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## PATHWAYS

When Dustin Webb was six years old, he wrote a story about becoming an astronaut. "I want to be an astronaut for a job. I will go in a spaceship to space. When I grow up I will walk in space. I will be as fast as I want. Ernie [an imaginary pet monkey] will go with me. He will steer the spaceship. He will feed me and sleep with me. Teach Ernie to talk so I can be understood."

Dustin needed Ernie's help because Dustin has cerebral palsy-he can't walk, talk, or feed himself.

Today Dustin is ten years old and goes to school in a mainstream class in West Chester, Pennsylvania. Dustin's family has never gotten him a monkey, but they've found a better helper-a computer. His family began experimenting with an Apple when he was still a preschooler. Now he communicates with the aid of a Toshiba 1100 Plus laptop, an Artic Symphonix voice synthesizer, and Morse code translation software. Using three switches, one at each hand and one on his head, he can tap out Morse code fast enough to hold a conversation with a patient listener. Dustin is also expert at using a letter board to converse, but his real ambitions are learning to use a keyboard, getting a faster laptop with a hard disk and a better screen, and stepping up to a synthesizer with a more natural-sounding voice.

Kids are fascinated by Dustin's cool electric wheelchair and by his computer. Teachers and other adults are won over by his computer savvy. He has won several awards for writing. In fact, says his mother, Ann, Dustin's abilities are limited only by how well he can use his electronic tools.

Only a few computer companies develop products for the almost 38 million disabled people in the United States (see "Building Bridges" in the February 1990 issue of COMPUTE!). Adapted access or augmentative communication are the aims of those who tailor computer systems to the needs of disabled people. IBM and Apple
have ongoing adapted-access development projects. Apple, for example, provides a "sticky key" program in its Macintosh system software that allows multiple simultaneous keystrokes for one-finger typists.


But it's small companies that produce most of the real-world products. Joe Sullivan of Duxbury Systems in Littleton, Massachusetts (508-4869766), is well known for well-crafted Braille translation software. Another small developer is MicroSystems Software of Framingham, Massachusetts (508-626-8511), which developed the Morse code translation software and some other programs that Dustin uses. Founded by Dick Gorgens, former head of Alloy Computer Products, MicroSystems focuses on networking utilities, developers' tools, and neural networks. But it also offers a line of PC-compatible software, called HandiWARE, that addresses the needs of people with different types of disabilities.

HandiKEY translates input from alternative devices-a mouse, joystick, sip-and-puff tube, headstick, foot switch, or any external switchinto standard PC keyboard input. Scan and select a predefined or userdefined cell on the screen, and Handi-
$K E Y$ types out the word or text string that the cell represents. HandiCODE allows Morse code input from external devices and supports most of the standard speech synthesizers on the market with voice output. HandiCHAT works in a pop-up window and synthesizes voice directly from typed or alternative input.

HandiWORD is a statistically weighted predictive dictionary that works with other HandiWARE programs and most word processors. When you type a letter, HandiWORD guesses the word you want to type and lets you finish it with just a keystroke or two. As you use it, the program analyzes your word usage and makes progressively more accurate guesses.
This significantly speeds typing for Morse, one-fingered, or headstick typists. MAGIC (MAGnification In Color) interactively enlarges part or all of the screen for visually impaired users. The company also sells SeeBeep, a utility for the hearing-impaired that flashes the screen when the computer beeps.

Most of these programs draw on techniques developed years or even decades ago in university labs. Other companies have sold similar products, but their cost has been prohibitive to many potential users. The HandiWARE products are not only thoughtfully designed-easy to learn, easy to use, and well integrated with one another and with other popular applications-they are also inexpensive. Prices range from $\$ 20$ for SeeBeep to about $\$ 200$ for HandiWORD.

A portable system for adapted access that includes a laptop computer, voice synthesizer, alternative input device, and complete suite of HandiWARE software now costs around $\$ 5,000$ to $\$ 7,000$. Prices continue to fall, but even at that cost, it's a negligible expense measured against the freedom that adapted access gives to people like Dustin Webb. With a computer, Dustin and thousands like him are no longer cut off from the world. Instead, they are able to unleash their imaginations upon it.

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## ROOTS

Try a little archaeology. Summer is the perfect time to root around your family tree. You've got time on your hands and a PC in front of you, and summer is the time for family reunions. You've always wanted to pull together the threads that tie you to your relatives, by blood and by marriage. If you're like millions of Americans, you can't help wondering where your family has been, what it has done, and where you fit in.

These are natural questions. We're all fascinated by tales of courage, accomplishment, and tragedy. Most families have their share of these kinds of stories. All it takes is a little detective work to uncover them.

Your home computer may not be able to help you with the footwork, but it can make sense of the intertwining of your lineage. Three PC software packages take different tacks to help you in your genealogical quest. Depending on your level of interest, patience, and budget, you'll find one of these three suitable for sifting through the dust of ages. $\triangleright$

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Fun for the Family Tree Maker For a quick genealogy payoff, you won't find anything better than Family Tree Maker from Banner Blue. This PC program uses a card file interface to cushion you from the rigors of the database. Entering information is fast and painless, primarily because of the program's limited ambitions. It's when you've got your family safely saved to disk that Family Tree really takes root. The name hints at its forte-printing family trees. You won't find any that are more attractive, especially when you use a laser printer. Family Tree is the best choice for the dabbler in genealogy or the beginner eager to see some results. It's also the easiest to use of the three programs reviewed here.

## Boomers are reaching that age when one begins to think a bit more about family and mortality. . .

You can start with anyone in your family, a plus when your notes are disorganized. Each family unithusband, wife, and children-fills one of the onscreen family cards. Here you record such basic information as the date and place of birth, marriage, and death for the parents and the name, sex, and birth date of each child, if any. List a child, and Family Tree automatically creates a new family card with that person as husband or wife.

Family Tree publishes profes-sional-looking ancestor and descendant trees and a funky photo family tree with blanks you fill by pasting in pictures. It's easy to create just the right tree, since you decide how many generations to include and who serves as the trunk. A selection of borders and box styles lets you customize charts even more.

Family Tree is not for the serious genealogist; its database just isn't rugged enough. But for most of us, the program's simplicity and excellent tree making fit our recreational interest in family history just fine.

## Awkward at the Family Reunion

If you are serious about researching your family, have the patience of Job, and don't have a lot to spend, Family Reunion may fit the bill. This is a real database, with enough fields (the blanks you fill in) to overwhelm even the most meticulous researcher. You can record over 100 different pieces of information about each person listed
in your Family Reunion files. But the program is unnecessarily hard to set up and even harder to use. The database has the flavor of the early 1980s, when computer users were hackers and had the time and expertise to get the software to do precisely what they wanted it to do. In fact, the documentation includes a glossary of database terminology. Current programs should do more for us; they shouldn't require much specialized knowledge. The program would be easier to use if its documentation concentrated more on the actual operation of the program and less on secondary matters such as terminology.

Still, Family Reunion has its winning graces. Its price is right, and it can store over 1500 ancestor records on one $51 / 4-$ inch disk. You can define many of the database fields to suit your own needs, and some of the charts and work sheets are impressive. Family Reunion's six-generation ancestor chart isn't fancy-no boxes or borders here-but it's clear and easy to follow. You'll also like the family work sheets, which contain all the basic information about one family, complete with enough room for up to 20 children. You can even print blank work sheets for recordkeeping to take with you on your research trips.

## Professional Roots

The Lotus 1-2-3 of genealogy, Roots $I I I$ is impressive even before you install it on your hard disk. The sheer heft of its manual indicates that it's serious productivity software. It's not empty weight either, for the program is documented from start to finish. Roots III isn't software you'll pick up in an afternoon and be pushing to its limits by nightfall. But it packs the power that top genealogists (and wannabes) require. Everything's here-a nearly up-to-date interface, a powerful database that specializes in lightningfast searches, a tremendous printing and reporting capability, and enough extras to please a professional.

You can enter detailed footnotes, customize several vital fields individually for each entry ( $n$ ot databasewide, an important difference), and quickly update individual records. All kinds of data find a home in Roots. Know the date and place an ancestor was put on a ship's passenger list? Roots has a spot for it. Stumble across a mention of your great-grandfather's bar mitzvah? You can record the date and location in Roots.

Once you've got people in the database, Roots III makes it easy to study their connections. You can display the immediate family of anyone with a key combination, then step through the generation quickly. Or
you can trace the pedigree of an individual or ask Roots III to calculate the kinship of any two people in the database. Roots III prints 14 types of charts and reports, including the scholarly Register and Record Plan formats, three different pedigree charts, a family group chart, and a marriage record report. Roots III can also help you publish your genealogy data in book form.

The power doesn't come cheap. Roots III is by far the most expensive program highlighted here. And though you could certainly grow into its impressive list of features, be sure of your commitment to the hobby of genealogy before steering for Roots.

## Ashes to Ashes, Dust to Dust

It's hard to see how genealogy once got along without computerization. And with baby boomers getting older, expect computer-assisted genealogy to grow even stronger.

Boomers are reaching that age when one begins to think a bit more of family and mortality-two interests that converge productively in genealogy , the study of the passing of individuals and the permanence of families. Conveniently, these are the same people who propelled the PC into everyday use at work and at home. It's a safe bet that genealogy software and online research will become easier and more popular in the years ahead.

Computers make the perfect tools for personal archaeology. Hand me that trowel, please, and my work boots. I've got some digging to do in the late eighteenth century.

## Family Tools

## Family Reunion <br> FAMware

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Salt Lake City, UT 84121
(801) 943-6908

Requires IBM PC or compatible, 512 K
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## Family Tree Maker

Banner Blue Software
P.O. Box 7865

Fremont, CA 94537
(415) 794-6850

Requires IBM PC or compatible, 512 K
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Roots III
COMMSOFT
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Mountain View, CA 94043
(800) 327-6687
(415) 967-1900

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When a gamewright sets out to simulate a real-life situation, one of the toughest challenges he or she faces is the fact that people can compare the finished game against the real thing. Players want a golf simulation to feel like golf (minus the walking); they expect a flight simulator to feel like flying (without having to suffer the drastic consequences of mistakes).

Science-fiction simulations should be much easier, right? After all, nobody's going to be able to hop into a starcruiser and check out what it's really like to explore new planets. The sci-fi gamewright can be lazy and get away with practically anything!

Oh, if only it were so! Unfortunately, almost the opposite is true. The science-fiction audience loves to second-guess the author every step of the way. No matter how great you think your idea is, some reader, or game player, is going to figure out why you're a complete idiot. And then that same reader, or game player, will tell you and everybody else exactly how dumb your inventions are.

Take it from someone wellversed in the trade-you sometimes feel that it's easier to simulate reality than to simulate fantasy.

But, picky and nasty as it sometimes is, the science-fiction audience keeps coming back for more sci-fi games, if only because the computer is the only way the strange and powerful experience of science fiction can be recreated with such immediacy. Boot up your starship, and, for a few minutes, you really seem to soar between the stars.

The roots of starflight games go back to, logically enough, Starflight from Electronic Arts (415-571-7171). Working miracles with CGA graphics, this game gave you the feel of striding through the galaxy, of meeting alien races and either fighting or befriending them. All the while, you searched for the secret of the most ancient aliens-the secret that you had to find in order to save the galaxy. Playing Starflight was like living a grand old
space opera-without the fat lady.
Computer technology has come a long way since then. Star Control from Accolade (408-985-1700) and MicroProse's Lightspeed (301-7711151) are two new entries in the genre that Starflight defined. These two latest entries share several features. Both of them replace the flat, top-down star map of Starflight with threedimensional star maps that rotate in your view, so that you always get a sense that space is high and wide and deep. Both take you hopping from star to star without the possibility of getting lost that was part of the fun-and sometimes the tedium-of Starflight.


And both games give you a chance to compete with alien species in a race to colonize other worlds.

Despite these similarities, though, the games could hardly be more different. Star Control may have Starflight as its daddy, but its mama is the old arcade game Asteroids. In fact, you can skip the whole colonizing routine and just play space combat, with a stunning array of ships to choose from, each with its own particular strengths and vulnerabilities. You can spend hours just discovering different ships, exploring and mastering all of their many features.

When you get into the full game, it begins to resemble a wonderful sort of three-dimensional chess. You move from star system to star system,
searching for worlds to exploit or colonize, fortifying the ones necessary to your supply line. Time passes. Then, suddenly, you find yourself in the same star system with an enemy, and the combat begins. The game never lags, even during the star-map phase of the game. The early phases have a comfortable, unhurried feel.

Geoffrey, Emily, and I have decided that the game is a lot more fun when you play against humans-the computer is just too smart and fast for us. (We haven't figured whether that's because the computer opponent speeds up on my 486 machine or because we're just too klutzy to compete.) When we play against each other, Star Control is a great romp, especially when the viewer's perspective zooms in for close combat and zooms out for wider maneuvering. Dodging planets, swinging around to use our cool new weapons, we get the feel of realtime space combat in a way no other game has ever offered.

Lightspeed, on the other hand, while having a first-rate combat phase, concentrates on exploration and colonization. Like Starflight, it lets you meet aliens and try to make trade or make treaties. What do you trade for? Fuel and spare parts-space combat can really wreck an engine room.

In fact, the most wonderful innovation in this game is that engine room. You'll almost hear Scotty growling, "We're trying to get full power, Captain," as you scramble to steal parts from the blasters to keep the shields up.

Star Control for fast-action combat and chesslike maneuvering; Lightspeed for a fully developed universe and the unfolding of a story. Both games are superb examples of smooth, user-friendly design; both games take you into space with a level of reality that will satisfy all but the most fussy of sci-fi nerds. Yet despite their similarities, they are so different that they prove once again that a good game will always be fresh and new, no matter how many others have already gone down the same road.


The bogey came out of nowhere. You see him just off your tail. The adrenalin hits you like a fist. You call your wingman: "Viper One, I've got a bandit on my six. This is not good..."

The original Falcon ${ }^{\text {nT }}$ F-16 Fighter Simulation was acclaimed for its realism. Now, Falcon $3.0^{\text {Tu }}$ takes this authenticity to the edge. The flight models are real. The terrain is real. The radar and weapons systems are real. And the threats are real. No phony weapons or magic bullets here... just the best civilian F-16 simulation available. You don't just play Falcon 3.0, you strap yourself in and get ready for battle.

You go to afterburner and your Falcon jumps, slamming you back in the seat. The MiG 29 has just reached missile range... There! He's fired, the deadly rocket screams toward you, seeing nothing but the heat of your exhaust. Without thinking, you drop a series of flares hoping to confuse it, and yank back on the stick... 50 degrees... 80... over the top... your Head Up display shows you're pulling $9 g^{\prime}$ s...

With Falcon 3.0, you lead your own squadron of pilots. Your missions are straight from today's headlines: Panama, Iraq, or some other international hot spot. The mountains, valleys, and rivers you fly over conform precisely to military maps of the areas.


You and your wingman begin the aftack, deep behind enemy lines.
... Nearly blacked out, you ease forward on the stick. The g's drop, and you can see again. There he is! You're on HIS six now. This is going to be sweet. As you get tone you know he's yours.

True to the General Dynamics F-16 Falcon, Falcon 3.0 gives you all the exhilaration of flying one of the most advanced fighters in the world. And all the dangers.

Falcon 3.0, from Spectrum HoloByte ${ }^{\text {rTM }}$. If it were any more authentic, we'd be in trouble.

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## ITIAET

## A FIRST LOOK AT FALCON 3.0

Vou stay low after takeoff from King Khalid, eight F16s kicking up dust from the hardtack desert heading north to Basrah. You thread the needle through the known SAM sites in Kuwait and come out the other side OK.

Your AWACS plane, circling safely to the south, locates two Iraqi MiG-23s along your flight path, and you can't resist the targets. You don't have enough fuel for too much "mucking about," as your friends in the Royal Air Force say, but you take the flight to the left a little to try and get a
better angle on the attack. You line up both bogeys before switching your radar to ACM mode and getting a target lock-on. They immediately realize they're in trouble and break hard away, but two AIM120 AMRAAM missiles are on their way. It was a poor aspect angle for a shot, but you're rewarded with one explosion. You blow past the other bogey before he has time to recover and take a shot.

You barely have time to get back on course before entering the target area. You've been picked up by what's left of the

Basrah air defense network, and ZSU 23-mm antiaircraft guns start to hose the air in all directions. A look over your shoulder shows your guys holding a nice, tight formation as you start your run on the target, the National Defense Headquarters building. Switching to ground-mode radar, you line up the building dead ahead and hit the trigger once for target lock. A few more seconds to close the range. . . . You hit the pickle button twice more and feel the release of two $A G M$ 65 E laser-guided Maverick missiles.


COURTESY OF SPECTRUM HOLOBYTE

Pushing the throttle to afterburner stage 2, you accelerate off the target and look back just in time to see your two missiles slam into the front door of the building. That'll be one for CNN! Now, let's see if you can find that other MiG. . . .

## Release the Falcon

Rarely has a flight simulator update been awaited with so much anticipation. Three months before its scheduled release, the Falcon 3.0 message area on the GEnie online network already had well over two hundred messages. Since word first leaked out about its development, there has been an in-
credible amount of speculation (some good and some not so good) about what this simulation is all about. So, rather than start right in on what Falcon 3.0 is, let's talk a little about what it isn't.

First of all, Falcon 3.0 is definitely not just a VGA version of Falcon AT. This is new code-all of it. Both products simulate an F 16 Falcon jet fighter, but that's where the similarity ends.

Falcon 3.0 also doesn't cave in to those who complained that Falcon $A T$ was too complex. If anything, this version is even more complex. But that doesn't mean that the folks at Spectrum HoloByte have ignored the $D$

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## RICHARD

## SHEFFIELD

need-and the market-for entertaining jet combat games as well as serious simulations. Both are provided in Falcon 3.0. But more on that later.

## What It Is

Now let's talk about what Falcon 3.0 is. It's the most complete and accurate jet fighter simulation to be found this side of a security clearance. Period.

There are three areas which must be addressed to make a jet combat simulation accurate: the flight model, the terrain, and the instruments (including target acquisition systems).

Let's look first at the flight model, or rather the four flight models. A flight model is the set of mathematical equations used to simulate the way the aircraft responds to input from the controls and to the various other forces at work during flight: lift, weight, drag, speed, and so forth. Falcon 3.0 gives you four models to choose from with increasing levels of realism (and therefore increasing levels of difficulty).

The first three can be run on an IBM-compatible powered by an 80286 or higher CPU without modification. The fourth model is called the High Fidelity flight model. It requires a math coprocessor chip to operate.

The High Fidelity model is the one Spectrum HoloByte uses in the ASAT (Advanced Situational Awareness Trainer) developed for the Air Force. This is as real as it gets on a desktop computer. But a math coprocessor chip isn't required to enjoy Falcon 3.0. In fact, the subtle differences between the High Fidelity model (which requires the math coprocessor) and the Complex model (which doesn't) will probably be lost on all but the most sophisticated gamers.

## The Right Stuff

Achieving the "feel" of real flight requires more than just a good flight model. You also need a believable world to fly around in. Falcon 3.0 provides three combat areas: Kuwait/ Iraq, Panama, and Israel. The terrain in these $300 \times 300$ mile areas is accurately modeled on topographical maps. Say good-bye to pyramid mountains on a tabletop. The 3-D terrain features rolling hills along with mountains, valleys, rivers, and roads. These features are rendered realistically and can be fully utilized to mask your aircraft from the enemy.

That brings me to the instruments and targeting. The F-16 is, after all, just a complex weapons delivery system. Accurate, realistic, and complex are three words that come immediately to mind to describe Spectrum Holobyte's simulation. With five different radar modes, each with its own


Falcon 3.0 's opening screen.


Searching with an F-16 and an A-10.


A tank's fiery end in a desert battle.
Heads Up Display (HUD), it's no wonder that the designers felt little need for copy protection; the basic act of acquiring a target and firing a missile is almost impossible to accomplish without the keyboard layout (which shows some function for almost every key) and a detailed knowledge of the operator's manual.

Falcon 3.0 will test your skills with many more important radar parameters to keep in mind than ever before. At the same time you will be flooded with information. It will quickly become apparent why situational awareness is a prized skill among the jet pilot elite.

If all this sounds a little overwhelming (it did to me!), not to worry. The designers have gone to great lengths to make all this technology accessible to even the most inexperienced computer pilot. In the process, they have overcome the biggest complaint about the game's predecessor, Falcon AT. Falcon 3.0 is realistic and fun as well. Much more attention has been paid to the game part of the simulation than in previous versions.

## Four Action Modes

There are four modes of gameplay. The Instant Action mode is the first and the easiest. Often referred to as Rambo mode, this simplified version of the game is meant to get the novice up and flying quickly and to compete with other simpler air combat sims such as MicroProse's F-15 Strike Eagle II. In this mode, everything is easier; operating the radar, targeting, and even flying the aircraft are all easy to accomplish with just a few keystrokes to remember. When you start this mode, you are immediately placed in a target-rich environment, and the action is nonstop. Shoot down as many enemy planes as you can before getting killed. See if your score earns you a place in the list of top aces. Fun and action are emphasized over accuracy in the Instant Action mode, but it's a great way to start to learn your way around a very complex piece of software.

The heart of the game is the Campaign mode. The campaigns in each of the three battle areas are logic driven rather than scripted. So rather than have a limited set of missions laid out in a win/lose decision tree (as in Origin's Wing Commander) Falcon 3.0 generates your next mission based on what you accomplished in the previous one. This way no two campaigns are ever alike. Say your mission is to destroy a bridge to keep an armored division from crossing the river into your territory. If you fail, the bridge will remain standing and the tanks will cross. You will have to attack them-on the move and on your soil. Had you been successful, the tanks would've been jammed up on the other side of the bridge and much easier pickings.

There will be eight aircraft flying on your side in each mission (including your assigned wingman), but they may not all be F-16s. In some cases you may be escorting F-15s, B-52s, or Apache helicopters. And you will have to do more than just fly. As squadron leader it will be up to you to choose which pilots fly which mis-

## The Gulf War Connection

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sions. Each pilot will have different skill levels for dogfighting, bombing, and flying ability, as well as a fatigue rating. Each successful mission may improve your skill levels, but if you fly them too often, the fatigue factor will start to set in. This is a real factor to consider, since, like the real pilots in the Gulf War, your squadron will be expected to fly three sorties a day.

The Red Flag mode is billed as a training tool. Still under development when I visited Spectrum HoloByte, this mode is designed as a scenario generator that lets the player use a simple editor to place enemy air and ground forces. If it's developed as planned, this mode could be used in conjunction with the three battle areas to re-create many actual air battles of the last fifteen years-and to create new ones.

Communication mode allows two players to fight head to head or to fly together in a joint mission as part of a campaign. This first release in the Electronic Battlefield Series (EBS) supports direct connection, a modem, and possibly even a Local Area Network (LAN). Future additions to the EBS will allow you to fly cover for A-10 attack planes (Avenger A-10) or close-air support for a group of M1 Abrams tanks (Tank). And there continues to be discussion about a multiplayer version of the EBS to be played on one of the online networks.

## Setting Up the Hardware

The hardware requirements to run all of this are heavy. The $12-\mathrm{MHz}$ AT isn't the target market; it 's the absolute minimum. And a good bit of extra memory set up as EMS is required to run many of the features. Digitized sound, the VCR-like flight recorder, the 3-D TACTS (Tactical Aircrew Combat Training System) cube, and modem play all require EMS to function. EMS can also run some of the game's graphics to speed up the screen frame rate. If it comes to a choice between EMS and a math coprocessor upgrade, EMS is the clear winner. Not only is extra memory cheaper, but it buys you a lot more game enjoyment.

Based on the preliminary version of the software I tested, there are still a few unknowns. First is the artificial intelligence programmed in for the enemy aircraft. It's difficult to reach a good compromise between too hard to kill and too easy. Also yet to be seen is how this game performs on slower AT computers. There will be ways to decrease the detail level to improve speed, but it remains to be seen whether speed really improves enough to make the game playable. And if it is fast enough, do you lose a lot of enjoyment along with the detail level? We'll have to wait for the final version to find out.

All in all, it's hard to think of anything that's been left out of Falcon 3.0. It has an engaging campaign mode, modem support, a slick interface with animated sequences, a selection of flight models, and more bells and whistles than you have keys to operate. And as for realism, for once software lives up to its publicist's claim in the press release: "If it were any more authentic, we'd be in trouble."

IBM PC AT and compatibles, EGA or VGA; supports Ad Lib, Sound Blaster, Roland, and Tandy sound cards-\$69.95

## 64/128 VIEW

|  |
| :--- |he results are in and tabulated for the 1990 Gazette Readership Survey. Thanks to all of you from around the world who took time to participate. We published some preliminary figures last month; now we'll look at the final figures.

It's interesting to note that 77 percent of you own a 64 and 42 percent own a 128. Looking back at results from previous surveys, these figures have changed little over the years. (Since many readers own more than one computer, the figures total more than 100 percent.)

It looks as though 20 percent of you are planning to buy another computer this year. Early figures had 28 percent of you moving toward IBM or its clones, but as surveys continued to arrive, that figure topped out at 38 percent. The big surprise is that 24 percent of computer shoppers say they'll buy a 128 . Another 18 percent plan to buy a 64,16 percent plan to buy an Amiga, and 4 percent say they'll buy a Macintosh.

The survey reports that 59 percent of you own modems and 25 percent of you use them to access a commercial online service. QuantumLink, which is Commodore-specific, is the service of choice for 50 percent of those reporting. CompuServe is next with 13 percent. Many readers reported calling local bulletin boards and smaller services. At least one reader taps into the St. Louis library computer five hours a month, and another spends at least half an hour a day logged on with the Albuquerque Tribune newspaper.

A joystick is the most frequently owned peripheral ( 93 percent), followed by a dot-matrix printer ( 84 percent), a modem ( 59 percent), a mouse (49 percent), an REU ( 36 percent), and a letter-quality printer (26 percent).

Subscribers to the magazine account for 89 percent of those responding. Of the 8 percent who get Gazette on newsstands, I hope those who live in this country have heard that now it's only available by sub-
scription in the U.S. Friends pass their copies on to 2 percent, and the remaining fraction get the magazine some other way.

Those with family incomes of less than $\$ 20,000$ account for 3 percent of the replies, and those with family incomes of more than $\$ 100,000$ account for 2 percent. The biggest share ( 40 percent) falls in the $\$ 30,000$ to $\$ 50,000$ range. Advertisers like to know how wealthy readers are. I hope they'll take notice that 96 percent of you say that you'd be interested in buying 64/128 disk products at affordable prices and that Gazette ads affect 83 percent of you. A whopping 97 percent of you buy computer products by mail, with 3.6 products per year the average. One person (in the $\$ 100,000+$ category, naturally) says he buys at least 40 titles a year.

The majority of Gazette Disk subscribers ( 63 percent) are satisfied with the product, but many of you said you'd like for us to lower the price. In case you haven't noticed, we've recently done just that. The subscription price is now $\$ 49.95$, down $\$ 20.00$ from last year. That's about $\$ 4.00$ a month for 12 disks and magazines. PC and Amiga Resource Disk subscriptions cost the same, but subscribers get six disks for that price.

Many of you (40 percent) want more GEOS coverage, 24 percent don't, 24 percent are undecided, and 12 percent didn't answer.

Finally, what about our new format? Since October we've received a lot of mail about our new look. Some of you have praised it; others have expressed disappointment. At least one reader threatened legal action unless we returned to the old format. We were curious what readers in general would say when asked their opinion. According to the survey, 40 percent of you like it, 29 percent don't, and 31 percent are undecided.

Next month we'll discuss what all these figures tell us and how they'll affect Gazette in the future. Once again, thanks for sharing your comments and suggestions with us. $\square$

CONIENTS64/128 View TOM NETSEL
Gazette Readership Survey results are tabulated.

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MORTON KEVELSON Digitize graphics with Video Byte and ComputerEyes.

## Keyboard Art <br> DON RADLER

Low-resolution art may not get much respect, but it's fun.

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## Welcome to Metropolis

Metropolis is an online service for adult interactive-game enthusiasts, now available on Minitel ( 2900 Westchester Avenue, Suite 101, Purchase, New York 10577). Presented as an imaginary city rather than a database of services, Metropolis offers a wide range of interactive entertainment, including 21 multiplayer games, shopping, messaging, and chatting. The city contains Citizens' Directories, a Visitor's Centre, a Communications Centre, a Recreation Centre, and a Library.

For more effective interaction, Metropolis offers more than 75 action commands that include the use of body language and the expression of feelings and emotions. Subscribers can blush, dance, pinch, pout, whistle, whimper, scream, shrug, and create their own action commands.

Metropolis costs 16 cents per minute in the U.S. and Canada, but it can be reached by users in more than 20 countries. It's just one of the many online services offered by Minitel's worldwide network. Call (914) 6946266 for free "Getting Started" software for the 64 or IBM.

## Fly a Dragon

If you liked playing Dragons of Krynn, you'll love flying them into combat in DragonStrike ( $\$ 39.95$ ) from SSI ( 675 Alamanor Avenue, Suite 201, Sunnyvale, California 04086).

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## Seek and Destroy

Put on your camouflage fatigues and test your mapping skills with Metal Gear (\$14.95), a new release from Ultra Software (900 Deerfield Parkway, Buffalo Grove, Illinois 60089), a subsidiary of Konami.

Wind through five levels as you search for 20 special weapons and equipment to seek and destroy the title character and end the terror spree of the evil CaTaffy. Discover the weapons and equipment in enemy trucks and storehouses, or get them from certain soldiers of fortune.

As you try to capture weapons in your quest to rescue hostages, little do you realize that CaTaffy has unleashed against you the most powerful weapon of them all: Metal Gear. Luckily, you do have a few high-tech allies.

Your most vital tool is your transceiver, which lets you communicate with Commander South, who is at Fox Hound's Headquarters and feeds you crucial information on Metal Gear's location. The mission ends when you destroy Metal Gear-or he destroys you.


## Far Out

Far Out by Jack Modjallal of Encino, California, is this disk's Picture of the Month.

Welcome to "Gazette Gallery." Each month Gazette Disk features a collection of the best $64 / 128$ artwork submitted by our readers. We pay $\$ 50$ for each piece of art we accept and an extra $\$ 50$ for the one selected as Picture of the Month. Send original art to Gazette Gallery, COMPUTE Publications, 324 West Wendover Avenue, Suite 200, Greensboro, North Carolina 27408.
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## VIDEO DIETIIZERS



> WANT A QUICK AND EASY WAY
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f you're the type who can operate a camera but has trouble drawing a straight line, you'll appreciate a digitizer. With a digitizer and your 64 , you can create your own custom graphics without having to master a drawing or painting program.

A digitizer is an electronic device which can convert a photograph, drawing, or video image into digital data (binary numbers) that can be stored and manipulated by your computer. These images can then be sent to a printer, combined with documents, or used as you'd use any other computer graphic.

There are two types of digitizers available for the 64 . One is a scanner, an optical device used primarily for digitizing artwork, photographs, or other flat or printed material. (See "Take a Scan at This," an article about the Handyscanner 64, in our December 1990 issue.) The other type-the kind we'll examine in this article-works with a video signal, such as you might get from a video camera.

Video digitizers that operate with the 64 are not finicky; they'll accept a standard composite video signal from just about any video source, including camcorders, VCRs, and laser-disc players. Users must supply their own cameras or other video sources with the digitizers examined here.

Digitizers discussed in this arti-cle-ComputerEyes from Digital Vision and Video Byte II from the Soft Group-consist of cartridges that plug into the 64's user port, appropriate software, and instructions.

As a video signal enters a digitizer for processing, it requires from several seconds to as much as two minutes to digitize an image. These currently available video digitizers for the 64 are of the slow-scan variety. Even three seconds is a relatively long time in the video world, since a standard video display is completely updated at a rate of 30 frames per second.

If you work with either of these, in view of their slow-scan operation, a good freeze-frame feature on a VCR would be helpful. Since these digitizers work in black-and-white, a lowcost security camera would be a good choice for a video source. A simple black-and-white camera may even have a higher resolution than any of the color sources mentioned above.

## ComputerEyes

ComputerEyes consists of a hardware module, which plugs into the computer's user port, and supporting software on disk. Input of a video signal is through a standard RCA-type phone jack located on the side of the module's case. Two adjustments are provided; the first synchronizes ComputerEyes to your video source. This setting is easily done with the help of the supporting software. The second adjustment compensates for the brightness of the image or the intensity of the video signal. This rather sensitive setting has a direct bearing on the overall appearance of the image. A special scan mode lets you make a coarse adjustment of this control. The fine adjustment will have to be done very carefully by trial and error during the actual digitization process for best results.

The menu-driven software lets you capture an image in several formats. A single scan digitization creates a high-contrast black-and-white image in about six seconds. Four-level and eight-level captures can also be performed, requiring about 25 seconds and 50 seconds to complete, respectively.

All of the images are pure 8000byte bitmaps in the 64's high-resolution mode, which results in an image that is 320 pixels wide by 200 pixels high. The separate color data, which is always black-and-white, is not saved to disk; instead, the gray levels are generated by dithering the pixels. This type of bitmap image is well suited for printing with a dot-matrix printer.

Although you can use the digitized images in your own programs, the basic ComputerEyes software doesn't save the images in a format compatible with any of the commercial graphics packages available for the 64. To generate a compatible file format with ComputerEyes, you'll also have to buy one or more of Digital Vision's compatibility modules.

Compatibility modules are available for a variety of graphics programs. The high-resolution modules support Doodle- and Flexidraw-format files. These modules add lowcontrast and high-contrast capture modes to the three modes already built into the basic software. These extra capture modes make use of all five of the 64's gray levels (black, white,


This is a ComputerEyes four-level capture in Koala format.


Here's a ComputerEyes eight-level capture in Doodle format.


The GEOS ComputerEyes driver is available from Quantum Link.


Video Byte can capture an image in about three seconds.


Video Byte can create pseudocolor images in Koala format.
and three shades of gray). Since these modes don't rely on bitmap dithering to generate their shading, they have more detail and finer gradation than the basic capture modes.

The multicolor module supports the Koala file format. Images in the 64 's multicolor display mode are only 160 pixels by 200 pixels. The 64 trades off the lower resolution of the image for greater color flexibility in the display. As a result, the gray-scale captures in Koala format can produce a more natural-looking screen display than any of the high-resolution capture modes.

ComputerEyes compatibility modules are also available for capturing clip-art images that can be used with The Print Shop and The Newsroom page-layout programs. GEOS users have access to what is arguably the best ComputerEyes compatibility module. The GEOS ComputerEyes driver, which was created by Berkeley Softworks, is available for downloading from Quantum Link, or on disk from Geoworld magazine. This driver creates super bitmaps that are 640 pixels wide by 400 pixels high. The images are saved to disk in geoPaint format. Three scan modes àre available: a high-contrast black-and-white mode, a four-level dithered gray-scale mode, and an eight-level dithered gray-scale mode. The four-level and eight-level modes produce images that print out very well. Scanning times are approximately 20 seconds, one minute, and two minutes, respectively, for the three GEOS capture modes.

If you're interested in buying ComputerEyes, you'll have to hustle to get one. Digital Vision has indicated that it's ceased production of the 64 version of ComputerEyes. It will no longer be available once the current stock of hardware and software runs out, although Digital Vision will continue to provide user support as required. Used cartridges should be available from private sources.

## Video Byte II

Video Byte II from the Soft Group consists of supporting software and a standard-size 64 cartridge that plugs into the computer's user port. The video signal is fed in via a three-foot length of shielded cable, which terminates in a standard RCA-type phone plug.

There are no external adjustments, since the unit comes preset from the factory for a standard video signal. The lack of external adjustments could be a problem if your video source is slightly out of calibration. One solution is to buy a low-cost video enhancer to adjust the level of the signal. If you're the adventurous sort
and don't mind violating your warranty, you can pry open the Video Byte plastic cartridge to make adjustments. Inside are both coarse and fine adjustments for the video signal level.

The menu-driven software lets you capture an image in only the multicolor format, which is 160 pixels wide by 200 pixels high. The initial scan is in black-and-white, using four of the five available gray levels (black, white, and two shades of gray). The image capture time is only about three seconds. The short scanning time makes it possible for Video Byte to digitize live video if the action is relatively calm.

The software lets you adjust the overall tone of the image by shifting it into the third shade of gray. The software can also generate pseudocolor images by cycling through the 16 available screen colors. Colors can be cycled either one at a time or with all four colors at once. The digitized images are saved to disk in Koala format.

Video Byte can keep two digitized images in memory at once. The color map of the displayed image can also be stored for subsequent recall. This lets you quickly restore the original appearance of the image in case you've drastically modified it by the program's color controls.

## Conclusions

ComputerEyes and Video Byte II produce comparable images in multicolor format, which are suitable for display on the monitor or for modification with a paint program. Video Byte's three-second capture makes it the one to use for digitizing live video. ComputerEyes is the more versatile unit, as it supports both of the 64's graphic display modes and a variety of file formats. GEOS users in particular will find that ComputerEyes can be a good source of clip art for their projects.

On the other hand, Video Byte is still readily available and sells for about $\$ 50$ less than ComputerEyes. For the money you save, you might want to invest in the Soft Group's Explode V. 5 cartridge. This disk drive and printer cartridge allow you to print pictures both in color and sideways on your color dot-matrix printer.

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## K円YBOARD

11 graphics are not created equal. High-resolution and multicolor graphics get all the praise and respect, but what about low-resolution (lo-res) graphics? They're the Rodney Dangerfield of graphics.

Lo-res graphics may not get much respect from serious computer artists, but they can be fun. Lo-res art is not as beautiful or as complicated as hi-res and med-res art, but it's quick and easy on a 64 or 128 , and it's right there on your keyboard.

The standard letter and number keys provide 40 or so characters, in-cluding,,$+-<,>$, and /, but there are another 56 graphics characters available to Commodore users. These symbols, which you see printed on the front of many keys, can be accessed by pressing either the Shift key or the Commodore key while depressing the desired key. For example, in immediate mode you can create a circle by pressing the Shift key and the U and I keys, pressing Return, cursoring up to the line just beneath the semicircle you've just created, holding down the Shift key again, and pressing J and K to complete the circle.

Screen-capture programs such as Printmaker (COMPUTE's Gazette, January 1986) and Screen Store (May 1990) can be used to design a lo-res display. For many beginning programmers, however, the simplest approach could be typing the graphics directly into a BASIC program.


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Let's create a simple face to begin with; then we'll try something larger. Start by creating six lines of print statements with ten spaces between the quotation marks. Type in the following line and then press Return.

## 10 PRINT"(10 SPACES)"

To quickly duplicate this line, cursor up to the 10 , type 20 , and Return. Repeat this process, changing the number each time, until you have six lines numbered $10-60$.

Now list your program. These six blank lines will be your workscreen for creating a lo-res drawing. Cursor up to line 10 , and just to the right of the first quotation mark, hold down the Commodore key and press A and then S . Cursor to the right five spaces and press Commodore-A and Com-modore-S again. Then press Return. These will be our face's eyebrows.

On line 20, start to the right of the first quotation mark and press Shift-U and Shift-I. Cursor five spaces to the right and press Shift-U and Shift-I again, followed by Return. These will form the top halves of the eyes.

On line 30 , complete the eye by pressing Shift-J and Shift-K. Then move one space followed by a ShiftM, a space, a Shift-N, a space, and then Shift-J, Shift-K, and Return.

On line 40 we'll continue the nose. From the first quotation mark, cursor over four spaces and press Shift-Y, space, Shift-T, and Return.

On line 50, move in four spaces and press Shift-J, space, Shift-K, and Return to complete the nose.

On line 60 we'll create a mouth by moving in two spaces from the first quotation mark and, while depressing the Commodore key, pressing $\mathrm{Q}, \mathrm{E}$, R, E, R, E, and W. Then press Return.

By this time you should be able to see the simple face you've drawn in the listing. Now run the program and see if a face appears. In case you got lost in the previous instructions, here's the listing in our usual format.

```
KR 10 PRINT"{A}{S}{5 SPACES}
        {A}{S} "
BC 20 PRINT"UI{5 SPACES}UI "
SH 30 PRINT"JK M N JK "
EF 40 PRINT"{琣 SP\overline{ACES } Y T}
        {4 SPACES}"
MH 5\emptyset PRINT"{3 SPACES}J K
    {4 SPACES}"
GQ 60 PRINT",{Q}{E}{R}{E}{R}
        {E}{W}{2 SPACES}"
```

With a few simple modifications, a FOR-NEXT loop, and a delay to slow the action, you could easily make the face blink its eyes or change its expression. You might want to try adding color to your design. This will
require heavy use of the Inst/Del key. Doing a drawing in this order, however, keeps it from getting too confusing when you start to modify it. Of course, text can be added at any point to turn your sketch into a title screen. Touches like these are limited only by your imagination.

Now let's try a bigger example by drawing a polar bear. First, set up 20 lines of print statements as you did earlier, but this time start from 130 and insert 25 spaces between the opening and closing quotation marks. By keeping the line length less than 40 characters, we'll prevent confusion with wrapping lines.

As before, instead of typing in each line 20 times, just cursor back and increase the line numbers by 10 each time, pressing Return after each one. This will give you a screenful of print statements on which to create your lo-res drawing.

Now go back to line 130 and begin typing in the items listed between the quotation marks. The picture may be difficult to discern from this listing, but it should appear in your print statements as you type them in. The Shift key and the Commodore key are used quite frequently.

HH 100 POKE53280,15: POKE53281, 15
BF 110 REM BY DON RADLER
RG 126 PRINT" $\{C L R$ \} \{DOWN\} \{6 SPACES\}POLAR BEAR \{DOWN\}
CM 136 PRINT"\{6 SPACES\}N\{U\}N $\{4$ Y $\}$ M $\{U\}$ M $\{8 \text { SPACES }\}^{"}$
KF 140 PRINT" ${ }^{\prime}\{6$ SPACES $\} M N$ \{ 6 SPACES \}MN\{8 SPACES\}"
BH 150 PRINT"\{7 SPACES\}$\{H\}$ NP \{2 SPACES \}OM $\{\mathrm{N}$ \} (9 SPACES\}"
 \{2 SPACES $\}$ M 0 \{N $\}$ \{9 SPACES ${ }^{\text {" }}$
CM 170 PRINT" $\{7$ SPACES $\}$ \{H\} \{2 SPACES\}UI\{2 SPACES\} \{N\}\{9 SPACES $\}$

BA 180 PRINT" $\{7$ SPACES $\}$ M $\{2$ SPACES $\}$ JK $\{2$ SP̄ACES $\}$ N (9 SPACES $\}^{" 1}$
RX 190 PRINT" $\{6$ SPACES $\}$ N $\frac{M}{5}$ JK \{SPACE\}N M\{8 SPACES ${ }^{\text {S }}$
bC 206 PRINT"\{5 SPACES\}N $\{3$ SPACES $\}\{Y\}$ PO $\{\bar{Y}\}$ \{3 SPACES $\}$ M $\{7$ SPACES $\}$
QC 210 PRINT"\{4 SPACES\}N \{12 SPACES\}M\{ 6 SP̄ACES\}"
AJ 226 PRINT"\{4 SPĀCES $\}$ \{H\}
\{3 SPACES $\}$ \{H\}\{4 SPACES\}
\{N\}\{3 SPACES\}\{N\}
\{6 SPACES\}"
QJ 236 PRINT"\{4 SPACES $\}$ \{H\}
\{3 SPACES \}M\{4 SPACES\}N
$\{3$ SPACES $\} \bar{\S} N\}\{6$ SPACE $\bar{S}\}$
HK 240 PRINT"\{4 SPACES\}\{H\}
$\{4$ SPACES $\}$ M $\{2$ SPACES $\}$ N
$\{4$ SPACES $\} \bar{\S}\}\{6$ SPACE $\bar{S}\}$
GH 250 PRINT" $\{4$ SPACES $\}$ \{H\}M
\{2 P\}\{2 SPACES $\}$ MN
$\{2$ SPACES\}\{2 P\}
\{6 SPACES\}"
AM 260 PRINT" $\{4$ SPACES $\}$ M
$\{3$ SPACES $\} M$ \{M\}\{ $\boldsymbol{H}\}$ N
$\{3$ SPACES $\} \frac{\bar{N}}{13}$ @ $\}$
\{2 Spaces $\}^{"}$
XB 276 PRINT" $\{2 \mathrm{~T}\} \underline{N}\{2$ U\}M\{M\}

\{4 © $\}^{2}$
AR $28 \emptyset$ PRINT"\{4 SPACES\}\{H\}
\{2 SPACES\}\{N\}\{2 SPACES\}
NM $\{2$ SPACES $\}$ \&H\}
${ }^{11}$ SPACES $\}$ \{N\}\{ 6 SPACES $\}$
EX 290 PRINT" $\{4$ I $\} \mathrm{L}\{2 \mathrm{R}\}$ @M $\{4 \mathrm{P}\} \mathrm{NL}\{2 \mathrm{R}$ \}

Once you have your basic drawing, it's easy to add a little action. For example, add a simple FOR-NEXT loop and a line of text to show how cold a bear can be.

## 125 FORI $=1$ TO6 <br> 300 NEXT <br> 310 PRINT: PRINT"GOSH, IT'S COLD!"

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## WORD PROCESSOR UPDATE •VAMPIRE ADVENTURE COMPUTER CHECKS • AWESOME DUDES IN HSTORY



5veryone has a pet (not necessarily a PET) word processor. It may be the first one you used or perhaps one whose unique features meet your special needs. For most people, learning to use a new word processor is a headache-too much time invested for too little return. Not so with Timeworks' Word Writer 5.

Word Writer 4 was a winner. It had all the features found in a good word processor-plus a calculator, a basic outline processor, an expandable 85,000-word spelling checker, a word counter, a basic form-letter printout, a 60,000 -word thesaurus, eight readymade fonts, and the ability to import fonts from GEOS.

Word Writer 5 offers these features and more. It has two more fonts, a second macro capability (handy for predefining often-used phrases or functions), automatic linking of files, forced page breaks, letter case change, and variable text layout.

The most significant change is one that takes Word Writer 5 beyond the standard word processor. It comes with its own Art Library and a converter program that allows you to import graphics from GEOS or Doodle. Included are two conversion tables and a special program to help you place any graphic in a specific location without a lot of trial and error.

There are a few limitations. While text can be placed to either the right or left of a graphic, it cannot flow around a graphic. Two graphics can't be placed side by side. Still, it's an excellent way to handle small jobs without pulling out a desktop publisher.

Two templates and a help screen allow you to work almost manual free, although the manual is thorough and logical. It even includes a segment on understanding your printer-something we all could use a little help with. Quick-Start Mini-Manual lives
up to its promise to get you up and running within an hour, and customer support is available by telephone.

My criticism is limited. Word Writer 5 can skip lines only by repeated Returns. Text-formatting commands can't be strung together on a line, and there's no definable or relative autoindent. On the other hand, some features are accessible in more than one way. Perhaps this duplication could be eliminated, and the freed-up keys could be used for something else. I'd like to see more mac-ros-and see them saved within the text file so that those pertinent to a file would reload with it. A criticism of Word Writer 4 not addressed in the fifth edition is the lack of a bridge back to the Install program. Since the Install program is where you convert and load fonts and graphics, it would be more convenient to be able to reach it without exiting and reloading the program.

So, what about us sticks-in-themud who like our old word processors? Well, truthfully, I still prefer my original one. It has some features that Word Writer 5 doesn't have, and besides, we understand each other. But is there room in my life for Word Writer 5 ? Yes, because it has font and graphics capabilities not found in most word processors. It's a way station between my word processor and my desktop publisher.

I can heartily recommend Word Writer 5 to those of you new to word processing. It's a solid product that packs the power of a good word processor and adds the punch of graphics capabilities. There's a place on almost everyone's shelf for Word Writer 5 .
robin Joy minnick

[^2]
## TIMEWORKS

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CastleVania is the latest example of a Konami conversion from an arcade game to a hit for the home computer. This game is very easy to learn, but at times its challenge has made me ready to smash my joystick.


In CastleVania, you are a relentless adventurer trying to destroy the evil Count Dracula in his castle. In order to reach the Count, you must make your way through six progressively more difficult levels of his castle. Along the way, you fight bats, skeletons, zombies, ghosts, hunchbacks, eagles, and mummies. There are a lot of other creatures in the game, plus a supermonster waiting for you at the end of each level. More than anything, the monsters lend the game its ghoulish fun. I like games that have a lot of different monsters; they break the monotony of trudging through level after level. CastleVania is far from monotonous.

You view CastleVania from a third-person perspective, moving your character up and down steps and over obstacles. Joystick response is very good, but some levels require the utmost concentration and control that even this game expert found nerveracking. I finally gave up on stage 10 to write this review, but I'm going back to beat it later. That's the appeal of CastleVania; it does warrant replay.


#### Abstract

One part of a game that often goes overlooked is the manual. CastleVania's manual is humorous and contains a lot of helpful information. The most important part of the manual is its list of objects that you'll find in the game and a description of how to use


 them. Kudos to Konami for this.CastleVania's graphics are a little on the fuzzy side. That doesn't affect gameplay in any way, though. The music is riveting, and sound effects are good. Sometimes I turn off the sound to prevent it from making me any more tense. Overall, I find CastleVania to be a fun and challenging game. It adds another winner to the solid track record for Konami in the home computer game market. RUSS CECCOLA

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when I first got this disk, I thought it was going to be just another educational program like the ones I've used in school. I expected it to be really boring. Was I surprised to find a geography program that was this much fun!


I like Earth Disk One because it makes learning geography fun. It does this by showing you a 3-D, spinning
globe with nice graphics. I also like Earth Disk One because it's easy to use-it took me only about three minutes to learn how to use it.

After I loaded Earth Disk One, a menu appeared on the screen. The menu is very well written and easy to use. There are detailed instructions on how to use the program's five different modes. After reading all of the directions, I chose to go to the control screen.

From the control screen, you can choose to look at the Earth during each of its four seasons. You can also look at the Earth from seven different views: dawn, dusk, day, night, north, south, and plain view. And you can choose to see latitude and longitude lines, as well as the poles.

Next, I decided to see some of the graphics. Earth Disk One has the best graphics I've ever seen on any geography program. I certainly wasn't expecting a 3-D globe that actually spins on its axis. A feature of the graphics mode lets you see the length of days

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## BIIL AND TED'S EXCELIENI ADVEITURE

n a most bodacious and ultracool move, Capstone Software has brought to computer-gaming dudes everywhere a most excellent way to travel through time with Bill and Ted's Excellent Adventure. This arcade/action adventure is loosely based on the popular movie of the same name.

Bill S. Preston, Esquire, and Ted (Theodore) Logan are truly righteous high school dudes who find themselves in the most heinous predicament of failing history class. Their

Go against the grain. Cut down on salt.

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American Heart Association
and nights for different latitudes and longitudes. Another option lets you change the colors, which is entertaining but not important.

After looking at the graphics, I decided to check out the quiz mode. It lets you select from seven quizzes, with four questions in each quiz. One frustrating thing about the quiz mode is that you can't tell which questions you got right and which ones you got wrong-you're given your score, but regrettably, you aren't told the correct answers.

The information mode gives you facts about the physical features of the Earth. Unfortunately, you have to know a lot about geography to understand the information; plus, it doesn't help you much with the quizzes. In fact, the program suggests using an atlas to find most of the answers to the questions in the quizzes.

Edgeworth Software put a lot of effort into creating this game. Of all the educational games I've played, which is quite a few, this one is the best. It helps you learn geography while having fun at the same time. This is the first educational program I've ever really liked. I recommend Earth Disk One to anyone who is studying geography or who just wants
limited knowledge of historical facts and figures prompts them to reply to comprehensive essay questions with answers such as, "Napoleon is a short, dead dude!" To reverse their sliding grade average and avoid the impending doom that will surely follow failure, Bill and Ted must earn a "most triumphant" A+ on their final oral exam.

At the neighborhood Circle K, our heroes meet Rufus, a messenger from the future who shows them how to use a modified telephone booth for time travel. Their mission (and yours) is to travel through time and space to locate historical dudes and bring them back for the final exam.

Using the game's small, yellow telephone book, Circuits of Time Directory, you input a year to travel to different periods in world history. Depending on the level of difficulty, you help Bill and Ted bag the necessary number of historical dudes (and dudettes) to pass history class. Some of the famous dudes follow you back to the phone booth as soon as you locate them. Others you must coax into coming back by offering them something they want or need. You'll find these useful items scattered throughout time, so it's a good idea to collect

The GRAPEVINE GROUP, Inc. across it. For example, Joan of Arc (Miss of Arc to you) is tied to a burning stake when you find her in the year 1429. If you have the forethought to collect a fire extinguisher, you can save her and perhaps your grade.

Traveling to 410 B.C. gives you the opportunity to bag the noted philosopher Socrates-providing you can answer the question the old Greek dude poses. Helping Billy the Kid in a saloon fight in 1878 will convince him you're his friend, as will rescuing Marie Antoinette from a maze in a palace dungeon in 1793.

Only two historical dudes at a time can travel with you to the present, so it will be necessary to make several trips back to home base at the San Dimas Mall. Once the appropriate quota of famous dead dudes has been assembled, Ted's young and curvaceous Mom, Missie, will pick everyone up and provide a ride to school.

Al Einstein said time is relative.

This is true even when speeding through the circuits of time in a telephone booth. The sooner the historical dudes are collected and presented at school, the better the grade you receive. This can be made totally not easy by selecting the most difficult of the four levels of play.

Touted as an arcade/action ad-

venture, Bill and Ted's Excellent Adventure leans more toward arcade fun than mind-boggling adventure. My ten-year-old dude had little trouble

## See our ad in COMPUTE's Product Mart on page 157.

zapping himself through history. Although the graphics pictured on the box look awesome (obviously IBM format), the programmers could've paid more attention to the graphics in the 64 version. A much better effort is exhibited with the sound-as the music and speech are totally way cool.
STEVE HEDRICK

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When your bank statement arrives, you must note service charges, earned interest (if your account is one that earns it), and interest charges on deposits made to your account by the bank (if you have an account with overdraft protection). At the end of the tax year, you start looking for records of payment for different ex-penses-that's when a well-maintained checkbook is a necessity.

Checkbook, from Computer Craftware, takes care of all of those details and more. Its manual gives clear instructions on how to set up a checking account and make good use of the features available. You enter the amount and the payee, whom you can indicate using a two-letter code. That gives you $A A$ to $Z Z$-plenty of room for all categories.

To act as a reminder, a list of checks that you should write every month is available with one keystroke. Automatic payments are entered on the date you specify. When you receive your monthly bank statement, you mark those checks that have cleared, and Checkbook does the rest. Detailed lists showing those checks issued to different payees are available anytime.

The program uses Commodore commands for easy editing. Cursor keys allow full-screen editing. The bottom screen line tells you what you can do next. Menus give you all the options, and a simple two-key combination makes it easy to make selections. A utility menu offers everything from formatting a disk to changing the colors on the screen. A simple printer menu covers everything to make the program compatible with your printer.

And if you do write a great number of checks and would like the program to print those, that option is
available. The 128 version makes use of the 80 -column screen. You'll need a separate disk for each Checkbook file if you're using a 1541 or 1571 , but instructions are given for using the 1581 with partitions.

The program even shows a highlighted colored bar to alert you to the fact that you'll be overdrawn if you process a current check. It seems as though Computer Craftware has covered everything except how I can deposit more money into my account. ESTHER OLSON

Commodore 64 or 128- $\$ 34.95$
COMPUTER CRAFTWARE
17966 Arbolada Way
Tustin, CA 92680
(714) 953-8177

## Ghostusitris ||

Although the computer version of Ghostbusters II may disappoint admirers of the original, many will feel that the current offering provides more varied gameplay than did its predecessor.

For one thing, the game takes place in three different settings. In your first mission, you must descend into the Van Horne transit tunnel via cable, make it to the bottom alive, assemble a slime scooper by collecting the necessary pieces, and scoop up a gooey sample. You'll need the slime later to defeat the bloodthirsty Vigo.

Complicating matters are strength-sapping ghosts and falling rocks. Watch out for spirits who will saw away at your cable until it breaks, hurling you to your death. Defensive options include dodging and using a shield. Firing proton beams and setting off PKR bombs are your offensive choices.

You'll find this segment difficult at first for several reasons: sloppy joystick response, particularly when trying to collect objects; the awkwardness of using the joystick and keyboard simultaneously; and the failure of the manual to explain how to scoop up slime. After you've mastered this level, you'll wish there were a way to bypass it so that you could proceed immediately to greater challenges.

On Broadway, you control both the Statue of Liberty (by joystick) and
your team of Ghostbusters (by keyboard). Your destination is the Museum of Art, where you'll confront Vigo. To arrive safety, you (as Miss Liberty) must travel through a horizontally scrolling screen, shooting fireballs from your torch at endless waves of ghoulish attackers. At the same time, as the Ghostbusters, you have to run out and mop up the remains of your assailants to help replenish Miss Liberty's strength.

Making it through will be a lot easier for two players working together. For a single player, handling both Miss Liberty and the Ghostbusters will be quite a chore.

In the museum, all four of the Ghostbusters have to climb down a rope to the gallery without falling off. Then they must choose appropriate weapons, activate various Ghostbusters, rescue a kidnapped baby from Vigo's clutches, dispatch all humans under Vigo's control, and defeat the evil genius by trapping him in cross fire.

Success requires almost superhuman manipulation of the joystick, space bar, and Return key. Adding to the difficulty are the hazy graphicsthe weakest in the game-and the sheer volume of chores to be performed. A more reasonable approach would've been to add a fourth scenario featuring some of the museum's challenges.

Owners of 64s expecting the Amiga-style digitized graphics displayed on GBII's packaging will be disappointed. Nevertheless, most of the artwork is attractive and clear, and the animation is graceful.

Extremely annoying are the lengthy reboots required after you've been killed. This is particularly frustrating in the museum segment, where an early demise is the natural state of affairs.

Still, Ghostbusters II is mildly diverting entertainment. While it isn't worth writing home about, it doesn't deserve to be completely written off, either.
LEN POGGIALI

Commodore 64 or 128-\$29.95

## ACTIVISION

3885 Bohannon Dr.
Menlo Park, CA 94025
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| Q U E |
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## Down Periscope

I am writing to let you know that Periscope and Periscope II are trademarks owned by the Periscope Company.
These products are debuggers for use in programming the IBM PC. COMPUTE and COMPUTE!'s Gazette have published programs of the same name. Our attorney has advised us that we must ask you to change the name of your programs in order to protect our ownership of the trademark.
SHARON BAILEY, VICE PRESIDENT
THE PERISCOPE CO.
ATLANTA, GA
We are more than happy to comply with your request. Since our similarly named programs are disk-sector editors, we'll change the name to SectEd. We regret any inconvenience or confusion that may have resulted from the inadvertent duplication of program names.

## Bug-Swatter

SectEd 64, formerly known as Periscope II (February 1991), has two typos in the listing that create syntax errors during sector edits. Lines 420 and 450 each begin with IF INCOS. The COS should be replaced by an equal sign, making each line begin $I F I N=$.

Line 690 of Pharaoh's Revenge (November 1990) is too long to enter as printed. Here's the correct listing.

QP $69 \emptyset$ PRINTSPC (N)"\{RVS\} <5\}£" ;:FORJ= ØTOKI/2:PRINT" \{RVS\}\{T\}";:NEXT

## Under the Menu

Many programs for the 128 use popup menus. After a menu disappears, the information that was underneath it returns to the screen. I've tried listing the programs to see how they do it, but all of these programs are written in machine language. Could you tell me how they do this using BASIC and maybe include a short demonstration program?
H. H. FELTY JR.

WINSTON-SALEM, NC

Pop-up menus don't actually cover underlying text. Instead, the program saves the part of the screen that will be affected before the menu pops up. The saved portion of the screen is then restored when it's time to exit the menu.

For a program to help you create windows to your own programs, check out Window Wizard (September 1986). If you don't have access to that issue, try the following BASIC code. It writes a screenful of text, saves the region where the window will go, draws the window, and then restores the screen after a key has been pressed. Line 10 dimensions arrays for holding the screen characters and colors. Line 30 uses the subroutine at lines 160-200 to print the main screen. Lines 40-70 read the screen data from where the window will be and color data for that region from color memory. The window data is written in a different color at line 90. Line 100 waits for a keypress. And lines 110-140 restore the original screen data and color.
JR $1 \emptyset$ DIM $\operatorname{DD}(13,2 \emptyset): \operatorname{DIM}$ CL $(13$, 20): POKE 5328の, $0:$ POKE 53 281,0
KS 2ø AS="COMPUTE ":PRINT CHR\$ (147) ; CHR $(150)$

BB 30 WW=39:FOR X=1 TO 23:GOSU B 160:NEXT
QH 40 FOR $X=1$ TO 13:FOR $Y=1$ TO 20
DM 50 DD $(X, Y)=\operatorname{PEEK}(1 \oslash 23+Y+X * 4 \emptyset$ )
MF $60 \operatorname{CL}(\mathrm{X}, \mathrm{Y})=\operatorname{PEEK}(55295+\mathrm{Y}+\mathrm{X} * 4$ g)

XH $7 \emptyset$ NEXT Y, X
BD $8 \emptyset$ AS="WINDOW DATA ":PRINT \{SPACE\}CHRS(19);CHRS (154 )
FA $9 \emptyset W W=2 \emptyset: F O R \quad X=1$ TO 13:GOSU B 160:NEXT
QF $10 \emptyset$ GET AS:IF AS="" THEN 10 $\theta$
ES 110 FOR $X=1$ TO $13: F O R ~ Y=1 ~ T$ - 20

FD $12 \theta$ POKE $1023+Y+X * 4 \theta, D D(X, Y$ )
FR 130 POKE $55295+Y+X * 40$, CL (X, Y)

GH 140 NEXT $Y, X$
GX 150 END
HR $160 \mathrm{Y}=\mathrm{INT}(\mathrm{X} / \mathrm{LEN}(\mathrm{A} \$)-\mathrm{INT}(\mathrm{X} /$ $\operatorname{LEN}(A S))) * \operatorname{LEN}(A \$)+.5)+1$ : $C \$=A \$$

QS 170 IF $Y>1$ THEN $B \$=M I D \$(A S$,
Y) : $C \$=B \$+L E F T \$(A S, Y-1)$

SE 180 FOR $Z=1$ TO 3:C $=C \$+C \$: N$
EXT
DE 190 PRINT LEFT (C\$,WW)
MC 200 RETURN

## Custom Characters

I'm interested in customizing the character set of my 64C, but I don't have any idea where the memory locations for the characters are. Could you tell me the location for the character and graphic sets and how my computer determines the location? HUBERT CHAN
ST. ALBERT, AB
CANADA
The 64C (which, for programming purposes, is simply a 64 with a new case) has its character set at address 53248 (\$D000). This is a read only memory (ROM) location. An interesting thing about 64 ROM areas (including BASIC and Kernal ROM) is that numbers poked there are stored in the underlying RAM, but when you peek the same location, only the ROM value is read.

To define your own character set, you'll need to tell the video chip to look at a non-ROM area so that it will "see" the characters that you define. To modify the 64's character set, copy the old character set to the new location in RAM and work with it there. While transferring, remember that the native character set is 512 characters long: two contiguous 256 -character groups for the two text modes produced with the Shift and Commodore keys. Each character is 8 bytes in size. The entire character set, then, is $8 \times$ 512 , or $4096(4 K)$ bytes long. A full transfer, with the RAM address symbolized by RAMADR, will look something like this in BASIC:

## FOR $X=0$ TO 4095:POKE RAMADR + X,PEEK $(53248+X)$ :NEXT

How do you determine what RAM address to use? There are several possibilities here, but they depend on some additional factors. First, the VIC-II
video chip can "see" only 16 K of memory at a time. For this reason, the 64's memory is divided up into video banks numbered 0 through 3. It's not advisable to use banks 0 and 3 for experimenting with video information from BASIC because they're located at the system-RAM/low-BASIC-program and ROM areas, respectively (although bank 0 is the default setting).

Of those remaining, bank 1 extends from address 16384 (\$4000) to 32767 (\$7FFF); bank 2, from 32768 (\$8000) to 49151 (\$BFFF). Only bank 1 is completely available for BASIC programmers, though some caution must be taken not to overwrite video information with the program or variables. A machine language program is required to get at all of bank 2 .

To make the VIC look where you want, set bits 0 and 1 of address 56576 (\$DD00) to the desired bank number (bits $0-3$ are represented in two-bit binary form as 00,01,10, and 11). Also, bits 0 and 1 of address 56578 (\$DD02) must both be set, no matter which bank you choose. If the bank number is symbolized by BANK, a BASIC line for changing the video bank looks like this:

## POKE 56576,(PEEK(56576) AND 252) OR BANK:POKE 56578, PEEK(56578) OR 3

Once the bank has been chosen, your custom character set needs a suitable location within the bank. It must be suitable because the character set will be vying for space with text-screen RAM and/or a bitmap (if you choose to use one).

The text screen takes up $1 K$ of memory locatable at any of the 16 possible addresses within the video bank which are evenly divisible by 1024. Another way of putting this is that the possible locations for the screen are some multiple of 1024 added to the starting address of the video bank you've chosen. Store that multiple, as a value from 0 to 15 , in the upper four bits of address 53272 (\$D018). With the multiple symbolized by $N, a$ BASIC line for doing this is

```
POKE 53272,(PEEK(53272) AND 15)
    +16*N
```

The VIC is told where to look for the character set in much the same way.

Here, the bank offset is in multiples of $2 K$-full 2048 bytes-in recognition of the fact that most custom character sets will have only one mode. Because there are eight $2 K$ boundary addresses, only three bits are needed to specify which one to use. They are bits 1, 2, and 3 of the same register that signals where the screen is. If $N$ is the needed 2 K multiple, select the character location from BASIC by using the following line.

POKE 53272,(PEEK(53272) AND
241) $+2 * N$

## Proofreader Error

When loading The Automatic Proofreader in 128 mode, I get a syntax error in line 30 . I'm sure the program has been entered correctly. Can you help?
HANS SPARREBOOM
TOFIELD, AB
CANADA
Several of these incorrect listings were printed and given to our art department before we noticed the error. We thought they were all replaced with corrected versions, but occasionally one still turns up. In line 30 of The Automatic Proofreader, replace the word WAIT with GRAPHIC, and it should work.

As you may have noticed, we don't always print The Automatic Proofreader and MLX in every issue as we once did. By omitting these, we have more space for program listings. Since these two programs make it much easier to type in our BASIC and machine language programs, we strongly recommend their use. If any new subscribers don't have a copy of these programs, send us a selfaddressed, stamped envelope, and we'll see that you get both listings.

## Wrong Info

In the March issue, Rich Mauney asked about getting a program on the June 1990 Gazette Disk. According to my user group, the June Gazette Disk is not, and never was, available. Could you please clear up this question?
ROBERT L. CLARK
paso robles, CA
We don't know where your user group got that idea. The June issue was the last COMPUTE!'s Gazette in its old
format, and it had a companion disk just as any other issue. If you were-or your group was-a disk subscriber at that time, you should have received the disk. If you didn't, contact our Greensboro office. That disk and other back issues are available for $\$ 9.95$, plus $\$ 2.00$ shipping and handling. We did not publish in July, August, or September, but we were back in business with the October issue.

## Dictionary Cruncher

At one time a reader wrote asking how commercial spelling checkers can have 80,000 words or more in them. The answer had something to do with the coding scheme. Where did I read that? I'm thinking about a similar technique for a RAM-based dictionary for a program I'm working on.
DALE G. HALBACH
COSTA MESA, CA
The "Feedback" letter you referred to was in the January 1989 issue of COMPUTE!'s Gazette. (We located it using the Gazette Index disk.) It concerned the word storage format of the SpeedCheck dictionary. SpeedCheck uses two special tricks to save disk space. The first is to leave off the starting letter of the word, since all words in a particular alphabetical group begin with the same letter anyway. The second trick separates words by setting the high bit of the last byte (character) of each. Because text characters don't use the high bit, no information is lost, and a byte of storage that would have otherwise been expended on a separator character is saved.

## Form Maker

My 128 does almost everything I need a computer to do. It keeps my finances organized, prints my posters, does my correspondence, and helps educate my children. In spite of all this, there's one thing I see PCs and Macs doing that I cannot. Is there a program that will help me make forms?
ELROY GANDY
GARNISH, NF
CANADA
Check out Business Form Shop (\$39.95) from Broderbund (17 Paul Drive, San Rafael, California 94903). It generates and prints invoices, expense account records, financial statements, and various reports.

# The Gazette 

 Productivity
## Harness the productivity power of your 64 or 128 !

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Compute the answer at the click of a key!

Who makes me write this column every month? I used to blame my editor, Tom Netsel, for forcing me to sit down at the computer each month and write this page. I had this problem, however, before he became my boss at Gazette.

I used to blame other magazine editors for shackling me to the computer while I wrote columns and articles for them. Maybe they weren't totally to blame.

I used to blame my boss at work for grafting me to the computer for all-night, nonstop programming marathons. For a while I thought he was the heavy, but no longer.

Now I know who's really to blame. Now I know who forces me to spend so much time hunched over a keyboard, squinting at a monitor. Now I know who the real culprit is.

My computer!
I used to believe that computers were labor-saving devices. Computers, after all, were just the latest descendant in a long line of household and office appliances, including vacuum cleaners, refrigerators, copying machines, and microwave ovens. Computers, like other machines, were supposed to make our lives simpler and free us from backbreaking toil.

Now I realize that this is just a myth. The culprit behind this myth is the word automation. Computers were supposed to automate work. We were to become the masters, and computers our slaves. We would tell the computer what needed to be done, and the computer would do it. We could sit back and relax while all this work was being performed for us.

Somehow, this master-slave thing got mixed up. Instead of the computer's being the slave, it somehow started acting like the master. Instead of my being the master, I somehow ended up as its slave.

Remember when you started a computer using the BASIC language and when the computer was up and running, it would come back and say, "READY"? That was neat, wasn't it?

Did you ever think how ironic that sweet, innocent little word really is?

The computer is always ready. If you leave your computer on (as I admit I do), it is ready 24 hours a day! I sit down at my computer. It's ready. I pass by the computer on the way to the kitchen. It's ready. I'm in the bathroom brushing my teeth. The computer is ready. I'm tossing and turning in my bed at two in the morning. The computer is still ready!

Over time the thought that the computer is ready has imprinted itself deeply into my subconscious. I may be a lazybones and want to sit down to dinner with my family, but the

computer is ready. I may want to sack out on the couch and watch a little TV, but the computer is ready. I may want to go ride my bike, catch a movie, or browse in a bookstore, but you-know-who is still ready!

The worst part is that I know it!
It's like the computer has this tiny voice that sings a siren song to me at all hours of the night and day. "I'm ready, Freddie!" it croons softly and sweetly with its little cursor rhythmically tapping its foot on the screen. "I'm here. I'm yours. I'm ready to work, play, do anything I'm capable of doing. All you have to do is sit down and type."

So, big bohunk kind of guy that I am, what do I do? Do I turn my back on the computer and walk away? Do I
rinse the computer from my brain and go about living the rest of my life? Heck, no. I'm a wimp! I hear it calling me , and I have to answer.
"Well, OK," I say as I slip sideways into the computer's room. "I'll just type a few lines. Then I'll get up and go do the other things I'm supposed to be doing."

The computer cursor seems to blink with a brighter, perkier beat. Four hours later, where am I? Still sitting at the keyboard, typing just one more line. Still entering more data. Still drawing just one more graphics screen. Still playing just one more round of Tetris, Mario, or Computer Solitaire.

Usually, I can get away with spending so much time with my computer, but not always.

One night I was working on just one more line in a program that was already 26 feet long (I measured the printout). My wife had been hinting all night that she was going to bed soon. She had hinted that it would be nice if I joined her.

Did I pick up on these hints? Huh-uh, and I paid. I really paid. About two in the morning, my poor wife no longer felt in a romantic mood. Insulted, ignored, and just plain mad, she stormed out of the bedroom, down the stairs, and into the kitchen where I was working on the computer.

She threw a pillow at me, which bonked me on the nose. She heaved a big yellow blanket at me, which floated down over my head. "Go ahead!" she cried. "Stay all night with your electronic mistress! See if I care!" She stormed out crying.

As I sat there in the kitchen in a state of shock with the blanket over my head, I began thinking that maybe my wife was right. Maybe she had hit the mark in more ways than one.

To all you fellow wimps out there, be very careful. Your computer mistress (or the male equivalent) can demand so much of your time that there is little time for other things in life. Like your spouse.

## J I M B U T T E R F I E L D

Ihere's a tiny (nonsymbolic) assembler built into most machine language monitors, such as Supermon. It allows you to type in mnemonic commands, and it changes them to machine code. For example, if you type A 033C LDA \#\$04, this instruction will change to A9 04, and the monitor will prompt you with A 033E so you won't need to calculate the address.

That's fine for small programs and for experiments. As you write bigger programs, however, you'll want to buy a full-scale, commercial symbolic assembler. It will make quite a difference in the way you develop programs.

Most people describe full assemblers in terms of mechanical features. In other words, they say how the use of symbols simplifies calculation and speeds program writing. I'll talk about some of these features in a moment, but there's a more important aspect.

With a symbolic assembler, you can save your source code. That's incredibly useful. It means you can go back and adjust your program, adding a bit here, trimming there.

That way, you can easily go through a full development cycle. Write it, test it, and then go back and adjust it as needed. You can start by putting in test-coding that will help you debug. When your program looks good, out goes that extra code.

Over the longer term, you can return to old programs and trim them up for new requirements or new machines. When you do, you'll be grateful for the comment lines that you wrote; they'll help you remember what you had in mind at the time of the original coding.

Symbols help by automatically working out addresses within your program and allowing system calls and hardware registers to be referenced by name rather than by address.

As you write a program, you might want to branch ahead to as-yetunwritten code. No problem. Give that code a symbolic name. The assembler will expect you to supply code with such a name. If you don't, it
will remind you with an undefined symbol message.

Want to figure out the length of a text string? For example, you might have coded a message as a group of bytes. Instead of counting the length of this message, you can have the assembler do it, this way:

## MESSAGE .byte "GOOD-BYE, CRUEL WORLD!",\$0A MLEN $=$ *-MESSAGE



The asterisk means, roughly, "here," so that the phrase *-MESSAGE subtracts the address beyond the end of the string from the address of the string's start. Result: the length of the string. If you ever change the string, the length will be recalculated automatically.

You might use symbols to code SID $=$ \$D400 or SID EQU \$D400. After such a definition, you would be able to write STA SID $+\$ 18$ rather than STA \$D418. Some programmers find it hard to remember that the SID chip is at memory location \$D400 and find the symbolic address is a help. Similarly, they might prefer JSR

CHROUT rather than JSR \$FFD2.
Comments help you remember what a particular piece of code is intended to do. They can help you spot code as you scan a large listing. Comments are also useful for long-term program maintenance. Weeks or months after your original program is written, you may want to go back to the source. Perhaps you want to revise the program, or perhaps you want to use some of the code in another project. Either way, the comments will remind you of the way the job is organized.

Comments are also useful to help other people read your code. Sometimes they draw attention to interesting coding tricks that might otherwise be missed.

Many assemblers have extra features that are useful for advanced coding. Macros permit canned code to be invoked, often customized for the particular application. A similar feature is the include command, which allows prewritten code to be called into your current project. Conditional assembly allows you to produce several versions of the same program from a single source. For example, you might have a program that assembles two separate versions for the 64 and 128. Some assembler systems come in two pieces: an editor that allows you to write and update source code and an assembler that converts it into the final object program. Others are integrated into a single operating system. There are a couple of assemblers that cleverly use the built-in BASIC editor of Commodore 8-bit machines.

Assembler program packages seem to have erratic availability: in stock, out of production, repackaged, and then extinct. The problem may be that dealers find that such packages don't have a steady market. Commodore Development Package, for example, seems to appear and disappear periodically.

If you know other programmers who are using a specific assembler, try to get that one to make it easier to exchange ideas and coding.

BASIC math on the 64 can range from the extremely simple to the complex. Let's begin a series that explores that range, beginning with the former and working toward the latter. You'll be amazed at how quick and versatile this computer is in solving math problems. All math operations can be performed in either program or immediate mode (with or without line numbers). The four basic math operations are addition $(+)$, subtraction ( - ), multiplication (*), and division (/). Let's illustrate all four:

## 10 INPUT"FIRST NUMBER";A 20 PRINT:INPUT"SECOND

 NUMBER";B$30 \mathrm{C}=\mathrm{A}+\mathrm{B}$
40 PRINT:PRINTA"+"B"="C
This is the classic way of gathering user input and then performing math operations on it. In the following examples, little or no error checking is provided, so enter logical numbers. Note that the + and $=$ signs are the entities between quotes, not the variables A, B, and C. Therefore, the + and $=$ signs are printed literally, while the variables' values get printed. Here's the same program for subtraction with positive answers:

```
10 INPUT"LARGER NUMBER";A
20 PRINT:INPUT"SMALLER
    NUMBER";B
30 IFA=<BTHENPRINTCHR$(147):
    RUN
40C=A-B
50 PRINT:PRINTA"-"B"="C
```

This is similar to the first example, with a check at line 30 to ensure positive answers. Here's an example with multiplication and division in one problem:

```
10 INPUT"FIRST NUMBER";A
20 PRINT:INPUT"SECOND
    NUMBER";B
30C=A*B:D =A/B
40 PRINT:PRINTA"X"B"="C
50 PRINT:PRINTA"/"B"="D
```

The above problems can be abbreviated slightly by eliminating one variable and by combining the math and printing operations. Here's how line 30 of the first example could look:

30 PRINT:PRINTA"+"B"="A+B


Incidentally, addition, subtraction, and division are usually expressed literally and mathematically the same way, as,+- , and // respectively. Multiplication, however, can be expressed literally as capital X, but the math operator must be the asterisk (*).

Using division, fractions can easily be converted to decimals:

## 10 INPUT"NUMERATOR";N

 20 PRINT:INPUT"DIVISOR";D $30 \mathrm{~A}=\mathrm{N} / \mathrm{D}$40 PRINT:PRINT"DECIMAL EQUIVALENT IS"A

The BASIC function that instantly takes the square root of a number before you can release your finger from the RETURN key is SQR( ). Here's an easy one for the computer:

10 INPUT"NUMBER TO TAKE
SQUARE ROOT OF";N
$20 \mathrm{~S}=\mathrm{SQR}(\mathrm{N})$

30 PRINT:PRINT"SQUARE ROOT OF"N" ="S

Use the up arrow for exponents:

## 10 INPUT"NUMBER TO SQUARE";N $20 \mathrm{~S}=\mathrm{N} \uparrow 2$ <br> 30 PRINT:PRINT"SQUARE OF"N"="S

Here's a method for determining any root of a number:

## 10 INPUT"NUMBER TO TAKE A ROOT OF";

20 PRINT:INPUT"WHICH ROOT";R $30 \mathrm{~A}=\mathrm{N} \uparrow(1 / \mathrm{R})$
40 PRINT:PRINTR"ROOT OF"N"IS"A
Try this by entering 64 and 3 at the prompts; this will yield 4 as the cube (third) root of 64.

Let's use a variant of the above programs in a practical example to calculate how many cubic yards of concrete you'd need for a driveway:

## 10 INPUT"DRIVEWAY LENGTH IN FEET";L

20 PRINT:INPUT"DRIVEWAY
WIDTH IN FEET"; W
30 PRINT:INPUT"CONCRETE
THICKNESS IN INCHES";T
$40 \mathrm{~T}=\mathrm{T} / 12$ :REM CONVERT INCHES TO FEET
$50 \mathrm{CF}=\mathrm{L} * \mathrm{~W} * \mathrm{~T}: \mathrm{CY}=\mathrm{CF} / 27$
60 PRINT:PRINT"YOU NEED"CF "CUBIC FEET"
70 PRINT:PRINT"OR"CY"CUBIC YARDS OF CONCRETE."

Notice the illegal algebraic, but perfectly legal BASIC, operation in line 40. T's first value is input as inches and then converted to feet by dividing by 12 ( 12 inches per foot). It's OK to change T's value like that as long as you won't ever need the first value of T again in the program. Line $50 \mathrm{mul}-$ tiplies all the feet together to arrive at cubic feet and then converts cubic feet to cubic yards by dividing by 27 ( 27 cubic feet per cubic yard). To calculate only cubic yards, we could use only one variable, say, C:

# Best-Selling Commodore Books from COMPUTE 

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$50 \mathrm{C}=\mathrm{L}^{*} \mathrm{~W}^{*} \mathrm{~T}: \mathrm{C}=\mathrm{C} / 27$
60 PRINT:PRINT"YOU NEED"C "CUBIC YARDS OF CONCRETE."

Again, $\mathrm{C}=\mathrm{C} / 27$ makes no algebraic sense, but it's legal in BASIC. I like to minimize the number of variables used in a program, although this practice does make a program somewhat more difficult for you (or anybody else) to understand later.

Math performed with computers is the same math done with calculators, or, for that matter, with pencil and paper. Certain conventions have been adopted which are universal. For instance, in most problems, the math operations are performed from left to right. Keeping that in mind, what's the answer to this problem?

$$
12+6-3
$$

The answer is 15 . And 15 would be the answer also if the numbers were rearranged:
$-3+6+12$
Adding and subtracting are commutative; that is, they can be done in any order. Just be sure that the signs stay with the numbers. Multiplication
and division are trickier:
12/6*3
The answer is 6 because in problems which contain only these two operations, the computer will tackle the math from left to right. How about this one, where operations are mixed?
$4+6 / 2 * 3$
Is it 21? 15? 5? 13? The correct answer is 13 , because mixed mathematical operations are traditionally performed in this order: multiplication and division first (left to right), then addition and subtraction. The first letters form the memory aid My Dear Aunt Sally. In the problem above, 6 is divided by 2 to get $3 ; 3$ is then multiplied by 3 to get 9 ; then 9 is added to 4 to get 13 . Don't take My Dear Aunt Sally too lit-erally-multiplication doesn't take precedence over division, nor does addition take precedence over subtraction. But both multiplication and division do take precedence over either addition or subtraction. Going further, what's the answer to this problem?
$(3+4)^{*}(5+6)$

Did you guess 29 ? No, the answer is 77 . To cause the computer to preempt My Dear Aunt Sally requires extra effort. Any operations within parentheses take precedence over $M y$ Dear Aunt Sally. Thus, 3 must be added to 4 to get 7; then 5 is added to 6 to get 11 ; then 7 and 11 are multiplied to get 77 .

Here's a final test. What's the answer to this problem?

## $15 \uparrow 3 / 12^{*} 4+6^{*}(4+5)$

This example introduces exponents, which take precedence over other operations. The easiest way to solve it is to enter it with the word PRINT in front and then press RETURN.

That's math in the immediate mode. But before you do that, try to predict an approximate answer.

Although we studied this not long ago, we'll continue our BASIC math series next month with a review of the somewhat arcane, but nevertheless quite useful, trigonometric functions.

Thanks to calculators and computers, trig functions are now a mere keypress away. They're also more accurate than those interpolated from trigonometric tables or calculated with the help of a slide rule.

I${ }^{-1}$ ry this the next time you save a program to disk. Immediately after you enter a filename in a SAVE command but before you enter the closing quotation mark, hold down the Shift key and press the space bar, hold down the Commodore key and type DUDE, hold down the Shift key and press @, and then type the terminating ", 8 and press Return. When you list the disk directory, the computer will show the filename with a ,8,1 extension. Now, all you have to do to load and run the program is move the cursor to the first column of the line containing the filename and press Shift-Run/Stop.
STACY OLIVAS
GRAHAM, WA

## Instant Disk Status

Type in and run the following program to gain instant access to your 64's disk drive's error status.
KE $10 \mathrm{DV}=8: \mathrm{SA}=49152$
MG 20 FOR $I=S A$ TO SA $+43:$ READ $D$ : POKE I, D:C=C+D:NEXT:POK E SA+9, DV
KD 30 IF $C<>6193$ THEN PRINT "E RROR IN DATA STATEMENTS" : END
KC $4 \emptyset$ PRINT "TO CHECK DISK STA TUS, ENTEP SYS";SA
EE 49152 DATA $169,0,32,189,255$ , 169
KA 49158 DATA $15,168,162,8,32$, 186
MX 49164 DATA $255,32,192,255,1$ 62,15
EE $4917 \theta$ DATA $32,198,255,32,2 \emptyset$ 7,255
FM 49176 DATA $32,210,255,201,1$ 3,2ø8
CQ 49182 DATA $246,169,15,32,19$ 5,255
SR 49188 DATA $32,204,255,169, \varnothing$ , 133
XQ 49194 DATA 198,96
The next time your disk drive light flashes rudely in your face, type SYS 49152 and hit Return. After consulting with your disk drive, this program echoes the cause of the drive's irritation to the screen.

As presented above, this program returns the error status of the disk drive known as device 8 . To modify the program to check a different device, change line 10 so that the vari-
able DV is set equal to another number-such as 9 for device 9—and run the program again. You can also enter the command POKE 49161, $x$ after running the program above, where $x$ is the desired device number. This program stores its errordetecting machine language routine in memory starting at 49152 . You can

change this starting address by changing the value assigned to SA in line 10. If you change the starting address, you must also change the SYS instruction to reflect the routine's new location. FRANCISCO FELIX
LA PAZ, BAJA CALIFORNIA SUR MEXICO

## Color-Coded Directories

Make your directories more colorful by using the following two commands to format your disks:

OPEN15,8,15,"N0:" + CHR\$(141) + CHR\$(x)+"name,id"
CLOSE 15
Name is a disk name comprised of 16 or fewer characters, id is any twocharacter disk identification, and $x$ is one of the following color values:

| Value | Color | Value | Color |
| ---: | :--- | :--- | :--- |
| 5 | white | 151 | gray 1 |
| 28 | red | 152 | gray 2 |
| 30 | green | 153 | light green |
| 31 | blue | 154 | light blue |
| 129 | orange | 155 | gray 3 |
| 144 | black | 156 | purple |
| 149 | brown | 158 | yellow |
| 150 | light red | 159 | cyan |

The directory of the newly formatted disk will list to the screen in the color that you have selected. MATT L. GATSKIE AKRON, OH

## Two-Line BSAVE

This short BSAVE routine allows 64 owners to save any area of the 64's memory to disk. You can save machine language programs, custom ROM routines, and graphics data.

To use this two-line BSAVE, make F\$ equal to the desired filename, DV equal to the drive's device number (usually 8 ), SA equal to the starting address, and EA equal to the ending address plus one; then GOSUB 1000. Alternatively, you could insert this code anywhere you use it, eliminating the need for the RETURN in the last line.
JX 100ø SYS 57812 FS,DV:POKE 1 73,SA/256: POKE 172,SAPEEK (173)*256: POKE 78ø , 172
XK 1010 POKE 782,EA/256: POKE 7 81,EA-PEEK (782)*256:SY S 65496:RETURN
This subroutine is actually very simple in operation. After setting the file parameters using a ROM routine located at 57812 (\$E1D4), the subroutine initializes the starting and ending addresses and calls the welldocumented Kernal routine, SAVE. RANDY THOMPSON
TWIN PEAKS, WA
"Programmer's Page" is interested in your programming tips and tricks. Send submissions to "Programmer's Page, " COMPUTE's Gazette, 324 West Wendover Avenue, Suite 200, Greensboro, North Carolina 27408. We pay $\$ 25-\$ 50$ for tips we publish. ■


SciCalc 64 is written entirely in machine language, but it loads and runs like a BASIC program. To enter it, use $M L X$, our machine language entry program; see "Typing Aids" elsewhere in this section. When $M L X$ prompts, respond with the following values.

## Starting address: 0801

Ending address: 1 AB 0
When you've finished typing, be sure to save the program before exiting MLX.

## Getting Started

After you load and run SciCalc 64, you may want to practice entering numbers and performing calculations with the following examples.

To compute $342+98765$
Type 342 Return $98765+$
To compute $(5+3) *(6+2) / 3$
Type 5 Return $3+6$ Return $2+* 3 /$

To enter a negative number, such as -6 , use the back arrow.
Type $6+$
To compute $-(5.393 e-5)-3.66$
Type 5.393e-5+3.66 -
To compute $\sin (3 \uparrow 2 / 4.66)$
Type 3 Return $2 \uparrow 4.66$ / Ctrl I


Let's look at some conventions regarding use of the keyboard. Some functions are called by pressing a single key, such as F, M, Return, or Del; others require you to press two keys simultaneously. For example, Shift-C means press a Shift key and the C key simultaneously. $\mathrm{C}=-\mathrm{B}$ indicates that the Commodore logo key at the lower left of the keyboard is to be pressed simultaneously with the B key.

## The Stack

The stack is displayed at the top left of the screen. Although the stack can contain 50 numbers, only the first ten entries are displayed. The top two stack entries are labeled $X$ and $Y$ on the calculator display. These are special because all calculator functions, such as multiplication, addition, sine, cosine, and so on, are performed on one or both entries. Results are also displayed in the X register.

Functions that require one operand (such as sine, cosine, compute logarithm, and square root) operate on the X register (the top stack entry) and display the answer in the X register. Functions that require two operands, such as multiplication, subtraction, and so on, operate on the Y and X registers, displaying the answer in X .

When you enter a number, you'll see a solid cursor on the rightmost character of the top stack entry, indicating input mode. During this mode you can enter the keys $0-9$, the decimal point, and E to indicate exponentiation. After entering E, you may press the minus sign to indicate a negative exponent. Except for this one special case with exponents, typing a minus sign will compute a subtraction ( $\mathrm{Y}-\mathrm{X}$ ), so be careful. Don't use the minus key to enter a negative number. Type the number first; then press the back-arrow $(-)$ key to change the number's sign.

Pressing the Del key during input mode deletes the last character entered. Pressing Return during input mode terminates input mode and places the number on the stack. Pressing Del when no cursor is displayed deletes the top stack entry. Pressing Return when no cursor is displayed duplicates the top stack entry.

## The Memory Registers

The memory registers are displayed at the top right. Although you can store 100 different numbers in memory, only ten are displayed at any one time. Memories 0 to 9 are displayed when the calculator is first started. The other memories can be displayed with the cursor keys. Press cursordown to display the next lower set of memories. Press cursor-up to display the next higher set of registers.

## Mode Indicators

Below the stack display are three boxes labeled Degrees, Radians, and Gradients. These indicate the format used for such trigonometric functions as sine, arc sine, and so on. A check mark appears beside the current format.


#### Abstract

Near the bottom is a box labeled Record. A check mark will appear beside this box when a macro is being recorded. Macros are explained later.


## Error Handling

If an error occurs during an operation, an error message will be displayed on the bottom line of the calculator. Press the fl key to clear it.

## BASIC Programs

SciCalc 64 has the ability to keep a number of BASIC programs in memory at the same time. The total number is limited only by the amount of memory available. Memory from hexadecimal address \$B000 to \$FF00 is used for program storage, which gives about 20224 bytes. You can select among programs stored there and execute them at any time.

Let's demonstrate with an example. Load and run SciCalc 64. When the working screen appears, press the X key to exit to the normal BASIC environment. While in this environment, you can perform any normal BASIC function, such as loading, running, or writing programs. You should not run any machine language programs, however. For our demonstration, type in the following short program and save it to disk with the name Permutations.
$10 \mathrm{X}=1$ : $\operatorname{IF} \operatorname{CS}(0)=0$ THEN 30 20 FOR A=1 TO CS(0): $\mathrm{X}=\mathrm{A}$ *X: NEXT $30 \mathrm{CS}(0)=\mathrm{X}$

Now type SYS2065 and press Return to restart the calculator. Now load Permutations into the calculator. Press C=-L; then type Permutations and hit Return at the prompt. To get a list of all BASIC programs loaded into SciCalc 64, press C=-B. Currently, Permutations is the only one.

Permutations calculates the number of different ways in which $n$ objects may be arranged. The formal notation is $n!$. For example, the letters $A, B$, and $C$ may be arranged in six different ways.

ABC ACB BAC BCA CAB CBA
$3!=3 * 2 * 1=6$
Let's test the program. Type 3, then press the B key, and then enter Permutations and a Return to execute the program. The 3 is replaced by 6 ,
showing that the computation was performed correctly. We have added a new function to the calculator, but how does it work?

To execute a program, the calculator searches storage to verify that the program is present in the computer. If the program is not found, an error message is issued. If the program is found, it is copied to BASIC program memory. Then the stack and memory registers are passed to the BASIC program by means of two arrays which are created automatically by the calculator. Array $\mathrm{CS}(49)$ is created for the stack, and array $\mathrm{CM}(99)$ is created for the memory registers. $\mathrm{CS}(0)$ corresponds to the X register (the top of the stack), $\mathrm{CS}(1)$ corresponds to Y , and so on. $\mathrm{CM}(0)$ corresponds to memory register $0, \mathrm{CM}(1)$ corresponds to memory register 1 , and so on. Any change made to either array is reflected in the stack and/or memories when the calculator regains control.

On occasion, you may need to make use of a BASIC program that prints something to the screen and/or uses the INPUT command. Press the C key (clear screen and execute BASIC) for this purpose. The B key (execute BASIC) neither clears the screen before executing nor redraws the calculator screen after BASIC finishes executing. This is beneficial for programs like Permutations, since it prevents an annoying screen flash. (A summary of all SciCalc 64 commands is printed below.)

## Macros

In addition to executing and using BASIC programs, SciCalc 64 possesses another programmable feature known as macros. A macro is a list of instructions or commands that the program saves and performs later, saving the user from having to enter them every time that command is used.

To demonstrate, press the R key and then ! followed by Return. Notice that a check mark appears beside the Record box, indicating that a macro is being recorded. Everything you type now will be recorded until you press R again, which terminates recording.
Press B, then type Permutations, press Return, and then press the R key again.

We have just created a macro named !. To test this macro, press

Shift-M. At the prompt, press ! followed by Return. What was just recorded will be played back verbatim. We have created a macro that saves us from a lot of typing when using the Permutations program.

Macros execute commands with only a couple of keypresses. Macro names can be up to 16 letters long, but by keeping them short, macros can be executed by typing $M$ and then typing the macro name. For example, type 9 M ! to execute Permutations again to see how many permutations there are of nine items.

Let's demonstrate another macro that executes a BASIC program as part of its computations. The formula for the number of unique subsets of size $k$ items which can be made from a set of $n$ things is as follows:
$\frac{n!}{k!(n-k)!}$
This formula has two variables, so we'll adopt the convention that $n$ is entered first followed by $k$. Enter 4 and then 3 to put two values to work in the stack. Now press R and type SUBSET followed by a Return to begin recording. Now press the following keys. The explanation of each keystroke follows.

## Keys Function <br> $\mathbf{0} \mathbf{P}$ put $k$ in memory 0 <br> W swap X and Y <br> ${ }_{1 \mathbf{P}}$ put $n$ in memory 1 <br> W swap X and Y <br> - $n-k$ <br> M! $\quad(n-k)$ ! <br> 0 F fetch $k$ <br> M! $k$ ! <br> * $k!(n-k)$ ! <br> $\mathbf{1 F}$ fetch $n$ <br> M! $n$ ! <br> W $\quad$ swap $X$ and $Y$ <br> / final result <br> $\mathbf{R}$ end the macro

Note that this macro calls a BASIC program three times and uses the ! macro. Macros can call any number of BASIC programs, can be nested up to ten deep, and can be up to 4090 bytes long. 4096 bytes have been allocated for macro storage.

## Numeric Functions

Here's a list of SciCalc 64 's numeric functions and their explanations. The
results of most operations appear in the X register.

C=-D Set Degrees mode for trigonometric functions.
$\mathbf{C}=-\mathbf{R}$ Set Radians mode for trigonometric functions.
$\mathbf{C}=-\mathbf{G}$ Set Gradients mode for trigonometric functions.
$\leftarrow$ Change the sign of X. For example, 5.5 would become -5.5 , and -5.5 would become 5.5.
Shift-A Compute the absolute value of X.
Shift-D Compute the logarithm of X to the base 10 . The decimal logarithm of 100 is 2 .
Shift-E This returns the value of 10 raised to the exponent X. For example, if $\mathrm{X}=2$, the value 100 is returned.
Shift-N Compute the logarithm of X to the base $e(2.718281828)$. For example, if $X=100$, the value 4.605170186 is returned.

Shift-X This returns the value of $e$ ( 2.718281828 ) raised to the exponent X. For example, if $\mathrm{X}=$ 4.605170186 , the value 100 is returned.
Shift-T Compute the square root of X.

Shift-Q Compute the square of $X$.
Shift-I Compute the integer value of X, stripping X of any fractional value. For example, 3.456 would become 3.
Shift-F Compute the fractional value of X, stripping X of any integer value. For example, 3.456 would become 0.456.
Shift-V Compute the reciprocal of X (the value $1 / \mathrm{X}$ ). For example, 5 would become $1 / 5$ or 0.2 .
Shift-3 Compute a random number and put it in the X register. This function is implemented using BASIC's RND(0) function.
Shift- $\uparrow$ Put the value of $\mathrm{pi}(\pi)$ in the X register.
Ctrl-I Compute the sine of X.
Ctrl-O Compute the cosine of X.
Ctrl-A Compute the tangent of X .
Ctrl-S Compute the inverse or arc sine of X .
Ctrl-C Compute the inverse or arc cosine of X.
Ctrl-G Compute the inverse or arc tangent of X .

* Multiply Y times X.
/ Divide Y by X.
Shift-S Modulus. Divide Y by X. The
remainder is left in X . For example, if $Y=9$ and $X=5$, the result would be 4 .
$\uparrow$ Compute Y to the power X .
Shift-R Compute the Xth root of Y.
For example, if $\mathrm{Y}=64$ and $\mathrm{X}=3$, the cube root of 64 is returned, namely 4 .
+ Add Y to X.
- Subtract X from Y.


## Memory Register Commands

F Fetch. Copy a number from a memory register to X . The memory registers are numbered from 0 to 99. Type the number of the register you wish to access; then type F.
P Put. Copy a number from $X$ to a memory register. The memory registers are numbered from 0 to 99.
Type the number of the register you wish to store to; then type P.
Cursor Up Display the next higher set of memory registers.
Cursor Down Display the next lower set of memory registers.

## Stack Commands

SciCalc 64 implements several functions which allow you to manipulate the stack. They are listed below.

W Swap Y and X. Put the value in X into Y, and vice versa.
O Roll. Move a stack entry into X. The stack entries are numbered from 1 to 49 , with 1 the top entry (the X register) and 49 the bottom entry. Entry 50 is inaccessible with the Roll or Pick functions. Type the number of the entry you wish to move into X ; then type O . Typing 1 O duplicates the top entry. Typing 2 $O$ is equivalent to the Swap operation.
I Pick. Copy a stack entry into X. The stack entries are numbered from 1 to 49 , with 1 the top entry (the X register) and 49 the bottom entry. Entry 50 is inaccessible with the Roll or Pick functions. Type the number of the entry you wish to copy into X; then type I.
Return Press Return when not in input mode to duplicate the top stack entry. If the calculator is in input mode (a cursor is displayed on the top stack entry), press Return to leave input mode; then press Return again to duplicate.
Del Hit Del when not in input mode to delete the top stack entry. If the
calculator is in input mode (a cursor is displayed on the top stack entry), press Return to leave input mode; then press Del to delete.

## Clear Commands

Shift-Clr These keys clear the calculator, including the stack, memory registers, macros, and BASIC programs. You must type Y and then press Return at a prompt before clearing takes place.
Shift-Inst Use these keys to clear the stack and memory registers. Macros and BASIC programs are untouched. You must type Y and then press Return at a prompt before clearing takes place.

## BASIC Programs

C $=$-L Load a single BASIC program into the calculator. Type the program filename and then press Return. The program is loaded from disk device 8.
$\mathbf{C}=-\mathrm{S}$ Save all BASIC programs. The calculator can have numerous BASIC programs in memory at the same time. This command saves all the programs currently in memory to disk in one file. The $\mathrm{C}=-\mathrm{A}$ command can then be used to load this file.
$\mathrm{C}=-\mathrm{A}$ Load a file of BASIC programs saved with the $\mathrm{C}=-\mathrm{S}$ command.
$C=-B$ Display a list of all the BASIC programs that have been loaded with $\mathrm{C}=-\mathrm{L}$ and/or $\mathrm{C}=-\mathrm{A}$.
B Execute a BASIC program which has been loaded with $\mathrm{C}=-\mathrm{L}$ or $\mathrm{C}=-$ A. Enter the program name at the prompt.
C Clear the screen; then execute a BASIC program which has been loaded with $\mathrm{C}=-\mathrm{L}$ or $\mathrm{C}=-\mathrm{A}$. Enter the program name at the prompt. After the program finishes executing, the calculator screen will be redrawn.
X Exit to the BASIC environment. . While in BASIC, you can perform any normal BASIC operation, such as running or creating programs. Type SYS2065; then press Return to reactivate the calculator.

## Macros

R Record a macro. Enter the macro name; then press Return. Enter the information or instructions you want recorded; then press R again to terminate recording.

S Save all defined macros to disk in a single file．Enter the filename at the prompt；then press Return．
L Load macros from disk．Enter the filename at the prompt；then press Return．
Z Define whether or not the screen should be constantly updated when a macro is executing．Type 0 Z to disable screen updating．Type 1 Z to enable it．The default mode is en－ abled．Macros execute much faster with screen updating disabled，but errors in macro logic are more easi－ ly found with screen updating enabled．
$\mathbf{C}=\mathbf{-} \mathbf{M}$ List the names of all defined macros．
Shift－M Execute a macro．Enter the macro name at the prompt；then press Return．
M Execute a one－or two－letter macro name．Type M and then the macro letter（s）．This is a convenience for quick execution of often－used macros．

## Miscellaneous Commands

Q Quit the calculator．Use this com－ mand only when you are finished with the calculator．Type Y at the prompt and then press Return．
D Redraw the calculator screen．

## SCICALC 64

0801：वC 08 ØA 00 9E $2 \varnothing 323064$ 0809：36 32 Ø0 00 Øø 4C ED 08 D5 Ø811：4C $\quad 67 \quad 99 \quad 8 \mathrm{~A} \quad 10 \quad 03 \quad 4 \mathrm{C} 71 \quad 69$ ஏ819：08 38 E9 0148 2C A8 1A E6 ब821：16 $63 \quad 269308 \quad 2 \varnothing$ E7 14 DB 0829：20 DA 1568 20 F5 0A $2 \varnothing 36$ 0831：5E 68 A 0 00 8C A9 1A B1 77 0839：FB $08 \quad 29 \quad 7 \mathrm{~F} \quad 2 \varnothing \quad \mathrm{D} 2 \mathrm{FF}$ C8 7B 0841：28 10 F4 20 E7 $14 \begin{array}{llllll} & 20 & 7 D & 57\end{array}$ 9849：日D $2645 \begin{array}{lllllll}52 & 52 & 4 \mathrm{~F} & 52 & \text { gの } & 2 \mathrm{~A}\end{array}$ 0851：20 0615 C9 85 D 6 F9 20 B5
 ब861：26 7D ØD 92 Dø D2 C5 D3 DC 0869：D3 20 C6 31 3A 20 Ø6 60 6A 0871：28 93 日8 2C A9 1A 106313 0879：28 1A 0 日 20 DD 15 A9 001 A 0881：8D A9 1A 20 90 FF 4C 2A 4F 6889： 69 20 A4 0 F 2ø CD ØD 4C 4A 0891：D7 ØA AØ Øø 8C AB 1D 8C FD 0899：AA 1D 8C AC 1D 8C A8 1A 29 98A1：Bl 2 F D9 $\mathrm{Fl} 18 \mathrm{Fg} 01 \quad 60 \quad 97$ 08A9：C8 C 067 9ø F3 A9 FC 85 FD g8B1：22 A9 $6285 \quad 23$ A9 AE 8578 08B9：F7 A9 1A 85 F8 A5 2F 85 ØE Ø8Cl：F9 A5 $30 \quad 85 \mathrm{FA}$ Ø8 A9 3012 Ø8С9：78 850178 Aの $0 \emptyset$ C4 22 CF
 68D9：85 61 28 A9 FF 60 B1 F9 6B 08E1：91 F7 C8 D6 E9 E6 FA E6 A6
 98F1：2F 11 A9 $0^{\circ} 08 \mathrm{DAC}$ 1D 8D F9 98F9：AA 1D 8D AB 1D 8D F6 1D 3D و9ø1：2ø AE 19 2ø 44 A6 $2 \varnothing \quad 72 \quad 63$

9909：0A A9 14 8D 60 63 A9 08 4D 9911：8D $61 \quad 83$ A9 71 8D 92 93 ED 6919：A9 08 8D 030320 1A ØB BB 0921：26 99 日F 26 CD ØD 26 D7 48 6929：0A A2 FB 9A 26 F5 142033 0931：36 694 C 2A 99 AA Eø 2E AF 6939：D6 13 2C AA 1D $7648 \quad 20 \quad 64$ 9941：0F ØD Bø 43 AD AA 1D 09 C3 6949：40 8D AA 1D 60 E6 45 DØ E7 6951：13 2C AA 1D $3031 \quad 20$ ØF 14 6959： 6 D B $\quad 2 \mathrm{C}$ AD AA 1D 9980 DA 6961：8D AA 1D 60 Eø 2D D 16 16 6969：2C AA 1D 10 GD AC AC 1D 72 6971：B9 FF 61 C9 $45 \mathrm{D} \varnothing 634 \mathrm{C}$ DC 6979：日F 6D 8A 4C 89－69 8A 2612 6981：E6 ØC 90 04 20 ØF ØD 6014 9989：C9 14 D 65 2C AB 1D 36 6D 6991： $66 \quad 2661$ ØF 4C 27 ØE AC 93 9999：AC 1D D 603 4C 31 øD B9 8E 99Al：FF 01 AE AA LD Fg 14 C9 13 69A9：45 DØ 66 8A 29 7E 4C B9 95 99B1：09 C9 2E D6 66 8A 29 BF F9 09B9：8D AA 1D CE AC 1D 4C 3171 99C1：0D C9 9D D6 11 2C AB 1D 29 69C9：10 $66 \quad 20$ 3C बF 4C 27 ØE 33 99D1：20 55 ØF 4C 27 ØE 20 8D 2F 99D9：0A 90 1F $984820 \quad 36$ OF Cø Ø9E1：20 9F $\begin{array}{llllllll}6 E & 68 & \text { A8 } & \text { B9 } & 88 & 12 & 83\end{array}$ 69E9：8D F9 69 B9 8912 8D FA A8 Ø9F1： $69 \quad 20$ F8 094 C 22 ØA 4C 8B 69F9：F8 692093 ØA 9ø 2B $98 \quad 89$ ØAø1：48 2б 36 ØF 68 A8 B9 D8 2B gA09：12 8D F9 99 B9 D9 12 8D $4 \varnothing$
 ØA19：20 D6 0E $2 \varnothing$ E8 69206144
 ØA29：27 $\begin{array}{llllllll}\text { EE } & 20 & 87 & \emptyset A & 90 & 19 & 98 & 2 \mathrm{E}\end{array}$ ØA31：48 $20 \quad 36$ ØF 68 A8 B9 6C EE 6A39：11 8D F9 99 B9 6D 11 8D 3C ØA41：FA 9920 F8 694 C CD ØD CA 6A49：C9 DE DØ 10 $2 \varnothing 36$ ØF 28 2D ØA51：55 日F A2 A8 A0 AE 20 A3 56 ØA59：ØE 4C 22 ØA C9 $23 \mathrm{~F} \emptyset$ Ø1 2A 0A61：60 2036 ØF $2 \varnothing 55$ ØF A9 83
 9A71：24 38 A2 63 BD øø 03 Bø CE 9A79：03 BD BC 1D 9D BC 1D 9D 9F ØA81：ø0 03 CA 10 EF 60 A2 6 B 62 ØA89：AØ 11 DØ ØA A2 87 AØ 1273 ØA91：D6 64 A2 D7 A6 1286 FB 37 0A99：84 FC AA A0 øø 8A D1 FB 58 ØAA1：Fの ØA 18 B1 FB Fø 05 C8 45 ӨAA9：C8 C8 Dø F1 8A 6020 9B 3 F ØABl：BC A5 65 A4 6460 A9 20 9C gAB9：4C D2 FF 2012 日B 20 7D 25 ØAC1：$\emptyset D \quad 922 \varnothing$ D 6 D2 C5 D3 D3 3B GAC9：20 Cl $2 \varnothing$ CB C5 D9 $2 \varnothing$ 2E 23
 ØAD9：ØB 20 FF ØC A9 20 AØ 2570 gAE1：20 D2 FF 88 D 0 FA 6018 8E ØAE9：20 F6 FE 20 7D ØD 92 FG 82 ØAF1：øF $2 \emptyset$ Øø $6 \emptyset$ AA A9 9E 85 5A GAF9：FB A9 A1 85 FC Aø Ø6 CA 38 ØB $\emptyset 1: 3 \emptyset$ ØE B1 FB 48 E6 FB D $\varnothing 4 \mathrm{~F}$ ØB $09: 02$ E6 FC 6810 F4 30 EE A4 ØB11：6Ø Aø 01 A2 16 18 4C Eø 64

 ØB29：Cø Cø B2 FØ ØF C0 B2 AE C4 ØB31：$\varnothing D \quad 12$ DD D8 DD Fø $9 F 20$ 8C ØB39：DD $2 \varnothing 2 \varnothing$ DD Eø ØF $2 \varnothing$ DD ØA
 ØB49：2ø DD $2 \varnothing 2 \varnothing$ DD Fø ØF $2 \varnothing$ DD ØB51：DD DD ØD 12 DD 26 DD Fø AC



ØB69：Fの ØF 2ø DD $2 \emptyset 2 \emptyset$ DD Fø CB ØB71：ØF 20 DD DD $\begin{array}{llllll} & \text { ØD } & 12 & \text { DD } & 20 & 3 D\end{array}$ ØB79：DD Fø ØF $2 \varnothing$ DD 2020 DD 2C ØB81：Eの ØF $2 \varnothing$ DD DD ØD 12 DD DA
 ØB91：DD F6 ØF $2 \emptyset$ DD DD ØD 1249 ØB99：DD $2 \emptyset$ DD E® 0 F $2 \varnothing$ DD 2646 ØBAl：2ø DD Fø ØF $2 \emptyset$ DD DD ØD 8F ØBA9：12 DD $2 \emptyset$ DD Fø $0 F 2 \emptyset$ DD 04 ØBB1：2ø $2 \varnothing$ DD Fø ØF 2ø DD DD 3D ØBB9：øD 12 DD $2 \varnothing$ DD Fø $\begin{array}{lllllll} & 2 \sigma & 89\end{array}$ ØBCl：DD $262 \varnothing$ DD Fø GF 26 DD 92 ØBC9：DD ØD 12 DD 20 DD F6 ØF 9B ØBD1：2ø DD $2 \varnothing 2 \varnothing$ DD Fø ØF $2 \varnothing 66$ ØBD9：DD DD ØD 12 DD $2 \emptyset$ AD $\mathrm{F} \emptyset$ D4 ØBE1：0F C 0 BD 2020 AD F 0 ØF 12 ØBE9：CØ BD DD ØD 12 DD Fg 64 4A
 ØBF9：Cø Cø Cø AE Fø 1620 DD Al øC61：øD 12 DD Fø 94 $2 \varnothing$ DD 2ø 6B øС $09: 444547 \begin{array}{lllllll}52 & 45 & 45 & 53 & 2 \emptyset & \text { A8 }\end{array}$ ØC11：DD FG 16 2ø DD ØD 12 DD 3 E
 ØC21：Cの Cø Cø Cø Cø B3 Fø 16 BA
 øC31：DD $20 \begin{array}{llllllll}52 & 41 & 44 & 49 & 41 & 4 \mathrm{E} & \mathrm{B} 6\end{array}$ ØC39：53 20 DD F0 16 20 DD ØD C7 ØC41：12 DD Eø $042 \varnothing$ AB Cø Cø 2A ØC49：Cø Cø Cø Cø Cø Cø Cø B3 54 ØC51：Fの 1620 DD ØD 12 DD Fø A6 ØC59：ø4 20 DD $47 \begin{array}{lllllll}52 & 41 & 44 & 49 & 15\end{array}$ ØC61：45 4E 5453 DD F0 16206 E ØC69：DD ØD 12 DD FØ 6428 AB 57 øC71：Сø Cø Cø Cø Cø Cø Cø Cø 89 ØC79：Cの B3 Fø 1620 DD ØD 12 Ø3 ØC81：DD F6 $642 \varnothing$ DD $28 \quad 5245$ A 6 ØC89：43 $4 \mathrm{FF} \begin{array}{llllll}52 & 44 & 26 & 26 & \text { DD F6 } & \text { D3 }\end{array}$ ØC91：16 20 DD ØD 12 DD F0 Ø4 37 ØC99：2ø AD C $\varnothing$ C $\varnothing$ C $\varnothing$ C $\varnothing$ C $\varnothing$ C $\varnothing$ 9 ØCA1：Cø Cø Cø BD Fø 16 2ø DD 3C ØCA9：ØD 12 AB FØ 25 CØ B3 ØD Fl ØCB1：12 DD FG 2526 DD ØD 12 5F
 øCC1：Dの CE $2 \varnothing$ C3 $414 \mathrm{4C} 43554 \mathrm{D}$ øCC9：4C $41 \begin{array}{lllllllll}54 & 4 \mathrm{~F} & 52 & 2 \emptyset & 42 & 59 & \text { C8 }\end{array}$ ØCD1：2ø D2 $4 \mathrm{~F} \quad 42 \begin{array}{lllllll}52 & 54 & 2 \emptyset & \mathrm{~F} 8\end{array}$

 øCE9： 03 C9 30601860 C9 20 F7 ØCF1：9ø ØA C9 8090 F6 C9 Aの AA ØCF9：9＠ $62 \mathrm{~B} \varnothing \mathrm{~F} \emptyset \quad 38 \quad 6048 \mathrm{~A} 97 \mathrm{D}$ ØDø1：92 $2 \varnothing$ D2 FF 686048 A9 C5 $\begin{array}{llllllll}\text { ØD } 09: 12 & 2 \emptyset & \mathrm{D} 2 & \mathrm{FF} & 68 & 60 & 8 \mathrm{~A} & 2 \mathrm{C} \\ 94\end{array}$ ØD11：AB $1 \mathrm{D} \quad 3 \emptyset \quad$ ØE $\mathrm{CE} A B \quad 1 D \quad 48$ D6 ØD19：2ø 55 ØE $2 \varnothing 27$ 日E 2ø 7A A8
 ØD29： $016 \emptyset \quad 99 \quad \emptyset \emptyset \quad 92$ EE AC 1D 51 ØD31：20 4B ØE Dø 0160 A2 01 CC ØD39：AØ 03 2ø E8 GA AD AC 1D 74 ØD41：F0 2A 49 FF 38 69 0F $18 \quad 25$ ØD49：69 03 A8 A2 0118 20 F6 B1

 ØD61：D2 FF 90 F2 20 97 0D 20 7D ØD69：D2 FF 18 60 A0 11 A2 0185 ØD71：18 20 F6 FF 2807 ØD A9 9E ØD79：30 4 C D2 2 FE 48 8A $48 \quad 98 \mathrm{AE}$ ØD81：48 20 AC 9 D FØ 1F C9 $\mathrm{F} \emptyset \quad \mathrm{B} 6$ ØD89：Dø $162 \varnothing$ AC $\emptyset D$ Eø 1685 3E
 6D99：FF C8 C4 B7 Dø F8 F6 El 28 ØDA1： 26 D2 FF 90 DC 68 A8 68 CB ØDA9：AA $68 \quad 60$ BA $\mathrm{FE} 66 \quad 61 \mathrm{D} \varnothing \mathrm{CD}$ ØDB1： $03 \mathrm{FE} \quad 97 \quad 91 \mathrm{BD} 96 \quad 01858 \mathrm{~B}$ ØDB9：BB BD $07 \quad 0185$ BC Aø 0072 ØDC1：B1 BB 60 A9 B5 85 FB A9 AE

## PROGRAMS

ØDC9：1A 85 FC $60 \quad 20 \quad 27$ ØE 20 D
 6DD9：B7 1D A9 16 8D B8 1D AD E4 GDE1：AA 1A 85 FB AD AB 1 A 85 IE GDE9：FC AD B8 1D 38 E9 03 A8 EE ØDE1：AE B7 1D $18 \quad 20$ Eg FF 20 5B ØDF9：$\emptyset 7$ GD AD AC 1A F $\quad 03$ Ø9 FE QE＠1：30 2C A9 $2 \emptyset \quad 20$ D2 FF AD 71 ØE09：B7 1D 38 E9 $91 \quad 09$ 30 20 9A ØE11：D2 FF 2の FF gC 20 5A ØE 3E बE19：20 93 बE EE B7 1D AD B7 20 ØE21：1D C9 $\quad$ 日B $90 \quad \mathrm{C} 4 \quad 60 \quad 20 \quad 4 \mathrm{~B} \quad \mathrm{DB}$ 0E29：ØE DØ Ø1 60 A9 Ø1 8D B7 CA ØE31：1D A9 ब3 8D B8 1D $2 \emptyset$ C4 BE
日E 41：B7 1D AD B7 1D C9 日B 90 68 のE49：Fの 60 AD C2 1D ØD D7 1D C1 ØE51：D $0 \quad 03 \quad 69 \quad 01 \quad 60$ AD AD 1A $\quad 03$ ØE59：60 AE B7 1D AC B8 1D 20 BC ØE61：E8 日A 20 A7 ØE 20 DD BD 5D
 ØE71：D $\mathrm{F} 89849 \mathrm{FF} 38 \quad 69$ बF 9E 0E79：18 6D B8 1D A8 AE B7 1D 72

 0E91：F5 60 A5 FB $18 \quad 69 \quad 0585$ 2B 0E99：FB 90 F6 E6 FC 60 A2 B5 89 ØEA1：Aの 1A $86 \mathrm{FB} 84 \mathrm{FC} \mathrm{A} \emptyset \quad \emptyset \emptyset 7 \mathrm{E}$ gEA9：B1 FB $85 \quad 6184 \quad 70$ C8 B1 8D ØEBL：FB $85 \quad 66 \quad 99 \quad 80 \quad 85 \quad 62$ C8 32 のEB9：A2 00 B1 FB 9563 E8 C8 Fl ØEC1：C $\emptyset \quad 05$ 9の F6 A5 6645 6E C $\emptyset$ ØEC9：85 6F A5 61 6Ø A2 B5 Aø E8 ØED1：1A 86 FB 84 FC A 00 Bl 80 ØED9：FB $85 \quad 69$ C8 $\quad$ B1 $\mathrm{FB} \quad 85 \quad 6 \mathrm{E} \quad 06$ ØEE1：45 66856 F Bl FB 9980 Fl ØEE9：85 6A C8 A2 $\emptyset \emptyset$ Bl FB 95 FA ØEF1：6B E8 C8 C $\emptyset 9590$ F6 A5 21 0EF9：61 $6086 \mathrm{FB} 84 \mathrm{FC} 2 \emptyset$ 1B E2 ØFØ1：BC AØ Øø A5 6191 FB 84 CD ØF09：7Ø C8 A5 66 Ø9 $7 \mathrm{~F} \quad 25 \quad 62$ 9F ØF11：91 FB C8 A2 Øø B5 639169 ดF19：FB E8 C8 C 065 9の F6 60 4D ØF21：A9 Øø $85 \quad 22$ A9 $9285 \quad 23$ 6A ØF29：AD AC 1D $2 \emptyset$ B5 B7 A2 B5 76 ØF31：Aの 1A 4C FB ØE 2C AB 1D $\quad 65$ ØF39：30 01 60 A9 0ø 8D AB 1D g1 ØF41：8D AA 1D AC AC 1D FØ Ø9 Ø4 ØF49：20 21 ØF A9 00 8D AC 1D E8 ØF51：60 4C 7A ØF AØ E5 B9 B4 F7 0F59：1A 99 B9 1A 88 DØ F7 60 9B ØF61：A $\emptyset \emptyset$ B9 BA 1A 99 B5 1A 6F ØF69：C8 C0 F5 90 F5 AØ $0 \emptyset$ 98 AE ØF71：99 AA 1B C8 C $0 \quad 95$ 9Ø F8 2B ØF79：60 Aø Ø4 A9 Øø 99 B5 1A F6 ØF81：88 10 FA 6020 C3 CC C5 BC ØF89：Cl D2 3F Øø $2 \emptyset$ C3 CC C5 94 ØF91：C1 D2 $2 \emptyset$ C1 CC CC 3F Ø日 7D ØF99：A2 80 2C A2 40 2C A2 ØØ D ØFAl：8E A7 1A 2C A7 1A $3 \emptyset \quad \emptyset 5 \quad \emptyset 2$ ØFA9：7Ø Ø6 A9 GF 2C A9 ØD 2C F5 ØFB1：A9 $114820 \quad 07$ ØD A2 ØD B2 ØFB9：86 22 AØ Ø3 A6 22 18 $2 \emptyset$ F5 ØFCl：F0 FF $2 \emptyset$ B7 日A E6 22 E6 EE ØFC9：22 A5 22 C9 14 9ø EB 6866 ØFD1：AA $2 \emptyset$ DD $\emptyset F 2 C$ C5 1D $3 \emptyset$ DC ØFD9：$\emptyset 160$ A2 13 AØ 6318 2Ø 77 ØFE1：FØ FF A9 BA 4C D2 FF $2 \emptyset 27$ ØFE9：1C 10 2Ø 55 ØF AØ 04 B1 28 ØFF1：FB 99 B5 1A 88 10 F8 60 A3 ØFF9：2Ø 1C 10 A $\emptyset \emptyset 4$ B9 B5 1A C7 1001：91 FB 8810 F8 $60 \quad 20$ 5E E2
 1011：1A 99 B5 1A E8 C8 C 005 ED 1019：9 $\quad \mathrm{F} 4 \quad 60 \quad 20 \quad 36$ 10 $\quad 20 \quad 4443$ 1021：10 A9 B6 Aø 1B 1865 FB 94
$\begin{array}{lllllllll}1029: 85 & \mathrm{FB} & 98 & 65 & \mathrm{FC} & 85 & \mathrm{FC} & 60 & \mathrm{CC} \\ 1031: A 2 & 12 & 4 \mathrm{C} & 14 & 98 & 20 & 9 \mathrm{~F} & 9 \mathrm{E} & \mathrm{FF}\end{array}$ $1039: 20$ F7 B7 2061 ØF A5 15 Ø8 1041：D $\emptyset$ EE 60 A5 14 C9 $64 \mathrm{~B} \emptyset 2 \mathrm{D}$ 1049：E7 AØ ØØ 84 FC ØA 26 FC 27 1051： $\mathrm{gA}_{\mathrm{A}} 26 \mathrm{FC} 18651485 \mathrm{FB}$ A3 1059：90 02 E6 FC 60 20 1C 10 BA 1061：A5 14 Fg CC C9 $32 \mathrm{~B} \emptyset \mathrm{C} 885$ 1069：C6 14 20 4410 A6 FB 8A D7
 1079：B5 1A 99 AD 1D C8 E8 Cø A7 1ø81： 05 9ø F4 68 A8 $20 \quad 63$ ØF $\quad 99$ 1089：20 55 日F A2 Øб BD AD 1D 8A 1091：9D B5 1A E8 E 05 9Ø F5 Fl 1099：60 A9 05 AA D6 D6 AD AA 87 10A1：1A 186932 8D AA 1A AD 1E 10A9：AB 1A $69008 D$ AB 1A EE 91 $10 B 1: A C$ 1A $A D A C 1 A C 9 \quad 0 A 9 \emptyset C B$ 1ØB9： 0 F A9 B6 8D AA 1A A9 1B A7 $10 \mathrm{Cl}: 8 \mathrm{D}$ AB 1A A9 00 8D AC 1A 1B 10C9：60 AD AA 1A 38 E9 32 8D D7 10D1：AA 1A AD AB 1A E9 00 8D 44 10D9：AB 1A CE AC 1A 10 0F A9 D3 1ØE1：78 8D AA 1A A9 1D 8D AB 21 10E9：1A A9 69 8D AC 1A 60 A2 AC 10F1：AA A9 1520 AØ 19 Fg Ø1 C2 1ØF9：60 6C FC FF A2 85 A9 ØF 92 1101：20 Ag 19 Fg 01 60 A9 B5 20 1109：85 FB A9 1A 85 FC Aø øØ 25 1111：98 91 FB E6 FB Dg 02 E6 DF 1119：FC A5 FB C9 AD A5 FC E9 27 1121：1D 90 ED 60 A2 8D A9 ØF 67
 1131：11 A9 бø 8D øø Bø 8D Ø1 FD
 1141： 06 8D A5 1A A9 Aø 8D A6 AE 1149：1A A9 $0 \emptyset$ 8D A3 1A A9 B 045 1151：8D A4 1A $60 \quad 20 \quad 3610$ A5 4 C 1159：14 8D AD 1A 60 20 70 ØA AE 1161：A9 93 20 D2 FF A2 80 6C 66 1169：Øб 03 AC 99 ØF B2 9F ØF ØD 1171：A5 9C 日F 51 FØ 10 44 DA AF 1179：15 94 FD $1093 \quad 25 \quad 1149$ A8 1181： $07 \quad 10 \quad 4 \mathrm{~F} \quad 72$ 10 57 9A 10 5F 1189：46 E8 ØF 50 F9 日F 91 9F BE 1191：10 11 CA 10 CD 4A 13 4D 65 1199：28 $13 \begin{array}{llllllll}52 & \text { B9 } & 13 & 53 & 24 & 15 & \text { BD }\end{array}$ 11A1：4C ØE 15 5A 55 11 B6 4A 5C 11A9：16 B $\emptyset \quad$ B5 16 AE 95174257 11B1： $45 \quad 18 \quad 43 \quad 3 B \quad 18 \quad 58 \quad 5 \mathrm{E} \quad 1188$ 11B9：BF CD 15 A7 C7 15 Ø0 20 FE 11C1：79 12 20 CC BC $20 \quad 80 \quad 126 \mathrm{~F}$ 11C9：4C 53 B8 2の 日C BC $2 \sigma$ C5 59 11D1：$\varnothing E 4 \mathrm{C}$ 2B BA $2 \sigma$ DB 114 C FD 11D9： 12 BB A2 7B Ag 1A 4C D2 D8 11E1：$\sigma E \quad 20 \quad 22124 \mathrm{C}$ 6B E2 20 6E 11E9：22 12 4C 64 E2 $20 \quad 22 \quad 12 \quad 5 \mathrm{~F}$ 11F1： 4 C B4 E2 $2 \sigma \quad 36 \quad 12 \quad 20$ B4 B4 11F9：BF A2 $8 \emptyset$ A $\emptyset$ 1A $2 \emptyset$ D2 $0 E$ C3 1201：20 6A B8 4C 0A $12 \quad 2036$ BA 1209：12 2C A7 1A $30 \quad 9970 \quad 91 \quad 5 \mathrm{~F}$ 1211：60 A2 8A AØ 1A D 04 A2 28 1219：85 A 0 1A 2 0 D2 日E 4C 2B FF 1221：BA 2C A7 1A $30 \quad 0970 \quad 01$ CB 1229：60 A2 94 AØ 1A D D EC A2 53 1231：8F A 1 1A D 0 E6 20 CC 11 F7 1239：20 B4 BF 20 DB 11 20 6A 62 1241：B8 20 71 BF A5 $61 \mathrm{~F} \emptyset \quad 9991$ $1249: 2 \sigma$ CE ØE 2б 12 BB 4C ØE 1B
 1259：AD B6 1A $8566 \quad 60 \quad 2 \emptyset$ 日E A 1261：E3 4C 日A 1220 EA B9 A2 AF 1269：99 AØ 1A 4C 1C 12 A2 9E 97 1271：Ag 1A 20 1C 12 4C ED BF 8F 1279：A2 AD A＠1D 4C FB ØE A2 51 1281：AD AD 1D 4C D2 gE C9 CC 3C

1289：BC C6 C 6 11 D6 D5 11 5F 76 1291：B4 BF Cl 58 BC CE EA B9 6E 1299：D8 ED BF C4 65 12 C5 6 FF 58 12A1：12 D1 CC 11 D4 71 BF 99 E 2 12A9：E2 11 ØF E8 11 Ø1 EE 11 6F $12 \mathrm{~B} 1: 13 \quad 67 \quad 12 \quad 63$ F4 $11 \quad 07$ 5F EC 12B9：12 øの $2 \sigma 12$ BB $2 \sigma \mathrm{C} \sigma 11 \mathrm{FC}$ 12C1：20 C4 GD 20 D6 GE 4C 2B 7D 12C9：BA 20 D5 11 A2 BA AØ 1A 7A
 12D9：B8 2D 53 B8 2A 2 B BA $2 \mathrm{~F} \quad 3 \mathrm{E}$ $12 \mathrm{E} 1: 12$ BB D3 BB 12 5E 7B BF F4 12E9：D2 CA 12 Øø 20 D3 Cl D6 17 12F1：C5 20 CD C1 C3 D2 CF D3 B3 12F9：3F øの $2 \sigma$ CC CF Cl C4 $2 \sigma$ BD 1301：CD C1 C3 D2 CF D3 3F 6070 1369：2 C5 D8 C5 C3 D5 D4 C5 6D 1311：20 CD C1 C3 D2 CF 3 F 日も 83 1319：20 D2 C5 C3 CF D2 C4 2ø 6C 1321：CD C1 C3 D2 CF 3F Øø A2 62 1329： 99 A9 $13 \begin{array}{lllllll}60 & 67 & 19 & 20 & \mathrm{FB} & 7 \mathrm{E}\end{array}$ 1331：14 8D Ø1 Ø2 A9 Ø1 8D Øø 71 1339：$\varnothing 2$ 2の C1 $19 \mathrm{~B} \emptyset \quad 2 \mathrm{C} 20 \mathrm{FB}$ A4
 1349：ØA A2 Ø9 A9 1320 FF 18 gA 1351：DØ Ø1 $60 \quad 20$ Cl $19 \mathrm{~B} \emptyset 1214$ 1359：20 5 EE 日8 $\quad 20$ 7D 6D 4 E 4F $\quad 36$ 1361：20 4D $41 \quad 43524 \mathrm{~F}$ 日0 4C 63 1369：44 Ø8 AD C2 1D Fø 3198 3D 1371：48 A2 日曰 AC D7 1D C 0 1E 02 1379：90 15 20 5E 08 20 7D 0D DF 1381：4D $41 \quad 43 \quad 52 \quad 4 \mathrm{~F} \quad 20 \quad 5354 \quad 22$ 1389：41 43 4B $\quad$ Øの $4 \mathrm{C} 44 \quad$ 日8 BD CB 1391：Cб 1D 99 D8 1D E8 C8 EØ 1F 1399：03 90 F4 8C D7 1D 68 A8 79 13A1：C8 983865 F9 8D C 6 1D 54 13A9：A5 FA 69 g0 8D Cl 1D 20 5C 13B1：B8 $14 \quad 8 \mathrm{C}$ C2 1D 4C D7 8A CA 13B9：2C C5 1D 1g 4B Aø 10 B9 C2 13Cl：C6 1D $99 \quad 60 \quad 62 \quad 88$ 10 F7 10 13C9：AD A5 1A 85 FB AD A6 1A C9 13D1：85 FC 2054 1A A9 60 8D 48 13D9：C5 1D 20 A4 ØF AE C3 1D 50 13E1：86 22 AC C4 1D 8423 E8 DF 13E9：D 01 C8 8E A5 1A 8C A6 10 13F1：1A 8A 38 E5 FB $48 \quad 98$ E5 45 13F9：FC AA A9 Ø0 A8 $91 \quad 22$ C8 17 1401：91 22 C8 $91 \quad 22$ 4C A8 1656 1409：A2 19 A9 13 20 FF 18 D 01 1411： 04 8D C6 1D $6 \emptyset$ Aø 10 B9 A8 1419： $06 \quad 0299$ C6 1D 88 10 F7 84 1421：20 Cl 19 90 10 A9 00 85 A2 1429：AE A9 Bg 85 AF 20 F1 19 7C 1431：A2 62 2g 68 1A AD C6 1D E7 1439：18 69 日3 6D A5 1A 8D C3 73 1441：1D AD A6 1A 69 ØØ 8D C4 65 1449：1D A2 FF 8E C5 1D 4C A4 71
 1459：14 Fg 14 30 F4 20 B8 14 FA 1461：8D C2 1D 98 EE C 0 1D D 0 B3 1469：4B EE Cl 1D 4C B5 14 A5 64 1471：C6 Fg 4120 E4 FF 2C C5 A8 1479：1D $10 \quad 3948$ EE C3 1D D 1071 1481： 03 EE C4 1D AD C3 1D 85 8D 1489：24 C9 FD AD C4 1D $85 \quad 25$ 9B 1491：C9 AF 68901 B 20 5E 98 BE 1499：20 7D 6D 4D $4143 \quad 52$ 4F B2 14A1：20 $42 \begin{array}{llllllll}125 & 46 & 46 & 45 & 52 & 20 & 85\end{array}$ $\begin{array}{lllllllll}14 A 9: 46 & 55 & 4 C & 4 C & 60 & 4 C & 44 & 98 & 5 A\end{array}$
 14B9：4B 15 AD C 6 lD $85 \quad 24 \mathrm{AD} 83$ 14Cl：Cl 1D 8525 Ag 01 B1 24 A5 14C9： $48 \quad 88$ Bl 24 A8 68 4C 5383 14D1：15 AC D7 1D Fg gF A2 1287 14D9：B9 D7 1D 9D C $\emptyset$ 1D 88 CA A8 14E1：10 F6 8C D7 1D $60 \quad 48$ A9 83

14E9：60 8D C5 1D 8D C2 1D 8D 3F 14F1：D7 1D $686020 \quad 5214 \mathrm{Fg}$ C3 14F9：FB 6020 F5 1420 EF 0 CC A8 15ø1：B6 F8 4C D2 FF $2 \varnothing$ E4 FF C2 1509：C9 60 F6 F9 60 Aの 69 A2 10 1511：ED A9 1220 E6 16 D 00113
 1521：4C 4D 17 A2 ED A9 1228 2C 1529：FF 18 D 06160 A9 6885 B2 1531：F9 A9 Ag 85 FA 20 2C 1A F9 1539：D6 6160 AD A5 1A 85 AE 42 1541：AD A6 1A 85 AF A6 $694 C$ E5 1549：B4 $17 \begin{array}{llllllll}48 & \text { A9 } & 36 & 78 & 85 & 61 & \text { A6 }\end{array}$ 1551：68 $60 \quad 48$ A9 $\begin{array}{llllll}37 & 85 & 61 & 58 & 95\end{array}$ 1559：68 60 20 CC CF C1 C4 28 CF 1561：DØ D2 C7 3A $2 \varnothing$ CE C1 CD D2 1569：C5 3 F 日6 26 CC CF Cl C4 36 1571：2の Cl CC CC 3 A 26 CE Cl 34 1579：CD C5 3 F 日6 28 D3 C1 D6 8E 1581：C5 20 Cl CC CC 3A 20 CE F9 1589：C1 CD C5 3 F Øø $2 \emptyset$ C5 D8 99 1591：C5 C3 D5 D4 C5 3 F 60 20 E2 1599：C3 CC C5 C1 D2 281262811 15A1：C5 D8 C5 C3 D5 D4 C5 3F A6 15A9：00 20 D1 D5 C9 D4 3F 0893 15B1：41 4 C 4C 2 E 15B9： 06 4D 41 15C1：45 00 2C 50 2C 57 A2 6010
 15D1：86 F9 84 FA $2 \emptyset 12 \mathrm{C}$ 1A $\mathrm{D} \varnothing \mathrm{B} 4$
 15E1：D6 ØD 26 2D 6E 4C D7 6 A EC 15E9：A2 61 A9 14 D $\emptyset$ Ø2 A6 D6 CE 15F1：48 A 011820 Fg FF 20 EE 15F9：DA ØA A9 ØD $2 \varnothing$ D2 FF 68 CE 1601：38 E9 91 DØ E9 A2 61 Aø 6D 1609： 0 C 18 20 Fg FF $2 \varnothing$ 2C 1A 47 1611：D 06686 BC 日A 4 C DA 1543 1619：A6 D6 Ag ØC 18 20 F6 FF 46 1621：A $6 \quad 62 \quad 20 \quad 38$ 1A 85 FB A2 27
 1631：E8 E4 FB 90 F4 A9 øD 20 1C 1639：D2 FF $2 \varnothing 40$ 1A A5 D6 C9 B5 1641：14 9ø CA 20 BC 0 A 4 C D5 73 1649：15 A2 5B A9 1520 FF 18 EF 1651：D6 6160 A9 6085 F9 A9 80 1659：Bの 85 FA 26 C9 19961286 1661：AD A3 1A 85 AE AD A4 1 A 78
 1671：68 1A 28 1F 1728 8C 19 B9 1679：20 54 1A A9 062024 1A 8B 1681：98 $38 \quad 65$ FB AA A5 FC 69 C 3 1689：00 A8 284317 A5 FB 3897 1691：ED A3 1A 48 A5 FC ED A4 97 1699：1A AA 20 8C 19 A5 F9 8D 2B 16A1：A3 1A A5 FA 8D A4 1A Ag 5E 16A9： $0868 \quad 20 \quad 241$ A 8 A C8 20 E2 16B1：24 1A $38 \quad 60$ Ag 00 A2 6 C 3A 16B9：A9 15 2ø E6 16 D 80166 C8 16Cl：2Ø $219 \begin{array}{lllllll}17 & 85 & 22 & 2 \varnothing & 19 & 17 & 5 A\end{array}$ 16C9：85 23 26 CC FF AD A3 1A 6A 16D1：18 $69 \quad 62$ AA AC A4 1A 90 ØC 16D9： 01 C8 20.43 17 A5 22 48 CC 16E1：A6 23 4C $9 \mathrm{~B} \quad 1684 \quad 22$ A2 17 16E9：6C A9 15 2ø FF 18 Dø 015 E 16F1：60 20 1F 17 A2 $\quad 01 \quad 2 \emptyset$ C6 CB 16F9：FF B 828 A4 22201917 7C 1701：D9 B1 $15 \mathrm{~F} \emptyset \quad 64$ A9 18 D $\varnothing 02$ 1799：1A C8 B9 B1 15 Dø EE A9 3C
 1719：2Ø E4 FF Bø $06 \quad 6 \emptyset 2 \emptyset \mathrm{C} \emptyset \quad 4 \mathrm{E}$ 1721：FF $966720 \quad 3018$ AA 4 CC D9 1729：14 98 A2 6120 C6 FF $\mathrm{B} \varnothing 94$ $\begin{array}{lllllll}1731: F 2 & 26 & 19 & 17 & 2 \varnothing & 19 & 17 \\ 24 & 2 D\end{array}$ 1739：9Ø 56 g4 A9 94 DØ E4 4 CC 58 1741：CC FF A9 $\emptyset \varnothing 85 \mathrm{AE}$ A9 FF 45

1749：85 AF D6 08 A9 00 $85 \mathrm{AE} \mathrm{C7}$ 1751：A9 B $\varnothing 85 \mathrm{AF} 86 \mathrm{FB} 84 \mathrm{FC} 56$
 1761：19 17 A6 002024 1A E6 A2 1769：FB D6 62 E6 FC 24907882 1771： $0 E$ A5 FB C5 AE A5 FC E5 D7 1779：AF 9ø E4 A9 10 Dø A4 $2 \varnothing 08$ 1781：30 18 A5 FB 85 F9 A5 FC 9E 1789：85 FA Aø $60 \quad 98 \quad 2 \varnothing \quad 24$ 1A F4 1791：C8 4C 24 1A A2 7D A9 15 Dø 1799：20 FF 18 D 60160209749 17Al：19 26 2C 1A $D \varnothing 0160$ AD 84 17A9：A3 1A 85 AE AD A4 1A 8585 17B1：AF A $06084 \quad 22$ A2 06 AC 76 17B9： $06 \quad 62$ BD C3 15 99 $01 \quad 926 \mathrm{~F}$ 17C1：C8 E8 E6 6490 F4 8C 60 5C 17C9： $8220 \quad 591928$ C 6 FF 9652 17D1： 63 4C 24 17 A2 6120 C9 AD 17D9：FF Bø F6 A9 26201317 6C
 17E9：36 18 2612 日B 26 7D GD 3C 17E1：92 Dø D2 C5 D3 D3 2ø C6 49 17F9：31 3A $28 \quad 46494 C 45 \quad 20$ DD 1801：45 $58 \quad 49 \quad 53 \quad 54 \quad 53004 C \quad 84$ 1869：44 98 A4 22 B9 B1 15 Fø C3 1811： $06 \quad 201317$ C8 D6 F5 Aの 36 1819：00 2038 1A 201317 E6 5C 1821：F9 D8 62 E6 FA A5 F9 C5 59 1829：AE A5 EA E5 AF 90 E8 48 Bl 1831：20 CC FF A9 Ø1 20 C3 FF 4F 1839：68 60 A2 98 A9 15 2б FF 75 1841：18 Dø ØB $^{6} 6 \emptyset$ A2 8 EE A9 15 D $\emptyset$ 1849：20 FF 18 D $\emptyset 6460$ A9 FF 8E 1851：2C A9 60 8D A9 1A $20 \quad 97 \quad 68$ 1859：19 26 C9 19 B $\emptyset \quad 05$ A2 04 CB 1861：4C $1498 \mathrm{C} 8 \quad 84 \mathrm{FB} 26 \mathrm{AE} 4 \mathrm{D}$ 1869：19 Aの $\emptyset \varnothing 20 \quad 38$ 1A 38 E5 D $\varnothing$ 1871：FB $85 \quad 22$ C8 $20 \begin{array}{llllllllll} & 38 & 1 A & E 9 & D 1\end{array}$ 1879：ø0 $85 \quad 23$ A5 2B $1865 \quad 2270$ 1881：85 2D A5 2 C C $65 \begin{array}{lllll}23 & 85 & 2 \mathrm{E} & 28\end{array}$ 1889：A5 FB 1865 F9 85 F9 A5 64 1891：FA 69 g6 85 FA 20 C6 68 DF 1899：20 59 A6 $2 \varnothing$ 33 A5 A9 60 8A 18A1：2の 9ø FF AØ 00 B9 F1 18 F2 18A9：99 AE 1A B9 F8 18 99 AF 3 C 18Bl：1B C8 C $\varnothing 6790$ EF A5 2 F E8 18B9：85 F7 A5 $36 \quad 85$ F8 A9 FC C2 18C1：85 22 A9 628523 A9 AE 4D 18C9：85 F9 A9 1A $85 \mathrm{FA} 2 \varnothing$ C6 31 18D1：ø8 A9 FC 18652 F 8531 B 5 18D9：A9 $0265 \quad 3085 \quad 32$ A9 FF 57 18E1：8D A8 1A 2 C A9 1 A 10 105 E3 18E9：A9 9326 D2 FF 4C AE A7 3B 18F1：43 $\begin{array}{lllllllll}53 & 01 & 01 & 61 & 00 & 32 & 43 & 78\end{array}$ 18F9：4D FB $\quad 01 \quad 01 \quad 0064 \begin{array}{lllllll}68 & 67 & 39\end{array}$ 1901：19 AE B7 1D AC B8 1D 18 CE
 1911：B $\varnothing 69$ B9 61 Ø2 $2 \varnothing$ D2 FF 5 B 1919：C8 D $\varnothing$ F2 $2 \varnothing$ 7D ØD 1220 A8 1921：92 20 Øø $2 \emptyset$ F5 14 C9 ØD 47 1929：Fø 22 C9 14 DØ ØA AD Øø Eø 1931： 02 Fの CE CE 00 Ø2 B0 C9 9A
 1941：CØ 10 B6 BD EE Øб Ø2 99 DE 1949：01 0290 B5 20 D7 ØA A9 08 1951：Ø1 AØ Ø2 A2 08 2Ø BA FF CC 1959：AD Ø0 ø2 A2 61 Aø Ø2 20 7B 1961：BD FF AD $\emptyset 0 \quad 626086$ F9 C 6
 1971：A 00 8C 00 Ø2 B1 F9 FØ 41 1979：ø6 2б D2 FF C8 D 6 F6 38 C 6 1981：20 FØ FF 8E B7 1D C8 8C 39 1989：B8 1D 60 AD A3 1A 85 FB D2 1991：AD A4 1A 85 FC 60 A9 96 1C 1999：85 F9 A9 Bø 85 FA 602046 19A1：FF 18 FØ 66 AD 61 Ø2 1897

19A9：59 60 A9 4E 60 A9 F6 85 D7 19B1：2B 85 F7 85 7A A9 1D 856 C 19B9：2C 85 F8 85 7B E6 $2 \mathrm{~B} \quad 66 \quad 09$ 19C1：A9 $0085 \mathrm{F9}$ A9 Aø $85 \mathrm{FA} \cdot \mathrm{EE}$ 19C9：26 2C 1A D0 021860 C8 61 19D1：26 38 1A CD $06 \quad 02 \mathrm{D} \varnothing 12 \mathrm{FD}$ 19D9：A2 ø0 C8 2638 1A DD 615 F 19E1： 02 D6 07 E8 EC 0682 90 B4 19E9：F1 60 20 40 1A 4 C C9 19 E3 19F1：A5 F9 85 F7 A5 FA 85 F8 C2 19F9：AØ $00 \quad 2038$ 1A $4818 \quad 65$ 8B 1Aø1：F7 AA C8 $2 \emptyset \begin{array}{llllll}38 & 1 A & 48 & 18 & C 9\end{array}$ 1A69：65 F8 85 FA 86 E9 A5 AE A4 1A11：38 E5 F9 8522 A5 AF E5 5 F $\begin{array}{lllllll}1 A 19: F A & 85 & 23 & 20 & C 6 & 08 & 68 \\ \text { A8 } & 62\end{array}$ 1A21： $68 \quad 38 \quad 60204 B \quad 15 \quad 91$ FB 73 1A29：4C $53 \quad 15 \mathrm{AD} \quad 60 \quad 20 \quad 381 \mathrm{~A} 10$
 1A39：4B 15 B1 F9 4C 5315 A9 A8 1A41：00 $26 \quad 38$ 1A $1865 \mathrm{F9}$ AA 1 B 1A49：C8 2638 1A 65 FA 85 FA AF 1A51：86 F9 60 A 60 A2 00 BD B5 1A59：ø日 022024 1A C8 EC ø日 22
 1A69：FF 38 7D A3 1A 9D A3 1A 3 E 1A71：98 49 FF 7D A4 1A 9D A4 89 1A79：1A 6081 Øø $0 \varnothing$ Øø $0 \varnothing 8184$ 1A81： 49 ØF DA Al $86 \quad 65$ 2E Eの 9A 1A89：D4 86 7E A5 DD 5E 7B $\quad$ ØE 61 1A91：FA 3512 7B 06 AD FC 98 CB 1A99：7F 5E 5B D8 AA 8213 5D 01



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# PROGRAMS 

| $R$ | $O$ | $B$ | $E$ | $R$ | $T$ | $M$ | $A$ | $R$ | $C$ | $U$ | $S$ |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |

1esigning air-core coils for shortwave radios or other electronic circuits requires complicated formulas and trial-and-error adjustments. CoilCalc is a computer-aided design program that should be an invaluable aid to ham radio operators or other electronic hobbyists.

Coils are important components of tuning circuits found in radio transmitters and receivers. When designing an air-core coil for a tuned circuit, the inductance of such a single layer coil is dependent on three variables: coil diameter, coil length, and the number of turns of wire in the coil. As a condition of the number of turns, wire size is a related factor.

Change any of these variables, and you change the inductance of the coil. Inductance is measured in units called henries.

Using a computer to do the num-ber-crunching can make the selection of an inductor much easier. CoilCalc is a program that will calculate the inductance of a coil from its parameters; or if the inductance is known and you're winding your own coils, it will calculate coil length, coil diameter, and number of turns (wire size).

## Getting Started

CoilCalc is written entirely in BASIC. To help prevent typing errors, use The Automatic Proofreader to type it in; see "Typing Aids" elsewhere in this section. When you've finished typing, be sure to save a copy of the program.

## How to Use the Program

If you have a coil whose inductance is not known or if you need to know the inductance of a tuned circuit, select the inductance-unknown option after you've run CoilCalc. The calculation of the coil parameters is done initially with the wire size as specified. This is done on the basis that the coils will be closely wound with the maximum number of turns used for the length considered.

A custom calculation can be selected where the number of turns is used to obtain a more accurate result.

Also, the dimensions may be tailored more exactly to fractional ones, with the resulting change to the inductance given as a percentage. When the wire size becomes larger than 10 percent of the coil diameter, it's best to use the custom option. In this mode the wire's diameter is included with the coil diameter for increased accuracy.


Keep in mind, however, that the result is approximately the true value; the actual value will be affected by the effects of the distributed capacitance. CoilCalc's calculations are based on the use of enameled wire. Should you wish to change to a different type of wire, the data statements giving the number of turns per linear inch for enameled wire, 8 gauge through 40 gauge, can be changed to suit.

## An Example

Let's try an example. Suppose you wish to find the inductance of a coil having 8 turns of \#12 enamel wire wound over 1 inch, with a inside diameter of 0.5 inch.

The menus will direct you to the inductance of a coil where you'll be asked to enter the wire gauge, coil diameter, and coil length. Supply the above figures. CoilCalc will then display the inductance as 0.69 microhenries. This is based on a closely wound coil, having the maximum of 12 turns of \#12 wire over the one inch. Additional variables, however, may affect the accuracy of this calculation.

## Need More Accuracy?

Assume the coil in question, however, is loosely wound and that the wire diameter is larger than 10 percent of the coil's diameter. In this case we should select the custom option by hitting the Ctrl key. This option now asks for the number of turns, which would be entered as 8 , followed by the coil diameter and length as before. The new inductance value will be displayed as 0.4 microhenries, a more accurate value for this particular coil. The percent of change is also given, but in this case we aren't concerned with the resulting change.

Select the custom option again, but this time enter 12 turns with the same diameter and length as before. CoilCalc now indicates an inductance of 0.9 microhenries; this value compared to the original of 0.69 is the result of increased accuracy, as the wire diameter is included in the calculations. This shows that when dealing with small coils and large wire sizes, the custom design option should be consulted.

Run the program again. This time select the known-inductance option and assume you want a coil whose inductance is 25 microhenries. Suppose we plan to use \#22 wire on a form having a diameter of 1.5 inches. How long will the coil have to be? Again CoilCalc will ask for the wire size and coil diameter, but because the inductance is known, it will calculate the length for you.

If you provide the length, the program will determine what diameter the coil should have. If you provide any two parameters, CoilCalc calculates the third. On completion of the calculation, an approximate figure of 0.65 inch using 24 turns would be indicated. This also gives a tolerance of 3.3 percent, indicating the inductance is 3.3 percent higher than requested.

Now select the custom option so you may tailor the parameters to more convenient fractional sizes. Entering different values of turns and length will allow you to obtain a

# PROGRAMS 

length or a number of fractional turns that＇s best suited to you．You＇ll find， for example， 25 turns and a length of 0.75 inch give a value of 25.8 micro－ henries，or 3．2－percent higher； 27 turns and a length of 1 inch give 25.11 microhenries，or 4－percent higher．If you enter a value of turns for a given length that exceeds turns／inch of the wire gauge selected，you＇re told that the gauge has changed．

CoilCalc limits the calculation of lengths up to 4 inches and not less than 0.05 inch．You should make a change in wire size or coil diameter when this limit is reached．

## COILCALC

KH $\emptyset$ REM COPYRIGHT 1991 COMPUT E PUBLICATIONS INTL LTD－ ALL RIGHTS RESERVED
HD løø REM＊＊INITIALIZE＊＊ \｛SPACE \}*
EM 110 HD $\$="\{$ RVS $\}$ INDUCTOR \｛3 SPACES $\}$ DESIGN\｛OFF ${ }^{\prime \prime}$
QF $12 \sigma$ DIMTN（4б）：FORI $=8$ TO 4 $\quad$ ：RE ADTN（I）：NEXT
RR 136 DEFFNPU $(X)=3 * V A L(C D \$) * I$ $\mathrm{N}+9$＊ $\mathrm{IN} *(\mathrm{X}):$ DEFFNNN $(\mathrm{X})=\mathrm{T}$ N（GA）$\uparrow 2^{*} \cdot 2^{*}$ VAL（CD\＄）$\uparrow 2^{*} \mathrm{X}$ $\uparrow 2$
CE 140 POKE $53280,0:$ POKE $53281, ~ \emptyset$ ：POKE 646,7
JH $15 \emptyset$ REM＊＊MENU PAGE＊＊＊ GG $16 \emptyset$ PRINT＂\｛CLR\}\{4 RIGHT\}"HD \＄
BE $17 \emptyset$ PRINT＂\｛DOWN\} \{RIGHT\} PARA METERS FOR A SINGLE－LAY ER，＂：
FM $18 \emptyset$ PRINT＂ 18 RIGHT\}AIR-CORE I NDUCTOR USING ENAMEL WI RE．＂
HP 190 PRINT＂$\{2$ DOWN $\}$ \｛RIGHT \} SE LECT：1－INDUCTANCE UNK NOWN＂；
BJ 195 PRINT SPC（59）＂2－ \｛6 SPACES ${ }^{\prime \prime}$ CHR\＄（34）＂ \｛5 SPACES \}KNOWN"
RQ $2 \emptyset \emptyset$ INPUT＂$\{3$ DOWN $\}$ \｛RIGHT \}CH OICE：$\{2$ SPACES $\} 1$
\｛3 LEFT $\}^{\prime \prime}$ ；AS
MB 210 IFAS＜＞＂1＂ANDAS＜＞＂2＂THEN $2 \emptyset 0$
BM 220 IFAS＝＂1＂THEN260
KS 230 PRINT＂$\{$ DOWN \} \{RIGHT\}ENTE R THE VALUE OF INDUCTAN CE＂
EH 240 INPUT＂ 112 RIGHT $\}$（IN MIC ROHENRIES）＂；IN
KG 250 GOTO $39 \emptyset$
MQ $26 \emptyset$ REM＊＊CALCULATE INDUC TANCE REQUIRED＊
BB 270 PRINT＂\｛CLR\}\{5 RIGHT\}"HD \＄
JA 286 PRINT＂\｛DOWN\}\{RIGHT\}DETE RMINE INDUCTANCE REQUIR ED：－＂
QX 290 PRINT＂\｛DOWN\} \{RIGHT\} SELE CT 1－INDUCTANCE OF AN E XISTING COIL＂
HF 300 PRINT＂$\{8-$ RIGHT $\} 2-$ INDUCT

ANCE OF A TUNED INDUCTO $\mathrm{R}^{\prime \prime}$
MK 310 INPUT＂$\{$ DOWN \} \{RIGHT \}CHOI CE $\{2$ SPACES $\} 1\{3$ LEFT $\} "$ ； BS：IFBS＜＞＂1＂ANDBS＜＞＂2＂T HEN310
QJ 320 IFB $=$＂1＂THEN 406
GE 330 PRINT＂\｛CLR\}\{5 RIGHT\}"HD $\$$
AP 340 INPUT＂\｛DOWN\}\{2 RIGHT\}EN TER EREQ．IN KHZ＂；FRS
HK $35 \emptyset$ INPUT＂\｛DOWN $\{2$ RIGHT $\}$ EN TER CAPACITANCE IN MMFD S＂；CAS
QP 360 IN $\$=S T R \$$（INT（ $100 * 25330 *$ $10 \uparrow 6 /(\mathrm{VAL}(\mathrm{CA})$ ） $\mathrm{VAL}(\mathrm{FR} \$)$个2）+ ．5）／ 100 ）
MG 370 PRINT＂\｛DOWN \}\{2 RIGHT\} IN DUCTANCE REQUIRED IS：＂： PRINT＂$\{$ DOWN $\}$ \｛ 7 RIGHT \}"I NS＂MICROHENRIES＂
SM 380 GOSUB1310
EF 39 Ø IN＝VAL（IN\＄）
GD $40 \emptyset$ REM＊＊CALCULATE INDUC TOR SIZE＊＊
JS 410 PRINT＂\｛CLR\}\{6 RIGHT\}"HD S：IFB $\$=$＂2＂ORA $=$＂ 2 ＂THEN4 30
RJ $42 \varnothing$ PRINT＂$\{2$ DOWN\}\{RIGHT\}FO R AN EXISTING INDUCTOR \｛SPACE\}ENTER ALL": PRINT ＂\｛RIGHT\} PARAMETERS.": GO TO440
RC $43 \emptyset$ PRINT＂$\{2$ DOWN $\}\{$ RIGHT \}TO DETERMINE AN INDUCTOR \｛SPACE\}SIZE ENTER": PRIN T＂\｛RIGHT\}ANY TWO PARAME TERS．
EC $440 \mathrm{FL}=\varnothing$ ： $\mathrm{CO}=5: \mathrm{RO}=6$ ：GOSUB127 $\emptyset:$ PRINT＂WIRE SIZE \｛3 SPACES $\}$（AWG $8-4 \varnothing$ ）：＂
CC $450 \mathrm{RO}=8$ ：GOSUB1270：PRINT＂CO IL DIAMETER（INCHES）：＂
AX 460 RO＝10：GOSUB1270：PRINT＂C OIL LENGTH\｛3 SPACES $\}$（IN CHES）：＂
PE $470 \mathrm{CO}=30: \mathrm{RO}=6$ ：GOSUB1270：IN PUTGAS：GA＝VAL（GA\＄）：IFGA \＄＝＂＂THENFL＝FL＋1：GOTO490
FF $48 \emptyset$ IFGA＜8ORGA＞4 4 THENGOSUB1 300：GOTO $44 \sigma$
XF 490 RO＝8：GOSUB1279：INPUTCD\＄ ：IFCD $\$=$＂＂THENFL＝FL +1
HA $50 \emptyset$ IFIN $>$ ØANDEL $=\emptyset$ THEN $52 \emptyset$
CF 510 RO＝10：GOSUB1276：INPUTCL \＄：IECL $\$=$＂＂THENFL＝FL +1
FP 520 IFFLANDIN\＄＝＂＂THENGOSUB1 280：GOTO 440
DP 530 IFFL＞1THENPRINT＂$\{$ RVS \}RE QUIRE TWO PARAMETERS！＂： GOTO 446
AC 540 IFIN $\$=$＂＂THEN58 0
FM 550 IFGAS＝＂＂THEN650
PE 560 IFCDS＝＂＂THEN720
XS 570 IFCL $\$="$＂THEN82 0
 2＊（TN（GA）＊VAL（CL\＄））$\uparrow 2$
HQ $585 \mathrm{IN}=\mathrm{IN} /((3$＊VAL $(\mathrm{CD} \$))+$（ 9 ＊ VAL（CL\＄）））＋．5）
SX 590 IN＝IN／1 $\sigma \emptyset$
QD 606 PRINT＂ \｛DOWN\}AN INDUCTOR WITH THE ABOVE PARAMET ERS＂
HJ 610 PRINT＂$\{$ RIGHT \}WILL HAVE \｛SPACE\}AN INDUCTANCE OF ：＂：PRINT＂\｛DOWN\}
\｛6 RIGHT \}"IN"MICROHENRI ES＂
SM 620 PRINT＂\｛DOWN\}\{2 RIGHT\}WI TH CLOSE SPACING OF＂TN（ GA）＊VAL（CL\＄）＂TURNS．＂
PM 630 GOTO1040
PJ 640 REM＊＊CALCULATE AWG\＃ \｛SPACE \} * * *
CJ 650 N＝INT（ 10 ＊SQR（（ $3 *$ VAL（CDS $)+9$＊VAL（CL\＄））＊VAL（IN\＄）／ （．2＊VAL（CD\＄）$\uparrow 2))+.5) / 1 \emptyset$
DH 660 FORI＝8TO46：IFSGN（TN（I）＜ N／VAL（CLS））THENNEXT
HS 670 PRINT＂\｛DOWN\} \{RIGHT\}AN I NDUCTANCE OF＂IN＂MICROHE NRIES＂
BM 680 PRINT＂$\{$ RIGHT\}WILL REQUI RE＂N＂TURNS．＂
AS 690 PRINT＂\｛DOWN\}AWG\#"I"HAS" TN（I）＂PER INCH，CLOSE S PACED＂
SJ $70 \emptyset$ PRINT＂OR USE SMALLER AW G，LOOSELY SPACED．＂
MK $710 \mathrm{GA}=\mathrm{I}:$ GOTO106 0
PE 72 R REM＊＊CALCULATE DIAME TER＊＊＊
AS $730 \mathrm{Nl}=\mathrm{TN}(\mathrm{GA})$＊VAL（CL \＄）
PB $746 \mathrm{MF}=\mathrm{N} 1 \uparrow 2 * .2 / \mathrm{IN}$
CQ 75 Ø CD＝INT $(106 *(3+S Q R(9+4 * M$ F＊9＊VAL（CL\＄）））／（2＊MF）＋． 5）$/ 1 \emptyset 0: C D \$=L E F T \$(S T R \$(C$ D），5）
BB 760 PRINT＂$\{$ DOWN\}FOR AN INDU CTANCE OF＂IN\＄＂MICROHE NRIES＂
AP 770 PRINT＂AND THE ABOVE PAR AMETERS，THE DIAMETER＂
GK 780 PRINT＂REQUIRED IS： \｛DOWN \} "CDS" INCHES."
CD 790 PRINT＂$\{$ DOWN \} \{RIGHT \}WITH ＂TN（GA）＊VAL（CLS）＂TURNS
\｛SPACE\}OVER "CLS" INCH.
＂：CL＝VAL（CL\＄）：GOSUB1240
FD $8 \emptyset \emptyset$ PRINT＂\｛DOWN\} \{RIGHT\}TOLE RANCE＂INT（1øg ${ }^{\circ}$（L／VAL（ IN（）-1$)+.5) / 1$＂$^{\circ}$＂
CK 810 GOTOIの60
DK $82 \emptyset$ REM＊＊CALCULATE LENGT H＊＊
CE $830 \mathrm{RO}=12: \mathrm{CO}=16: \mathrm{GOSUB} 1270: \mathrm{P}$ RINT＂\｛RVS\}DOING THE CAL CULATION！＂：CO＝1：GOSUB12 78
CJ 840 IFFNNN（1）＞FNPU（1）THEN94 $\emptyset$
MB 850 FORI $=1$ TO4STEP． 1
RD 860 IFSGN（FNNN（I）－FNPU（I））$=$ -1 THENDF $=$ ABS（FNNN（I）－FN PU（I））：NEXT：GOTO98
ME 876 IFDF $\angle A B S$（FNNN（I）－FNPU（I ））THENI＝I -.1
DQ 880 PRINT＂FOR AN INDUCTANCE OF＂IN\＄＂MICROHENRIES＂
KG 890 PRINT＂\｛RIGHT\}AND THE AB OVE PARAMETERS，COIL LE NGTH＂
JD $9 \emptyset \emptyset$ PRINT＂\｛RIGHT\}REQUIRED I S：\｛DOWN\}"I" INCHES,":N1 $=\operatorname{INT}(1 \sigma * T N(G A) * I+.5) / 1 \emptyset$ ：$C D=V A L(C D \$): C L=I$
MM 910 GOSUB1240：PRINT＂\｛DOWN\} \｛8 RIGHT\}WITH"N1"TURNS.

JP 920 PRINT＂$\{$ DOWN \} \{RIGHT \}TOLE RANCE＂INT（1øø日＊（L／VAL（

# PROGRAMS 

GH 760 GET\＃l，V1s，V1s，V1s，V1s，v 2\＄，V3\＄
RP 770 PRINTASC（V1 $\$+Z \$)+A S C(V 2$ S＋Z\＄）＊ 256 V 3 ；
AC 780 FOR $L=$ ．TO X
PF 790 GET\＃1，V1\＄，V2\＄：PRINTV1\＄V 2S；：NEXT
XX 80ø GET K\＄：IF K\＄＝＂Q＂THEN83 $\emptyset$
KS 81ø IF K\＄く＞＂＂THEN GOSUB221 $\emptyset$
XJ 82の PRINT：IF V2 $\langle<>" \|$ THEN $X$ ＝Y：GOTO760
MX 830 CLOSE1
SQ $84 \emptyset$ PRINT：PRINT MS（10）：GOSU B2210：GOTO240
SF 850 REM＊＊＊DISK COMMAND＊＊＊
JX $860 \mathrm{LN}=33:$ GOSUB2060：IF TXS＝ ＂＂THEN900
EH 870 OPEN1，DN，15：PRINT\＃1，TX\＄
MF 880 INPUT\＃1，EN，EMS，ET，ES：GO SUB219 1
CK 890 PRINTEN；EMS；ET；ES：GOSUB $221 \varnothing$
FB $9 \emptyset \emptyset$ CLOSE1：GOSUB22の日：GOTO4 0 $g$
PC $91 \emptyset$ REM＊＊＊READ \＆DECODE＊＊＊
DQ 920 FIS＝＂＂：LN＝16：S＝1：IF FL \｛SPACE\}THEN $\mathrm{S}=3$
GG 930 GOSUB2060：IF TXS＝＂＂THE N40の
GG 940 GOSUB2190：PRINTMS（6）
KR 950 OPEN1，DN，15，＂I日＂：OPEN2， DN，2，＂\＃＂
MD 960 PRINT\＃1，＂U1＂；2；$\cdot$ T；S
CG 970 GET\＃2，TRS，SES：TRS＝TR\＄＋Z S：SES＝SES＋ZS
AR 98 90 VOR VL＝5 TO 244 STEP 32 ME 990 PRINT\＃1，＂B－P＂；2；VL
KK $100 \emptyset$ FOR $I=1$ TO 16：GET\＃2，BY \＄
DK $101 \emptyset$ IF BY $=$ SS $\$$ THEN 1636
DX 1020 FI $=\mathrm{FI} \$+\mathrm{BY}$ ：NEXT I
FD 1030 IF FI\＄＝TXS THEN1086
GG 1040 FIS＝＂＂：NEXT VL
JK $105 \emptyset$ IF ASC $(T R \$)\langle>$ ．THEN $S=$ ASC（SES）：GOTO960
BP 1060 GOSUB2200：GOSUB2190：PR INTMS（5）
DP 1070 GOSUB2210：GOTO153 0
SJ $1080 \mathrm{ZZ} \$=\mathrm{S} 1 \$: \mathrm{S} 1 \$=" \mathrm{Cl}:$ PRINT\＃1 ，＂B－P＂；2；VL－3
EP $109 \emptyset$ FOR L＝1 TO 30
QE 1160 GET\＃2，BYS：IF BY\＄＝＂＂TH EN $B Y \$=Z S$
XH 1110 IF $\mathrm{L}=20$ AND $\mathrm{BY} \$=\mathrm{Z} \$ \mathrm{THE}$ N S1\＄＝ZZS：GOSUB2190：PR INTM\＄（15）：GOSUB2210：GO TO153 $\sigma$
CF 1120 S $1 \$=\mathrm{S} 1 \$+\mathrm{BY} \$: \mathrm{NEXT}$
QG 1130 S2S＝＂＂：ADS＝＂＂：SS＝S
AK 1140 FOR L＝．TO 13：T\＄（L）＝＂＂ ：NEXT
QF $1150 \mathrm{KK}=144:$ IF FL THEN $K K=4$
QX 1160 PRgNT\＃1，＂U1＂；2；；T；．：P RINT\＃1，＂B－P＂；2；KK
XC 1170 FOR L＝1 TO 16
GJ 1180 GET\＃2，BY\＄：IF BY\＄＝SS\＄T HEN 1206
QS $119 \emptyset \mathrm{~T} \$(1)=\mathrm{T} \$(1)+\mathrm{BY} \$:$ NEXT
KH $12 \emptyset \sigma \mathrm{TK}=\mathrm{ASC}(\operatorname{MID}(S 1 \$, 20,1))$ ：SK＝ASC（MID\＄（S1\＄，21，1） ）
HJ $121 \varnothing$ PRINT\＃l，＂Ul＂；2；．；TK；SK ED 122 PRINT\＃1，＂B－P＂；2；68

SD 1236 FOR L＝1 TO 187：GET\＃2，B Y\＄：IF BY\＄＝＂＂THEN BY\＄＝ Z \＄
QS 1240 S 2 ＝S $2 \$+B Y \$: N E X T: C L O S E$ 2：CLOSE1
CG $1250 \mathrm{~T} \$()=.\mathrm{TX} \$: \mathrm{T} \$(2)=\mathrm{C} \$(\mathrm{ASC}$ （MIDS（S1\＄，23，1）））
CS 1260 FOR L＝10 TO 27
FG 1278 BY $\$=\operatorname{MID}(S 2 \$, L, 1): I F B$ Y ＝$=\mathrm{Z}$ \＄THEN1290
JG 128 T $\mathrm{T}(3)=\mathrm{T} \$(3)+\mathrm{BY} \$:$ NEXT
HK $1290 \mathrm{~T} \$(4)=\mathrm{C} \$($ ASC $(M I D \$(S 1 \$$, $22,1))+15$ ）
GA $1300 \mathrm{X}=\mathrm{ASC}(\mathrm{MID}(\mathrm{S} 1 \$, 29,1))+$ $\operatorname{ASC}(\operatorname{MID}(S 1 \$, 36,1)) * 25$ 6
$\mathrm{XQ} 1310 \mathrm{~T} \$(5)=\operatorname{STR}(\operatorname{INT}(\mathrm{X} / 4))+"$ $\mathrm{K}\{2$ SPACES $\}$＂+ STRS $(\mathrm{X})+"$ BLOCKS＂
KA 1320 MM＝ASC（MIDS（S1\＄，25，1）） ： $\mathrm{DD}=\mathrm{ASC}(\mathrm{MID}(S 1 \$, 26,1)$ ）：YY＝ASC（MID\＄（S1\＄，24，1 ））
EE $1330 \mathrm{HH}=\mathrm{ASC}(\operatorname{MID}(S 1 \$, 27,1))$ ：NN＝ASC（MID\＄（S1\＄，28，1） ；
GB 1340 TS $(6)=\operatorname{STR} \$(M M)+" / "+S T R$ \＄（DD）＋＂／＂＋STRS（YY）
PS $1350 \mathrm{X} \$=\mathrm{STR}(\mathrm{NN}): \operatorname{IF}$ LEN $(\mathrm{X} \$)$ $=2$ THEN $X \$=" \quad g^{\prime \prime}+$ RIGHT $\$$ （ $\mathrm{X} \$, 1$ ）
JX $1360 \mathrm{~T} \$(6)=\mathrm{T} \$(6)+" \mathrm{C}+\mathrm{STR}(\mathrm{H}$ H）+ ＂：＂+XS
AH 1370 IF FG THEN EG $=$ ．：RETURN
DF 1380 FOR L＝30 TO 47
FQ 1390 BY\＄＝MID（S2S，L，1）：IF B $\mathrm{Y} \$=\mathrm{Z}$ \＄THEN1410
QM $1400 \mathrm{~T} \$(7)=\mathrm{T} \$(7)+\mathrm{BY} \$: \operatorname{NEXT}$
GB 1410 WP＝ASC（LEFT $\$(S 1 \$, 1)$ ）
DK 1420 IF WP＞133 THEN T $\$(8)="$ YES＂：GOTO144 $\varnothing$
HP $1430 \mathrm{~T} \$(8)=$＂NO＂
PE 1440 Q $=2$ ：FOR L＝2 TO 6 STEP \｛SPACE\} 2
BX $1450 \mathrm{X}=\mathrm{ASC}(\operatorname{MID}(\mathrm{S} 2 \$, \mathrm{~L}+2,1))$ ＋ASC（MIDS（S2S，L＋3，1））＊ 256
SS 1460 GOSUB2240：ADS＝ADS＋AS：T $\$(9)=T \$(9)+Q \$(L-Q)+A \$$
AR $1470 \mathrm{Q}=\mathrm{Q}+1: \mathrm{NEXT}$
RX 1480 X＝93：FOR $I=10$ TO 13
JX $149 \emptyset$ FOR $L=X$ TO X +28
XJ 1500 BY\＄＝MID $(S 2 \$, L, 1): I F B$ $\mathrm{Y} \$=\mathrm{Z} \$$ THEN 1530
DB $1510 \mathrm{~T} \$(\mathrm{I})=\mathrm{T} \$(\mathrm{I})+\mathrm{BY} \$$
PD 1520 NEXT L：X＝X +29 ：NEXT I
SB 1530 CLOSE 2：CLOSE1：GOSUB22 6 0：GOTO 380
GB 1540 REM＊＊＊UPDATE SCREEN＊＊＊
SJ 1550 PRINTHMS＂\｛3 DOWN \}"
XA 1560 FOR L＝．TO 9
CD $157 \varnothing$ PRINTTAB（TX +16 ）T $\$(\mathrm{~L}) \mathrm{LE}$ FT\＄（S\＄，21－LEN（T\＄（L）））
AC 1580 NEXT：PRINT
QS 1590 FOR $L=10$ TO 13
SE 1600 PRINTTAB（TX＋3）T\＄（L）LEF T\＄（S\＄，29－LEN（T\＄（L）））
DQ 1610 NEXT：RETURN
KS 162 REM＊＊＊ENCODE \＆WRITE＊＊ ${ }_{\text {R }}^{\text {R }}$

DF 1630 GOSUB2190：IF T\＄（．）＝＂＂ \｛SPACE\}THEN PRINTMS (12 ）：GOSUB2210：GOSUB2200： GOTO40 0
KR $1640^{\circ}$ PRINTMS（13）：GOSUB $221 \varnothing$

DM 165 IF $K \$\rangle$＂Y＂THEN195
SX 1660 GOSUB2190：PRINT M\＄（7）： FOR L＝．TO 5：TT\＄（L）＝＂＂ ：NEXT
MB 1670 FOR $\mathrm{I}=$ ．TO 1
BG $1680 \mathrm{X}=\mathrm{LEN}(\mathrm{T} \$(\mathrm{I})): \mathrm{TT} \$(\mathrm{I})=\mathrm{T} \$$ （I）
GP 1690 IF $X<16$ THEN FOR $J=1$ T $0 \quad 16-\mathrm{X}: \mathrm{TT} \$(\mathrm{I})=\mathrm{TT} \$(\mathrm{I})+\mathrm{S}$ S\＄：NEXT J
DE 1706 NEXT I
$\mathrm{BF} 1710 \mathrm{~L}=2: \mathrm{FOR} \mathrm{I}=3$ TO 7 STEP \｛SPACE\}4
HA $1720 \mathrm{X}=\mathrm{LEN}(\mathrm{T} \$(\mathrm{I})): T \mathrm{~T} \$(\mathrm{~L})=\mathrm{T} \$$ （I）
CE 1730 IF $\mathrm{X}<18$ THEN FOR $\mathrm{J}=1 \mathrm{~T}$ $018-\mathrm{X}: \mathrm{TT} \$(\mathrm{~L})=\mathrm{TT} \$(\mathrm{~L})+\mathrm{Z}$ \＄：NEXT J
QR $1740 \mathrm{~L}=3$ ：NEXT I
KJ 1750 DT $\$=\operatorname{CHRS}(\mathrm{YY})+$ CHR $(\mathrm{MM})+$ CHRS（DD）＋CHRS（HH）＋CHRS （NN）
QJ 1760 FOR L＝1 TO 9 STEP 4
SM 1770 X \＄＝MIDS（AD\＄，L，4）：GOSUB 229 g
QH $1780 \mathrm{HI}=\mathrm{INT}(\mathrm{X} / 256): \mathrm{LO}=\mathrm{X}-\mathrm{HI}$＊ 256
$\mathrm{HX} 1790 \mathrm{TT} \$(4)=\mathrm{TT} \$(4)+\mathrm{CHR} \$(\mathrm{LO})$ ＋CHRS（HI）：NEXT
BD 1800 FOR L＝10 TO 13：TT\＄（5）＝ TT \＄（5）＋T \＄（L）：NEXT
CJ $181 \emptyset \mathrm{X}=\mathrm{LEN}(\mathrm{TT} \$(5))$
DC 1820 IF $\mathrm{X}<95$ THEN FOR $\mathrm{L}=1 \mathrm{~T}$ $095-\mathrm{X}: \operatorname{TT} \$(5)=\operatorname{TT} \$(5)+Z$ \＄：NEXT
ED 1830 S $1 \$=\mathrm{CHR}(\mathrm{WP})+\mathrm{MID}(S 1 \$$ ， $2,2)+\mathrm{TT} \$()+.\mathrm{MID}(\mathrm{S} 1 \$, 2$ g，4）＋DT \＄＋MID\＄（S1\＄，29，2 ）
CF $1840 \mathrm{TM} \$=\mathrm{CHR}(\mathrm{WP})+\mathrm{MIDS}(\mathrm{S} 2 \$$ ， $2,2)+\mathrm{TT} \$(4)+\mathrm{TT} \$(2)+\mathrm{MID}$ \＄（Sl\＄，28，2）
AB 1850 S 2 \＄＝TMS＋TT\＄（3）＋MID\＄（S2 $\$, 48,45)+\mathrm{TT} \$(5)$
DB 1860 OPEN1，DN，15，＂Iด＂：OPEN2 ，DN， 2 ，＂\＃＂
AC 1876 PRINT\＃1，＂U1＂；2；．；T；SS： PRINT\＃1，＂B－P＂；2；VL－3
PR 1880 PRINT\＃2，S1\＄；：PRINT\＃1，＂ U2＂； 2 ；．；T；SS
HB 1890 CLOSE2：CLOSE1：OPEN1，DN ，15，＂IØ＂：OPEN2，DN，2，＂\＃

QB 1900 PRINT\＃1，＂U1＂；2；；T；：P RINT\＃1，＂B－P＂；2；KK
QG 1910 PRINT\＃2，TT\＄（1）；：PRINT\＃ 1，＂U2＂；2；；T ；．
CA 192 19 CLOSE2：CLOSE1：OPEN1，DN ，15，＂Ig＂：OPEN2，DN，2，＂\＃

EF 1930 PRINT\＃1，＂U1＂；2；；TK；SK ：PRINT\＃1，＂B－P＂；2； 68
EB 1940 PRINT\＃2，S2\＄；：PRINT\＃1，＂ U2＂； 2 ；$\cdot$ ；TK；SK
JR 1950 CLOSE2：CLOSE1：GOSUB220 0：GOTO4 0
SA 196 Ø REM＊＊＊PRINTER DUMP＊＊＊
QH $197 \emptyset$ GOSUB219
BQ 1980 IF $T \$()=." "$ THEN PRINT M\＄（11）：GOSUB2210：GOTO2 640
FH 199ø OPEN4，4，7：CLOSE4：IF ST $\langle\varnothing$ THEN PRINTMS（14）：G OSUB2210：GOTO2040
GC 2000 PRINTM\＄（4）：OPEN4，4，7


I
he evil Gorn system has established a secret base in your galaxy and plans to launch a major attack. Your mission is to find the enemy base and destroy it.

Finding the enemy base will not be easy. It has a cloaking device that makes it invisible to your ship's scanners, and its shield protects it from your fire. Its only weak points are the four generators that supply its power. If you can disable these generators and render the base visible, you can destroy it and stop the Gorn invasion.

Star Strike is a one-player game that requires quick reflexes and a good memory. It also takes some patience.

## Getting Started

Star Strike is written entirely in machine language, but it loads and runs like a BASIC program. Enter the program with $M L X$, our machine language entry program; see "Typing Aids" elsewhere in this section. When $M L X$ prompts you, respond with the values given below.

Starting address: 0801
Ending address: 1808

CR 2240 AS="": $\mathrm{Z}=1:$ FOR $\mathrm{I}=1$ TO 3 EE $2250 \mathrm{~V}=\mathrm{INT}(\mathrm{X} /(4 \sigma 96 / \mathrm{Z})): \mathrm{A} \$=\mathrm{A}$ \$+MIDS (HXS,V+1,1)
EQ $2260 \mathrm{X}=\mathrm{INT}\left(\mathrm{X}-\mathrm{V}^{*}(4096 / \mathrm{Z})\right)$
SC $2276 \mathrm{Z}=\mathrm{Z}$ * $16:$ NEXT
KD 2280 AS=AS+MIDS(HXS,X+1,1): RETURN
HX 2290 AS="":X=.:FOR I=1 TO 4
KK 2306 AS=MIDS (XS,5-I, 1)
EM 2310 FOR J=1 TO 16
HA 2326 IF AS=MIDS (HX\$,J,1) TH EN2346
EQ 2330 NEXT J
AS $2340 \mathrm{X}=\mathrm{X}+(16 \uparrow(\mathrm{I}-1))^{*}(\mathrm{~J}-1): \mathrm{N}$ EXT I:IF $X>65535$ THEN $\{S P A C E\} X=$.
GC 235 Ø RETURN
PP 2360 REM***QUIT***
AA 2370 CLOSE $2: C L O S E 1: P R I N T "$ \{CLR\}"CHRS (142): END
XF 2380 DATA" EILENAME:", $16, "$ \{5 SPAC̄ES\}DISK:", 16," \{5 SPACES\}TYPE:",
QC $239 \emptyset$ DATA" $\{4$ SPACES $\} C L A S S: "$ ,18,"STRUCTURE:", .," \{5 SPA CES \}SIZE:",
JE $240 \emptyset$ DATA" MODIFIED:", $1 \emptyset, "$ \{3 SPACES \}AUTHOR: ", 18
RJ $241 \emptyset$ DATA"WRTE ETCT:",1," \{3 SPA ACES \} $\overline{M E M O R Y}: ", 12$, "\{4 SPACES\}NOTES:",1 XX $242 \emptyset$ DATA"CBM PRḠ", "BASIC P RG","ASSEMBLY PRG"
JC 2430 DATA"D-DATA FILE", "SYSTE M FILE", "DESK ACCESSOR

FA $2440{ }^{\prime \prime \prime}$
EA 244 の DATA"APPLICATION", "APP LICAT $\bar{I} O N$ DATA", "FONT F ILE"
PA $245 \emptyset$ DATA"PRINTER DRIVER"," INPUT DRIVER", "DISK DR IVER"
PP 2460 DATA"SYSTEM BOOT FILE" , "TEMP", "AUTO-EXEC"
DP 2470 DATA"SEQUENTIAE", "VLIR
BH 248 D DATA"\$","-\$"," EXA:\$"
HA 2490 DATA" $\Rightarrow=$ GEOINFO EDITOR <=-"," \{RVS\}D\{OFF\}:DIR ECTORY \{RVS\}C\{OFF\}:DIS K CMD $\{4$ SPACES $\}\{R V S\} Q$ \{OFF\}: QUIT"
PR 250ø DATA" \{RVS\}R\{OFF\}:READ \{RVS\}W\{OFF\}:WRITE
\{RVS\}P\{OEF\}:PRINT", "PR INTING..."
XC 2510 DATA"EILE NOT FOUND.", "READING \& DECODING... ","

XJ $252 \varnothing$ DATA"NO FILE SELECTED. ", "TH İS CAN'T BE CHANG ED. ", "pRESS ANY KEY."
PS 2530 DATA"NOTHING TO PRINT. ", "NOTHING TO WRITE.",
"ARE YOU SURE (Y/N)?"
MC 2540 DĀTA"PRINTER NOT READY .", "INNPUT NOT A GEOS F ILE."

■

K E V I N D I X O N


BEFORE YOU CAN ATTACK AN ENEMY SPACE STATION, YOU MUST FIRST DISABLE THE GENERATORS THAT POWER ITS CLOAKING DEVICE IN THIS ARCADE-STYLE GAME FOR THE 64

When the title screen appears, plug a joystick into port 1 and press the fire button. You'll see your mother ship in the middle of the screen with your ship docked alongside. You'll find your score at the top of the screen, along with the number of lives you have remaining, the amount of energy you have, the sector you are in, and the number of generators you have destroyed. You'll always start in sector 11 with 2500 units of energy and four spare lives.

To maneuver your ship, use the joystick. Push left and right to rotate your ship. Push forward to thrust in the direction it's pointing. Press the fire button to launch a photon blaster. Pull back on the stick to activate your hyperspace device to jump to another sector. As you fly around the galaxy, your energy decreases. Firing the photon blaster uses one energy unit. Using hyperspace depletes 100 energy units.

When you move off the edge of the screen, you'll move into an adjacent sector. There are 64 sectors in the galaxy, arranged in an $8 \times 8$ grid. The first number in the sector indicator is
the $x$ location，and the second is the $y$ location，so sector 11 is the first sec－ tor，and 88 is the last．

As you explore the area，you＇ll see quite a few asteroids in different sec－ tors．These asteroids have gravity，and if you are not careful，they＇ll pull your ship in，and you＇ll be destroyed．Col－ liding with an asteroid decreases your overall energy supply rather quickly． If you are lucky，you can hit an aster－ oid and survive，but your energy will be very low．

Your mother ship also has gravi－ ty．When you wish to dock with it to replenish your energy，return to sector 11 and fly close to the gray landing pad．When you approach the pad， slow down and let the mother ship＇s tractor beam pull you in．When you are docked，your energy will be resup－ plied to 2500 energy units．Whenever your ship is docked，it is protected by the mother ship＇s shields．

Before you can destroy the ene－ my base，you must find the four gen－ erators that are supplying power to the base＇s cloaking device and shields． The generators are hidden inside four asteroids somewhere in the galaxy．

You must search the galaxy，fir－ ing your photon blaster at asteroids． An asteroid must be hit about 30 times before it will explode．If a gener－ ator is hidden inside，it will appear after the asteroid disintegrates．Gener－ ators look like large red diamonds， and you must hit them about 30 times before they will explode．After a gen－ erator has been destroyed，one of the Xs in the upper right corner of the screen will become reversed，indicat－ ing that you have one less generator to find and destroy．

As you search for generators，the enemy base launches homing robot missiles at you．You＇ll hear an alarm from your ship＇s sensors whenever a missile is launched．Missiles track your movement and follow you，no matter where you go in the galaxy． You can＇t outrun these missiles，but you can outmaneuver them．If a mis－ sile hits you，you lose 500 units of en－ ergy．You can destroy missiles if you hit them with four shots of your pho－ ton blaster，and they＇re also vulnera－ ble to collisions with an asteroid or your mother ship．

When a missile enters your sec－ tor，pay attention to what direction it came from．The enemy Gorn base is
in that direction．Sometimes you can locate the base before all four genera－ tors are destroyed．If a missile sudden－ ly appears in your sector and your launch alarm goes off simultaneously， you＇ll know that the enemy base is in that sector，even though you can＇t see or hit it．Remember the sector num－ ber，because the base will be there when you have destroyed all four gen－ erators and made it vulnerable．

Once you have destroyed all four generators and have located the base， start attacking it．Its shields will be down，but it can now launch missiles more frequently．The base has to be hit about 200 times with your blaster before it can be destroyed，so be pre－ pared to return to your mother ship for energy．You＇ll probably find it nec－ essary to return several times during a game，as missiles sap your energy．

If you manage to destroy the base，head back to your mother ship and dock．You＇ll receive bonus points for the number of lives you have re－ maining．

If you find yourself in trouble－ for example，you＇re heading straight for an asteroid or you＇re surrounded by missiles－you can escape by using your hyperspace device．Use the hy－ perspace sparingly，however，as it costs 100 units of energy．Also，you． may find yourself landing right on top of a deadly asteroid．

If you wish to pause the game at any time，press Run／Stop．Press any other key to resume play．

## STAR STRIKE

$\begin{array}{llllllllll}9801: & 9 B & 98 & 70 & 17 & 9 E & 32 & 34 & 30 & 6 \mathrm{E}\end{array}$
 ஏ811： $2 \emptyset \quad 2 \emptyset \quad 2 \emptyset \quad 2 \emptyset \quad 2 \sigma$ Aø C4 B9 $\quad 66$ ஏ819：3C 6899 F 8 Øб 99 FD 98 F 6 0821：99 $33 \quad 03$ 88 D 0 Fl A 069 4C 6829：B9 日C $98 \quad 99 \mathrm{FF}$ g3 88 Dg A1 g831：F7 A9 3C 85 2D A9 $1 \mathrm{~F} \quad 85$ 5B ஏ839：2E 4C $\quad 00 \quad 0111 \mathrm{EA} 94$ 3C FB 9841：1F $81 \quad 16$ B9 $6 \mathrm{E} \quad 99 \quad 99$ E8 53 9849： $07 \mathrm{C} 8 \mathrm{D} 0 \mathrm{~F} 7 \mathrm{EE} \quad 62 \quad 91 \mathrm{EE} 19$ ஏ851： 05 Ø1 C6 F9 D6 ED A2 0323 ஏ859：2の $24 \quad \emptyset 3 \mathrm{~F} \emptyset \quad 33 \mathrm{C} 9 \quad 67 \mathrm{D} \emptyset 95$ Ø861：16 A2 Ø1 2の 34 Ø3 D D ØA Aø ஏ869：A2 $\quad \emptyset 4 \quad 2 \emptyset \quad 34 \quad \emptyset 3 \quad 18 \quad 69 \quad 97 \quad 65$ ஏ871：1Ø 95 A2 ØA $2 \emptyset \quad 34 \quad 03 \quad 85$ 1D 6879：A8 A5 A7 85 A9 A5 FE 85 FB ஏ881：F7 A5 FF 85 F8 20 6C $63 \quad 73$ 9889：A5 F8 85 FF A5 F7 85 FE 72

 68A1：A6 18 A5 FC 65 A6 85 F7 58 08A9：A5 FD 65 A7 85 F8 $2 \emptyset$ 6C EF 68B1： 93 4C $13 \quad 01$ E8 $20 \quad 34 \quad 93 \mathrm{FB}$


 ஏ8D1： 93 E6 A7 4C 5C 91 E8 $2 \emptyset$ AF
 68E1：18 69 Ø4 A8 D 6 D6 E8 2617 08E9：34 63 D 0 日A A2 02 2Ø $34 \quad 21$ 98F1： $6318 \quad 69$ Ø6 DG ED A2 188 A2 Ø8F9：2の $34 \quad 63$ Dø E6 A9 $\emptyset \emptyset 85$ F7 9901：A7 A4 FB Fの 0 C 66 FA 2A 37 9999：26 A7 C6 FB CA D 62 A8 D8 6911：60 48 Bl FE 85 FA A9 68 FE 6919：85 FB 68 A4 FE D $\emptyset 62$ C6 4A 6921：FF C6 FE C $\varnothing$ E7 D $\emptyset$ DE A4 B5 9929：FF C $\emptyset \quad 97$ Dø D8 A9 3785 BA 6931： 0158 4C 00 ØE A4 A8 FØ A8 ஏ939：22 A5 F7 38 E5 A8 Bø 63 7E 9941：C6 F8 38 85 F7 A5 FC E5 8A 9949：A8 BG 62 C6 FD 85 FC B1 3A 9951：F7 8891 FC 98 D 6 F8 C4 42 6959：A9 F 6 ØA B1 F7 C6 FD C6 76 6961：F8 C6 A9 10 EC 6078 E6 98

 6979：$\emptyset \mathrm{E}$ 5E $4 \mathrm{~B} \quad 68 \mathrm{CD}$ 日B 4449 9D g981：58 $91 \quad 20$ BA E1 65 8D 1022 6989：78 98 F1 38 A8 $63 \quad 20 \quad 23$ D1
 Ø999：34 42 C $\emptyset \quad 5 \mathrm{~F}$ FC $\quad 06 \mathrm{C} \emptyset \quad 57$ 3D 99A1：7C $22 \quad 65$ C4 72 C1 53 FC A5 Ø9A9： $07 \quad 30 \quad 84 \mathrm{BE}$ 3C F4 $\quad$ Ø8 18 A5
 69B9：53 CC $\quad 9788 \mathrm{FE}$ 2D $66 \quad 9 \mathrm{~F} \quad 6 \mathrm{~A}$ の9C1：1F $\quad \emptyset \emptyset$ 1C 3 F C5 $5 \mathrm{~F} \quad 8 \emptyset$ C8 $5 \emptyset$
 69D1：54 Fg F9 48 14 6 B 日1 E2 BF 69D9：A7 E $\emptyset 67 \mathrm{C} \emptyset \quad 01$ 日F 80 A3 CD g9E1：A7 CA $21 \quad 47$ A2 $58 \quad 28$ ØA E3 99E9：01 $84 \quad 50 \quad 91 \quad 97 \quad 20$ E6 6097 Ø9F1：44 1B 80 D 6 A9 F2 9679 BD 69F9：28 10 gø 7ø FC 17 3C C5 AD ØA01：7C A1 B3 E5 201359 2C BC
 gA11：C 08 7C 1 E 8A 85 A2 Ag 5D gA19：7C C9 DF F8 0180 4C F9 06
 ØA29： 02 B6 64 E1 C9 F2 F7 79 日E ØA31：70 $68 \quad 84$ E2 C8 $97 \quad 81$ 1C D7 0A39：E6 E7 CB $4 \mathrm{C} \quad 67 \quad 18 \quad 40 \quad 2 \mathrm{C} \quad 3 \mathrm{E}$ 6A41：3C $34 \quad 62$ 3E F2 B3 38 F3 6F ØA49：F3 E5 AC 2350 Ø8 Øø Eの 1C ØA51：F8 $\quad 2 \mathrm{~F} \quad 7 \mathrm{E} \quad 33$ 9A $9 \mathrm{~F} \quad 2 \mathrm{~F} 85$ E7 6A59： 03 AF 85 GF 1D 61 E 6 3F 6A ＠A61：69 $64 \quad 97$ E4 E7 CB 5D E7 6B ØA69：A1 0311 DA 7F F9 D9 Eg 57 gA71：29 F4 B6 gA 7C 24 E2 3F 48
 ØA81：9D 9C 2C A9 1F 86 ØA89：1E 1A A1 328 F 81 Bg E6 55 gA91：A1 $58 \quad 28$ gA EA C $\emptyset$ 2A D3 B4 ØA99：ØC 9C 3A 80 97 5C $6 F \quad 05$ 7B GAA1：$\emptyset \emptyset \quad$ A3 06 5E 8A $94 \quad 62$ A4 55 ØAA9：E8 28 2E 8A $88 \quad 62$ Al 28 E3 9AB1：9A AA 98 9A FE 98 1B FF 0 B
 ØAC1：A9 7C 3E AA Fg ØF AB E8 $4 \emptyset$ ØAC9： 65 AF EF $2 \mathrm{E} \quad 62 \quad 60 \quad 64 \mathrm{D} 8 \mathrm{9F}$ ØAD1：C6 8D 4C C1 $92 \quad 61 \quad 528091$ $\begin{array}{llllllllll}\emptyset A D 9: 14 & 1 A & 65 & 65 & 38 & 14 & 68 & 85 & 17\end{array}$ ØAE1：46 5F F5 5C 2A A5 5C ஏ8 1B GAE9：A9 5C 2E 2A Ag 3B 3D FG AF ØAF1： $2 \mathrm{E} \quad 96 \quad 4 \sigma \quad 3 \mathrm{~B} \quad 92 \quad \emptyset 0 \quad 2 \mathrm{E} \quad \mathrm{DF}$ A6 6AF9： 65 3B 64 Fl C2 88 gø FC 40
 6B69：99 40 5B A9 5057 D9 $\mathrm{F} \sigma 86$ ØB11：69 A7 FG F5 6A 7C EA A6 05 0B19：68 FB 66 7B FG $4 \mathrm{E} 55 \quad 58 \mathrm{AA}$


#### Abstract

ØB21：1F 79 DD 3 E 559597 AE 82 ØB29：95 ØE E9 66 Ø1 DD 76 Øø 9D ØB31： $\mathrm{BF} 5 \mathrm{~F} \quad \emptyset \emptyset \quad \mathrm{DE}$ EC $\quad \emptyset \emptyset \quad \emptyset \mathrm{F}$ BC 2 F ØB39：Øø 02 D8 3 A $78 \quad 9 \mathrm{~F} \quad 7 \mathrm{~B} \quad 86$  ØB49：5E B4 $\quad 06 \quad 59$ BB 09 B6 7B FC ØB51：ØA BA $57 \quad 3659$ E5 3D 5D A3 ØB59：5D $16 \quad 77$ 6D DE $57 \begin{array}{lllll}59 & \text { D6 } & 47\end{array}$ 9B61：7A DE DD EA 64 DD E7 64 E5 ØB69：BF 75 B4 $2 \mathrm{D} 5670 \quad 3 \mathrm{E}$ B9 96 ØВ71：E $\emptyset 65$ A5 8 0 ØD 5E 8B ØD FB


 ØВ79：1F D5 $22 \quad 94 \mathrm{~B} \emptyset \quad$ 曰 $\emptyset \mathrm{CA} 86 \mathrm{BA}$

 ØB91： 30 C2 F1 E2 4C 59 1C 07 E3 ØB99：A9 33 E5 31 B1 E1 2150 C8 ØBA1： |  | $\emptyset 1$ | $C 8$ | $3 F$ | 48 | $9 C$ | 78 | $2 \emptyset$ | $C C$ |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | ØBA9：DC 51 ØBB1：$\varnothing 5 \quad 93 \quad 68 \quad \emptyset 1 \quad \emptyset 4 \mathrm{FF}$ F9 FD 2E ØBB9：F8 FA FC F7 FE FB D5 33 F $\emptyset$ ØBCl：EF DF $\quad$ BF $6513 \begin{array}{llllll}95 & 13 & 92 & 43 & 86\end{array}$ $\begin{array}{llllllllll}\text { ØBC9：} & \text { A } 2 & C C & 49 & 46 & 45 & 44 & 2 \emptyset & C 5 & 33\end{array}$ $\begin{array}{lllllllll}\text { ØBD1：} & 4 \mathrm{E} & \mathrm{B} \emptyset & 10 & 47 & 59 & 5 A & 28 & 12\end{array} 48$ ØBD9：D3 4543544 F 52 3A 1 LD 2 E GBE1：1D $20 \quad 585858$ 9D $9458 \quad$ D9 ØBE9：$\varnothing \varnothing$ C7 $414 \mathrm{D} \quad 45 \quad 2 \emptyset \quad 4 \mathrm{~F} \quad 56$ ØBF1： $45 \quad 52$ AA C1 9 F C3 $8847 \quad 15$

曰C＠1：42 $53 \quad 21$ C5 CD 21 gD 53 EF 9C $99: 49$ A $4 \quad 20 \quad 4143434 \mathrm{~F} 4 \mathrm{D}$ 1A のC11：50 $4 \mathrm{C} 49 \begin{array}{lllllll}53 & 48 & 45 & 44 & 21 & \text { C3 }\end{array}$ ØC19：$\sigma \varnothing \quad 65 \quad 22$ BD C1 D2 $2 \sigma 2 \emptyset 4 \mathrm{C}$ øC21：D3 D4 D2 C9 CB C5 øø 42 ø7 ØC29：59 20 CB $45 \quad 5649$ 4E $2 \emptyset \quad 58$


 ØC49：28 $14 \quad 66 \quad 20$ F7 FB F7 90 DC ØC51：F7 $55 \mathrm{C} \emptyset$ Ø1 F7 $99 \mathrm{FB} 36 \mathrm{E} \varnothing$ ØC59：18 D $1 \mathrm{C} \quad 64$ øC 1412 Øø 50 ØC61： $0 \emptyset$ F4 2089 3C $90 \quad 8420$ 9F ØC69：øø 10 8410 B9 $10 \quad 42$ 1ø 10



 ØC91：$\varnothing 4 \quad$ Ø3 $80 \quad 66$ 8A $\emptyset \emptyset \quad 18$ C8 2A
 ØCA1：A2 gø AC 03 日E E 2 TE FD C7
 gCB1：$\emptyset 4 \mathrm{~F} \quad$ Ø8 AA CE 41 1C 4C B3
 ØCCl：14 D $\emptyset 1 \varnothing E 4$ Øの $2 \emptyset 2 \emptyset$ $2 \emptyset$ A9 ØCC9：AF 5 F D1 $5964 \mathrm{E} \emptyset \quad 18$ 14 49 ดCD1：DF ØC Ø1 86 A2 48 Fg ØF 8C ØCD9：A $\begin{array}{llllllll} & 24 & 86 & C E & 61 & D 6 & 73 & C 6 \\ \text { 1D }\end{array}$ ØCE1：$\emptyset B \quad A A \quad A C \quad 16 \quad \emptyset 4$ D $\emptyset \quad 7420$ 8D
 ØCF1：FB A9 $2 \emptyset 85 \mathrm{FC} 3 \mathrm{D}$ बF D8 A2 ØCF9：85 FE A2 98 E8 76 Bl FD EB 9D91：91 FB 88 D 0 F9 E6 FC E6 4D
 9D11：85 Ø1 AD $76 \quad 27 \quad 99 \quad 90 \quad 54$ BD
 ØD21：$\emptyset \emptyset \quad 24$ C8 C $\emptyset \quad 2 \emptyset$ D $\emptyset \quad \mathrm{F} 5$ E8 82 ØD29：37 $\quad 77$ 5A CE AD 65 D 05551 9D31：C2 $15 \begin{array}{llllllll} & 10 & 42 & 50 & B C & 3 A & 60 & 62\end{array}$ $\begin{array}{lllllllll}\text { ØD } 39: B C & 97 & 44 & 64 & 82 & 24 & 9 C & 34 & 4 \mathrm{E}\end{array}$ ØD41： 09 Ø8 3B 99 AA 4D C2 01 EA GD49：4E 42 BA 33 g1 EA GB 8D FC ØD51： $04 \quad 36 \quad 15$ 1A C9 $\quad 621183$ 3B 9D59：10 AB 64 8A 38218 DD F8 F5 ØD61：A3 $85 \quad 24 \mathrm{~F} \emptyset \quad \emptyset 6$ A9 $81 \quad \emptyset 4 \quad 2 \emptyset$ 9D69：54 C8 Al A7 $20 \quad 78 \quad 17 \quad 1 \mathrm{~F}$ BE ØD71：49 1F 29 1D DG ØD A9 ØA 97 ØD79：58 DC E5 80 C8 93 C2 20 F5

6D81：E6 924443 C6 4318 F3 A6 ØD89：CE $\begin{array}{lllllllll} & \text { D } & 3 C & 14 & 2 B & C 9 & C D & 65 & 29\end{array}$ 6D91：50 43 1A 98 EE C8 67 CC DD ØD99：19 5E ØE CE Fø 64 AD 34 AD gDAl：E8 ØC 8 8 Cl Ag 1B CE 68 D6 ØDA9：06 D6 46 A9 63 8D 3B DC FF
 ØDB9： $67 \quad 63 \quad 78 \mathrm{CC}$ 日B $96 \quad \emptyset 6$ A7 42 ØDC1：8A C 6 FA $71 \quad 18$ B9 6160 Dl ØDC9：B1 $25 \quad 8018$ C9 9066 63 F4 GDD1：94 86 4B 9D $06 \quad 69$ 96 94 E2 gDD9：2F $64 \quad 80 \quad 21 \quad 31$ Cg 8 CD Cl 36 QDE1：61 C8 A1 C3 E6 60 D6 07 8C GDE9：65 BE $80 \quad 6216$ 5D DE 99 E3 ØDF1：00 8E 64 E2 24 C3 23020 D6 9DF9：4E 8A 7A 4C 59 3A B9 43 5C ØE $1: 1 \mathrm{C} ~ 4 \mathrm{E} \quad 04 \quad 1 \mathrm{~A}$ ØE．69：F6 21781167 3B $11 \mathrm{~B} \varnothing \mathrm{FF}$ ØE11：15 $20 \quad 79$ 3C 4 C 81 E4 $90 \quad 75$ ØE19：A8 B9 76 ØE DD 9B 90 0368 ØE21：20 $626785 \quad 61$ EC 6 日 6904 gE29：9D 1638 9D 3A D 16 2A FB DF gE31：74 EA E6 C9 F6 C7 E1 C9 2F gE39：38 E9 E2 A9 F4 8727 DE D5 gE41：1E 9E $3 \mathrm{BB} \quad \mathrm{B} 4 \quad 6784 \quad \mathrm{C} 4801 \mathrm{~B}$ gE49：2C A9 9A Fø C9 78 6F 2A 61
 פE59：50 $18 \quad 691060$ D2 04 C2 EA gE61：2A 3 A 47 A 9 日 40 C4 61 E6 12
 ØE 71：54 $83 \quad 4 \mathrm{C} \quad 54 \quad 77 \quad 61 \quad 18$ ED C6 ØE79：E8 øø 56 1D 5A 19 5B 3E D2 gE81：5A 19 2F DE Fl 68 C5 56 F1 פE89：A3 15 DE $8 \mathrm{~F} \quad 56$ 1C $48 \quad 85 \mathrm{CA}$ QE91：6C $41 \quad 13$ 1E 89 FF Dø 42 A8 ØE 99：3C 95 A2 $598041 \quad 1 \mathrm{~F}$ AF 1 A ＠EAl：12 A＠ $5 \mathrm{E} \quad 06 \quad 04$ 9E 80 2F E5 GEA9：51 156084 1F C9 67 D 067 ØEB1：øC $38 \quad 708 \mathrm{FED}$ E4 8640 B9 ØEB9：CC $65 \quad 94 \quad 12 \begin{array}{llllll}28 & 8 A & 61 & C 6 & 53\end{array}$ gEC1：$\sigma E \quad 80 \quad 10$ D 0 FE 23 DC 2173
 ØEDI：øø D $687 \begin{array}{lllllll}87 & 27 & 64 & 10 & 98 & 4 \mathrm{~F}\end{array}$
 ØEE1：8 $8 \quad$ F1 42 AD $8 \varnothing \quad 63 \quad 35 \quad 38$ 9ø ØEE9：E9 ØC 4A 4A AA 76 Øø $14 \begin{array}{llllllll} & 2 F\end{array}$ ØEF1：87 9406 C 642 E4 1818 7D gef9：A9 28 D1 A1 C2 23 F 618 E5 ØE 61：8A 65 FD 85 FD $0 E$ B8 65 D4 ØFg9：FE 3B 1D A5 FE $54 \quad 76$ D 472 9F11：85 FE $68 \quad 20$ AF $1320 \quad 50$ 1A 6F19：13 A9 23 CA 6B E3 58 2F 67
 ØF29：C9 28 B $\emptyset \quad \mathrm{F} 7$ AA $2 \varnothing$ D5 12 5F GF31：D $\varnothing$ F1 CE AA AD 8A 63 3A 90

 GF49：12 Bø $85 \quad 0191$ FD EE 2 FFE
 9F59：88 65 99 $28 \quad 66$ 99 E8 6621 ØF61：88 D $\varnothing$ F1 8071 日E 34 E1 4C ØF69：C8 $88 \quad 28$ D 6 E3 1C 41 AF E1 ØF71： 03 2E 60 A9 33 4F 776069 बF79：18 AD D7 $6 \mathrm{D} \quad 824414 \begin{array}{llllll} & 48 & 66\end{array}$ ØF81： 06 Ø2 8 BD 4148 ØA 94 8D E8 9F89：D1 AD 10648 BD 81 AD 101 C GF91：95 $\quad 63 \quad 61 \quad 60$ AE $40 \quad 118 \mathrm{EE} 94$ gF99：63 $3464 \mathrm{D} \varnothing$ gC 65 日E E8 6 B GFAl：8E 66 B4 AA 61 8D 9C 62 5B ØFA9：20 8C 13 CE 1D $6541 \quad 60 \quad 2 \mathrm{~A}$ ØFB1：3＠3A Ø3 øC B8 8ø 4C 74 6C gFB9：14 7D E8 日ø C2 D6 4Ø A6 F6 ØFC1：बD 88 B9 $62 \quad 51 \quad 36$ D $\emptyset .8065$ ØFC9： $99 \quad 606 \mathrm{C} \quad 24 \quad 36 \quad 6011 \quad 64 \mathrm{FB}$



QEE1：D7 6242 1B 823564 A6 BE QFE9：50 28 2E 64 9A QB $^{6} 6914 \begin{array}{lllll}14 & 2 \mathrm{E}\end{array}$
 QFF9：2C 97 बF $06 \quad 2681 \quad 134 \mathrm{C}$ CF 1001：57 14 E6 F2 $62 \begin{array}{llllll}28 & 29 & 20 & 40\end{array}$ 1069：Dの ØA 79 DD 6514 AD 3E 33 1011：80 80 96 $91 \quad 67 \mathrm{BF}$ D 618 AD 1019：69 12 D8 2E $2618 \quad 688652$ 1021：38 वC 00 82 F3 40 5C ØE EF 1629：60 $74 \begin{array}{llllllll}58 & 36 & 69 & 8 \varnothing & 99 & \emptyset \varnothing & 82\end{array}$ 1631：3C 2B BB $762 \varnothing 11$ FG F9 40 1039：8D 7A 1F BØ 日6 B7 64 9D A1 1641：17 80 D6 F6 A6 06 FD 0F A6 1649：10 12 66 Fø F8 4A A3 2927 1051：77 Fg Fl 46 FE 12 EC AA 76 1059：BD F6 4206 E6 A9 3F 1C B5 1061：42 Cø $04 \mathrm{~B} \emptyset 57 \mathrm{BF} 9 \mathrm{D} 80 \mathrm{D} 3$ 1069：9の C8 Cø 21 Dø D3 47 7C 日F
 1079：4C 3515 CE 580310 A9 35 1081：28 8D $64 \begin{gathered}\text { C } 4 \\ 13 \\ 13 \\ 68 \\ \text { CB } \\ 86\end{gathered} \quad 38$
 1691：43 $66 \quad 3980$ D8 244 C 16 日A 1099：50 $61 \quad 30$ øC $80 \quad 03 \quad 914674$

 10B1：62 $601 \mathrm{C} 79 \quad 64 \quad 02 \quad 29$ A3 3 C 10B9：B8 41 AD 5F B3 1A 46 Eg 99 1øC1：60 6620 A6 1B AD 66 D8 16
 1øD1： 06 8D 8C 11 B8 $6 \emptyset$ Fø $9 B$ AD 10D9：B4 3 E EB $4 \mathrm{C} \quad 76 \quad 15 \quad 13 \mathrm{AB}$ FF 1ØE1：63 B5 66 2C 8 A $\quad 33$ 3E $\begin{array}{lllllll}10 & 97\end{array}$ 1ØE9：ØA A8 A2 øø B9 $4 \emptyset$ ØF Fø 6B 10E1：28 8D $63 \begin{array}{lllllll}64 & 88 & 64 & E B & 49 & A B\end{array}$ 10F9：D8 $3881 \quad 84$ DD 49 D8 $\mathrm{E} 6 \quad \mathrm{AB}$ 1101：81 04 BB 15 4A C9 6816 日E 1169：06 20 ØF 16 4C B4 15 C8 A1 1111：E8 Eø 64 D 6 CD 98 BF C4 82 1119：81 57 BC $18 \quad 342 \mathrm{~F} 75$ C4 F8
 1129：$\sigma E \quad C 5$ EE $4 \mathrm{E} \quad 4 \mathrm{C} 71 \quad$ ø2 $\quad \mathrm{D} \varnothing \quad 94$ 1131：Fg 418284508663 AD C5

 1149：24 C9 38 Dø 03 Aの 128043 1151：CE 03 A2 $631076 \quad 66$ gC 7A 1159：81 Øø FD $4 \mathrm{EE} 46 \quad 66 \quad 97 \quad$ øø $\quad 39$ 1161：Fの 12 AE EB ØA 7912 ØD 7C 1169：9A $38 \quad 48$ C8 F8 66 2D 39 EF 1171：$\varnothing E \quad 70$ DE $\quad \varnothing 0$ DE $9 \mathrm{C} \quad 044044$ 1179：35 10 99 F® 3A DF 6C 64 日B 1181：B8 FG $\quad 27 \quad 56 \quad 97 \quad 978 D \quad 594 \mathrm{~F}$ 1189：2F 86 3F C 658 D8 8D 31 C9 1191：81 $84 \quad 70$ 9C FA $0186 \quad 69 \quad 5 \mathrm{~F}$ 1199：88 0F 67 AA 4 C B6 16 D8 91 11A1： 74 06 97 F 0 1F B6 10 E7 C3 11A9：C3 1C 2313 FE 44 2D DA 88 11Bl：6ø 2 C BD 73 ØC 0064 E 3 ØB 11B9：1D 98 8A B2 Fø 19 Bø $\emptyset D 67$ 11C1：92 $2169 \mathrm{~F} \sigma 16 \mathrm{FE} 13 \mathrm{5}$ A 6 11C9：FB 16 BD Cø 19 C9 F7 F6 64 11D1：03 DE 6860 B4 98 b1 7C C6 11D9：76 92 F6 77 AA D8 $\quad 06 \quad 7299$ 11E1：4E 18 406 A 9E $3000 \quad 0297$
 11F1：C9 $\begin{array}{ll}\text { AA } & 27 \\ \text { 日C } & 80 \\ 35 & 53 \\ 93 & 4 \varnothing\end{array}$ 11F9：E1 62 B3 0118 A9 06 9D 25 1201：92 65 EA 8A 8A 061153 7F 1269：51 BC $65 \quad 88 \quad 8 \mathrm{C} 4 \mathrm{C} 7 \mathrm{AA} 17 \mathrm{CF}$ 1211：EE Ø8 40 A9 5F 17 5E øø 65 1219：1D 16 DE $4 \mathrm{~F} \quad 67 \mathrm{FE} 36 \quad 68 \mathrm{CA}$ 1221：Fの 11 DE 41 D 697 BD 5161 1229：C5 66 Аø Аø A9 07 D2 29 2ø 1231：68 C6 6А 46 A4 62 B9 80 EF $\begin{array}{llllllllll}1239: & 67 & \text { D } 9 & 67 & \text { C } & 54 & 83 & 57 & \text { D } 6 ~ & 74\end{array}$

## PROGRAMS

1241：4F A2 61 E8 60 BB 48 1A 61 1249：D9 D $\emptyset$ F6 A9 6412 AB AD 75 1251：41 9D 91 C7 6б 9D 08 ØE C 6 1259：9D E6 7980 日A 9D 62 BD C5 1261：77 日E 2D 43 6A 62 C1 6986 1269：14 $63 \quad 6066 \quad 3543$ A9 5 FF 34 1271：A1 2A $97 \quad 25$ EØ 2315 9D 91 1279：6ø 21 B9 ØA 1F 612 C 9D E $\emptyset$ 1281：43 60 50 C2 E2 FG 54 DE FB
 1291：Fg 21 AA F8 GE 64 4C 57 4D 1299：18 76 AC $198 \mathrm{C} 96 \quad 62 \quad 3871$
 12A9：53 $62 \quad 6083$ 1A C7 1B 80 E2 12B1：37 8D AA $858602 \quad 2 \mathrm{E} \quad 334 \mathrm{E}$ 12B9：51 16 29 7F 9061010032 12C1：8D EB 8D 58 B8 FE $27 \mathrm{D} \varnothing \mathrm{BF}$ 12C9：6D 7E 67 E7 26 26 5 FF CF BF 12D1：41 øø 5A E7 26 8ø C1 10 F6 12D9：52 $6042 \quad 29$ gl AE 3A GC 5D 12E1：AC $89608 \mathrm{EE} 8 \mathrm{E} \quad 868 \mathrm{C} 43 \quad 92$ 12E9：3C 06 A4 8A 99 BD 145425 12F1：A8 BD 6284 BC $2 \varnothing$ B6 1254 12F9：EC 1F 796922 CC 268 8C 2 D 1301：1D 48 7A 01643540 C3 $6 \varnothing$ 1309：83 B5 Aø 2615 5A 50 DD 65 1311：30 CC Fø 65 36 63 CE FD 1A 1319：03 3C बA 71 C9 $66 \quad 71 \quad 29$ 9A
 1329：C3 9E 5D 43 Fg 58 5A 196 F 1331：37 Fg 11 AD FF 67 C9 3416 1339：Fg 6A A9 12 8D 6473 øC A1 1341：A9 1ब 8D 5B AD 1E ØE GA B3 1349：AA AD $10614 \mathrm{E} \quad 38 \quad 27$ 3A 1 E 1351：33 B2 50 5C C 0 C2 $\begin{gathered}\text { B } 6 \\ 27 \\ 27\end{gathered}$ 1359：AD DE 15 5C 21 C8 6234 DA 1361：90 1B D1 4238 ED B5 Bø 8A 1369：Bø 日F 25 ØE 18 6D 22 0E F9 1371：DD CE 3D $9 \varnothing 63 \begin{array}{lllllll}64 & 66 & \mathrm{DF} & 7 \mathrm{~F}\end{array}$ 1379：01 $82 \quad 668 \mathrm{C} 916346$ 2E 9A 1381：5E 47 2E 19 AD GB 2903 EE
 1391：2B $51 \quad 32 \quad 32$ 4С В9 1B 26 AA 1399：90 1A AD 00 4B FC 2D 40 2D 13A1：$\sigma E 35$ AD C8 CD 2E 83 AC 39
 13B1： 23 AD Eø 8E 95 1A F1 604 E 13B9：36 13 3A 28 44 $63 \begin{array}{lllllll}12 & 1 C & F 7\end{array}$ 13C1：4B 06 FA F 6 D6 450033 FA 13C9：$\emptyset E$ EE $3213 \quad 2 \varnothing$ Aø AD 6716 13D1：C5 FA AD 4D 5F Dø F5 AD FB 13D9：96 Dø F 049 9B EB 390738 13E1：Fø E6 2ø 1D 16 2D 2480 3E 13E9：00 D 17 CE 2 B 2 D 1D 2D 89 13F1：85 608360 A9 FE $4 \mathrm{~B} \quad 2471$ 13F9：5A 1 A AB 67 A $\quad \mathrm{F} \varnothing 19$ 3E F8 1461：9B 1F C9 $61 \mathrm{Fg} \quad 2698$ AA 64 1409：DE 1C BE 4C 164297414 D 1411：72 4C 1B 1A D $\varnothing$ AD 41458 F 1419：A9 66 8D 4849 2E D6 8D FF 1421：58 882 E 3C 6293 A9 7D 53 1429： $65 \quad 128741 \quad 26$ Fの ØC B9 F3 1431：E6 29 C6 F6 1569 1F 4C 95 1439：57 1A CE 2C 66 F2 6C 7F 84 1441：1B A9 E1 2ø GA 1C AC E1 9B 1449：22C6 9980966 D 88 61 3A 1451：56 866526 D3 18 D $6 \quad 27$ B9 1459：AE 1E GE BD 8B 77 Dø 1F F8 1461：BD D8 FG 1A BD 84 1D CD 66 1469：2A GE FG 12 CD F0 393442 1471： 0 A 9D $57 \mathrm{~B} \emptyset 5 \mathrm{5A} 409 \mathrm{D} 0813$ 1479：ØD A 60 CE 65 D 625 AD AF 1481：62 66 Fg B6 51 4C A5 40 CC 1489： 0 F Ø8 92 Ø2 06 30 08 A4 53 1491：CE 2D 65 4C B5 lA EE 日F D4


14A1：18 4C FG FF Ag A7 3C 1235 14A9：D $\emptyset$ A $6 \quad 62$ 16 A7 $62 \quad 27$ 9E 63 14Bl：8A 6D E8 9F 8A 6379 2A F6 14B9：36 $64 \quad 7 \mathrm{C}$ 2A $42 \quad 38 \mathrm{AD}$ BC 53 14C1：28 Eø 2 B 40 A8 16 ØE E9 45 14C9：00 6D 86 5A C4 6C BC 6F 6C

 14E1：32 1264 9A 84 gD AF C9 5F 14E9：$\sigma \mathrm{A}$ B $\emptyset 63 \quad 2054 \mathrm{lC} \mathrm{AE} 869 \mathrm{C}$
 14F9：68 4C CD BD Ag 2126 BB 84 1501：1A C2 15 6A 87 6D 39 60 6F 15ø9：AD 23 ØE 17 4A 4A 29 日E E2 1511：18 693100 3C BB A9 64 EF 1519：82 $2 \mathrm{C} \quad 1211 \quad 69$ AA A9 98 Cl 1521：9D $23 \quad 64$ CA D6 F8 E3 A3 E5 1529：76 2A D8 $6846 \quad 97 \quad 3 \mathrm{C} \quad 664 \mathrm{E}$ 1531：7F 76 5C 60 A8 $6 D$ B1 FG 96 1539：68 GE 20 2340 B $\varnothing 83$ CE EB 1541：80 5820 C8 6888 AC 68 D 6 1549： $68 \quad 89 \mathrm{CD} 66 \mathrm{~B} \emptyset$ ØB 82 EA 9 B 1551： 6 A 6496674 C D9 50 0C 7A 1559：60 38 ED 37601 EFO 4C 9C 1561：37 1B $6 \varnothing$ g6 61 D 6 1C AD 8B 1569：33 9217 AD 32 日E D $\varnothing 12$ 日D 1571：80 CF 35 9B 8349 1C 54 FD 1579： $06 \quad 4641 \mathrm{Bl} 50 \mathrm{~B} 6 \quad 0436 \mathrm{FB}$ 1581：ø2 日B A2 $122649801 C 58$ 1589：9の AD $87 \quad 69$ 4の 4 AA C $\varnothing$ 4C E7 1591：C1 1A DD 4C 62 4F $38 \quad 62 \quad 63$ 1599：2B 22 FC 1640 1D 61 5B B6 15A1：18 $26 \quad 63$ 1A 60 B9 1D 19 2B 15A9：72 4C 8A 9948 D8 $2 \varnothing$ D 6 B8 15B1：FB 26 E1 FF F6 FB 28 F8 DE 15B9：DF 60 A9 364 C 66 26 D7 38 15C1：gF A9 18 A2 C6 $81 \quad 0278$ C3 15C9：1B 8A $2080 \quad$ D4 21 C8 11 FD
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## Only on Disk

In addition to the type－in programs found in each issue of the magazine，we offer addi－ tional features and programs every month on the Gazette Disk．Check out＂Gazette Gallery＂for original 64 and 128 artwork and look for our bonus programs as well．These programs and their instructions appear only on disk．Here are descriptions of this month＇s bonus programs．

## Labyrinth Adventure

## Arthur Moore

You face twisting passages，hidden traps and a pilfering foe in this two－player adven－ ture．Two joysticks and a little greed are required．

Try to reach the staircase that leads to another dungeon in this three－level maze， but you can＇t escape without first collecting some wealth．You can find your own trea－ sure，but it＇s more fun to steal your opponent＇s．

## Crossword Creator

Randy Thompson
Have you ever tried to create a crossword puzzle？If you have，then you know how frustrating it can be．With Crossword Cre－ ator you can enter up to 100 words and have the computer do all the difficult letter－ matching and layout work．

Once you have created a puzzle，you can edit it，save it，or erase it．Best of all， you can print copies and see if your friends can solve your puzzle．This one is a must for crossword fans．

# How to Type In COMPUTE＇s Gazette Programs 

Each month，Gazette publishes pro－ grams for the Commodore 128 and 64. Each program is clearly marked by title and version．Be sure to type in the correct version for your machine．All 64 programs run on the 128 in 64 mode．Be sure to read the instructions in the cor－ responding article．This can save time and eliminate any questions which might arise after you begin typing．

We regularly publish two pro－ grams designed to make typing easier： The Automatic Proofreader，for BASIC programs，and MLX，for entering ma－ chine language programs．

When entering a BASIC program， be especially careful with DATA state－ ments，as they are extremely sensitive to errors．A mistyped number in a DATA statement can cause your ma－ chine to＂lock up＂（you＇ll have no con－ trol over the computer）．If this happens， the only recourse is to turn your com－ puter off and then on，erasing what was in memory．This could cause you to lose valuable data，so be sure to save a pro－ gram before you run it．If your computer crashes，you can always reload the pro－ gram and look for the error．

| When You Read： | Press： |  | See： |
| :---: | :---: | :---: | :---: |
| \｛CLR\} | SHIFT | CLR／HOME | 曲 |
| \｛HOME \} |  | CLR／HOME | \％ |
| \｛UP\} | SHIFT | $\dagger$ CRSR | 咈 |
| \｛DOWN \} |  | $\dagger$ CRSR $\downarrow$ | H． |
| \｛LEFT\} | SHIFT | $\leftarrow$ CRSR $\rightarrow$ |  |
| \｛RIGHT \} |  | $\leftarrow$ CRSR $\rightarrow$ | II |
| \｛RVS\} | CTRL | L | 耻． |
| \｛OFF\} | CTRL | 0 |  |
| \｛BLK \} | CTRL | 1 |  |
| \｛WHT\} | CTRL | 2 | ：＂：m |
| \｛RED \} | CTRL | L 3 | \％＂： |
| \｛CYN \} | CTRL | L |  |

## Special Characters

Most of the programs listed in each issue contain special control characters． To facilitate typing in any programs from Gazette，use the following listing conventions．

The most common type of control characters in our listings appear as words within braces：$\{D O W N\}$ means to press the cursor－down key；\｛5 SPACES \} means to press the space bar five times．

To indicate that a key should be shifted（hold down the Shift key while pressing another key），the character is underlined．For example，A means hold down the Shift key and press A．You may see strange characters on your screen，but that＇s to be expected．If you find a number followed by an under－ lined key enclosed in braces（for ex－ ample，$\{8 \mathrm{~A}\}\}$ ），type the key as many times as indicated（in our example，en－ ter eight shifted A＇s）．

If a key is enclosed in special brackets，［飞］，hold down the Commo－ dore key（at the lower left corner of the keyboard）and press the indicated character．


Rarely，you＇ll see a single letter of the alphabet enclosed in braces．This can be entered on the Commodore 64 by pressing the Ctrl key while typing the letter in braces．For example，$\{\mathrm{A}\}$ means to press Ctrl－A．

## The Quote Mode

You can move the cursor around the screen with the Crsr keys，but you may want to move it under program control， as in examples like \｛LEFT\} and \｛HOME ，in the listings．The only way the computer can tell the difference be－ tween direct and programmed cursor control is the quote mode．

Once you press the quote key， you＇re in quote mode，which can be confusing if you mistype a character and cursor left to change it．You＇ll see a graphics symbol for cursor left．Use the delete key to back up and edit the line． Type another quotation mark to get out of quote mode．If things get too confus－ ing，exit quote mode by pressing Re－ turn；then cursor up to the mistyped line and fix it．If the mistake involves cursor movement，you must press the quote key to reenter quote mode．

## When You Read：



See：
$\leftarrow$
$\uparrow$

## 

## For Commodore 64 Only




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## $\nabla$ SOFA SERVER GRACEFUL \& FUNCTIONAL

 Einally-a piece $F$ of furniture that is as functional as it is attractive. The wooden sofa server is constructed from select hardwoods with a lovely beveled glass top. Because it slides conveniently over a couch or chair, it is perfect for drinks, TV. snacking, casual dining, playing cards, or just keeping things within easy reach. Perfect as a telephone table. The spacious bottom shelf can hold books, plants, or knick-knacks and the built-in magazine rack keeps newspapers and magazines at your fingertips. The sofa server is so attractive and practical, it can serve as an accent table, end table, or night stand in your living room, family room, bedroom, or anywhere that this lovely piece could be handy. $11^{\prime \prime} \mathrm{W} \times 16^{1 / 2} 2^{\prime \prime} \mathrm{D} \times 24^{\prime \prime} \mathrm{H}$. Available in oak or cherry finish with a limited one year warranty. \$99.98 (\$11.75) \#A1987C-Cherry; \#A1987K-Oak

## V COOK OUT INDOORS - THE HEALTHY WAY - WITH NO SMOKE

Are you one of the millions of Americans who loves to barbecue - but not only in summer? Then the Contempra Indoor Electric Char-B-Que is for you. Constructed of beautiful stoneware and measuring $15^{\prime \prime} \times 11^{3} / 4^{\prime \prime} \times 41 / 4^{\prime \prime}$, this barbecue provides a 150 square inch cooking area, large enough for the entire family or for company. This energy efficient indoor electric grill has a unique reflector system that directs heat at the food,
 while fat drippings drain through a tray shielded from heat for virtually smokeless cooking. The unique design keeps the stoneware cool enough to handle. Plus, clean-up is a cinch since all parts except the heating unit are dishwasher safe Instruction booklet with recipes included. U.L. listed; 1-year limited warranty; made in the US.A. $\$ 59.98$ ( $\$ 7.00$ ) \#A1936.

$\nabla$ FOLDAWAY EXERTRACK ${ }^{\text {™ }}$

Staying in shape is vital for our health and well being with today's lifestyle. Cetting to the gym may not always be easy in our busy lives. We have just the answer for all you people on the go or just for the ones who enjoy to get fit at home. That's why the Foldaway Exertrack is the perfect way to exercise. This personal treadmill has a speedometer/odometer to monitor speed and progress. It measures 38 " $\times 21^{\prime \prime} \times 3$ " and features a safe rubber track and an adjustable handlebar that faces forward or back. ward for running and walking comfort. No electrical connections or motors needed. Exercise has never been simpler. Order one today and get on the right track with the Exertrack. Folds away for easy storage, light weight and compact. At a great price! \$131.98 (\$15.00) \#A1977.

## $\nabla$ INFRARED IMPROVEMENT

ome infrared heat treatments are an increasingly popular form of natural pain relief. Now the means of applying that heat have been significantly improved. Heating surface has been tripled, the larger contour head comfortably angled for reaching neck and back. Replaceable interior infrared bulb is now 10 w , giving $45 \%$ more heat. Reaches deeper than heating pads or hot water bottles. The new infralux has two heat settings: High and Low (plus off) which allows you to experiment and choose most comfortable setting. It comes with its own zippered vinyl bag for neat storage or packing for travel. UL-listed. \$39.98 (\$4.25) \#A1906.


## $\nabla$ THE BUSINESS CARD COMPUTER

Carry your office with you. The world's first credit card size 8 K computer lets you store over 8000 characters. That's approximately 500 names, phone numbers and addresses, important memos or appointment schedules. Recall a file by fast forward scrolling or simply by using the direct search feature which automatically finds a file for you. Access all this pertinent information in no time. It also features a full-function calculator, a currency exchange memory and a security code key for privacy. Easy to use and carry. Carrying case and battery included. $\$ 49.98$ ( $\$ 5.00$ ) \# A1898.



\& FOOD DEHYDRATOR

Even if it weren't so specially low-priced, this food dehydrator would be immensly econom. ical. Using almost none of your valuable time, it makes nutritious, preservative-free, refined-sugarfree, healthful dried fruits and snacks, plus yogurt - at a tiny fraction of their price in stores. Simply slice fruit into lemon juice, spread on the perforated plastic stacking trays and forget it for 12 to 24 hours. With electrical coil at bottom, the unit is engineered for convection heating; no fan needed, so it's energy-efficient and noiseless. A 28-page instruction book provides guides for adjustable vents and timing plus enticing recipes. Treat kids to crispy banana chips, make dried apples, apricots, raisins.even beef jerkey and vegetables for soups and camping trips.. try zucchini slices with sesame seeds - a dieter's dream substitute for hi-cal chips. 12" dia. U.L. Listed. 5-tray Dehydrator (shown) \$51.98 (\$6.25) \#A1887X. 3-tray Dehydrator \$41.98 ( 55.25 ) \#A1886X.

## $\nabla$ TEACH AN OLD LAMP NEW TRICKS



Any lamp that takes a standard bulb can be up. dated with the Touchtronic dimmer. No rewiring needed-just screw into lamp socket. Then your touch on any metal part becomes the "switch"-touch once for low light, again for medium, a third time for full wattage. Handy when you're entering a dark room, great at bedside and a real comfort to the arthritic or the ill. You'll save time, money and electricity-no more 3-way bulbs to buy and you pay for only as much light as you need. U.L. listed; one-year factory warranty. \$15.98 (\$4.00) \#A1700. 2 for $\mathbf{\$ 2 7 . 9 8}$ (S6.00) \#A17002.


## V CAR-THEFT PROTECTION - WITH NO INSTALLATION

With Sonic Sentry, the value of a car alarm brings you peace of mind - without the expense and bother of installation. You can switch it from one vehicle to another. Just plug Sonic Sentry into the cigarette lighter; cord reaches 5 feet, so the unit can occupy dash or seat when vehicle is parked, where the flashing lights can make a browsing thief think twice. The petite $41 / 2^{\prime \prime} \times 4^{\prime} / 4^{\prime \prime} \times 2^{\prime \prime}$ box is capable of emitting a truly ear-piercing alarm, concentrated inside the car, where it can most effectively repel an intruder. Activated by the light that accompanies the opening of car door, hood or trunk, it also senses impact or "unnecessary roughness"; the shriek lasts for one minute and only the key stops it unplugging the lighter activates a back-up battery. Stuck on the road? Switch Sonic Sentry to its mode showing HELP in flashing red lights and put in the window to attract aid. It's protection you can't afford not to have, at $\$ 74.98$ ( $\$ 7.00$ ) \#A1989.

## V INFRAVIB INFRARED HEAT MASSAGER



The infravib Mas sager is good news for your aches and pains. This state of the art device combines infrared heat and a powerfu wand massager in one unit. Deep pene trating Infrared has two settings and gives fast temporary relief to sore joints and muscles. Massager soothes and relaxes tired and aching muscles. Massager has a long flexible shaft with four massaging attachments (body, acu point, leg and foot, and scalp) and two massage levels. Try Infravib-it might be just what the doctor ordered. $\mathbf{\$ 8 9 . 9 8}$ (\$6.25) \#A1952.


## V LAMBSWOOL DUSTERS


ambswool contains a natural static charge that makes dust literally leap off surfaces. This magnetic attraction is just the thing for dusting off bric-a-brac, china, crystal, pictures, anything. Our dusters are imported from England. They are the fluffiest, highest quality lambswool in the world! We offer a set of four lambswool dusters our $27^{\prime \prime}$ duster, our telescoping duster which extends to more than four feet - lets you reach high corners, top shelves, overhead lights and collapses to $28^{\prime \prime}$, and two mini dusters for extra fragile objects. \$22.98 (\$4.00) \#A1870

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SNEAK PEEKS

明ThHWORYS SOK indows falls short in two areas: There's no batch language, and for system-level macros, you have to depend on the wimpy Recorder accessory. BatchWorks SDK 2.0 from Publishing Technologies not only cures the Windows batch-file blues, but it also has powerful features you'll be surprised to find in a program with such a reasonable price tag.


Add batch files and macros to your control menu with BatchWorks SDK.

BatchWorks is conceptually divided into two parts: a batch component and a macro component. There's really no difference in the way the batch and macro languages work except that you can't run a macro by double-clicking on it as you can a batch file. This saves you from accidentally launching a macro and having it send keystrokes to an application that isn't intended to receive them.

There are two ways to create batch files and macros. You can enter batch statements in an ASCII text editor (Text, a first-class editor, is included with BatchWorks), or you can record your macros as you create them and edit them later.

The Batch Works language itself contains nearly 100 commands that do everything from running a program to sending keystrokes to an application. To give an example, here's a simple batch file that runs Microsoft Excel.

DirChange("c: \ss \excel \xls") Run("c: \ss \excel \excel.exe","") Call("expand.ptm","")

The first line changes the directory to Excel's XLS subdirectory, where work sheets are stored. The next line runs Excel, and the last line calls a BatchWorks macro-EXPAND .PTM-that expands the Excel window to an optimum size.

One especially elegant feature of BatchWorks is that it enables you to install batch files and macros so they appear as part of the control menuthe menu that's available from every window. Using this menu option, you could, for example, access the macro to run Excel from any Windows application.

All this is impressive, but the program's coup de grâce is its compiler. With the compiler, you can take your newly created batch files and compile them to stand-alone EXE programs. You can then distribute these programs, free of royalty fees, to any Windows user.
CLIFTON KARNES

Scheduled Release: June 1991
For IBM PC and compatibles-\$149
PUBLISHING TECHNOLOGIES
7719 Wood Hollow Dr., Ste. 260
Austin, TX 78731
(512) 346-2835

## EARI WENEER Baseball II

Acomplete graphic makeover is the big news for the latest ver sion of Earl Weaver. The nondescript players are replaced by larger, digitized players, making full use of the popular VGA graphics standard. The split screen is gone, replaced by a view of the field that faithfully re-creates the view of major league baseball as seen on television all summer long. You can even set TV angles to get the best view of the game from anywhere
in the park.
The editing and team-building facilities have been greatly enhanced, even down to choosing the color for your fences when creating your own ballpark. The number of players you can have on your roster has been increased from 25 to 40 . One of the most innovative features to be added, however, is the ability to download stats from online sources like Stats Inc. or the USA Sports Center for use in the game. That's a real boon for fantasy players who use Earl Weaver to run their leagues.


Several different camera angles turn this ball game into a televised event.

Smaller improvements that add up to big enhancements include better playing from the computer opponent, a bigger selection of pitches to choose from, and access to the commissioner options without having to completely exit the game. All of this means a brighter spring training for all PC baseball players. $\downarrow$
PETER SCISCO

Scheduled Release: May 1991
IBM PC and compatibles- $\$ 49.95$
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## What Are Sneak Peeks?

Sneak Peeks are advance reviews of upcoming software and hardware products. Every effort is made to ensure that the information contained in these reviews is accurate at the time they are published. COMPUTE will review the final edition when it becomes available.

# FOR THE BEST IN CHESS, MAKE THE PERFECT MOVE. 



## Check.



## And Mates.

The Royal Game of Chess will never be the same. Interplay Productions now challenges you to choose from three different chess programs, each offering its own unique blend of stunning animation, spectacular sound, and powerful algorithms designed to test your tactical and strategic thinking.

- Checkmate ${ }^{\mathrm{TM}}$, winner of the 1990 World Personal Computer Blitz. Chess Championship in Lyon, France, is so powerful that Amiga Games Guide called it "easily the strongest-playing chess program yet for a personal computer."
- Battle Chess ${ }^{\mathrm{TM}}$, a SPA award winner for best graphics, brings chess to life by combining a magnificent chess logic system with colorful, humorous,
and dramatic three-dimensional animations. Video Games \& Computer Entertainment went so far as to call it "the next step beyond all existing chess programs."
- Battle Chess II: Chinese Chess ${ }^{\text {TM }}$ uses even more animation and sound than the original Battle Chess ${ }^{\text {TM }}$ to bring the world's most widely played version of chess to the West. Computer Gaming World called it "a feast for chess lovers which will leave you wanton to play again 15 minutes after each game!"
All of Interplay's chess programs have 2D or 3D graphics, multiple levels of difficulty, and allow a choice of opponents (computer, face-to-face, or modem).

If you're looking for a challenging opponent, want to find a program that'll teach you or your children how to play, or just experience some new twists on strategy and tactics, Interplay has a game for you.
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## GAMES <br> C $\begin{array}{llll}\mathrm{H} & \mathrm{O} & \mathrm{I} & \mathrm{E}\end{array}$

## king's oufis I

ing Graham quests again, this time in a gaming environment far easier to navigate than before! If typing ever turned you away from adventure, you no longer have an excuse not to embrace adventure games. The splendid synergy of graphics, sound, and gameplay in King's Quest $V$ makes for one of the most rewarding quests in computer history.


Sumptuous panoramas will unfold before you in King's Quest V.

Previously in Sierra games, you moved a character around a 3-D screen with joystick, mouse, or keyboard and typed in commands at the bottom of the screen on a text entry line. King's Quest $V$ does away with typing. Instead, the game can be played entirely with a mouse. The keyboard and joysick are also active, but I found the mouse easier to use.

When you move the cursor to the top of the screen, a row of icons pops up that allows you to perform all of the game's functions. You can select the icons on the bar directly with the cursor or avoid the icon bar entirely. The second button on the joystick or mouse cycles through the icons by changing the cursor to an eye (for examining), hand (for using objects), character (for moving), head (for talking), or an inventory object (for using an object on something else). This is the way to play King's Quest V. Go near the icon bar only to save games, choose an object from your inventory, or control volume level and other environment variables.

After a minute spent mastering the interface, you begin the real fun. You assume the role of King Graham of Daventry, and upon returning from a walk, you realize that your castle and family are missing. With the help of Cedric the owl, you must find the castle and its occupants and defeat the evil wizard responsible for their disappearance. The journey will take you to a variety of places, from desert to ice caves, and will introduce you to many distinctive characters, such as the Queen of the Bees and the King of the Rats.

The story and miniquests of the game are woven together beautifully, and members of the animal kingdom that you save from disaster will return the favor in either the most unlikely places or your hour of need. Save the King of the Rats, and he'll later free you from jail, allowing you to continue your quest. You also have the opportunity to prevent the destruction of an ant community. As it turns out, the ants prove to be adept at finding a needle in a haystack-a task you'll have to complete in order to finish your quest.

Expect some trouble with the puzzles as a result of the game's convoluted plotting. With so much depending on what characters you've met or need to meet, problem solving may require some extremes of imagination. If I hadn't had the hint book, I might never have cleared some of the game's obstacles. You might choose to play with a few friends; someone is bound to have some insight or interesting suggestions. As a game played alone, though, King's Quest V might be too much of a challenge.

The strongest element of King's Quest $V$ is the use of graphics. The pictures in the 256 -color version of the game were painted by artists and then optically scanned for breathtaking results. For machines supporting fewer colors, the game's developers chose the standard approach to computer graphics: using paint programs to create facsimiles of the originals. The resulting art is good but not stunning.

Further enhancing your total gaming experience is the superb music in King's Quest $V$ : a good reason to buy a sound board, although even those computer owners with only an internal speaker will be in for a treat.


Though a beautiful game, King's C is not without its sinister myste

The soundtrack is nonstop, and the theme of the music varies with the screens displayed.

My suggestion to Sierra after seeing King's Quest V is that it not change the interface at all and use that interface on all its adventure games. The company assures me that Quest's interface will become its standard. This means, with Sierra games at least, that you will never again have to contend with a parser and a key-board-a welcome promise indeed. RUSS CECCOLA

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## STORMOVIIK SU-25

so you think you've finally mastered modern air combat. You can spout information about Snakeyes, Rockeyes, and Walleyes like an ordnance chief. But what would you do with a Betab-250 or a ZAB-500? You won't find these weapons hanging on a hardpoint of an F-16 or Stealth Fighter, and details on how to use them are written with Cyrillic letters. This stuff belongs to the other side.

Stormovik $S U-25$ creates a whole new world of Soviet weapons, acronyms, and terms. Just the thing to humble an overconfident jet jock.


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Starting with the new aircraft, there are plenty of things to learn. The SU25 is a superb ground-attack aircraft, a real bomb truck. Comfortable at low or high speed, it can deliver anything from unguided rockets to laser-guided antitank missiles. Built for low-level attacks, it will frequently take you down in the weeds at less than 50 meters.

The premise for the game is unlikely but not altogether impossible. In 1991, peace continues to spread across eastern Europe. Good news for most, but disarmament could mean curtains for some of the world's largest companies-defense contractors. To keep things stirred up, hawkish military officers on both sides of the crumbling Iron Curtain are recruited by the defense industry to use regular military units to commit terrorist acts. As a Soviet pilot assigned to fight these terrorists, you'll face some of the best equipment in the world. You may find yourself shooting down an American-made A-10 attack aircraft and dodging Soviet SAMs at the same time.

You may choose from a variety of interesting missions that are offered. They range from attacking fuel dumps and armor to escorting commercial airliners to protecting downed pilots. And even though stormovik literally means "ground-attack aircraft," a few air-to-air missions are also thrown in for grins. The flight characteristics used in the simulation seem pretty good, though the plane handles


In command of serious firepower, pilots in Stormovik represent the elite.
unusually well with a full bomb load and hard banking does not seem to result in the loss of altitude you would expect.

Graphically, the view from the cockpit is well done but nothing new or exciting. Fans of LHX Attack

Chopper, also by Electronic Arts, will find themselves on familiar ground, as the same graphic engine seems to have been used to drive Stormovik $S U-25$. Numerous exterior views of the plane are offered, as you would expect, along with zooming and time compression.

The game supports Ad Lib and CMS sound cards. The sounds produced are good but not spectacular; more could have been done in this area. The manual is also good but not great. It's a little light on tactics and not nearly as hefty as a MicroProse manual, though it is accurate and the fold-out map of the battle area is helpful.

Game designer Rick Tiberi hasn't pioneered any new ground technically, but the game subject matter and content are certainly well done and refreshing. The missions flow from one to the next in a logical manner and increase in difficulty as time goes by and your rank increases. And there is enough variety in the assignments to keep you coming back to see what's next.

Stormovik SU-25, the game, is a lot like the aircraft itself-not real flashy but solid, well constructed, and capable of doing the job. Fans of highspeed flight certainly won't be disappointed, and the idea of fighting to preserve peace adds an interesting edge to the game.
RICHARD SHEFFIELD

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$\square$nybody who has been to Vegas or Atlantic City is familiar with video poker machines, this generation's answer to the slots. Strategic Video Poker claims to teach you how to win at these machines by simulating one on your PC. Its graphics and playability are modeled closely


Strategic Video Poker could give you a vital edge over video poker machines.
after the real thing. An unfriendly installation procedure may cause problems for novices, but more experienced users will soon be drawing to an inside straight.

The game's claims lie in its "Computed Payoff Calculation." The strategy behind this theory is linked to the payoff schedules for any particular machine-if you know how to interpret the schedule, you stand a better chance of winning. Strategic Video Poker combines a mild PC diversion and a well-intentioned, well-informed, brief manual. It could make you a winner.
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and dragon races, as well as the usual dwarves, elves, hobbits, and human vagrants. Each character has a colorful screen of information displaying a portrait, health, gold, carrying capacity, skill levels, items in knapsack, and weapons/armor in use. Good news: You no longer have to type in a fiveor six-letter spell-casting abbreviation that resembles $X y$ Write's mnemonic commands. Each spell's full name and point cost are displayed during battle.


Miner dwarves aren't exactly happy to see you in Bane of the Cosmic Forge.

The old wire-frame, two-color Wizardry caves are gone, replaced by handsome stone corridors with animated, flickering torches. A few deft touches are impressive, such as the sculpted fountains, locked alcoves, and treasure caches. The game's developers didn't take these far enough, however, since the same walls and objects serve for all interiors, regardless of appropriateness. I found only one deviation: complete darkness, which the game substitutes whenever the accompanying text describes outdoor environments.

Monster encounters are animated. Individual groups approach or retreat, their members in turn striking different poses and wielding impressive weaponry. Though none of this is functional in any arcade sense-you can't aim a projectile at a momentarily parrying bushwhacker-it does enhance the overall gaming reality. Watching monsters vanish one by one as your spells, swords, and missiles take effect makes personal satisfaction a reward in your crusade against evil.

Saving games in progress is no longer limited to the Inn, nor would that be convenient, given the increased size and scope of this adventure. Bane resembles past Wizardry products in other respects, though. Finding hidden passages and complet-
ing arcane puzzles are of prime importance, and I found the accompanying notes excellent. Overall, Bane of the Cosmic Forge is an attractive addition to the computerized role-playing fantasy scene.
BARRY BRENESAL

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## MILHIT SHITI

Remember the old ladder games? I do. I spent hours with Loderunner and Donkey Kong, jostling little 8 -bit, $3-\mathrm{MHz}$ heroes from one screen to the next. But that was yesterday. Today's ladder-oriented diversion runs at 8 MHz , has more bits than you can shake a joystick at, and supports VGA. The name of this dazzling diversion? Night Shift, from LucasFilm Games.


BEAST doesn't make your job any easier with its frequent breakdowns, but in Night Shift, that's just part of the fun.

Night Shift brings the twenty-first century to confirmed ladder leapers like me with its simple premise. You're F. Fixit, employee of Industrial Might and Logic, and you work the night shift in neoenvironmentalist Glenn T. Bingham's toy factory. Specifically, you operate Bingham's Environmentally Active Solution for Toys (BEAST), a ladder-laden toy generator fashioned from recycled bicycle wheels, trash cans, and broken chairs. The product: a line of dolls with
names like Baby Vader and C1.5PO. Production is the object of this game, and you and BEAST are turning 'em out as fast as you can. Alas, there is a problem. BEAST keeps breaking down. To keep it running, you must climb ladders, flip switches, tighten bolts, light burners, pedal bicycles, dodge lawyers, vacuum up lemmings, and so on. The action is accompanied by Ad Lib, Tandy, or Sound Blaster sound. Even standard, tinny PC speaker sound isn't bad. There's firstclass animation and genuinely appealing screen art, plus your choice of keyboard or joystick control. It's good!

Could it be great? A save-game option would be appreciated, and the easily misplaced copy-protection wheel could be done away with altogether. But those complaints notwithstanding, Night Shift is one you'll enjoy. Just don't play it so late that you miss the day shift!
STEVE HUDSON

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Code breaking is safe but difficult. Wiretapping requires following the electrical flow of some fairly complex telephone lines; substitute the wrong microchip, and alarms sound. Car chases involve caging a suspect between two vehicles you control on a large city map grid. Choose faster automobiles, and their sporty designs may alert your quarry too soon; inconspicuous cars may be too slow to overtake opponents.


Terrorist strongholds provide the backdrop for espionage in Covert Action.

Break-ins are the heart of Covert Action. You have limited carrying capacity and must choose your weapons and burglary devices carefully. Overhead perspective and realistic floor plans (with sofas, stereos, and wall safes) provide the backdrop as you move Max or Maxine from room to room. Meanwhile, of course, terrorist organization guards are afoot. If you trigger an alarm, they'll meticulously search every inch of the building. During a break-in you may uncover valuable evidence or even make an arrest, but being caught in a hail of bullets costs you valuable recovery time.

Covert Action offers four levels of difficulty, and each adds fresh twists to already complex cases. When you jump from local to national assignments, goon squads go on alert and gun for you, rather than waiting in their headquarters for your visits. At the regional level, coded messages sometimes arrive with no spaces between words. Wiretapping circuitry includes blank microchips, leaving you to infer their design.

Some configurability has been
built into Covert Action, allowing you to stress those gaming elements you prefer. Your character receives credit for four training sessions at the start of his or her epic adventure. Apply these sessions to the espionage activities of your choice, and the resulting changes simplify certain tasks. Training for code breaking and wiretapping, for instance, would certainly make those tasks easier, especially at higher levels of difficulty where problems really begin. Combine these options for customization with the mean, quick arcade-and-tactics play of break-ins, and Covert Action stands as a well-balanced game, even though the opposition may seem overwhelming.

As broadly realistic as Covert Action is, I wince at its stereotypes. The terrorist organizations are almost entirely Middle Eastern and South American, and nearly all operatives in every organization are Arab and Hispanic. Given that programming is a conscious (some programmers I know would say superconscious) activity, these ethnic choices were probably planned. As such, they are both offensive and inaccurate. That aside, Covert Action is a challenging, welldesigned, attractive game with a nearly endless variety of crimes to solve and criminals to round up. Your ultimate goal is to catch all 26 masterminds, and you'll need at least 52 cases to accomplish it. Take some friendly advice: Purchase Covert Action at once, so you can get an early start on your clandestine activities.
BARRY BRENESAL

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## all's Will

$N$ot every game from 1982 warrants recycling, but the addictive Oil's Well is worth a second look. Originally released for 8-bit cartridge computers, the game is now fully redesigned to take advantage of high-resolution VGA graphics and sound cards. But even if your com-
puter is a standard system limited to CGA graphics and ordinary internal speaker sounds, Oil's Well promises hours of amusement.

The object of the game is to maneuver an oil-drill bit deep beneath the earth's surface, guzzling every drop of crude you encounter along the way. The more oil devoured before time runs out, the higher your total score. You earn extra points when you gobble oil goblets and avoid the destructive little beasties that delight in demolishing your oil-drilling equipment. Steer clear of land mines, or your bit will bite the dust and gobble goo no more. Be prepared to wage several battles against unrelenting environmental opposition before you navigate an entire screen.


Slater the petrosaur seems surprised to see you in his bathroom in Oil's Well.

Since you begin each game with only three drill bits and your first replacement is 10,000 points away, each bit is precious. Ingest all the oil pellets onscreen, and you advance to the next maze of obstacles. But don't give up! Oil's Well only ends well if you meet Slater, an animated petrosaur who lives beneath the oil fields.

Oil's Well is perfect for when you want mindless arcadelike challenges; despite drilling deep, there's no depth of play. Nevertheless, Oil's Well delivers good fun. $\triangleright$
CAROL HOLZBERG

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## MICROIEAGUE foitball: THE COACH'S CHALIENGE

Ihe title says it all: This game simulates the decisions and strategies that go into coaching a professional football team and presents
them in animated fashion on your PC. For all of you Monday morning quarterbacks who think you could have pulled Sunday's game out of the fire, this game is a ticket to fantasyland.

The main package includes 20 great NFL (and AFL-remember those?) teams of the past. Choose two and get ready to write history. Coach Bart Starr's Packers of 1966 against the undefeated 1972 Dolphins; run Broadway Joe's 1968 New York Jets against the awesome Chicago club of 1985. Any way you slice it, there's plenty of action.

## MicroLeague Football is pure

 strategy-no arcade action or joystick finesse required. After choosing your teams, you and your opponent (either the computer or another person) make all of the defensive and offensive calls. If you get stuck, you can ask the computer to make the decision for you, but that takes away from the fun of it.Play in either Normal or Expert mode. The Normal mode provides a diagram of formations and plays which you can choose during the game. In Expert mode, you call the plays strictly by number, with the aid of a card listing offensive and defensive plays ( 22 separate offensive plays, not including kicks; seven defensive postures, with multiple blitz patterns and double-team calls).

Input for calling plays is at first difficult but becomes easier with practice. A more consistent interface would make the game easier to learn. Start out in Normal mode; then, after a few games, move up to the Expert level. Also, it's difficult to decide whether or not to accept a penalty because the results of disputed plays aren't immediately clear. You may give up a 15 -yard rushing gain for a

10-yard penalty gain if you don't pay strict attention to the animation.

Although not as complex as some other computer football simulations, MicroLeague Football succeeds in capturing the feel of a real pigskin contest. The animated players, which represent real athletes, react fairly predictably within the parameters of their statistical abilities. That makes the strategy of play calling all the more important.

A few added features would've boosted this game's realism quotient. A 30-second clock would have added tension to the battle between the hash marks. Instead, time ticks away according to some inscrutable system clock, which makes it difficult to know when to call those last precious timeouts.


MicroLeague Football stresses strategy, but you won't miss any of the action.

To its credit, the game does account for weather conditions (you set these at the beginning of the game), injuries (the game produces these at random), and penalties (also random). These variables make player performances less predictable and put a more human face on the game.

MicroLeague Football supports CGA and EGA graphics, but even on a 16 -color monitor there isn't much detail. You can follow the players on the screen, but the uniforms are either blue or cyan-no hometown colors for your favorite team. Your viewpoint is from the side of the field looking down. You can see about 30 yards of the field at any one time-the screen scrolls horizontally as players move down the field on a run or pass play.

Sound is limited to the internal PC speaker and consists of beeps and whistles. You can turn off the sound by pressing the Alt and S keys simul-
taneously (undocumented).
The depth of this game reveals itself when you create your own league. Creating a league is incredibly simple. Initialize a league by giving it a name; then decide on the number of conferences you want in your league (one, two, or six) and assign teams to the league. On the main program you can choose from among the 20 included teams; other teams are available for your league on franchise disks you purchase separately.

Playing in a league lets you build statistical records over the history of a season. The game's Quick Play option is ideal for compiling stats. It's possible, for example, to play a complete four-game season with 18 teams in six conferences, with a best-of-five conference championship series and best-of-seven world championship series, in 15 minutes. Think of it as your own personal Super Bowl.

Straightforward, basic, welldesigned, and fun-MicroLeague Football presents the strategic side of the computer gridiron. Its simplicity fosters an addictive urge to switch the computer on during spare moments to watch how you would fare against some of the best teams to ever play the game.
PETER SCISCO

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## WARIORDS

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tant to you if you're ever planning to buy additional equipment or software. Even just one peripheral.

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barry brenesal

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Jones's mean streets. You'll parlay education and experience into better jobs, but beware spoiled groceries, unexpected doctor bills, and that inescapable rent payment. While essentially a board game played on a computer, Jones is a compelling diversion enhanced by appealing graphics and clever asides.
EdDIE HUFFMAN

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## PRODUCTIVITY

## C $\mathrm{H} \quad \mathrm{O} \quad \mathrm{I}$ C E

## WHIOSPTITER

.o you treat your computer like any piece of office equipment, flipping it on in the morning and off when you head for home? Or do you regard your PC as a powerful tool that can always be tuned for a little more speed, a little more power? If you consider yourself a power user, a program like Merrill \& Bryan's InfoSpotter takes the guesswork out of souping up your system. It's a utility lover's utility.

InfoSpotter provides a multifaceted view of your system. You get information about system configuration, diagnostics, detailed memory maps, IRQ tables, disk and serial port tests, and various utilities including a file locator and a global file delete function.

The program, which can run either as a stand-alone or memoryresident utility, features a menu bar across the top with choices including Config, Memory, Interrupts, EMM, XMM, DOS, BIOS, Tests, Settings, and User. From each of these, a dropdown menu offers several choices.

In short, it's hard to imagine what InfoSpotter doesn't offer. The program has value for every level of user. InfoSpotter proved indispensable recently for installing network hardware and software on several systems. During that installation, InfoSpotter helped resolve several conflicts that occurred involving IRQ settings, port addresses, and interrupts, generally lowering my level of anxiety.

The Config menu provides options to display a screenful of information about your system and what's installed, including memory, drives, devices, and ports. InfoSpotter also examines your system startup files and will make suggestions for modifying CONFIG.SYS if such changes would improve performance. InfoSpotter also includes a utility for modifying CONFIG.SYS and AUTOEXEC.BAT files.

The program provides a great deal of information regarding memory deployment-a big help in successfully blending conventional, extended, and expanded memories. Being able to "see" the results of experimentation with memory managers makes obtaining the desired results faster and less agonizing.


Defuse potential problems and explore every cranny of your PC with InfoSpotter.

On a more advanced level, InfoSpotter offers tools for a wide range of exploration. Disk and memory dumps are available; boot, partition, and BIOS tables can be examined; and interrupt usage can be monitored. Programmers will be able to see how their software affects the system and can use InfoSpotter's Templates feature to display easy-to-read memory dumps of the data structures their programs have created. $\triangleright$

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InfoSpotter is easy to use and supports a mouse, as well as the keyboard. The program provides contextsensitive, online help as well as a complete help index, creating a friendly environment for less technically inclined users. In fact, the program's documentation encourages the use of InfoSpotter as a tool for learning about computers.

No PC environment should be without some system analysis software. InfoSpotter is one of the most extensive programs of this type available, and its versatility and ease of use make it worth considering for any software library. After all, why pass up an opportunity to get everything possible out of your system?
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## IT'

[ike death and taxes, legal documents are unavoidable. You must deal with them to conduct your affairs in an orderly fashion. It's Legal offers you a quick, easy way to prepare legally binding documents yourself, without the expense of attorney's fees.

The program is entirely menu driven, has screens which are very easy to follow, and supports a mouse. Menus are offered for the preparation of simple wills, living wills, general and special powers of attorney, revocations of powers of attorney, certificates of temporary guardianship, promissory notes, and residential and commercial leases.

Sure, you can do the same thing with forms you can buy at the stationery store, but those forms rarely offer you the opportunity to create a document tailored to your individual needs. In each of its documents, It's Legal offers you the choice of including or excluding those provisions which are optional without damaging the legality of the document. On the other side of the coin, the program warns you if you attempt to omit any
field which is essential for your document to be complete.

I was impressed by the ease of installation and use of the program, its speed of execution, and the clarity of the language of the documents which it produces. It supports a variety of printers and produces trim, pleasing documents. The manual is a model of simplicity and clarity.


Prepare personal legal documents for most occasions with It's Legal.

Modestly priced, It's Legal is a worthy addition to your library. It may lead you to prepare some documents, such as those for temporary guardianship of children, which might not have otherwise occurred to you.
CHARLES IDOL

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## THE NORTOM BRCKIUP AND THE MORTON EDITOR

,he Peter Norton name represents a growing force in the PC utility program world. First there was The Norton Utilities, a best-selling package of lifesaving disk and file tools. Now Symantec, which owns Peter Norton Computing, has released new versions of two other benchmark Norton creations: The Norton Backup
and The Norton Editor.
Everybody knows that backing up your hard disk is the first commandment of serious computing. But no matter how many times you hear this, chances are you don't back up as often as you should-and that's courting disaster. The Norton Backup, a network-oriented backup program that also works for users of standalone PCs, tries to make backing up as easy as possible so that you won't procrastinate.

Network users can take advantage of The Norton Backup's ability to automatically back up hard drives using multiple DOS devices as targets, including partitions, tape drives, and disk servers. Just enter the backup parameters, hit the Enter key, and head for home. Advanced features for setting the level of data verification, routing backups to more than one device, setting archive flags, and backupschedule prompting are only a few of the options provided. However, most home users must back up their hard disks to floppies, which has to be one of the most boring tasks in the world. The Norton Backup does everything possible to make backing up to floppies quick and painless.


For text editing and disk management, The Norton Editor and The Norton Backup make a lean, mean, formidable team.

The program interface is simple and uncluttered. Once you've installed the program, you can select one of five backup types, from a full backup of the entire disk to various partial backup schemes that copy only those files that are new or have been changed since the last backup. The usual procedure is to make a full backup right away and to make only partial backups thereafter, in order to save time and effort. $\triangleright$


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The Norton Backup also uses more efficient data compression schemes than does the DOS backup command, saving even more time and floppies. (Though I found that a high level of data compression slows backup and restoration times for individual disks, your reward is using fewer disks overall.)

The DOS backup command requires that you format floppies before backing up to them, but The Norton Backup formats them for you. It even rejects bad floppies without aborting the backup sequence; not every backup program on the market will do that. (Having been through the aggravation of nearly completing a fortyfloppy backup and then having to do it all over again because the last floppy developed a bad sector, I'd buy The Norton Backup for this feature alone.)

The Norton Backup is a solid program with no bugs that I could find (I didn't test it on a large network). The only feature I wished for was a timed backup, so backups could be set to occur automatically at a specific time each day (say, 5:01 p.m.). The manual is a model of clarity, but it needs a more comprehensive index.

The Norton Editor is a lean, mean ASCII text editor geared primarily toward programmers. Though The Norton Editor does have such basics as word-wrap, block markers (for copying, moving, and deleting blocks), and rudimentary paragraph formatting, you wouldn't want it as your primary word processor. But if you write your own Pascal, C, or BASIC programs, it can save you time and effort with several useful features. Autoindenting keeps your code orderly, while an outlining feature displays only lines that begin with a number or letter in the leftmost column. A matching brackets feature finds missing brackets within a line. Along the bottom of the screen is an info bar that gives a running account of RAM use, file size, number of lines, and program settings. Using a hot-key scheme, you can pop out to DOS at any time to run another program and then return to the editor by just pressing Enter. Two files can be viewed at the same time-useful when you want to compare two versions of program code. There's also mouse support including Windowslike menus and dialog boxes.

Probably the biggest advantage of The Norton Editor is its small size and parsimonious use of memory. You can run it in 130 K of RAM-you can't do that with any of the leading word processors on the market and still edit files of any size. The Norton Classic Editor, an earlier version of the program included with the package, can run in as little as 50 K . This is the editor for programmers with older machines or those who want an editor that doesn't steal RAM from big code files. The only serious problem I found with either program is the lack of a usable Undo command.

The Norton Backup and The Norton Editor uphold the Norton tradition of usefulness, simplicity, and value. Put both on your shopping list if you're in the market for utilities.
steven anzovin

The Norton Backup: IBM PC and compatibles, 512 K RAM, hard disk: supports mouse-\$149
The Norton Editor: IBM PC and compatibles, 130K RAM; supports mouse- $\$ 99$

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Ihis is the first upgrade to Samna's full-featured, character-based word-processing line since the debut of its popular Ami and Ami
Professional for Windows. Modifications in this 3.0 release add some improved features to an already noteworthy product.

The most significant changes involve increased support for laser printers. Samna Word IV now allows you to install as many fonts as disk space permits, instead of the 30 maximum allowed in previous product versions. Compugraphic's Intellifont has been added to improve font images on screen. Margin setting for proportional printing has also been simplified to adjust automatically when type style or size is altered.

WordBase Manager, a textsearch utility, is an import from the recently discontinued Samna Word Plus IV. Like TextWare (and the first of its kind, Unix's GREP), WordBase indexes your documents for quick re-
trieval later, as opposed to $P C$-Browse or $V q$, which perform full text searches every time they are invoked. It's an unusual feature, not often found in word processors, and potentially very useful. Academics can build book and chapter indices with it. Researchers can swiftly locate and compile data from a large number of sources. Corporations have been using similar applications lately to build hypertext presentations for staff, sales, and management.

Samna Word IV's other features aren't new, but they remain distinctive enough to warrant comment. The thesaurus, for instance, provides not only synonyms, but antonyms as well. Access to 12 different foreign language keyboards (including a Greek/math set for engineers) is easy. A documentdescription page tracks usage within the word processor, including edit and creation time, revision dates, numbers of pages, and edits and keystrokes. There's also revision marking, which saves both deletions and additions you've made while editing. Your document can be viewed and printed in its final form, pre-edited form, or with changes only.

Not included is Samna Word Plus IV's integrated spreadsheet. It was a good one but lacked some of the high-end, memory-intensive financial operations only possible in pre-80386 days through stand-alone spreadsheets. Though currently offered to Samna Word IV users as a separate module, it now suffers in comparison to larger, integrated programs that also include a database and programming language, like Informix's Smartware II. More regrettable are Samna Word IV's file-exchange utilities, which have not been upgraded from previous releases. The exchanger imports only ASCII files and balks at any high-bit characters or changes to margin settings.

Graphics conversions were always handled better than text in Samna Word releases, embracing TIFF (.TIF), Lotus 1-2-3 (.PIC), and PC Paintbrush (.PCX) formats. Lotus announced after its recent merger with Samna that this release is intended to show loyalty to the product's character-based constituency, but there's such a thing as maintaining tradition too long. Samna Word IV's menu interface is an example. Two

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years ago when I looked at Samna Word Plus IV, a thorough revision of the interface was in the works, yet it never saw the light of day. Whatever the reason, Samna Word IV's menu structure is both attractive (each option on its own line in capital letters) and unintuitive. Consider the command allocated to F9, :DO, short for do a standard editing function. But it won't DO paragraph indentation; that's another function key. And it won't enhance text with underlining or boldface; that's yet another key. But F9 will do graphics, ASCII/ Samna Word format interchanges, Page Preview, and searches. The logic there, if any, is arbitrary.

Some commands, in addition, have bent out of shape to accommodate first letter menu choices. Format doesn't realign paragraphs; it sets form parameters such as margins and headers. Samna Word IV's Repage is closer to a more standard Format command, changing document structure to fit formatting parameters.

Samna Word IV's documentation is good, fortunately, and comes with excellent online tutorial files. It also includes removable cards for XTand AT-style keyboards that list many Word IV commands and their keys.

Is Samna Word IV 3.0 competitive in the current character-based word-processing market? Registered Word IV users will find the upgraded features almost compulsory at $\$ 49.95$. It's otherwise priced competitively with WordStar and WordPerfect, though it lacks the intuitive keyboard handling of the former and the conversion utilities of the latter. It does have some fine and unusual features that aren't standard among word processors. Samna Word IV's learning curve is steep, but the view from the top is excellent.
BARRY BRENESAL

[^4]
## CHECKII

Six months' work on COMPUTE's BenchMark Program for our hardware test lab section made me a veteran of hardware diagnostics and benchmark tests. When I got CheckIt, I was prepared to be highly critical of anything that fell short of my expectations. Thankfully, CheckIt fell easily into the category of well done. This software should be in the library of anybody who needs quick, accurate, and comprehensive system information for IBM PCs and compatibles.


Inspect your computer system without leaving your chair using Checklt.

In maintaining collections of diverse hardware in company systems, correct identification of components is very important. CheckIt does this well and displays or prints easy-tounderstand reports. But don't worry if you're new to computers. Getting the information is as easy as running the program and using the pull-down menus to view the system information.

Effortlessly getting system information doesn't mean techies won't find CheckIt useful. On the con-trary-practically every nook and cranny of a system is explored when you ask for all tests to be performed. Hard and floppy drive performance, serial and parallel ports, memory, video, and mice are just a few examples of what you can test. A list of device drivers, interrupts, and IRQs will help you track down those notorious TSR conflicts.

CheckIt will give you the edge you need to keep equipment humming. It will identify most of the problems you run into, and by knowing what's wrong (or getting ready to go wrong), you can take evasive action
before your system gives you real trouble. I can't recommend this program strongly enough. Long after I'm done with COMPUTE's BenchMark Program, CheckIt will be beside it on my shelf.
RICHARD LEINECKER

IBM PC and compatibles, 384 K RAM \$149

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## WHO-WHAIWHEN

with so many Personal Information Management (PIM) software packages flooding the market, it's easy for some to get lost in the crowd. By concentrating on a few areas, who-what-when breaks from the pack and excels. Designed as a people organizer, a project manager, and a time-management tool, who-what-when has the ability to view a project and the people involved from a number of different perspectives.


Coordinate schedules and keep your projects on track with who-what-when.

The who facet presents a "people" view that cross-references people and projects, so that any person can be cross-referenced with any other person or project to display all their common tasks. Another component of the who module is a card file that stores basic information about people along with a telephone list.

The what module displays pro-


# WHETHER IT'S GOLF, AR COMBAT, OR ADVENTURE , 

# CロחתPUTE HASTHE OFFICIAL GUIDE 

The Official Guide to Jack Nicklaus Computer Golf by Mike Harrison
Foreword by Jack Nicklaus $\$ 12.95$

224 pages
Here's the inside story. Learn how professional course designers decide where to put bunkers, trees, and greens. Also includes tips for all the Jack Nicklaus golf games, including Jack Nicklaus' Unlimited Golf \& Course Design. This is the only authorized guide to all the Jack Nicklaus computer simulations from Accolade.

## The Official Book

of Ultima
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Introduction by Lord British
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244 pages
Written with the assistance of Lord British, Ultima's creator, this official guide includes inside information found nowhere else. Packed full of hints, tips, anecdotes, and never-before-published clues for all six Ultima adventures.

The Official F-15
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224 pages
This is the official guide to MicroProse's best-selling F-15 simulators. Covers both F-15 Strike Eagle and F-15 Strike Eagle II. Filled with step-by-step instructions and clear diagrams.


YeSII want the official guides checked below.

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Computer Golif
$\square$ The Official Book of Ulitima

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jects, the people involved in them, and project deadlines and milestones. With this module, you set up projects and milestones and develop a calendar to manage a project. Alternatively, who-what-when can display a Gantt overview of a project in a time-line format.

The when portion of the program displays a personal calendar for appointments, tasks, and deadlines. Also available are daily and weekly office calendars.

A fourth facet of the program is its etc. module, used for general reference, printing, and housekeeping. Enter the names of the people you want to attend a meeting, find the free time for each person, and coordinate a meeting around each person's schedule. Generate reports to set priorities, schedule project commitments, or develop mailing lists.

Hard disk installation of the program involves no more than typing INSTALL and designating the default drive in which you'd like the application and its data to be placed. You'll need 1.5 megabytes of free hard disk space free, though.

Help is available by pressing the F1 key for simple instructions and background regarding a particular who-what-when application. What is lacking, however, is a panic key that will step a user through a difficult situation.

A nice feature of who-what-when is its ability to use a hot key to switch to a user's favorite applicationscommunications, word processor, or spreadsheet-while staying in the program.

When you install who-whatwhen, it gives you the option to hot key in and out of who-what-when and other software. For example, you can use the default memo module for short notes, or you can choose to access your favorite word-processing program instead. The same can be done with the program's default autodial hot key and your communications software, and the calculator hot key and your spreadsheet. If you have no favorite alternative utility application, the who-what-when hot keys can be set up to access other software.

Chronos will release a network version later this year, called who-what-when Enterprise, which will link PC nodes on a network together to co-
ordinate personal and office calendars, project schedules, project milestones, card files, telephone lists, memos, and messages.

Focused on maximizing human resources, who-what-when is first class for small work groups.

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C H O I C E

## MICROSOFI <br> GAME SHOP

xperience the challenge and the fun of learning BASIC by playing and modifying games. Programmers from the early days of computing did. Now you can, toothough with much greater easethanks to Microsoft Game Shop.


Have fun learning BASIC as you modify game code in Microsoft Game Shop.

In the early 1980 s, learning to program in BASIC was a necessary part of owning a personal computer. The scarcity of commercial software drove computer owners to learn pro-
gramming-the best way at the time to get their marvelous machines to perform amazing tricks and play engaging games.

Computer magazines of the day offered plenty of type-in programs and BASIC programming tutorials, which readers eagerly studied, tested, and modified.

Within a few months, these early hackers (this was back when the term hacker was a badge of honor) were hooked. They practiced BASIC until it became second nature and then turned their attention to the faster, more powerful languages. The challenges of programming-logical thinking, problem solving, and cre-ativity-turned many lives in new directions. Youngsters shelved dreams of becoming firemen or cowboys and pursued livelihoods as programmers. Older hands used programming abilities to energize aimless careers.

With the maturation of the personal computer industry, we now have commercial software available for almost any use. Magazines no longer devote countless pages to programming instruction, and user group members spend less time discussing loops and arrays.

These changes have made the personal computer more a tool for work and less a tool for creative recreation. With its combination of crossword puzzle, Rubik's Cube, action game, and adventure game, Microsoft Game Shop provides an opportunity to return to the good old days of computing. It's recreational, educational, and challenging.

Microsoft Game Shop includes a full-featured version of Microsoft's QuickBASIC interpreter plus six classic computer games, including a version of Tetris that you can both play and modify using QuickBASIC.

Learning wouldn't be fun without adequate help, and this package gives you plenty. Support includes QBI Advisor, an electronic BASIC programming reference guide, and QuickBASIC Express, an online introduction to using the QuickBASIC interpreter. The package also includes Learn BASIC Now, a 490-page text that provides step-by-step programming instruction plus dozens of sample programs-all carefully dissected and explained.

QuickBASIC has its roots in

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[^5]
## BASICA and GW-BASIC, but it's

been enhanced, extended, and upgraded to keep up with the times. Quick$B A S I C$ provides instant syntax checking as you write your programs and also includes diagnostic error messages.

When programming in Quick$B A S I C$, you'll work in a windowed environment with pull-down menus, mouse support, and a hypertext online reference manual. When editing, you can cut, copy, and paste; you also have access to full search-and-replace capabilities.


In QSpace, defend your space stations from a ferocious enemy missile attack.

The language itself makes many improvements on the older versions of BASIC. Under QuickBASIC, line numbers are optional; IF/THEN/ ELSE/END IF blocks, SUBprogram blocks, and FUNCTION blocks are permitted; flow-control structures have been enhanced and now include SELECT CASE and LOOP WHILE/UNTIL provisions; long integers, fixed-length strings, and constants are supported; user-defined data types are permitted; and code and data capacity have been extended from 64 K to 160 K .

Microsoft Game Shop combines this advanced, friendly programming language with a half-dozen games to get budding programmers involved and interested. These games-
QBlocks, QSpace, QBricks, QSynth, QMaze, and QShips-are essentially the same as those that budding programmers laboriously typed in from magazine listings years ago.

For the most part, these games are dated. Kids who've grown up on Nintendo and Turbo Grafx-16 no doubt will find them dull. But with Microsoft Game Shop, your fun and challenge are less in playing the games
than in understanding how and why they work.

As you finish a session with one of the games, a screen offers suggestions for how you might change the game to make it more interesting or more challenging.

For example, the suggested options for modifying QSpace include changing the speed of the enemy missiles and targeting crosshairs, changing the sound effects or the colors of the pieces, changing the number of missiles, or altering the size and duration of explosions.

These most obvious changes are designed to whet your appetite. Once you begin tinkering with program code, you're learning to program. As your confidence builds, you'll want to make bigger changes, and before long, you'll dream up your own game scenarios and design your own programs from scratch.

All of the game programs included with Microsoft Game Shop come with extensive comments. In other words, the purpose of nearly every line and its interaction with other lines in the program is fully explained. It's easy to learn how QuickBASIC works and how the programs work by studying the code.

Although neither exceptionally challenging nor state of the art in terms of graphics or sound, these simple games are an excellent milieu in which to learn programming. The visual nature of these games usually makes programming mistakes quite apparent and thus easily correctable. Games also give you ample opportunity to use most of the features and commands of the language. Once you understand how these games are put together, you'll have a sound basis for creating your own games and applications. You'll be an old hand with loops, counters, timers, functions, and subprograms.

Playing and modifying the games involve rather a seat-of-the-pants approach to learning programming. For a more structured step-by-step introduction to QuickBASIC, you'll study the Learn BASIC Now manual in conjunction with more than 130 program samples that come on the QuickBASIC disks.

In working through the manual, you'll be introduced to commands and concepts one by one. It's a build-
ing process that you can take at your own pace. Learn BASIC Now also serves as a reference manual when you need a quick reminder of how to use a certain BASIC statement.

No programmer is exempt from mistakes, and no program is ever written without bugs. Learning to debug programs is a big part of learning to write programs. The Learn BASIC Now manual includes a chapter dedicated to this task. This section includes tips on how to spot common programming errors-syntax errors, logic errors, and runtime errors-and how to use QuickBASIC commands to find and eliminate pesky bugs. Microsoft Game Shop even includes a few error-riddled program samples to provide some debugging experience.


In QBricks, you control a paddleball with some well-planned computerized twists.

You'll come to rely heavily on QBI Advisor, an outstanding online programming reference program. With the click of a mouse button or the press of a couple of keys, you'll access a wealth of information. QBI Advisor has information about how to use the program and its menus, as well as specific information about each of the keywords in the Quick$B A S I C$ language.

When you seek help on a BASIC keyword, you first see a screen with a quick explanation. At that point you can opt to view a more detailed explanation or to see an example of how the keyword would be used in a program. These help screens often refer you to similar or associated commands, and again, a click of the mouse or a press of a key will fetch information on those topics.

Another helpful feature of $Q B I$ Advisor is that it includes online tables of ASCII characters and keyboard scan codes.

Successful programming involves a significant amount of work with reference materials. The well-designed and detailed QBI Advisor will save you a lot of time and will help keep your desk from becoming a disaster area cluttered with books, charts, tables, and manuals.

As implied by the name, the QuickBASIC interpreter is an interpreted language. This means that as you run your programs, QuickBASIC reads each statement in the program, converts the statement to codes that your computer's CPU can understand, and then sends those codes along for processing. This is a timeconsuming process, and its effect shows in programs involving significant number crunching or serious arcade action; you might be surprised at how slowly a computer can run.

If you're a beginning programmer, however, you'll find interpreted languages more than adequate and, in fact, beneficial in that they allow you to test programs quickly without having to compile them first.

If you end up being bitten by the programming bug, there's an easy upgrade path from Game Shop. Microsoft's QuickBASIC is a compiled language that can run any of the programs created with Game Shop.

When a program is compiled, all of its commands and statements are converted to machine code stored in a separate file. That new file, a standalone program, can run on any computer. It doesn't need QuickBASIC to work, and it will be executed up to ten times faster than the interpreted version.

Years ago, being computer literate meant learning to program in BASIC. Although there is less emphasis on programming today, programming remains a challenging, creative, and even entertaining enterprise; and computer users who understand programming will always be a step ahead of those who don't.

BASIC is an ideal first language. Its ease of use provides programmers with a simple way to learn and experiment with programming concepts that are the building blocks of programs written in any language.

For learning to program, Microsoft Game Shop provides an excellent introduction with plenty of fun and useful tools. First time programmers
have a chance to experience the challenge and excitement of the old days of computing, but with all the comforts afforded by today's technology. TONY ROBERTS

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## MICROSOFT

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## CAICUIUS

1unning Calculus reminds me how tough learning and then teaching calculus was and illustrates how much easier a program can make the process. You probably can't learn the subject by using software alone, but you approach enlightenment sooner by supplementing your study with this package. And if you're learning algebra, geometry, analytic geometry, or trigonometry, you'll benefit from many of the chapters.


Derivatives are made visual by Calculus.
Calculus runs in the Windows operating system. That means you need at least an AT class computer with a 286 processor and an EGA graphics card or better. Sure, those are stiff requirements, but one of the beauties of this program is that it takes advantage of the latest technology to effectively present information.

During my teaching career, I explained to my students that functions were like number-processing black
boxes. The box was an equation that performed operations on numbers that are plugged in, and out comes the result. They all said, "Huh?"

Now you can actually see a function as a boxlike icon. The input numbers fall into the box, and out the bottom comes an answer. That's what I call an effective illustration of functions! All of the examples included are interactive. You can alter the function and experiment with different input numbers to see what comes out.

The prize for the hardest concept to teach goes to the graphing of lines and functions. Once again, this program does a tremendous job of showing how the math works and offers you the chance to dynamically interact. You can pick different equations and numbers, and you'll see how the various factors affect the graph.

The final hurdle on the road to understanding advanced mathematics is the derivative. It's tough to make sense of the old phrase rate of change, but when Calculus presents it, you can actually see a derivative and how it relates to a function. That's a lot better than graphing hundreds of functions and dozens of derivatives for each one before learning the concept.

Calculus comes with lots of extras that make learning even easier. There are online explanations of chapters if you need help; they consist of problems, tutorials, or a mixture of both. Optional sets of hints for the problems and positive reinforcement for right answers are also part of the package. The developers went the extra mile to make certain that this program was everything that an advanced mathematics program should be.

If you're looking for a terrific supplement to your children's math education, by all means buy this program. Anyone who uses Calculus-especially the mathematically timid-will be reaping the benefits for years to come. RICHARD LEINECKER

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to experience and experiment with telecommunications. The ready-to-go pages that are included get them started but are easily modified to encourage experimentation. Introduce your kids to Logo Express, and they may not let you use your computer for weeks.
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PC STUOY BIBBIE

What does the Bible mean when it says to love one another? There are several ways to decide. One way requires a stack of dictionaries, concordances, and cross references, along with hours of page flipping. The other way is to turn on your computer, load PC Study Bible, and go!

In many ways, PC Study Bible is a Bible student's dream come true. The basic package integrates three versions of the Bible (the King James Version, the American Standard

Version, and the New International Version) with a multifaceted concordance, a notepad, a word processor, and Nave's Topical Bible. Optional add-ons include additional Bible versions plus a Greek-Hebrew dictionary. The result is a truly powerful study tool.

At the heart of the program is the Bible reference section. You can start at any book, chapter, and verse, and move to other references with ease. Multiple windows allow you to work with several translations at one time, and scrolling through one automatically scrolls through the others. And if you're simply reading, there's an automatic variable-speed scrolling feature.

PC Study Bible's concordance works with any of the program's Bible versions. You can search for words or phrases, and do and/or searches within verses. You can also locate words you don't know how to spell. Simply enter the first few letters followed by a plus sign, and a list of likely spellings pops onto the screen. If you're looking for proper names or places, however, you must capitalize the first letter. Otherwise, the screen will say nothing found.

As mentioned, PC Study Bible includes Nave's Topical Bible, which cross-references Bible topics in more than 100,000 verses under almost 20,000 different headings. It includes outlines on hundreds of subjects and is valuable for in-depth topical studies.

Biblesoft offers Strong's GreekHebrew Dictionary and Englishman's Concordance as an add-on option. It provides immediate insight into He brew and Greek words and gives you fingertip access to original definitions and derivations. You can even locate every place where a given Greek or Hebrew word appeared in original texts. A good concordance is tremendously powerful and, compared to the traditional page turning of a printed concordance, research with this electronic one is essentially effortless.

As you work with the program, chances are good that you'll want to record scriptural passages, word info, and your own comments. To make this easier, PC Study Bible includes a built-in notepad. The program also includes a word processor, although you may want to use your own word-processing package for final editing.


Every verse of the Bible is indexed and ready for reference in PC Study Bible.

PC Study Bible has features galore, but how does it work in practice? Very well. Installation is simply a matter of making a directory and copying disks, although there are lots of disks to copy. The user interface is straightforward, using a combination of function keys, pop-up menus, and single-key commands to call various functions. This is a package that won't take long to master, but it's one you'll be using for a long time to come.
STEVE HUDSON

IBM PC and compatibles, 320K RAM, two floppy drives or a hard drive. Basic pack-age-\$149.95, starter edition (King James or New International Version without Nave's Topical Bible)-\$79.95

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## MIXED.UP MOTHE GODSE

Iothing brings classic literature to life like colorful illustrations. Combine these with the lessons of a nursery rhyme and events in a child's own life, and you have an unbeatable way to educate and entertain at the same time. Mixed-Up Mother Goose, an adventure game aimed at preschoolers, does just that. Combining inspired graphics and ease of play unlikely to frustrate even a four-yearold, it draws a child in and allows him or her to learn by playing a game. Type in a name, select a representative animated character, and almost immediately a child is winging into an extended adventure astride Mother Goose's goose.

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## $\stackrel{\text { A }}{\text { REVIEWS }}$

The yarn-spinning spinster herself greets the child outside her cottage, asking for help in straightening out her mixed-up rhymes. Mary can't seem to find her little lamb, and Jack and Jill need their pail before they can make an ill-fated uphill climb. Those and 16 other rhymes must be set right before the game can end. Just by going through this process, a child can't help but learn.

After the child's name has been typed, no further typing or complicated keystrokes are required. The character is maneuvered using a joystick, mouse, or arrow keys. An object is picked up simply by walking up to it; the nursery rhyme characters speak when approached. Doors open automatically.

Besides providing an elementary, engaging introduction to the personal computer, Mixed-Up Mother Goose teaches problem solving, object recognition, and even map reading as the child winds his or her way through
fairy tale territory with the help of a colorful poster. Of course, there's also a boost to reading skills and an appreciation of rhyming and wordplay as


The old woman who lived in a shoe isn't the only nursery rhyme character you'll meet in Mixed-Up Mother Goose.
the rhymes unfold. For children who have never read Mother Goose before, this game might well be an enticement to seek out the stories. is available in Microform.


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Best of all, though, Mixed-Up Mother Goose is fun. The characters are vibrant and distinct, meandering through a colorful landscape strewn with pumpkin houses and castles, lost candlesticks and wandering fiddlers three. Lost objects usually appear relatively close to their owners, preventing frustratingly long travels. Simply changing scenes often unveils unexpected delights-whether it's the old woman's shoe or the crooked man's little crooked house.

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For programming in QuickBASIC, The Waite Group's Microsoft QuickBASIC Bible is required reading.

As the book moves from tutorial to general information to specific information, every inch is put to good use, including the inside covers (where quick reference indices appear in both alphabetical and categorical order). The coverage of compatibility between earlier versions of QuickBASIC, ANSI BASIC, interpreted BASIC, and PowerBASIC is good. Sample programs (available on disk for a reasonable \$18.95) have good comments and usually manage to be somewhat useful. They also tend to avoid duplicating the online help and

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even refer you to sample programs included with the product, a refreshing change from books that rehash the manual and sometimes even duplicate sample files.

Two interesting appendices list files available on CompuServe to aid the BASIC programmer. Appendix A describes, by category, scores of articles available to users of Microsoft's Knowledgebase, used internally by Microsoft's product support team and available on CompuServe as well. Appendix B contains similar descriptions of program files on CompuServe. My only complaint is that the latter doesn't give credit to its authors, nor does it list the distribution terms of each program (public domain, shareware, freeware, and so on). Of course, this list will be out of date in a few years, but I still think it's an excellent idea. There's a lot of good code out there.
TOM CAMPBELL

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## $1 \cdot 2 \cdot 3$ BELEASE 3.1: THE COMPLETE REFERENCE

ike a tour guide, Mary Campbell escorts her readers on a welldocumented expedition through the layers of Lotus 1-2-3's convoluted internal architecture. In her newest reference manual, $1-2-3 \mathrm{Re}$ lease 3.1: The Complete Reference, she tirelessly explores and explains all of release 3.1's myriad features.

Beginning with the basics, Campbell explains $1-2-3$ 's basic elements, such as the work sheet's components, menu terminology, and control key sequences. She subsequently details data entry, manipulating the work sheet's appearance, and printing. In later chapters she describes $1-2-3$ 's more advanced functions, such as


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FAST FACTS

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This past March in San Jose, California, the Computer Game Developers' Conference nominated several computer games as worthy of special notice. Conference attendees having cast their ballots, the following winners emerged.
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Best Visual Presentation in a Computer Game
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## Best Audio Presentation in a Computer Game

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## Most Innovative Game

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## Best Producer

Greg Hammond
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## 1989 North American Software Sales



Source: Software Publishers Association

1990 North American Software Sales


Source: Software Publishers Association

Based on information submitted from 150 of the country's leading software publishers, the Software Publishers Association (SPA) announced that retail personal computer software sales increased 22 percent in the fourth quarter of 1990, compared with the same period one year earlier. MS-DOS sales increased 18.1 percent, and Macintosh sales were up 12.5 percent. Sales of Windows applications increased 198 percent. Education software sales for MS-DOS computers increased by one-third, while MS-DOS entertainment packages posted a 30 -percent gain. Word processing remained the biggest software category.


[^0]:    APROTEK 2400 Baud Modem for $64 / 128 . . \$ 99.95$ 64, 64C Power Supply CARTRIDGE EXPANDER for $64 / 128$. $\$ 29.95$ COMMODORE 1700 RAM Expansion...... $\$ 79.95$ COMMODORE 1764 Expansion Module.. $\$ 99.95$ CARDCO G-WIZ Interface...................... $\$ 49.95$ COMMODORE 1660 Modem............................. $\$ 14.95$ XETEC S. Graphix Sr. Interface $\$ 79.95$ Micro C-128 Power Supply
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[^2]:    Commodore 64 or 128-\$39.95

[^3]:    IBM PC and compatibles; 512 K RAM for CGA, EGA, or Hercules, 640 K RAM for MCGA, VGA, or Tandy 16 -color; hard disk recommended; mouse or joystick optional; supports Roland MT-32, Ad Lib, Game Blaster, Sound Blaster, and other music boards-\$34.95

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