. Martha Davis, a clinical psychologist at the Kaiser Foundation in Los Angeles. She runs stress reduction classes and has written several books on the topic.

There's also an audio tape that teaches you deep relaxation exercises and meditation techniques. The tape guides you through *Relax*'s three tension-relaxation programs and lists some hidden causes of stress. A calm, reassuring voice insures that you are comfortably relaxed during your training session. Just thinking of the narrator's voice can have a calming effect later.

Relax also has some entertaining games for measuring your ability to control stress. One game is a kaleidoscope of colors and patterns against a background of soothing music. As you relax, the patterns and colors change, blending together into a more harmonious image. Subdued colors like blue and green fill the screen and rounded shapes emerge. Occasionally the screen divides and each half moves away vertically, above and below the centerline. Then a new pattern forms at the center of the screen. The sensation is almost hypnotic.

When you're tense, the kaleidoscope shows bright colors like red and orange. Instead of rounded shapes and patterns, the screen fills with straight lines and sharp-cornered figures. New patterns form at the top and bottom of the screen and move to the center.

The kaleidoscope is designed to let you get in touch with your body and the way it feels at various levels of tension and relaxation. By learning to recognize your states of stress, hopefully you can transfer that awareness to everyday life.

Subliminal Messages

A second game offers the greatest challenge to your stress control. On the screen, a balloon drifts over the countryside. You control it by tensing and relaxing your body. As you relax, the balloon floats higher. You earn points by touching clouds and avoiding flying arrows. You gain more points for subtle changes in your tension level than for gross changes. This enhances your ability to recognize and control body stress cues.

Relax also allows you to program subliminal messages to reinforce your relaxation responses and attain your objectives. The messages are briefly flashed on the screen during the graph program and can be "seen" only by your subconscious mind. Although the effectiveness of subliminal messages has been debated for years, some people maintain that they really work. Typical messages might be: "Relax" to lower your stress level; "Clean Air" to help you quit smoking; and "Think Thin" to help you lose weight.

Relax is an original product for personal computers. However, like any other self-help device, computerized or not, you must spend time learning how to monitor your own behavior. Then you can apply the techniques for change. The goal of *Relax* is not just to monitor but to teach you how to reduce stress.

Synapse is already discussing enhancements and new features for *Relax*. One idea is to provide body sensors in addition to the headband. These sensors could be placed anywhere to measure electrical signals from various muscles.

Another application for the *Relax* system is to use it as a general-purpose input device. For example, *Chicken*, a previously released Synapse game for Atari computers, can be played using the *Relax* headband instead of the paddle controllers. Other games that require paddle inputs could also be played by subtly controlling your stress level. If the game requires you to press a fire button, you could attach both the *Relax* headband and a joystick with a Y-connector.

Relax may signal a new era in home computing. For the first time, your computer can potentially be used to better your health.

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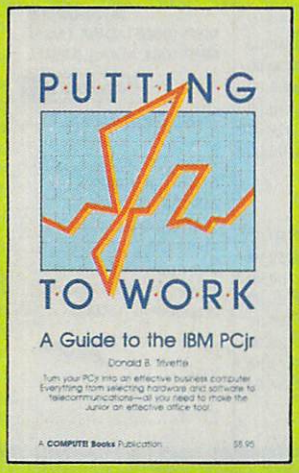

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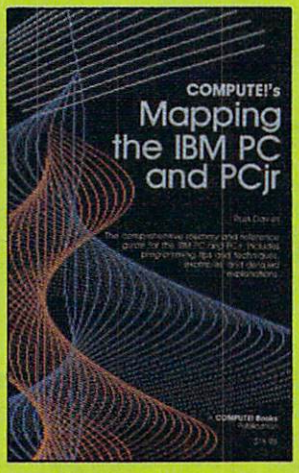

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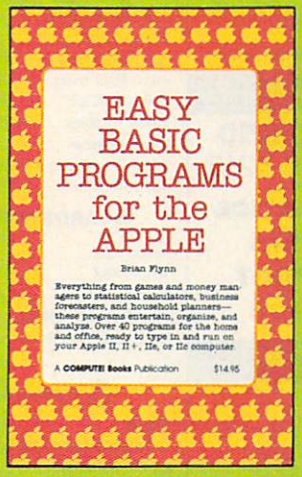

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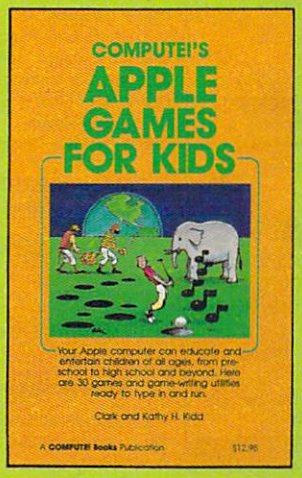

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Sidekick For PC And PCjr

Richard Mansfield, Senior Editor

Requirements: IBM PC or compatible with at least 64K RAM and a disk drive, or Enhanced Model PCjr.

Lately, one of the most popular categories of software for IBM computers has been the windowed "desktop" utilities package. And perhaps the most popular of these is Borland International's *Sidekick*.

Sidekick has several quite useful features: a notepad for jotting down ideas; a calculator for quick arithmetic (including hexadecimal); a calendar with built-in diary; a telephone dialer; and an ASCII table. Each of these tools can be called up by hitting Ctrl-Alt, even while another program like a word processor is running.

A window opens on top of the current program and reveals the *Sidekick* menu, from which you select one of the tools. If you want your modem to dial someone, you can search through a personal directory of names and numbers. The dialer will even call a number that is typed somewhere on the screen outside the window. Such flexibility is typical of the power of *Sidekick*: Nearly every tool is multilevel and multifunctional.

You control window positions and colors, and you can even transfer data from the screen into one of your note files. The time and date can be automatically stamped onto your notes. Filing notes, too, is automatic, as are most of *Sidekick*'s features.

This is an exceptionally easy-to-use, convenient system. The idea is that many of the things you'd need on or near your desk can be contained within the computer—and computer-contained tools can be automated, more powerful than their real-world counterparts. For example, when you call the calendar, today's date is highlighted, you can flip around easily by month or year, and you can bring up a diary to enter reminders for future appointments or make notes about the day's activities. It's much more powerful than a simple wall calendar, yet, equally important, it's quite easy to use.

Excellent help screens are always available, instructions are clear and sensible, and it's compatible with most other software. Nevertheless, nothing is perfect this side of heaven. There are four minor annoyances. It would be nice to have an alarm clock feature, particularly one that could trigger a batch file automatically. The notepad is virtually a word processor in itself, but it relies on commands which are quite similar to *WordStar*'s. That's fine for people used to *WordStar*, but not so easy for the rest of us. The calculator doesn't give any feedback when you enter a function like addition. That can be unsettling at times; you don't know for sure you've actually hit the right key. And, finally, you've got to pay extra for the non-copy-protected version.

Aside from these few cavils, *Sidekick* is exceptionally useful and entirely deserves its immense popularity.

Sidekick
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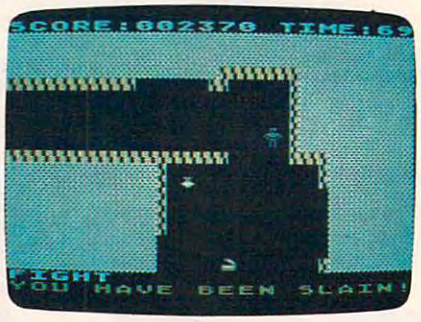
Gateway To Apshai



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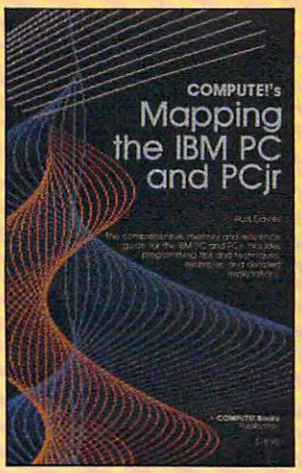

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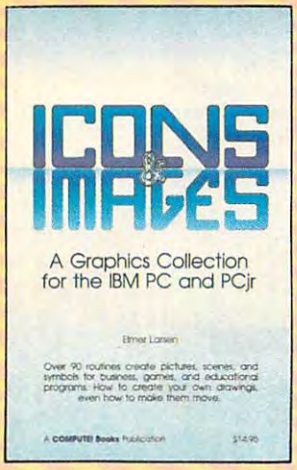

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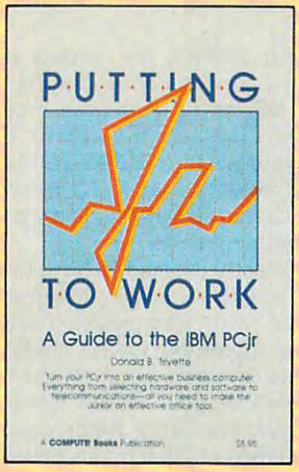

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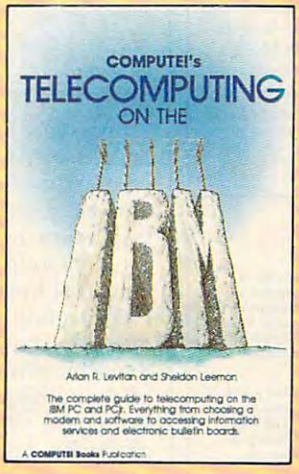

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are hidden pits and other traps, sometimes cunningly disguised as treasure. There's even a teleportation trap that picks you up and drops you back who knows where.

The title screen warns you it's a game for thinkers, and rest assured: You won't get out of this one without a measure of mental exertion. When should you fight? Where should you run? What weapon? Which shield? Healing potion or confusion spell?

A status screen displays your vital signs—strength, agility, and luck—as well as your overall health. It shows your score, how many lives are left, and what level you're on. By pressing the joystick button, you can check your supplies. Pressing the button again brings up a third screen—perhaps the most important to your survival—which shows what's in your hands. Simply finding a weapon, armor, or spell is not enough; you must be holding it, too.

There are eight levels to the Apshai labyrinth, and on each level you can choose any one of 16 different dungeons. To complete the game, you must explore one dungeon on each level; once you've mastered one set of dungeons, you can select a different set to make later games as exciting as the first. A little figuring reveals that there are 128 different dungeons, each with a unique floor plan. With roughly 60 rooms per dungeon, that gives you more than 7500 different rooms to explore. You won't get tired of this game in a weekend.

There are hundreds of adventure games available these days, and many have impressive titles and credits. But the real question is not one of cover art or advertising hype. Instead, you want to know if the game is worth an investment of money and time. Does it fire the imagination? Is it challenging?

In the case of *Gateway to Apshai*, I can answer each question with an unqualified "yes." As you concentrate on the game, you'll soon be hopelessly caught up in the fate of that little guy on the screen. It's easy to get carried away with *Gateway to Apshai*. I jumped every time one of those swamp rats appeared. My sword arm got sore from gripping the hilt of the joystick, and there are wrinkles in my permanent-press armor from hours in front of the monitor.

Gateway to Apshai
Epyx
1043 Kiel Court
Sunnyvale, CA 94089
$39.95 (Atari & Commodore 64)
$53.00 (Coleco Adam)

Championship Lode Runner

Michael B. Williams

Requirements: Commodore 64 and a disk drive; or an Apple II-series computer with at least 48K RAM and a disk drive. Joystick optional.

So you've conquered all 150 screens of *Lode Runner* and are tired of creating your own? What's next? Brøderbund has the answer: a sequel to *Lode Runner* that's even more demanding than the original.

Championship Lode Runner offers you 50 of the toughest challenges you're likely to find in videogaming. Aimed at those who have reduced the original *Lode Runner* to bits, *Championship Lode Runner* offers nothing new in terms of features, but poses new challenges designed *by* champion Lode Runners *for* champion Lode Runners.

Brøderbund makes it clear that *Championship Lode Runner* is only for experienced *Lode Runner* players. You will need every ounce of your knowledge to survive, so first-time Runners should tune up on the original before attempting this championship version.

The Bungeling Empire Strikes Back

As in *Lode Runner*, the leaders of the power-hungry Bungeling Empire have made a fortune in gold from excessive fast-food taxes. As a Galactic Commando, your job is to raid the elaborately designed treasury rooms and recover all the gold chests, at every step outsmarting the Bungeling guards.

Apparently the leaders have become outraged at your success in their previous compound, so they've created a new one with fewer rooms, but greater challenges. To move to the next room, you must clear each screen of gold chests worth 500 points each. For every room you complete, you receive 2000 bonus points and an extra life.

Unfortunately, you're not the only hunter. The Bungeling guards try to keep you from taking the chests and advancing to the next room. If a guard snatches a gold chest, you must trap him to retrieve it.

Your laser drill pistol bores holes

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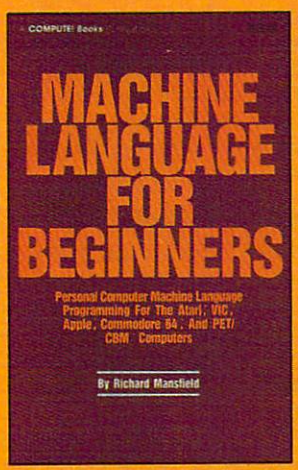

"If you know BASIC and want to learn machine language, this is the place to start . . . . Building on your experience as a BASIC programmer, Mansfield very gently takes you through the fundamentals of machine language."—Whole Earth Software Catalog

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"Presents the machine language novice with a very good tutorial in simple, understandable terms."—Antic

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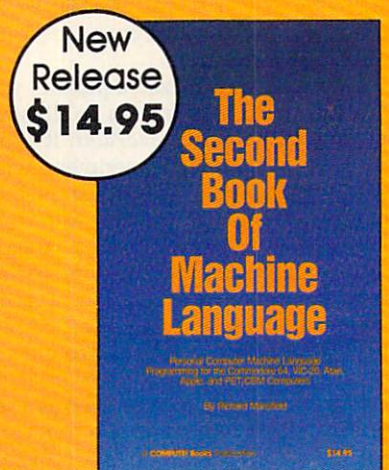
The Second Book of Machine Language for the Commodore 64, VIC-20, Apple, Atari, and PET/CBM



The Second Book of Machine Language picks up where *Machine Language for Beginners* left off. This new book contains one of the most powerful machine language assemblers currently available. The LADS assembler is a full-featured, label-based programming language which can greatly assist you in writing machine language programs quickly and easily.

It's also a clear, detailed tutorial on how large, complex machine language programs can be constructed out of manageable subprograms.

There are powerful computer languages and there is good documentation, but rarely has a sophisticated language been so completely documented as it is in this book. When you finish with this book, you'll not only have a deeper understanding of machine language—you'll also have one of the most powerful machine language assemblers available. And since everything is thoroughly explained, you can even add custom features to the assembler to create a custom language that does just what you want it to (the book shows you precisely how to modify the assembler).

For Commodore 64, Apple (II, II+, IIe, and IIc, DOS 3.3), VIC-20 (8K RAM expansion required), Atari (including XL, 40K minimum), and PET/CBM (Upgrade and 4.0 BASIC). Disk drive recommended.

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and passageways through the fissured brick floors in the compound. Bungeling guards can become trapped in the pits, which fill up after a period of time. Trapping a Bungeling guard is worth 100 points; if the hole fills while he's trapped, you earn another 100 points. Trapping a guard is the only certain method of retrieving a snatched chest.

Invisible Pitfalls

Each new screen requires new strategies to complete it; experienced players pause the game from time to time to plan a course of action. It is entirely possible, by executing a certain move, to make it impossible to finish the screen without starting over.

The screens contain both solid and fissured bricks, ladders, and ropes. Later screens are laden with traps which cause you to plummet a number of levels—sometimes to the bottom of the screen. They are invisible, but finding them is part of the fun.

The program saves high scores on disk along with a name of up to eight letters. You can also save games in progress; you can restore a game once without penalty, but every time you restore the same game thereafter, you lose one life.

Brøderbund has a special reward for anyone who conquers all 50 screens: You can enter a 19-character victory message on the high-score display, and you'll receive a personalized *Championship Lode Runner* Champion Certificate from Brøderbund—and you will have earned it.

If *Championship Lode Runner* has you stumped and you're obsessed with victory, Brøderbund offers a hint book for $9.95. The book provides step-by-step hints and diagrams for solving each level, along with the placement of traps. Seasoned players will welcome these hints (*not* solutions). Even expert players will value seeing each screen in advance.

Championship Lode Runner is a must for *Lode Runner* veterans. All that's missing is the design mode—you'll have to use the original version for that. But if you've exhausted the possibilities of the original, *Championship Lode Runner* gives you 50 more "impossible" challenges. And this time, Brøderbund promises you won't find them so easy.

Championship Lode Runner
Brøderbund
17 Paul Drive
San Rafael, CA 94903
$34.95

MacVision For Apple Macintosh

Charles Brannon, Program Editor

Requirements: Apple Macintosh and a source for standard video images. Color or black-and-white video camera, tripod, and Imagewriter printer recommended.

MacVision is a combination of hardware and software that lets you digitize any image from a video camera, videocassette recorder, or laser disc player. The digitized picture can be loaded into *MacPaint*, *MacWrite*, or almost any Macintosh application. It can be modified, merged with text and graphics, and printed on the Imagewriter.

The *MacVision* digitizing box plugs into the printer or modem port. A phono jack accepts any NTSC-standard video source. After installing the software on an application disk, it becomes part of the operating system as a desk accessory. When you select MacVision from the desk accessories menu, another menu appears in addition to whatever menus are being used by the application. The menu contains eight choices: Adjust, Scan Window, Scan Screen, Save Screen,

Print Window, Print Screen, Printer, and Modem.

Printer and Modem are used to tell *MacVision* which port you've plugged it into. Adjust presents a vertical graph that helps you set the digitizer's brightness and contrast controls. These controls are crucial to obtaining a quality image. I found that Adjust leaves you with a well-balanced, but grainy picture. You will almost always need to fine-tune while scanning the image.

Scan Window creates a picture within a small window on the screen, taking about six seconds per scan. This option is most useful for adjusting controls or for taking casual snapshots. You can also print the window or transfer it to the Clipboard, ready to be pasted into another application. Scan Screen makes a much better picture by using the entire 512 × 384 resolution of the Macintosh. This takes 22 seconds. Then you can either dump the picture to the Imagewriter with the Print Screen option or save it on disk with Save Screen.

MacVision simulates gray scales with varying dot densities, similar to the halftones in published photographs. The pictures seem to be about half the resolution of newspaper photos. If photo-reduced, they're almost photographic in quality. But if you're sloppy with the controls, you'll get really grainy pictures. Also, remember that your subject will have to remain perfectly still for as long as 22 seconds—longer if you're trying to adjust controls on the fly.

Once you've digitized a picture, you can paste it into *MacWrite* as an illustration or modify it with *MacPaint*. It's fun to capture a face and experiment with new hairstyles, moustaches, beards, and symmetrical analysis (where you copy half of a face vertically, flip it, and merge it back—a technique usually done with a mirror to analyze personality). I even wrote a simple game in Microsoft BASIC in which the objects bouncing around are the faces of friends.

MacVision could also be used as a security system. If two scans of a room are not identical, then something is moving. It's even conceivable that *MacVision* could provide the link for visual recognition. After all, Koala Technologies dubs *MacVision* as "vision for a visionary computer."

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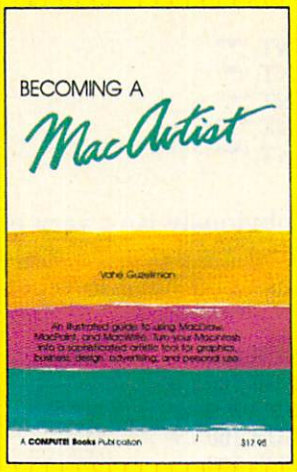

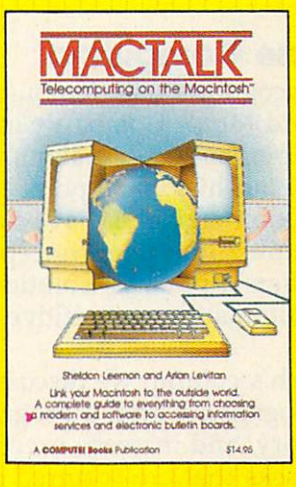

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THE BEGINNER'S PAGE

Tom R. Halfhill, Editor

Assembly Line Computing

Henry Ford is recognized as a famous person for founding the Ford Motor Company, inventing the Model T automobile, and making himself a multimillionaire. But historians point out that his greatest contribution may well have been popularizing the assembly line. The concept of the assembly line offers a practical solution to a common problem: automating a repetitive task for greater efficiency.

In last month's column we discussed how subroutines—programs within a program—can save time, memory, and increase execution speed by performing tasks that are required over and over again. But there's yet another way you can increase the efficiency of your programs whenever a repetitive job is called for: looping.

Looping is such a powerful, valuable technique that—like subroutines—it is a primary technique in all computer programming languages. And nearly any program you write will contain some kind of loop. (In fact, most programs *are* one giant loop.) A program shorn of its loops would be about as efficient as a modern factory without assembly lines. Fortunately this indispensable technique is easy to learn, and in its simplest form, involves only two BASIC keywords: FOR and NEXT.

When To Loop

By the way, it's important to realize that there's not much overlap between subroutines and loops. In other words, you won't often encounter a situation when a subroutine or a loop will be equally efficient ways of solving a certain programming problem. Generally, subroutines are useful when you need to perform a particular task again and again *in different parts of a program;* loops are useful when you need to repeatedly perform a task *in one section of a program.* Let's demonstrate this difference by setting up a sample problem.

Suppose for some reason you want to print a column of asterisks (*) down the left side of the screen, perhaps as a border for a title screen. Without using either subroutines or loops, you might take this approach:

```
10 PRINT "*"
20 PRINT "*"
30 PRINT "*"
40 PRINT "*"
50 PRINT "*"
60 PRINT "*"
70 PRINT "*"
80 PRINT "*"
...
```

This obviously isn't very efficient.

Creating a subroutine to do the job doesn't help because you have to repeatedly call the routine:

```
10 GOSUB 100
20 GOSUB 100
30 GOSUB 100
40 GOSUB 100
50 GOSUB 100
60 GOSUB 100
70 GOSUB 100
80 GOSUB 100
90 END
100 PRINT "*"
110 RETURN
```

Clearly, there's a better way. Here's how to solve the problem with a loop that is constructed with an IF-THEN and a GOTO statement:

```
10 X=0
20 PRINT "*"
30 X=X+1
40 IF X<8 THEN 20
```

Line 10 sets the variable X to a value of 0. Line 20 prints an asterisk. Line 30 adds 1 to the value of X. Line 40 checks the value of X to see if it is less than 8. If so, it jumps back to line 20.

The loop in this case consists of lines 20–40. At the conclusion of the first pass through the loop, X equals 1. During each pass, line 30 adds 1 to X again (*increments* X). Therefore, after the second pass through the loop, X equals 2; after the third pass, X equals 3; and so on. (When a variable is used like this, it's called a *counter.*) Line 40, the last line in the loop, always checks to make sure X is less than 8, because we want to print no more than eight asterisks. Each time line 40 determines that X is less than 8, it circles back to line 20 for another pass through the loop, and another asterisk is printed.

After eight passes (or *iterations*), the counter X finally reaches a value of 8. Then it fails the IF-THEN test in line 40, and the program ends.

A Better Way

Notice how this simple loop prints the eight asterisks with only half as many program lines as

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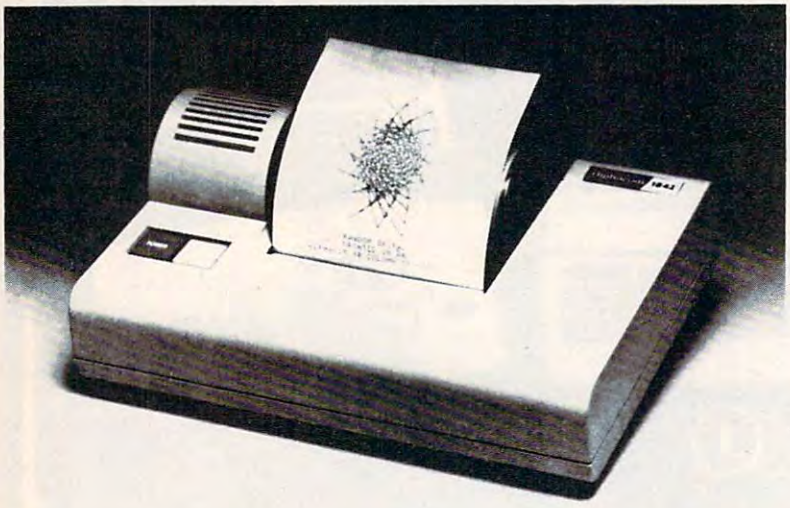

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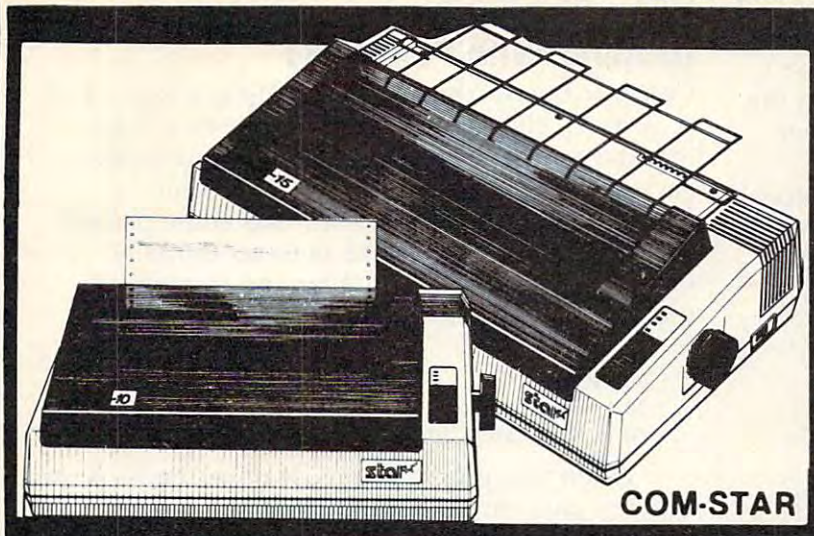

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COM-STAR PLUS+ Print Example: ABCDEFGHIJKLMNOPQRSTUVWXYZ ABCDEFGHIJKLMNOPQRSTUVWXYZ 1234567890

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the two crude methods above. Its efficiency becomes even more apparent when you realize that you could print *any* number of asterisks without making the program longer—simply reset the maximum value for the counter by changing the 8 in line 40 to 10, or 50, or 1000, or whatever you want.

Incidentally, this loop can be made to repeat in a couple of different ways (*only the third example works on the TI without Extended BASIC*):

```
40 IF X=8 THEN END
50 GOTO 20
```

or

```
40 IF X>7 THEN END
50 GOTO 20
```

or

```
40 IF X<>8 THEN 20
```

Like any versatile language, BASIC usually has more than one way to say the same thing.

In fact, BASIC includes two special keywords that let you construct loops in an even more compact fashion:

```
10 FOR X=1 TO 8
20 PRINT "*"
30 NEXT X
```

Now we're getting somewhere. Even if you don't understand yet how this loop works, it simply *looks* more efficient—or, in programming jargon, more *elegant*. Besides that, it's the easiest way to make a loop.

Looping With FOR-NEXT

Constructing a loop by incrementing a counter (X = X + 1), checking the counter to see if it has reached a certain value (IF-THEN), and circling back for another pass (GOTO) is a useful programming technique, but it has some pitfalls. The most common mistake is to accidentally GOTO the wrong line number and reinitialize the counter variable during each pass:

```
10 X=0
20 PRINT "*"
30 X=X+1
40 IF X<8 THEN 10
```

When this program runs, it never ends. After the first pass through the loop, X has been incremented to a value of 1, and then line 40 circles back for another pass. Okay so far. But line 40 circles back to line 10 instead of line 20 as intended. Line 10 sets X equal to 0 again, and the process repeats. X never reaches 8. The result is an *endless* or *infinite loop*—the computer obediently keeps printing asterisks forever, or at least until you break out of the program or cut off the power.

Sometimes, depending on the circumstances, you have to make a loop with counter variables and IF-THENs. But a better alternative is the FOR-NEXT statement. FOR-NEXT automatically increments the counter for you and always circles back to the right line. All you have to do is set up the FOR-NEXT statement correctly in the first place, and that requires only three easy steps:

1. Mark the beginning of the loop by entering FOR X=1 TO 8 (of course, you can define the number of times the loop will repeat by substituting any number you want for the 8).
2. Enter the program lines for the repetitive task you want the computer to perform during each pass through the loop (such as PRINT "*" in the example above).
3. Mark the end of the loop by entering NEXT X.

That's it. The FOR part of the statement takes care of incrementing the counter X during each pass. It also replaces the IF-THEN statement in the earlier example by performing the loop only the number of times you specify. And the NEXT part of the statement always circles back to the FOR. By using FOR-NEXT, potential mistakes are avoided, less memory is consumed, and the program probably runs faster, too.

There's much more to FOR-NEXT loops; this month we've just scratched the surface. Next month's column will reveal some additional techniques and cover some peculiarities of FOR-NEXT on different computers. ©

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TELECOMPUTING TODAY

Arlan R. Levitan

Uploading And Downloading

The fine art of saving and sending information over phone lines via modem is often a source of bewilderment to folks just starting out in telecomputing. The most frequently asked questions that appear in my electronic mailbox are:

"How do you download files from bulletin board systems or commercial information services?"

"How can I send copies of programs that I have written to other computers with a modem?"

"How can I compose the electronic mail that I write to my friends ahead of time to avoid having to pay for typing my letters while online?"

All of these messages typically end with the phrase, "I've tried every way I can think of to make this work. Help!"

Saving information received via modem for later use (*downloading*) and sending information to others (*uploading*) is not that difficult. Successful file transfers don't require deep technical knowledge—just a basic understanding of some fairly simple concepts.

What It Takes

The ultimate success of your attempts at uploading and downloading depends on a number of things:

1. A terminal program designed for your computer that has the proper capabilities.

Terminal software that does not specifically include features for uploading and downloading stands about as much chance for success as David Stockman floating a personal loan from the Joint Chiefs of Staff. You wouldn't book a seat on a plane that doesn't have wings, would you? Don't expect terminal programs that weren't designed with file transfers in mind to do the job. We'll review the most useful features to look for later.

2. Proper operation of the terminal software.

This is up to you. The fact that your terminal software allows file transfers is no guarantee of success, just as owning a car is no guarantee that you'll qualify for a driver's license. In both cases, knowing how to properly operate the technology in hand is the key. There's an old data processing saw that goes, "The difference between a novice and an expert is having read the manual." Old as its teeth may be, that saw still cuts pretty true. Before getting started, think out the sequence of instructions that must be issued to your terminal program and to the remote system.

3. Software running on the remote computer that is compatible with your computer and terminal software.

It's not enough that your terminal program allows file transfers; the software at the opposite end of the line may not have every feature supported by yours. This is where some people get hung up (pun unintended) through no fault of their own. If either program deviates slightly from the agreed-upon protocols, one of them may figuratively throw up its hands and scream "I quit!" We'll look at why this happens more frequently than it theoretically should (usually with different type computers and/or terminal programs on either end of the link).

Avoiding Errors

If every link in the telecomputing chain doesn't work perfectly, errors will result, but the tolerance for error varies. Text files are usually less critical than program files. If, for example, the word COMPUTE! were changed to COMPOTE! by line noise or some other error, a person reading the text would probably notice the mistake and be able to infer how the word is supposed to read.

This isn't true with program files. The file must be an exact duplicate of the original or it won't run—or perhaps worse, it might run and yield inaccurate results. You could inspect the file, but a machine language program looks like a bunch of binary garbage to the average person. It's practically impossible to spot an error by context alone. For this reason a method of error checking is essential to transmitting binary files intact.

Capturing Information

The easiest type of downloading to implement in a terminal program is simple text capture. After you switch on this feature, all the information that appears on your system's screen is also

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transferred to another storage medium. The most flexible terminal programs allow incoming data to be saved in a disk file, a memory buffer (a reserved block of memory), or directly to a printer.

Saving to disk is fairly quick and allows you to read, print, or even modify the information later. If data is saved in a memory buffer, the terminal program fences off a large portion of Random Access Memory (RAM) as a temporary storage area. Usually you can view this buffer and turn it on and off as you desire.

Since your computer has a limited amount of RAM, most terminal programs warn you when the buffer is nearly full so you can instruct the remote system to pause while you transfer the buffer to disk. A memory buffer with this feature is nice to have if your computer's disk drive is not particularly quick. Otherwise, you'll be constantly waiting for your disk drive to keep up with the information you're receiving. (In fact, some computers cannot transfer incoming information directly to disk without losing pieces of data.)

Dumping the information to a printer leaves you with a handy record, but it can burn up a lot of paper and also makes it kind of tough to pour all of those printed characters back into your computer.

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XON/XOFF Pacing

You might be wondering how, as mentioned above, you can instruct a remote computer to pause while you transfer a memory buffer to disk. Most information services and bulletin board systems (BBSs) use a convention called *flow control* to act as a traffic cop during transmission. The most common flow control scheme uses the character produced by hitting CTRL-S on your keyboard as the signal to temporarily stop sending information. (If your computer lacks a CONTROL key, check your terminal program manual for a substitute. All terminal programs have some way of sending standard control codes.) CTRL-S is the transmission-off or *XOFF* signal. CTRL-Q is the transmission-on or *XON* signal.

These key combinations let you stop and restart the information that zips across your screen. Similarly, the software in the remote system and your computer can automatically use XON/XOFF to insure that incoming data is halted if either computer is busy handling some other chore for a few moments.

XON/XOFF is generally an option you can set in most commercial terminal programs and should be turned on ordinarily. Since the XON/XOFF characters are not usually visible on your screen, most people are completely unaware of their use.

Error-Checking Methods

Soon after people began using microcomputers for telecommunications, it became apparent that a reliable system was needed for transferring binary program files.

Ward Christensen, a coauthor of the first microcomputer BBS, developed a public domain terminal program for CP/M systems called MODEM7. When MODEM7 users logged onto Christensen's BBS and asked to transfer a binary file, they instructed the BBS to run a utility program called XMODEM.

The basic XMODEM ground rules laid down by Christensen back in 1976 are still used today by almost every BBS, regardless of which computer it's running on. The *XMODEM protocol*, as it's called, also is available for transferring files on the CompuServe and Delphi information services.

In next month's column, we'll examine XMODEM in detail and show step by step how the uploading process works. We'll also cover some tricks for saving money when sending E-Mail messages. Until then, BCNU.

Arlan R. Levitan
The Source: TCT987
CompuServe: 70675,463
Delphi: ARLANL

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Computers And Society

David D. Thornburg, Associate Editor

Visual Computing
Part 2

Last month we discussed the power of a highly visual computing environment, such as that provided by the Macintosh. I argued that many people who are not primarily analytical in nature may balk at the use of purely text-based computer languages, but that these same people may benefit greatly from highly visual programming environments such as those provided in *Pinball Construction Set, Lode Runner, Multiplan,* etc.

One argument against program construction sets is that many of them are very limited in their domain of applicability. You would have a hard time, for example, constructing a pinball game with *Multiplan,* or balancing a checkbook with *Lode Runner.* This limited domain of applicability means that a person with programming needs in many areas will have to master many types of construction sets.

In fact, it is the limited domain of applicability that allows these construction sets to be so easy to learn. The visual vocabulary with which you communicate with the system is limited to "words" that are relevant to the task at hand. It is, however, appropriate to ask whether all visual programming environments must be restricted to a limited domain of applicability.

Is it possible to create a general-purpose visual programming language? There seems to be ample evidence that it is possible. One program that points strongly in this direction is *Helix* for the Macintosh (from Odesta).

David Thornburg is a strong proponent of visual programming environments and has written 12 books, including The KoalaPad Book, *published by Addison-Wesley, and* 101 Ways to Use a Macintosh, *published by Random House. Some material for this column has been excerpted from his forthcoming book* Mindtools.

An Electronic Abacus

Helix is a database system built around a general-purpose visual programming language. To get some picture of *Helix's* power, we will explore its use to create a document that checks for a taxpayer's ability to benefit from Schedule G of the IRS tax forms.

With *Helix,* you create a database as a collection of objects. These objects include *fields* representing different types of data to be provided by the user, *abaci* containing the computational tasks to be performed on the data, *templates* defining the forms for data entry, *selections* through which forms can be entered and examined, *indexes* specifying the order of a search, and *queries* defining the search criteria. Of these, probably the most exciting object is the abacus.

I draw special attention to the abacus because it is the tool through which you program the computer, and because the manner in which you construct programs is purely visual.

To illustrate *Helix,* we will start by creating a new database called Tax Forms. By selecting the field icon and carrying copies of it to the main window, we can define the various input fields we want in our report—name, Social Security number, etc. Each field can represent one type of information, either text, number, date, or a logical flag (True/False, Yes/No, etc.).

You have control over the format of all nontext data types. The income data we have chosen is needed to determine whether the taxpayer is eligible for the benefits of Schedule G.

The BASIC Alternative

The following BASIC program performs the same task as the Helix program we will create:

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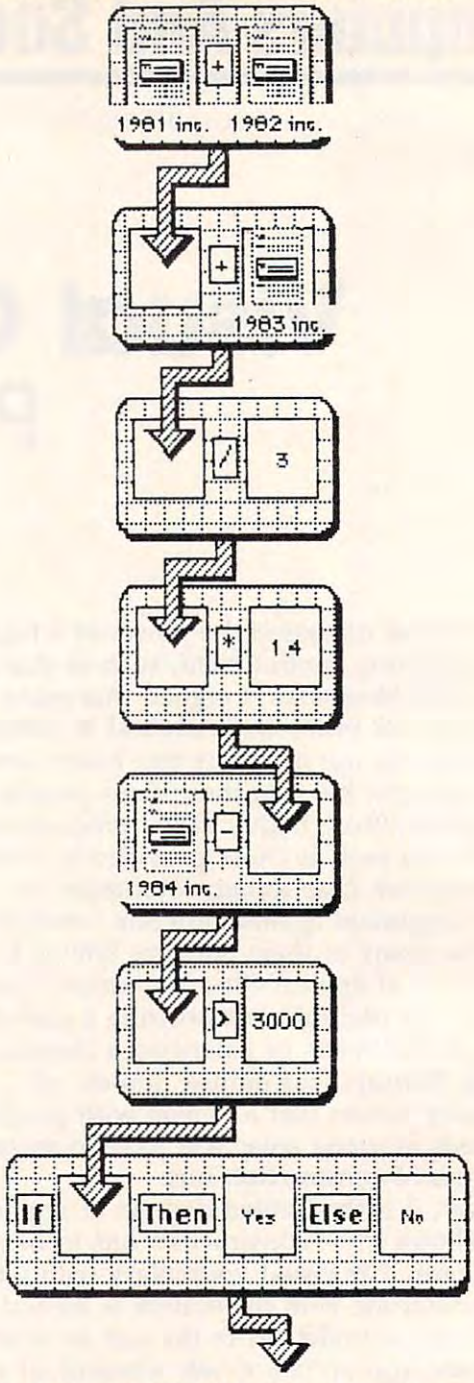
```
10 REM BASIC PROGRAM FOR SCHEDULE G
20 PRINT "ENTER NAME";
30 INPUT N$
40 PRINT "ENTER SOCIAL SECURITY NUMBER";
50 INPUT SS$
60 PRINT "ENTER 1981 INCOME";
70 INPUT Y1
80 PRINT "ENTER 1982 INCOME";
90 INPUT Y2
100 PRINT "ENTER 1983 INCOME";
110 INPUT Y3
120 PRINT "ENTER 1984 INCOME";
130 INPUT Y4
140 SUM = Y1 + Y2 + Y3
150 SUM = SUM/3
160 SUM = SUM* 1.4
170 IF(Y4-SUM)>3000 THEN 200
180 PRINT N$;"DOES NOT QUALIFY FOR
    INCOME AVERAGING"
190 END
200 PRINT N$;"DOES QUALIFY FOR INCOME
    AVERAGING"
210 END
```

In *Helix*, you define a special object called an abacus to contain the computational part of this program—except the program is created by building a flowchart, not by typing in many lines of instructions. This program is constructed from tiles that represent the math operators (plus, minus, times, etc.), text operators, logic operators, branching operators (IF-THEN-ELSE), and so on. Because *Helix* can use such a wide range of data types, it lets you construct very open-ended types of programs. Some of these tiles are visible in the figure—an abacus that corresponds to the Schedule G flowchart.

The arrows show the flow of calculation. The unconnected arrow at the end of the screen shows that the result of this abacus (YES or NO) is to be passed to the outside world. Each region of a tile (the large boxes) can be filled with a field, an abacus, the result of another tile, or constant information of any appropriate form. You can control the type and format of the constant information as well as the format of the overall result.

An Abacus For Computational Tasks



Creating The Form

Once this abacus is created, the form can be built. This form contains both constant and variable information. The variable regions can be filled with input fields or abaci.

Once a form is created, it can be filled in. As soon as any abacus in the form has enough data to perform its task, it does so and prints the result in the appropriate place.

How difficult is it to learn to use a tool like *Helix*? I learned the basics of this programming environment in less than 30 minutes. Anyone who already knows a procedural language like Logo, LISP, or Forth should be able to master *Helix* in that time. Programmers whose knowledge is limited to BASIC may have to spend up to an hour getting used to the fact that a collection of abaci represents many independent programs, all of which coexist in the system at the same time.

But I would expect that people with no prior exposure to computer programming whatsoever should be able to master *Helix* in a few hours. With the single exception of PILOT, I know of no text-based language for which this statement can be made.

Helix is one of the first construction sets that comes close to being a visual programming language. Given the overwhelming popularity of construction sets, it won't be the last. ©

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INSIGHT: Atari

Bill Wilkinson

More About HELP! On HELP?

Several of you were kind enough to write and point out (with only a few snickers) that I goofed in my February column's description of the HELP key. Specifically, I gave you the wrong value for SHIFT+HELP. Here is the corrected table. Remember, though, that you must POKE location 732 back to zero if you PEEK there and find that the HELP key has been pressed.

Key(s) Pressed	Value in 732 ($2DC)
HELP alone	17 ($11)
CONTROL+HELP	145 ($91)
SHIFT+HELP	81 ($51)

B Is For Bad BASIC

I was inundated with letters from people who responded to *my* request for help in that same February issue. I had asked if anyone knew how and why the Atari BASIC built into the XL machines caused the infamous keyboard lockup. As I stated then, I was under the impression that the oh-so-little (but oh-so-damaging) coding mistake which caused the problem with Atari cartridge BASIC had been fixed.

Well, it turns out that I was both right and wrong. I was right about that particular bug being fixed. I was right in believing that Atari had a version of BASIC which corrected the problem. What I had not been aware of was the number of 600XLs and 800XLs that Atari has sold which contain an intermediate version of BASIC with even more severe problems.

If we call the original Atari BASIC *revision A*, then the most current version being shipped and installed by Atari (in XE machines as well) is *revision C*. So what about *revision B*? In fact, Atari gave me an early release of rev B in cartridge form. ("Rev" is the usual contraction of "revision" if you're into techie language.) However, when I learned that it had significant problems and that Atari was dropping it in favor of rev C, I promptly ignored and forgot about rev B.

Unfortunately, Atari didn't do likewise. Atari (the old Atari, that is) ordered a few thousand (tens of thousands? hundreds of thousands?) ROMs using rev B, which they certainly weren't going to throw away, so kerplunk into all the 800XL and 600XL computers they went.

As I said, I had kind of ignored rev B because I was under the mistaken impression that very few machines using it had been shipped. Boy, did my mail tell me I was wrong! So now, how can I help all of you out there who are stuck with rev B BASIC? Three ways: First, show you how to tell what revision of BASIC you really have. Second, tell you how to avoid the problem most of the time. Third, tell you how to fix the problem permanently.

What Have I Got?

I am indebted to Matt Ratcliff for showing me a location within Atari BASIC which tells you what version of BASIC you have.

If you PRINT PEEK (43234) and see this value:	Then you have this revision of Atari BASIC:
162	A
96	B
234	C

Despite what you may have heard or read from other sources, there is *no* practical way to avoid some of the problems associated with rev B. Many Atari "experts" won't believe me, but that's not surprising. Even though we wrote—and, in 1983, COMPUTE! published—*The Atari BASIC Source Book*, with the complete source code of Atari BASIC rev A and a detailed explanation of the keyboard lockup bug, I saw a user group newsletter just three weeks ago in which someone claimed that hitting SYSTEM RESET cleared up the problem. Honest, there is *no* reasonable way to avoid the bug in rev A, either.

However, there is a way to minimize the effects of the worst bug in rev B: Don't use the SAVE or CSAVE commands. Instead, use LIST and ENTER. (Disk users simply substitute the words LIST and ENTER for SAVE and LOAD, respectively. Cassette users use LIST"C" and ENTER "C" in place of CSAVE and CLOAD.) Even this technique will *not* help you avoid the bug. It will just make it easier for you to recover when you get bitten.

In a nutshell, the problem in rev B is that your program and/or your data can get hopelessly scrambled. Unlike rev A, though, you may not notice the scrambling until some time after it first occurs, since the scrambling often does not cause a lockup. How can you tell if your data is scrambled? You can't, easily. How can you tell if

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your program is scrambled? Just LIST it on the screen or a printer. If it looks okay, it probably is okay.

So start by deciding how much time you are willing to throw away, if worst comes to worst. (For me, that's about 15 minutes. If I were using cassettes, I might make that 30 minutes.) Then, every time you have typed that much time's worth of new material into your program, LIST the progam on the screen or printer to be sure it's okay. If it is not okay, even if some lines just look funny or scrambled, *turn off your power and reboot*. Do not attempt to fix your program. The odds are you will only make the situation worse. Only after rebooting should you re-ENTER the last listing from your disk or cassette.

If the screen or printer listing appears okay, you can go ahead and LIST the program to disk or cassette. This way you can have reasonable confidence in that version if you need to re-ENTER it later.

Alternate Solutions

Sidelight for all Atari cassette users: The technique I just described is a good idea no matter what version of BASIC you are using. Remember that you can easily verify a LISTed tape by re-ENTERing it back over itself. Do *not* type NEW before using ENTER"C". If a tape has an error, the most you will wipe out using this trick is one line. If it has no errors, the ENTER will terminate normally. (Disk users may also use this verification trick, but it seems unnecessary if you always use write-with-verify mode on the disk. Atari DOS defaults to this mode.)

You probably noticed that I said there was no easy way to tell if your data (strings, arrays, etc.) had been scrambled. As far as I can tell, though, any scrambling in these areas is fixed every time you use the RUN command. (If you want to feel super-safe, type NEW and re-ENTER your last LISTed version.) And there appear to be only two ways the bug can occur while a program is running: (1) If you ENTER an overlay in the middle of your program. (2) If you DIMension a string or array when you are several levels deep in a GOSUB and/or FOR nest (several means 64 GOSUBs or 22 FORs or some combination of the two which uses about 256 bytes of stack space).

Maybe the best solution of all is to forget about rev B BASIC entirely and get a different BASIC for your computer. You could buy one of the enhanced BASICs available on disk or cartridge from several independent companies. Or you could buy one of the new XE-series computers, which have rev C BASIC built-in. Or you can order a rev C BASIC cartridge from Atari itself. Perhaps to atone for the bugs in rev B, Atari is offering the rev C cartridges at a nominal cost. Send $15 (no extra shipping and handling charges) to:

Atari Corp.
Customer Relations
390 Caribbean Drive
Sunnyvale, CA 94088

The cartridge works with all eight-bit Atari computers. (Remember that when you plug in a cartridge on an XL or XE, the built-in BASIC is disabled and control passes to the cartridge.)

Bits And Pieces

When I told you above that you need to LIST your program periodically, did you automatically start allocating two or three cassettes or a blank disk for each program? If you didn't, you might as well ignore my advice. *Never* use the same cassette or same filename on a disk to keep *successive* LISTings of SAVEd programs. If you have a good version of a program SAVEd as "D:MYPROG.SAV" and then, in the process of adding more lines to that program, you encounter one of the nasty editing bugs, what happens when you SAVE it again with that same filename? You just wiped out your last good copy.

At the very least, keep the last *two* versions of every program, every word processing document, every data file, etc. (I always keep three copies and usually keep at least as many as a blank disk will hold.) Unless, of course, you value your own time at less than 25 cents an hour.

More than a few of you have written with questions about my enhanced DOS 2.0S (from COMPUTE!, August and September 1984) for the 1050's dual density. First, I want to thank you for the nice words and shrug off the complaints. Then, I have the pleasure of telling you that Atari will soon be releasing DOS 2.5, which uses 1024 sectors (out of a possible 1040) on a 1050 drive in dual density mode. It is very, very compatible with DOS 2.0S. Do I have to tell you that it's completely incompatible with my earlier version? I don't? Good, then I won't mention who helped write it for Atari.

The ink wasn't dry on the March issue of COMPUTE! when I started getting letters (and even two phone calls) asking me to please explain how to read/write a sector directly from/to the disk. I said I would oblige if enough of you asked, so sector I/O, and a recap of Atari I/O in general, is a future topic. But first, next month's column will explain the bugs in rev C BASIC in more detail and even divulge *how* they happened. ©

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THE WORLD INSIDE THE COMPUTER

Redefining Computer Literacy

Fred D'Ignazio, Associate Editor

Last month's column ("The Home Computer Revolution: Another False Start?") projected that the true home computer of the future would be a "digital utility center" that would act as a translator and a terminal, digitizing and uniting such technologies as computing, telecommunications, information storage, audio, and video. This month's installment examines the implications of these developments for educators, parents, and children.

Simultaneously Disappearing

Home computers are a long way from being digital utility centers. But they are moving swiftly in that direction. For that reason, it is important for us to keep this in mind when we teach children the computer skills they will need when they grow up. By looking at what the computer might become, we can better define the skills that our children should acquire.

This is a particularly important time to be looking ahead and examining the bundle of skills that are collectively defined as computer literacy. Personal computers have been around for almost ten years, and the proponents of computer literacy have had time to develop dramatically different points of view.

The oldest camp of computer literacy advocates sticks staunchly to the view that to become computer literate you must learn how to program. Different groups espouse different programming languages, such as BASIC, Logo, Pascal, or even machine language.

The next group of computer literacy advocates claims that programming is a narrow discipline that only a few specialists should learn. Instead, we should be teaching our children how to use computer productivity tools such as word processors, database managers, and communications programs.

A third group of people feels that computer literacy is being oversold and is, in fact, a nonissue. They claim that computers are swiftly becoming user-friendly black boxes and are simultaneously disappearing inside other appliances and are becoming invisible (like electric motors). According to this group, soon we will no longer be dealing with computers. Instead we will be operating computerized telephones, word processors, and other computerized appliances. And as computers themselves disappear, so will computer literacy. With the new easy-to-use computerized appliances, computer literacy will be about as appropriate as telephone literacy, refrigerator literacy, or bathtub literacy. Even small children will discover how to use these appliances, just as they learn how to turn on the TV, open the refrigerator door, and learn how to ride a bicycle.

The Brick-By-Brick Approach

In light of the future potential and evolution of the home computer, I believe that all of the

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Fred appears regularly as the "family computing" commentator on "The New Tech Times," a half-hour public TV program on consumer electronics that airs weekly on more than 240 stations across the country.

Fred's column appears monthly in COMPUTE!.

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above avenues to computer literacy are limited, fragmented, and incomplete. Surely a brilliant teacher or parent can take any one of the above approaches and introduce their children to all the possibilities of computers, but what are the rest of us to do?

In homes and schools today, most children are being introduced to computers by means of what my old friend Suzie Barnes calls the *incremental approach.* Every year the computer comes with new kinds of software that can do one or two new things, so children are taught that this is what computers can do. As computers can do more, we add that to the list of what we teach our children. "This is what a computer is," we tell them, "and this is what a computer can do."

For example, only a few years ago computers could do nothing, so simple hands-on experience was enough. Then computers came with programming languages, so that's what we taught our children. Now they come with productivity tools, so we teach them word processing and databases. Maybe next year they will all come with modems and communications software, so we'll teach that and call it computer literacy. And the year after that?

There is nothing wrong with this approach per se, since it does provide children with a hands-on familiarity with computers. But, on its own, it gives children an incredibly narrow, shallow, and passive image of how they can interact with computers. And, even more important, how they should view themselves—and their own minds—vis-à-vis computers.

We are teaching computers the same way we would build a house if we had no concept of the whole structure, and we built the house simply by placing one brick on top of another brick, and standing back every now and then and saying, "Now this looks interesting." We are defining the ultimate structure by the way it looks in its present, incomplete, and unrealized state. And we are focusing on the primitive materials and completely ignoring the architecture.

What's more, the architecture is not merely a new technology such as the digital utility center. Rather, it is our relationship to the technology. It is the way we use the technology, think about the technology, and react to the technology. Most important, it is the way the technology teaches us to think about ourselves—especially our minds.

Toward A New Definition Of Computer Literacy

In earlier articles in COMPUTE! I have written about new approaches to teaching our children about computers. (See "Beyond Computer Literacy," COMPUTE!, September 1983; "How to Get Intimate with Your Computer," COMPUTE!, November 1983; and "Build a Computer in Your Mind," COMPUTE!, September 1984.)

I am worried that if most children's meager exposure to computers is limited to the incremental approach, they will grow up seeing computers only as automated tellers, digital watches, and point-of-sale terminals. Their image of computers will be so constrained and fettered that they will not see beyond these mundane, trivial uses of computers.

In most schools, students are learning that computers are programming engines and information processors. Programming, for example, even Logo programming, is taught in most classrooms as a mechanical skill, like mechanical drawing, carpentry, or automobile repair. Productivity programs are seen as the means to move data around—history data, biology data, economics data.

Programming and data processing are aspects of computers, but they are not the most powerful or central parts of computers. And they are not the most important computer skills our children can learn.

Experts are completely agreed on at least one point: that in the future our children will be using computers to work, to play, and so on. So the question is not whether our children will use computers but how well they use them. If our children use computers only to type text, perform tedious calculations, and prepare reports from databases, then they will be losing the chance for computers to make any significant contribution to their lives. The truth is, we don't need computers to do any of these things. We can do all of them already.

Why We Need Computers

Similarly, if computers are limited to automated drillmasters and electronic workbooks, their impact on young people will be trivial. We don't need computers to teach us facts, figures, and new subjects. We already have other resources, notably parents, teachers, movies, filmstrips, videotapes, books, audio tapes, and so on that do this rather well.

We don't need computers to teach us what to think about—that is being done already. Instead, we need them to teach us how to think better. And also how to learn better, and how to communicate better. And how to imagine better. And how to build a coherent, well-articulated code of ethics that helps us make sense of everything we learn, think, communicate, and imagine.

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This is not that hard to do. All it takes is to use these "back to basics" goals as a yardstick when we teach computers to our children. This means, for example, that teaching programming is not enough. Instead we need to teach programming in a manner that will help children think, learn, communicate, and imagine better. And we can't teach productivity tools just for their own sake. We must gauge their utility by how well they help improve children's thinking, learning, communication, and creativity skills.

Our ultimate goal isn't computer literacy. It is to help our children cope with the world of the future by using computers as one of the resources at their disposal. We can help our children be more prepared for that world by stretching and broadening their image of the ways computers can be used and by encouraging them not to become too dependent on computers.

All of this discussion hinges on how we view computers. Are they separate minds that will one day do much of our thinking work for us? Are they pipelines to giant libraries of information that can provide us with a flood of new information? Are they mind enhancers and adjuncts to our brains? Or are they reservoirs of concepts, ideas, and thinking skills that we can learn, borrow from, and use to help us think better on our own?

For my own children, I prefer the final image. I don't want my children to see the computer as an office where they go to get work done, or a filing cabinet to retrieve information, or an annex to their brain that they have to plug into before they do any thinking. Instead I want them to see computers as a mental gymnasium that they frequently visit to strengthen their mental muscles. And they not only carry the beneficial effect from using the exercise with them all day long, but they can build their own gymnasium inside their head, so they can exercise their minds even when they are nowhere near a computer. I call these mental gymnastics "neoprogramming." And I believe they are the surest route to long-term computer literacy.

What Do You Think?

Is the digital utility center the revolution in home computing that we have been waiting for? Is neoprogramming the path to computer literacy? Write and tell me what you think.

Especially write if you disagree with me, or if you have experiences or examples you'd like to share. Here's my address:

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

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C. Regena

Japanese Characters

I just returned from an interesting trip to Japan. I met several TI-99/4 users and spoke to a Commodore user group at Misawa Air Force Base. I ate all kinds of food and slept on the floor, experiencing real Japanese life that most tourists wouldn't see. I closed my eyes during the drives down narrow streets, but had fun shopping in the crowded stores. There were dozens of computer magazines—much like our magazine racks. I bought several that had interesting program listings to type in. The programming is in BASIC, so I can understand it, but I cannot understand the Japanese articles which tell what the programs do.

I was able to spend only a couple of hours in the Akihabara district of Tokyo seeing all the electronics shops. I would have enjoyed a longer time there, but then I would have just spent more money. Some people collect dolls or other trinkets, but it seems I collect computers. I bought an MSX computer that looks like lots of fun. (See "MSX Is Coming," Parts 1 and 2, COMPUTE!, December 1984 and January 1985.) I decided on a 64K Hitachi MB-H2 because it has a built-in cassette recorder and two cartridge slots (one is reserved for future disk drive expansion). It has one built-in music program that turns the keyboard into an organ. Another built-in program is like the Macintosh's *MacPaint*.

MSX BASIC is Microsoft BASIC with extended graphics commands such as LINE, CIRCLE, and PAINT. The music commands are similar to those in TI BASIC because the computer has the same sound chip found in the TI. MSX computers also use the TI video chip that allows 32 sprites. A graphics key lets you change the keyboard to graphics characters (similar to those on Commodore computers) plus some Japanese Kanji characters. Another key sets the keyboard to Hiragana characters (like our cursive writing), and a SHIFT adds the Katakana characters (comparable to our printing).

Reprogramming The Keyboard

This brings us to the following program. I've had several inquiries about how to print Japanese or Chinese characters on the TI, or how to change our QWERTY keyboard to a Dvorak keyboard. This program allows the keys to print the Japanese Katakana characters. You would use a similar technique for any other symbols you choose.

Reprogramming the keyboard requires two steps: You need to define the appropriate symbols, then print them on the screen when the corresponding key is pressed. I decided to use CTRL as the key to switch characters because I wanted to keep the English alphabet intact.

To find out what character code is returned for each keypress, you can refer to a chart in the appendix of the *User's Reference Manual* that came with the TI, or you can run a short program. As a key is pressed, the character code is printed on the screen. Notice that if you hold down CTRL while pressing a key, the computer returns a different number than it returns if the key is pressed by itself.

```
110 CALL KEY(0,K,S)
120 IF S<1 THEN 110
130 PRINT K
140 GOTO 110
150 END
```

You'll see that CTRL in combination with the number keys yields values greater than 156. For our special definitions, we are limited to numbers up to 156. Therefore, use SHIFT instead of CTRL for the top row. This means the symbols will be redefined.

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Phonetic Japanese

Each Japanese Katakana symbol represents a syllable. The following chart places the characters in the same order as on the MSX computer keyboard, with a few exceptions on the right side of the keyboard:

SHIFT	1	2	3	4	5	a	i	u	e	o
CTRL	Q	W	E	R	T	ka	ki	ku	ke	ko
CTRL	A	S	D	F	G	sa	shi	su	se	so
CTRL	Z	X	C	V	B	ta	chi	tsu	te	to
SHIFT	6	7	8	9	0	na	ni	nu	ne	no
CTRL	Y	U	I	O	P	ha	hi	fu	he	ho
CTRL	H	J	K	L	;	ma	mi	mu	me	mo
CTRL	N	M	,	.	/	ya	yu	yo	wa	wo
SHIFT	+	-	:	<	>	ra	ri	ru	re	ro

When you run the program, instructions appear and then you can press a key. The Japanese Katakana symbol will appear along with the *romaji* or romanized syllable. You can use the program to practice "writing" Japanese or to learn how to read the symbols. You may want to use these character definitions and placements to expand to a Japanese language program which uses words and phrases.

Once you're familiar with this programming technique, you can change the character definitions to symbols for a different Asian language. Or you can try printing a code, such as Braille. Or you can convert your TI keyboard into a keyboard of graphic shapes.

Program Explanation

S$ is the array to hold the syllables. To make things easy I just used the character number as the element number in S$. The characters from 128 to 156, however, subtract 128 for the element number. The highest symbol character number is 94, so the DIM statement reserves 94 for the array size. In a larger program you could be more efficient by numbering the elements differently, and you would need only about 50 elements.

Lines 150–350 define the characters for the symbols on the top row of the keyboard (SHIFT and the numbers) with the corresponding syllable sounds.

Lines 370–400 define the characters for the main section of the keyboard (CTRL and the letters), using the DATA statements in lines 420–630. The FOR-NEXT loop goes from character number 128 to 156 and READs first a character definition, then the syllable. Be careful typing the DATA lines. Don't use any extra commas, and don't put a comma at the end of a line. Each DATA statement except the last has three sets of character definitions with syllables.

Lines 540–650 define characters and syllables for the rest of the keyboard. Lines 660–710 print brief instructions. Lines 720–780 detect which key is pressed and accept only valid keys. The IF-THEN statements make sure the keypress is within certain ranges to print a symbol and a corresponding syllable. Line 790 prints the Japanese character. Lines 800–840 print the corresponding syllable, then return to the CALL KEY statement for the next keypress.

If you prefer to save typing effort, you can obtain a copy of this program by sending a blank cassette or disk, a stamped, self-addressed mailer, and $3 to:

C. Regena
P.O. Box 1502
Cedar City, UT 84720

Please specify the title of the program ("Japanese Katakana Characters") and that you need the TI version.

Japanese Katakana Characters

```
100 REM  KATAKANA
110 DIM S$(94)
120 CALL CLEAR
130 PRINT "CONVERTING THE TI KEYBOA
    RD"
140 PRINT :"TO JAPANESE CHARACTERS"
    :::::
150 S$(32)=" "
160 CALL CHAR(33,"FE0212101010102")
170 S$(33)="A"
180 CALL CHAR(64,"0404081868080808"
    )
190 S$(64)="I"
200 CALL CHAR(35,"107E42020404080B"
    )
210 S$(35)="U"
220 CALL CHAR(36,"007C101010010FE")
230 S$(36)="E"
240 CALL CHAR(37,"0808FE1828284808"
    )
250 S$(37)="O"
260 CALL CHAR(94,"00087E0808101102")
270 S$(94)="NA"
280 CALL CHAR(38,"0000380000007E")
290 S$(38)="NI"
300 CALL CHAR(42,"007E0204281020C2"
    )
310 S$(42)="NU"
320 CALL CHAR(40,"107E0408101424A9"
    )
330 S$(40)="NE"
340 CALL CHAR(41,"0004040808101102")
350 S$(41)="NO"
360 REM
370 FOR C=128 TO 156
380 READ C$,S$(C-128)
390 CALL CHAR(C,C$)
400 NEXT C
410 REM
420 DATA 007E027E02027E,YO,0024FE24
    04040808,SA,6060302824202202,TO
430 DATA 0054540404081102,TSU,007E04
    0810182442,SU,407C4404040808081,K
    U
```


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```
440 DATA 00203C642820201E,SE,002212
    020404081,SO,007E0204180C,MA
450 REM
460 DATA 007E0202040810 2,FU,3008001
    008003008,MI,001020204 5C62,MU
470 DATA 0004140814102 2,ME,0038080
    808087C,YU,207E22222C20202,YA
480 DATA 00102C43,HE,10107C1010549 2
    1,HO,1016FA1212222242,KA
490 DATA 407EC80808101,KE,00002001 2
    204183,SHI,003C040404047C,KO
500 REM
510 DATA 0020202038202 3F,HI,38007C
    101010202,TE,402C70167804020 1,K
    I
520 DATA 043808083E08101,CHI,100824
    22224202,HA,007E42441C08081,TA
530 DATA 7E42020204040808,WA,003810
    781010100C,MO
540 CALL CHAR(47,"7E027E0204040808"
    )
550 S$(47)="WO"
560 CALL CHAR(43,"7C007C0404081 02")
570 S$(43)="RA"
580 CALL CHAR(45,"2424040408080 81")
590 S$(45)="RI"
600 CALL CHAR(58,"00282828 2A4C08")
610 S$(58)="RU"
620 CALL CHAR(60,"4040404448506")
630 S$(60)="RE"
640 CALL CHAR(62,"003E424242427E")
650 S$(62)="RO"
660 PRINT :"USE THE SHIFT KEY WITH
    THE"
670 PRINT "TOP ROW OF KEYS,"
680 PRINT "PLUS, MINUS, COLON,"
690 PRINT "GREATER THAN, OR LESS TH
    AN."
700 PRINT :"SLASH IS 'WO'."
710 PRINT :"USE CTRL WITH OTHER KEY
    S.":
720 CALL KEY(0,K,S)
730 IF S<1 THEN 720
740 IF K>156 THEN 720
750 IF (K=94)+(K=64)+(K=60)+(K=62)+
    (K=58)+(K=47)+(K=45)THEN 790
760 IF (K<128)+(K>43)=-2 THEN 720
770 IF K<32 THEN 720
780 IF (K=34)+(K=39)THEN 720
790 PRINT :TAB(12);CHR$(K);"  ";
800 IF K<128 THEN 830
810 PRINT S$(K-128)
820 GOTO 720
830 PRINT S$(K)
840 GOTO 720
850 END
```

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IBM Personal Computing

Donald B. Trivette

Titling Your Vacation

Most of us vacation at comfortable places like the beach or the mountains, but my neighbors Don and Judy Getz prefer the extraordinarily *un*-comfortable. One year they spent a month at the Khyber Pass in northern Pakistan; last year they took a boat-bus-train trip up the Amazon and through rural Brazil, Bolivia, and Peru. Just 21 fun-filled days, they say, sleeping on hard beds, drinking bottled water, and coping with South American railway schedules.

When you go to Cochabamba and Cotabambas, you've *got* to take slides and movies (documentary evidence) to show the folks back home what a grand time you've had. And once you've returned, it's useful to title the slides so that six months from now, *you* can tell Cochabamba from Cotabambas. That's why Don called and wanted to know if I had a computer program that would produce professional-looking titles he could photograph directly from the computer screen. I thought I had several programs that would do just that.

The Missing Mouse

The first program that came to mind was *ColorPaint* for the PCjr. You've probably seen the

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results of this program in the advertisements for the Junior. Remember the pair of blue and white butterfly fishes swimming in a video aquarium around a red treasure chest filled with gold doubloons? *ColorPaint* produces stunning color graphics.

Unfortunately, *ColorPaint* requires a mouse controller, and I don't have a mouse yet, so we couldn't use my new *ColorPaint* to make titles.

The next program I pulled off the shelf was *PC Paintbrush*. Although *PC Paintbrush*, like *ColorPaint*, is really meant for making drawings, it too has a text feature. According to the manual, there are six fonts (type styles): Roman, Sans Serif, Greek, Script, Old English, and Computer. The fonts can be displayed in a variety of colors, sizes, and manners. For example, the Roman font can be displayed in red 30-point bold italic. If that isn't exactly what you had in mind, how about lightly outlined blue letters (blue-Roman-light-outline on the menu)? The combinations are almost endless.

PC Paintbrush runs on the PC and the PCjr and uses either a mouse or a joystick. Since I do have a joystick on the PCjr, *PC Paintbrush* seemed just the thing.

But no. *PC Paintbrush* needs 192K of memory and my PCjr has only 128K; my PC has 320K, but no joystick. I briefly considered plugging the PCjr joystick into the PC, but that won't work because my PC doesn't have a game controller board. (And even if it did, IBM made the joystick plugs incompatible.)

Labeling A Lost City

Next I tried *DR Draw* by Digital Research. Luckily, *DR Draw* requires neither a mouse nor a joystick; you can use a mouse if you have it, but the program will also run on a mouseless PC. It won't run on a PCjr, but there is a PCjr version called *Jr Draw*.

DR Draw employs menus throughout, and best of all, it is written so well that you don't have to read the manual to use it. That's my kind of program. The first menu that popped up said:

CRE REC EDIT SAVE DIR OUTP
EXIT

We pressed keys until discovering that the TAB key highlights different selections, and that the space bar actually picks a selection. Since we wanted to create a new screen, we picked CRE. The next menu was equally descriptive:

ADD CHNG SEL MOVE COPY UNDL DEL

We highlighted ADD and pressed the space bar. That brought forth:

TEXT POLY CIRC ARC LINE
MRKR BAR

Of course, text is what we wanted for titles. We entered *Machu Picchu* for the first title and positioned it on the screen, but the font wasn't anything spectacular. It really didn't do justice to this lost fortress-city of the Incas.

After exploring the menus, we discovered that CHNG (yep, CHANGE) leads to submenus to change the style, view, scale, layout, and color of text. By manipulating the location and scale, we were able to get the title sized just right. With a few presses of the Tab key and space bar, *Machu Picchu* took on a professional look.

Not Enough Colors

A few titles later, we experimented with adding some graphic elements to the picture. First a big yellow sun, then a few squiggly red lines for seagulls. Nothing elaborate. By combining stock geometric shapes, we tried adding rippling waves and fluffy clouds. However, four circles do not a cloud make. Not only were the results less than realistic, but the process was slow on a mouseless computer.

Still, in all we made a dozen title screens and saved them on disk to be recalled and photographed later.

Unfortunately, there's a serious hardware limitation when using a graphics program on the IBM PC. The standard IBM color/graphics adapter supports a maximum of three colors in graphics mode, so our title slides were limited to red, green, and yellow. (For owners of more advanced hardware, *DR Draw* has software and instructions to install non-IBM graphics adapters, printers, and plotters.) The PCjr has a more sophisticated built-in color/graphics adapter that displays a rainbow of 16 colors.

I have one other graphics program on my shelf: *DR Graph*. It's similar to *DR Draw* and is even easier to use for making all kinds of graphs and charts. Without reading the manual, you can draw pie charts, exploded pie charts, and bar graphs just by filling in blanks on the screen. It doesn't have any freehand sketching or picture-making capabilities, but there is a quick and simple way to format several different graphs on one screen.

Sometimes I wonder what these programs could do if I *did* read the manuals.

PC Paintbrush
IMSI
1299 Fourth Street
San Rafael, CA 94901
$139

DR Draw *and* DR Graph
Digital Research, Inc.
60 Garden Court
Monterey, CA 93942
$295 each

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ScriptSave

Automatic Disk Saves For Commodore 64 *SpeedScript 3.0*

J. Blake Lambert, Assistant Editor

Have you ever watched your computer suddenly blink off due to an unexpected power failure, and then realized that you haven't saved your text for an hour or more? All that work down the drain. But with "ScriptSave" these accidents won't be quite so disastrous. The machine language program is designed to work with a Commodore 64, a disk drive, and the SpeedScript 3.0 *word processor* (COMPUTE!, *March 1985).*

While you are working with a computer, you're tethered to a lifeline. That lifeline is the computer's power cord. If the lifeline is disconnected or interrupted for even a brief moment, your computer suffers an attack of amnesia. Random Access Memory (RAM) chips need a constant flow of electricity to maintain their information—the information you put into the computer. Usually a power failure does not damage the computer, but it does obliterate the program or text you were working on.

Luckily, most people live in areas with reliable power sources. However, electrical service in some locales is subject to frequent interruptions. And sometimes your wayward foot, a passer-by, a small child, or even a pet can accidentally knock a power cord loose. A split-second is all it takes for the computer to forget.

Unfortunately, the writer is often forgetful, too. To protect yourself against power interruptions, you should periodically save your work on disk. But when you're working intensely, it's easy to forget this important duty. If the power does fail, you can generally remember where you left off, but it's often impossible to remember how you got there. Even if you frequently rewrite your documents, losing any of the intermediate versions interferes with the creative process.

An Extra Rope

"ScriptSave" is the solution. ScriptSave is a short (less than 256-byte) utility that ties into the Commodore 64 version of *SpeedScript 3.0*. Every ten minutes, it waits for you to finish the paragraph you're working on, and then automatically saves your text (except for the final return character) on disk with a special filename. That way, if a power failure unexpectedly strikes, you can later recover all but the last few minutes of your work.

ScriptSave is a BASIC loader and boot program: It loads and executes *both* the machine language automatic-save routine and *SpeedScript 3.0*. Before running ScriptSave, save it to disk; since *SpeedScript* loads into the same area of memory as the ScriptSave loader, the loader is erased each time it is run. Make sure both programs are on the same disk, and change the filename in line 30 of ScriptSave (listed below as "SS3") to the filename for *SpeedScript 3.0* as stored on your disk. Generally, it is best to start with a blank disk and place ScriptSave on the disk first. This way, you can use LOAD"*",8: followed by SHIFT–RUN/STOP to boot up for a writing session.

Once you load and run ScriptSave, this prompt should appear:

File:

Type in a legal Commodore filename, but limit it to 14 characters or less. Press RETURN. ScriptSave automatically loads and runs *SpeedScript 3.0*. Now you can start writing and stop worrying about periodic saves.

When ScriptSave stores your work, it precedes the filename you specified with a two-digit version number. For example, if you choose the filename ARTICLE, the first version will be called 01ARTICLE, the second version 02ARTICLE, and so on.

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Of course, you can still save manually anytime you wish. *SpeedScript 3.0* functions normally except for one detail—it assumes that all your saves are on disk. You no longer have to press T or D to specify Tape or Disk after selecting the f8 SAVE option.

Additional Notes

When you finish writing, you will probably want to save a final version of your text. Later, if you want to scratch the intermediate versions off your disk, there's a quick method using *SpeedScript*'s disk commands. First, press CTRL–↑. When *SpeedScript* prompts Disk Command:, type s:??*article* and press RETURN (substitute for *article* the filename you specified in ScriptSave).

There's another trick you can use to give yourself more time between saves or to force an early save. Since ScriptSave uses the internal time-of-day clock, you can exit *SpeedScript 3.0* by tapping RESTORE and pressing the Y key, and then POKE 56330,0 to reset the timer and delay the save. Or you can POKE 56330,16 to set the timer for an immediate save, which will be activated the next time you press RETURN while in *SpeedScript*. You can toggle ScriptSave off and on by entering SYS 52993. Each time ScriptSave is toggled on, it resets the version number to 01 and prompts you to enter a new filename. All of these commands (except for toggling ScriptSave on) should be followed by RUN to reenter *SpeedScript*. One caution, however: While these manipulations are usually safe, there is a chance that exiting and reentering *SpeedScript* will erase your text.

ScriptSave

Please refer to "COMPUTE!'s Guide to Typing In Programs" before entering this listing.

```
10 FOR I=52993 TO 53246:READ A:CK=CK+A:PO
   KE I,A:NEXT                    :rem 175
20 IF CK<>29572 THEN PRINT"{RVS}ERROR IN
   {SPACE}DATA STATEMENTS":STOP   :rem 215
30 PRINT"{CLR}LOAD"CHR$(34)"SS3"CHR$(34)"
   ,8"                            :rem 30
40 PRINT"{4 DOWN}SYS52993"        :rem 132
50 POKE631,19:POKE632,13:POKE633,13:POKE1
   98,3:END                       :rem 104
52993 DATA 173,236,2,73,1,141     :rem 155
52999 DATA 236,2,208,12,160,2     :rem 155
53005 DATA 185,252,207,153,189,10 :rem 95
53011 DATA 136,16,247,96,160,3    :rem 199
53017 DATA 185,248,207,153,33,19  :rem 52
53023 DATA 136,16,247,169,48,141  :rem 51
53029 DATA 167,2,141,168,2,169    :rem 208
53035 DATA 212,160,207,32,30,171  :rem 28
53041 DATA 169,227,160,207,32,30  :rem 38
53047 DATA 171,32,0,172,160,2     :rem 138
53053 DATA 185,254,1,153,167,2    :rem 201
53059 DATA 240,3,200,208,245,140  :rem 33
53065 DATA 237,2,169,32,141,189    :rem 4
53071 DATA 10,169,112,141,190,10  :rem 28
53077 DATA 169,207,141,191,10,32  :rem 44
53083 DATA 96,207,76,13,8,160     :rem 161
53089 DATA 1,140,238,2,136,140    :rem 195
53095 DATA 8,220,140,9,220,140    :rem 191
53101 DATA 10,220,96,138,201,13   :rem 231
53107 DATA 240,9,201,141,240,7    :rem 187
53113 DATA 104,104,76,196,10,162   :rem 36
53119 DATA 95,142,239,2,173,10    :rem 202
53125 DATA 220,41,240,240,70,206  :rem 26
53131 DATA 238,2,208,214,238,168  :rem 47
53137 DATA 2,173,168,2,201,58     :rem 151
53143 DATA 208,20,169,48,141,168  :rem 51
53149 DATA 2,238,167,2,173,167    :rem 212
53155 DATA 2,201,58,208,5,169     :rem 154
53161 DATA 48,141,167,2,169,214   :rem 255
53167 DATA 160,207,32,113,9,173   :rem 250
53173 DATA 237,2,162,167,160,2    :rem 199
53179 DATA 32,189,255,169,1,162    :rem 12
53185 DATA 8,160,0,142,27,19      :rem 101
53191 DATA 32,186,255,32,197,18     :rem 8
53197 DATA 32,96,207,174,239,2    :rem 216
53203 DATA 96,18,14,147,211,67    :rem 205
53209 DATA 82,73,80,84,211,65     :rem 160
53215 DATA 86,69,146,0,32,194     :rem 161
53221 DATA 76,65,75,69,32,204     :rem 161
53227 DATA 65,77,66,69,82,84      :rem 131
53233 DATA 13,198,73,76,69,58     :rem 175
53239 DATA 0,162,8,208,24,138     :rem 153
53245 DATA 201,13                 :rem 64
```

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Dynamic Function Keys For VIC & 64

Albert Chu

Now you can put those do-nothing special function keys on your computer to work. The accompanying programs provide several handy functions for BASIC programmers—available at the touch of a key.

Not too long ago, special programming aids that added new keyboard features to your computer had to preempt certain seldom-used keys, or else require you to press an awkward combination of keys. A conflict arose when you wanted to use the key for its original purpose. What then?

Fortunately, most of today's computers come with all-purpose programmable function keys. On some computers (such as the Commodore Plus/4, 16, and IBM PC/PCjr), these special function keys are preprogrammed to perform various tasks. But on other computers (such as the Commodore 64 and VIC-20), the function keys do nothing. It's up to you to program them.

The f1–f8 keys on the 64 and VIC are quite easy to program in BASIC. It's simply a matter of detecting the keypress with an IF-THEN statement and passing control to the appropriate subroutine. However, if the functions you want to assign to the keys are programming aids, the BASIC program that reads the keys will interfere with the BASIC program you're working on. What's needed is a machine language program that runs transparently, in the "background."

That's exactly what you get with "Dynamic Function Keys." It reprograms all eight functions of the four keys on the 64 and VIC. With a single keypress, you can instantly change the screen colors, freeze a listing, clear a portion of the screen, and much more. And the machine language program runs invisibly in the background, leaving your BASIC program intact.

Eight Programming Aids

Here's a list of features provided by Dynamic Function Keys:

f1 changes the screen colors for a more readable display—cyan characters on a black background.

f2 changes the screen colors to black on white for the VIC, and black on light gray for the 64. This combination is especially readable when using the Supermon machine language monitor.

f3 enables automatic-repeat for all the keys, just like the cursor keys. Simultaneously press f3 and the key you want to repeat, then release f3 while holding down the other key. (On the 64, you don't have to release f3 to keep the key repeating.)

f4 exits the infamous Commodore "quote mode." When editing the text between quotes in a PRINT statement, the cursor can stop acting normally—cursor movements are stored within the string as reverse characters, instead of being interpreted literally. Usually you must hit RETURN or SHIFT–RETURN to escape from quote mode, then move the cursor back up to the line and begin editing again. Now you can simply press f4 to escape from quote mode.

f5 is a general-purpose pause key. It temporarily freezes almost all visible activities of the computer. By pressing f5, you can temporarily stop a listing from scrolling, then start it again. (Sometimes this causes a line to be listed twice on the screen; this can be safely ignored.) Or you can halt a running BASIC program. To unfreeze the computer, press the Commodore key at the bottom-left corner of the keyboard.

f6 tabs the cursor to a predetermined tab stop. On the 64, tabs are ten spaces apart; on the VIC, f6 tabs the cursor to the right screen margin.

f7 clears the screen from the top line to the cursor position.

f8 clears the screen from the cursor position to the bottom line.

Hints For Use

Be sure to type in the right listing for your computer; the programs are very similar but not identical. If you have a VIC with 8K or more memory expansion, substitute the modifications in Program 3 for lines 220 and 300 in Program 2.

As always, save the program on disk or tape before running it for the first time. The program is a BASIC loader which POKEs the machine language into memory. After it runs, type NEW to erase the BASIC portion. Then type SYS 750

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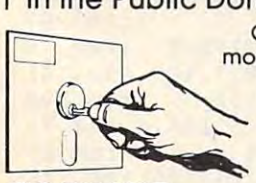

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to activate the machine language portion.

Before running a BASIC program of your own—especially a program that defines the function keys for its own purposes—you should disable Dynamic Function Keys by pressing RUN/STOP–RESTORE. Otherwise, the programs may interfere with each other, or you could blank out a section of the screen by accidentally hitting f7 or f8. Of course, if you want to freeze program execution with f5, you'll have to keep Dynamic Function Keys active.

To reenable Dynamic Function Keys, enter SYS 750.

I recommend that you disable the utility before executing any input/output operations, such as saving or loading a program.

Programmer's Notes

Dynamic Function Keys is an interrupt-driven routine that resides at the top of memory. Although you activate it with SYS 750, that address contains only an instruction to jump to the section of code that links the program to the IRQ. Dynamic Function Keys works by altering an interrupt vector which points to routines in Read Only Memory (ROM) for checking the RUN/STOP key, updating the clock, and performing other chores. The program alters this vector to point to its own routines instead.

The values in the A, X, and Y registers are stored on the 6502/6510 stack whenever the computer calls the new interrupt routine every 1/60 second. It is essential to save the contents of these registers so that everything can be restored when returning from the interrupt.

During each interrupt, the program checks to see if a function key has been pressed. If none was, the program restores the registers and continues with the normal IRQ routine.

If a key was pressed, the program checks to see if the screen editor is in quote mode. If so, it continues with the normal interrupt, unless f4 (the quote mode exit key) was pressed. This lets you imbed function key codes in a string as usual without the new functions getting in the way. If you want to use f4 in a BASIC program, refer to it with CHR$(138).

After it detects that a function key was pressed, the program checks the SHIFT key (to distinguish between f1 and f2, for example). Then it executes the appropriate function.

Interpreting The Keys

If you pressed f1 or f2 (to change screen colors), Dynamic Function Keys simply places the color codes into the screen color registers.

When f3 is pressed, the program sets the key repeat flag at memory location 650 (decimal) to 128 until the key is released. Then it stores a 0 to turn off the automatic repeat.

The f4 (exit quote mode) key triggers the program to test for quote mode. The escape option is bypassed if the screen editor is not in quote mode. Otherwise, the program stores zeroes in three memory locations: 212 (the quote mode flag), 216 (the number of inserts left), and 199 (the reverse-character flag). Next, it erases the characters left by the f4 key and moves the cursor backward one space to cover up any signs the f4 key left behind.

The f5 (pause) key does not actually stop the computer, of course. Instead, the computer repeatedly scans the keyboard until the Commodore key is pressed. Only then will the machine exit the loop and continue with the interrupt. Since the keyboard buffer remains active during this looping, any other keys you press while the computer is frozen will be executed after it "thaws." If you press f5 when no program is running, the cursor will disappear until you hit the Commodore key.

When you push f6 (tab), the program determines the cursor position by calling a Kernal routine, and then moves the cursor by calling another Kernal routine.

To clear a portion of the screen when you press f7 or f8, the program first finds the cursor position. Locations 209 and 210 contain the low and high bytes of the memory address corresponding to the cursor's row, and location 211 indicates the cursor position in that row. Then the program fills screen memory with spaces either above or below the cursor position.

Program 1: Dynamic Function Keys For Commodore 64

Please refer to "COMPUTE!'s Guide to Typing In Programs" before entering this listing.

```
Ø REM{6 SPACES}--- 64 VERSION ---:rem 178
100 S=(PEEK(56)-2)*256+176:FORI=STOS+333:
    READA:CK=CK+A:POKEI,A:NEXT     :rem 36
110 POKE56,(S-2)/256:POKE55,(S-2)-INT((S-
    2)/256)*256                    :rem 40
115 IFCK<>44952THENPRINT"ERROR IN DATA":S
    TOP                           :rem 241
120 POKE750,76:POKE751,S-INT(S/256)*256:P
    OKE752,S/256                   :rem 29
130 F=S+13:POKES+2,F-INT(F/256)*256:POKES
    +7,F/256                       :rem 34
140 PRINT"{CLR}{DOWN}{RIGHT}{RVS} DYNAMIC
     FUNCTION KEYS {DOWN}         :rem 207
150 PRINT" <SYS 750> TO ACTIVATE  :rem 78
160 DATA 120,169,189,141,20,3,169,192,141
    ,21,3,88,96,72,138,72,152      :rem 190
170 DATA 72,166,197,56,224,3,144,6,224,7,
    176,2,144,12,224,64,208        :rem 85
180 DATA 5,169,Ø,141,138,2,24,144,109,224
    ,5,240,8,164,212,208,101       :rem 108
190 DATA 164,216,208,97,173,141,2,41,1,20
    8,98,224,4,208,13,141,33       :rem 124
200 DATA 208,141,32,208,169,3,141,134,2,2
    Ø8,73,224,5,208,7,169,128      :rem 171
```

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```
210 DATA 141,138,2,208,62,224,6,208,12,32
    ,159,255,173,141,2,41,2          :rem 56
220 DATA 240,246,208,46,165,209,24,101,21
    1,133,253,165,210,105,0,170,169
                                     :rem 197
230 DATA 4,133,252,169,0,133,251,168,169,
    32,224,4,208,4,196,253,240       :rem 224
240 DATA 15,145,251,200,208,2,230,252,196
    ,253,208,245,228,252,208,241,104
                                     :rem 254
250 DATA 168,104,170,104,76,49,234,224,4,
    208,17,169,12,141,33,208,169     :rem 76
260 DATA 6,141,32,208,169,0,141,134,2,240
    ,227,224,5,208,34,165,216        :rem 161
270 DATA 208,4,165,212,240,16,164,211,136
    ,169,32,145,209,169,157,141,119
                                     :rem 224
280 DATA 2,169,1,133,198,169,0,133,212,13
    3,199,133,216,240,107,224,6      :rem 18
290 DATA 208,50,165,211,160,0,56,201,40,1
    44,4,233,40,160,255,201,11       :rem 190
300 DATA 176,4,169,10,208,18,201,21,176,4
    ,169,20,208,10,201,31,176        :rem 157
310 DATA 4,169,30,208,2,169,39,192,255,20
    8,3,24,105,40,133,211,208        :rem 167
320 DATA 53,165,209,230,211,24,101,211,16
    8,198,211,165,210,105,0,133,252
                                     :rem 189
330 DATA 169,0,133,251,162,7,134,254,169,
    231,133,253,169,32,192,232,208
                                     :rem 171
340 DATA 4,228,252,240,15,145,251,200,208
    ,2,230,252,192,232,208,245,228
                                     :rem 152
350 DATA 252,208,241,104,168,104,170,104,
    76,49,234                        :rem 157
```

Program 2: Dynamic Function Keys For VIC-20

Please refer to "COMPUTE!'s Guide to Typing In Programs" before entering this listing.

```
0 REM --VIC VERSION--                :rem 208
100 S=(PEEK(56)-2)*256+224:POKE56,(S-2)/2
    56:POKE55,S-2-INT((S-2)/256)*256
                                     :rem 187
110 FORI=STOS+286:READA:CK=CK+A:POKEI,A:N
    EXT                              :rem 65
115 IFCK<>40605THENPRINT"ERROR IN DATA":E
    ND                               :rem 121
120 F=S+13:POKES+2,F-INT(F/256)*256:POKES
    +7,F/256                         :rem 33
130 POKE750,76:POKE751,S-INT(S/256)*256:P
    OKE752,S/256                     :rem 30
140 PRINT"{CLR}{DOWN}{RVS}DYNAMIC FUNCTIO
    N KEYS{DOWN}                     :rem 178
150 PRINT"<SYS 750> TO ACTIVATE      :rem 78
160 DATA 120,169,237,141,20,3,169,192,141
    ,21,3,88,96,72,138,72,152        :rem 184
170 DATA 72,166,197,224,64,208,7,169,0,14
    1,138,2,240,112,224,47,240       :rem 227
180 DATA 8,164,212,208,104,164,216,208,10
    0,173,141,2,41,1,208,101,224     :rem 38
190 DATA 39,208,12,169,8,141,15,144,169,3
    ,141,134,2,208,77,224,47         :rem 136
200 DATA 208,7,169,128,141,138,2,208,66,2
    24,55,208,12,32,159,255,173      :rem 28
210 DATA 141,2,41,2,240,246,208,50,224,63
    ,208,46,165,209,24,101,211       :rem 197
220 DATA 133,253,165,210,105,0,170,169,30
    ,133,252,169,0,133,251,168,169
                                     :rem 157
230 DATA 32,224,30,208,4,196,253,240,15,1
    45,251,200,208,2,230,252,196     :rem 49
240 DATA 253,208,245,228,252,208,241,104,
    168,104,170,104,76,191,234,224,39
                                     :rem 64
250 DATA 208,12,169,30,141,15,144,169,0,1
    41,134,2,240,112,224,47,208      :rem 253
260 DATA 34,165,216,208,4,165,212,240,16,
    164,211,136,169,32,145,209,169
                                     :rem 173
270 DATA 157,141,119,2,169,1,133,198,169,
    0,133,212,133,199,133,216,240:rem 121
280 DATA 74,224,55,208,13,56,32,240,255,1
    60,21,24,32,240,255,24,144       :rem 215
290 DATA 57,224,63,208,53,165,209,230,211
    ,24,101,211,168,198,211,165,210
                                     :rem 212
300 DATA 105,0,133,252,169,0,133,251,162,
    31,134,254,169,250,133,253,169
                                     :rem 154
310 DATA 32,192,250,208,4,228,252,240,15,
    145,251,200,208,2,230,252,192    :rem 95
320 DATA 250,208,245,228,252,208,241,104,
    168,104,170,104,76,191,234       :rem 224
```

Program 3: Modifications For 8K Or More Expansion

```
115 IFCK<>40577THENPRINT"ERROR IN DATA":E
    ND                               :rem 129
220 DATA 133,253,165,210,105,0,170,169,16
    ,133,252,169,0,133,251,168,169
                                     :rem 161
300 DATA 105,0,133,252,169,0,133,251,162,
    17,134,254,169,250,133,253,169
                                     :rem 158
```

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IBM Disk Rx

Michael A. Covington

Did you erase a file by accident? Maybe you can resurrect it with "IBM Disk Rx." This interesting utility also lets you explore how information is stored on your disks. It runs on any IBM PC with at least 128K RAM and a disk drive, or Enhanced Model PCjr with Cartridge BASIC. For DOS 2.0 or 2.1.

If you're anything like me, about once a month the dreaded misfortune befalls you: You find you've erased your only copy of an important program or document. Perhaps you thought you had a second copy when you didn't, or perhaps it was just a silly mistake. Maybe you typed the wrong filename because you were thinking about two files at once.

Fortunately, deleted files can often be recovered. When you delete a file from an IBM PC or PCjr disk, the data isn't really erased. Instead, the space on the disk that the file occupied is marked as free space for future use. The contents of the file aren't overwritten until the space is needed for something else. So if you've accidentally deleted a file—and you haven't yet written anything else onto the disk—there's at least a chance you can get the file back. "IBM Disk Rx" lets you search through a disk to locate your data, reconstruct the file in a memory buffer, and then save a copy on a new disk.

How To Recover A File

In brief, here are simple instructions for using IBM Disk Rx:

1. Make sure to write nothing else on the disk containing the data you want to recover. Any new files or data would probably overwrite the deleted file. Immediately after the accident, remove the disk from the computer and set it aside.

2. Call up IBM Disk Rx and start it running. When it's ready, insert the disk with the deleted file into the drive. By following the Disk Rx screen instructions, you can display sectors of the disk on the screen, one at a time.

3. Step through the disk, sector by sector, hunting for pieces of your lost file. Press N (for *Next unallocated sector*) as many times as necessary until you come to the first sector of your file. Then press the A key to add that sector to the Disk Rx memory buffer. Then press N again to find the next sector, and so forth. Nine times out of ten, you can work your way through the whole file using just the N and A keys; you'll know you're done when you reach a sector that isn't part of the file.

4. After you've put together all of your file in memory (the Disk Rx buffer holds up to 48K), press Q to quit. Disk Rx asks you to insert another disk and type a filename. Then it saves a copy of the rebuilt file.

But sometimes it's not this simple. It's not always easy to recognize pieces of your deleted file or to determine their proper order. Some skill is involved; IBM Disk Rx can't work miracles by itself. As we'll explain in a moment, if you accidentally delete a file from a heavily used disk, the sectors you need to retrieve may be scattered all over the disk and are difficult to reorganize. Occasionally it may be easier to recreate a lost file than to reconstruct it. That's a choice you'll have to make after examining a problem disk with Disk Rx.

Searching For Sectors

To use Disk Rx effectively, you must learn to recognize fragments of your deleted file when you see them. As you view the contents of each sector on the screen, keep in mind that Disk Rx has to translate some characters to make them displayable. For example, Disk Rx does not skip to a new line when it encounters a carriage return character in a sector. If it did, an entire sector might not fit on the screen. Instead, control characters such as carriage returns and linefeeds are represented by adding 32 to their ASCII values and displaying the result in inverse video. This is like pressing a Ctrl key combination on the keyboard—a Ctrl-A, for instance, shows up as the letter A in inverse video.

If you accidentally erased a text file, your job

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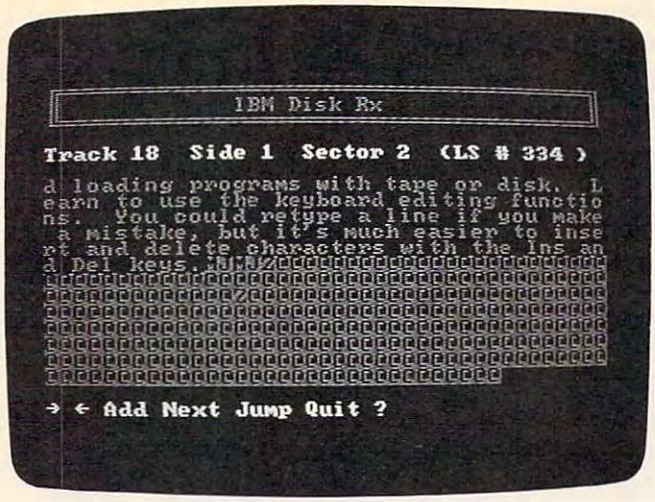

Figure 1: A sector containing a text file is easy to spot. Notice the Ctrl-M, Ctrl-J denoting the end of a line, and the Ctrl-Z at the end of the file.

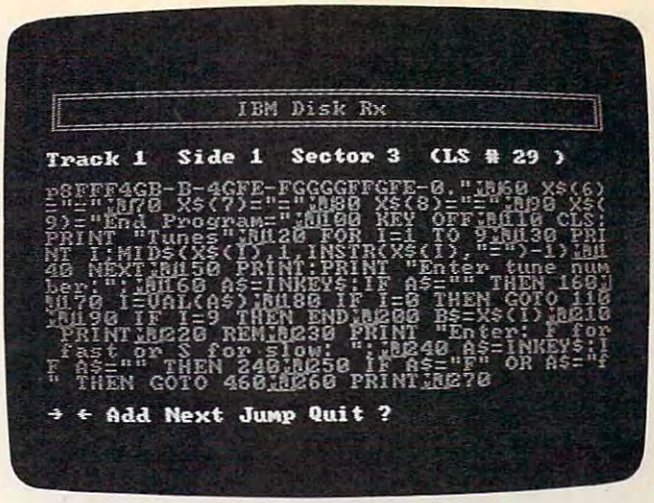

Figure 2: Sectors containing BASIC programs are harder to identify. This ASCII file is easier to read than a tokenized BASIC file.

is relatively easy. Most of the text *does* appear onscreen as normal characters. For ASCII text files, the end of a line is represented by Ctrl-M and Ctrl-J (carriage return and linefeed). The end of a file is usually denoted by Ctrl-Z, after which there may be random data (usually repeated material from the previous sector). Most word processing files follow this system (Figure 1), though additional special characters may also be present.

Other types of files look quite different. Tokenized BASIC programs, for instance, are a jumble of characters in which only the variable names, quoted strings, and comments are recognizable (Figure 2). And in a machine language program, you may not be able to recognize anything except a few messages (Figure 3). The main challenge in these cases is to identify the beginning of your file. Also, these files usually don't end with Ctrl-Z like text files. However, spurious material at the end of a program is unlikely to cause problems if the program is a closed loop.

To get a feel for how different types of files appear onscreen, practice examining some sectors with Disk Rx. The utility won't alter or harm your disks in any way.

Restoring Order

Your second task when reconstructing a deleted file is putting the pieces back together in the proper sequence. This is made a lot harder by the way an IBM computer stores files on a disk.

The basic problem is that files aren't necessarily stored in blocks of contiguous sectors.

Figure 3: Sectors which store pieces of machine language programs are the hardest to recognize. Everything but the comments appears as garbage.

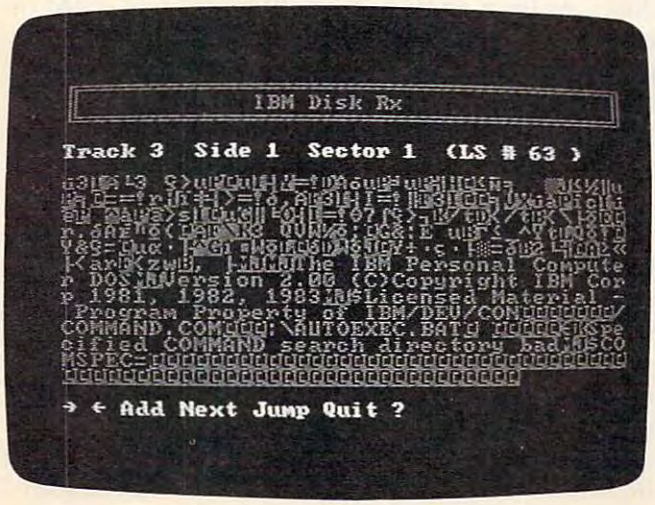

Figure 4: This sector contains directory information for the disk.

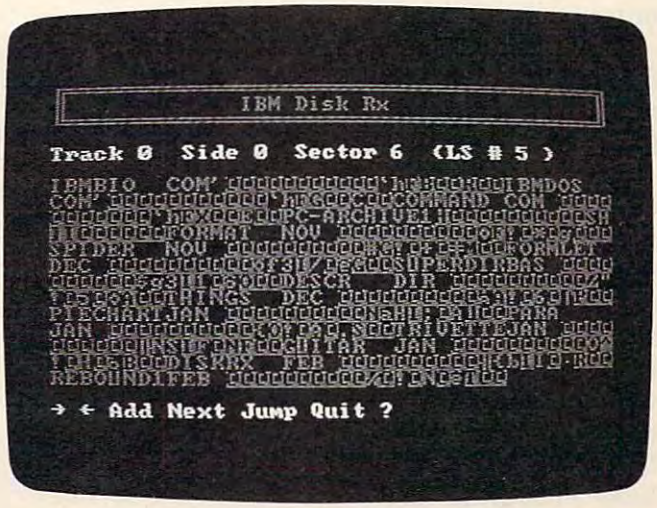

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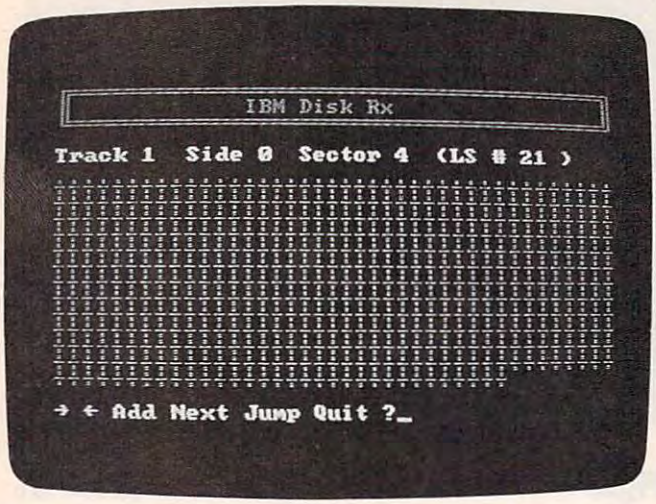
Figure 5: A blank (unused) sector.



For instance, assume that you've saved two files on a freshly formatted disk. Now let's say you delete the first file, then save a new file which is longer than the deleted one. DOS (the Disk Operating System) starts writing the new data in the gap left by the deleted file. When it runs out of room there, it skips over the sectors occupied by the second file and saves the rest of the new data in another block. Therefore, the new file is split into two parts, or noncontiguous blocks, around the existing file.

As you might expect, a heavily used disk—on which you've saved and deleted many files of different lengths—can get pretty messy. A long file might be scattered in separate blocks all over the disk. They're not only noncontiguous, but also nonconsecutive. The last part of a file might be stored in a block before the first part of a file.

All this is normally something you'd never think about because DOS takes care of the messy details. DOS keeps a map on the disk to keep track of which blocks of sectors belong to which files (called *allocation*). The map also tells DOS how to put the sectors together in the proper order (called *linkage*).

When you delete a file, the sectors of actual data are left undisturbed, but unfortunately, the *map* is altered. All of the allocation and linkage information is erased.

Some disk operating systems (for example, Commodore and Atari) store the linkage information within the data sectors themselves. It's therefore easy to reconstruct deleted files on these disks since each sector points to the next sector in the linked chain of files. But since PC-DOS stores the linkage information in a map which is altered when the file is deleted, you have to link sectors back together the hard way. If the disk hasn't been used much, you might be lucky enough to find all or most of the sectors contiguous and consecutive. Otherwise, you must examine each sector, one by one, and restore the proper order yourself. Fortunately, Disk Rx has a few features to make the job possible.

Solving The Puzzle

When sectors of a deleted file are randomly scattered all over a disk, your best bet is probably to recover your file in more than one piece, then put the pieces together in the correct order using the COPY command in DOS.

To do this, retrieve a block of sectors using the Disk Rx buffer. Save each block as a separate file on a scratch disk. When you've collected all the blocks that belong to the lost file, try to reassemble them on the scratch disk in the right order with COPY. (See your DOS manual for instructions on combining, or *concatenating*, multiple files with the COPY command.)

An alternative is to search through the disk until you find out where the scattered blocks of sectors are, then use the Disk Rx buffer to reassemble them in the proper sequence. Disk Rx lets you jump directly to any sector when you press the J key.

One warning is in order: If you are piecing together a file and cannot locate the original last sector of the file, you'll get strange results when you try to reload the partial file. Without the last sector, the file will be missing its end-of-file marker (the Ctrl-Z character mentioned above). In this case, random data will appear to be appended to the end of the file when it is reloaded into memory. Or, if you have a program already in memory when you load the partial file, any portion of the program in memory that's beyond the end of your partial file will be added to the file.

Exploring Disks

You can also use Disk Rx to examine the contents of any sector on a disk, whether or not it is part of a file. You can even examine non-IBM disks, as long as they have 40 tracks and eight or nine 512-byte sectors per track. (This doesn't mean that the program can read *any* disk; generally only IBM-compatible computers use the disk format of 40 tracks with eight or nine sectors of 512 bytes.) Internally, DOS refers to sectors by their logical sector numbers (Table 1). The same numbering system is used for all disks, though some disks lack some of the sectors (there is no side 1 on a one-sided disk, and no sector 9 on any track of an eight-sector disk).

Table 2 is a guide to the special areas that DOS records at the beginning of each disk. The boot record is generated by the FORMAT command in order to distinguish between system and nonsystem disks. Then comes the *file allocation*

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table (FAT), the map which identifies the status of each sector (free space, last sector of a file, or part of a file which continues in sector number so-and-so). The FAT looks like gibberish on the screen; each entry occupies one and a half bytes, and fairly elaborate techniques are needed to decode it.

Finally, there is the directory (Figure 4), which lists all the files (and/or subdirectories) together with codes for the sectors in which they begin. Examining the directory can be a good way to find out what files have been erased, since the filenames are clearly legible and a special character replaces the first letter of the name of each erased file. Note also that the directory sectors list hidden files such as IBMBIO.COM, even though the DIR command doesn't.

How It Works

The heart of Disk Rx is a machine language routine that asks DOS to read a particular sector, identified only by logical sector number. The statements in lines 90–210 POKE this routine into memory. You can use this routine in your own programs to read disks sector by sector. Note that before the routine is called, DOS must be notified that the user may have changed disks; this is done by executing any DOS operation that refers to drive A. I used CHDIR (line 260) because it does not cause an error if a non-IBM disk is inserted.

To set aside a large buffer in which to store the reconstructed file, Disk Rx manages memory in a somewhat unusual way. The CLEAR statement in line 50 tells the BASIC interpreter not to use addresses from hexadecimal 3C00 to the top of the 64K segment. As indicated in Table 3, this area contains a 48K workspace in which the recovered file is put together, followed by the machine language subroutine and some space for its parameters, including the 512-byte sector itself.

Table 1:

Sector-Numbering In DOS 2.0 And 2.1

The same numbering system is used for all disks, and DOS keeps tabs on which numbers are not used on particular disks (that is, sector 9 of any track does not exist on eight-sector disks, and side 1 does not exist on a one-sided disk).

Logical Sector Number	Track	Side	Sector
0	0	0	1
1	0	0	2
2	0	0	3
3	0	0	4
4	0	0	5
5	0	0	6
6	0	0	7
7	0	0	8
8	0	0	9
9	0	1	1
10	0	1	2
11	0	1	3
12	0	1	4
13	0	1	5
.	.	.	.
.	.	.	.
.	.	.	.
717	39	1	7
718	39	1	8
719	39	1	9

Table 2:

Special Sectors At The Beginning Of Disks

8-sector, 1-sided disk	8-sector, 2-sided disk	9-sector, 1-sided disk	9-sector, 2-sided disk	Area
0	0	0	0	Boot record
1	1	1–2	1–2	First copy of FAT
2	2	3–4	3–4	Second copy of FAT
3–6	3–7, 9–10	5–8	5–11	Directory

Table 3:

Special Disk Rx Memory Locations (Hex)

0000–3BFF	BASIC program and variables.
3C00–FBFF	48K buffer for storing recovered files.
FC00–FC20	Machine language subroutine to read disk sectors.
FD00–FDFF	Transfer area for contents of sector.
FF00	Indicates which disk drive to read (0 = A, 1 = B, etc.).
FF01	Low byte of logical sector number.
FF02	High byte of logical sector number.
FF03	Return code from subroutine (successful read = 0, error = 1).

Table 4:

Important Disk Rx Variables

DISKREAD	Address of machine language subroutine.
FAT	Array in which file allocation table is stored.
FATP	Pointer used to read FAT.
FATSIZE	Number of elements actually used by array FAT.
FATV	Decoded FAT entry for a particular sector (unallocated sector = 0).
NONDATA	Number of sectors occupied by boot record, root directory, and file allocation table. Counts the nonexistent ninth sector on eight-sector disks.
PCT!	Percentage of buffer used.
SCTR	Logical sector number of current sector.
SECTORS	Sectors per track (eight or nine).
SIDES	1-sided disk = 1, 2-sided disk = 2.
STP	Points to next available byte in buffer where file is retrieved.
STPF!	STP in floating-point form.
SUM	Checksum to verify correct typing of DATA statements.

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To identify unallocated sectors (which are likely to contain deleted files), the program decodes the FAT entry for each sector and searches for values of 0. This is done in lines 1130–1170 and 1660–1720.

The rest of the program is relatively simple. As each sector is read, Disk Rx displays the contents by PEEKing the 512 bytes of memory beginning at hex FD00. If the sector is to be added to the workspace, these 512 bytes are POKEd into locations starting at STP (Storage Pointer), which is initially hex 3C00. At the end, the contents of the workspace are written out to a file one byte at a time.

IBM Disk Rx

Please refer to "COMPUTE!'s Guide to Typing In Programs" before entering this listing.

```
DC 10 REM IBM Disk Rx
EM 20 SCREEN 0: WIDTH 40: CLS: KEY OFF
DM 30 DEF SEG: POKE 91,1: POKE 92,25
PB 40 GOSUB 1500
EA 50 CLEAR,&HFF10: CLEAR,&H3C00
CP 60 DEFINT A-Z
JH 70 OPTION BASE 0: DIM FAT(536)
GJ 80 ' Poke mach.lg. routine into pla
      ce
MP 90 I=&HFC00: SUM=0
EJ 100 READ J: IF J>255 THEN 120
FP 110 POKE I,J: SUM=SUM+J: I=I+1: GOT
       O 100
FD 120 IF SUM<>J THEN PRINT "Typing er
       ror in DATA statements":END
ID 130 DATA &HA0, &H00, &HFF, &H8B, &H
       16
FO 140 DATA &H01, &HFF, &HB9, &H01, &H
       00
NC 150 DATA &HBB, &H00, &HFD, &HCD, &H
       25
PO 160 DATA &H73, &H07, &HC6, &H06, &H
       03
IB 170 DATA &HFF, &H01, &HEB, &H05, &H
       C6
FA 180 DATA &H06, &H03, &HFF, &H00, &H
       9D
DH 190 DATA &HCA, &H00, &H00, 3346
DL 200 POKE &HFF00,0
HN 210 DISKREAD = &HFC00
DB 220 ' Set up
ND 230 PRINT: PRINT "Place the disk yo
       u wish to"
NM 240 PRINT "examine into drive A."
GL 250 GOSUB 1740
OF 260 CHDIR "A:\"  'tells DOS a new d
       isk has been inserted
ON 270 POKE &HFF01,1: POKE &HFF02,0
LE 280 CALL DISKREAD
OL 290 IF PEEK(&HFF03)=0 THEN 380
AG 300 GOSUB 1500
NF 310 PRINT "Non-IBM disk or unreadab
       le FAT."
IG 320 PRINT
GP 330 PRINT "Assumed to be 2-sided di
       sk,"
KJ 340 PRINT "with 8 or 9 sectors per
       track,"
OA 350 PRINT "all sectors unallocated
       "
KA 360 SECTORS=9: SIDES=2: NONDATA=12
KP 370 GOSUB 1740: GOTO 520
AE 380 GOSUB 1500: I=PEEK(&HFD00)
DM 390 IF I=&HFF THEN SIDES=2: SECTORS
       =8: NONDATA=11
LD 400 IF I=&HFE THEN SIDES=1: SECTORS
       =8: NONDATA=7
GJ 410 IF I=&HFD THEN SIDES=2: SECTORS
       =9: NONDATA=12
CC 420 IF I=&HFC THEN SIDES=1: SECTORS
       =9: NONDATA=9
FJ 430 IF SECTORS=9 THEN FATSIZE=531 E
       LSE FATSIZE=476
MD 440 IF SIDES=0 THEN 310
HL 450 PRINT "Analyzing file allocatio
       n table..."
JD 460 FATP=1: GOSUB 1570
OJ 470 ' If 9-sector disk, read the re
       st of the FAT
JM 480 IF SECTORS<>9 THEN 520
JD 490 POKE &HFF01,2: CALL DISKREAD
GD 500 GOSUB 1570
JB 510 ' Initialize
NG 520 SCTR=NONDATA: STP=&H3C00
FK 530 GOSUB 1500: COLOR 15,0
EH 540 PRINT "This is a";SIDES;"-sided
       , ";SECTORS;"-sector disk."
GD 550 COLOR 7,0
LF 560 PRINT: PRINT "Scan begins with
       the first data sector."
OA 570 PRINT "Then press:": PRINT
CP 580 PRINT CHR$(27);"  to view the p
       receding sector"
CN 590 PRINT CHR$(26);"  to view the f
       ollowing sector"
PL 600 PRINT "A  to ADD the current se
       ctor to the"
AF 610 PRINT "        file being recons
       tructed"
IO 620 PRINT "N  to view the NEXT unal
       located sector"
FF 630 PRINT "J  to JUMP to a specific
        sector"
OG 640 PRINT "Q  to QUIT."
GP 650 GOSUB 1740
JF 660 ' Display a sector
FD 670 GOSUB 1500: COLOR 15,0
EO 680 IF SCTR<0 THEN SCTR=0
JO 690 IF SCTR>32767 THEN SCTR=32767
OC 700 PRINT "Track";INT(SCTR/(9*SIDES
       ));
BE 710 IF SIDES=2 THEN PRINT " Side";I
       NT((SCTR MOD 18)/9);
HC 720 PRINT " Sector";1+(SCTR MOD 9);
BC 730 PRINT " (LS #";SCTR;")"
GN 740 COLOR 7,0: PRINT
GA 750 POKE &HFF01,SCTR MOD 256
HH 760 POKE &HFF02,INT(SCTR/256)
LH 770 CALL DISKREAD
KP 780 IF PEEK(&HFF03)=0 THEN 810
MO 790 PRINT "<< Nonexistent or unread
       able sector >>"
```


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```
JL 800 GOTO 860
JC 810 FOR I=&HFD00 TO &HFEFF
GO 820  J=PEEK(I)
JG 830  IF J>31 THEN PRINT CHR$(J);: G
       OTO 850
LE 840  COLOR 0,7: PRINT CHR$(J+64);:
       COLOR 7,0
OI 850 NEXT I
BB 860 COLOR 15,0: PRINT: PRINT
LG 870 IF INKEY$<>"" THEN 870
CH 880 PRINT CHR$(26)+" "+CHR$(27)+" A
       dd Next Jump Quit ?";
HH 890 Q$=INKEY$: IF Q$="" THEN 890
PD 900 IF Q$=(CHR$(0)+CHR$(75)) THEN S
       CTR=SCTR-1: GOTO 670
NB 910 IF Q$=(CHR$(0)+CHR$(77)) THEN S
       CTR=SCTR+1: GOTO 670
GC 920 IF Q$="A" OR Q$="a" THEN 980
OF 930 IF Q$="N" OR Q$="n" THEN 1130
GO 940 IF Q$="J" OR Q$="j" THEN 1220
BO 950 IF Q$="Q" OR Q$="q" THEN 1280
DK 960 BEEP: GOTO 890
EF 970 ' Add sector to workspace
KN 980 PRINT: PRINT "Adding..."
NO 990 STPF!=STP
EN 1000 IF STPF!>=64512! THEN PRINT "O
       ut of workspace.":GOTO 1100
DN 1010 FOR I=0 TO 511
JL 1020   POKE STP+I,PEEK(&HFD00+I)
PF 1030 NEXT
CO 1040 STP=STP+512
FG 1050 PRINT "Done.  Workspace now";
EI 1060 STPF!=STP
JE 1070 IF STPF!<0 THEN STPF!=STPF!+65
       536!
GC 1080 PCT!=100*((STPF!-15360)/49152!
       )
DK 1090 PRINT INT(PCT!+.5);"% full."
IG 1100 PRINT CHR$(26)+" "+CHR$(27)+"
       Next Jump Quit ?";
IE 1110 GOTO 890
DD 1120 ' Go to next free sector
FF 1130 GOSUB 1500
GG 1140 PRINT "Searching for unallocat
       ed sector..."
CP 1150 SCTR=SCTR+1: LOCATE 8,1: PRINT
        SCTR: GOSUB 1660
KF 1160 IF (FATV=0) AND (SCTR<=719) TH
       EN 670
LI 1170 IF SCTR<719 THEN 1150
AC 1180 PRINT: PRINT "No more unalloca
       ted sectors."
GK 1190 PRINT: COLOR 15,0
OK 1200 PRINT CHR$(26)+" "+CHR$(27)+"
       Jump Quit ?": GOTO 890
HC 1210 ' Jump to a particular sector
LP 1220 PRINT: INPUT "Track ( 0 to 39
       )";T
JK 1230 H=0: IF SIDES>1 THEN INPUT "Si
       de ( 0 or 1 )";H
BL 1240 PRINT "Sector ( 1 to";SECTORS;
       ") ";
HF 1250 INPUT S
JA 1260 SCTR = T*SIDES*9 + H*9 + S - 1
HK 1270 GOTO 670
FE 1280 ' Write out workspace to file
EA 1290 IF STP=&H3C00 THEN 1470
CI 1300 GOSUB 1500: PRINT
BF 1310 PRINT "Ready to create a disk
       file from"
MF 1320 PRINT "contents of workspace."
QM 1330 PRINT
GP 1340 PRINT "Place the disk you wish
        to use into"
GK 1350 PRINT "the appropriate drive (
       drive A is OK)."
AF 1360 GOSUB 1740: GOSUB 1500
KF 1370 PRINT "Enter name of file to b
       e created:"
GP 1380 INPUT N$:IF INSTR(N$,".") THEN
        1390
DF 1385 N$=N$+".BAS"
JA 1390 OPEN N$ FOR OUTPUT AS #1
MI 1400 PRINT: PRINT "Writing..."
FP 1410 FOR I=&H3C00 TO STP
EL 1420   PRINT #1,CHR$(PEEK(I));
GA 1430 NEXT I
PI 1440 CLOSE #1: PRINT "All done."
PM 1450 FOR DELAY=1 TO 1000: NEXT
BD 1460 ' End program
MK 1470 COLOR 7,0: POKE 92,24: CLS: KE
       Y ON
IE 1480 CLEAR,&HFF10: END
BO 1490 ' Subroutine -- display header
PD 1500 CLS: COLOR 7,0
DP 1510 A$=CHR$(186): B$=STRING$(38,20
       5)
JP 1520 PRINT CHR$(201);B$;CHR$(187);
OB 1530 PRINT A$;"              IBM Disk
        Rx                ";A$;
NM 1540 PRINT CHR$(200);B$;CHR$(188)
JE 1550 RETURN
MH 1560 ' Subroutine -- read FAT
MK 1570 FOR BYTE=&HFD00 TO &HFEFF
KB 1580  FAT(FATP)=PEEK(BYTE)
OJ 1590  FATP=FATP+1
IG 1600  IF FATP>FATSIZE THEN RETURN
EH 1610 NEXT BYTE
JM 1620 RETURN
BI 1630 ' Subroutine
IL 1640 '  accepts SCTR (sector number
       )
DL 1650 '  returns FATV (value of its
       FAT entry)
MN 1660 C=2+INT((SCTR-NONDATA)/SIDES)
LL 1670 IF (C<1) OR (SCTR>719) THEN FA
       TV=&HFF0:RETURN
GE 1680 I=INT(C*1.5)+1
EF 1690 FATV = FAT(I) + 256*(FAT(I+1)
       AND &HF)
DA 1700 IF (C MOD 2)=0 THEN RETURN
JM 1710 FATV = INT(FAT(I)/16) + 16*FAT
       (I+1)
JP 1720 RETURN
GK 1730 ' Subroutine -- wait for keyst
       roke
EL 1740 WHILE INKEY$<>"": WEND
BK 1750 PRINT
CF 1760 PRINT "(Press any key to conti
       nue)";
PA 1770 WHILE INKEY$="": WEND
KB 1780 RETURN
```

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Apple IIc RAM Disk Mover Part 1

Christopher J. Flynn

In addition to demonstrating the RAM disk and subdirectory options with ProDOS and an Apple IIc, this article presents a utility for rapidly copying a number of programs from the floppy drive to the RAM drive. The actual program listing and complete instructions for use will appear next month in Part 2.

One of the conveniences of the Apple IIc is its built-in disk drive. An Apple disk holds about 143,360 characters, or 140K bytes, of information. (One K is equal to 1024 bytes.)

Typically, people use a disk to store both programs and data. If a disk contains programs that total about 40K, then only 100K remains for data. So a single-drive system can be a bit limiting in terms of storage capabilities.

One answer is to buy a second disk drive. But wait—there's another alternative you should consider first. Did you know that your Apple IIc has a second built-in disk drive that will hold about 60K of information? Of course, it's not a regular mechanical disk drive. Rather, it is an electronic drive known as a *RAM disk*. A RAM disk sounds like some futuristic propulsion mechanism, but it's really just a section of Random Access Memory that, with the proper software, works like a disk drive. If you could use the RAM disk for program storage, you could use the conventional disk drive entirely for data storage. This article will show you how.

The Apple IIc has 128K of RAM organized as two separate 64K sections or *banks*. Each bank is addressed from location 0 through location 65535. Most programs, including Applesoft BASIC, are designed to use only the first 64K bank. Thus, the second 64K bank is generally free for use as a RAM disk. Some programs, such as the new releases of Logo and Pascal, do, however, use the entire 128K.

The Apple IIc's disk operating system, ProDOS, has the necessary software to use the second 64K bank as a RAM disk. ProDOS can make the second bank look like any other disk drive to the computer.

The big advantage of the RAM disk (besides the fact that it's free) is its speed. It is entirely electronic, so there are no moving parts to slow down data access.

However, this characteristic is also the RAM disk's biggest disadvantage. Because RAM chips require constant power to maintain their information, the RAM disk forgets everything the instant the power goes off. Therefore, you still must use the mechanical drive for permanent storage.

Accessing The RAM Disk

Here is a simple experiment you can do. It shows how RAM program files work.

1. Insert the ProDOS Utilities disk in your IIc. Turn on the computer. Exit the Utilities program. You should be in Applesoft and ProDOS should be active.

2. Check to see what, if anything, is stored in the RAM disk. Type:

   CAT /RAM

   There should be 120 blocks available. At 512 bytes per block, this gives 61,440 bytes of storage—about 43 percent of the capacity of a floppy disk. This should certainly hold a few programs.

3. Try saving a program with the RAM disk. Enter the following one line program:

   10 PRINT "I AM IN THE RAM DISK"

   Save the program by typing:

   SAVE /RAM/DEMO

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4. Erase the program from memory with NEW. Now load the program by typing:

LOAD /RAM/DEMO
or
RUN /RAM/DEMO

If you try this simple experiment, you'll notice a few things. First, loading and saving are incredibly fast. Sure, the demo program is on the small side, but try a larger program if you like. The speed will amaze you. Meanwhile, the internal mechanical drive stands by quietly the whole time.

Second, all the commands are preceded by /RAM/. In ProDOS terms, /RAM/ is the volume directory for the RAM disk. When you format a blank floppy disk with the Utilities program, you assign the disk a volume label, a name for the disk. The format program automatically places a volume directory on the disk, and the volume directory is given the same name as the disk's volume label. The RAM disk, on the other hand, is a permanent part of your computer. You can only have one RAM disk and you don't need to format it. So it makes sense for everybody to use the same volume directory for the RAM disk. Apple decided that the RAM disk would be called /RAM/.

Moving Programs To /RAM/

If you want to move programs from a floppy disk to the RAM disk, all you have to do is type a series of LOAD and SAVE commands. After doing this a few times, however, you will quickly realize that it is a tedious process.

There is a better way. You can use the computer to move the files for you. After all, computers are supposed to be labor-saving devices, aren't they? The solution is a special program which automatically copies your files from the floppy disk to the RAM disk.

Before going further, there are some sticky details that should be resolved.

1. The /RAM/ volume directory holds a maximum of 12 entries. How can a larger number of files be handled?
2. How will a copy program know which files to move to /RAM/?
3. How will a copy program move a program? If it executes a LOAD, won't the copy program itself be destroyed?

Questions 1 and 2 can be answered together. All ProDOS volume directories have a limit on the number of entries they can hold. A floppy disk volume directory can hold up to 51 entries, while the /RAM/ volume directory is limited to 12. Fortunately, ProDOS provides a *subdirectory* feature to overcome these restrictions. One or more of the entries in a volume directory can be a directory itself or, in other words, a subdirectory. The subdirectory can have as many entries as you need.

Subdirectories have another important advantage. They are a great way to organize information. You can keep all programs in one subdirectory and data files in another. This is almost like having an invisible barrier on your disk; programs will be in one part and data in another part.

Naming The Subdirectories

The RAM disk subdirectory for programs will be called:

/RAM/PROGRAMS/

It would be very convenient if all the programs on floppy disk were also in a subdirectory because the copy program would always know where to find them. Let's establish a standard convention. All BASIC programs on disk will be stored in the subdirectory:

/XXX/PROGRAMS/

where XXX represents the volume directory of the disk.

Moving the programs (question 3) presents a real challenge. With the LOAD command, the incoming program would destroy the copy program. One way of solving this is to use another ProDOS feature—EXEC files.

The EXEC Approach

An EXEC file is a text file that contains a series of ProDOS or BASIC commands. The ProDOS and BASIC commands can even be mixed in the same EXEC file. You run the EXEC file by typing:

EXEC *filename*
or
- *filename*

The dash is a special command that tells ProDOS to run the program specified by the *filename*. Dash is general-purpose. It will run a BASIC or binary program, or execute the commands in an EXEC file.

The task of moving programs from floppy disk to RAM disk can be performed by an EXEC file with a series of LOAD and SAVE commands:

```
LOAD /XXX/PROGRAMS/PROGRAM1
SAVE /RAM/PROGRAMS/PROGRAM1
LOAD /XXX/PROGRAMS/PROGRAM2
SAVE /RAM/PROGRAMS/PROGRAM2
```

where XXX is the floppy disk volume directory.

These commands can be repeated as many times as it takes to copy all the programs.

Creating Subdirectories

You might be wondering how to set up the PROGRAMS subdirectory. You have two choices with floppy disks. When you format a disk with the

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Utilities program, it has provisions for establishing subdirectories. It is a good idea to establish a PROGRAMS and a DATA subdirectory on each disk you format.

You can also use the ProDOS command:

CREATE /XXX/PROGRAMS

to create a subdirectory. (Again, XXX represents the disk volume directory.)

The second method also is used to set up subdirectories on the RAM disk. CREATE can be a direct command, or it can be executed from within a program.

Next month: the "RAM Disk Mover" program and guidelines for its use. ©

64 Tape To Disk Transfer

Clark Book

If you have just acquired a disk drive after months of using a cassette recorder, here's a valuable program you'll want to add to your library.

The ability to make backup copies of your programs as a safeguard against loss is indispensable. It's also useful to make disk copies of tape programs to speed up loading. If the program is written in BASIC, there's no problem; you simply load it from tape and save it to disk. But machine language programs are another story, especially if you don't have a machine language monitor.

"64 Tape to Disk Transfer" is listed below as a BASIC loader which puts a machine language program into memory (the unused block starting at location 679, or $02A7 hex). Be sure to save a few copies of the program before running it for the first time. When you type RUN, the BASIC portion of the program is erased from memory, leaving only the machine language portion. The machine language remains safe in memory until you turn off the computer.

Using The Program

Here are step-by-step instructions for using Tape to Disk Transfer:

1. Clear the computer by turning it off, then on again. Then load the Transfer program.

2. Insert the tape with the program you want to backup into the cassette recorder. Make sure it's rewound. Insert a formatted disk into the drive.

3. Clear the screen. Type RUN and press RETURN, then SYS 679 and press RETURN. Follow the instructions which appear on the screen. When the normal screen is restored, you'll see a flashing cursor just after the word LOADING.

4. Enter a disk filename for the program you're copying and press RETURN. Avoid using a filename that already exists on the disk, and limit the filename to five characters or less. Forgetting about these two requirements will cause the backup to fail.

5. If the red light on the disk drive is flashing when the cursor returns, a disk error was detected and you'll have to diagnose the problem and start over. Otherwise, the transfer was successful. If you want to make another copy of the same program, clear the screen and type SYS 706. This will return you to the flashing cursor. Type another disk filename and press RETURN.

6. When loading a program from disk that was made with Tape to Disk Transfer, use the LOAD"*filename*",8,1 command. Notice the 1 appended to the command; this specifies a nonrelocating load. We'll explain why this is necessary below.

Strange Screens

To save space in Tape to Disk Transfer, several shortcuts were taken. For example, the program saves the contents of every memory location beginning at location 828 ($033C) and ending at the last address of the program being backed up. That includes screen memory and the sprite data pointers at 2040 through 2047. This should not cause any serious problems. However, the screen will do some strange things when you reload the program after saving it. This is because the old screen image is being loaded along with the program. If you clear the screen before typing the

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