Sound of the Future

BY PAUL C. SCHUYTEMA

Not only can computers talk, but they can listen, play a fugue, or blurt out a hot sax riff at the click of a mouse button.

Sound on the computer has truly entered the mainstream, and the acceptance of this capability has led to a rapid development of sound technology. Now, a PC-sound addict can record an aria in 44-kHz, 16-bit, CD-quality audio (more about this later) and paste it into a memo to his boss.

Sound is one of those computer features you only abstractly miss until you have actually experienced it. Take it from a former nonbeliever: When you plug sound—real sound—into your PC, you will never go back.

YOUR COMPUTER'S SMART. BUT CAN IT TALK?

Sound can transform the output of your computer. A computer without sound relies entirely on vision, which is reasonable because vision is a human's most important sense. But close behind sight is hearing. Having both sight and sound adds a completeness to the computer experience.

Hearing Is Believing

But what good is a talking computer? What do we really need sound for? Answering that question could be arbitrarily complex, but let's look at the beast in simple terms. In terms of your PC, sound comes in two "flavors": digital sound and music.

Digital sound is real-world sound that has been sampled (captured live or off tape) by the computer and represented as binary data. The sounds of glass breaking and the swing of a golf club are examples of digital sound.

Music is played back differently. Sound devices often employ integrated FM synthesizers to create a wide array of musical sounds, from the whining of an oboe to the beeps and boops associated with early electronic synthesizers. PC music comes in two species as well, manufacturer-specific music and MIDI (Musical Instrument Device Interface). While any manufacturer could create its own proprietary music interface, the industry standard is MIDI, a data format that allows a wide range of devices (from computers to the electronic drum sets in your favorite MTV video) to share musical data.

Now that we know a little more about PC sound, the question remains: What good is sound? The answers are many. Sounds can make computer entertainment and education programs come

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alive. PC users can record their own sounds to augment applications or leave voice notes on spreadsheet files. Sound can be an aural cue to swap disks or enter another record of data into a database. And sound is essential to the growing field of PC multimedia. In multimedia, visual images are combined with sounds to create interactive experiences (such as encyclopedias, training programs, and reference materials) which the user can control and explore at his or her own rate and level of interest. For ideas about the uses of sound, just flip through the pages of COMPUTE, and you'll see that sound for the PC is everywhere.

What follows is a sampling of sound devices available for personal computers. An exhaustive list would be prohibitively long because so many manufacturers are offering sound equipment now.

The most common type of sound device is a sound card. The sound card is an internal circuit board you would install in your computer's expansion bus. Sound cards generally provide access to sampling, MIDI, and manufacturer-specific synthesis. We'll also talk about several portable devices, such as external peripherals which include sound cards as well as an integrated amplifier and speaker.

How do you decide what type of sound device is best for you? There are several things to consider: cost, compatibility, and purpose. If the card is only for entertainment, a simple 8-bit card would probably do fine, but if you're interested in speech or recording your own music—or if you have an audiophile's ear for sound—look into the new generation of 16-bit cards. If MIDI is your game and you want the features of a full-fledged synthesizer, look into cards like the Roland SCC-1.

ATI Stereo-F/X

The ATI Stereo-F/X is an 8-bit stereo card which allows you to record at either 11 kHz or 22 kHz in stereo (provided you have a stereo microphone or line input). You can record in 11 kHz, 22 kHz, or 44 kHz in mono.

The ATI card installs easily with no jumpers to configure, and the card holds the current settings in memory, allowing you to software-select the volume to a comfortable level and change it only when you need to (it remains constant even after power-down).

The Stereo-F/X comes with the usual assortment of software: drivers, DOS and Windows digital sampling software, a library of sounds and songs, and a program that allows you to synchronize sound and graphics. The software also gives access to the most intricate parts of the card, and the manual provides clear documentation on how to take advantage of the card in your own programming.

The ATI card allows connection to MIDI devices via an optional connector box, but the card has its own 11-voice FM synthesizer that allows it to play MIDI files without any extra equipment. It also sports a joystick port which is software selectable to provide smooth performance on even the fastest computers (a godsend for those of us with 486s). The Stereo-F/X is fully compatible with Sound Blaster and Ad Lib (and doesn't require any memory-resident programs for compatibility), and it simulates stereo when playing mono Sound Blaster files.

The Stereo-F/X is bundled with a pair of small, card-powered speakers, and the card has a built-in eight-watt amplifier (the most powerful I've seen on a card) that delivers plenty of power to the speakers. Setting the card up for Windows is a bit of a chore, since it requires tracking down the information in a cluttered READ.ME file. The READ.ME file gives the wrong location for the Windows drivers, so I had to hunt for them. Once I slogged through the cryptic process (hindered by the less-than-intuitive manner sound is set up in Windows), everything worked fine.

In the included Windows sampling software, the version I received was a newer version than the software manual referred to, and a small additional sheet notified me of this. The newer version of the software separates the mixer program from the recording program, which is at once an improvement and a drawback. It's a nuisance because I had to move from window to window to adjust the volume and the stereo balance. But this proved to be a good idea when I used other software, such as Windows' own Sound Recorder or media player. It allowed me to use a third-party program easily while controlling the ATI card.

Ad Lib Gold 1000

The newly designed Ad Lib Gold 1000 card boasts an impressive array of features. The card provides 20 independent FM channels (16-bit stereo with 96 dB of dynamic range) and 2 digital channels. It also offers 12-bit stereo sampling and the ability to accept either 8-, 12-, or 16-bit data. It can sample at rates from 44 kHz down to 5.5 kHz (the higher the sample rate, the better the sound quality).

The card has a self-contained 1.2-watt amplifier, which was weaker than those of the other cards for powering speakers. Headphones or self-powered speakers worked fine, however.

The Gold 1000 comes bundled with a DOS and Windows mixer program, a music player (jukebox), and a DOS-based voice recorder, as well as other utilities.The card is difficult to install because of its numerous jumpers and cryptic instructions (the instructions label the jumpers according to a diagram and not according to the numbers printed on the card). The dual joystick jumper is especially difficult to adjust. The instructions are also a little foggy about setting up the IRQs and DMAs, never explaining them clearly (although conflict warnings abound).

When it comes to audio quality, the Gold 1000 sounds great (with self-powered speakers). However, at this time it suffers from compatibility problems. The card supports previous Ad Lib formats, but there aren't nearly enough software titles that take advantage of the new capabilities to make this card even as compatible as some of those smaller, compatible-only cards.

By far the best feature of this card is its sound quality, and it looks as if it won't be long before the software catches up to its capabilities. The Gold 1000 is also user upgradable, and it can support a CD-ROM interface and a Surround Sound module as well as a telephone-answering system.

Sound Master II

The Covox Sound Master II is an 8-bit mono audio board that performs well and comes supplied with an interesting array of software. The board sports a four-watt, built-in amplifier.

While the card isn't fully Sound Blaster compatible, it does include a memory-resident program that can emulate Sound Blaster sounds (not Sound Blaster MIDI or voices).

The card comes bundled with a solid package of software, including PC-Lyra, a visual MIDI music composition program.

The most unique feature of the Sound Master II is the voice recognition software. Voice Master allows you, through the included headset microphone, to create DOS macro files that will activate at your spoken word. You simply train the software to recognize your command and edit the macro. Then, when you're running the software, you tap a hot key and speak your command.

I found that the recognition works very well. When you're training the software, you record each command three times, and the software averages

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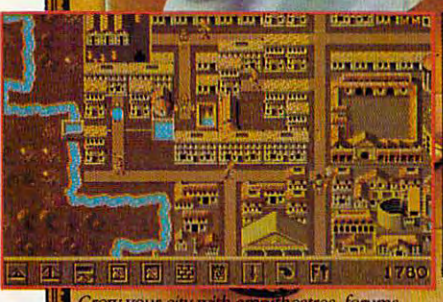

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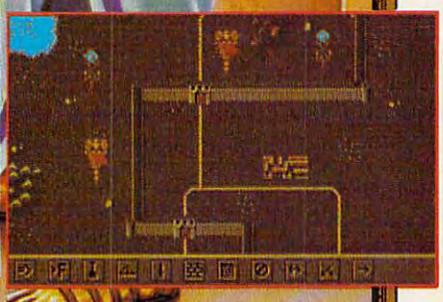

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them all together, to allow the widest possible range of recognition.

The Sound Master includes two speakers, a headset microphone, and MIDI cables, but no joystick port.

While the Sound Master is very impressive in its varied uses, setting the card up is difficult because of its awkward documentation (some is outdated) and clunky IRQ and DMA setups. It took a while to get the Windows multimedia drivers to find the card, even though it was "visible" in DOS.

Pro AudioSpectrum 16

Media Vision's Pro AudioSpectrum 16 is one of the new generation of 16-bit cards that adds another level of realism to the sound quality. By doubling the resolution of digital samples, the quality of a 16-bit card's sound approaches that of a CD's.

Installing the Pro AudioSpectrum 16 is a breeze, the DOS installation works well with the defaults (no manual jumpers on the card to set), and installing the Windows drivers is as easy as running an installation program and restarting Windows. The installation program even lets you know every addition and modification it makes to your SYSTEM.INI and WIN.INI files.

The Pro AudioSpectrum 16 is supplied with the graphically impressive TrackBlaster Pro DOS-based, four-track recording "studio" as well as a customized version of Voyetra's sequencer program. The Windows-based Pocket Recorder and Pocket Mixer programs take a little while to get used to, since there are so many things that you're able to control. During recording, the Pocket Recorder provides a VU meter reminiscent of a tape deck, and the Pocket Mixer allows you to adjust recording (and playback) levels for each form of input and output. The mixer also provides controls for volume, balance, bass, and treble. The Pocket Recorder doesn't allow any cut-and-paste editing for digital samples, but it does offer a wide array of interesting effects.

While the Pro AudioSpectrum 16 claims full Ad Lib and Sound Blaster capability, you must load the PAS program into memory to make the board behave like them. When you're using an extremely memory-hungry software program, the PAS program might eat up enough memory so that your program won't load.

The Pro AudioSpectrum 16 also comes with an interesting text-to-speech TSR program for DOS that allows the card to "read" any selected text in a male robotlike voice. While I'm a little skeptical about the usefulness of this program, it's very interesting to play with. You invoke it with a hot key when the text you want it to read is on the screen and then highlight the text and press Enter. The program is very limited, since you have to select the text, and it will not work with Windows. I am, however, excited by any program (or person) that can pronounce my last name correctly.

The Pro AudioSpectrum 16 is a true 16-bit stereo card, and it records extremely clean sound. It also contains a SCSI port that allows the connection of a CD-ROM drive. (Media Vision also makes a complete multimedia kit.)

SCC-1

If digital samples and games aren't your forte but you have an interest in MIDI, the SCC-1 from Roland is a great card. Basically, the SCC-1 is a preset synthesizer on a card. I use the term *preset* because you can't alter the waveforms and filters of a particular sound; the SCC-1 sounds are built in.

This isn't really a problem (for a desktop computer user) because the SCC-1 contains 127 instrument sounds (from a French horn to a jazz

LINKS 386 Pro

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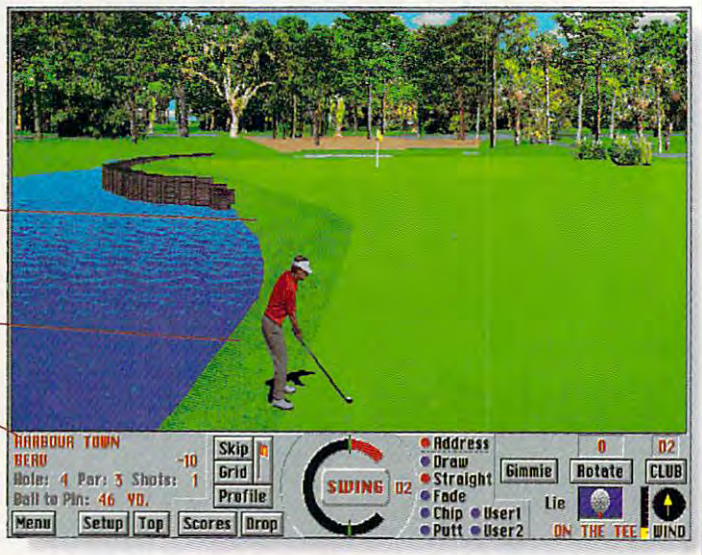

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guitar) and many of the sounds are variable, meaning that the card can create 317 instrument sounds. Beyond that, the card boasts nine complete drum sets as well as a library of special sound effects.

Roland has been in the electronic music business for a long time. The quality of the sounds of the Roland synthesizer is the best I've heard on a PC card. The demo songs that come with the card are so realistic that I found myself thinking that they must have been sampled. I could hardly believe they were just a MIDI file.

This card has limited uses, however. It's not a game card (but it does emulate the Roland LAPC-1's music with breathtaking quality, though digitized sounds and effects are absent), nor can it use programs like Windows' Sound Recorder to sample digital sounds. This is a MIDI synthesizer card, pure and simple, and while this card follows the MIDI standard, it also follows the more stringent GS sound format. The best environment for this card exists when you have a MIDI device (like a keyboard) connected for input and a sequencer program (such as Passport Design's Master Tracks Pro) loaded into your computer.

One of the advantages of the SCC-1 card is that its low computer overhead and unobtrusive presence mean it can be paired with another sound card. Put an SCC-1 into a computer with a 16-bit card like Pro AudioSpectrum 16 or Sound Blaster 16 ASP, and you have an unbeatable combination of talent.

Sound Blaster Pro

Look at nearly any game that supports sound, and you'll see that it supports the Sound Blaster card. When you're looking at a third-party card, Sound Blaster capability is a big draw. So how well does the Sound Blaster Pro card itself perform?

All things considered, it's the industry standard, and it lives up to its reputation. The Sound Blaster Pro is an 8-bit card, so the sampling isn't as crisp as that of a 16-bit card, but it's very good, and you can boost the sampling rate to 44 kHz for superior sound.

What keeps the original Sound Blaster Pro ahead of the competition is the fact that it is the original. When you install the card, you aren't forced to use a pile of memory-resident programs to emulate the Sound Blaster (some emulation programs take up so much memory that you can't run certain programs).

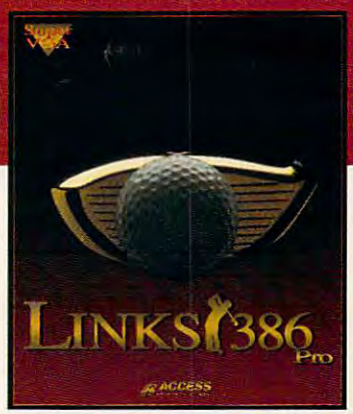
The Sound Blaster Pro card (and 100-percent compatibles) can synthesize speech, which is an important consideration with many of the newer games and multimedia programs. The Sound Blaster Pro also sports a CD-ROM interface and the software to play CD audio through the card.

The Sound Blaster Pro comes with a healthy array of bundled software, including Voyetra's Sequencer Plus Pro MIDI sequencing software (cables included). You also get text-to-voice utilities and a digital recording editor. Ironically, the Sound Blaster Pro is a little weak in its Windows support (you get drivers, a mixer, and a jukebox). You don't get a customized wave recorder, so you must use the one supplied with Windows, which doesn't give you the options you'll want to have when making recordings.

Sound Blaster 16 ASP

Creative Labs has moved beyond the Sound Blaster Pro and has recently released the 16 ASP. This stereo sound card is a 16-bit board that employs an advanced signal processor to do real-time, on-the-fly compression of digital sound data. With multimedia coming into its own, the demand for processor power is becoming more of a premium,

by the game itself.



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Strategy Plus:

"...with LINKS 386 Pro, *Access* has not so much pushed back the 'envelope' as redefined the term 'simulation.' Right from the opening screen it's clear that something special is happening here."

"...represents a new generation of computer game. Just play it and love it."

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"...for sheer, unadulterated realism, no golf simulation equals the performance of LINKS 386 Pro."

"...if you're serious about golf simulations, treat yourself to LINKS 386 Pro. And if you don't own a 386 to run it on, youi've finally got a real good reason to lay out the money for an upgrade."

Computer Gaming World:

"...if you have a fast 386 or 486, think of LINKS 386 Pro as a Ferrari or a Corvette."

"...the ground texturing is dramatically realisti

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and Creative Labs designed the 16 ASP to be a sleeker, more nimble sound card, especially in the Windows environment.

The Sound Blaster 16 ASP installs easily, but the manual warns that there may be compatibility problems when trying to get the 16-bit addressing to work. The card features a healthy selection of Windows-specific bundled software. The most notable accessories are the Creative WaveStudio and Monologue. Creative WaveStudio is a high-powered wave editor that goes far beyond the tiny Windows Sound Recorder. Monologue is a little Windows application that can read and speak the contents of the Clipboard (and provides powerful capabilities when included within a macro).

The 16 ASP also includes HSC's InterActive, a Windows multimedia authoring program.

Like the Pro, the 16 ASP has a CD-ROM interface. The 16 ASP also has an optional Wave Blaster daughter board that uses sophisticated sampling technology to provide nearly flawless MIDI instrument sounds. The basic instrument sounds are created by digital samples that are tweaked to fit the particular MIDI tone (as opposed to a traditional synthesized instrument which is created by a blending of sound waves and filters). The 16 ASP is also GS MIDI compatible.

The 16 ASP records very cleanly and can reach resolutions up to 16 bits at 44 kHz. The ASP compression makes a noticeable difference in the amount of memory the samples gobble up (less than expected), and the sound quality is as good as it gets.

External Sound Devices

While sound cards can be great, installing a card into the computer might not be practical. The slots may be full, or you may wish to use sound with a laptop for presentations. One of the most popular and easiest-to-use external sound products is Disney's Sound Source. This inexpensive external device connects to the computer's parallel port. The Sound Source runs on one nine-volt battery and is extremely lightweight. It features an integrated amplifier and speaker with a front-mounted volume control and a headphone jack. While the Sound Source isn't a sound-recording device, it can play back wave digital files created by other cards through Windows' Sound Recorder application. The Sound Source is compatible with a wide variety of applications and comes with a substantial library of voice clips and sound effects.

AudioMan is an external, Windows-specific sound device from Logitech which allows both playback and recording of Windows' WAV files. The AudioMan contains an integrated speaker and microphone as well as a headphone jack. It also plugs into the computer's parallel port and provides a pass-through connection for the printer. The AudioMan is ruggedly constructed, making it a good choice for on-the-road use. It's powered by either AA batteries or AC current.

Digispeech has recently released its Port-Able Sound external sound device. Port-Able Sound is an external system which is compatible not only with Windows but with internal sound cards such as Sound Blaster Pro and Pro AudioSpectrum. The device plugs into the computer's parallel port and also allows printer data to pass through. The Port-Able Sound device features a built-in microphone and speaker, stereo sound, and both line-in and line-out jacks. The device can record both 8-bit and 16-bit sound. It's powered by either six AA batteries or an included AC adapter.

Media Vision has created the Audio Port, a pint-sized external device that plugs into the computer's parallel port. The Audio Port is a self-contained unit: There are no cables, and its parallel plug, speaker, and amplifier are all contained in a unit just a little bigger than a pack of cards. The unit runs on either four AAA batteries, a six-volt battery eliminator, or an included AC adapter. The card records at 8 bits through its microphone jack and comes with software to allow it to emulate Ad Lib and Sound Blaster.

MA-12 Micro Monitor

Smaller speakers might be all you ever need to generate your PC sound. But if you're a professional, an enthusiast, or someone who just likes your sound loud and rich, take a look at the MA-12 Micro Monitor from Roland. The MA-12 is a self-powered (ten-watt) four-inch speaker system with the capacity to blow you off your desk chair.

The Sound Experience

Sound cards can give your computer the gift of music as well as the gift of gab. Once you've heard what a sound-savvy computer can do, you'll never settle for a mute desk companion again. ❑

Manufacturers' Prices and Addresses

Ad Lib Gold 1000
$299.95
Ad Lib Multimedia
220 Grand-Allee E, Ste. 850
Québec, PQ
Canada G1R 2J1
(800) 463-2686

ATI Stereo-F/X
$149.00
ATI Technologies
3761 Victoria Park Ave.
Scarborough, ON
Canada M1W 3S2
(416) 756-0718

Sound Master II
$229.95
Covox
675 Conger St.
Eugene, OR 97402
(503) 342-1271

Sound Blaster Pro
$299.95
Sound Blaster 16 ASP
$349.95
Creative Labs
1901 McCarthy Blvd.
Milpitas, CA 95035
(800) 998-5227

Port-Able Sound
$198.95
Digispeech
550 Main St., Ste. J
Placerville, CA 95667
(916) 621-2093

AudioMan
$179.00
Logitech
6505 Kaiser Dr.
Fremont, CA 94555
(510) 795-8500

Pro AudioSpectrum 16
$299.00
Audio Port
$199.00
Media Vision
47221 Fremont Blvd.
Fremont, CA 94538
(800) 845-5870

SCC-1
$499.00
MA-12 Micro Monitor
$145.00 per speaker
Roland U.S.
7200 Dominion Cir.
Los Angeles, CA 90040
(213) 685-5141

Sound Source
$49.95
Walt Disney Computer Software
500 S. Buena Vista St.
Burbank, CA 91521
(800) 688-1520

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64/128 VIEW

The lone programmer of the northern plains keeps cranking out 64 software.

Tom Netsel

Readers who type in Gazette programs will undoubtedly recognize Daniel C. Lightner's name. He lives in Sidney, Montana, a town of about 5500 people in the eastern part of the state near the North Dakota border. Sidney may not be a hotbed of Commodore activity, but it doesn't dampen Lightner's enthusiasm for the 64. Here are portions of a letter he sent me that demonstrate the spirit and dedication he shares with many 64 users.

"I have a program that I sent to Accolade in March of 1991. They sent it to a developer in New York who kept it for more than a year. Accolade finally wrote me saying that they had decided to no longer support 64 software. So after much thought, my spouse and I have decided to take a stab at marketing it ourselves.

"We have tried to tabulate the cost requirements and equipment that would be involved, where to buy supplies, and things like that. We have been conferring with small business representatives and have recently established a base from which to operate. It's called MicroStorm Software.

"At present, we have one product. The program is called Risers and Sliders. I've had several friends and family members learn to play it, and they all seem to enjoy it. It's an addicting game, and I believe people will get many hours of enjoyment from it. I realize it isn't Super Mario Brothers, but I believe it has a place alongside programs such as Boulder Dash and Qbert.

"After reading your editorial (requesting new software), I've decided to send the program to you for review. That will help us decide on a course of action. We have every intention of expanding, especially in the 64 area."

People who are active in user groups benefit from sharing ideas with other 64 owners. Lightner, however, doesn't have that luxury.

"There were only three other people in this area that I knew who owned 64s. Two of them have gone to the PC and no longer turn on the fun one. The other was my computer pal, and he moved to Washington three years ago. I feel like the Lone Ranger. I was on Q-Link, but there weren't any local access numbers within 250 miles. I had to call Bismark, North Dakota, to access it. That cost me about $20 every time I called.

"I've been trying to come up with some programs that you might want to publish, but this Micro nightmare has been pigging most of my time. When I do, I'll send them in. Winter is the best time for programming. The children are in school, and it's too cold to be out of doors. It gets down to 30 below 0 around here, averaging about 10 below at night. I can't think of anything more rewarding than being published in Gazette."

Thanks for sharing your programs with our readers. We'll be looking forward to seeing more type-ins as you and Montana start to thaw. Risers and Sliders arrived and is out for review. I hope you and other 64 enthusiasts will keep us informed of your activities. ❐

GAZETTE

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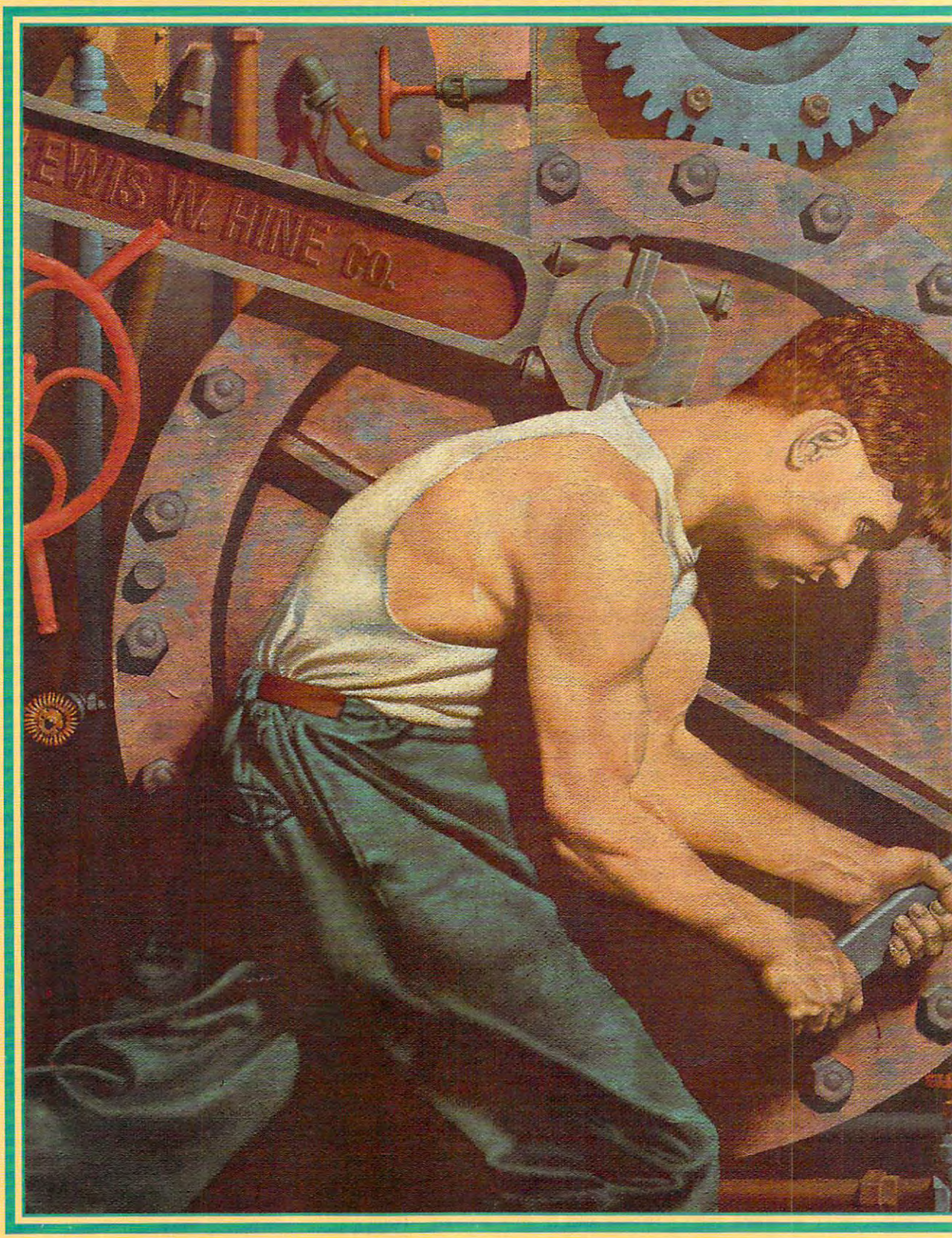

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8-BIT BEYOND MACHINES CONTINUE STATE OF TO HOLD OUT PROMISE THE ART

BY DON RADLER

A recent peek into the world of PCs made me give new thought to what our Commodores really do for us. I was called upon by a couple of friends and relatives to help them with their new PCs. I wasn't much help—I don't know any computer like I do my 64, but I try.

As I was trying, I noticed something striking. Since most computer users point and click to make their machines do things, they don't seem to learn what's behind that user-friendly graphical interface or what's inside the black box itself. And they don't care. Their computer becomes just like a television or washing machine. It's just another home appliance.

For manufacturers to sell home computers by the millions, that's exactly what they have to be: tools that are easy to use. They don't have to be understood, they don't have to be used at anywhere near their potential, and they certainly don't have to enhance their owners' intellectual grasp. From the manufacturers' point of view, they simply have to be purchased.

Mimicking the way cars are sold, PC manufacturers stress their machines' speed and power. Then they throw in an "automatic transmission" to make them easy to drive—the user-friendly interface. In the words of one computer industry analyst reacting to the latest home PC offerings, "Customers are paying for the no-brain nature of the machine."

The graphical user interface (or GUI, pronounced "goo-ey") is the feature that lets people use computers without taxing their brains. A GUI replaces the command line interface with which Commodore users give their machines instructions in words and numbers that both the computer and the operator understand. (It's not a big leap from the simple disk-operating commands of the command line interface to actual programming, which is computing's most demanding—and most reward-

ILLUSTRATION BY RENÉ MILOT

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ing—activity. That's why a large percentage of Commodore users program more than PC owners do.)

The Macintosh, whose look and feel launched GUIs in the first place, was described by Joel Shurkin in *Engines of the Mind* as "a machine that requires almost no knowledge of computers. . . . The user does not have to learn operating system commands. All that is required is moving the mouse to the right picture and clicking a button, and the machine does the rest."

In December 1990, Robert Bixby, writing in the PC section of COMPUTE, said this about GUIs:"Users like graphical interfaces, find them easy to work with, and can even develop an affection for them—three statements that could never be made about the command line interface."

Then, in the July 1992 issue, William Harrel described many PC owners' feelings about programming:"The word *programming* brings to mind never-ending lines of confusing and unforgiving computer code complete with bugs and a lot of trial and error. Who needs it? Let the programmers program. Just give me software that does what it's supposed to."

Those quotes pretty well cover the attitude of most non-Commodore computer users I've talked with. It's an attitude considerably different from that of the loving owners and fans of the Commodore 64 and 128. The difference was presaged way back in January 1986 when Fred D'Ignazio wrote a column in COMPUTE!'s Gazette about software then on the drawing boards known as "smart power tools." Fred wrote: "In less than five years, computer tools' power, complexity, and richness will be completely masked from the user. The tools will edit our prose, reshape our ideas, organize our information, and manipulate our numbers, all with almost no supervision by us. Microcomputer companies will have satisfied their critics at last."

We may be satisfied, but as D'Ignazio points out,"we will have sacrificed something even greater—control. To be so easy to use, smart power tools will have to take control over the problems we want solved. The human's job will be reduced to pushing buttons."

D'Ignazio warned that computers "as easy to use as a TV" could become a threat to our thinking skills. Most people would simply accept the machines' answers, never wondering if the answers were right or wrong and never caring how they were derived.

When that article appeared, it read like science fiction. Today, as we all know, it's the state of the art.

A Mindless Approach

This mindless approach is fostered by many schools once they install computers. Look into what they call computer literacy, and you'll see that they're simply teaching how to use the computer as an appliance. Typically, most schools have kids load user-friendly programs and then instruct them to follow the prompts, pointing and clicking away. Does this help kids learn anything beyond just pushing another button?

You would assume that any kind of computer literacy is better than none at all. But the way computers are used in most schools won't attract the best and brightest into computer science. And it won't help America compete with other nations in the Information Age.

If you think this isn't already a serious problem, look at the cover story in the September 28, 1992, issue of *Business Week* about how Japan's Hitachi is threatening to become the world's premier technology company. In that article the author said that Hitachi holds the largest portfolio of Japanese patents and has topped America's list of patent earners for most of the last decade.

It seems to me that 64/128 users have been blessed with some special protection against the trend toward computer unwittingness that stems from PC owners' love affair with user-friendly design.

Walk into a store like Babbage's and look at the shelf space allotted to software for the 64 and 128. It's way down from your last visit, isn't it? Read the ads for new software and see how few titles are issued for the 64 or 128 in comparison to Amiga, Mac, and IBM. Pretty sad, as many letter writers have noted.

Or is it?

A Little Help

Obviously, the big boys are supporting the Commodore market less and less. But the little guys who started it all in the first place, the hackers and inventors who really wanted to know what made their machines tick—those guys are still there. They develop hardware like CMD's RAMDrive and software like Ron Hackley's Fun Graphics Machine. They find new things for old machines to do, many of them things that are done no better by the whiz-bang state-of-the-art platforms. And they share their knowledge, expertise, and products with the Commodore community.

In the Amiga, Mac, and PC worlds—the hotbeds of today's computer development—state-of-the-art means more power, more speed, and more storage capacity. But above all, it means more ease of use. That's where the action is. And that's where the 64/128 user is being left out.

Is that bad? Maybe not.

Most home PCs are used the way most Commodores are used: for word processing, recordkeeping, home finances, and for playing games. For these purposes, the bigger PCs simply don't need all the speed and power they have.

An Educational Process

Meanwhile, our 8-bit Commodores, with much less speed and power, successfully handle all of these activities and much more. Because we have to think about them and figure how to get the most from them, we tend to learn from them. The process of using our machines remains an educational process. This is true, at least in part, because we use words and numbers to communicate with our computers and don't just mindlessly point and click.

Cultures that have not yet learned to read and write interact without symbolic words and numbers. By relying on verbal forms of communication, people in these cultures handle abstract ideas poorly. Their language skills remain stunted; as a result, their social progress is retarded. It's arguable that pointing and clicking in place of communicating with words and numbers is, indeed, a regressive move toward such a preliterate culture.

A New Dark Age

In the Information Age, the GUI may well be the harbinger of both computer and general illiteracy. The mouse might turn out to be a mole, the leader of a lemminglike rush into a faster and more powerful Dark Age. Once again, we might find ourselves the victims of thoughtless application of the technology we invent in an attempt to make our lives better. In his *Briefer Psychology*, way back in 1890, William James wrote that "the more other facts a fact is associated with in the mind, the better possession of it our memory retains."

In contrast, simply pointing and clicking at some icon leaves the facts and the relationships between them hidden within the machine, giving little exercise to the human brain.

Alan C. Kay was the original designer of the Macintosh GUI. In a

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special issue of *Scientific American* on "Communications, Computers and Networks" (September 1991), he expressed some thoughts and concerns about ideas versus the representation of those ideas.

"In the near future, all the representations that human beings have invented will be instantly accessible anywhere in the world on intimate, notebook-size computers. But will we be able to get from the menu to the food? Or will we no longer understand the difference between the two? Worse, will we lose even the ability to read the menu and be satisfied just to recognize that it is one?"

Thanks to the early Commodore years without GUIs and other user-friendly software and thanks even more to computer magazine writers and editors, I pretty much know what goes on inside my machine. Name a memory address, and I probably know what function it controls and what values I can poke in to get the result I'm looking for. Judging from their letters in "Feedback" and by the fact that most of them have had their machines for nearly five years, so do many other Commodore users. (I don't exclude GEOS users. Most of them became familiar with their machines before GEOS came along.)

Now that the big boys have turned away from the Commodore and are devoting their time to making no-think software for the state-of-the-art platforms, I'm convinced that most 64 and 128 owners will continue out of necessity to learn more about their machines.

Get to Work

If you're an active 64 or 128 user, you may be doing many or all of the things in the following list. For those readers who aren't, however, here are some intriguing activities to pursue with a Commodore.

- Transfer your personal records to disk using SpeedFile from Gazette, or build a file of magazine articles of interest to you using a modified version of the swift and powerful Gazette Index.
- Try word processing with SpeedScript. Use one or more of Gazette's many accessory programs to modify SpeedScript to your needs.
- Take a crack at desktop publishing with a program like Newsroom from Springboard, or try sketching or cartooning with Blazing Paddles from Baudville or with Doodle from Crystal Rose. The Fun Graphics Machine from the FGM Connection is another good choice. For an even easier bit of artistic expression, see what you can do with the graphics characters right on your keyboard along the lines described in an article that I wrote in Gazette (June 1991).
- Get into music with Basically Music from Gazette, the simplest way I've ever seen to control all three voices of the powerful SID chip.
- Try some programming in BASIC, which is as easy a language as there is. Programming will hone your logic and planning skills like nothing else. If something you write in BASIC runs too slowly for you, get hold of a compiler like Blitz! from Skyles Electric Works or BASIC 64 from Abacus.
- Teach yourself another computer language such as Logo, C, or Forth, or even try machine language. Gazette provides plenty of help for the latter in every column that Jim Butterfield writes.
- Type in a RAM disk program from the several that have been featured in Gazette through the years. This software enhancement acts like a superfast disk drive, calling up programs as quickly as you can enter the command.
- If you don't yet have one, get a cartridge that speeds up loading programs, such as the Epyx FastLoad that I use. Most of these cartridges include several utilities, such as disk and file copiers. They start at quite reasonable prices.
- Buy a modem and start to telecommunicate with other Commodore users. You can do this one-on-one over a local telephone line, through a bulletin board service (BBS), or on a large online network such as QuantumLink.
- Join a Commodore user group and meet with others who share your interest in computers.

However forsaken your Commodore computer may be by its manufacturer and now by most of the big software producers, there's still plenty of life in the 8-bit world. You can see proof of that every month in COMPUTE's Gazette and at user group meetings all over the world. Continue to approach the Commodore as something you enjoy because you think about it, not because you can use it without thinking at all.

Feel bad because the state of the computing art is passing you by? You really shouldn't. In fact, maybe you should feel thankful. ❑

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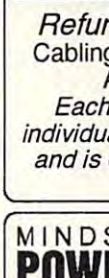

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WESTERN HERITAGE

You don't have to be a city slicker like Billy Crystal to enjoy a taste of the Old West. Now, you can experience it in the comfort of your own home with a new graphics library from Horse Feathers Graphics. Called Western Heritage, this software is a creative collection of 90 graphics, 42 borders, and 11 fonts (including one that's a secret code of Indian symbols). This program is perfect for horse lovers everywhere, but there's more to Western Heritage than its name implies.

First of all, the name is misleading. Granted, the majority of borders and graphics in this library are Wild West related—cowboys-and-Indians stuff—but it also contains borders and graphics for a variety of equestrian activities. Such items as English saddles, miniature steeplechasers, boots, hunt caps, and riding crops make up seven of the borders. The artwork includes graphics for polo, horse racing, jumping, and veterinary medicine, as well as a blue-ribbon graphic for certificates and awards. So if you're planning a barbecue, a hayride, a horse show, or even a polo match, you'll be able to find the perfect graphics for your posters, invitations, and decorations in Western Heritage.

Kids will especially enjoy using the Indian Symbol font. This unusual font converts the standard keyboard characters into 57 authentic Indian symbols. A handy reference card lists the Indian meaning of each symbol as well as the keyboard letter or number that creates it. Using the card, kids can create secret messages by either replacing letters with symbols or, for a more authentic exercise, using the Indian translations of the symbols to create messages.

Press the T key, for example, to print a thunderbird. This can be used with the symbols from other letters to form a word. However, in Indian picture writing, the thunderbird means *happy*. So kids could use the thunderbird in a message to wish a friend a happy birthday. As a mother who has raised three children, I know the Indian Symbol font has a lot of potential as a rainy day activity for young children.

According to the manufacturer, Western Heritage requires The Print Shop 2.0 or 1.0 with The Print Shop Companion or The Graphics Library Holiday Edition. I experimented using just version 1.0 of The Print Shop and found that you can still incorporate graphics from the Western Heritage disk into cards, posters, and so on. If you want to use the Western Heritage borders and fonts, however, you have to use The Print Shop Companion. You'll also need the Companion package if you want to modify any of the borders and fonts. Western Heritage works with both sides of The Print Shop disks, with 7- and 9-pin printers.

GEOS users who don't have The Print Shop can experiment with simple conversion programs and change the graphics into ones that are usable with geoPaint. This will allow you to use the graphics with GEOS without using The Print Shop at all.

The Western Heritage collection is well worth checking into because it isn't the sketchy outline graphics that you sometimes see in clip art kits. These are unique and detailed designs. The set includes portraits of several notorious outlaws (Jesse James, Butch Cassidy, William Bonney) as well as good guys like Daniel Boone. The portraits look like they were adapted from woodcuts of the 1800s.

In addition to portraits, there are generic drawings of cowboys, wranglers, miners, square dancers, and Indians. Several whimsical cartoons complete the portrait group, making this a very versatile graphics program.

Then there are typical Western graphics: wagon wheels, brands, rope, cattle, and six different types of carriages and wagons. But what good is a wagon without a horse? The program offers a choice of 24 different varieties, including such favorites as Appaloosa, Morgan, Arabian, show horse, race horse, Clydesdale, and wild bronco. There's even a picture of Santa's sleigh being pulled by a pony.

Some of the graphics are wonderfully detailed. My favorites are the Indian chief, rain dancer, bull rider, and pony heart. This last one is an intricate combination of a heart and a pony's head. These designs aren't just rehashes of other graphics; they're all original art created by Donna C. Mason.

The Western Heritage fonts remind me of Wild West wanted posters and old saloon signs. You can almost hear spurs jingling when you look at them. The kit also has fonts called sticks, twine, and rope that look like letters created from those materials. An unusual part of the kit is a rather ornate font called Very English. At first, its curlicues and curves seemed out of place in this Western package. Later, I wondered if the designers weren't poking subtle fun at the greenhorns and dandies on their English saddles who were also a part of the Old West.

Western Heritage is packaged in a handsome, shrink-wrapped three-ring notebook, with the disk safely tucked into an inside pocket. The reference manual is filled with tips and suggestions. To get you started, Horse Feathers has included several ideas for posters, letterheads, and cards. Your imagination will suggest hundreds of others. With these graphics, it'll be easy to design your own unique invitations for that Western party I mentioned earlier. You can make decorations and posters for the event, too. Print time varies, depending on the printer you own, but it took me approximately an hour to design and print a dozen invitations. If you decide on a border, graphics, and font ahead of time, you can do it even faster.

You can also make replicas of Old West wanted posters. There are step-by-step directions for this in the reference manual. More advanced users can use geoPaint or scanner programs to incorporate pictures of their friends into posters of wanted desperadoes.

All in all, I think you'll find Western Heritage offers great graphics and is easy enough for most kids to use. It makes a great addition to your graphics library.

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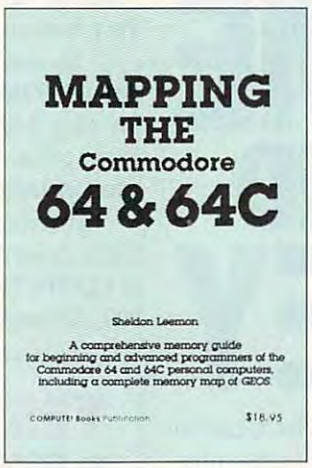

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REVIEWS

DRAW-PRINT IN COLOR

As a new owner of a Star Micronics NX-1000C Rainbow printer, I soon discovered that there wasn't a whole lot of software that supported its color printing capabilities. As a matter of fact, there wasn't any except geoPaint. So when I discovered a program that would allow me to create and print color graphics with my printer, that piece of software was a blessing. That program is G. P. Software's Draw-Print in Color paint program for the NX-1000C and a 64 or 128.

This program comes with a very comprehensive manual and two function key overlays: one for the 64 and the other for the 128. A two-step loading process is required to boot this program, which is not copy-protected. From there, you're prompted to select either text mode or bitmap mode, both of which are available.

With Draw-Print in Color, you draw and color your own graphics on a 320 × 200 bitmapped screen. The drawing pencil or crayon can be controlled from the keyboard or mouse. The program does not support joysticks. (For this review, I'll call the drawing implement a crayon.) There are several crayon aspects that you can adjust to suit your own preferences.

You control the crayon's three modes—Color, Move, and Erase—with the right mouse button or the 1 key on the keyboard. With the number keys 2–9, you can adjust the size of the crayon's tip from one to eight pixels in width for drawing, coloring, or erasing. The left mouse button changes the crayon's color. You can also use the up arrow or space bar to achieve the same function from the keyboard. I found the up arrow to be the best selector of the three, taking me through the range of colors one color at a time. The space bar and mouse button cycle so quickly through the colors that it's difficult to stop on the desired one.

When I used the large-crayon setting to color, the tip skipped and jumped erratically in the direction the crayon was moving. When I tried to color a large area of the screen, the crayon would jump into an area of the drawing that I didn't want colored. Erasing had similar results.

Drawing with the mouse was smooth and fluid, but if I moved it too quickly, the line I was drawing would skip. I found that I could use the keyboard for detailed placement of the crayon in eight directions, and I could

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draw continuous lines with the curso keys in their respective directions.

With this program, you have the ability to create detailed graphics in the drawing area. Draw-Print assigns the function keys to turn a coordinate display on or off, switch between bitmap and text modes, erase the screen, and invert the position of the crayon. Inverting the crayon, however, also changes the crayon's mode of operation, which I found objectionable.

The coordinate display in the lower right corner of the screen, used to read the crayon's position on the screen, becomes important when making accurate horizontal or vertical mirror images of portions of the screen. After you flip the screen, your graphic image may lose some of its color information due to the 8- × 8-pixel limitation of hi-res bitmapped graphics. This should happen only with a full screen rotation, however.

A method for stamping or pasting images is also described in the manual. The background and border colors will not appear on the final printed document. This feature is here only to permit you to view your drawing against different color contrasts. If you select a white background, that will give you an idea of how your graphic will look when printed on paper.

You must enter text mode to save or print your finished drawing. From this mode you can also load previously created graphics. Should you have a problem with the loading or saving process, the drive's error channel is displayed in the lower left corner after each disk function. This section of the program is very straightforward and easy to use. To abort any of the functions, just press the Run/Stop key. Specific error messages generated by the program are also described in the manual.

I think you'll find that Draw-Print in Color is the only program that you'll need to start drawing graphics and printing them in color on your Rainbow printer. The only feature missing that I would like to see here is the ability to load other graphic formats. But for those of us who have color printing capabilities and want to put them to use, Draw-Print in Color is just the program we need. I think this would be a good program for Star to package with its Rainbow printers, just as Commodore did with GEOS and the 64.

KENNETH MURCHISON

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FEEDBACK

Missing text, saving partially entered programs, border graphics, and more

Bug-Swatter

After the January issue was printed, we noticed that two lines of type in John Elliott's feature, "Thanks for the Memory," were lost at the printers. Here's what you missed.

The top of page G-4 should read "Since it installs internally in the 64 and 128 and their drives."

And the article ends on page G-6 with "to the point that you can challenge the capabilities of machines costing thousands more."

Although there wasn't much text left out, the omissions certainly made for confusing reading.

The mailing address listed in the review of Invoice Writer II (December 1992) is incorrect. To order this program, send $10 to Maurice Randall, P.O. Box 606, Charlotte, Michigan 48813. We regret printing the old address.

Herbert Bradle of Bethpage, New York, had trouble with line 0979 of Sub Attack II (August 1992). MLX would not accept it. We found that a printing imperfection caused the *F* in the last value to look like an *E*. Line 0979 should read as follows.

```
0979:25 A9 1C 47 09 18 A9 80 FC
```

Save Before Quitting

When entering a program from Gazette, I often am interrupted before I can enter the entire program. When this happens, I turn off the peripherals but leave the computer on until I can resume typing. On occasion, several days elapse before I can return to the program. How can I save the portion of the program already typed in? This happens in BASIC, and with MLX, escape is impossible. Retyping the entire program from the beginning is very frustrating.

JACK CHRISTLAW
LIVONIA, MI

Many Gazette program listings are quite long, and typing them in at one sitting is often impractical if not impossible. It's not necessary, however, to leave your computer on with the program in memory until you can enter the entire listing. It's quite easy to work on incomplete programs, adding to them whenever it's convenient.

When you're typing in a BASIC program from Gazette and you have to quit before you've entered the entire listing, simply save what you've entered so far. Give it a filename and save it with the usual SAVE command. When you're ready to resume work on it, load the file—but don't try to run it—and simply resume typing where you left off. If you can't remember which was the last line you entered, list the program to find out. The last line in the listing will be where you left off.

You can repeat this process any number of times until the entire program has been entered. Just be sure to save the current version with a unique filename. You may want to add a number to each filename to identify the latest version: PROGRAM1, PROGRAM2, and so on. If you like, you can scratch earlier versions to clear them from your disk. Just be sure to save your final version before you attempt to run it. Your program could contain syntax errors and more serious problems that could cause it to crash.

When entering a machine language program with MLX, our machine language entry program, the process is handled by means of a menu. When you run MLX, a Command menu appears before you start work. It presents options to enter data, display data, load a file, save a file, and quit. When you begin typing in a program, you enter the starting and ending addresses and then the data itself. Should you decide to quit during a session, press Return at the beginning of a line, and the menu will reappear. Note the address where you stop since you'll need it when you begin work again. Select the Save option from the menu and enter a filename with which to save the data that you've entered so far.

When you're ready to resume work, load and run MLX again, using the same starting and ending addresses that are listed in the magazine. Select the Load File option from the menu and load your incomplete program. After the program loads, the menu will reappear. Select the Enter Data option, but this time use the address where you left off to resume entering data. If you want to check what you've entered so far, use the Display Data option to see it.

For more complete information about using MLX, read the instructions that are printed with its listing. MLX is printed in Gazette several times a year. You may also write to "Typing Aids" in care of our Greensboro office for a free copy of MLX and The Automatic Proofreader.

Above the Border

I have tried and tried to figure out how software programmers make graphics appear over the border. Could you explain how to do this and how to utilize it in my own programs?

MATT PAKES
PLANO, TX

Graphics that appear in the border areas are normally sprites. These are the most easily implementable objects not constrained by border dimensions. Although sprites

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can occupy positions beyond the border, they're not normally visible because the border has a higher priority than the sprites. In other words, the border is the last thing drawn.

The way to actually display sprites over the border involves fooling the VIC display chip into not knowing where the border is supposed to start. This is done with the vertical fine-scrolling function. By setting the SCROLY register at location 53265 ($D011) to 25-row mode and then switching to 24-row mode in the last line of text (by using a raster interrupt), the VIC chip never realizes that it should begin displaying the border. The top and bottom portions of the border disappear.

To learn the details of raster interrupts and how to use them for border graphics, you might try reading Commodore 64 Programmer's Reference Guide *from Commodore and* Mapping the 64 *from COMPUTE Books.*

Changing the disk drive number via the hardware method, and enhancements to File Logger

Cutting Jumpers

I have two 1541 disk drives and want to change the address of one of them via the hardware method. I followed the instructions in the owner's manual but can't tell which wires are the jumpers in question. Please help.

M. A. BROWN
GREENSBORO, NC

The "jumpers" referred to in the instruction manual are actually two round disks of solder, each about ¼ inch in diameter. Each disk is separated into semicircles, with a thin strand of solder connecting each half.

Unplug the power cord from the wall and open the disk drive following the instructions in the user's manual. The jumpers are found near the center of the circuit board, toward the front. Jumper 1 is nearest the front.

Changing the device numbers is accomplished by taking a sharp, pointed object and scratching away the thin strand of solder connecting the two halves on one or both of the jumpers. Do this very carefully so you don't damage the circuit board or any other components.

Here's a chart showing which device numbers are produced when you cut various jumpers in your drive.

Jumper Cut	New Device Number
None	8
1	9
2	10
1 and 2	11

Changing the disk drive number via the hardware method is permanent unless you're handy with a soldering iron; so don't do so unless you have to. If you're unsure about exactly what you're doing, have your local Commodore dealer do the modifications for you.

File Logger Update

I've just finished loading and testing Roger Bachelder's File Logger program (June 1992). It's a good program, but I've come up with an enhancement. The following lines can be added.

```
425 IF ASC(K$)>191 THEN
    K=ASC(K$+CHR$(0))-192:
    GOTO 440
375 IF K$=" " THEN 520
```

This code will allow the program to handle locked files, those that are protected from being scratched.

Also, whenever the original version comes across a file that has been scratched, it lists the file type as XXX. If you don't want scratched files to be listed at all, then add the following line to the program.

DONALD KLICH
MT. PROSPECT, IL

Rename Disk

In order to keep track of my programs in an orderly fashion, I'd like to change the disk name to something more meaningful that would correspond to the disk's contents. Without formatting and naming a new disk and copying the files to it, is there a simple way to change a disk's name?

JIM MASTRANGELO
LAWRENCE, KS

Here's a short program that should do the trick. It asks for the new disk name; pads its length to the required 16 characters; opens disk and direct access channels 15 and 8; reads track 18, sector 0 into a buffer; moves the buffer pointer to the first byte of the disk name; puts the new name in the channel 8 buffer, replacing the old name; writes the buffer and name to the disk; and then closes the channels.

```
10 INPUT"NEW DISK NAME";NN$
20 IF LEN(NN$)<16 THEN NN$
   =NN$+CHR$(160):GOTO20
30 IF LEN(NN$)>16 THEN
   NN$=LEFT$(NN$,16)
40 OPEN15,8,15,"I"
50 OPEN8,8,8,"#"
60 PRINT#15, "U1:"8;0;18;0
70 PRINT#15, "B-P:"8;144
80 PRINT#8, NN$;
90 PRINT#15,"U2:"8;0;18;0
100 CLOSE8:CLOSE15
```

Note that this program doesn't affect the disk's two-character ID; it changes the name only. Keep a separate ID for each disk.

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BEGINNER BASIC

Larry Cotton

THROUGH A LOOP IN STEPS

Continuing with our look at FOR-NEXT loops, this month we'll examine STEP, an optional BASIC keyword used inside these loops. Whenever STEP is omitted, the counter inside a FOR-NEXT loop increases in increments or steps of 1. If we assign a number to STEP, it increases—or decreases if it's a negative number—in increments of that number. Here's an example that prints the odd numbers from 1 to 10.

STEP lets your 64 count in increments greater than or less than 1.

```
10 FOR T=1 TO 10 STEP 2
20 PRINT T
30 NEXT
```

To print the even numbers, use FOR T=2 TO 10 STEP 2. STEP can be either positive or negative. The following will count down from 10 to 1.

```
10 FOR T=10 TO 1 STEP -1
20 PRINT T
30 NEXT
```

STEP can also have a decimal value.

```
10 FOR T=1 TO 10 STEP .5
20 PRINT T
30 NEXT
```

Run this, and it will spit out a column of numbers from 1 to 10 in steps of .5: 1, 1.5, 2, 2.5, 3, and so on.

Here's a short program that makes use of a couple of machine language routines to plot a sine wave on the 64 or 128's high-resolution screen. You can see how various values of STEP influence how fast and completely the sine wave is drawn.

```
SB 10 FORT=49152TO49327:READA:
      POKET,A:NEXT
JP 20 POKE820,14:REM SCREEN CO
      LOR
MC 30 K=256:XL=828:YL=830:M=49
      152:A=90:B=40:C=20
PR 40 SYS49262:REM COLOR/CLEAR
PF 50 REM MAX X=255!
CG 60 FORX=0TO255STEP.5
DF 70 Y=INT(A+B*SIN(X/C))
XX 80 GOSUB100:NEXT
JK 90 GOTO90
PA 100 POKEXL,X:POKEYL,Y:SYSM:
       RETURN
SG 1000 DATA169,0,133,254,56,1
        69,199,237,62,3,72,41,
        248,10,38,254,10,38,25
        4,10,38
PK 1010 DATA254,72,141,64,3,16
        5,254,141,65,3,104,10,
        38,254,10,38,254,109,6
        4,3,133
QM 1020 DATA253,165,254,109,65
        ,3,133,254,173,60,3,41
        ,248,101,253,133,253,1
        73,61,3
CP 1030 DATA101,254,133,254,10
        4,41,7,101,253,133,253
        ,165,254,105,32,133,25
        4,173,60
CC 1040 DATA3,41,7,170,189,101
        ,192,141,63,3,160,0,17
        7,253,13,63,3,145,253,
        96,128
FB 1050 DATA64,32,16,8,4,2,1,8
        0,169,8,13,24,208,141,
        24,208,169,32,13,17,20
        8,141,17
PR 1060 DATA208,169,63,133,216
        ,169,0,133,215,168,145
        ,215,160,63,162,32,145
        ,215,136
HM 1070 DATA208,251,198,216,20
        2,208,246,169,4,133,23
        2,169,0,133,231,168,17
        3,52,3
GS 1080 DATA162,4,145,231,200,
        208,251,230,232,202,20
        8,246,96
```

STEP appears in line 60. Try changing its value and note the effect when you run the program again. Even if you don't understand what's happening in this program, you can see the immediate value of STEP in a FOR-NEXT loop. Incidentally, to restore a normal BASIC screen, hold the Run/Stop key and tap the Restore key.

Another valuable use for STEP is to create interesting sounds. Here's a short program that plays a truly funky sound.

```
GF 10 FORL=54272TO54295:POKEL,
      0:NEXT:POKE54296,15
FQ 20 FORD=1TO500:NEXT
KS 30 POKE54278,255
HA 40 POKE54287,4
XM 50 POKE54276,23
HH 60 FORA=1TO130STEP.3
DP 70 POKE54273,A
AK 80 NEXT
DA 90 POKE54278,0
```

Again, STEP is in line 60. The decimal parts of the values aren't actually poked to 54273 in line 70, but the STEP size slows the program just enough to enhance the sound. Changing the STEP size and other values in the program creates an infinite variety of otherworldly sounds that you may want to try.

Right now I'm going to depart from my usual column and include a few paragraphs that you might expect to read in "World View." I was in Germany late last year and picked up a copy of *64'er* (*das Magazin für* Computer Fans). The machine is definitely alive and kicking on the other side of the Atlantic. Here are some of the highlights of this German publication for 64 and 128 users.

The 64 was prominently featured in many ads at around 233 Deutsche marks (about $150). Other items offered in ads were 1541 disk drives (about $160); a mouse; the Final Cartridge; scanners; digitizers; and, of course, *viele Spiele* (many games).

Speaking of games, the "64'er Hit Parade" contained a list of the ten hottest sellers in Germany: Turrican 2 (Rainbow Arts), Zak McKracken (Lucasfilm Games), Turrican (Rainbow Arts), Pirates (MicroProse), Maniac Mansion (Lucasfilm Games), Grand Prix Circuit (Accolade), Last Ninja 3 (System 3), Oil Imperium (Reline), Creatures 2 (Thalamus), and Tetris (Mirrorsoft).

The articles are in German, but if you read that language, you could enjoy articles on copy protection schemes, a program of the month (submitted by readers), fast loaders, MIDI, 3-D high-resolution images, and readers' games that would fit in 2K.

Regular columns include "Assembler Corner," "Profi Corner" (a disk control program in ML), and "Software Corner." One column attracted my attention so that I felt compelled to translate completely. It was "BASIC Corner." ❐

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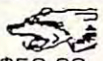

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MACHINE LANGUAGE

Jim Butterfield

ENCRYPTION

Encrypt and decrypt secret messages using a keyword and your 64.

There's no security in substitution ciphers, but there are a number of simple encryption methods that cannot be broken too easily. A simple example is the Vignère method of encryption, which uses a keyword to encode each letter of the message individually.

Another simple encryption technique called a Caesar cipher adds a fixed value to each letter. If we add 3 to each letter, *A* becomes *D*, *B* becomes *E*, *C* becomes *F*, and so on. (At the top of the alphabet, letters wrap around, so that *Z* becomes *C*.) To decode, we would subtract 3. The Vignère cipher, in contrast, adds a different value to each letter; these values are taken from a keyword.

Suppose our Vignère key is the word *COMPUTE*. The first letter, *C*, is the third letter of the alphabet, so we could offset the first character of our secret message by 3. The 15th letter is *O*, and the 13th is *M*. So the second and third characters of our message would be offset by 15 and 13, respectively. In this way, a simple message such as *FEED ME* would be ciphered to read *ITRT HY*. Note that the three *E*s in the original text become three different letters in the cipher text. To decrypt the message, you would need the key, and you would subtract the offset.

Let's write a simple Vignère ciphering program using the word *COMPUTE* as our key. It will encode only unshifted alphabetic characters. The code starts at hex address 2000, decimal 8192; at that point, we reset our pointer to the start of the keyword.

```
2000  A2 00     LDX  #$00
```

Then we get the next character from our key string. At the end of our key, we'll reset X and do it again. After we get our key character, we move X to the next position.

```
2002  BD 3F 20  LDA  $203F,X
2005  F0 F9     BEQ  $2000
2007  E8        INX
```

Reduce the key character to a number in the range 0–31 and store it. A valid alpha character will be in the range 1–26. If we are encoding, we'll add this value; if decoding, we'll subtract.

```
2008  29 3F     AND  #$3F
200A  8D 01 21  STA  $2101
```

Time to input from the keyboard. Save the X register, get the input key, and restore the register. If there's no key pressed, do it all again.

```
200D  8E 00 21  STX  $2100
2010  20 E4 FF  JSR  $FFE4
2013  AE 00 21  LDX  $2100
2016  A8        TAY
2017  F0 F4     BEQ  $200D
```

If the input is not in the range *A–Z*, skip the enciphering.

```
2019  C9 41     CMP  #$41
201B  90 1A     BCC  $2037
201D  C9 5B     CMP  #$5B
201F  B0 16     BCS  $2037
```

We encipher by adding the key value. On the other hand, if we are deciphering, the next two bytes will be changed to read $38, $ED (SEC, SBC) so as to subtract the value.

```
2021  18        CLC
2022  6D 01 21  ADC  $2101
```

We'll skip over some code that adjusts the character if the math takes it above or below the *A–Z* range. The adjustment basically adds or subtracts 26, the number of letters in the alphabet.

The enciphered character is printed, and we go back to get another key value.

```
2031  20 D2 FF  JSR  $FFD2
2034  4C 02 20  JMP  $2002
```

If the input character was not in the cipher range, we print it. If it's a Return, we quit.

```
2037  20 D2 FF  JSR  $FFD2
203A  C9 0D     CMP  #$0D
203C  D0 CF     BNE  $200D
203E  60        RTS
```

Tacked onto the end is the cipher key. There's plenty of room for your own key here; it may be longer. Don't forget to put a binary 0 at the end.

```
203F 43 4F 4D 50 55 54 45 00
  :COMPUTE
```

The BASIC program is straightforward. It's set for encoding; to decode, change lines 130 and 240 to the values in the REM statements.

To encrypt a multiline message, call SYS 8192 for the first line and SYS 8194 for the remainder. That way, the key won't be reset for each line, and your code will be harder to break.

```
100 DATA 162,0,189,63,32,240,
    249,232,41,63
110 DATA 141,1,33,142,0,33,32,
    228,255,174,0,33,168
120 DATA 240,244,201,65,144,26,
    201,91,176,22
130 DATA 24,109: REM 56,237
140 DATA1,33,201,91,144,2,
    233,26,201,65,176,2,105,26
150 DATA 32,210,255,76,2,32,32,
    210,255,201,13,208,207,96
160 DATA 67,79,77,80,85,84,69,0
170 REM THE ENCRYPTION KEY
    SPELLS COMPUTE
200 FOR J=8192 TO 8262
210 READ X:T=T+X
220 POKE J,X
230 NEXT J
240 IF T<>7730 THEN STOP:
    REM 7890
300 PRINT "ENTER LINE OF
    TEXT:"
310 SYS 8192
```

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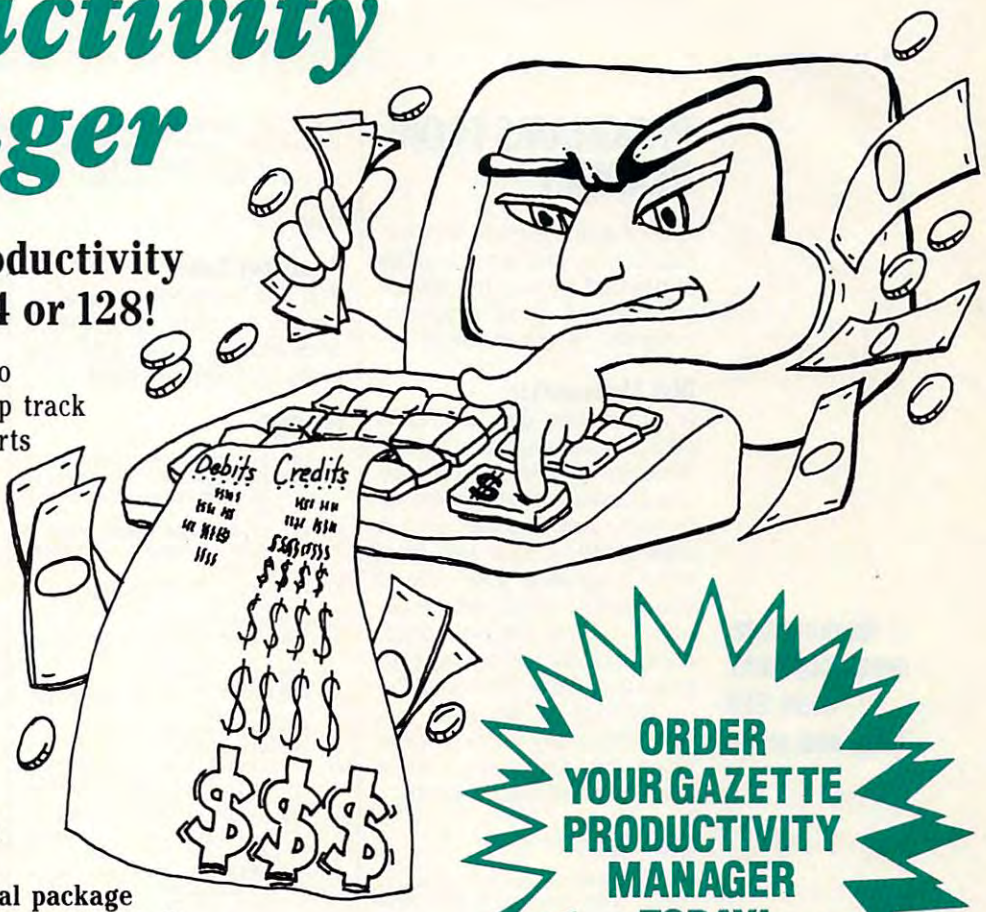

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PROGRAMMER'S PAGE

Randy Thompson

PROGRAMS FROM READERS

Here are some more interesting, useful, and amusing tips submitted by our readers. If you have a good programming tip, I'd like to see it.

Destroy data, speak pig Latin, print SEQ files, and more.

Disk Unformatter

A reformatted disk still holds your old data—just the disk's directory and BAM (Bit Allocation Map) are actually erased. In fact, any hacker with a disk editor could resurrect most if not all of your data. If you want absolute data security or if you're just plain paranoid, use the following program to erase a disk completely. WARNING: Be sure you don't have any important data on the disk in your drive when you run this program.

UNFORM

```
CS 10 A$="M-E"+CHR$(5)+CHR$(2)
      :FOR I=0 TO 33:READ A:A$
      =A$+CHR$(A):NEXT
RQ 20 OPEN 15,8,15:PRINT#15,A$
      :CLOSE 15
MD 30 DATA 162,1,32,26,2,120,1
      69,206,32,21,254,88,166,
      6,232,224,41,208,239,162
PM 40 DATA 18,134,6,169,240,13
      3,0,36,0,48,252,76,0,254
```

This program essentially destroys the disk's DOS formatting—thus the name Disk Unformatter. If you want to use the disk, you'll have to format it once again.

HONG PHAM
ANTIGONISH, NS
CANADA

Habla Ig-Pay Atin-Lay?

Here's an amusing program that translates English (or anything else you throw its way) into the ever-popular language known as pig Latin.

PIG LATIN

```
XJ 100 PRINT:INPUT "ENTER WORD
       ";A$:IF A$="" THEN END
EM 110 X=1:M$=MID$(A$,2,1):IF
       {SPACE}M$="H" OR M$="L"
       OR M$="R" THEN X=2
MQ 120 PRINT MID$(A$,1+X);"-";
       MID$(A$,1,X)+"AY"
EG 130 PRINT:PRINT "ANOTHER WO
       RD (Y OR N)?"
KG 140 GET K$:IF K$<>"Y" AND K
       $<>"N" THEN 140
DP 150 IF K$="Y" THEN 100
```

SCOTT LANG
TIGARD, OR

Persistent Colors

Run this program to set your screen's colors, and they'll stick around—even after you press Run/Stop–Restore.

COLORS

```
HM 100 REM COLOR RESTORE
AR 110 FOR I=52992 TO 53042:RE
       AD D:POKE I,D:C=C+D:NEX
       T
PH 120 IF C<>6705 THEN PRINT "
       ERROR IN DATA STATEMENT
       S":END
KP 130 INPUT "BORDER COLOR (0-
       15)";B
EB 140 POKE 53280,B
RH 150 INPUT "BACKGROUND COLOR
        (0-15)";B
JC 160 POKE 53281,B
AS 170 INPUT "CURSOR COLOR (0-
       15)";B
DS 180 POKE 646,B
AE 190 SYS 52992
XE 200 DATA 173,134,2,141,160,
       207,173,33,208,141,162,
       207,173,32,208
DS 210 DATA 141,161,207,162,29
       ,160,207,142,0,3,140,1,
       3,96,172
QF 220 DATA 160,207,140,134,2,
       172,161,207,140,32,208,
       172,162,207,140
HK 230 DATA 33,208,76,139,227,
       0
```

This program is designed to work on the 64 only.

GEZA LUCZ
KINIZSI, HUNGARY

Sequential File Printer

Greg Waggoner wrote this program to help a friend set up a BBS. It sends sequential text files to the screen or the printer. While reading or printing a file, you can pause the program by holding down the Shift key or abort the program by pressing the Back Arrow key. When the program reaches the end of a file, it stops and asks you to enter another filename. Just press Return to exit the program.

FILE PRINT

```
RR 10 PRINT "{CLR}":D=8
XM 20 PRINT:F$="":INPUT "FILEN
      AME";F$:IF F$="" THEN EN
      D
GP 30 OPEN 15,D,15:OPEN 8,D,8,
      "0:"+F$+",S,R":CLOSE 8:I
      NPUT#15,E,E$:CLOSE 15
XG 40 IF E THEN PRINT E$:GOTO
      {SPACE}20
FS 50 PRINT "{RVS}S{OFF}CREEN
      {SPACE}OR {RVS}P{OFF}RIN
      TER?"
MB 60 GET K$
MQ 70 IF K$="S" THEN 100
RA 80 IF K$="P" THEN 150
FH 90 GOTO 60
QJ 100 OPEN 8,D,8,"0:"+F$+",S,
       R"
RK 110 IF PEEK(653)=1 THEN 110
HB 120 GET K$:IF K$="←" THEN C
       LOSE 8:GOTO 20
EQ 130 GET#8,A$:IF ST=64 THEN
       {SPACE}CLOSE 8:GOTO 20
FD 140 PRINT A$;:GOTO 110
EB 150 OPEN 8,D,8,"0:"+F$+",S,
       R":OPEN 4,4,7
GQ 160 IF PEEK(653)=1 THEN 160
PQ 170 GET K$:IF K$="←" THEN C
       LOSE 8:CLOSE 4:GOTO 20
PB 180 GET#8,A$:IF ST=64 THEN
       {SPACE}CLOSE 8:CLOSE 4:
       GOTO 20
GK 190 PRINT#4,A$;:GOTO 150
```

GREGG WAGGONER
OLNEY, TX

Ascending Tones

You've probably seen (and heard) programs that produce clicks whenever you press a key, but this program is a little more melodic. When you type or enter code, you'll hear an ascending tone as the cursor moves toward the right side of the screen. Press Return, and the tone returns to where it started.

TONES

```
BP 100 FOR I=49152 TO 49228:RE
       AD D:C=C+D:POKEI,D:NEXT
GS 110 IF C<>9456 THEN PRINT"E
       RROR IN DATA STATEMENTS
       ":STOP
CP 120 SYS49152
PX 130 DATA 120,169,43,162,192
       ,141,20,3,142,21
RF 140 DATA 3,162,25,169,0,157
       ,255,211,202,208
GP 150 DATA 250,169,63,141,5,2
       12,169,240,141,6
XF 160 DATA 212,169,17,141,4,2
       12,169,15,141,24
JD 170 DATA 212,88,96,166,203,
       224,64,240,18,169
SJ 180 DATA 17,141,4,212,165,2
       11,105,14,141,1
XJ 190 DATA 212,141,0,212,76,4
       9,234,169,16,141
DD 200 DATA 4,212,76,49,234,23
       ,212
```

R. THOMPSON
EUGENE, OR

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GEOS

Steve Vander Ark

WHAT'S HOT ON QUANTUMLINK

Here are some exciting new programs for GEOS that can be found on Q-Link.

Programs being written these days by people such as Kent Smotherman and Irv Cobb are so clever and interesting that I could almost say we're seeing the golden days of GEOS shareware. The pace may have slowed, but the quality of the work is better than ever.

We've seen a lot of great GEOS programmers over the years. Many of them have moved on to other platforms, but their work survives them in the GEOS libraries on QuantumLink. Here's a brief tour of the latest Q-Link uploads.

One of the recent uploads to Q-Link has done what everyone knows can't be done: change BSW, the GEOS system font. Irv Cobb is the fellow responsible for doing the impossible with his recent file CHANGE-BSW.ARC (uploaded by Irv Cobb).

This little AUTO-EXEC file will change the system font, BSW 9 point, into one of several other 9-point fonts during boot. You heard right: The system font, the untouchable and often unreadable BSW, is no longer out of reach. This file includes four fonts you can use, including a boldface version of BSW. This program runs on the 64 or the 128, but affects only the 40-column system font. Irv is promising a version which will change the 80-column BSW as well.

Kent Smotherman has been pouring out scads of neat little GEOS programs lately. His latest wonders are a chess recordkeeper (CHESSECRETARY2, uploaded by Kent LS) and a utility (BOOTIE) that automatically fires up AUTO-EXEC files on any drive other than the one you're booting from.

Those who have gritted their teeth and struggled with the mouse editor in Preferences will appreciate another of Kent's programs. Mouser allows you to browse through photo albums, find a likely bitmap, and copy it to your pointer. A file called MICE, also uploaded by Kent, is a small album of likely images.

Gateway users in particular will appreciate Kent's directory manager program (DIRMASTER, uploaded by Kent LS). With Directory Master you can sort and rearrange GEOS disk directories to your heart's content. It runs perfectly well under Gateway, a program which has needed a way to organize directories efficiently. Directory Master includes features to make easier the mundane task of keeping everything straight and orderly.

Kent is continually adding to the libraries, so by the time you get there to look around, you might very well discover more treasures with his name on them. All Kent's programs are specifically designed for the 64, but many of them will work just fine on the 128.

There's plenty more. One which I will certainly be using is Diskmaster, uploaded by Steven E. Eyrse. (His onscreen name is ScenicFilm.) This utility changes master disks to regular GEOS disks, which means that you no longer have to move files to the border of your boot disk in order to throw them out. The current version changes the disk status only temporarily, since GEOS changes it back automatically the next time you reboot. A more permanent version has been promised.

Another program from ScenicFilm is Calcmove. The calculator desk accessory is slightly modified by this program to appear at a new, user-specified position. The whole process is as easy as a few mouse clicks, and the result can make the calculator even more useful by getting it out of the way of your work. Steve's programs are specifically written for the 64.

Take a look in the other libraries of GEOS files, and you'll find more treasures waiting for you. In the font library, for example, you'll find several new LQ fonts to be used with GEOS LQ, the incredible new printer control system found in CMD's Perfect Print collection. Try BLKLETTERS LQ uploaded by Aqua Regia or ITALIQUE LQ by JonS1.

George Wells has uploaded a complete selection of printer drivers to support the Epson-compatible 9- and 24-pin printers. These drivers do everything from printing in multiple passes to printing color documents in shades of gray. Just wander into those libraries, and you'll find his excellent files everywhere.

So, what impossible things will these talented folks think of to do next? You never know. There are still a few applications GEOS lacks. For example, it needs a terminal program to support 2400 bps and an 80-column desktop publishing package. My personal dream is to see a presentation program that will let the user create a script similar to a HyperCard stack on the Macintosh and display screens of information, complete with support for multicolor graphics, geoRAW digitized sounds, and SID music files. The basic concept is straightforward, and the Commodore is certainly capable of doing the job.

What about you? If you have any great ideas for GEOS programs, let me know. I'll keep track of them and, if I get enough good suggestions, I'll publish a wish list in an upcoming column. You can contact me through this magazine, or electronically on Q-Link (SteveV14), or GEnie (S.VANDERARK). ❐

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When three science teachers came to my multimedia workshop recently, they brought lots of raw materials to make their own multimedia lessons. They brought pages of leaves from their leaf collections. They brought their bug collections. They also brought their Encyclopedia of Animals videodisc collection from Optical Data. As soon as they arrived at my workshop, the teachers got busy making things.

They propped their bugs on a music stand and used a video camera to scan color images of the insects into the computer. They put pages of leaves facedown in my Howtek personal color scanner and created beautiful, full-color computer images of the foliage. They used my color and gray-scale hand scanners from Logitech to capture photographs they had brought from manuals, guidebooks, and personal photo collections.

They captured sounds from audio CDs: surf breaking on the coast in Cape Cod; fierce, crashing waves in a chilling winter storm; soft sounds of water lapping on a creek bed; wind whistling through trees; leaves flapping and crunching in late fall; and bugs humming and buzzing.

The teachers brought these materials from their "teacher drawers" and "teacher closets." They were science specimens and slices of the real world that spiced up children's lessons and brought a tired, dusty curriculum to life.

In my workshop, the teachers learned how to use a computer to stir these ingredients into a rich multimedia stew filled with sounds, captions, still images, video, and background music. Next they took turns collecting video bites of their colleagues. These were tiny video and audio clips of each teacher explaining key concepts or describing the specimens. We turned these tiny clips into pop-up windows on the computer screen. We wove them into a minitutorial and a pop quiz on invertebrate animals such as the amoeba, the volvox, and the vorticella.

I think of my multimedia classroom as a kitchen for aspiring multimedia chefs. The teachers and students bring a hodgepodge of potluck curriculum materials to my kitchen, and I teach them how to cook up a delicious multimedia dish.

What kinds of ingredients do my multimedia recipes call for? Almost anything will do! Teachers come to my workshops hauling boxes of stuff, including old photos, leaves, bugs, fish, textbooks, crafts, sculptures, paintings, children's pictures, art, souvenirs, fossils, rocks, tree branches, CDs, tapes, videos, musical instruments, library books, buttons, stamps, playing cards, trading cards, and so on.

In my multimedia workshop, I show my apprentice chefs how these ingredients from the real world add sound, color, and moving images to their lessons. I encourage them to take this same cookbook approach back to their classrooms to make their lessons more meaningful and exciting for their students.

In the multimedia kitchen, I stress that the two most important ingredients are your body and your imagination! Recently, I worked with a group of math teachers. What does math have to do with multimedia? A lot, really, when you remember that most children—and most adults—are mathphobic because they can't visualize math concepts and can't apply math rules and symbols to everyday problems.

I challenged my math chefs to cook up some mathematical concepts using only their bodies and the tables and chairs in our classroom. Over the next hour of the workshop I was amazed at all of the ingenious—and hilarious—concoctions that the chefs dreamed up. Here are a few of their scenarios.

- A human fraction consisting of three math teachers kneeling on top of a table and four kneeling underneath a table.
- A moving equation of "sets" consisting of teachers rushing in and out of groups based on their ages, heights, gender, grades taught, and big numbers they wore on their name badges.
- A human graph made up of three teachers of ascending height holding up a fourth (much thinner) teacher demonstrating a line on a graph with a positive slope.

Each time a team of chefs presented a math concept, we captured the concept on video as a still image inside the computer. We entered a computer paint program and added captions and arrows to the image. Then, we digitized a math teacher's voice, and challenged students to identify the concept correctly.

If you were called into the kitchen, what kind of multimedia potluck could you bring together? What kind of multimedia dish would it be fun for you to cook up? What special sights, words, and sounds can you combine that will bring a subject you love to life? You might have the potential to become a gourmet multimedia cook or at least a short-order chef at a multimedia fast-food restaurant. ❐

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DROP-DOWN MACROS

By Richard Penn

There are many utilities for programming the function keys on the 64—many even double the available number with key combinations to 16. The trouble is, the more function key combinations you have, the harder it is to remember what they all do. With 16 key combinations to remember, it isn't exactly obvious what Shift-Ctrl-f5 does.

With Drop-Down Macros you'll never forget which function key combination to press. This utility for the 64 lets you select any of 16 macros from a pull-down menu. Simply highlight your choice with the cursor keys and hit Return to execute the macro. That command then executes as if it were typed on the keyboard. For faster operation, all 16 macros have function key shortcuts too.

You can say good-bye to cumbersome key commands and CHR$ codes that other programs require for defining function keys. With Drop-Down Macros, programming macros was never easier. You can even incorporate or pick up commands from the screen.

Getting Started

Drop-Down Macros is written entirely in machine language; enter it with MLX, our machine language entry program. See "Typing Aids" elsewhere in this section. When MLX prompts you, respond with the following values.

Starting address: C000
Ending address: CEFF

After you've finished typing in the program, be sure to save a copy to disk with the name Drop-Down Macros.

Activation

To activate Drop-Down Macros, load the program with the ,8,1 extension, type *NEW*, and then type *SYS 49152*. Along with a message informing you that Drop-Down Macros has been installed, you'll see several commands to get you started.

Three Ways

Drop-Down Macros is flexible and friendly. It lets you access macros in three ways. You'll probably use the menu most of the time. Press Ctrl-Shift at any time, and the names of all 16 macros appear in a window. You can cursor to any macro and press Return to activate it. If you call the menu and then change your mind, press Run/Stop to cancel it.

Next to each command is its function key shortcut. Once you've become familiar with a macro, you can bypass the menu and activate the macro by pressing the appropriate keys. You can press f6, for example, to list a disk's directory.

Keys f1–f8 are printed in one color on the menu since they're the standard function keys. Keys f9–f12 are another color to remind you that they're accessed by holding down the Commodore key in conjunction with one of the four function keys. Similarly, the last four function keys are accessed with the Ctrl key. To prevent key conflicts, the function keys are disabled while a program is running, but the menu still works.

Picking up Macros

Unlike some utilities, Drop-Down Macros makes it very easy to program new macros. Simply press Ctrl-Return, and you'll be prompted for the key to define. Highlight the macro that you want to program from the menu and hit Return or, alternately, press its function key. (As before, press Run/Stop to cancel the menu.)

Next, you'll be asked to type in a name for the macro. This is the five-character name that will appear on the menu; any characters beyond five are truncated. When you've named the macro, you'll be prompted for the command itself. This line of code can be up to 80 characters (two screen lines) in length. Enter commands in the order that they're to be executed and use the back arrow (È) to indicate a Return keypress. Whenever Drop-Down Macros executes a macro in direct mode, it will print a "live" Return for each back arrow.

You can also "pick up" commands already printed on the screen. When prompted to enter a macro, use the cursor keys to move the cursor to the line that you want to pick up and press Return. Drop-Down Macros picks up logical lines, so the cursor can be anywhere on the line when you press Return. Also, remember to add a back arrow to the end of a line if you want the macro to execute automatically.

For example, if you're writing a tricky macro, first test it in direct mode. When it's working correctly, press Ctrl-Return and enter a name. Cursor up to the macro, add a back arrow to the end of it, and hit Return to pick it up.

If you need to list a group of lines often, put the LIST command in a macro that's selected with a single keypress, such as f1, f3, f5, or f7. From then on, pressing that one function key will put you in business.

When defining macros, note that the input routine lets you use all keys (it uses the 64's built-in BASIC editor). This can pose problems. Moving the cursor past the bottom line, for example, will make the screen scroll, and pressing Shift-Clr/Home will clear the screen. These potential problems are trade-offs for the line-pickup feature.

Saving Macros

If you've defined several macros and want to save them, press Ctrl-D (think D for disk) and enter a filename at the prompt. To cancel the saving process, press Run/Stop-Restore. This will save a new copy of Drop-Down Macros with your special macros included. To reload them, load this file in place of the original program.

Built-in Power

Drop-Down Macros comes with 16 default macros. As you'll see, many of these are rather powerful. It's not practical to type all of these manually, but when they're only a menu away, they're very handy to have. Here's a list of the default macros.

RUN runs the program currently in memory.

ASCII prints a chart of ASCII codes. Press Ctrl to slow the listing or Run/Stop to halt it at the desired spot.

LIST lists the BASIC program that is in memory.

SCREN prints a chart of screen codes. As with the ASCII chart, press Ctrl to slow the listing or Run/Stop to stop it.

HARD sends the program listing to the printer without printing the READY prompt at the end of the listing. Make sure your printer is turned on before

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you select this macro.

DIR loads the disk directory into memory.

BLANK blanks the screen to prevent monitor burn-in when you must leave your monitor turned on but inactive for a while. Press any key to bring back the display.

ERROR displays the disk error when the drive light is blinking.

NEW executes a NEW command to erase the program in memory.

UNNEW recovers a program should you accidentally erase it with the NEW command. Like all similar utilities, it's important to know that making a syntax error or entering a variable before using UNNEW will render your program unrecoverable, so be careful.

UNDEL loads a scratched disk program into memory if no other disk operations have been performed following the scratch. Remember that the file is only loaded into the computer. It's still scratched on disk, so be sure to resave it immediately.

BYTES returns the length of the program in memory.

INIT initializes the disk in the drive.

VALID validates the disk in the drive.

RESET resets the disk drive as if you turned it off and on again. This process takes a few seconds.

VERFY verifies the most recently saved program.

These macros are defaults in the original program. You can overwrite any or all of these defaults with your own macros at any time.

DROP-DOWN MACROS

```
C000:A9 37 85 01 A9 00 8D 0E 5B
C008:DC 85 5F A9 A0 85 60 A9 65
C010:FF 85 5A 85 5B 85 58 85 BD
C018:59 20 BF A3 AD FF FF 8D 7B
C020:FF FF A9 01 8D 0E DC A9 EE
C028:95 8D 04 DC A9 42 8D 05 9C
C030:DC A9 00 8D B5 E5 8D BD 81
C038:E5 8D 3D EB A9 01 8D BA 9D
C040:E5 A9 CF 8D B6 E5 8D BB 16
C048:E5 8D BE E5 8D 3E EB A9 3D
C050:FF 8D 89 02 A9 EA 8D 54 EE
C058:E9 8D 55 E9 78 A9 8F 8D 92
C060:14 03 A9 C0 8D 15 03 A9 5E
C068:35 85 01 A9 ED 8D 02 03 4D
C070:A9 C6 8D 03 03 A2 E9 A0 71
C078:94 86 33 84 34 86 37 84 43
C080:38 A2 00 BD E9 C8 20 D2 28
C088:FF E8 C9 00 D0 F5 60 AD 4A
C090:8D 02 CD 96 C9 F0 1B 8D 52
C098:96 C9 C9 00 F0 14 C9 05 81
C0A0:D0 10 A9 7F 8D 0D DC 20 36
C0A8:CF C1 A9 81 8D 0D DC 4C 76
C0B0:31 EA A5 C5 CD 92 C9 F0 D3
C0B8:F6 8D 92 C9 C9 40 F0 EF 29
C0C0:AD 8D 02 C9 04 D0 69 A5 35
C0C8:C5 C9 01 D0 05 A9 35 4C 52
C0D0:D8 C0 C9 12 D0 5A A9 37 C3
C0D8:8D 06 CF A9 35 8D 07 CF F4
C0E0:A9 32 8D 08 CF A9 8D 8D C3
C0E8:01 CF A9 53 8D 02 CF A9 07
C0F0:D9 8D 03 CF A9 35 8D 04 61
C0F8:CF A9 30 8D 05 CF A9 3A A0
C100:8D 09 CF A9 52 8D 0A CF CD
C108:A9 45 8D 0B CF A9 4D 8D 61
C110:0C CF A9 0D 8D 0D CF A9 7D
C118:0E 85 C6 AD 86 02 8D 8F 9E
C120:C9 AD 21 D0 29 0F AA BD BD
C128:DA E8 8D 00 CF 4C 31 EA 02
C130:A5 3A C9 FF D0 0D A5 C5 1A
C138:C9 03 90 07 C9 07 B0 03 B2
C140:20 46 C1 4C 31 EA AE 8D 82
C148:02 E0 01 F0 0D E0 02 F0 15
C150:0E E0 04 F0 0F A2 00 4C F1
C158:66 C1 A2 04 4C 66 C1 A2 36
C160:08 4C 66 C1 A2 0C 8E 9A E0
C168:C9 C9 03 D0 02 A9 07 38 AD
C170:E9 04 18 6D 9A C9 8D 9A 75
C178:C9 A9 00 8D 94 C9 8D 95 A0
C180:C9 A9 AD 85 FB A9 C9 85 01
C188:FC A2 50 18 AD 94 C9 6D 7F
C190:9A C9 8D 94 C9 AD 95 C9 C8
C198:69 00 8D 95 C9 CA D0 EB E2
C1A0:18 A5 FB 6D 94 C9 85 FB C2
C1A8:8D 98 C9 A5 FC 6D 95 C9 3F
C1B0:85 FC 8D 99 C9 A6 C6 E0 D8
C1B8:B1 B0 13 A0 00 B1 FB 9D 0A
C1C0:00 CF E8 C8 C0 50 B0 04 8E
C1C8:C9 00 D0 F1 86 C6 60 A9 24
C1D0:C1 8D 18 03 A2 02 B5 00 54
C1D8:9D E9 94 E8 E0 C6 D0 F6 81
C1E0:A2 C7 B5 00 9D E9 94 E8 05
C1E8:D0 F8 A9 00 85 FB A9 02 B9
C1F0:85 FC A9 E9 85 FD A9 95 57
C1F8:85 FE A0 00 B1 FB 91 FD B1
C200:E6 FD D0 02 E6 FE E6 FB AF
C208:D0 02 E6 FC A5 FB C9 00 D3
C210:D0 EA A5 FC C9 08 D0 E4 32
C218:A9 00 85 FB A9 D8 85 FC 9B
C220:A9 E9 85 FD A9 9B 85 FE 4B
C228:A0 00 B1 FB 91 FD E6 FD 44
C230:D0 02 E6 FE E6 FB D0 02 36
C238:E6 FC A5 FB C9 E8 D0 EA 63
C240:A5 FC C9 DB D0 E4 A2 00 2E
C248:BD 00 D0 9D D1 9F E8 E0 60
C250:2F D0 F5 20 51 C5 20 07 4B
C258:C3 AD 11 D0 10 FB A9 00 1E
C260:8D 1B D0 A2 02 BD E9 94 27
C268:95 00 E8 E0 C6 D0 F6 A2 ED
C270:C7 BD E9 94 95 00 E8 D0 1F
C278:F8 A9 00 85 FB A9 02 85 4D
C280:FC A9 E9 85 FD A9 95 85 CB
C288:FE A0 00 B1 FD 91 FB E6 E5
C290:FD D0 02 E6 FE E6 FB D0 54
C298:02 E6 FC A5 FB C9 F8 D0 9C
C2A0:EA A5 FC C9 07 D0 E4 A9 30
C2A8:00 85 FB A9 D8 85 FC A9 2A
C2B0:E9 85 FD A9 9B 85 FE A0 78
C2B8:00 B1 FD 91 FB E6 FD D0 CB
C2C0:02 E6 FE E6 FB D0 02 E6 5D
C2C8:FC A5 FB C9 E8 D0 EA A5 58
C2D0:FC C9 DB D0 E4 AD 11 D0 A0
C2D8:10 FB A9 00 8D 15 D0 20 1D
C2E0:51 C5 A2 00 BD E1 9B 9D 1F
C2E8:F8 07 E8 E0 08 D0 F5 AD F4
C2F0:11 D0 10 FB A2 00 BD D1 57
C2F8:9F 9D 00 D0 E8 E0 2F D0 BC
C300:F5 A9 47 8D 18 03 60 A9 E5
C308:FF 8D F8 07 A9 FE 8D F9 E0
C310:07 A9 FD 8D FA 07 8D FC 2A
C318:07 A9 FC 8D FB 07 8D FD 1B
C320:07 A9 FB 8D FE 07 A9 FA 50
C328:8D FF 07 A9 09 A2 08 9D 72
C330:26 D0 CA D0 FA A9 0F 8D 8F
C338:25 D0 A9 0C 8D 26 D0 A9 CC
C340:FF 8D 1C D0 8D 1D D0 8D CB
C348:17 D0 A9 AA 8D 10 D0 A9 67
C350:F4 8D 00 D0 8D 04 D0 8D 6E
C358:08 D0 8D 0C D0 A9 24 8D 8D
C360:02 D0 8D 06 D0 8D 0A D0 D0
C368:8D 0E D0 A9 32 8D 01 D0 89
C370:8D 03 D0 A9 5C 8D 05 D0 28
C378:8D 07 D0 A9 86 8D 09 D0 8A
C380:8D 0B D0 A9 99 8D 0D D0 34
C388:8D 0F D0 A9 00 8D 1B D0 8C
C390:A2 1A B5 D8 09 80 95 D8 82
C398:CA D0 F7 AD 11 D0 10 FB 7B
C3A0:A9 FF 8D 15 D0 A9 1B 85 E8
C3A8:FB A9 04 85 FC A0 13 98 9A
C3B0:48 A0 00 A9 20 A2 0D 91 56
C3B8:FB C8 CA D0 FA 18 A5 FB 56
C3C0:69 28 85 FB A5 FC 69 00 6B
C3C8:85 FC 68 A8 88 D0 E0 A9 DC
C3D0:00 85 C7 85 D4 85 D8 A9 23
C3D8:01 85 CC A9 13 20 D2 FF 35
C3E0:A9 11 20 D2 FF A9 00 8D E6
C3E8:8E C9 A2 01 8A 48 20 D3 18
C3F0:C4 68 AA E8 E0 11 90 F4 3A
C3F8:AD 11 D0 10 FB A9 FF 8D CA
C400:1B D0 A9 37 85 01 A5 C6 36
C408:8D 97 C9 A9 00 85 C6 8D 43
C410:9B C9 A2 01 18 A0 00 20 A1
C418:F0 FF A9 12 8D 8E C9 8A 35
C420:48 20 D3 C4 68 AA 8A 48 E7
C428:A0 06 A2 FF CA D0 FD 88 F5
C430:D0 F8 20 9F FF A5 C5 C9 4A
C438:3F F0 60 C9 03 90 09 C9 7C
C440:07 B0 05 68 AA 4C A5 C4 37
C448:20 E4 FF A8 68 AA C0 0D 22
C450:F0 62 C0 11 F0 07 C0 91 CA
C458:F0 1E 4C 26 C4 A9 00 8D 28
C460:8E C9 A9 91 20 D2 FF 8A C8
C468:48 20 D3 C4 68 AA E8 E0 85
C470:11 90 A7 A2 01 4C 14 C4 EB
C478:A9 00 8D 8E C9 A9 91 20 A9
C480:D2 FF 8A 48 20 D3 C4 68 8B
C488:AA CA A9 91 20 D2 FF 20 D4
C490:D2 FF E0 01 B0 84 A2 10 9C
C498:4C 14 C4 68 A9 01 8D 9B 74
C4A0:C9 20 C9 C4 60 20 C9 C4 78
C4A8:A5 C5 8D 92 C9 8D AE 95 C8
C4B0:20 46 C1 60 20 C9 C4 A5 71
C4B8:C5 8D AE 95 CA 8A E0 08 02
C4C0:B0 03 BD 7E C9 20 76 C1 80
C4C8:60 A9 35 85 01 AD 97 C9 A3
C4D0:85 C6 60 8E 9A C9 AD 8E A9
C4D8:C9 C9 12 D0 05 A9 00 4C 24
C4E0:F9 C4 8E 9A C9 E0 09 90 88
C4E8:09 E0 0D 90 0A A9 07 4C 2B
C4F0:F9 C4 A9 0E 4C F9 C4 A9 3C
C4F8:0F 8D 86 02 A9 1C 85 D3 FA
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C500:AD 8E C9 85 C7 A9 20 20 DC
C508:D2 FF CE 9A C9 A9 00 A0 16
C510:05 18 6D 9A C9 88 D0 FA 88
C518:A8 A2 05 B9 AF CE 20 D2 A0
C520:FF C8 CA D0 F6 AE 9A C9 B5
C528:E8 E0 0A 90 05 A0 01 4C A3
C530:34 C5 A0 02 A9 20 20 D2 5C
C538:FF 88 D0 FA A9 46 20 D2 29
C540:FF A9 00 20 CD BD A9 20 11
C548:20 D2 FF A9 0D 20 D2 FF C1
C550:60 A2 00 BD 0B C7 48 BD 56
C558:80 3E 9D 0B C7 68 9D 80 B3
C560:3E E8 D0 EF BD 0B C8 48 52
C568:BD 80 3F 9D 0B C8 68 9D 9E
C570:80 3F E8 E0 81 90 ED 60 C1
C578:A9 7F 8D 0D DC A9 31 8D B8
C580:14 03 A9 EA 8D 15 03 AD 2F
C588:8F C9 8D 86 02 A2 00 BD C0
C590:8C C8 20 D2 FF E8 C9 00 FC
C598:D0 F5 20 CF C1 A9 81 8D 50
C5A0:0D DC A9 00 85 C6 AD 9B 5D
C5A8:C9 F0 03 4C 2E C6 AE 9A FE
C5B0:C9 E0 08 B0 06 BD 86 C9 63
C5B8:8D 9A C9 A9 00 A0 05 18 2A
C5C0:6D 9A C9 88 D0 FA A8 8C BB
C5C8:9C C9 A9 20 A2 05 99 AE 57
C5D0:CE C8 CA D0 F9 A2 00 BD 74
C5D8:A7 C8 20 D2 FF E8 C9 00 D2
C5E0:D0 F5 AC 9C C9 A2 00 20 AA
C5E8:CF FF C9 0D F0 10 99 AE 10
C5F0:CE C8 E8 E0 05 90 F0 20 AD
C5F8:CF FF C9 0D D0 F9 A2 00 2A
C600:BD BB C8 20 D2 FF E8 C9 A8
C608:00 D0 F5 AD 98 C9 85 FB 56
C610:AD 99 C9 85 FC A0 00 20 F6
C618:CF FF C9 0D F0 0C C9 5F 42
C620:D0 02 A9 0D 91 FB C8 4C F6
C628:17 C6 A9 00 91 FB 78 A9 3F
C630:8F 8D 14 03 A9 C0 8D 15 1C
C638:03 58 A9 0D 20 D2 FF 60 10
C640:78 A9 31 8D 14 03 A9 EA 5E
C648:8D 15 03 58 AD 8F C9 8D 94
C650:86 02 A2 00 BD CB C8 20 C4
C658:D2 FF E8 C9 00 D0 F5 A9 E1
C660:00 85 C6 A0 00 8C 90 C9 4F
C668:A9 A4 20 D2 FF C6 D3 20 08
C670:E4 FF F0 FB AC 90 C9 C9 53
C678:0D D0 07 C0 00 F0 F0 4C 9F
C680:BC C6 C9 14 D0 19 AC 90 6D
C688:C9 F0 E4 C6 D3 A9 20 20 E5
C690:D2 FF 20 D2 FF C6 D3 C6 42
C698:D3 CE 90 C9 4C 68 C6 C0 C4
C6A0:10 F0 CC C9 20 F0 08 C9 47
C6A8:21 90 C4 C9 60 B0 C0 AC 14
C6B0:90 C9 99 9D C9 20 D2 FF 7A
C6B8:C8 4C 65 C6 A9 20 20 D2 B7
C6C0:FF A9 0D 20 D2 FF A9 01 47
C6C8:A2 08 A0 FF 20 BA FF AD 57
C6D0:90 C9 A2 9D A0 C9 20 BD 71
C6D8:FF A9 00 85 FB A9 C0 85 B6
C6E0:FC A9 FB A2 FF A0 CE 20 41
C6E8:D8 FF 4C 2E C6 48 78 A9 41
C6F0:8F 8D 14 03 A9 C0 8D 15 DC
C6F8:03 A9 FF 8D 89 02 A9 35 28
C700:85 01 A9 FF 85 3A 58 68 F5
C708:4C 83 A4 AA AA AB AA AA E1
C710:AB AA AA AB AA AA AB AA 32
C718:AA AB AA AA AB AA AA AB F0
C720:AA AA AB AA AA AB AA AA D3
C728:AB AA AA AB AA AA AB AA 4A
C730:AA AB AA AA AB AA AA AB 09
C738:AA AA AB AA AA AB AA AA EB
C740:AB AA AA AB AA AA AB FF B7
C748:FF FF A0 6A AA AA 6A AA 12
C750:AA 6A AA AA 6A AA AA 6A 8D
C758:AA AA 6A AA AA 6A AA AA DE
C760:6A AA AA 6A AA AA 6A AA 4B
C768:AA 6A AA AA 6A AA AA 6A A5
C770:AA AA 6A AA AA 6A AA AA F6
C778:6A AA AA 6A AA AA 6A AA 63
C780:AA 6A AA AA 6A AA AA 7F D2
C788:FF FF A0 AA AA AB AA AA DA
C790:AB AA AA AB AA AA AB AA B2
C798:AA AB AA AA AB AA AA AB 71
C7A0:AA AA AB AA AA AB AA AA 54
C7A8:AB AA AA AB AA AA AB AA CA
C7B0:AA AB AA AA AB AA AA AB 89
C7B8:AA AA AB AA AA AB AA AA 6C
C7C0:AB AA AA AB AA AA AB AA E2
C7C8:AA AB A0 6A AA AA 6A AA D2
C7D0:AA 6A AA AA 6A AA AA 6A 0E
C7D8:AA AA 6A AA AA 6A AA AA 5F
C7E0:6A AA AA 6A AA AA 6A AA CB
C7E8:AA 6A AA AA 6A AA AA 6A 26
C7F0:AA AA 6A AA AA 6A AA AA 77
C7F8:6A AA AA 6A AA AA 6A AA E3
C800:AA 6A AA AA 6A AA AA 6A 3F
C808:AA AA A0 55 55 55 AA AA 03
C810:AB AA AA AB AA AA AB AA 34
C818:AA AB AA AA AB AA AA AB F2
C820:AA AA AB AA AA AB AA AA D5
C828:AB AA AA AB AA AA AB AA 4C
C830:AA AB AA AA AB AA AA AB 0B
C838:AA AA AB AA AA AB AA AA ED
C840:AB AA AA AB AA AA AB AA 64
C848:AA AB A0 55 55 55 6A AA 03
C850:AA 6A AA AA 6A AA AA 6A 8F
C858:AA AA 6A AA AA 6A AA AA E0
C860:6A AA AA 6A AA AA 6A AA 4D
C868:AA 6A AA AA 6A AA AA 6A A7
C870:AA AA 6A AA AA 6A AA AA F8
C878:6A AA AA 6A AA AA 6A AA 65
C880:AA 6A AA AA 6A AA AA 6A BF
C888:AA AA A0 00 91 53 45 4C DE
C890:45 43 54 20 54 48 45 20 90
C898:4B 45 59 20 54 4F 20 44 B2
C8A0:45 46 49 4E 45 0D 00 0D DF
C8A8:45 4E 54 45 52 20 4D 41 3E
C8B0:43 52 4F 20 4E 41 4D 45 BB
C8B8:3A 0D 00 0D 0D 45 4E 54 E9
C8C0:45 52 20 4D 41 43 52 4F 6D
C8C8:3A 0D 00 91 53 41 56 45 65
C8D0:20 4D 41 43 52 4F 0D 0D 19
C8D8:45 4E 54 45 52 20 46 49 68
C8E0:4C 45 4E 41 4D 45 3A 0D C8
C8E8:00 0D 20 20 20 20 20 20 A5
C8F0:20 44 52 4F 50 2D 44 4F F1
C8F8:57 4E 20 4D 41 43 52 4F AD
C900:53 20 49 4E 53 54 41 4C 0E
C908:4C 45 44 0D 0D 20 20 20 B5
C910:43 54 52 4C 2D 53 48 49 F9
C918:46 54 20 20 20 20 20 20 CB
C920:20 20 20 20 20 20 20 4D E0
C928:41 43 52 4F 20 4D 45 4E 7B
C930:55 0D 20 20 20 43 54 52 C0
C938:4C 2D 52 45 54 55 52 4E C6
C940:20 20 20 20 20 20 20 20 D3
C948:20 20 20 20 44 45 46 49 07
C950:4E 45 20 4B 45 59 0D 20 DE
C958:20 20 43 54 52 4C 2D 44 14
C960:20 28 44 20 46 4F 52 20 CC
C968:44 49 53 4B 29 20 20 20 B9
C970:20 53 41 56 45 20 4D 41 FC
C978:43 52 4F 53 0D 00 00 04 CD
C980:01 05 02 06 03 07 00 02 AC
C988:04 06 01 03 05 07 12 0E 66
C990:10 00 12 FF E0 01 04 00 81
C998:8D CB 06 00 19 44 52 4F 74
C9A0:50 2D 44 4F 57 4E 20 4D A6
C9A8:41 43 52 4F 53 52 55 4E C9
C9B0:0D 00 FF FF 00 00 FF FF CA
C9B8:00 00 FF FF 00 00 FF FF 4C
C9C0:00 00 FF FF 00 00 FF FF 54
C9C8:00 00 FF FF 00 00 FF FF 5C
C9D0:00 00 FF FF 00 00 FF FF 64
C9D8:00 00 FF FF 00 00 FF FF 6C
C9E0:00 00 FF FF 00 00 FF FF 74
C9E8:00 00 FF FF 00 00 FF FF 7C
C9F0:00 00 FF FF 00 00 FF FF 84
C9F8:00 00 FF FF 00 4C 49 53 A3
CA00:54 0D 00 00 FF FF 00 00 03
CA08:FF FF 00 00 FF FF 00 00 9D
CA10:FF FF 00 00 FF FF 00 00 A5
CA18:FF FF 00 00 FF FF 00 00 AD
CA20:FF FF 00 00 FF FF 00 00 B5
CA28:FF FF 00 00 FF FF 00 00 BD
CA30:FF FF 00 00 FF FF 00 00 C5
CA38:FF FF 00 00 FF FF 00 00 CD
CA40:FF FF 00 00 FF FF 00 00 D5
CA48:FF FF 00 00 FF 50 CF 37 F5
CA50:36 38 2C 31 37 34 3A 50 F6
CA58:CF 37 36 39 2C 31 36 37 C7
CA60:3A 4F D0 31 2C 34 3A 43 FD
CA68:CD 31 3A 4C C9 3A 50 D2 E7
CA70:31 3A 43 4C CF 31 3A 50 62
CA78:CF 37 36 38 2C 31 33 39 D3
CA80:3A 50 CF 37 36 39 2C 32 D5
CA88:32 37 0D 00 FF FF 00 00 A6
CA90:FF FF 00 00 FF FF 00 00 26
CA98:FF FF 00 00 FF 58 3D 50 5A
CAA0:C5 28 35 33 32 38 30 29 F8
CAA8:3A 50 CF 35 33 32 38 30 BF
CAB0:2C 30 3A 50 CF 35 33 32 A0
CAB8:36 35 2C 31 31 3A 50 CF 32
CAC0:31 39 38 2C 30 3A 57 C1 E1
CAC8:31 39 38 2C 31 3A 50 CF F1
CAD0:31 39 38 2C 30 3A 50 CF F1
CAD8:35 33 32 38 30 2C 58 3A BC
CAE0:50 CF 35 33 32 36 35 2C 6D
CAE8:32 37 0D 00 FF 3F 43 48 D2
CAF0:52 24 28 31 34 37 29 3B DC
CAF8:3A 46 4F 52 54 3D 30 54 98
CB00:4F 32 35 35 3A 50 CF 32 AA
CB08:31 32 2C 31 3A 3F 43 48 FA
CB10:52 24 28 54 29 3B 3A 50 1F
CB18:CF 32 31 32 2C 30 3A 50 54
CB20:CF 32 31 31 2C 34 3A 3F 4B
CB28:54 3A 4E C5 0D 00 FF FF 07
CB30:00 00 FF FF 00 00 FF FF C7
CB38:00 00 FF FF 00 3F 43 48 9B
CB40:52 24 28 31 34 37 29 3B 2E
CB48:3A 46 CF 54 3D 30 54 4F 70
CB50:31 32 37 3A 58 3D 50 C5 B5
CB58:28 32 30 39 29 2B 32 35 B9
CB60:36 2A 50 C5 28 32 31 30 A0
CB68:29 3A 50 CF 58 2C 54 3A 80
CB70:50 CF 58 2B 35 34 32 37 F7
CB78:32 2C 31 34 3A 50 CF 32 82
CB80:31 31 2C 34 3A 3F 54 3A 77
CB88:4E C5 0D 00 00 4C 4F 41 6B
```


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```
CB90:44 20 22 24 22 2C 38 0D 18
CB98:4C 49 53 54 0D 00 FF FF C0
CBA0:00 00 FF FF 00 00 FF FF 38
CBA8:00 00 FF FF 00 00 FF FF 40
CBB0:00 00 FF FF 00 00 FF FF 48
CBB8:00 00 FF FF 00 00 FF FF 50
CBC0:00 00 FF FF 00 00 FF FF 58
CBC8:00 00 FF FF 00 00 FF FF 60
CBD0:00 00 FF FF 00 00 FF FF 68
CBD8:00 00 FF FF 00 50 CF 35 86
CBE0:38 2C 30 3A 20 20 20 20 2B
CBE8:20 20 20 20 20 20 20 20 80
CBF0:20 20 20 20 20 20 20 20 88
CBF8:20 20 20 20 20 20 20 20 90
CC00:20 4F D0 31 2C 38 2C 31 76
CC08:35 3A 49 CE 31 2C 41 24 C1
CC10:2C 42 24 3A 3F 3A 3F 41 1B
CC18:24 2C 42 24 3A 43 4C CF A0
CC20:31 0D 00 00 FF FF 00 00 95
CC28:FF FF 00 00 FF 4E 45 57 DC
CC30:0D 00 00 00 FF FF 00 00 50
CC38:FF FF 00 00 FF FF 00 00 D1
CC40:FF FF 00 00 FF FF 00 00 D9
CC48:FF FF 00 00 FF FF 00 00 E1
CC50:FF FF 00 00 FF FF 00 00 E9
CC58:FF FF 00 00 FF FF 00 00 F1
CC60:FF EF 00 00 FF FF 00 00 F9
CC68:FF FF 00 00 FF FF 00 00 02
CC70:FF FF 00 00 FF FF 00 00 0A
CC78:FF FF 00 00 FF 50 CF 32 25
CC80:30 35 30 2C 31 3A 53 59 BA
CC88:53 34 32 32 39 31 3A 50 95
CC90:CF 34 35 2C 50 C5 28 33 A5
CC98:34 29 3A 50 CF 34 36 2C CA
CCA0:50 C5 28 33 35 29 3A 43 12
CCA8:4C 52 0D 00 FF FF 00 00 9E
CCB0:FF FF 00 00 FF FF 00 00 4A
CCB8:FF FF 00 00 FF FF 00 00 52
CCC0:FF FF 00 00 FF FF 00 00 5A
CCC8:FF FF 00 00 FF 4C 4F 41 73
CCD0:44 20 22 2A 22 2C 38 0D BA
CCD8:00 FF 00 00 FF FF 00 00 72
CCE0:FF FF 00 00 FF FF 00 00 7A
CCE8:FF FF 00 00 FF FF 00 00 82
CCF0:FF FF 00 00 FF FF 00 00 8A
CCF8:FF FF 00 00 FF FF 00 00 92
CD00:00 00 FF FF 00 00 FF FF 9B
CD08:00 00 FF FF 00 00 FF FF A3
CD10:00 00 FF FF 00 00 FF FF AB
CD18:00 00 FF FF 00 43 4C 52 AB
CD20:3A 3F 3A 3F 22 50 52 4F 2A
CD28:47 52 41 4D 20 4C 45 4E 04
CD30:47 54 48 20 3D 22 33 36 9E
CD38:30 37 32 2D 28 46 52 45 17
CD40:28 30 29 2D 28 46 52 45 38
CD48:28 30 29 3C 30 29 2A 36 9D
CD50:35 35 33 36 29 0D 00 FF 1B
CD58:00 00 FF FF 00 00 FF FF F3
CD60:00 00 FF FF 00 00 FF FF FB
CD68:00 00 FF FF 00 4F 50 45 27
CD70:4E 31 35 2C 38 2C 31 35 F2
CD78:2C 22 49 30 22 3A 43 4C AB
CD80:4F 53 45 31 35 0D 00 FF 32
CD88:00 00 FF FF 00 00 FF FF 24
CD90:00 00 FF FF 00 00 FF FF 2C
CD98:00 00 FF FF 00 00 FF FF 34
CDA0:00 00 FF FF 00 00 FF FF 3C
CDA8:00 00 FF FF 00 00 FF FF 44
CDB0:00 00 FF FF 00 00 FF FF 4C
CDB8:00 00 FF FF 00 4F 50 45 77
CDC0:4E 31 35 2C 38 2C 31 35 43
CDC8:2C 22 56 30 22 3A 43 4C 9D
CDD0:4F 53 45 31 35 0D 00 FF 82
CDD8:00 00 FF FF 00 00 FF FF 74
CDE0:00 00 FF FF 00 00 FF FF 7C
CDE8:00 00 FF FF 00 00 FF FF 84
CDF0:00 00 FF FF 00 00 FF FF 8C
CDF8:00 00 FF FF 00 00 FF FF 94
CE00:FF FF 00 00 FF FF 00 00 9D
CE08:FF FF 00 00 FF 4F 50 45 C8
CE10:4E 31 35 2C 38 2C 31 35 94
CE18:2C 22 55 4A 22 3A 46 4F 79
CE20:52 54 3D 31 54 4F 31 32 2B
CE28:35 30 3A 4E 45 58 54 3A 07
CE30:43 4C 4F 53 45 31 35 0D 08
CE38:00 FF 00 00 FF FF 00 00 D5
CE40:FF FF 00 00 FF FF 00 00 DD
CE48:FF FF 00 00 FF FF 00 00 E5
CE50:FF FF 00 00 FF FF 00 00 ED
CE58:FF FF 00 00 FF 56 45 52 2C
CE60:49 46 59 20 22 2A 22 2C 8B
CE68:38 0D 00 00 FF FF 00 00 65
CE70:FF FF 00 00 FF FF 00 00 0E
CE78:FF FF 00 00 FF FF 00 00 16
CE80:FF FF 00 00 FF FF 00 00 1E
CE88:FF FF 00 00 FF FF 00 00 26
CE90:FF FF 00 00 FF FF 00 00 2E
CE98:FF FF 00 00 FF FF 00 00 36
CEA0:FF FF 00 00 FF FF 00 00 3E
CEA8:FF FF 00 00 FF FF 52 55 40
CEB0:4E 20 20 41 53 43 49 49 19
CEB8:4C 49 53 54 20 53 43 52 A5
CEC0:45 4E 48 41 52 44 20 44 D9
CEC8:49 52 20 20 42 4C 41 4E B9
CED0:4B 45 52 52 4F 52 4E 45 7A
CED8:57 20 20 55 4E 4E 45 57 11
CEE0:55 4E 44 45 4C 42 59 54 0C
CEE8:45 53 49 4E 49 54 20 56 3E
CEF0:41 4C 49 44 52 45 53 45 43
CEF8:54 56 45 52 46 59 00 00 BB
```

Richard Penn, the author of Xlogic (September 1992), lives in Montreal, Quebec, Canada. ❐

BAFFLES

By Michael Gresham

Baffles is a one-player game of strategy in which you must find ten diagonal mirrors, called baffles. These baffles are hidden randomly under a 10× 10 grid. This game for the 64 is both interesting and challenging.

Baffles is written entirely in BASIC. To help avoid typing errors, use The Automatic Proofreader to enter the program. See "Typing Aids" elsewhere in this section. Be sure to save a copy of the program before exiting Proofreader. Note that line 910 fills two complete screen lines. Your cursor will drop down to a third line after you enter it. Be sure to cursor back up to line 910 and then press Return. To avoid any problems when entering this line, you may want to use a question mark (?) as a shorthand symbol for the PRINT statement.

Using the Program

When the game begins, the 10 × 10 grid appears with 40 numbered lasers surrounding the perimeter, facing into the grid. You have three choices at this point: fire a laser, look for a baffle, or quit the game. Press F to fire one of the lasers, press L to guess the location of a baffle, or press Q if you decide that you want to end the game and reveal any hidden baffles.

Firing a Laser

Activate a laser by typing its number. Only a one- or two-digit number from 1–40 will be accepted. Use the Del key to make corrections. Press Return without typing in anything to cancel the option.

When a laser beam is fired, it travels unseen in a straight line until it hits a baffle or reaches one of the edges of the grid. If the beam hits a baffle, it is deflected 90 degrees and continues traveling until it hits any other baffle or leaves the grid. The new direction of a deflected beam is chosen by the position of the mirror. For example, if a beam is traveling down the grid and it hits a baffle that looks like the slash symbol (/), then the beam will be deflected to the left. If that beam were traveling up the grid toward the same baffle, the beam would be deflected to the right.

The laser that is activated is colored green. When the beam exits the grid, the laser that it strikes is colored red. By using the results of one or more laser beams as information, you should be able to determine the location of a baffle.

As another example, if a beam is fired down from laser 1 in the top left corner and there are no baffles, then the beam should exit at laser 30 on the opposite side of the playing grid. If it exits to the left at laser 35, for example, there could be a baffle at the intersection of those two lasers (column A, row E). Of course, the beam might have been deflected any number of times. If no baffle is found, try firing a second laser, such as laser 30 or laser 16. With practice, it becomes easier to read the laser results as a series of deflections and misses.

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Looking for Baffles

When you think that you know where a baffle is located, press L to look for a baffle. You will be asked to type in two letters, representing the column and row of your guess. The column letters (from A to J) are highlighted in red, and the row letters (also from A to J) are yellow. Each letter is accepted as soon as it is typed in. If you make a mistake, you can cancel the option by pressing Return before entering the row letter.

If your guess is correct, a baffle will be revealed as a yellow diagonal. An empty location is represented as a red asterisk. The game ends when all ten baffles are located.

Keeping Score

The score is kept just below the playing grid, although keeping score isn't necessary. For those people who want to see how good they are or how much they've improved, the object is to find all of the baffles while accumulating the lowest possible score. Each activated laser adds one point to the score, and each guess adds two points. No points are added if you guess a location that has already been revealed.

Theoretically, the lowest possible score is 20, but that would be difficult to achieve. To get a score that low, you'd have to find all ten baffles in exactly ten guesses. Someone who has practiced often (and is very lucky) may receive a score of 30 to 40. An average score would probably be from 40 to 60 points.

Helpful Hints

Although it happens very rarely, it is possible that some baffles may appear hidden, even when hit by lasers. This situation can cause your score to increase dramatically while you're attempting to find the last baffles. While I don't know how many different ways there are to hide baffles, I can offer a few hints. The starting and ending points of a laser beam can be interchanged. This means that if the beam from laser 1 exits at laser 4, then a beam from laser 4 must exit at laser 1. There are actually only 20 laser combinations in any game. By writing down these results (in the form 1 : 4 or 1–4), you can avoid finding the same laser beam path twice and keep your score low.

Even though the path of a laser may seem obvious after one or more baffles have been revealed, the laser beam could have been deflected by even more baffles. Usually, these baffles will reveal themselves after other lasers have been used.

A helpful side effect of writing this program in BASIC is that the laser beam travels considerably slower than the speed of light. If the path of a laser beam is very long because of deflections, the beam will take some time to reach the second laser. Watch for baffles in the path of these lasers.

If all else fails, a good rule is to assume that the missing baffles are on the same column or row as one of the other baffles. Use these locations one at a time as guesses until the baffles are found. This method should not be used unless all possible laser combinations have been fired, since it will increase your score even faster.

BAFFLES

```
PK 5 REM COPYRIGHT 1993 - COMP
     UTE PUBLICATIONS INTL LTD
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CE 10 POKE 53281,0:POKE 53280,
     0
QJ 20 GOSUB 1330
HP 30 PRINT"{CLR}";:FOR I=1 TO
      10:FOR J=1 TO 10:B(I,J)
     =0:NEXT J,I
CH 40 R=RND(-TI):FOR BA=1 TO 1
     0:B=2:IF RND(1)<.5 THEN
     {SPACE}B=3
RH 50 I=INT(RND(1)*10)+1:J=INT
     (RND(1)*10)+1:IF B(I,J)<
     >0 THEN 50
AM 60 B(I,J)=B:NEXT BA
DB 70 GOSUB 1110:BA=0:SC=0
XE 80 CY=21:CX=15:GOSUB 240:PR
     INT "{WHT}SCORE: 0"
AQ 90 CY=22:CX=0:GOSUB 240
FF 100 PRINT "{GRN}"TAB(10)"
     {RVS}F{OFF} - FIRE LASE
     R":PRINT TAB(10)"{RVS}L
     {OFF} - LOOK FOR BAFFLE
     "
DJ 110 PRINT TAB(10)"{RVS}Q
     {OFF} - QUIT GAME";
XD 120 POKE 198,0:WAIT 198,1:G
     ET A$
DJ 130 GS=-(A$="F")-2*(A$="L")
     -3*(A$="Q"):ON GS GOSUB
      280,820,1380
HE 140 GOSUB 1070:IF GS=3 THEN
      CY=23:CX=0:GOSUB 240:G
     OTO 170
SD 150 IF BA<10 THEN GOTO 90
GX 160 CY=22:CX=4:GOSUB240:PRI
     NT "{YEL}YOU'VE FOUND A
     LL OF THE BAFFLES!"
FG 170 PRINTTAB(12)"{WHT}PLAY
     {SPACE}AGAIN? [{GRN}Y/N
     {WHT}]":POKE 198,0
CK 180 WAIT 198,1:GET A$:IF A$
     ="Y" THEN 30
EA 190 IF A$<>"N" THEN 180
JA 200 POKE SD+24,0:END
DG 210 REM
EJ 220 REM ***** POSITION CURS
     OR *****
PH 230 REM
RK 240 POKE 781,CY:POKE 782,CX
     :POKE 783,0:SYS65520:RE
     TURN
DK 250 REM
KK 260 REM ***** FIRE LASER **
     ***
PM 270 REM
EE 280 GOSUB1070:CY=22:CX=12:G
     OSUB240:PRINT"LASER TO
     {SPACE}FIRE: ";
QD 290 L$="":C=0
MC 300 PRINT "{RVS} {OFF}
     {LEFT}";
RQ 310 POKE198,0:WAIT 198,1:GE
     T A$:IF A$=CHR$(13) THE
     N PRINT " ":GOTO 350
CM 320 IF A$=CHR$(20) AND C>0
     {SPACE}THEN PRINT A$;:C
     =C-1:L$=LEFT$(L$,C):GOT
     O 310
KX 330 IF A$<"0" OR A$>"9" OR
     {SPACE}C=2 THEN 310
FB 340 PRINT A$;:L$=L$+A$:C=C+
     1:GOTO 300
BS 350 IF L$="" THEN RETURN
RS 360 L=VAL(L$):IF L<1 OR L>4
     0 THEN 280
XR 370 SC=SC+1:IF (L>10 AND L<
     21) OR L>30 THEN 410
MK 380 AA=L-1:IF L>20 THEN AA=
     30-L
QM 390 XL=15+AA:YL=3:IF L>20 T
     HEN YL=16
QP 400 P=55296+XL+40*YL:FOR I=
     0 TO 80 STEP40:POKE P+I
     ,5:NEXT:GOTO 440
SD 410 AA=L-11:IF L>20 THEN AA
     =40-L
MR 420 YL=6+AA:XL=25:IF L>20 T
     HEN XL=12
BE 430 P=55296+XL+40*YL:FOR I=
     0 TO 2:POKE P+I,5:NEXT
HK 440 DY=(L<31 AND L>20)-(L<1
     1)
FE 450 DX=(L<21 AND L>10)-(L>3
     0)
EM 460 X=1:Y=41-L:IF L<31 THEN
      X=31-L:Y=10
CM 470 IF L<21 THEN X=10:Y=L-1
     0
GF 480 IF L<11 THEN X=L:Y=1
```


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```
RP 490 FR=2000+L*100:POKE SD+4
       ,65
CF 500 FQ=FR+PEEK(SD+27)/2:HF=
       INT(FQ/256):LF=FQAND255
       :POKE SD,LF:POKE SD+1,H
       F
JS 510 B=ABS(B(Y,X)):IF B<2 TH
       EN 550
QS 520 IF DX=0 THEN 540
RJ 530 DY=1+2*((DX=1 AND B=3)
       {SPACE}OR (DX=-1 AND B=
       2)):DX=0:GOTO 550
RQ 540 DX=1+2*((DY=1 AND B=3)
       {SPACE}OR (DY=-1 AND B=
       2)):DY=0
DM 550 X=X+DX:Y=Y+DY:IF X<11 A
       ND X>0 AND Y<11 AND Y>0
        THEN 500
GD 560 POKE SD+4,64:IF Y=0 THE
       N E=X
CH 570 IF X=11 THEN E=Y+10
KD 580 IF Y=11 THEN E=31-X
MX 590 IF X=0 THEN E=41-Y
MX 600 IF (E>10 AND E<21) OR E
       >30 THEN 640
EA 610 AA=E-1:IF E>20 THEN AA=
       30-E
QM 620 XE=15+AA:YE=3:IF E>20 T
       HEN YE=16
KR 630 P=55296+XE+40*YE:FOR I=
       0 TO 80 STEP40:POKE P+I
       ,2:NEXT:GOTO 670
CK 640 AA=E-11:IF E>20 THEN AA
       =40-E
QS 650 YE=6+AA:XE=25:IF E>20 T
       HEN XE=12
KR 660 P=55296+XE+40*YE:FOR I=
       0 TO 2:POKE P+I,2:NEXT
HP 670 FR=2000+E*100:HF=INT(FR
       /256):LF=FRAND255:POKES
       D,LF:POKESD+1,HF
EF 680 POKE SD+4,65:FOR T=1 TO
        200:NEXT:POKE SD+4,64
XB 690 PRINT TAB(11)"{RED}EXIT
        AT LASER #";E
HP 700 CY=21:CX=21:GOSUB240:PR
       INT"{WHT}"SC"{2 DOWN}"
XA 710 PRINT TAB(8)"{BLU}PRESS
        {RVS}SPACE{OFF} TO CON
       TINUE";
PR 720 POKE 198,0:WAIT 198,1:G
       ET A$:IF A$<>" " THEN 7
       20
MK 730 C=6-8*((L/2)=INT(L/2)):
       P=55296+XL+40*YL:IF YL>
       3 AND YL<16 THEN 750
EA 740 FOR I=0 TO 80 STEP 40:P
       OKE P+I,C:NEXT:GOTO 760
RB 750 FOR I=0 TO 2:POKE P+I,C
       :NEXT
AF 760 C=6-8*((E/2)=INT(E/2)):
       P=55296+XE+40*YE:IF YE>
       3 AND YE<16 THEN 780
SP 770 FOR I=0 TO 80 STEP 40:P
       OKE P+I,C:NEXT:RETURN
BM 780 FOR I=0 TO 2:POKE P+I,C
       :NEXT:RETURN
GP 790 REM
KE 800 REM ***** LOOK FOR A BA
       FFLE *****
PQ 810 REM
AS 820 GOSUB1070:CY=22:CX=10:G
       OSUB240:PRINT "{RED}BAF
       FLE X LOCATION: ";
DC 830 POKE 198,0:WAIT198,1:GE
       T A$:IF A$=CHR$(13) THE
       N RETURN
BC 840 IF A$<"A" OR A$>"J" THE
       N 830
SR 850 X=ASC(A$)-64:PRINT A$
BS 860 PRINTTAB(10)"{YEL}BAFFL
       E Y LOCATION: ";
DB 870 POKE198,0:WAIT 198,1:GE
       T A$:IF A$=CHR$(13) THE
       N RETURN
QF 880 IF A$<"A" OR A$>"J" THE
       N 870
JA 890 Y=75-ASC(A$):PRINT A$
GG 900 B=B(Y,X):IF B>=0 THEN 9
       20
EJ 910 PRINT" {WHT}{RVS}THAT L
       OCATION HAS ALREADY BEE
       N CALLED{OFF}";:POKE198
       ,0:WAIT198,1:RETURN
PE 920 SC=SC+2:CY=21:CX=21:GOS
       UB240:PRINT"{WHT}"SC"
       {2 DOWN}"
GG 930 IF B>0 THEN 990
CQ 940 PRINT TAB(10)"{RED}
       {RVS}THAT IS NOT A BAFF
       LE{OFF}";:B(Y,X)=-1
EQ 950 CY=Y+5:CX=X+14:GOSUB240
       :PRINT"{RED}{OFF}*";
FQ 960 FR=1000:FORBZ=0 TO 10:F
       R=2500-FR:HF=INT(FR/256
       ):LF=FRAND255
MF 970 POKE SD,LF:POKE SD+1,HF
       :POKESD+4,65:FOR T=1 TO
        5:NEXT:POKE SD+4,64:NE
       XT BZ
FM 980 POKE198,0:WAIT198,1:RET
       URN
CM 990 PRINT TAB(8)"{YEL}{RVS}
       YOU HAVE FOUND A BAFFLE
       !{OFF}";:B(Y,X)=-B:BA=B
       A+1
BQ 1000 CY=Y+5:CX=X+14:GOSUB24
        0:A$="M":IF B=3 THEN A
        $="N"
SQ 1010 PRINT"{YEL}"A$;:FR=100
        00:FOR BL=0 TO 10:FR=2
        1000-FR:HF=INT(FR/256)
        :LF=FRAND255
GD 1020 POKESD,LF:POKESD+1,HF:
        POKESD+4,65:FORT=1 TO
        {SPACE}20:NEXT:POKESD+
        4,64:NEXT BL
FB 1030 POKE198,0:WAIT198,1:RE
        TURN
PF 1040 REM
CX 1050 REM ***** CLEAR SCREEN
         BOTTOM *****
BG 1060 REM
QG 1070 CX=0:FOR CY=22TO24:GOS
        UB240:SYS59903:NEXT CY
        :RETURN
XJ 1080 REM
JE 1090 REM ***** DRAW GAME SC
        REEN *****
KJ 1100 REM
FS 1110 PRINT TAB(16)"{YEL}BAF
        FLES{DOWN}"
PJ 1120 PRINTTAB(15)"{RED}ABCD
        EFGHIJ"
HS 1130 PRINT TAB(12)"{7}{RVS}
        £{BLU}{2 SPACES}0{7}0
        {BLU}0{7}0{BLU}0{7}0
        {BLU}0{7}0{BLU}0{7}1
        {2 SPACES}{*}"
XC 1140 PRINT TAB(12)"{7}{RVS}
        {2 SPACES}{BLU} 1{7}2
        {BLU}3{7}4{BLU}5{7}6
        {BLU}7{7}8{BLU}9{7}0
        {2 SPACES}{BLU} "
PP 1150 PRINT TAB(12)"{7}{RVS}
        {2 SPACES}{OFF}£{BLU}
        -{7}-{BLU}-{7}-{BLU}-
        {7}-{BLU}-{7}-{BLU}-
        {7}-{*}{RVS}{BLU}
        {2 SPACES}"
MX 1160 PRINT TAB(11)"{YEL}J
        {7}{RVS}40{OFF}*++++++
        ++++{BLU}*{RVS}11{YEL}
        {OFF}J"
QS 1170 PRINT TAB(11)"{YEL}I
        {BLU}{RVS}39{OFF}*{7}+
        +++++++++*{RVS}12{YEL}
        {OFF}I"
PG 1180 PRINT TAB(11)"{YEL}H
        {7}{RVS}38{OFF}*++++++
        ++++{BLU}*{RVS}13{YEL}
        {OFF}H"
QM 1190 PRINT TAB(11)"{YEL}G
        {BLU}{RVS}37{OFF}*{7}+
        +++++++++*{RVS}14{YEL}
        {OFF}G"
HD 1200 PRINT TAB(11)"{YEL}F
        {7}{RVS}36{OFF}*++++++
        ++++{BLU}*{RVS}15{YEL}
        {OFF}F"
AE 1210 PRINT TAB(11)"{YEL}E
        {BLU}{RVS}35{OFF}*{7}+
        +++++++++*{RVS}16{YEL}
        {OFF}E"
GX 1220 PRINT TAB(11)"{YEL}D
        {7}{RVS}34{OFF}*++++++
        ++++{BLU}*{RVS}17{YEL}
        {OFF}D"
AA 1230 PRINT TAB(11)"{YEL}C
        {BLU}{RVS}33{OFF}*{7}+
        +++++++++*{RVS}18{YEL}
        {OFF}C"
GP 1240 PRINT TAB(11)"{YEL}B
        {7}{RVS}32{OFF}*++++++
        ++++{BLU}*{RVS}19{YEL}
        {OFF}B"
KG 1250 PRINT TAB(11)"{YEL}A
        {BLU}{RVS}31{OFF}*{7}+
        +++++++++*{RVS}20{YEL}
        {OFF}A"
BH 1260 PRINT TAB(12)"{BLU}
```


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```
        {RVS}{2 SPACES}{7}{*}
        {OFF}-{BLU}-{7}-{BLU}-
        {7}-{BLU}-{7}-{BLU}-
        {7}-{BLU}-{7}{RVS}£
        {2 SPACES}"
SA 1270 PRINT TAB(12)"{BLU}
        {RVS} {7}{2 SPACES}3
        {BLU}2{7}2{BLU}2{7}2
        {BLU}2{7}2{BLU}2{7}2
        {BLU}2 {7}{2 SPACES}"
HX 1280 PRINT TAB(12)"{7}{*}
        {RVS}{2 SPACES}0{BLU}9
        {7}8{BLU}7{7}6{BLU}5
        {7}4{BLU}3{7}2{BLU}1
        {2 SPACES}{7}{OFF}£"
RX 1290 PRINTTAB(15)"{RED}ABCD
        EFGHIJ":RETURN
CE 1300 REM
JA 1310 REM ***** SOUND SETUP
        {SPACE}*****
EG 1320 REM
XR 1330 SD=54272:FOR L=0TO24:P
        OKESD+L,0:NEXT:POKESD+
        3,8:POKESD+5,41:POKESD
        +6,89
FF 1340 POKE SD+14,117:POKE SD
        +18,16:POKE SD+24,143:
        RETURN
DJ 1350 REM
XM 1360 REM ***** REVEAL BAFFL
        ES *****
FM 1370 REM
SX 1380 CY=6:CX=15:GOSUB240:PR
        INT"{YEL}";
CH 1390 FOR I=1 TO 10:PRINT TA
        B(15);
HR 1400 FOR J=1 TO 10:B=B(I,J)
        :IF B<=0 THEN PRINT "
        {RIGHT}";:GOTO 1430
DP 1410 IF B=2 THEN PRINT "M";
        :GOTO 1430
RP 1420 IF B=3 THEN PRINT "N";
QC 1430 NEXT J:PRINT:NEXT I:RE
        TURN
```

Michael Gresham, 21, has been programming the 64 in BASIC and machine language for eight years but says he still has a lot to learn. He lives in Dunnsville, Virginia.

LARGE NUMBER CALCULATOR

By Bruce M. Bowden

Calculate exact solutions for large factorial and power problems to as many as 5964 digits with this remarkable large number calculator for the 64. You can also send the results to your printer.

When a number is multiplied by itself N times, it's said to be raised to the power of N–1. For example, 2 raised to the power of 3 is 2 multiplied by 2 multiplied by 2. Note that the base (2 in this case) is written N times but actually multiplied by itself N–1 times.

The factorial of any positive integer number, X, is that number multiplied by 1 less than itself, multiplied by 2 less than itself, and so on down until multiplied by 1. Here's an algebraic way of writing this formula.

X! = X(X–1)(X–2)(X–3) . . . (4)(3)(2)(1)

An exclamation mark is used to indicate that a factorial operation is taking place. As a practical illustration, one may write out 5! (read 5-factorial) as 5 times 4 times 3 times 2 times 1, or 120.

A special case is 0!, which is assigned a value of 1. Factorials are also defined, in higher mathematics, for fractional, negative, and complex numbers, but with this program we're sticking to the more common case of positive integers.

Large Number Calculator will give you exact solutions to power and factorial problems, separately or combined, to as many as 5984 digits. After the solution is found, various options are available for displaying, printing, or chain multiplying it to arrive at new solutions.

Typing It In

Large Number Calculator is written entirely in BASIC. To help avoid typing errors, enter it with The Automatic Proofreader. See "Typing Aids" elsewhere in this section. When you've finished, save the program before running it.

Getting Started

Run Large Number Calculator and then press any key for a quick program description. Press another key, and you'll have two options to solve for X to the power of Y or solve for X-factorial. X and Y are integer values which you provide the program.

As a demonstration, press f1. You're prompted for the number which is to be raised to a power. Let's say that we want to know what 17 to the 21st power is. Enter *17* and press Return. Now you're prompted for the power. Enter *21* and press Return. You're advised that the solution has 26 digits. In a moment, the solution will appear in blocks of six digits which are read from left to right and from the top down. There are often leading 0s, and these can be ignored. You should see the following.

000000 000069 091933 913008
732880 827217

Now press any key to get to the options screen. The following options are available:

f1 ** Review the solution
f3 ** Multiply the result by a number
f5 ** Multiply the result by a factorial
f7 ** Multiply by an exponential
f2 ** Start over
f4 ** Send solution to printer
f6 ** End

To continue our demonstration, press f2 (Shift-f1) to start over. Now we're back to the original two options. Let's calculate 93! (93-factorial). Press f3. Now enter *93* at the prompt. You're advised that 93! has 145 digits. After about one and a half minutes, the following solution is displayed.

000001 156772 507081 641574
759205 162306 240436 214753
229576 413535 186142 281213
246807 121467 315215 203289
516844 845303 838996 289387
078090 752000 000000 000000
000000

Press any key for the option screen. Suppose you want to multiply this solution by 17 to the 21st power. To do so, press f7. Again, enter *17* and *21* at the prompts as you did the first time. After less than half a minute, the new solution is shown:

000000 000079 923649 611670
206135 264796 971537 140352
563408 351224 973345 747405
439544 378291 335514 104653
718355 692345 124600 883020
375497 054614 028846 092611
076902 757597 184000 000000
000000 000000

This number is 170 digits long. Press any key to return to the option screen.

Now, try multiplying the result by 201-factorial. Press f5, then enter *201* at the prompt. There will be a wait of about 16½ minutes before the new so-

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lution is arrived at and displayed. I won't list them all here, but the answer contains 548 digits. Since it fills more than one screen, you'll see the message *NOT FINISHED YET* below the number. At this message press any key to see a continuation of the digits.

To quit the program cleanly, merely press the f6 (Shift-f5) key.

LARGE NUMBER CALCULATOR

```
MS 10 REM COPYRIGHT 1993 - COM
      PUTE PUBLICATIONS INTL L
      TD - ALL RIGHTS RESERVED
SP 20 PRINT"{CLR}{3 DOWN}{N}":
      POKE 53280,6:POKE 53281,
      6
FG 30 PRINT"{YEL}":MS$="LARGE
      {SPACE}NUMBER CALCULATOR
      ":GOSUB 5000
SD 40 PRINT"{CYN}":MS$="BY BRU
      CE M. BOWDEN":GOSUB5000:
      PRINT"{2 DOWN}{WHT}"
KQ 50 MS$="COPYRIGHT, 1993":GO
      SUB5000:MS$="COMPUTE PUB
      LICATIONS INTL LTD":GOSU
      B5000
JP 60 MS$="ALL RIGHTS RESERVED
      ":GOSUB 5000:GOSUB6000
EG 110 PRINT"{CLR}{4 DOWN}
       {WHT} THIS PROGRAM WILL
       GIVE EXACT SOLUTIONS"
HB 120 PRINT"{2 SPACES}FOR POW
       ER (X↑Y) AND FACTORIAL
       {SPACE}(X!)"
XX 130 PRINTTAB(14)"PROBLEMS."
       :PRINT"{2 DOWN}
       {2 SPACES}IF THE PROBLE
       M IS OF THE FORM X↑Y, X
       "
PE 140 PRINT"{4 SPACES}AND Y M
       UST BE POSITIVE INTEGER
       S,"
DF 150 PRINT"{5 SPACES}AS MUST
        X WHEN CALCULATING X!"
       :PRINTTAB(13)"(X-FACTOR
       IAL).{2 DOWN}"
CX 160 PRINTTAB(5)"YOUR SOLUTI
       ONS ARE LIMITED TO":PRI
       NTTAB(14)"5964 DIGITS."
KX 170 GOSUB 6000
BM 180 PRINT"{CLR}{6 DOWN}":MS
       $="CHOOSE A SUITABLE FU
       NCTION:":GOSUB5000
KC 190 DIMM(1000):M(1000)=1:M(
       4)=1000
QB 200 DEFFNL(X)=LOG(X)/LOG(10
       )
EG 210 PRINT"{3 DOWN}":PRINT"F
       1 ** SOLVING FOR X TO T
       HE POWER OF Y{2 DOWN}"
RA 220 PRINT"F3 ** SOLVING FOR
        X FACTORIAL"
CC 230 GETA$:IFA$=""OR(A$<>"
       {F1}"ANDA$<>"{F3}")THEN
       230
RG 240 PRINT"{CLR}{2 DOWN}":ON
       ASC(A$)-132GOTO250,720
CD 250 PRINT"ENTER THE NUMBER
       {SPACE}WHICH IS BEING R
       AISED{2 SPACES}TO A POW
       ER:{2 DOWN}"
HE 260 PRINTTAB(10);:INPUTX
EG 270 IFX>=0THEN300
BP 280 PRINTX;"IS A NUMBER LES
       S THAN ZERO,":PRINT"WHI
       CH IS NOT ALLOWED. TRY
       {SPACE}AGAIN."
MH 290 GOTO260
QH 300 IFLEN(STR$(INT(X)))>4TH
       ENPRINT"{DOWN}
       {4 SPACES}TOO MANY DIGI
       TS! TRY AGAIN.{DOWN}":G
       OTO260
AA 310 GOSUB320:GOTO330
FQ 320 M(2)=INT(X):RETURN
QR 330 PRINTTAB(8)"{2 DOWN}NOW
        ENTER THE POWER:
       {2 DOWN}"
DC 340 PRINTTAB(10);:INPUT Y
CD 350 IFY>=0THEN380
JC 360 PRINTY;"IS A NUMBER LES
       S THAN ZERO, WHICH IS N
       OT ALLOWED. TRY AGAIN."
KP 370 GOTO340
RK 380 IFX<>0THEN400
HJ 390 PRINT"{2 DOWN}
       {4 SPACES}ZERO TO ANY P
       OWER IS STILL ZERO":GOS
       UB 6000:GOTO840
MQ 400 IFY<>0THEN420
FC 410 PRINT"{2 DOWN} ANYTHING
        TO THE POWER OF ZERO I
       S ONE.":GOSUB 6000:GOTO
       840
XM 420 IFLEN(STR$(INT(Y)))>7TH
       ENPRINT"TOO MANY DIGITS
       ! TRY AGAIN.":GOTO340
FA 430 M(3)=Y:A=5964:IFF0=1THE
       N670
DC 440 B=INT(FNL(M(2))*M(3)+1)
ME 450 IFQ$<>""THEN470
PH 460 Q$=STR$(X)+" TO THE POW
       ER OF"+STR$(Y):PRINT"
       {2 DOWN}";Q$;" HAS";B;"
       DIGITS."
HJ 470 IFB>ATHEN730
RK 480 PRINTTAB(7)"{2 DOWN}STA
       NDBY FOR COMPUTATION...
       "
JP 490 M(0)=INT(FNL(999)/FNL(M
       (2))):M(5)=M(2):M(2)=IN
       T(M(2)↑M(0)+.5)
MB 500 M(1)=M(3)/M(0):M(3)=INT
       (M(1))
AS 510 M(5)=INT(M(5)↑(INT((M(1
       )-INT(M(1)))*M(0)+.5))+
       .5):IFM(3)=0THEN620
BA 520 M(1)=0
XG 530 M(0)=(M(2)*M(M(4))+M(1)
       )/INT(1E6+.5):M(1)=INT(
       M(0))
HE 540 M(M(4))=INT(INT(1E6+.5)
       *(M(0)-INT(M(0)))+.5)
AG 550 M(4)=M(4)-1:IFM(M(4))<>
       0THEN530
GX 560 M(4)=M(4)+1:IFM(M(4))<>
       0THEN580
FG 570 M(4)=M(4)-1:GOTO530
GB 580 M(4)=M(4)-1:IFF0=0THEN6
       00
SX 590 M(2)=M(2)+1
SJ 600 M(M(4))=M(1):M(3)=M(3)-
       1:IFM(3)=0THEN620
RA 610 M(4)=1000:M(1)=0:GOTO53
       0
SA 620 M(0)=M(4):IFF1=1THEN750
DK 630 F1=1:A=M(5):GOTO660
FE 640 PRINTTAB(10);:INPUTY:Y=
       INT(ABS(Y)):X=1:GOSUB32
       0:F0=1:F1=1:GOTO420
EJ 650 M(4)=M(0):GOTO750
CK 660 M(2)=A:M(3)=1:B=INT(A/F
       NL(M(2)+.1)):GOTO610
EG 670 B=INT(FNL(M(3))*M(3)-FN
       L(EXP(1))*M(3)+FNL(2*↑*
       M(3))/2)+1
AC 680 IFQ$<>""THEN700
AM 690 Q$=STR$(M(3))+" FACTORI
       AL":PRINT"{2 DOWN}";Q$;
       " HAS";B;"DIGITS."
DF 700 IFB>ATHEN730
DG 710 PRINTTAB(7)"{2 DOWN}STA
       NDBY FOR COMPUTATION...
       ":GOTO530
QM 720 C=2:PRINT"ENTER THE NUM
       BER FOR WHICH YOU NEED
       {SPACE}A{3 SPACES}FACTO
       RIAL:{4 DOWN}":GOTO640
SR 730 PRINT"{2 DOWN}
       {4 SPACES}SORRY, THIS R
       ESULT IS TOO LARGE!"
FP 740 PRINT"{2 DOWN}YOU ARE O
       NLY ALLOWED 5964 DIGITS
        TOTAL.":GOSUB 6000:GOT
       O840
XJ 750 PRINT"{CLR}{2 DOWN}";Q$
       ;" IS EQUAL TO:"
BD 760 PRINT"{2 DOWN}":X=1
AA 770 N$=MID$(STR$(M(M(4))),2
       ,LEN(STR$(M(M(4))))):IF
       M(M(4))=0THENN$=""
AF 780 M(4)=M(4)+1:IFLEN(N$)=6
       THENPRINTN$,:X=X+1:GOTO
       800
AQ 790 FORZ=1TO6-LEN(N$):PRINT
       "0";:NEXT:PRINTN$,:X=X+
       1
FB 800 IFM(4)=1001THEN830
MX 810 IFX<>41THEN770
DE 820 PRINT:PRINTTAB(10)"
       {2 DOWN}(NOT FINISHED Y
       ET)":GOSUB 6000
DE 825 PRINT"{CLR}{DOWN}":MS$=
       "CONTINUING...":GOSUB50
       00:GOTO760
AE 830 PRINT:PRINT"{DOWN}":MS$
       ="--- END OF SOLUTION -
       --":GOSUB 5000:GOSUB600
```


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```
        Ø
CQ 840 PRINT"{CLR}{4 DOWN}":MS
       $="CHOOSE A SUITABLE FU
       NCTION KEY:":GOSUB5000
QP 850 PRINT"{2 DOWN}F1 ** REV
       IEW THE SOLUTION"
CX 860 PRINT"{DOWN}F3 ** MULTI
       PLY THE RESULT BY A NUM
       BER"
BJ 870 PRINT"{DOWN}F5 ** MULTI
       PLY THE RESULT BY A FAC
       TORIAL"
JD 880 PRINT"F7 ** MULTIPLY BY
        AN EXPONENTIAL"
FE 890 PRINT"{DOWN}F2 ** START
        OVER":PRINT"{DOWN}F4 *
       * SEND SOLUTION TO PRIN
       TER"
ED 900 PRINT"{DOWN}F6 ** END"
SE 910 M(4)=1000:GETA$:IFA$=""
       THEN910
KR 920 T=ASC(A$)-132:IFT<1ORT>
       7THEN910
CX 930 PRINT"{CLR}{2 DOWN}":ON
        T GOTO 650,940,940,940
       ,980,990,950
DC 940 Q$="THE FINAL SOLUTION"
       :ON T-1 GOTO 970,720,96
       Ø
JS 950 STOP
EQ 960 FØ=0:F1=0:GOTO250
AK 970 INPUT"WHAT IS THE NUMBE
       R";A:GOTO660
HK 980 RUN 180
PM 990 PRINT"{CLR}{2 DOWN}
       {RVS} OUTPUTTING THE SO
       LUTION TO A PRINTER
       {3 SPACES}{OFF}"
JG 1000 PRINT"{2 DOWN}BE SURE
        {SPACE}THAT THE PRINTE
        R IS SWITCHED ON AND I
        S DEVICE NUMBER 4."
MG 1010 GOSUB 6000:M(4)=M(Ø)
MX 1020 OPEN3,4,7:PRINT#3,CHR$
        (14)Q$;" IS EQUAL TO:"
        CHR$(15):PRINT#3:PRINT
        #3:X=1
RS 1030 N$=MID$(STR$(M(M(4))),
        2,LEN(STR$(M(M(4))))):
        IFM(M(4))=ØTHENN$=""
QP 1040 M(4)=M(4)+1:IFLEN(N$)=
        6THENPRINT#3,N$,:X=X+1
        :GOTO1060
HC 1050 FORZ=1TO6-LEN(N$):PRIN
        T#3,"Ø";:NEXT:PRINT#3,
        N$,:X=X+1
KB 1060 IFM(4)=1001THEN1080
KD 1070 GOTO1030
PA 1080 PRINT#3:PRINT#3:PRINT#
        3,"{6 SPACES}--- END O
        F SOLUTION ---"
EF 1090 FORT=1TO5:PRINT#3:NEXT
        :CLOSE3:GOTO840
GB 5000 REM MESSAGE CENTERING
        {SPACE}ROUTINE
KQ 5010 FOR MX=1 TO 20-LEN(MS$
        )/2:PRINTCHR$(32);:NEX
        T:PRINTMS$:RETURN
HP 6000 PRINT"{HOME}{21 DOWN}
        {YEL}"
ER 6010 MS$="PRESS ANY KEY TO
        {SPACE}CONTINUE":GOSUB
         5000
BD 6020 GET A$:IF A$="" THEN 6
        020
CC 6030 PRINT"{WHT}":RETURN
```

Bruce M. Bowden, a programmer at COMPUTE, claims he wrote Large Number Calculator to help him manage his personal finances.

FILE INDEX 128

By Donald Klich

Have you ever tried to locate a file or program but couldn't remember which disk it was on? Have you ever wanted to modify a program and its backups but couldn't remember how many copies you had on how many disks? File Index 128 can help you.

File Index 128 is a utility for the 128 that lets you print an alphabetically arranged report of the files and programs on one or more disks. This report can be placed in a binder to help you organize your disk collection and keep track of files and programs.

File Index 128 is written entirely in BASIC 7.0. To help avoid typing errors, enter the program with The Automatic Proofreader. See "Typing Aids" elsewhere in this section. Be sure to save a copy of the program before you exit Proofreader.

A Master List

When you run File Index 128 and prepare to print a directory, you have the option of including sequential files, programs, user files, and relative files. Just press Y or N at the individual prompts. You then have the option of including a conventional directory listing that lists block size and file type. You are then prompted to insert a disk and press any key to start the sorting process. Make sure that your printer is on.

File Index 128 lets you sort numerous disks in order to prepare a master listing of your files and programs. After the first disk has been processed, you then have the option of entering another disk. File Index 128 can handle up to 2000 files. (If you wish to enlarge this capability, simply change the DIM statements in line 30.)

When you've entered all the disks that you wish to list, make sure your printer is set at the top of the form. If you requested conventional directories, these will print first, beginning with disk name and ID. Then, File Index 128 will print a master list in alphabetical order, with the file type, disk name, and ID following each filename.

In the future, whenever you want to find a certain program, simply check the master list. If you have copies of the program on several disks, they will be grouped together followed by the names of each disk for easy location.

FILE INDEX 128

```
MS 10 REM COPYRIGHT 1993 - COM
      PUTE PUBLICATIONS INTL L
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GP 20 REM PROGRAM TO READ DIRE
      CTORIES AND PRINT THEM A
      LPHABETICALLY.
DM 30 DIM A$(2000),B$(2000),C$
      (2000),D$(2000):COLOR4,1
      :COLOR0,1:COLOR5,4:GRAPH
      IC0,1
HF 40 PRINT"{5 DOWN}DO YOU WIS
      H TO INCLUDE:":PRINTSPC(
      10);"{YEL}SEQ{CYN}ENTIAL
       FILES? Y/N":GOSUB370:IF
      Y$="Y"THENSS=1:ELSEIFY$<
      >"N"THEN40
CJ 50 PRINTSPC(10);"{YEL}PR
      {CYN}O{YEL}G{CYN}RAM FIL
      ES? Y/N":GOSUB370:IFY$="
      Y"THENPP=1:ELSEIFY$<>"N"
      THEN50
EP 60 PRINTSPC(10);"{YEL}US
      {CYN}E{YEL}R{CYN} FILES?
       Y/N":GOSUB370:IFY$="Y"T
      HENUU=1:ELSEIFY$<>"N"THE
      N60
FR 70 PRINTSPC(10);"{YEL}REL
      {CYN}ATIVE FILES? Y/N":G
      OSUB370:IFY$="Y"THENRR=1
      :ELSEIFY$<>"N"THEN70
HX 80 V=3:PRINT"{DOWN}PRINT TH
      E DIRECTORIES? Y/N":GOSU
      B370:IFY$="Y"THENV=4:ELS
      EIFY$<>"N"THEN80
KE 90 Q=1:OPEN15,8,15:OPEN4,V
QQ 100 T=18:S=0:PRINT"{DOWN}IN
       SERT AN INPUT DISK, THE
       N ANY KEY":GOSUB370
GS 110 OPEN5,8,5,"#":PRINT#15,
       "U1";5;0;T;S
PQ 120 FORI=1TO144:GOSUB380:NE
       XTI
DM 130 M$="":FORI=1TO16:GOSUB3
       80:IFASC(Y$)=160THENNEX
       TI:GOTO150
QM 140 M$=M$+Y$:NEXTI
FG 150 GOSUB380:GOSUB380:N$=""
```


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```
        :FORI=0TO1:GOSUB380:N$=
        N$+Y$:NEXTI:S=1:PRINT#4
        :PRINT#4:PRINT#4,SPC(10
        );M$,N$
FR 160  PRINT#15,"U1";5;0;T;S:G
        OSUB380:T=ASC(Y$):GOSUB
        380:S=ASC(Y$):FORJ=1TO8
        :GOSUB380
DF 170  IFSS=1ANDASC(Y$)=129THE
        ND$(Q)="SEQ":GOTO220
XH 180  IFPP=1ANDASC(Y$)=130THE
        ND$(Q)="PRG":GOTO220
AE 190  IFUU=1ANDASC(Y$)=131THE
        ND$(Q)="USR":GOTO220
GX 200  IFRR=1ANDASC(Y$)=132THE
        ND$(Q)="REL":GOTO220
FM 210  FORI=1TO31:GOSUB380:NEX
        TI:NEXTJ:GOTO280
SP 220  GOSUB380:GOSUB380:FORI=
        1TO16:GOSUB380:IFASC(Y$
        )<>160THENC$(Q)=C$(Q)+Y
        $:NEXTI:GOTO240
JE 230  NEXTI
CX 240  FORI=1TO9:GOSUB380:NEXT
        :GOSUB380:B=ASC(Y$):GOS
        UB380:B=B+256*ASC(Y$):Z
        =Z-B:GOSUB380:GOSUB380:
        A$(Q)=M$:B$(Q)=N$
RC 250  PRINT#4,SPC(10);B;:IFB<
        10THENPRINT#4,SPC(4);:G
        OTO270
QA 260  IFB<100THENPRINT#4,SPC(
        3);:GOTO270:ELSEPRINT#4
        ,SPC(2);
EX 270  PRINT#4,C$(Q);SPC(19-LE
        N(C$(Q)));D$(Q):Q=Q+1:N
        EXTJ
EQ 280  IF T<>0THEN160:ELSECLOS
        E5
JC 290  PRINT"ARE ALL INPUT DIS
        KS ENTERED? Y/N":GOSUB3
        70:IFY$="N"THEN100
RK 300  IFY$<>"Y"THEN290
DA 310  CLOSE15:CLOSE4:OPEN4,4:
        Q=Q-1:PRINT"{DOWN}SET P
        RINTER TO HEAD OF FORM
        {SPACE}- PRESS ANY KEY
        {SPACE}WHEN READY":GOSU
        B370:P=1:GOSUB400
EA 320  FAST:W=0:T$="ZZZZZZZZZZ
        Z":FORI=1TOQ:IFC$(I)<T$
        THENT$=C$(I):W=I
CF 330  NEXT:IFW=0THENFORJ=1TO6
        0-L:PRINT#4:CLOSE4:SLOW
        :END
PK 340  PRINT#4,SPC(10);C$(W);S
        PC(18-LEN(C$(W)));D$(W)
        ;SPC(3);A$(W);SPC(19-LE
        N(A$(W)));B$(W):C$(W)="
        ZZZZZZZZZZ":LC=LC+1:IF
        LC>59THENFORJ=1TO6:PRIN
        T#4:NEXTJ:GOSUB400
DJ 350  GOTO320
GK 360  PRINT#4,SPC(16);"NAME";
        SPC(8);"TYPE";SPC(7);"H
        EADER";SPC(8);"ID":PRIN
        T#4:RETURN
PX 370  GETY$:IFY$=""THEN370:EL
        SERETURN
HJ 380  GET#5,Y$:IFY$=""THENY$=
        CHR$(0)
PX 390  RETURN
MC 400  LC=5:PRINT#4,SPC(16);"M
        ASTER FILE INDEX
        {5 SPACES}PAGE";P:PRINT
        #4,SPC(16);"FILE";SPC(8
        );"FILE";SPC(8);"DISK";
        SPC(8);"DISK"
KR 410  PRINT#4,SPC(16);"NAME";
        SPC(8);"TYPE";SPC(7);"H
        EADER";SPC(8);"ID":PRIN
        T#4:P=P+1:RETURN
```

Donald Klich has been involved with system design since 1963 (IBM 630). He is now retired and lives in Mount Prospect, Illinois.

MEMORY FLEXER

By Scott Gifford

When you're programming, wouldn't it be nice to have another 64 next to you? You could run and list other programs and look at a disk directory without erasing the program that you're working on. Memory Flexer does just that—almost. Instead of providing you with another computer, this utility for the 64 divides the memory in your computer into two parts, each of which can hold its own program. This allows you to do things other programmers can only dream about.

Typing It In

Memory Flexer consists of two parts, a BASIC program and a machine language program. The first part, Memory Flexer, is written in BASIC. To help you enter it without typing errors, use The Automatic Proofreader. See "Typing Aids" elsewhere in this section. Be sure to save the program before exiting Proofreader.

Switcher is the second part, and it is written in machine language. Enter it with MLX, our machine language entry program. Again, see "Typing Aids." When MLX prompts, reply with the following values.

Starting address: CF08
Ending address: CFEF

Be sure to save this program with the filename SWITCHER, since Memory Flexer loads and executes this file when it runs. Make sure that you save both programs on the same disk.

How to Switch

Load and run Memory Flexer. The disk drive will run for a few seconds, and then it will ask you for the primary and secondary border colors (0–15). They will change to let you know which bank you are in. The defaults are blue (14) for the primary bank and black (0) for the secondary.

After you've selected the border colors, the screen will clear and you'll be instructed to hit Return five times. Notice that the cursor will jump to five different lines with SYS and other commands. This activates Memory Flexer and clears the program.

To switch between memory banks, simply type *SWAP*. Neither bank will interfere with the other. Each bank can have its own set of variables that will not clear when you switch banks.

Immediately after activating Memory Flexer, it's a good idea to test it by attempting to store a brief program (such as 10 PRINT) in each bank. If you get an *OUT OF MEMORY ERROR* message, Memory Flexer has to "cough." Clear it by typing *NEW* in both banks, and it should run fine.

Disk Operations

One use for Memory Flexer is to simplify disk operations. For instance, if you want to see the directory without erasing a program you are working on, just load the program into the other bank. For another use, you might want to keep a short program to read the error channel in one bank.

Cut-and-Paste Programming

Perhaps the most powerful feature of Memory Flexer is the ability to easily move lines between two programs. You could, for example, create a library of subroutines you often use and simply paste them into programs as you need them.

To move a section of lines, load the program you are copying from into one bank and the program you are copying to into the other. List the lines to be copied, and then swap banks and press Return with the cursor on the lines. If you need more than one screenful, simply repeat the process.

Memory Flexer resides at 53000,

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which may conflict with some very long machine language programs that start at 49152. The primary bank is about twice as large as the secondary, so try to keep the longer program there. Also, very large programs may not fit into either bank. Programs saved from the secondary bank must be loaded back in without a ,8,1. Otherwise, they will load into the secondary bank, which is inaccessible without Memory Flexer.

MEMORY FLEXER

```
PK 5 REM COPYRIGHT 1993 - COMP
     UTE PUBLICATIONS INTL LTD
     - ALL RIGHTS RESERVED
MD 10 IFA=0THENA=1:LOAD"SWITCH
     ER",8,1
JA 100 OPEN1,0
HG 105 PRINT"{CLR}{6 DOWN}"
QF 195 PRINT
BE 200 PRINTSPC(10)"PRIMARY CO
     LOR #14{2 LEFT}";
CD 210 INPUT#1,C$:PRINT
FG 220 V=VAL(C$):IF V<0ORV>15
     {SPACE}THEN PRINT"{UP}I
     NVALID;{UP}":GOTO200
CM 230 POKE53186,V
GJ 240 PRINTSPC(10)"SECONDARY
     {SPACE}COLOR #0{LEFT}";
CA 250 INPUT#1,C$:PRINT
EK 260 V=VAL(C$):IF V<0ORV>15
     {SPACE}THEN PRINT"{UP}I
     NVALID;{UP}":GOTO200
JJ 270 POKE53205,V
MX 280 PRINT"{CLR}{3 DOWN}SYS
     {SPACE}53000{2 DOWN}"
AM 290 PRINT"NEW{2 DOWN}"
KS 300 PRINT"SWAP{2 DOWN}"
FM 310 PRINT"NEW{2 DOWN}"
AB 320 PRINT"SWAP{2 DOWN}"
GM 330 PRINT"{HOME}PLEASE HIT
     {SPACE}RETURN FIVE TIME
     S."
GG 999 END
```

SWITCHER

```
CF08:20 DA CF 20 94 CF AD 05 AE
CF10:03 8D 37 CF AD 04 03 8D 89
CF18:36 CF A9 25 8D 04 03 A9 7A
CF20:CF 8D 05 03 60 A0 03 B9 21
CF28:00 02 D9 D6 CF D0 06 88 47
CF30:F0 06 4C 27 CF 4C FF FF 75
CF38:A9 3A A0 00 99 00 02 C8 E8
CF40:C0 04 D0 F8 A5 2B CD B0 11
CF48:CF D0 1E A5 2C CD B1 CF ED
CF50:D0 17 4C 55 CF A9 00 8D AF
CF58:20 D0 20 DA CF 20 7D CF B7
CF60:20 E3 CF 20 94 CF 4C 35 B6
CF68:CF A9 01 8D 20 D0 20 E3 BB
CF70:CF 20 7D CF 20 DA CF 20 D8
CF78:94 CF 4C 35 CF A0 00 B9 ED
CF80:2B 00 91 FB C8 C0 0C D0 D9
CF88:F6 B9 75 02 91 FB C8 C0 AF
CF90:10 D0 F6 60 A0 00 B1 FB B5
CF98:99 2B 00 C8 C0 0E D0 F6 33
CFA0:B1 FB 99 73 02 C8 C0 12 49
CFA8:D0 F6 B1 FB 8D 20 D0 60 53
CFB0:01 08 03 08 0A 08 0A 08 40
CFB8:30 75 00 00 30 75 00 08 2D
CFC0:30 75 01 32 75 34 75 3B BB
CFC8:75 3B 75 00 A0 00 00 00 A5
CFD0:A0 31 75 00 A0 00 53 57 BE
CFD8:41 50 A9 B0 85 FB A9 CF AC
CFE0:85 FC 60 A9 C3 85 FB A9 FE
CFE8:CF 85 FC 60 00 00 00 00 77
```

Scott Gifford programs his 64 in Flushing, Michigan.

IRA MINIMUM DISTRIBUTION

By Robert Nellist

The Internal Revenue Service has a well-deserved reputation for writing complex and confusing regulations. It really outdid itself, however, when it wrote the rules governing Individual Retirement Account (IRA) Minimum Distribution.

An IRA owner must start periodic minimum withdrawals from his or her account(s) starting in the year that he or she reaches age 70½—not 70 or 71, mind you, but 70½! The amount that must be withdrawn each year is determined by dividing the combined life expectancy of the owner and the oldest beneficiary into the balance in the account at the end of the preceding year. Combined life expectancy is computed using the ages reached in the year the owner reaches 70½. Depending on his or her month of birth, the owner could reach either 70 or 71 during that year.

To complicate matters even further, life expectancy is almost always expressed in fractions of a year and, in some cases, can be recalculated each year (rather than simply reducing it by one) to attain a slightly lower minimum withdrawal. Finally, if the owner's spouse is not the sole beneficiary, a different set of rules applies.

Of course, you don't have to be too concerned about all this because the institution holding the IRA will undoubtedly figure it for you when the time comes. But if you or a relative or friend would like to know ahead of time what an IRA's minimum distribution schedule will be, Minimum Distribution will print out a personalized, detailed projection based on the answers you give to a few questions. Just answer the questions as you run the program. Having this information in advance could prove important.

Typing It In

Minimum Distribution is written entirely in BASIC. To help avoid typing errors, enter it with The Automatic Proofreader. See "Typing Aids" elsewhere in this section. As always, save a copy before you run it.

Accuracy Considerations

The nearer an IRA owner is to the time when he or she must start periodic withdrawals, the more accurate the projection can be. However, if there will be no further deposits or withdrawals, the program can take the present balance and, using daily compounded interest, predict what the balance will be when its owner reaches 70½—even if that time is several years away. Accuracy will then depend entirely on how well you forecast the interest rate.

The Printout

Let's take a look at a typical printout. Under Account Number and Owner's Name are several of the statistics on which the projection is based. The term *MDIB Applied,* if it appears, indicates that the Minimum Distribution Incidental Benefit Requirement is in effect because the owner's spouse was not named as the sole beneficiary. In this case, the Beneficiary Age In Effect may differ from that person's actual age.

Now look at the projection chart itself. The owner's age is shown and then the year in which each minimum withdrawal must be made. The withdrawal amount appears in the far right column and is obtained by dividing the current life expectancy into the account balance. If the account is earning a decent interest rate, the balance will probably increase for the first few years despite the withdrawals. After studying the chart, an IRA owner may well decide to increase withdrawals in the early years in order to prevent sharply higher minimums in the later years from severely impacting his or her income tax.

A Grace Period

The IRS, in a burst of generosity, has decreed that the withdrawal deadline for the initial year may be delayed until April 1 of the following year without

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penalty. After that, however, withdrawals must be completed by December 31 of the year in which they are due.

Limitations

Recalculation (mentioned previously) is not used in this program. It would only reduce minimum withdrawal by a small amount and could cause complications in case of death.

The program can accurately compute combined life expectancy when the oldest beneficiary's age falls between 55 and 90 at the start of mandatory distribution. Anything outside this range would be very unusual.

MINIMUM DISTRIBUTION

```
PK 5 REM COPYRIGHT 1993 - COMP
     UTE PUBLICATIONS INTL LTD
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GK 10 CLR:POKE53281,12:POKE532
     80,12:POKE646,11
RG 20 DIM SP$(110),MD$(110),LX
     $(110):T$="00":Q$=".":V$
     =" ":BS$="NO BENEFICIARY
     "
FP 30 FOR X=1 TO 58:DA$=DA$+"=
     ":NEXT
KQ 40 PRINT"{CLR}{2 DOWN} M
     {DOWN} I{DOWN} N{DOWN} I
     {DOWN} M{DOWN} U{DOWN} M
     {DOWN}"SPC(3)"D I S T R
     {SPACE}I B U T I O N"
QE 50 PRINTTAB(3)"{5 DOWN}B Y"
     SPC(5)"R O B E R T
     {2 SPACES}N E L L I S T"
JE 60 PRINTTAB(14)"{5 DOWN}PRE
     SS ANY KEY"
QF 70 WAIT 198,15:GET M$
GD 80 PRINT"{CLR}{2 DOWN}ENTER
      THE IRA ACCOUNT NUMBER"
PB 90 INPUT C$:C$="IRA ACCOUNT
      NO.- "+C$
QS 100 PRINT"{DOWN}ENTER THE I
     RA OWNER'S NAME"
BG 110 INPUT D$:D$="OWNER'S NA
     ME- "+D$:CD=69-LEN(C$+D
     $)
CS 120 PRINT"{DOWN}ENTER THE M
     ONTH AND YEAR THE IRA O
     WNER{2 SPACES}WAS BORN
     {SPACE}- ";
HF 130 PRINT"SEPARATE WITH A C
     OMMA"
JS 140 INPUT"(EXAMPLE - 08,192
     4) ";MA,YA
FC 150 MA=MA+6:YO=YA+70:IF MA>
     12 THEN YO=YO+1
XG 160 OA=YO-YA
GX 170 PRINT "{DOWN}DOES THE A
     CCOUNT NAME AT LEAST ON
     E"SPC(6)"PERSON AS BENE
     FICIARY";
GA 180 PRINT" IN CASE OF THE"S
     PC(4)"OWNERS DEATH?
     {2 SPACES}<Y/N>"
KD 190 GET B$:IF B$="N"AND OA=
     70 THEN LX=16.0:BA$=" N
     O":GOTO 300
JJ 200 IF B$="N"AND OA=71 THEN
      LX=15.3:BA$=" NO":GOTO
      300
CK 210 IF B$<>"Y"THEN 190
BB 220 PRINT"{DOWN}ENTER THE Y
     EAR OF BIRTH OF THE OLD
     EST"SPC(3)"BENEFICIARY"
KJ 230 INPUT"(EXAMPLE - 1927)"
     ;YB:BA=YO-YB:IF BA>90 T
     HEN BA=90
DB 240 IF BA<55 THEN BA=55
PM 250 PRINT"{DOWN}IS THE OWNE
     R'S SPOUSE THE SOLE"SPC
     (10)"BENEFICIARY?
     {2 SPACES}<Y/N>"
MG 260 GET BS$:IFBS$<>"N"AND B
     S$<>"Y"THEN 260
RH 270 IF BS$="N"AND OA=70 AND
      BA<60 THEN BA=60
PK 280 IF BS$="N"AND OA=71 AND
      BA<61 THEN BA=61
GC 290 BA$=STR$(BA):GOSUB 1010
     :REM-COMPUTE LIFE EXPEC
     TANCY
QF 300 PRINT"{CLR}{2 DOWN}THE
     {SPACE}NEXT QUESTION AS
     KS FOR THE ESTIMATEDIRA
      BALANCE AT THE";
KM 310 PRINT" END OF"YO-1:PRIN
     T"THE PROGRAM WILL PROJ
     ECT THIS FOR YOU
     {2 SPACES}";
AD 320 PRINT" (USING DAILY COM
     POUNDED INTEREST) PROVI
     -DING THERE WILL BE NO
     {SPACE}";
HJ 330 PRINT"FURTHER DEPOSITS,
      WITHDRAWALS, OR CHANGE
      IN THE INTEREST
     {2 SPACES}RATE. "
JK 340 PRINT"{DOWN}DO YOU WANT
      THIS PROJECTION?
     {2 SPACES}<Y/N>"
HH 350 GET PR$:IF PR$="N"THEN
     {SPACE}490
RX 360 IF PR$<>"Y"THEN 350
DE 370 PRINT"{CLR}{DOWN}"TAB(1
     0)"SPECIAL COMPUTATION"
GF 380 PRINT"{2 DOWN}ENTER THE
      PRESENT YEAR"
CG 390 INPUT"(EXAMPLE - 1993)"
     ;PY
CB 400 PRINT"{2 DOWN}ENTER THE
      BALANCE IN THE ACCOUNT
      AT THE END OF"PY-1
CX 410 INPUT"(EXAMPLE - 50546.
     00)";CB$:SP=VAL(CB$)
XK 420 PRINT"{2 DOWN}ENTER THE
      CURRENT INTEREST RATE
     {SPACE}THE"SPC(5)"ACCOU
     NT IS EARNING"
BK 430 INPUT"(EXAMPLE - 5.5)";
     IR:IR$=STR$(IR):IR=IR/1
     00
QP 440 PRINT"{CLR}{2 DOWN}"TAB
     (13)"PLEASE WAIT":PRINT
     :YL=YO-PY
JJ 450 FOR R=1 TO YL:GOSUB980:
     PRINT:NEXT:REM-DAILY CO
     MPOUNDING
XF 460 PP$=STR$(SP):IF SP=INT(
     SP)THEN PP$=PP$+Q$
CD 470 PP$=PP$+T$:V=LEN(STR$(I
     NT(SP))):PP$=LEFT$(PP$,
     V+3)
QM 480 PRINT"{CLR}{2 DOWN}"TAB
     (5)"PROJECTED BALANCE -
     "PP$:GOTO 510
KQ 490 PRINT"{CLR}{2 DOWN}ENTE
     R THE ACCOUNT'S ESTIMAT
     ED BALANCE ATTHE END OF
     "YO-1
PS 500 INPUT"(EXAMPLE - 65432.
     00){2 SPACES}";PP$:SP=V
     AL(PP$):PP$=V$+PP$
PJ 510 PRINT"{2 DOWN}ENTER THE
      ESTIMATED YEARLY INTER
     EST RATETHE ACCOUNT IS
     {SPACE}EXPECTED ";
HP 520 PRINT"TO EARN OVER THEP
     AYOUT YEARS"
DJ 530 INPUT "(EXAMPLE - 7.55)
     {2 SPACES}";IR:IN$=STR$
     (IR):IF IR=INT(IR)THEN
     {SPACE}IN$=IN$+".0"
DE 540 PRINT"{CLR}":NY=INT(LX)
     :IF LX=NY THEN NY=NY-1
EQ 550 IR=IR/100:SY=YO
FR 560 FORX=OA TO OA+NY:IF LX<
     1THEN LX=1
KP 570 MD=SP/LX:LX$=STR$(LX)+Q
     $+T$:IF LX<10THEN LX$=V
     $+LX$
GG 580 LX$(X)=LEFT$(LX$,5)
SJ 590 MD=SP/LX:SP$(X)=STR$(SP
     ):MD$(X)=STR$(MD)
QM 600 IF SP<100000 THEN SP$(X
     )=V$+SP$(X)
KB 610 IF SP<10000 THEN SP$(X)
     =V$+SP$(X)
RF 620 IF MD<10000 THEN MD$(X)
     =V$+MD$(X)
BR 630 IF MD<1000 THEN MD$(X)=
     V$+MD$(X)
KA 640 IF MD=INT(MD)THEN MD$(X
     )=MD$(X)+Q$
CS 650 IF SP=INT(SP)THEN SP$(X
     )=SP$(X)+Q$
RC 660 MD$(X)=LEFT$(MD$(X)+T$,
     9):SP$(X)=LEFT$(SP$(X)+
     T$,10)
AP 670 PRINT X;TAB(4)SY;TAB(10
     )SP$(X)TAB(22)LX$(X)TAB
     (29)MD$(X)
PS 680 IF X=OA+NY THEN 710
SK 690 GOSUB 980:REM-DAILY COM
     PUNDING
QC 700 SP=SP-MD:LX=LX-1:SY=SY+
```


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```
      1
XH 710 NEXT:PRINT"{2 DOWN}"SPC
      (10)"PRESS P FOR PRINTO
      UT"
BB 720 GET M$:IF M$<>"P"THEN 7
      20
JJ 730 OPEN4,4:IF BS$="Y"THEN
      {SPACE}BS$="{2 SPACES}S
      POUSE ONLY "
GB 740 IF BS$="N"THEN BS$=" MD
      IB APPLIED "
MS 750 PRINT#4,""SPC(3)"M I N
      {SPACE}I M U M"SPC(3)"D
       I S T R I B U T I O N"
      SPC(3);
EA 760 PRINT#4,"P R O J E C T
      {SPACE}I O N"SPC(3)"C H
       A R T"
QK 770 PRINT#4:PRINT#4:PRINT#4
      ,""SPC(5)C$;""SPC(CD)D$
PF 780 PRINT#4:PRINT#4,""SPC(5
      )"OWNER'S AGE AT END OF
      "YO"-"OA;
RC 790 PRINT#4,""SPC(8)"BENEFI
      CIARY AGE IN EFFECT-"BA
      $:IF PR$="N" THEN 820
GS 800 PRINT#4:PRINT#4,""SPC(5
      )"SPECIAL COMPUTATION O
      PTION - ";
PS 810 PRINT#4,CB$" FOR"YL"YEA
      RS @"IR$"% ="PP$
DJ 820 PRINT#4:PRINT#4,""SPC(5
      )"BALANCE AT END OF"YO-
      1"-"PP$;
QD 830 PRINT#4,""SPC(9)"ANNUAL
       INTEREST RATE-"IN$" %"
      :PRINT#4
HM 840 PRINT#4,""SPC(5)"NO REC
      ALCULATION"SPC(11)BS$""
      SPC(11)"DAILY COMPOUNDI
      NG"
EF 850 PRINT#4:PRINT#4:PRINT#4
      :PRINT#4,""SPC(10)"AGE"
      SPC(6)"YEAR";
JQ 860 PRINT#4,""SPC(8)"ACCOUN
      T"SPC(7)"LIFE"SPC(7)"MI
      NIMUM"
JH 870 PRINT#4,""SPC(31)"BALAN
      CE"SPC(7)"EXPECT."SPC(4
      )"DISTRIBUTION"
CM 880 PRINT#4,""SPC(10)DA$:PR
      INT#4
SA 890 FOR Z=OA TO OA+NY
KX 900 PRINT#4,""SPC(9)Z""SPC(
      5)YO""SPC(5)SP$(Z)""SPC
      (5)LX$(Z);""SPC(5)MD$(Z
      )
PH 910 YO=YO+1
HF 920 NEXT:CLOSE4
GQ 930 PRINT"{CLR}{DOWN}"TAB(1
      1)"PLEASE CHOOSE ONE"
RM 940 PRINTTAB(6)"{2 DOWN}P =
       PROCESS ANOTHER ACCOUN
      T":PRINTTAB(6)"{DOWN}Q
      {SPACE}= QUIT"
PE 950 GET M$:IF M$="P"THEN 10
BK 960 IF M$="Q"THEN SYS64738
XF 970 GOTO 950
MX 980 FOR Y=1 TO 365:REM-DAIL
      Y COMPOUNDING LOOP
EQ 990 DY=(SP*IR)/365:SP=SP+DY
      :PRINTTAB(16)"{RVS}"Y"
      {UP}"
SF 1000 NEXT:RETURN
XF 1010 IF OA=70 THEN 1030:REM
      -LIFE EXPECTANCY COMPU
      TATION
PB 1020 FOR X=1 TO 36:READ LL:
      NEXT
XB 1030 FOR X=55 TO 90:READ LL
BQ 1040 IF X=BA THEN LX=LL:X=9
      0
RK 1050 NEXT:RETURN
SE 1060 DATA29.9,29.1,28.4,27.
      6,26.9,26.2,25.6,24.9,
      24.3,23.7,23.1,22.5,22
      .0,21.5
SS 1070 DATA21.1,20.6,30.2,19.
      8,19.4,19.1,18.8,18.5,
      18.3,18.0,17.8,17.6,17
      .4,17.3
BG 1080 DATA17.1,17.0,16.9,16.
      8,16.7,16.6,16.5,16.5
SQ 1090 DATA29.7,29.0,28.2,27.
      5,26.7,26.0,25.3,24.7,
      24.0,23.4,22.8,22.2,21
      .7,21.2
HR 1100 DATA20.7,20.2,19.8,19.
      4,19.0,18.6,18.3,18.0,
      17.7,17.5,17.2,17.0,16
      .8,16.6
SH 1110 DATA16.5,16.3,16.2,16.
      1,16.0,15.9,15.8,15.8
```

Robert Nellist, the author of Ancestry (January 1993), lives in Brockport, New York.

SNAKEY

By Farid Ahmad

Snakey is a game that can help you increase your typing speed. At the lowest level, Snakey can be played by children who are just learning their way around the keyboard; the most difficult level should give even experienced typists a workout.

Snakey consists of a BASIC program and a machine language program. To help prevent typing errors, enter the BASIC program with The Automatic Proofreader. See "Typing Aids" elsewhere in this section. Be sure to save the program before you try to run it. Save both programs on the same disk.

Use MLX, our machine language entry program, to enter the machine language portion. Again, see "Typing Aids." When MLX prompts, reply with the following addresses.

Starting address: CC08
Ending address: CECF

Be sure to save this program with the filename SNAKEY.ML. The BASIC portion loads this file when it runs.

Starting Options

When you run the game, you're first asked to choose a level of difficulty. The game then asks you for the keys on which you want to practice. You can choose alphabet only, numbers only, full keyboard, or specific keys.

If you choose to define specific keys, you're taken to a new screen where you can edit previously entered keys or enter new ones. You cannot enter spaces, as they would not be visible on the game screen.

Gameplay

Once you have made your selections, the actual game starts. Characters start to flow from the left side of the screen, rather like a snake crawling out of a basket. This "snake" of characters makes its way toward the right edge of the screen. The object of the game is to force Snakey back into its basket. To do this, you must type the letter at Snakey's head. But hurry. If you take too long, Snakey will grow another character at its head, and you'll have to type it instead. If Snakey reaches the other side of the screen, you lose.

At each level, Snakey grows at a specific rate, giving you time to react. Should you type in a wrong character, however, Snakey grows immediately. This means that if you start pressing keys randomly, Snakey will grow very quickly, even at the easier levels.

The computer will inform you when you have lost or won. If your score is the highest so far, it will also ask for your name. A separate high-score record is kept for each level and is displayed at the top of the screen during the game.

Modifying Snakey

You can easily change the initial length and reaction time associated with each level. List the program from line 1300 to line 1390. Increase the RT variable to increase reaction time, making the level easier. Increase the RS variable to increase Snakey's initial

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length, making the level more difficult.

You can also change the string that is used as the default for the Define Keys option. Just change the variable TS$ in line 1110.

SNAKEY

```
BM 0 REM COPYRIGHT 1993 - COMP
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PD 5 IF ML=0 THEN ML = 1:PRINT
     "{CLR}LOADING ML....":LOA
     D"SNAKEY.ML",8,1
FS 10 QQ=52232
FF 20 :
FG 30 GOSUB1010:REM "INITIALIZ
     E
JS 40 GOSUB1590
PD 50 GOSUB1260:REM "OPTIONS
ME 60 PO=0
BD 70 PRINT"{CLR}":SYSQQ,5,08:
     PRINT"PRESS ANY KEY WHEN
      READY":POKE198,0:WAIT19
     8,1
SA 80 GOSUB880:REM "DRAW SCREE
     N
QR 90 TI$="000000"
QX 100 GOSUB210:REM "UPDATE
JJ 110 IF PO=GL THEN GOTO580
BB 120 GOSUB380:REM "GET INPUT
KG 130 GOSUB460:REM "CHECK IT
PR 140 IF PO<>0THEN100
JD 150 CT$=TI$:GOTO680
HP 160 :
SR 200 REM-UPDATE:SELECTS AND
     {SPACE}PRINTS THE NEXT
     {SPACE}CHARACTER+MAKES
     {SPACE}SOUND
QJ 210 CC=PX(PO):PO=PO+1:IFPO=
     GLTHEN RETURN
BC 220 X=RND(1):X=X*TL+1
FP 230 XX=RND(1):XX=INT(XX*2)
XP 240 IFXX=0THENCC=CC+1:IFCC>
     22THENCC=21
FC 250 IFXX=1THEN{2 SPACES}CC=
     CC-1:IFCC<2 THENCC=3
SJ 260 PX(PO)=CC
SR 270 SNAKE$(PO)=MID$(TS$,X,1
     )
KC 280 SYSQQ,CC,PO:PRINTSNAKE$
     (PO)
SC 290 POKESS+1,X+50
PM 300 POKESS+4,17:FOR RR= 1 T
     O 5{2 SPACES}:NEXT
AM 310 POKESS+4,16
XM 320 RETURN
JF 330 :
XJ 370 REM-GET INPUT:GET INPUT
      FROM PLAYER
SE 380 R=0
CB 390 GET RE$:IFRE$<>""THEN41
     0
DA 400 R=R+1 :IF R<>RT THEN390
EX 410 RETURN
HP 420 :
KD 450 REM-CHECK IT :RETRUNS W
     HEN THERE IS WRONG RESP
     ONSE OR WHEN GAME IS OV
     ER
KS 460 IF RE$<>SNAKE$(PO)THEN
     {3 SPACES}RETURN
FH 470 SYSQQ,PX(PO),PO:PRINT"
     {SPACE}"
BQ 480 POKESS+1,PO*2+22
GG 490 POKESS+4,033:FOR RR= 1
     {SPACE}TO 5{2 SPACES}:N
     EXT
DD 500 POKESS+4,032
HA 510 PO=PO-1:IF PO<>0THENGOS
     UB380:GOTO460
EG 520 RETURN
BC 530 :
RA 570 REM-LOST
SE 580 SYSQQ,06,12:PRINT"{CLR}
     SORRY, YOU LOST"
AM 590 SYSQQ,08,08:PRINT"WHY D
     ON'T YOU TRY AGAIN ??"
CQ 600 GOTO770
GH 610 :
FB 670 REM-WON
DR 680 CC$=MID$(CT$,3,2)+":"+R
     IGHT$(CT$,2)
FA 690 SYSQQ,06,12:PRINT"{CLR}
     YOU DID IT!
JF 700 SYSQQ,08,08:PRINT"YOUR
     {SPACE}TIME WAS : "CC$
HD 710 IF CT$=>BT$(LE) THEN770
HQ 720 SYSQQ,12,0:PRINT"WOW!!
     {SPACE}THIS IS A NEW RE
     CORD AT LEVEL";LE
DX 730 SYSQQ,15,05:PRINT"WHAT
     {SPACE}IS YOUR NAME ";
DG 740 R1$="{2 SPACES}AZ":GOSU
     B1690
MR 750 R1$="":SYSQQ,15,23,6,R1
     $:BP$(LE)=R1$
PX 760 BT$(LE)=CT$:BB$(LE)=CC$
FQ 770 SYSQQ,20,0:PRINT"PRESS
     {SPACE}SPACE BAR TO CHA
     NGE OPTIONS
GP 780 SYSQQ,21,0:PRINT"
     {6 SPACES}OR ANY OTHER
     {SPACE}KEY TO PLAY AGAI
     N"
QD 790 SYSQQ,22,0:PRINT"
     {6 SPACES}WITH SAME SET
     TINGS
BP 800 POKE198,0:WAIT198,1:GET
      R$
DB 810 IF R$=" " THEN PRINT"
     {CLR}":{2 SPACES}GOTO50
GJ 820 GOTO60
BF 830 :
BX 870 REM-DRAW SCREEN
GH 880 SYSQQ,0,00:PRINT"{CLR}L
     EVEL=";LE
MC 890 SYSQQ,0,12:PRINT"BEST T
     IME ";BB$(LE)
BJ 900 SYSQQ,0,28:PRINT"BY ";B
     P$(LE)
DX 910 SYSQQ,10,0:PRINT"Q"
EP 920 FORR=1TO22:SYSQQ,R ,39:
     PRINT"Q":NEXT
ER 930 FORR =1TORS:GOSUB210:NE
     XT
XD 940 POKE198,0
CD 950 RETURN
JR 960 :
PH 1000 REM-INITIALIZE
RA 1010 POKE53280,0:POKE53281,
     0:
AS 1020 PRINT"{WHT}" :X=RND(-T
     I)
KQ 1030 DIM SNAKE$(50):REM CON
     TAINS THE ALPHBETS PUT
      ON THE SCREEN
SX 1040 DIMPX(50)
EQ 1050 PX(0)=10{5 SPACES}:REM
      ROW ON WHICH SNAKEOF
     {SPACE}COLUMN X IS PUT
BK 1060 CC=10:REM THE CURRENT
     {SPACE}ROW
HS 1070 PO=0 :REM THE CURRENT
     {SPACE}COLUMN
XH 1080 GL=39:REM GAME LOST
KH 1090 S1$="ABCDEFGHIJKLMNOPQ
     RSTUVWXYZ"
MS 1100 S2$="0123456789"
SF 1110 TS$="SNAKEY"
BQ 1120 FOR R= 0TO09:BT$(R)="9
     91000":BB$(R)="10:00":
     BP$(R)="UMARA":NEXT
XH 1130 :
XX 1140 REM-SOUND
SC 1150 FOR R=54272 TO 54296:P
     OKER,0:NEXT:SS=54272
GA 1160 POKE SS,255
KQ 1170 POKE SS+24,15:REM VOLU
     ME
QX 1180 POKESS+5,10*16+01:REM
     {SPACE}ATT/DELAY
AH 1190 POKESS+6,15*16+1 :REM
     {SPACE}SUS/REL
PP 1200 RETURN
DQ 1210 :
DJ 1250 REM-OPTIONS
RM 1260 RT=0
DD 1270 SYSQQ,4,4:PRINT"{CLR}C
     HOOSE LEVEL (0-9)
BK 1280 SYSQQ,5,4:PRINT"(0 IS
     {SPACE}EASY : 9 IS HAR
     D)
XR 1290 POKE198,0:WAIT198,1:GE
     T LE$:LE=VAL(LE$)
QX 1300 IF LE=0THENRT=150:RS=7
MX 1310 IF LE=1THENRT=100:RS=1
     0
XE 1320 IF LE=2THENRT=80:RS=11
RG 1330 IF LE=3THENRT=70:RS=12
PA 1340 IF LE=4THENRT=60:RS=13
KC 1350 IF LE=5THENRT=50:RS=14
GP 1360 IF LE=6THENRT=45:RS=15
KB 1370 IF LE=7THENRT=40:RS=20
SB 1380 IF LE=8THENRT=30:RS=20
DB 1390 IF LE=9THENRT=20:RS=20
XX 1400 IF RS>37 THEN RS = 37
EG 1410 IF RT=0THEN1290
SG 1420 PRINT:PRINTTAB(4)LE
CM 1430 :
SF 1440 XR=12:XC=3
```


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```
QS 1450 SYSQQ,XR,XC:PRINT"CHOO
        SE KEYS TO BE USED"
PG 1460 SYSQQ,XR+2,XC+3:PRINT"
        {RVS}A{OFF}LPHABETS ON
        LY
QS 1470 SYSQQ,XR+3,XC+3:PRINT"
        {RVS}N{OFF}UMBERS ONLY
QA 1480 SYSQQ,XR+4,XC+3:PRINT"
        {RVS}B{OFF}OTH
DA 1490 SYSQQ,XR+5,XC+3:PRINT"
        {RVS}D{OFF}EFINED
KR 1500 POKE198,0:WAIT198,1:GE
        TT$
BF 1510 IFT$="A"THEN TS$= S1$:
        GOTO1580
SA 1520 IFT$="N"THEN TS$= S2$:
        GOTO1580
GM 1530 IFT$="B"THEN TS$= S1$+
        S2$:GOTO1580
JS 1540 IFT$<>"D"THEN GOTO1500
QX 1550 REM-Z
EK 1560 PRINT"{CLR}":R1$="!{*}
        {K}{B}":GOSUB1690
RQ 1570 PRINT"{CLR}":GOSUB1690
        :SYSQQ,0,0,200,TS$
QR 1580 TL=LEN(TS$):RETURN
KG 1590 PRINT"{CLR}":SYSQQ,0,1
        3:PRINT"S N A K E Y"
GE 1600 PRINT"{2 DOWN}SNAKEY H
        AS JUST COME OUT OF IT
        'S BASKET.
QX 1610 PRINT"YOU MUST HELP PU
        T IT BACK IN BY TYPING
FE 1620 PRINT"{DOWN}THE CHARAC
        TER AT IT'S HEAD.
DA 1630 PRINT"{DOWN}BUT HURRY
        {SPACE}UP, IF SNAKEY M
        AKES IT TO
DJ 1640 PRINT"{DOWN}THE WALL O
        N THE OTHER SIDE, YOU
        {SPACE}WILL
DQ 1650 PRINT"{DOWN}NEVER BE A
        BLE TO CATCH UP WITH I
        T!
XP 1660 SYSQQ,23,13:PRINT"PRES
        S ANY KEY":POKE 198,0:
        WAIT198,1
EP 1670 RETURN
AG 1680 REM-XINPUT
RM 1690 R1 = LEN(R1$):POKE5294
        0,R1/2
AA 1700 FOR R2 = 1 TO R1
FG 1710 POKE 52940 + R2, ASC(M
        ID$(R1$,R2,1))
MP 1720 NEXT R2
CQ 1730 RETURN
```

SNAKEY.ML

```
CC08:20 FD AE 20 9E B7 86 02 EB
CC10:20 FD AE 20 9E B7 8A A8 A2
CC18:84 03 A6 02 E0 19 B0 3D B3
CC20:C0 28 B0 39 18 20 F0 FF F0
CC28:18 A9 00 65 03 85 FD A9 62
CC30:04 69 00 85 FE A5 02 F0 02
CC38:11 18 A5 FD 69 28 85 FD E9
CC40:A5 FE 69 00 85 FE C6 02 51
CC48:D0 EF A0 00 B1 7A C9 2C 91
CC50:F0 01 60 20 FD AE 20 9E 3A
CC58:B7 E0 02 B0 05 A2 0E 4C 6C
CC60:37 A4 CA 8E C9 CE 18 A5 60
CC68:FD 6D C9 CE 85 FB A5 FE E8
CC70:69 00 85 FC A5 FC C9 07 FA
CC78:F0 04 B0 0C 90 0D A5 FB 62
CC80:C9 E7 F0 07 B0 02 90 03 39
CC88:4C 5D CC AD CC CE C9 1A 63
CC90:90 05 A9 00 8D CC CE AC D2
CC98:C9 CE A9 A0 91 FD A9 20 02
CCA0:99 FF CE 88 D0 F4 99 FF F6
CCA8:CE A9 A0 91 FD 8C C7 CE C1
CCB0:20 FD AE 20 8B B0 A6 0D 2B
CCB8:E8 F0 05 A2 16 4C 37 A4 C2
CCC0:A5 5F 85 FB A5 60 85 FC 2C
CCC8:A0 02 B1 FB CD C9 CE 90 EC
CCD0:05 AE C9 CE E8 8A 8D C8 14
CCD8:CE AA F0 28 C8 B1 FB 85 AF
CCE0:04 C8 B1 FB 85 05 A0 00 26
CCE8:84 03 8C CA CE A4 03 B1 84
CCF0:04 AC CA CE 20 07 CD E8 9F
CCF8:F0 01 C8 E6 03 A5 03 CD 55
CD00:C8 CE D0 E6 4C 83 CD 84 CC
CD08:02 AC CC CE F0 1C A2 01 94
CD10:DD CC CE B0 04 E8 4C 21 30
CD18:CD E8 DD CC CE 90 0B F0 1D
CD20:09 E8 88 D0 EB A4 02 A2 31
CD28:FF 60 A4 02 99 FF CE C9 C4
CD30:40 90 0D C9 C0 B0 06 38 5B
CD38:E9 40 4C 40 CD 38 E9 80 0A
CD40:09 80 91 FD A2 00 60 AC 15
CD48:C7 CE B1 FD 49 80 91 FD FE
CD50:60 20 47 CD A9 00 85 C6 09
CD58:85 02 AA 85 03 E6 02 D0 6D
CD60:0C E8 E0 3B D0 07 20 47 36
CD68:CD E6 03 A2 00 A5 C6 F0 44
CD70:EC A5 03 4A B0 03 20 47 0A
CD78:CD AD 77 02 C9 A0 D0 02 E9
CD80:A9 20 60 20 51 CD C9 1D 79
CD88:D0 0E AD C7 CE CD C9 CE 52
CD90:B0 F1 EE C7 CE 4C 83 CD D7
CD98:C9 9D D0 0D AD C7 CE C9 5F
CDA0:00 F0 E0 CE C7 CE 4C 83 17
CDA8:CD AE C9 CE E0 28 90 38 FD
CDB0:C9 91 D0 13 AD C7 CE C9 D4
CDB8:28 90 C8 38 AD C7 CE E9 3D
CDC0:28 8D C7 CE 4C 83 CD C9 8F
CDC8:11 D0 1D 38 AD C9 CE E9 64
CDD0:27 8D CB CE AD C7 CE CD C1
CDD8:CB CE B0 A7 18 AD C7 CE 74
CDE0:69 28 8D C7 CE 4C 83 CD E5
CDE8:C9 14 D0 2B AE C7 CE F0 5E
CDF0:F4 8A A8 CA B1 FD 88 91 93
CDF8:FD C8 B9 FF CE 9D FF CE B8
CE00:E8 C8 EC C9 CE 90 ED 88 9B
CE08:A9 A0 91 FD A9 20 99 FF B5
CE10:CE CE C7 CE 4C 83 CD C9 84
CE18:94 D0 45 AC C9 CE B1 FD 92
CE20:C9 A0 F0 03 4C 83 CD AE D3
CE28:C9 CE CA 8A A8 E8 38 ED A7
CE30:C7 CE 8D CA CE EE CA CE 5A
CE38:A9 00 85 02 B1 FD C8 91 24
CE40:FD 88 B9 FF CE 9D FF CE F1
CE48:CA 88 E6 02 A5 02 CD CA 06
CE50:CE D0 E9 C8 A9 A0 91 FD 44
CE58:A9 20 99 FF CE 4C 83 CD 82
CE60:C9 0D D0 03 4C 7B CE AC 0B
CE68:C7 CE 20 07 CD E8 F0 08 0E
CE70:CC C9 CE B0 03 4C 92 CD 08
CE78:4C 83 CD AC C9 CE B9 FF 9E
CE80:CE C9 20 D0 04 88 4C 7E 62
CE88:CE C8 8C C8 CE D0 07 84 2A
CE90:04 84 05 4C B5 CE 38 A5 B5
CE98:33 ED C8 CE 85 33 85 04 59
CEA0:A5 34 E9 00 85 34 85 05 68
CEA8:A0 00 B9 FF CE 91 04 C8 5B
CEB0:CC C8 CE D0 F5 A0 02 AD B1
CEB8:C8 CE 91 FB C8 A5 04 91 D6
CEC0:FB C8 A5 05 91 FB 60 00 D0
CEC8:01 C7 00 A0 02 00 00 00 F2
```

Farid Ahmad is a frequent contributor. He lives Islamabad, Pakistan. ❐

ATTENTION USER GROUPS!

WE WANT TO HEAR FROM YOU!

Gazette will soon publish an up-to-date list of all Commodore 64/128 user groups across the U.S., throughout Canada, and around the world. We are now in the process of updating this information. If your user group has not appeared in any of our previous lists and you'd like to be included, please send your club name, address, and bulletin board service telephone number to the following address.

Commodore 64/128
User Group Update
COMPUTE's Gazette
324 W. Wendover Ave., Ste. 200
Greensboro, NC 27408

TYPING AIDS

MLX, our machine language entry program for the 64 and 128, and The Automatic Proofreader are utilities that help you type in Gazette programs without making mistakes. To make room for more programs, we no longer include these labor-saving utilities in every issue, but they can be found on each Gazette Disk and are printed in all issues of *Gazette* through June 1990.

We'll send you a free printed copy if you send an SASE to Typing Aids, COMPUTE's Gazette 324 West Wendover Avenue, Suite 200k, Greensboro, North Carolina 27408.

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THE AUTOMATIC PROOFREADER

The Automatic Proofreader helps you type in program listings for the 128 and 64 and prevents nearly every kind of typing mistake.

Type in Proofreader exactly as listed. Because the program can't check itself, be sure to enter each line carefully to avoid typographical errors or other mistakes. Don't omit any lines, even if they contain unusual commands. After you've finished, save a copy of the program before running it.

Next, type *RUN* and press Return. After the program displays the message *Proofreader Active*, you're ready to type in a BASIC program.

Every time you finish typing a line and press Return, Proofreader displays a two-letter checksum in the upper left corner of the screen. Compare this result with the two-letter checksum printed to the left of the line in the program listing. If the letters match, the line probably was typed correctly. If not, check for your mistake and correct the line. Also, be sure not to skip any lines.

Proofreader ignores spaces not enclosed in quotation marks, so you can omit or add spaces between keywords and still see a matching checksum. Spaces inside quotes are almost always significant, so the program pays attention to them.

Proofreader does not accept keyword abbreviations (for example, ? instead of PRINT). If you use abbreviations, you can still check the line by listing it, moving the cursor back to the line, and pressing Return.

If you're using Proofreader on the 128, do not perform any GRAPHIC commands while Proofreader is active. When you perform a command like GRAPHIC 1, the computer moves everything at the start of BASIC program space—including the Proofreader—to another memory area, causing Proofreader to crash. The same thing happens if you run any program with a GRAPHIC command while Proofreader is in memory.

Though Proofreader doesn't interfere with other BASIC operations, it's a good idea to disable it before running another program. To disable it, turn the computer off and then on. A gentler method is to SYS to the computer's built-in reset routine (65341 for the 128, 64738 for the 64).

AUTOMATIC PROOFREADER

```
0 CLR
10 VE=PEEK(772)+256*PEEK(773):
     LO=43:HI=44:PRINT"{CLR}
     {WHT}AUTOMATIC PROOFREAD
     ER FOR ";
20 IF VE=42364 THEN PRINT "64"
30 IF VE=17165 THEN LO=45:HI=4
     6:WAIT CLR:PRINT"128"
40 SA=(PEEK(LO)+256*PEEK(HI))+
     6:FOR J=SA TO SA+166:REA
     D B:POKE J,B:CH=CH+B:NEX
     T
50 IF CH<>20570 THEN PRINT "*E
     RROR* CHECK TYPING IN DA
     TA STATEMENTS":END
60 FOR J=1 TO 5:READ RF,LF,HF:
     RS=SA+RF:HB=INT(RS/256):
     LB=RS-(256*HB)
70 CH=CH+RF+LF+HF:POKE SA+LF,L
     B:POKE SA+HF,HB:NEXT
80 IF CH<>22054 THEN PRINT "*E
     RROR* RELOAD PROGRAM AND
      CHECK FINAL LINE":END
90 IF VE=17165 THEN POKE SA+14
     ,22:POKE SA+18,23:POKESA
     +29,224:POKESA+139,224
100 POKE SA+149,PEEK(772):POKE
      SA+150,PEEK(773):PRINT"
     {CLR}PROOFREADER ACTIVE"
110 SYS SA:POKE HI,PEEK(HI)+1:
     POKE (PEEK(LO)+256*PEEK(
     HI))-1,0:NEW
120 DATA120,169,73,141,4,3,169
     ,3,141,5,3,88,96,165,20,
     133,167
130 DATA165,21,133,168,169,0,1
     41,0,255,162,31,181,199,
     157,227
140 DATA3,202,16,248,169,19,32
     ,210,255,169,18,32,210,2
     55,160
150 DATA0,132,180,132,176,136,
     230,180,200,185,0,2,240,
     46,201
160 DATA34,208,8,72,165,176,73
     ,255,133,176,104,72,201,
     32,208
170 DATA7,165,176,208,3,104,20
     8,226,104,166,180,24,165
     ,167
180 DATA121,0,2,133,167,165,16
     8,105,0,133,168,202,208,
     239,240
190 DATA202,165,167,69,168,72,
     41,15,168,185,211,3,32,2
     10,255
200 DATA104,74,74,74,74,168,18
     5,211,3,32,210,255,162,3
     1,189
210 DATA227,3,149,199,202,16,2
     48,169,146,32,210,255,76
     ,86,137
220 DATA65,66,67,68,69,70,71,7
     2,74,75,77,80,81,82,83,8
     8
230 DATA 13,2,7,167,31,32,151,
     116,117,151,128,129,167,
     136,137
```

ONLY ON DISK

Here are the bonus programs that you'll find on this month's Gazette Disk.

Mutate
By Gary Noakes
Landover, MD

With its built-in capacity to connect directly to a television or VCR, your 64 can easily create professional-looking titles and sequences for your home videos. Mutate is a sophisticated but user-friendly program that makes it possible. Use the menu to select different fonts and video effects such as blanks, scrolls, and wipes. Mutate does all the work for you. Three help screens are always on hand to give descriptions of each menu function.

128 Utilities
By Eliud Campos Rivera
Arecibo, PR

This disk utility for the 128 is menu-driven. Simply move the cursor to the desired selection and press Return to delete files, format a disk, rename files, or copy programs to the same disk or to a different disk. It sorts directories, retrieves deleted files, and more.

You can have these programs and all the others that appear in this issue by ordering the April Gazette Disk. The price is $9.95 plus $2.00 shipping and handling. Send your order to Gazette Disk, COMPUTE Publications, 324 West Wendover Avenue, Suite 200, Greensboro, North Carolina 27408.

Send New Product Announcements and/or Press Releases on your Commodore 64/128 products to:
Tom Netsel c/o
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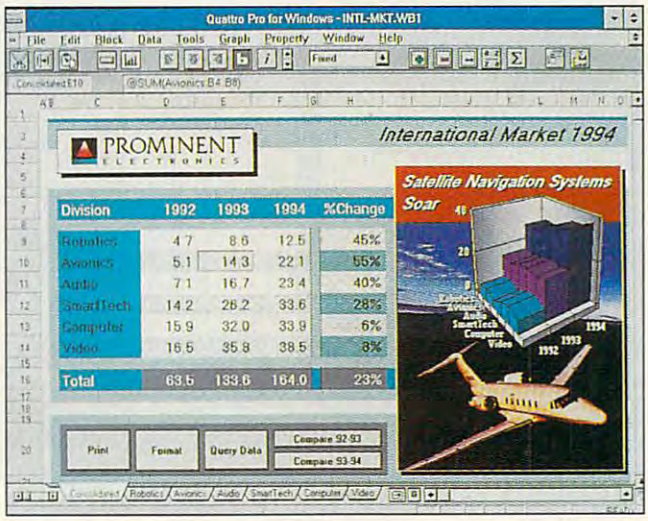
QUATTRO PRO FOR WINDOWS

A spreadsheet is like a soft, comfortable armchair: Once you've spent years sitting in such a chair, it's hard to switch, even if the new one's better for your back. Switching spreadsheet programs can also be quite unsettling after you've learned all the ins and outs of your old one and created complex spreadsheets with it. The good news is that moving from a DOS spreadsheet to Quattro Pro for Windows is not too traumatic. And moving from Quattro Pro for DOS to Quattro Pro for Windows will present few, if any, problems. Experienced Quattro Pro for DOS users will find much familiar in the new Windows version, as well as plenty of new features and capabilities.

The first time you launch Quattro Pro, you'll notice the new Windows interface, the notebook design, and a SpeedBar, Borland's version of the push-button icons that have become standard for Windows applications. Quattro Pro for DOS users will notice that some of the menu items have been rearranged to make them more consistent with other Windows applications. If you've been using Quattro Pro for DOS, Borland recommends that you keep using the DOS version while learning the Windows version. Good advice, since some tasks are accomplished quite differently. But given all the additional versatility and features of Quattro Pro for Windows and the short learning curve to get up to speed, most users will soon move over to this new version.

The notebook feature is what separates Quattro Pro from other Windows spreadsheets. Simply stated, each spreadsheet document (notebook) has 256 spreadsheets (pages) that can either be used together to help organize and manage multiple pages or used separately. Each notebook comes with tabs at the bottom of the screen to make moving from one page of the notebook to another fast and easy. Customizing the tabs to meaningful names is as simple as clicking the right mouse button on the appropriate tab.



It's an easy move from other programs to Quattro Pro for Windows.

The purpose of the notebook is to make organizing your spreadsheets easier. Although working with the notebook is easy and does offer some convenience, most users will opt to have separate files for most of their work and not take full advantage of the convenience of the multiple pages until they've used Quattro Pro for a while.

The multiple-page notebook does offer a tremendous advantage over linked spreadsheets. This is especially true if you keep track of monthly expenses or sales, or if you keep track of anything on a periodic basis. That's because the notebook makes linking information between pages easy. Pages of a notebook can also be grouped, allowing you to enter data or labels onto one page and have them appear on all the grouped pages—much easier than having to copy data from one sheet to another.

Quattro Pro's SpeedBar is just what experienced Windows users have come to expect: easy access to the most often used commands. The SpeedBar can be customized, although other products I've used make the task of customizing the icons easier. Some of the features on the SpeedBar are better than those on other products I've seen, such as the ability to widen a column to a width as large as the widest entry in the column, while other features aren't as good. The instant sum feature, for instance, isn't as versatile as Excel's.

Quattro Pro takes full advantage of the Windows environment, especially when it comes to formatting and printing spreadsheets. The full range of options is available and easy to access. It takes a bit of getting used to, but designing a spreadsheet so that the data is easy to present is fast and simple. I had no problem taking an old spreadsheet that previously required many pages and making it fit nicely on two sheets of paper. And by highlighting different sections of the sheet with different levels of shading, I was able to make the sheet easier to read and use, even though the type size had been reduced to get the required number of columns across one sheet of paper.

The graphing capabilities have also been upgraded and are more intuitive. Quattro Pro has smart graphing in that the software helps you create the graphs and their labels. Of course, you can make adjustments to Quattro Pro's selections. Most users will find Quattro Pro's two- and three-dimensional graphing and seven different types of graphs adequate for their needs.

Quattro Pro also comes with Borland's Database Desktop, which allows you to interactively view, edit, and query Paradox and dBASE database files. The Database Desktop also lets you link Quattro Pro spreadsheets with external database tables.

Quattro Pro for Windows is an important entry into the Windows spreadsheet arena. Like any new product, it has some features that are superior to the competition's and others that could be better; but if you're in the market for a Windows spreadsheet, Quattro Pro for Windows is certainly worth a look.

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PRINT SHOP DELUXE

Leave it to Brøderbund to flatten the learning curve—never before has creating professional-quality letterhead and fliers been so simple, so dynamic, so colorful. Leaving full-fledged desktop publishing contemporaries to pick the bullets out of their teeth, Print Shop Deluxe cajoles your PC and printer team into becoming a modern-day printer's devil.

Before you set your sights on a sideline career, however, note the power requirements here. Brøderbund recommends a 386SX for its publishing heavyweight—the 8-bit days of the earliest Print Shop can now head for the recesses of memory. A hard drive goes without saying, of course. After you add on the business and sampler graphics packs, you begin to speak of storage in megabytes, on top of the Windows files you'll probably already have installed. Still, with Stacker in place, Print Shop Deluxe performance suffers no degradation, and the cost in storage is more than offset by the joy of mixing and matching graphics.

Once you sit down with Print Shop Deluxe, expect to stay awhile. Not that the program forces perusal of the outsize and astute manual, but rather, the sheer number of options can lead to giddiness. Text may fade from barely perceptible gray to 300-dpi black; borders, outlines, and drop shadows can surround graphics blocks, lines of text, or even single letters; libraries of new graphics await. Just choosing the elements for a simple sign can lead to an hour-long debate over the merits of headlines versus rectangular graphics. Fortunately, numerous layouts, thoughtfully provided, can alleviate much of the trepidation. Just click on a filename—or use a combination of cursor keys and the Enter key if you don't have a mouse—and a ready-made page appears. You just select the appropriate graphics and text for the empty blocks.

How do you know what goes in a particular block? Each contains an icon. The T icon stands for text; the bear for images. You'll find yourself presented with blocks for column graphics, square graphics, row graphics, and ruled lines. Each of these sports a minilibrary of its own, so the number of visual possibilities grows tremendously. You may alter the properties of these blocks and their resident images via a small onscreen menu—resize, flip, add color, drain color, change color, rotate, shuffle objects forward or backward. These options apply to all text blocks as well.

With adequate hardware, Print Shop Deluxe works wonders.

What might you do with Print Shop Deluxe? Besides the aforementioned letterhead and signs, you'll want to try banners, greeting cards, and versatile calendars. You could even run the export utility to transfer a graphic to another type: EPS, CGM, PCX, or TIF. Tweak the graphic with a paint program before using it in a desktop publishing package of your choice, and then build a sign or memo there to transmit via fax card.

Images on tap run the gamut from balloons to butterflies, Celtic weavings to the Star of David. You can browse a series of graphics specially designed for insertion beneath initial caps for eye-catching text: Victorian, Incan, French, and modern, among others. The square graphics include pumpkins and bunnies, angels and Adirondack chairs; the column graphics, by nature tall and thin, offer lightning bolts and filing cabinets, pillars and pens. The effective and gorgeous borders put the finishing touch on small signs and do-it-yourself notepaper, and almost everyone will find something appropriate in the range of styles available.

Of course, no printing package can look as good on paper as it does onscreen, but Print Shop Deluxe comes close. A laser 150-dpi bon voyage card left no room for complaints with its superb gray scaling and TrueType fonts text output—very few jaggies. Color printing, the biggest selling feature of the package, likewise tends toward excellence; many laser-printer devotees may well come to envy color ink-jet owners, thanks to this product. As always, printing requires patience, and with multiple text and graphics blocks to collate, expect some time to pass before you see the final copy of your work.

In all an exciting product, Print Shop Deluxe provides the solution to your home and small business printing needs. Paired with a respectable printer, this program promises to announce your bake sales, attend your grand openings, express fond farewells, and keep you on schedule. What more could a big-time publisher on a small-time budget ask for?

Editor's note: After this review was written, Brøderbund announced that an upgrade for Print Shop Deluxe—version 1.2—will be available in April. New features will include import capability, allowing the program to import files from oth-

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THE COMPUTER BOWL IS FILLING UP.

The Computer Museum's 5th Annual Computer Bowl rapidly approaches. The contestants are training hard. Sponsors are lining up. Enthusiasm is at a fever pitch. The whole world is watching. Don't wait another nanosecond. Make your ticket reservations now. The Computer Bowl is filling up. And if it's anything like last year, The Computer Bowl will soon runneth over.

The Computer Museum's 1993 Computer Bowl Presented By: The Association for Computing Machinery (ACM); Date: May 14, 1993; Place: The San Jose Convention and Cultural Facilities, San Jose, California; Satellite broadcast to: The Computer Museum, Boston, Massachusetts.

EAST COAST TEAM: Mitchell E. Kertzman, Captain, Powersoft Corporation; John F. Burton, LEGENT Corporation; Neil J. Colvin, Phoenix Technologies Ltd.; Alain J. Hanover, Viewlogic Systems, Inc.; Patricia B. Seybold, Patricia Seybold Group. WEST COAST TEAM: Harry J. Saal, Captain, Network General Corporation; Jean-Louis Gassée, Be Incorporated; Jerry Kaplan, GO Corporation; Michael A. McConnell, SuperMac, Inc.; Lisa G. Thorell, Dataquest Incorporated. "THE EXAMINER," Bill Gates, Microsoft Corporation. JUDGES: Dr. David L. Nelson, Fluent, Inc.; John F. Shoch, Asset Management Company.

FOUNDERS: Pat Collins Nelson and Dr. David L. Nelson. UNDERWRITERS: Apple Computer, Inc. OFFICIAL SPONSORS: Bank of Boston, The Bank; BASF Information Systems, The Diskette; Intel Corporation, The Microprocessor; LEGENT Corporation, The Enterprise Systems Management Provider; MasPar Computer Corporation, The Massively Parallel Computing Company; Merrill, Pickard, Anderson & Eyre, The Venture Capital Firm; Network General Corporation, The Network Analyzer; Price Waterhouse, The Accounting Firm; Robertson, Stephens & Company, The Investment Bank; Stratus Computer, Inc., The Transaction Processor; Viewlogic Systems, Inc., The Official Electronic Design Automation Company; Visix Software Inc., The High Performance Workstation Software Company; Wellfleet Communications, Inc., The Internetworking Company. The Computer Bowl is broadcast on the PBS series, "Computer Chronicles," hosted by Stewart Cheifet. The Computer Bowl is a project to benefit the educational programs of The Computer Museum, 300 Congress Street, Boston, MA 02210. For tickets and sponsorship information (617) 426-2800 ext. 399.

The Computer Bowl

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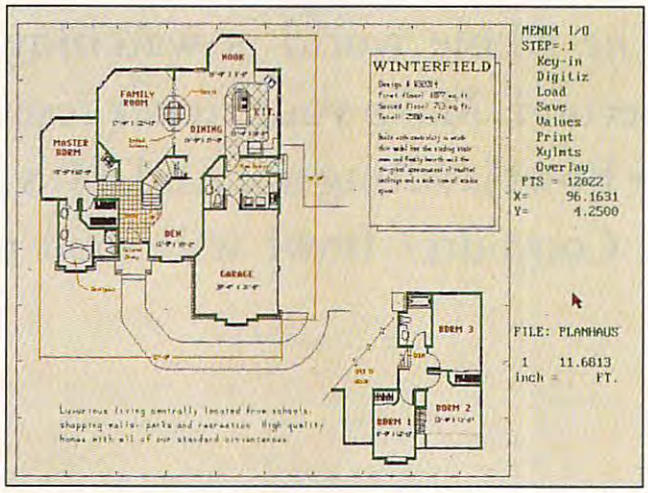
DRAFT & PRINT

These days, everybody's producing drawing programs for PCs. At one extreme are products aimed squarely at the professional market. At the other are packages intended for more casual use. Draft & Print, from Spirit of Discovery, seems to shoot for the middle ground. The package says it's "simple enough for the beginner, yet powerful enough for the professional."

How does it measure up? Generally speaking, it measures up well, starting with a straightforward setup routine. Besides letting you specify input and output devices, setup lets you set screen and text colors and even "linearize" your display so circles do indeed appear as circles on your screen. You also specify scale and drawing units, although only the English system (feet and inches) is directly supported.

D&P's drawing screen is a sight for sore eyes, especially once you've customized the colors to your own preferences. The drawing area is neat and uncluttered, with a space to the right reserved for cursor coordinate displays, menu commands, program messages, and so on.

How about drawing tools? D&P lets you draw lines, boxes, circles, arcs, grids, and more. You can move, mirror, rotate, and smooth, and you've got unlimited zooming. You can layer drawings and add, scale, and rotate text. Importing symbols is easy, and DXF files provide AutoCAD compatibility. A built-in library of basic symbols is useful, too.



For the most part, Draft & Print lives up to its claim of serving the drawing needs of both beginners and professionals.

The program can also give you exact dimensions, and it shows areas and perimeters of boxes and circles. Additionally, an Area command lets you calculate the area and perimeter of irregular figures, even those containing openings. You can use up to 2000 data points to define irregular shapes.

Oddly enough, D&P doesn't let you directly draw an ellipse. To create an ellipse, you must first draw a circle and then apply a scaling factor in the *x* or *y* direction.

D&P connects well with the outside world. It supports printers, plotters, and digitizers, and it can output high-resolution drawings on dot-matrix printers. Paper size can be specified from 8½ × 11 inches to 34 × 44 inches. D&P also includes a utility (Slidesho, executed from DOS) that lets you sequentially display a set of PIC files.

One unusual feature of D&P is spoken confirmation of commands. This package talks to you via Sound Blaster, Ad Lib, and Tandy sound, as well as through your PC's internal speaker. Voice quality is generally good, although the inflection may get on your nerves. One hearer likened it to the unfailingly sunny voice heard when you call information ("The number is . . ."). It should be noted, however, that the voice wasn't always understandable during testing of this feature using the internal speaker on two different PS/2s. Fortunately, you can turn off the voice during setup.

Another interesting feature: You can configure D&P to your level of ability (beginner, intermediate, or advanced). However, the only result at the lower levels seems to be the exclusion of certain subsequent setup options and program commands. On the beginner level, for instance, the Hatch command is not available and you cannot install a digitizer or plotter. The book says this keeps beginners out of trouble. But isn't experimentation one of the best ways to learn a program?

D&P features a menu-based point-and-click help feature. Clicking on an entry opens a text window where short entries describe the purpose and use of the designated command. Some entries also include a note which may contain additional information—or which may say "See manual for crucial details regarding this command." It would be helpful if those details were presented onscreen. Context-sensitive help would be even better.

Overall, D&P is a genuinely useful program. It's easy to use, and though the documentation lacks screen shots, it's loaded with helpful examples.

In fact, there's only one real complaint: D&P offers as options some things that other packages include as standard equipment. For example, D&P does offer math coprocessor support—but it's an option that costs an extra 30 bucks and must be ordered from the manufacturer. That's an aggravation in a package said to be powerful enough for pros. Other add-ons include a library of nine type fonts ($15) and a 50-minute training video ($20), plus an additional symbols library that's sent almost free ($5 for shipping and handling) to users who send in the registration card. These extras are nice, but I expect most users would gladly pay a few dollars more to have them included with the basic program.

Should you consider Draft & Print? Busy design

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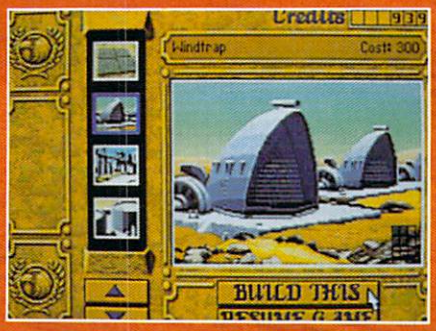

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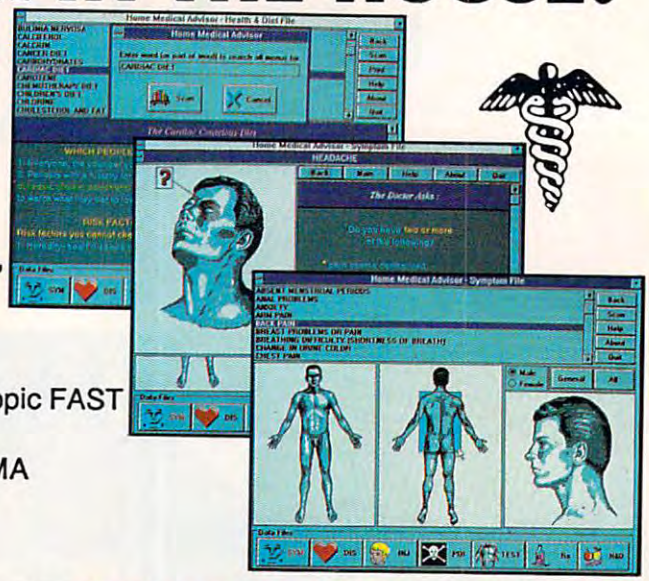

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professionals will probably want a package with built-in math coprocessor support. But if you're a beginner or an intermediate user, or even a pro who doesn't want or need a more costly package such as AutoCAD, then Draft & Print is definitely one to consider.

STEVE HUDSON

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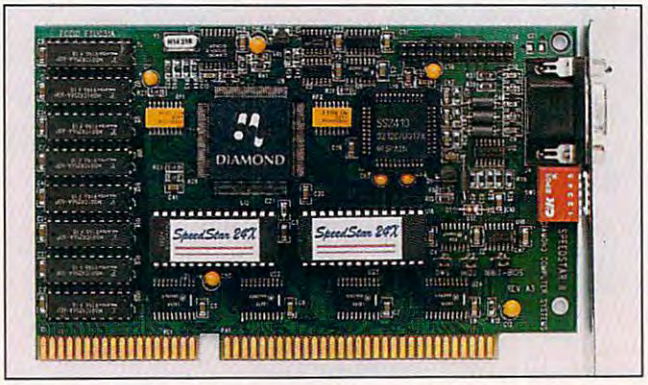
DIAMOND SPEEDSTAR 24X

Diamond Computer Systems' new SpeedStar 24X accelerator represents a minor coup in computer video. Not only does it outperform virtually every accelerator on the market today, but it costs little more than a standard VGA card.



Speed up your graphics with the Diamond SpeedStar 24X, an accelerator card that can dramatically improve performance.

Indeed, at $249 retail—and with street prices under $200—the SpeedStar 24X offers the best price-to-performance ratio of any video card currently available. Not to be confused with the SpeedStar Plus or the original SpeedStar 24, the 24X employs Western Digital's unique WD90C31 chip set to achieve true 24-bit color and blazing speeds. Accelerators based on the ubiquitous S3 chip improve only Windows performance; the 24X hastens DOS applications as well.

On a standard 33-MHz 386 machine, the SpeedStar 24X's Windows benchmark test scores were mediocre—only about 5 times the speed of normal VGA. On a 33-MHz 486 setup, however, the numbers improved dramatically—about 12 times the speed of normal VGA. This ranked the 24X above the fastest accelerators from competitors like ATI and Orchid, and even above the up-and-coming local bus video accelerators.

But numbers don't mean much in real-world computing, so I put the 24X through what I call the Wing Commander test. Origin's Wing Commander II is perhaps the most graphics-intensive game on the market, and it can make even a 486 computer seem slow. On my 33-MHz 386 with a standard VGA card, the animation was jerky and poorly timed with the digitized sounds. The 24X card brought the game to life, making the animation faster and much more fluid.

Another of the 24X's charms is its ability to run Windows in extended graphics modes. Its 24-bit color capabilities allow for a palette of 16.7 million colors in the 640 × 480 mode, and it has drivers for displaying 32,000 colors at 800 × 600, 256 colors at 1024 × 768, and 16

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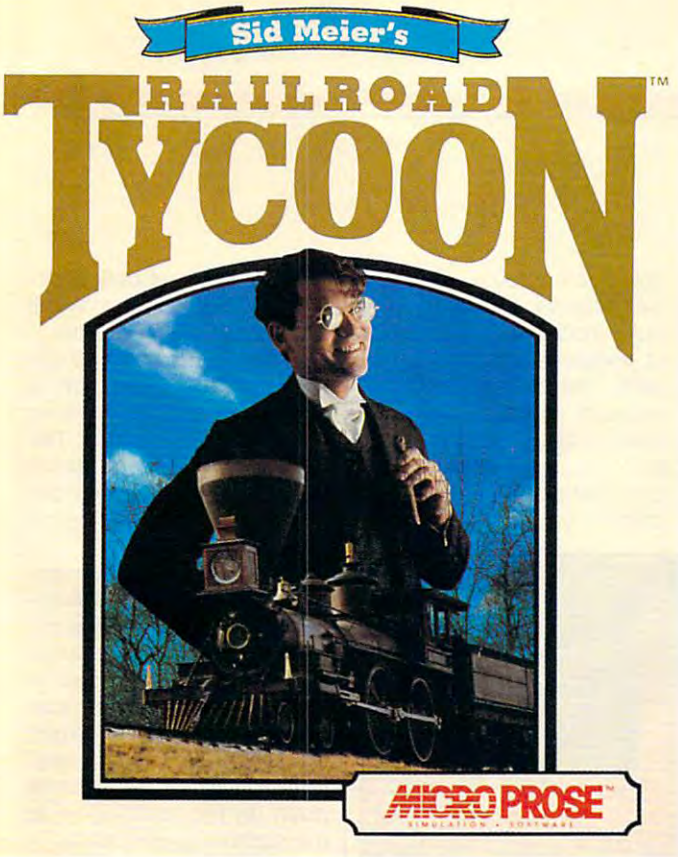

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colors at 1280 × 1024. The 800 × 600 mode is what I use most often, and the 32,000-color driver made Windows glorious to behold. Alas, at least one application balks at the extended spectrum: Aldus PageMaker 4.0 would not load with that driver installed. A quick call to Aldus, however, revealed that PageMaker has inherent troubles with 32,000-color drivers, so the hardware wasn't to blame.

The 24X comes with DOS drivers for everything from AutoCAD to WordPerfect, plus a copy of the Halo Desktop Imager for Windows (an impressive image-editing program) and one of the best instruction manuals I've ever read. The card is backed by a five-year warranty and unlimited technical support. Diamond also maintains a 24-hour BBS for downloading driver updates.

A few technical notes: The initial release of the 24X did not function properly on 50-MHz 486DX machines, but the problem has been corrected. As of this writing, the BIOS on the card is version 1.02. If you have an earlier BIOS, contact Diamond for an upgrade. Currently, there are no OS/2 drivers for the 24X, but a representative at Diamond indicated that the drivers are now in development.

The SpeedStar 24X is the perfect steroid to pump up lackluster video performance. Faster, cheaper, and more flexible than most accelerators, it gives graphics-intensive software new life.

RICK BROIDA

Diamond SpeedStar 24X—$229

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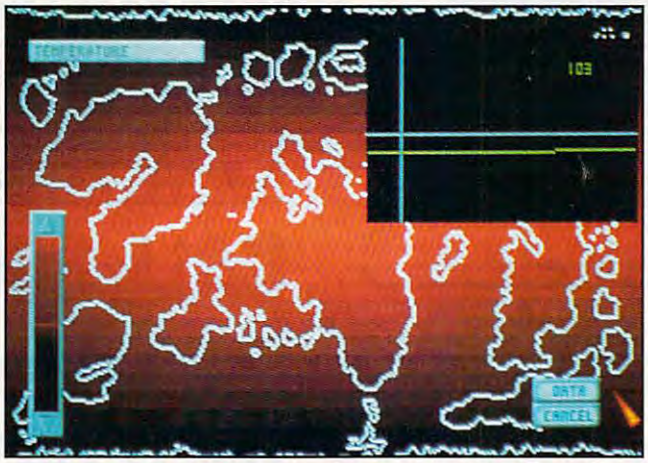
GLOBAL EFFECT

Hell hath no fury like a planet scorned. The popular "god sim" genre takes a pragmatic new twist in Global Effect, a complex game of environmental checks and balances. Would-be leaders can now create, rule, destroy, and save their pixel planets in one fell swoop.



Global Effect, an intriguing simulation with some unfortunate design flaws, challenges you to manage a planet.

Basic gameplay consists of building and managing cities, serviced by waste disposal, fuel sources, power stations, and food and water supplies. The trick is to construct a thriving civilization while maintaining a healthy ecological balance. You must keep population, pollution, and urban sprawl in check, while constantly monitoring environmental data, such as water and air pollution, carbon dioxide levels, ozone depletion, and global warming. The goal is simply to keep this ball of wax alive and well, by whatever means, as long as possible. Because each world is randomly generated, no two games are exactly alike.

Game modes include one player battling an aggressive computer rival and two players connected via null modem link. A plethora of pregame options begins with three fundamental styles of play: create a new world, save a troubled planet, or compete for global domination. In Creation mode, you must choose from a palette of eight predefined world types, including barren, archipelagos, forested, frozen, and mineral rich. There's also a user-defined "green" world, where you control such parameters as temperature, tree density, seismic activity, and fuel/mineral availability. Creation mode offers a fascinating—and often cruel—proving ground for your management skills against a multitude of environmental problems.

Well-weathered players can attempt to save a dying world, by far the game's most challenging segment. With only a limited amount of time, you must bring the world back from the brink in four nightmare scenarios: postnuclear fallout, widespread industrial pollution, global warming, and exhausted natural resources. This advanced mode of play is decidedly not for the weak willed or easily frustrated.

In the final two-player option, leaders compete to rule the world by economic means or military might. The challenge here is to curtail your opponent's advances while maintaining ecological stability.

Battles between conventional forces add yet another element of anxiety: the potential for nuclear exchange and its devastating ecological impact. The military scenario fares best between two human players; the computer opponent is prone to push its big red button at the slightest provocation.

Alas, the designers have corrupted this nearly perfect gaming environment with one unnecessary feature: the power meter. Every player action—from planting a tree to simply viewing updated information—requires power. Poor global management depletes power, while favorable ratings increase it. But the system is too unforgiving. As problems arise, the power available to fix them also decreases. It's an unbalanced, no-win situation, akin to a dog chasing its tail while walking a tightrope. Worse still, when the game ends, players must exit to DOS and reload the program to begin again.

The graphics throughout are handsomely drawn in 256-color VGA, featuring a top-down view of the large scrolling playfield and mouse-driven control-panel overlay. Though it offers detailed descriptions of individual game elements, the 79-page manual includes little in the way of instructions or tips for actual gameplay.

Global Effect is an engrossing, enigmatic work betrayed by its own complexi-

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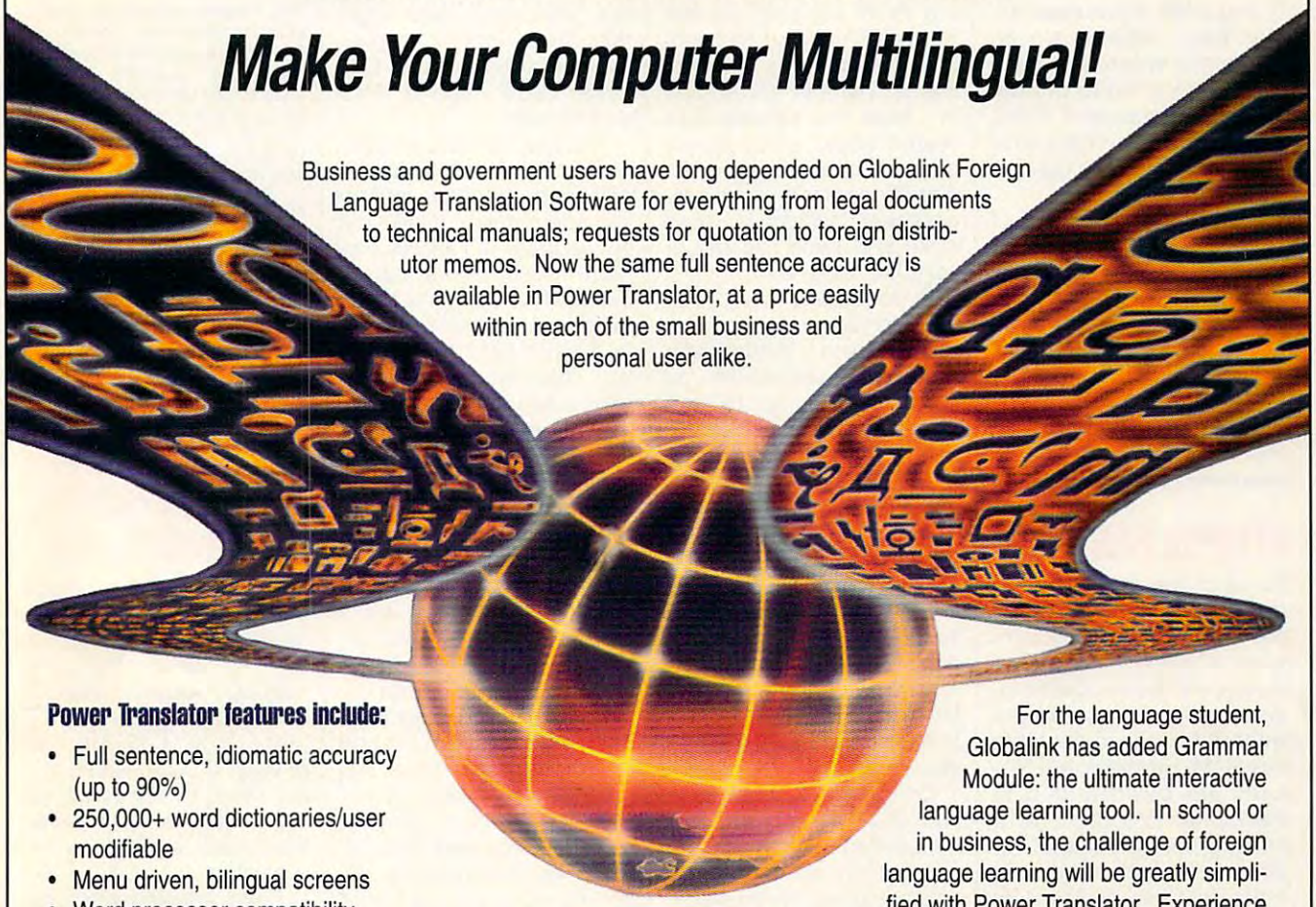

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ty and a few unfortunate design flaws. Tenacious players might eventually enjoy this complex model of environmental cause and effect. All others will find the role of planetary savior a tough job with few rewards.

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ECLIPSE FAX

Some of the most exciting products available today are Windows-based fax software, which in Windows enhanced mode can operate invisibly in the background without taking up valuable free RAM. Revolutionary features are being added to the top fax programs daily, making the volumes of recent reviews that compare these features useless. By the time the articles with comparison grids are published, the software features have changed so much that the comparisons are inaccurate.

One of the most interesting of the industry leaders in Windows fax software is Eclipse FAX, from Eclipse Systems, a new company. The onscreen, antialiasing, "clear view" feature, unique to Eclipse FAX, allows you to preview fine-print faxes without printing them by filling in the rough edges in the fax image displayed on the screen, and even on the printed image.

By setting the Windows printer up as Eclipse FAX and printing from any Windows application, faxing is as easy as printing. Selecting Print will pop up the Eclipse FAX Send Fax window, allowing you to select the fax number and recipient from the Eclipse FAX phone book, enter a new number into the program and phone book, add a cover sheet, schedule send time, and send the fax or save the fax to a file.

By loading a macro with Word for Windows, you can send a fax to a name within the Word document by cross-referencing to the phone book, using the dynamic data exchange feature of Windows. The macro automatically sets the Windows printer to Eclipse FAX prior to sending the fax and restores the default printer after the fax is sent, saving you the trouble of changing printer driver installations every time you send a fax. Unfortunately, this automatic feature only applies to Word for Windows.

Optical character recognition (OCR) allows you to edit incoming faxes and store them as text, which is 10 percent of the storage space required for fax image files. Eclipse FAX data compression of image files saves more disk space on saved image files. The OCR feature is accurate, fast, and versatile, recognizing a wide variety of text fonts, and it has a learning routine that can be used to teach the program additional fonts. The original bitmap of the faxed document can be revealed to help verify OCR accuracy.

Previewed fax documents can be edited and returned to the sender or forwarded to other fax numbers without printing the faxes and scanning them again. You can draw circles or ellipses on the onscreen fax image and type messages with any of the Windows fonts right from the fax-editing toolbar. Toolbar utilities include Cut, Paste, Copy, Append, Find, and Replace.

Eclipse FAX is compatible with Class 1, Class 2, and communications application specification (CAS), but not Send-fax or FAXBios modem control standards. Eclipse FAX supports transmission speeds from 2400 to 14,400 bps. Faxes can be sent immediately or scheduled for a different time, to one recipient or a group of recipients, from an unlimited number of phone books with a maximum of 16,000 entries per phone book.

Eclipse FAX has its own text editor, composes a full- or half-page cover letter, allows for a signature or logo to be added from a scanned image, and supports the use of a second sheet behind the cover letter. The Thumbnail View, available while editing, sorts and organizes multiple-page fax transmissions into one file which can be saved and sent later, rather than the file-per-page method used by other software.

Eclipse FAX has added some vital features in version 1.2, such as compatibility with Class 1 modems and 200-cps OCR support. Onscreen fax editing, an advanced file conversion utility, ease of use and installation, ultrafast processing (almost all tasks are performed much faster than with other packages), a revolutionary and extensive file index and sorting feature, and other advanced features mark Eclipse FAX as a new leader in the fax features race.

ALFRED C. GIOVETTI

IBM PC or compatible; 2MB RAM; hard drive with 1.5MB free; Windows 3.0 or higher (required for sending, DOS receive-only module with Class 2 fax board); VGA or better recommended; supports Class 1, Class 2, and CAS boards; supports Group 3 and Group 4 faxes; supports TIF, PCX, and DCX file formats; Microsoft mouse recommended—$119 ($149 for OCR version)

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I was relieved when neither one came shoehorned into a low footprint case. The MicroExpress minitower case and the Diamond Technologies desktop case let me have a field day installing and swapping cards.

There was a noticeable difference in the feel of the two. In general, the MicroExpress felt better. Its keyboard has a superb touch, the included Z-NIX mouse is sleek and comfortable, and the buttons on the case feel solid and durable. In fairness to the folks at Diamond Technologies, theirs costs approximately $400 less.

Both come with video systems well above basic Super VGA. The Diamond Technologies is equipped with a Diamond Stealth VRAM.

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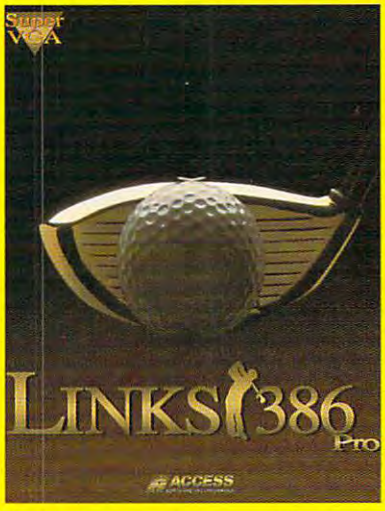

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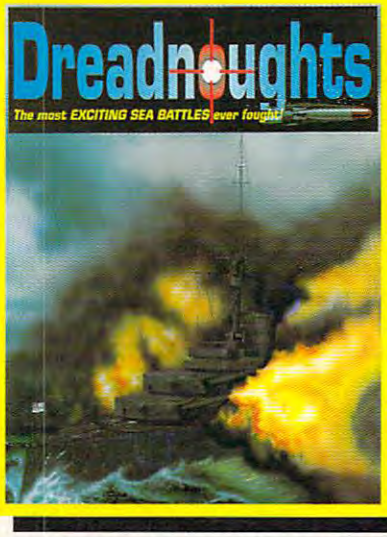

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REVIEWS

These cards are competitive with every nonaccelerator Super VGA card. The MicroExpress comes with an AVIEW Super VGA card with GUI hardware graphics accelerator capabilities.

The 486DLC chip is functionally compatible with Intel's 486SX. Both of these processor types lack the built-in math coprocessor of the Intel 486DX. Cyrix provides a math coprocessor add-on, which, when installed, provides full compatibility with 486DX chips.

Like its Diamond Technologies peer, the MicroExpress ME 486DLC/40 performs well.

You have to ask yourself what advantage you'd gain by buying a 486DLC when 486DX compatibility is so important. One answer is price. The Cyrix alternative is less expensive, even with the math add-on. And many people don't need the math coprocessor functions for the applications they normally run.

There are some other factors besides the obvious. The 486DLC has a smaller processor cache. Intel 486s all have 8K processor caches. The cache stores processor instructions. Keeping 8K of instructions within the processor saves time because the processor doesn't have to go directly to RAM to get the next instruction; it's already within its cache area.

The 486DLC has a 2K cache, and performance is reduced as a result. Fortunately, the performance isn't reduced by a proportional amount. That's because instructions often cause a jump or call to a location so far away that the cache is invalidated anyway.

There is an inherent advantage built into the 486DLC: a faster integer multiplication command. This command is frequently used at the machine level and can dramatically affect performance. The best use is in the area of graphics programming. That's a good area to improve in light of Windows and the proliferation of other graphics-intensive applications.

The best design doesn't mean much if the performance isn't there. But I found both units were up to par. I routinely ran demanding applications from Windows and was satisfied. Math-based programs like Mathematica performed at the same level as on my 486DX.

The MicroExpress has a 256K hard disk cache, while the Diamond Technologies unit has a 64K cache. Most of the performance differences between the two units resulted from this. I compiled identical programs on my own 486DX and these two units, and their performance times were within a few seconds of each other.

I write entertainment software using Super VGA graphics. Manipulating Super VGA graphics makes more demands on microprocessors than practically any other application type. Both of these computers performed at least as well as any computer in my lab. Part of that may be the fine video systems, but a large part of it is a result of the performance of the 486DLC.

Oddly enough, running Norton SYSINFO left me somewhat confused. All of the 33-MHz 486DXs where I work produced a Norton Index of between 70 and 74. The Diamond Technologies computer produced a Norton Index of 65, not too surprising in light of the smaller processor cache size. But the MicroExpress produced a Norton Index of 36. The MicroExpress's performance was good and not at all indicative of the low Norton Index.

Resorting to a benchmark test of my own making, I tested out the claim that the integer multiplication instruction was faster than that of the Intel chips. The 486DXs did 40 percent as many multiply instructions as add instructions. That's just about right, according to the Intel manual. The Diamond Technologies unit did 86 percent as many multiplies as adds, more than twice as good as the 486DXs. The MicroExpress did 100 percent as many multiplies as adds, 2½ times better than the 486DXs.

A technician at Cyrix explained that memory systems and motherboards need to be optimized for the 486DLC chip; otherwise, they perform about as well as 386DX chips. The difference between the two 486DLCs is probably due to system design considerations. If you're considering a 486DLC, you'd be

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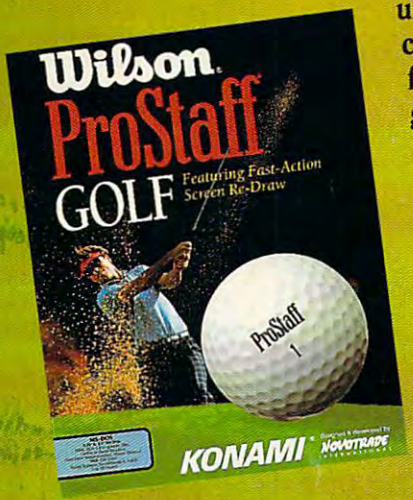

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REVIEWS

well advised to ask the vendor if the system was designed around the chip.

I continued with a benchmark test put out by Chips and Technologies. It measured the number of MIPS (Million Instructions Per Second) for different instruction categories. The results substantiated the low Norton Index I found for the MicroExpress. For almost every category the MicroExpress scored about the same as a 33-MHz 486DX, but lower than the Diamond Technologies.

I ran the PC Benchmark program. It goes through a battery of tests that time the instruction set. The results rated the Diamond Technologies best, the 486DX second, and the MicroExpress third.

The last test I ran was a 3-D benchmark program put out by Virtual Technologies. It goes through a series of 3-D graphics image manipulations. Bearing in mind that the video system has a lot to do with the results, I got the same rating order as with the PC Benchmark test.

Overall, the Diamond Technologies computer outperformed the MicroExpress and a 33-MHz 486DX. The MicroExpress didn't do as well as the 33-MHz 486DX. Given the same processor type, memory speed, and clock speed, that leads me to believe that the MicroExpress wasn't designed as well as it could've been. But since most of my usage involves disk access, the large disk cache made up for the difference. In practical terms, these three computers were neck and neck for real-life applications.

Your decision about whether to buy a 486DLC-based computer will depend on your needs. If price is important and getting every ounce of performance isn't, this might be an alternative to the more expensive Intel 486DX-based machines. After using these for six weeks, I'd recommend them as viable alternatives.

RICHARD C. LEINECKER

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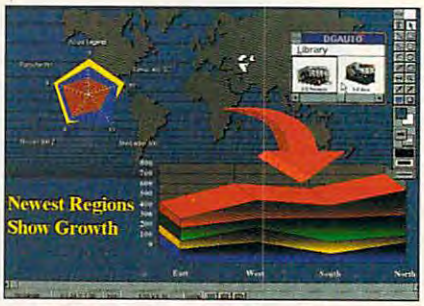

DeltaGraph Professional for Windows features an awe-inspiring array of charts.

many graphing programs on the market. But I've never seen one which even comes close to the scope and power of DeltaGraph Professional for Windows. We're all familiar with line and column and bar and stacked bar and pie charts, but those are just the beginning of this program's repertoire.

Its 2-D options include charts I'd never heard of. A bubble chart, for instance, is a clever way of plotting three parameters on two axes. Suppose you had a set of data on a population giving height and weight and the number of people with those characteristics. A bubble chart could use height and weight as the *x*-axis and *y*-axis, and plot a circle, or bubble, for each data point centered at the proper point, but with the radius of the circle determined by the number of people. To keep the circle radii within bounds, the program uses logarithmic scaling and presents a scale of the radii. Different populations could appear on the same chart by the use of different bubble colors. Novel and striking.

Another chart new to me is the spider chart. This time, suppose you had a set of data on the quality of the water at three different locations, with measurements of a number of constituents such as iron, chlorine, calcium, and so on. The spider chart would have a spoke for each constituent and would plot a point on that spoke for each location. The program connects the points for each location and fills the area defined with a different color for the different locations. The effect is dramatic.

The list of charts goes on and on,

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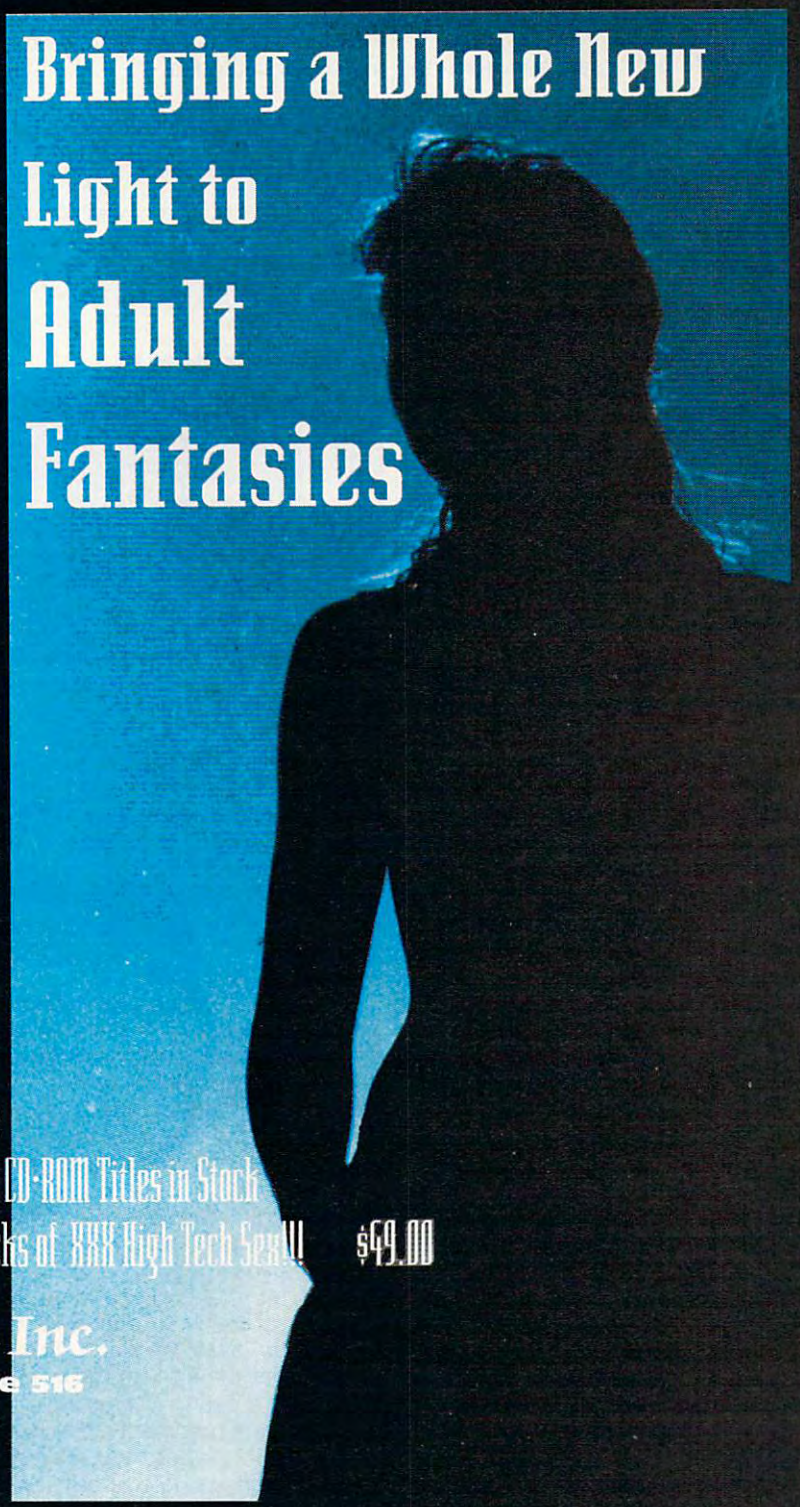

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with 40 different types and 80 subtypes. In 2-D, you can have stacked pie, multiple pie, area, time line, contour line, contour fill, ternary (triangle), polar, and many more, including hierarchy (organizational) charts. If 3-D turns you on, you can have column, ribbon, area, wireframe, surface line, surface fill, X-Y-Z scatter, and more. Even further, if you don't like the view of your 3-D charts, you can rotate them to suit yourself.

For scientific users, DeltaGraph offers six standard curve-fitting routines plus a user-defined option, error bar options, superscripted and subscripted text, and log-log and semi-log axis scaling. The program helps you prepare a slide show, including a stand-alone version, and even includes a spelling checker for the text in your charts. Import capability is extensive. For data, you can import from Data Interchange, dBASE, Excel, Harvard Graphics, Lotus 1-2-3, and Quattro, and export using the Windows OLE and DDE functions. For graphics, you can import from all the popular formats, including AutoCAD DXF and WordPerfect WPG, and export in a number of formats.

DeltaGraph supports both PostScript and Graphics Device Interface (GDI) printing, so you can send your files to a wide range of output devices. PostScript devices include some film recorders and any black-and-white or color laser printer that supports PostScript. GDI devices include all dot-matrix printers; any non-PostScript laser printer; ink-jet, thermal wax, and color GDI printers; plotters; and most film recorders. You can also print a program file directly to disk, creating a PostScript file you can send to a service bureau for printing to a Linotronic or other high-resolution imagesetter.

Program documentation is thorough, with an inch-thick user's manual. The manual includes a brief tutorial; while this doesn't take you through all the options by any means, it suffices to familiarize you with the program features sufficiently that you can explore the other capabilities on your own. With all this power, it's not surprising that the program is voracious in RAM and disk space. The literature is a little misleading in its recommendation of 4MB of RAM and 8MB of hard disk space. To load all the bells and whistles that DeltaGraph offers, you must have 18MB of disk space available.

This is a most impressive program. It left me and others with feelings of admiration and awe. If you have a need for high-quality presentation graphics, DeltaGraph Professional for Windows will not only fill your requirements but also probably suggest some striking creative object modes.

CHARLES IDOL

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Planet's Edge needs a few improvements to become a topflight adventure game.

PLANET'S EDGE

Cast your fate to the stars in this tantalizing sci-fi adventure from the creators of New World Computing's Might and Magic series. Though light years from perfection, Planet's Edge is a minor masterpiece of size, imagination, and diversity of play.

The game's premise is typically far-flung, but engaging. In the year 2045, the earth is visited by an alien vessel of mysterious origin. Nervous military leaders, fearful of the unknown, launch a preemptive strike against the orbiting ship. Though unsuccessful, the attack precedes a violent burst of electromagnetic energy. When the static clears, the alien ship is destroyed, but the earth has vanished.

Scientists stranded on a small lunar outpost scramble to decipher clues found in the alien wreckage. They determine that the earth remains intact, trapped in a cosmic wormhole, victim of a bizarre experiment code-named the Centauri Device. To reverse the earth's enigmatic fate, a duplicate of this mechanism must be assembled. You command a crew of four, searching the stars for eight pieces of the device, scattered throughout eight sectors of deep space.

Gameplay is divided into three basic sections: Moonbase, space travel, and planetary exploration. Lunar facilities include shipyards to custom-design increasingly larger, more powerful rockets. Because supplies are limited, raw materials must be mined or traded and

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then sent to Moonbase for processing into ship parts, weapons, and medical supplies. If a crew member is killed in action, don't fret: Moonbase cloning chambers will fashion another one to your exact specifications. Although rated in 16 attributes, characters cannot increase their skill levels with experience. Character development is one of the most endearing qualities of role-playing games, and its absence will strike many as cold and emotionally distant.

Space travel employs simple, menu-driven interaction among the ship's science officer, engineer, navigator, and weapons/communications station. A central display screen provides a window for manual navigation, planetary surface scans, realtime space combat, and dialogue between ship captains. Diplomacy takes a back seat to firepower, when all hostile alien encounters result in combat.

In the early stages of the game, this questionable tactic is usually one-sided and lethal. Another caveat: Space travel can be dull, especially on repeated trips to distant planets. The ability to multitask navigation with other shipboard duties would add atmosphere to the game and eliminate cabin fever.

Planetary exploration features a three-quarter top-down view of the massive, intricate alien landscapes and mazelike architecture. Here, you must avoid traps, solve puzzles, participate in elaborate schemes, gather information, retrieve items, and engage in tactical combat. The longer you follow the story's delightfully twisted plot, the larger and more challenging the game becomes. Set among approximately 100 star systems, each containing as many as a dozen planets (not all of which are accessible), your quest can be daunting in its magnitude. This section of the game is superbly designed, marred only by a clumsy, limited character interface.

Graphics are tastefully drawn from a 256-color VGA palette, obviously inspired by such groundbreaking titles as Starflight and Breach. Of course, there's always room for improvement: Alien speech, more dynamic combat effects, and even rudimentary character animation would help.

Just to be clear: Computer role-playing zealots need not apply. Those with imagination and tolerance for a few rough spots will find a universe of depth and challenge in Planet's Edge. I can't wait for the next voyage.

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playoffs is to select your game options. Fatigue, injuries, penalties, and fumbles are all options that can be toggled on or off, allowing you to control the game's difficulty and realism. But more importantly, you can choose whether you want to play a strategic game (where you choose the plays and the computer runs them), an action game (where the computer chooses the plays and you run them), or handle both strategy and action yourself.

One of Ultimate Football's slickest options is pass difficulty, which can be set to any of three settings. On the easiest setting, the screen freezes when you decide to pass the ball, giving you a chance to view the possible receivers and choose the one you think has the best shot of receiving. On the hardest setting, you have to handle both the pass and the catch in realtime.

After setting the options, you organize your players in the roster and can even monkey a bit with their speed, skill, and strength attributes. The color editor lets you modify your team's uniform. And if you like, you can even change a player's name or shirt number.

Then, it's off to the field, where men are men and referees wear those silly striped shirts. If you've chosen to coach your team, you select your team's formation and play, after which your players march onto the field for the hike. After the snap, if you're playing offense (and have elected to play the action, rather than delegate it to the computer), you control the player with the ball. If you're playing defense, you usually control the player closest to the ball but can switch quickly to any another player on your team.

As with any sports simulation, the gameplay is fast and furious. Nevertheless, the controls are smooth and handle well. Amazingly, you can control most of a play with only your mouse, eliminating the need to memorize a bunch of keystroke commands.

When you've gotten the hang of the game, the included construction set—which allows you to create, modify, or delete a league—gives you a chance to hone the game to fit your tastes exactly. With the construction set you can create new teams, create new players for your teams, and even edit the contents of your playbook.

With its well-rendered graphics, believable animation, digitized sounds, and smooth gameplay, Mike Ditka Ultimate Football scores a touchdown.

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ZOOKEEPER

Kids love animals, and Davidson's ZooKeeper puts that natural affection to work in a children's game that makes a fun-filled statement about our environment. The game keeps players hurrying from one animal's home to another to foil the efforts of troublemakers who are wrecking the zoo and making it impossible for the scientists there to leave long enough to release an animal back to the wild.

As a player, you begin as a lowly cage cleaner who must take care of the zoo's more than 50 different animals. You must capture the troublemakers who are feeding the beasts the wrong food, littering their habitats, ruining the climate, and upsetting the balance of nature. With every bad deed you right and every troublemaker you catch, Funk E. Monkey pops in to give you little rewards—a passport, sunglasses, even a teddy bear—that you can take along on your ultimate safari to release the animal, once you've seen that the zoo is secure.

Players must not only catch the hoodlums, but they must also clean up the mess, feed animals the appropriate food, and restore the proper climate and habitat. It's not an easy job. It's simple enough to know not to throw raw steak to the giraffes, but should you give those long-necked creatures bark, twigs, sprouts, or all or any combination of the above? And what sort of temperature and humidity should you set to ensure their comfort? ZooKeeper supports all major sound cards, and the game helps you with your choices by providing audible clues. If you select the right food, for instance, a voice calls out "yum!" Select the wrong one, and you hear "blech." There are also animated cartoon characters—the aforementioned Funk E. Monkey and Zoonie the Robot—standing by to give you hints when the going gets tough. Do your job well, and you work your way up to Zoo Master.

ZooKeeper not only highlights the needs of living animals but also calls attention to extinctions. As children track animals through the zoo, they find unidentified footprints that lead to glades bearing plaques that identify extinct animals and tell what happened to them. Lovely scanned-photo images of animals—from the television show "ZooLife with Jack Hanna" (Jack Hanna is the director of the Columbus Zoo) and from *ZooLife* magazine—show the animals as they appear in the wild. Register the product, and Davidson will donate $1 to the William Holden Wildlife Foundation.

The game boasts a hefty hardware requirement that may make it unsuitable for some users. It comes on ten disks. Count 'em, ten. And it consumes a 7½MB space on your hard disk. Installation takes 10 to 30 minutes, depending on your setup. Installing it for a printer with a Sound Blaster Pro, as I did, took the full half-hour. And don't think of running it if your PC has less than 640K of memory or anything less than a high-resolution VGA video system.

Although ZooKeeper is rated for ages 6–11, it isn't an easy game to play. The game's many clues and hints help. But it's still a good idea to keep an encyclopedia or children's animal book around so the kids can look things up. A fine memory for facts you picked up from your last outing to the zoo will also help.

CAROL ELLISON

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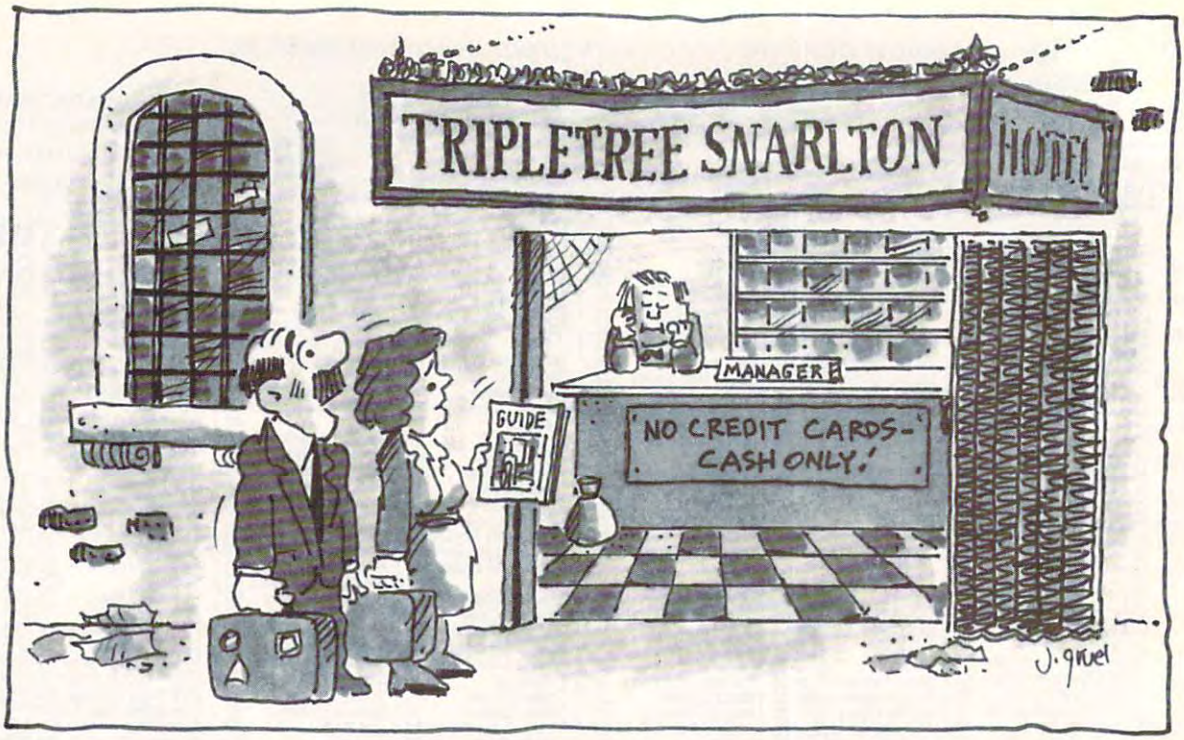

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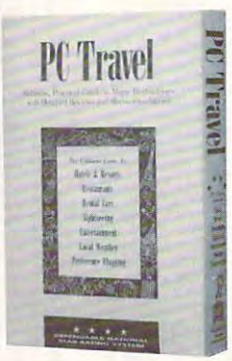

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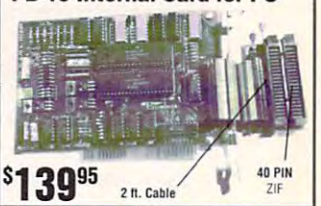

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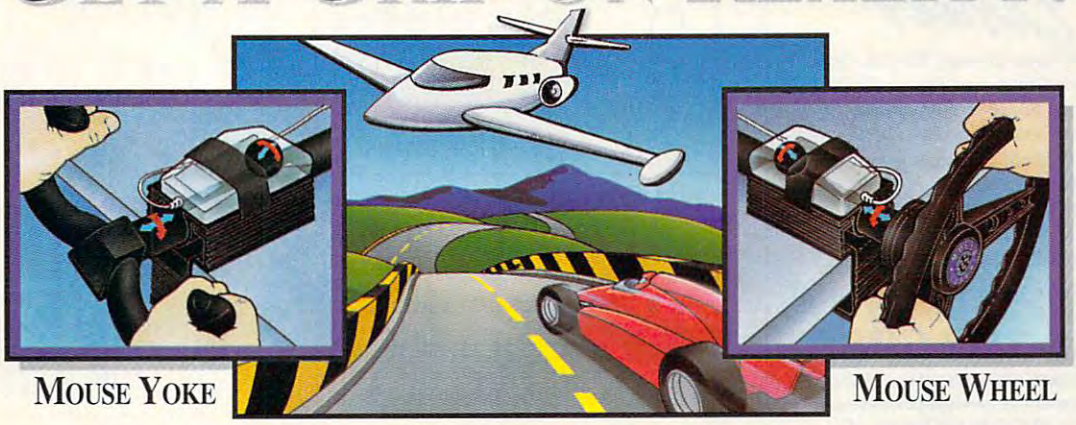

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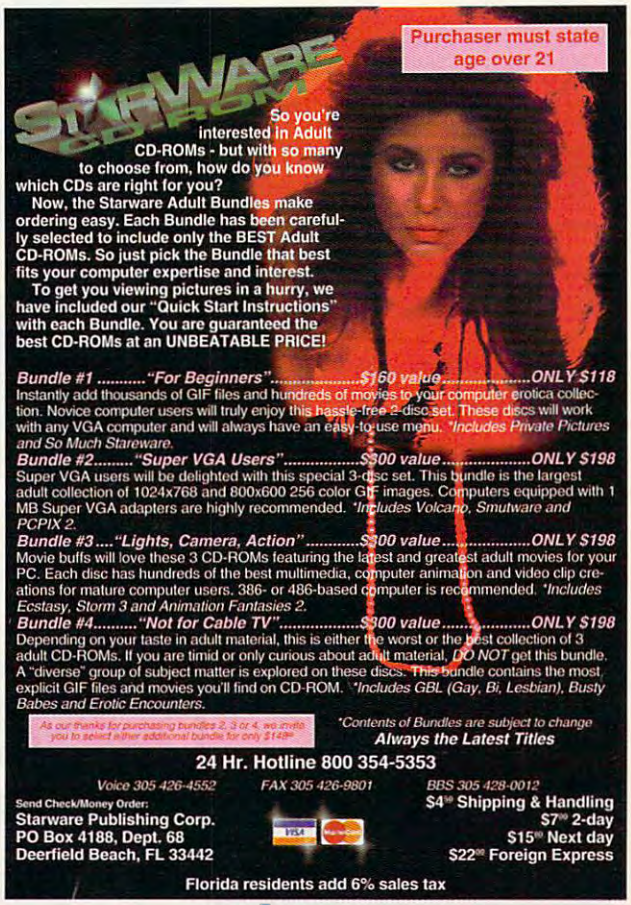

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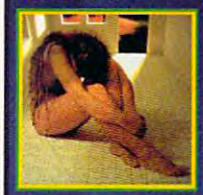

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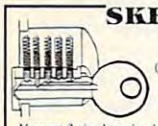

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NEWS BITS

David English

CES HIGHLIGHTS

The latest gadgets and software from the greatest electronics show on earth

What do you get when you combine the world's most surreal city with the nation's largest consumer electronics show? Winter CES, of course. It's when over 90,000 trend followers converge on Las Vegas to see what's new in cellular phones, wide-screen television, satellite receivers, videogames, computer software, and other electronic products.

This year, a lot of the CES gossip focused on the announcement of 3DO (pronounced "three-dee-oh"), a new CD-based entertainment platform that will be available this fall for under $700. 3DO is actually the product of a coalition of four companies: Electronic Arts (the successful computer- and videogame company), Time Warner (the entertainment and cable-TV company), Matsushita (which owns Panasonic and the Hollywood giant, MCA), and Kleiner Perkins (the venture-capital firm that helped launch Lotus and Compaq).

What makes the people at 3DO think their home-CD system can succeed where others have failed? The 3DO box contains a fast 32-bit processor, as well as special chips that independently process the animation, graphics, and sound. The prototype I saw at the Panasonic booth could easily handle high-resolution animation and full-motion video. In addition, the 3DO machine can grab its programs from a cable-TV hookup as well as from its built-in CD drive. 3DO even plans to ship a plug-in board that will bring its technology to the PC.

Other innovative hardware at CES included the UltraSound 3D sound card from Advanced Gravis. Similar to the new Q-Sound technology, UltraSound 3D provides the sensation of 360-degree sound from just two speakers. For example, you might hear an airplane swoop down behind you, pass through your head, and emerge to the front and right of you. I was genuinely confused when they put the motorcycle sound on—I wasn't sure whether it was coming from the headphones or from inside the building. The real kicker was the sound of a dentist's drill, which was almost too painful to experience. Unlike Q-Sound, UltraSound 3D works with headphones. It should be available by the time you read this for $249. According to the company, over 25 software developers will support the new 3-D technology, including Electronic Arts and Sierra.

On the software front, I•MOTION showed Alone in the Dark, which has some of the best 3-D character animation I've seen. As is the case with many of the new games, the backgrounds are bitmapped, while the characters and moving objects are generated with polygons. For this program, the developers combined fast polygon animation with rotoscoping to create lifelike movements. It's available now.

Speaking of advanced 3-D animation, I was surprised to see a first-rate multimedia CD-ROM product from Revell-Monogram, the world's leading manufacturer of plastic model kits. Shipping this summer, Power Modeler uses eye-popping 3-D graphics to help you build exotic sports cars and high-tech aircraft. It comes with one model, but you can easily buy the other models at toy stores and hobby shops. Once you've completed the models, the program lets you race them in its driving and flight simulator games.

Interplay used a 3-D mouse to demo its new multimedia CD-ROM game, StepStone. Like Virgin Games' upcoming 7th Guest, Interplay's StepStone is designed especially for CD-ROM with full-motion video characters, high-resolution backgrounds, and a full movielike musical score. It's truly impressive, and it's scheduled to ship sometime this summer.

Electronic Arts (EA) brought in the world chess champion, Garry Kasparov, to show off his new chess game, Kasparov's Gambit. It has an especially strong tutorial and stunning Super VGA graphics. For a chess game from the other side of the tracks, check out National Lampoon's ChessMeister 5 Billion and 1, from Spectrum HoloByte. It's Battle Chess meets *Animal House*. It's definitely crude, rude, and lewd.

EA is also starting its own line of educational software, called EA*Kids. The five titles cover every age group from 3 to 14 and range from an environmentally correct zoo ride to a program that lets you create your own music videos.

Other exciting software products shown at CES included LucasArts Games' X-Wing (a heart-stopping space-combat game, based on the Star Wars star fighter), Brøderbund's Where in Space Is Carmen Sandiego? (looks like the best Carmen yet), Mallard Software's Air Traffic Controller and Lunar Command (the company's first two stand-alone simulators), Origin's Ultima Underworld: The Stygian Abyss (with a terrific continuous-movement 3-D dungeon), Amtek's Tristan (a dynamite computer pinball game), Spirit of Discovery's Beat the House (the best gambling simulator and trainer), Konami's Air Warrior (the first Super VGA flight simulator), MicroProse's World Circuit (a hell-on-wheels racecar simulator), Tsunami's Wacky Funsters! (5½ arcade-game spoofs that include a Bambi-hunts-the-hunters game), and Maxis's SimFarm (SimCity goes country).

It looks like 1993 will be a great year for consumer electronics, with lots of innovative hardware and software. ❐

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C. Would you classify yourself as a(n) □ Entrepreneur (11) □ Telecommuter (12) □ Moonlighter (13)
□ Corporate Employee who brings work home (14)

D. Which online service(s) do you use? □ CompuServe (15) □ GEnie (16) □ America Online (17) □ Prodigy (18)

E. What other computer magazines do you subscribe to? □ PC/Computing (19) □ MPC World (20)
□ Computer Gaming World (21) □ Home Office Computing (22) □ PC Magazine (23) □ PC World (24)

F. Which Graphical User Interface do you use? □ Windows (25) □ GeoWorks (26) □ Other (27) □ None (28)

G. Total time you spend reading COMPUTE? □ < 30 min (29) □ 30+ min (30) □ 60+ min (31) □ 90+ min (32)

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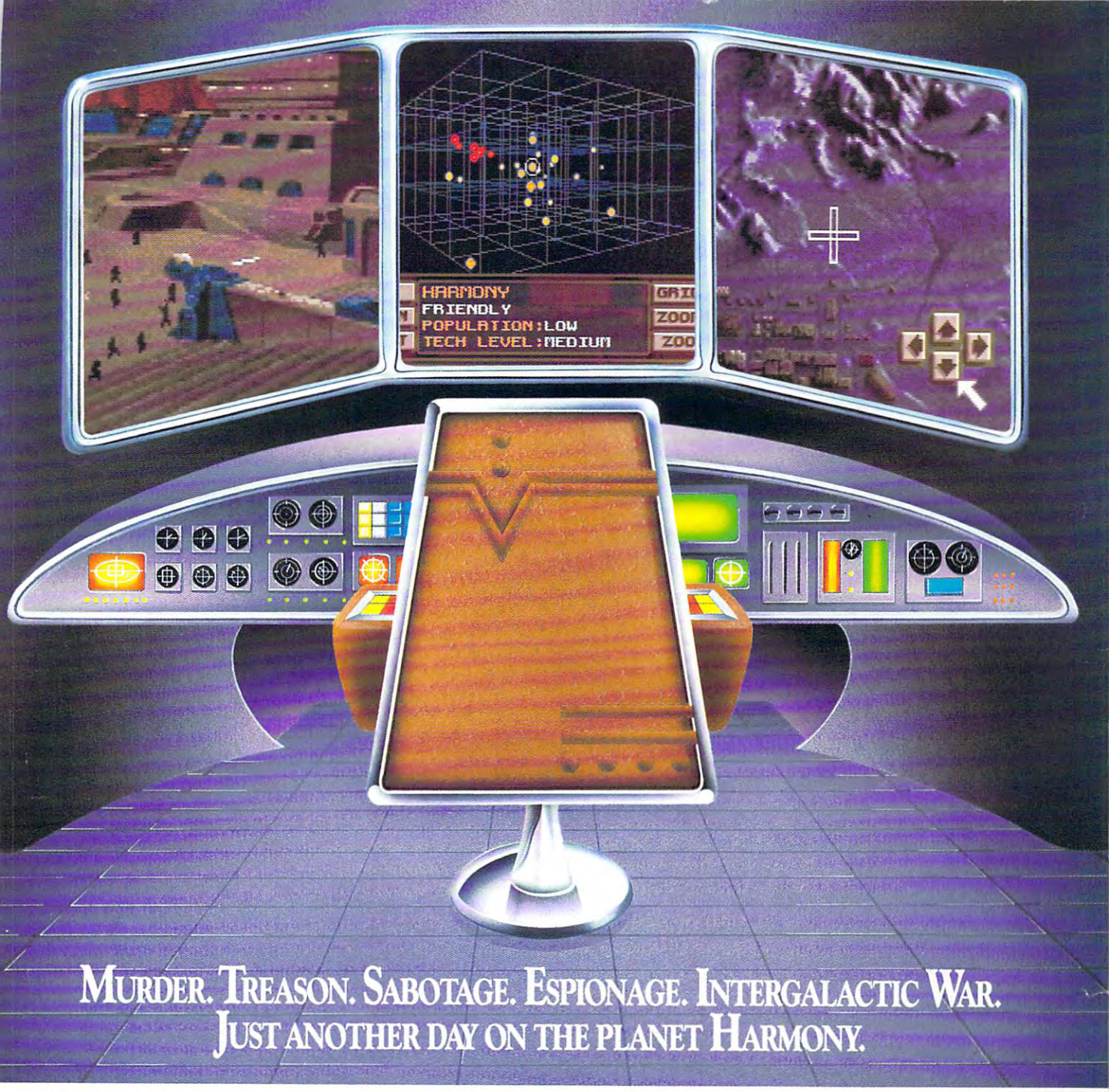

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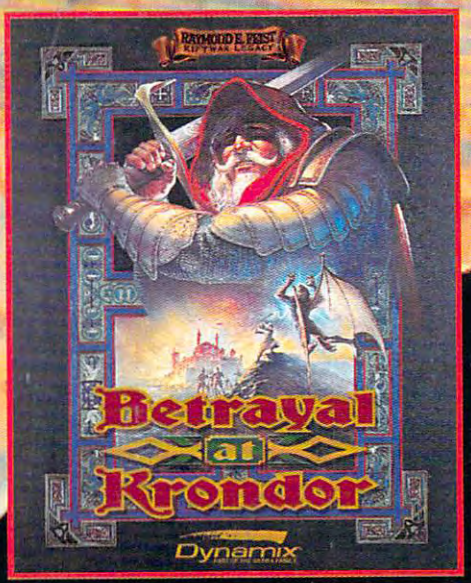

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