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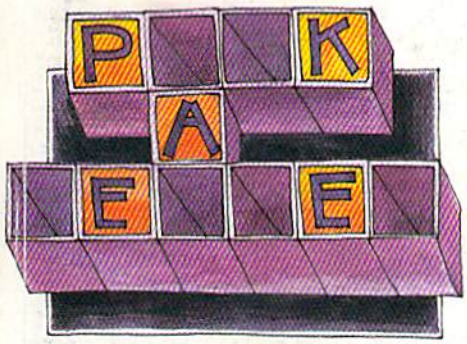

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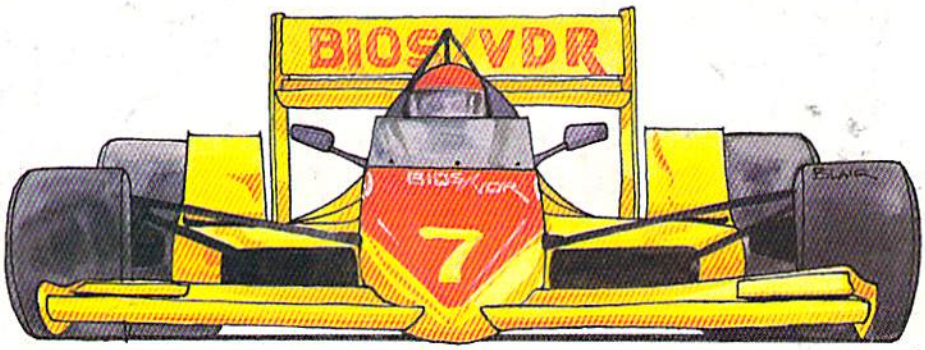

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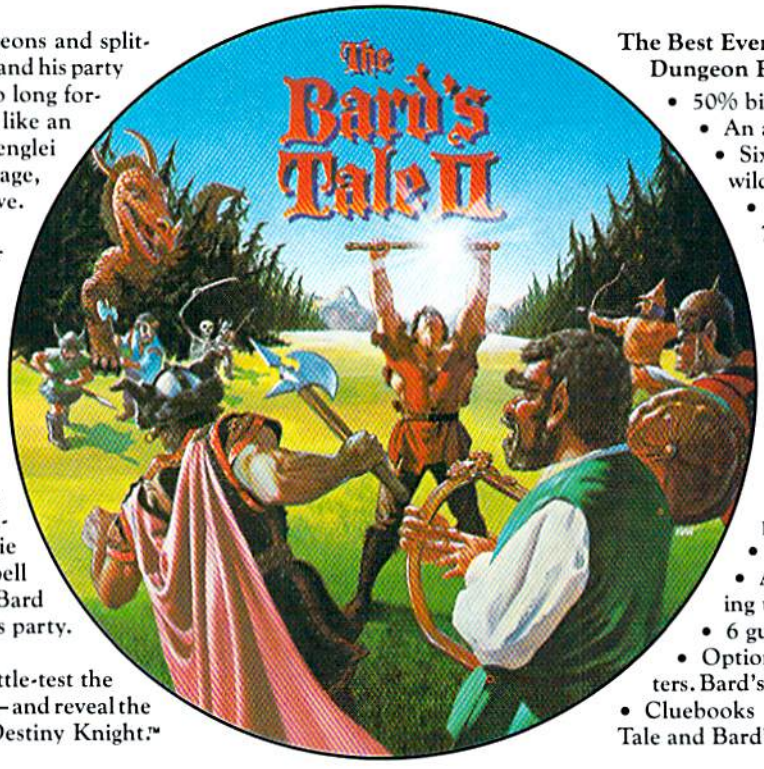

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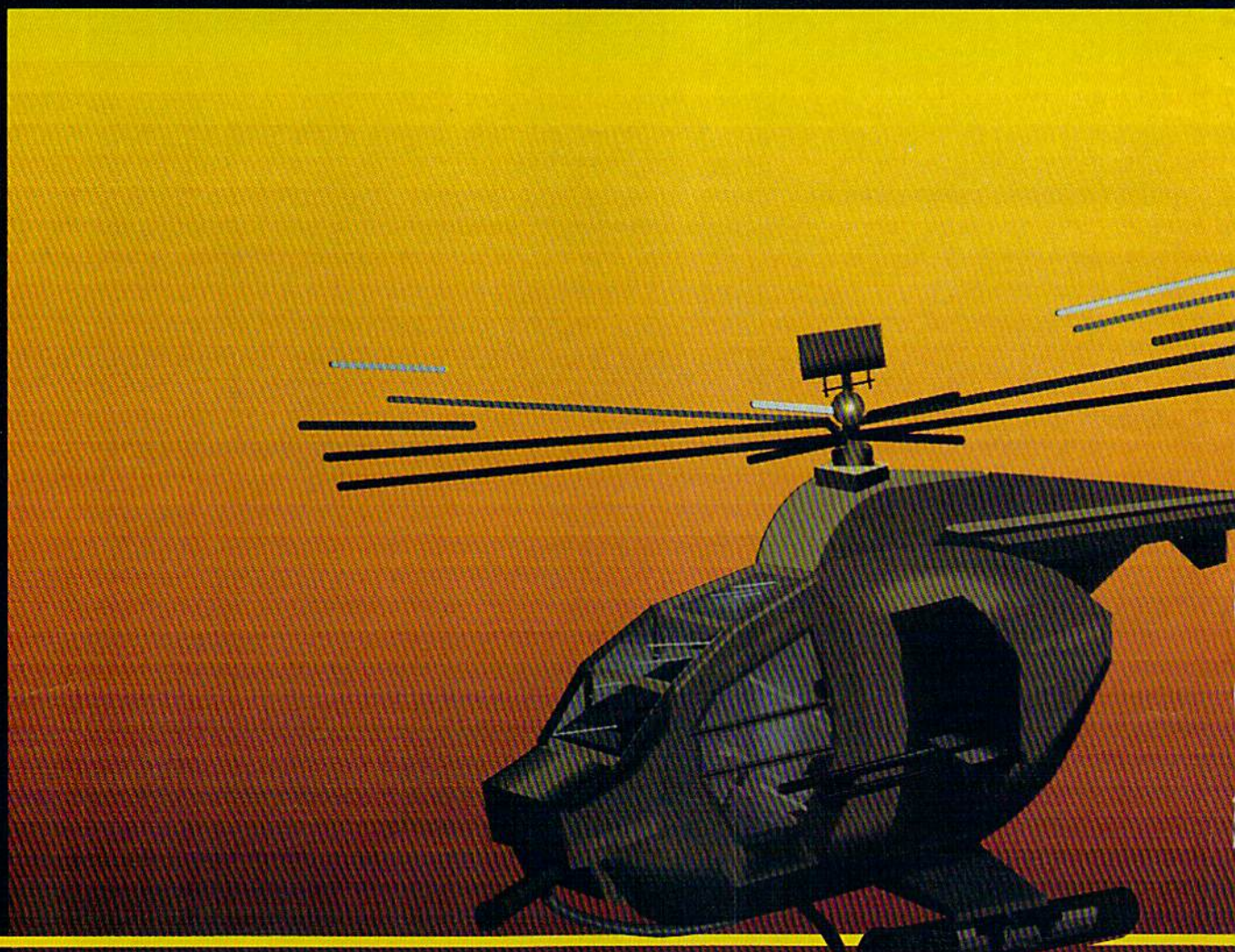

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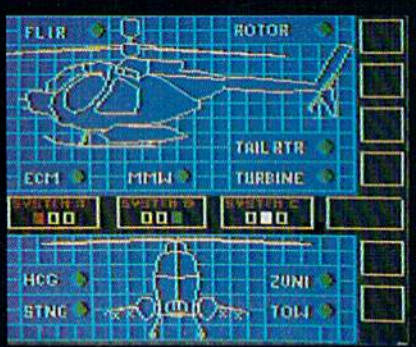

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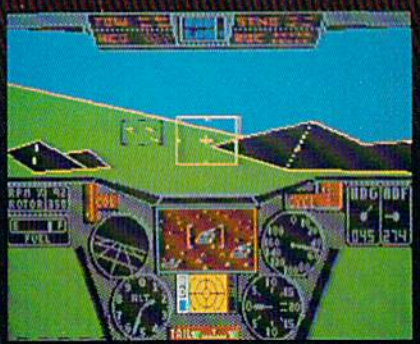

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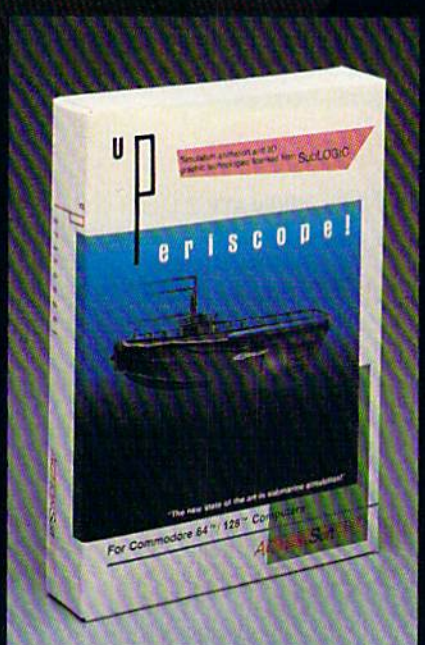

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editor's notes

Commodore is bringing its clone to America. By the time you read this, the PC10-I, Commodore's IBM PC–compatible computer, will be nearly ready for distribution in the U.S. The 512K PC10-I, which has been marketed in Europe and Canada for the past several years, includes a 5¼-inch 360K disk drive, a monochrome/color graphics card, and Centronics and RS-232 ports. The price has not yet been announced.

This is an interesting turn of events. Clones—machines which are compatible with the IBM PC—have been increasingly taking over the business end of microcomputing. The clones sell because they tap into an enormous amount of well-tested software and a huge base of users familiar with the de facto standard operating system for business microcomputing: MS-DOS.

Now Commodore, the leading manufacturer of personal computers, is introducing its own IBM knockoff to the American market. Clones are generally highly compatible with software and peripherals designed for the IBM PC. Yet compatibles attract buyers because they are often far less expensive than the real thing. Other clones, however, while costing about as much as an IBM-PC, offer additional features such as more memory or greater speed. It appears that the Commodore PC10-I will compete via pricing since its features are standard.

Commodore faces two difficulties with this introduction. The clone market has become one of the most highly competitive areas in the microcomputer industry: Fully functional IBM-PC compatibles are expected to be selling for less than $500 in early 1987. At these prices, profit margins are quite narrow. Also, as early as 1984 there were already nearly 50 clone manufacturers. Today, all the parts of a PC are widely available and it seems as though anyone so inclined has bought a soldering iron and set up a clone business. IBM itself, stung by a significant loss of market share, is rumored to be dropping the venerable PC from its product line.

This late in the game, Commodore is facing an uphill battle against such highly successful compatibles manufacturers as Tandy. What's more, if IBM does drop the PC, the new standard is likely to be a leap forward to AT (*advanced technology*) and even 80386-based clones. These powerhouse machines are neither as easy to clone nor as easy to market.

Of course, all this activity among the clones has not gone unnoticed at IBM. A recently announced alliance between IBM and chip-maker Intel Corporation has led to a flurry of speculation about possible new proprietary (or at least harder-to-copy) chips. This would make life more difficult for the clone manufacturers because new high-density, high-speed, specialized chips could well cost clone makers more than they would cost IBM-Intel to produce. And such chips may be difficult to reverse-engineer. All this spells possible trouble down the road for those who specialize in underselling IBM in IBM's markets.

But Commodore has a long history of selling cost-efficient, popular computers. In spite of the odds against this late introduction of their clone, it's too soon to count Commodore out of the running in this or any of its other endeavors. If nothing else, the Commodore's PC10 and PC20 (a version with a ten-megabyte hard disk) have done well for two years abroad and in Canada. Perhaps, with a low price and shrewd marketing, the Commodore clone will surprise us all.

In This Issue

"MetaBASIC" is one of the most impressive programs ever offered in COMPUTE!'s GAZETTE. When we first published this comprehensive utility for the Commodore 64 in the April 1985 issue, we knew that it would be popular and very useful to many readers. But we were surprised at the sheer number of letters from readers and of reviews in user-group newsletters. The version printed here includes a few minor modifications. In addition, "MetaBASIC Plus," which can be merged with MetaBASIC, adds 11 new commands. When combined, this super version of MetaBASIC includes a total of 43 commands to provide efficient, time-saving, and, ultimately, far easier programming. For Commodore 128 owners, we've included "MetaBASIC 128," which adds 11 commands to BASIC 7.0.

If you're shopping for your first printer or planning to upgrade from your present model, be sure to read "Deciding on the Right Printer" and "A 1987 Buyer's Guide to Printers." The first article explains how you can avoid frustration and wasted time and money by doing a little homework before making a purchase decision. The buyer's guide offers a comprehensive chart of current $500-and-under printers compatible with Commodore computers. "Printing Commodore Graphics" explains printing modes and interfaces, and includes several short demonstration programs which illustrate important, yet often misunderstood, techniques.

We hope you enjoy this issue.

Richard Mansfield, Senior Editor

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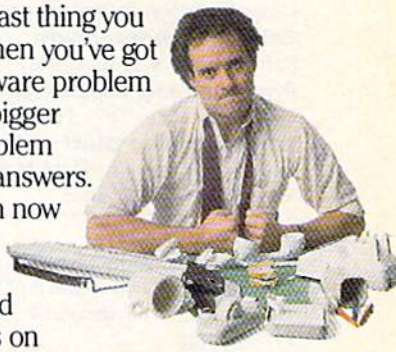

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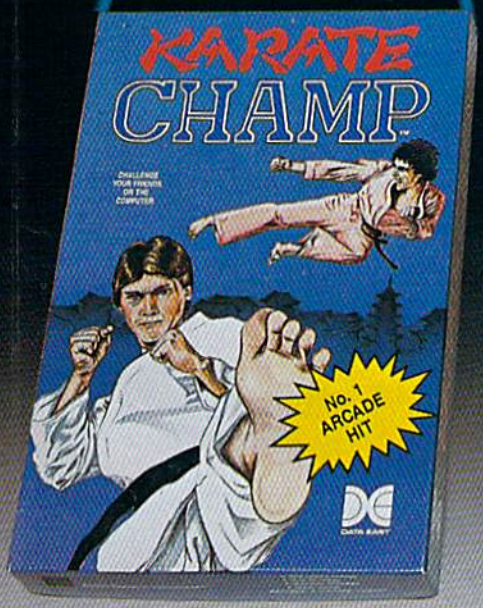

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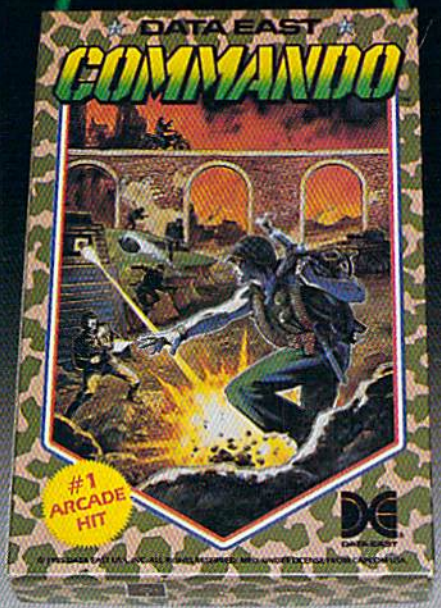

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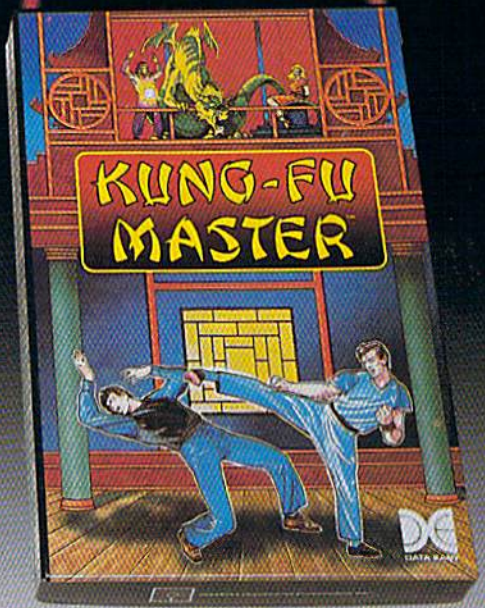

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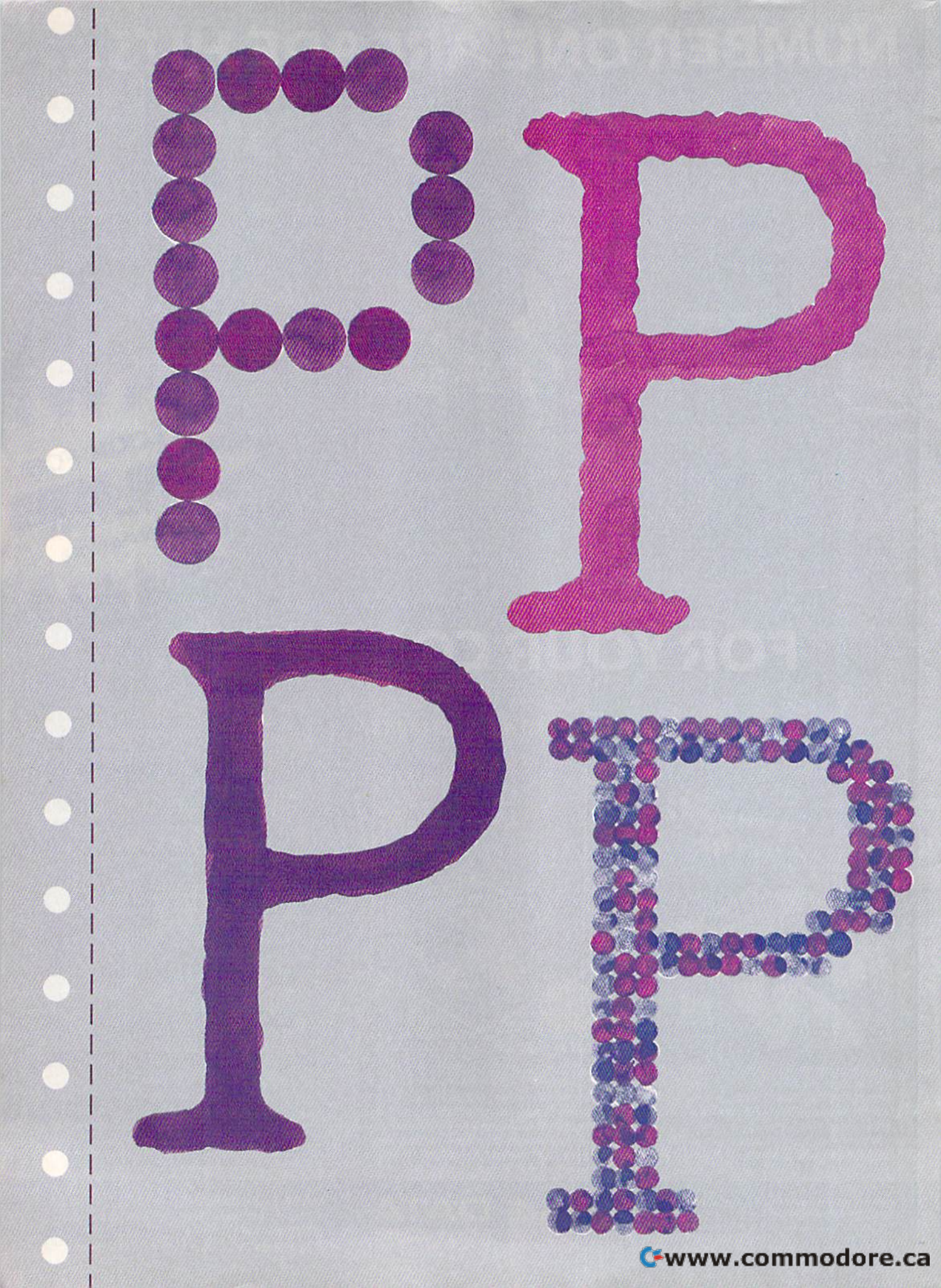

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Deciding On The Right Printer

Kathy Yakal, Assistant Features Editor

It's not an easy decision. If you haven't yet bought a printer, or would like to upgrade to a more sophisticated model, there are dozens of them available from several different manufacturers. Further, the large installed base of Commodore computers has had its own impact on the printer market, driving prices down and encouraging some manufacturers to offer Commodore-specific interfaces for printers.

Four years ago, printers were a pretty pricey addition to a home computer system. There were only a few, from a handful of manufacturers, that could be purchased for less than $500. And at that time, considering how expensive most home computers were, $500 was a good price.

Star Micronics broke some barriers for Commodore owners that same year by introducing the Gemini 10X. The original price was less than $300, it offered good print quality and graphics capabilities, was interfaced relatively easily to a Commodore 64, and used standard Underwood typewriter ribbons that could be purchased at an office supply store for less than $2.

The Gemini 10X became a very popular choice for the Commodore crowd, and Star went on to make their line even more appealing by introducing printers that came *Commodore-ready;* that is, printers equipped with an interface designed to plug directly into one of the Commodore 64's ports. Anyone who tried to interface a printer with a Commodore in the old days—and, in some cases, even now—can appreciate what a boon that was.

As the installed base of Commodore owners swelled into the millions, many other printer manufacturers began catering to this powerful consumer group. By 1985, there were more than half a dozen manufacturers that offered Commodore-ready printers, and more than twice that many models to choose from. As the price of Commodore hardware and software dropped, so did third-party printer prices.

Although a few companies have dropped out of the printer race, the lion's share is still in there competing. This segment of the home computer industry has not yet experienced the shakeout that other areas went through a couple of years ago. And that has left some of the players involved shaking their heads in wonder.

Whatever the reasons, the Commodore owner in 1987 has dozens of printers to choose from. (For a listing of inexpensive printers available, see "A Buyer's Guide to Printers," elsewhere in this issue.) Your decision about which one to buy—whether it's your first printer purchase or an upgrade—will be much easier if you take a number of factors into consideration first.

"The majority of people out there really don't think the printer is that big of an issue. It's kind of an afterthought issue," says Rick Lamb, Product Manager for the Thermal Transfer Printer Division of Okidata. "And that's really quite surprising—if the person put some thought into the purchase of a printer, this device can last and be used with any computer they can possibly own."

Not taking the effort to make a good decision can result in a lot of wasted time and money, and unnecessary frustration, says Lamb. "Usually, whatever is left of the discretionary income ends up being used on a printer. In my opinion, it would be worthwhile to delay the purchase until one had enough funds available to get something they really wanted."

Which Features?

Your approach to buying a printer will probably depend on whether you're a first-time buyer or a printer

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owner looking to upgrade. If you've never owned a printer, you may find that there's more to consider than you first thought. If you already have a printer, you probably have a good idea of what features you'd like to have, but you may still want to go into your dealer armed with a list of questions.

One thing to be very clear about when you begin shopping is how you plan to use the printer. The list of specifications for each unit is meaningless unless you know what you want the printer to do. Some printers may be able to do everything you want and much more; if you think your applications will expand over the next few years, it may be worth the extra expense. If not, you'll probably be able to find a less expensive printer that will suit your purposes—especially given the tremendous number of printers available these days.

To make the best possible decision about which printer to buy, here are some issues you may want to explore. We've broken them down into four different categories: *input, output, aesthetics,* and *long-term considerations.*

Input Considerations

Software/Hardware Compatibility

The question of hardware compatibility is not so much whether or not the printer will work with your computer, but how difficult it will be to interface them. A dealer may tell you whether or not a particular model is Commodore-compatible, but may not be clear on exactly what interface you need. If you buy a unit that is not Commodore-ready, be sure to find out which third-party interfaces will work.

Also, if you've already invested a lot of money in software, you'll want to make sure that programs with printout capabilities are compatible with the printer you buy. Probably the two most common applications with which you'd want to use a printer are word processing and personal publishing. The documention for such software generally includes a list of compatible printers.

In some cases, software has spurred people to buy a printer they otherwise would have done without. Brøderbund's *Print Shop* and Springboard Software's *The Newsroom* have actually sold printers. "Those packages have had a real positive impact in the marketplace," says Dennis Cox, Group Product Manager for the Peripherals Division of Epson America. *Print Shop* has certainly shown that it spans a broad range of users. It has been very positive and it certainly has helped in driving the sale of dot-matrix printers."

Output Considerations

Print Quality

How good does your printed copy need to look? After all, you're probably not buying a printer *just* to print things out, but also to make your documents look a certain way. A polished typewriter-style look is desirable if you're going to be using your printer for college papers or business correspondence and reports, but unnecessary for casual correspondence. In this price range, a daisywheel printer still offers the sharpest type, but many dot-matrix printers have what's called near-letter-quality (NLQ) mode, which produces near-typewriter-quality print.

Dot-matrix printers form char-

Infocom introduces four new gam

Infocom,™ the crazy people who brought you "Zork"® and "The Hitchhiker's Guide to the Galaxy,"™ has a habit of coming up with games that add a new dimension to interactive fiction. And the best keeps getting better. Case in point: "Leather Goddesses of Phobos."™ It has a scratch n' sniff card and a 3-d comic book to excite all your senses. Once your interest is piqued, you'll embark on a rowdy romp through the solar system. This hilarious spoof of 1930's pulp science fiction has 3 "naughtiness levels," for the prude to the lewd. "Leather Goddesses" is sure to amuse members of either sex.

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acters and graphics through a *printhead*, a configuration of tiny pins that strikes the paper through an inked ribbon. In this price range, a nine-pin configuration is the most common. Printers using a 24-pin printhead, which allows crisper type and better graphics capabilities, have only recently broken the $1,000 price barrier. We can, however, expect to see these printers become less expensive over the next year or so.

Graphics/Color Capability

The printhead, which prevents dot-matrix printers from printing letter-quality type, nevertheless makes them a good choice for a person who wants to print graphics. If you plan to program a lot of graphics displays, the *dot-addressable* graphics capabilities of these printers will probably serve your purposes best. Thermal transfer printers also offer good graphics capabilities.

If you use applications that require color, your choices are still fairly limited. It's a little early in the game for widespread availability of color printers. "It's a desirable feature—there's no question about that," says Cox. "But there are a number of areas that need to be addressed. The actual cost of the color mechanism in a printer is still just slightly out of the home user's budget range, in our perception. As time goes by and the economy of manufacturing comes down, color is going to reach into the home. You also need the software to support it, but that is rapidly being taken care of."

Font Support

Does the printer support the fonts you'll be using most often? Your word processor probably offers several fonts—superscript, subscript, boldface, expanded, and compressed—but not all printers are capable of printing them. If you anticipate needing different fonts, be sure the printer you purchase supports them.

Column Width

How many columns can be printed across the page? Very few printers are limited to 40-column printouts any more. If you can't imagine yourself ever using your printer for anything but program listings, more than 40 columns might well be unnecessary. Most printers offer at least 80 columns, and some go up to 136. For most word processing and graphics applications, 80 columns is fine. But many business applications, such as spreadsheets, require 136 columns.

Character Sets

Does the printer support different character sets? If you plan to use nonstandard characters, such as some foreign languages or scientific notations, you'll need a printer that supports them.

Speed

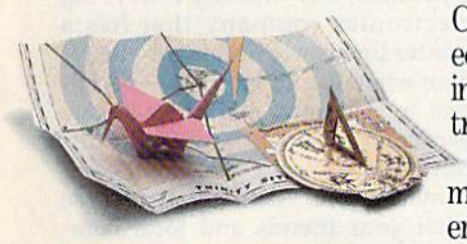
How fast can the printer print? Your needs will dictate whether or not you need a fast printer. Speed can vary widely: Draft mode is quite often up to ten times faster than correspondence or NLQ mode.

Aesthetic Considerations

Ease Of Use

This may well be the most important factor to consider when choosing a printer. As computers continue to support more general interest applications, more people

es. One really smells.



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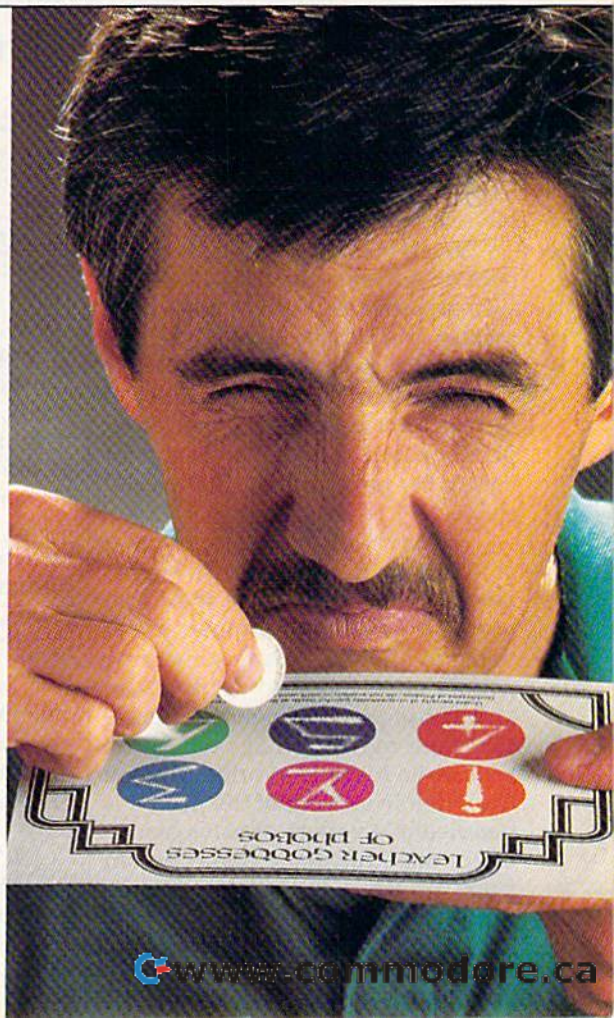

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without technical backgrounds are buying them. And nearly everyone wants something that's easy to set up and use.

What makes a machine easy to work with? There are several factors.

• *Setup.* What's involved in getting the printer correctly interfaced to your computer and ready to operate? Many printers now come Commodore-ready: The package includes a cable that plugs directly into the computer or the disk drive and runs to the printer. If the printer you want doesn't come Commodore-ready, find out what kind of interface you'll need, and how easy it is to find. Many printers have sat idle in people's homes while their owners frantically called friends, computer stores, and mail-order houses to find the right interface. It's best to get this kind of information before you buy.

• *Paper-handling.* If you're planning to use your printer just to print out program listings on continuous-feed paper, either tractor or friction feed works well, depending on the individual unit. Tractor-feed is normally more reliable for this kind of printing, but a badly-constructed tractor can create a lot of irritation if you have to keep stopping in the middle of printing jobs to re-adjust the paper. A friction-feed printer might suffice for this purpose, as long as it's well-constructed and you have the paper lined up straight.

But if you'll need to print correspondence and mailing labels as well as program listings, look for a printer that easily accommodates switching back and forth. Some tractor feed mechanisms adjust to handle many different sizes of printer paper or labels, and snap off easily for printing on individual sheets.

Where the paper goes into and comes out of the printer is important, too, especially if the space you have dedicated for computer use at home is limited. This is something people often forget to think about, and consequently spend unnecessary time moving things out of the way when it's time to print. Moving the paper in and out of the printer is handled in a variety of ways by different manufacturers. Some feed in from the front and some from the rear. On rear-feed printers, still the most common, it's very handy to have a sheet of plastic or metal that separates the two streams of paper. This is standard on some printers; if it's not, you can purchase an inexpensive wire separator that will do the job.

Paper-handling may seem like a fairly insignificant thing to consider when you're looking for a printer, but if you buy one that does the job badly, you'll be amazed at the time it consumes and the frustration it can create.

Many printers have sat idle in owner's homes while their owners frantically called friends, computer stores, and mail order houses to find the right printer.

• *Switch-selectable modes.* Most printers these days are equipped to print a variety of different type styles. If you anticipate having to change type styles often, you'll want a printer that lets you do that easily, without having to get at the machine's internal DIP switches. Some printers require short programming commands to change type styles, while others have buttons or switches on the outside to let you do that quickly.

• *Ribbon-changing.* Not too many years ago, changing a printer ribbon was much like changing the ribbon on an old manual typewriter: messy and time-consuming. Most newer printers use cartridges or cassettes, plastic-encased ribbons that snap in and out easily.

It's a good idea to find out what the average life of a ribbon is for a particular printer, how expensive new ones are, and how easy they are to purchase. Your printer could sit idle for a few weeks if ribbons run out quickly and are hard to find.

Noise Level

How noisy is it? Unless your printer is set up in a soundproof booth, this may be of some importance to you. If you plan to use the printer early in the morning or late at night, consider your surroundings and who might be disturbed by the noise. Your dealer should let you run a test to check the noise level.

Documentation

How thorough is the documentation? It's not always possible for you to look at this before buying, especially if you buy a printer through the mail, but, when possible, take a look at it. A truly user-friendly printer will not require a lot of documentation. If setup and operation of the unit are easy enough, the bulk of the documentation will focus on programming commands.

Long-Term Considerations

Stability Of The Manufacturer

If you anticipate needing long-term support for your printer, this is an extremely important consideration, and one that is not just a yes/no question. Try to find out how long the company has been around and, if possible, how healthy it is. A big electronics company that has a printer line is not necessarily better than a small company that specializes in computer peripherals; one particular product line can be discontinued as easily as a small company can fold. Ask around and see what your friends and local computer dealer know.

A sound manufacturer should offer good technical support for consumer problems. A toll-free (800) phone number for questions is ideal, but not always possible. There should be some way for printer owners to contact the manufacturer when major problems arise.

Length Of Warranty

How long is the warranty? This is crucial, especially if you buy a fairly new model, or a product from a relatively young company. One year is a fairly standard warranty time these days.

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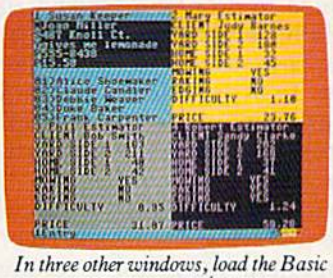
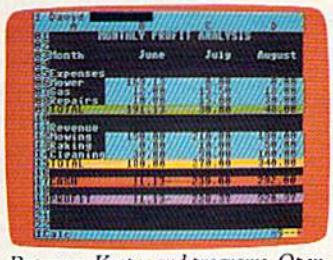


In three other windows, load the Basic program you wrote to price your services.



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Printwheel Availability

If you buy a daisywheel printer, how easy is it to find new printwheels? Many daisywheel printers use wheels that are the same as those used on typewriters. If this is true, you can probably get replacements easily from a local office-supply store. If not, find out where you can get them.

An Open Market

Opinions vary among manufacturers about whether the Commodore market has peaked or whether there is still considerable growth ahead. Today's printer manufacturer must watch that market closely, and tailor its products accordingly.

"Certainly, a year or two ago, it had significant impact, because the Commodore machines were a significant portion of the market," says Epson's Cox. "In 1984 and '85 we actually started to see a significant decline in what we categorize as the home printer market, which primarily had to do with the Commodores and some of the other low-end machines in that price category." Although Epson still offers a number of printers for that market, including the popular Homewriter 10, it has gone on to focus its efforts on the higher end of the market.

Okidata, meanwhile, continues to move a lot of product into the Commodore 64/128 pipeline, though constant evaluation is necessary. "We're obviously very concerned about the Commodore 64/128 market," says Okidata's Rick Lamb. "We're evaluating it on a month-to-month basis, and we think it's exceptional that it's going so well this year."

Whatever the future holds, there are many exceptionally capable printers available today. And new technologies are moving into the home computing market at a rapid pace. The buyer has, as never before, an opportunity to carefully evaluate the many machines now offered and then find the perfect printer to meet his or her individual needs.

A 1987 Buyer's Guide To Printers

For Commodore computer owners, the selection of printers has never been greater. In fact, the very availability of so many different printers can make choosing the one that's right for you a sometimes confusing process.

During the past year, printer prices have continued to drop and new printer models have been released in what has become a very competitive market. To assist readers in their printer-buying decisions, we've put together product information on the entire range of printers in the $500-and-under price category. The following chart lists the more important features and capabilities of these printers, and can help you to decide which one is right for you.

Among the features included in the printer listing are the following:

Compatibility. Commodore computers use a unique serial data communications format that is not compatible with either standard parallel or standard serial printer formats. In the past, the only way to avoid compatibility problems was to buy a Commodore printer. Over the last couple of years, manufacturers have developed printer interfaces that plug directly into a Commodore computer. If you're interested in one of these Commodore-ready units, be sure to find out if there is an additional charge for the cable. Even if the printer does not include a Commodore interface, you can buy third-party cables that work with most parallel printers.

Print Technology. This refers to how characters and graphics are actually transferred from printer to paper. There are three types in this price range: impact, thermal, and ink-jet.

Impact printers form characters by striking the paper through an inked ribbon, either with a *daisywheel* (a small wheel whose spokes have letters and numbers on their tips), or with a printhead containing a column of tiny wires or pins that form characters and graphics *(dot-matrix). Thermal* printers use either a column of hot pads that change the color of heat-sensitive paper, or a column of tiny spark plugs that evaporate a special aluminum coating onto the paper, exposing an underlying dark surface. So thermal printers require special paper, which often costs more than regular paper and has a shorter life. *Thermal transfer* printers work with any kind of paper because they use ribbons; heat from the printhead melts a waxlike ink onto the paper. *Ink-jet* printers spray ink onto the paper through tiny holes.

Speed. How fast does the printer operate? This can vary if the printer offers different modes. *Draft mode* is usually the fastest, but produces rougher, fainter type. *Near-letter-quality (NLQ)* or *correspondence mode* takes longer to print, but looks more polished. Some printer speeds vary depending on the type of *font* (such as pica or elite) used.

Pitch. How many characters fit on a line, measured in characters

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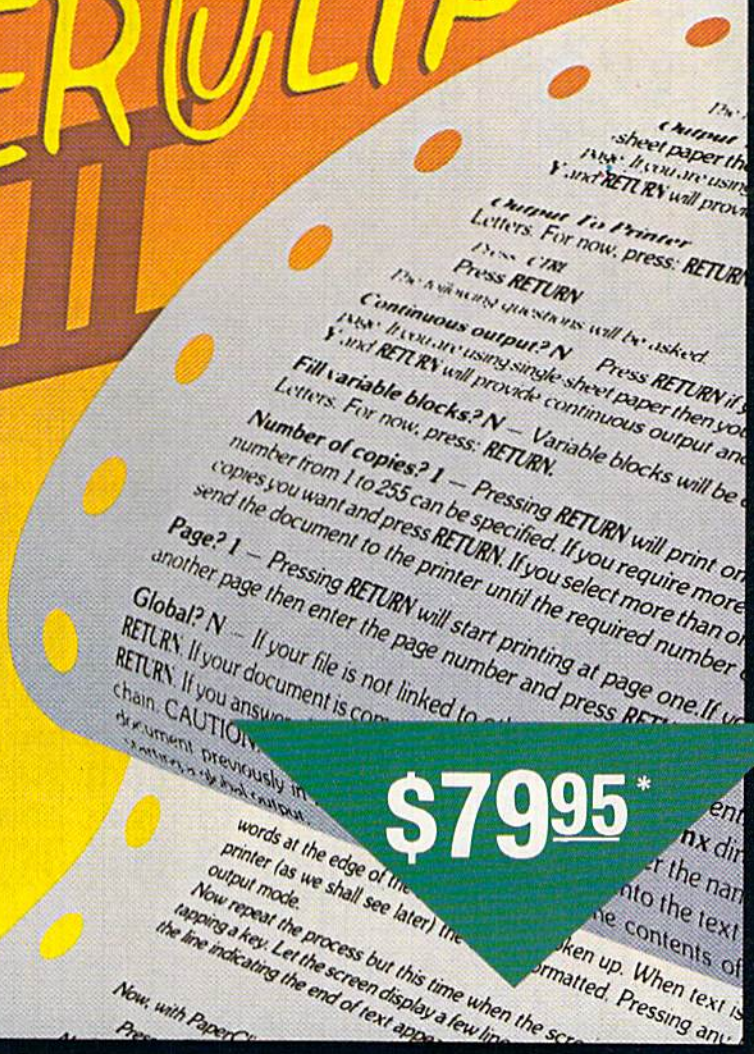

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Model Name	Manufacturer/ Distributor	Compatibility	Print Technology	Speed	Pitch	Buffer	Feed Type	Warranty	Suggested Retail Price	Comments
Alpha 42	Alphacom	Parallel or serial std	Thermal	2 lines/sec	10–15 cpi	1 line	Friction std	6 months	180	
Alpha 81	Alphacom	Parallel or serial std	Thermal	2 lines/sec	10–15 cpi	1 line	Friction std	6 months	169	80-column
Alphacom Aero	Alphacom	Parallel or serial std	Dot matrix	130 cps	5–16.5 cpi	2K	Friction and pin std	6 months	299	Dot-addressable and fully programmable graphics
Alphapro 101	Alphacom	Parallel or serial std	Daisywheel	20 cps	10–15 cpi	93 characters	Friction std	6 months	399.95	
Scribe	Apple Computer	Serial std	Dot matrix	50–80 cps	10–17 cpi	N/A	Tractor std	90 days	299	
Aprotek Daisy 1120	Aprotek	Parallel std; serial opt	Daisywheel	20 cps	10–15 cpi and proportional	2K	Friction std; tractor and cut-sheet feeder opt	1 year	279.95	Two-week trial available
SP-1000	Aprotek	Parallel or direct connect; IBM standard	Dot matrix	20–70 cps	10–15 cpi	1.5K	Friction and tractor std	2 years	169.95	Dot-addressable graphics; Commodore graphics built-in on Commodore version ($219.95)
Blue Chip 120/NLQ	Blue Chip Electronics	Parallel std	Dot matrix	120 cps	5–17 cpi	3 lines	Tractor std	6 months	279	
D12/10	Blue Chip Electronics	Commodore serial std	Daisywheel	12 cps	10 cpi	2K	Friction std; tractor opt	6 months	249	Comes with *Fleetwriter III* wordprocessor
D20/10	Blue Chip Electronics	Parallel and Commodore serial std	Daisywheel	20 cps	10 cpi	2K	Friction std; tractor opt	6 months	279	Comes with *Fleetwriter III* wordprocessor
M 120/10	Blue Chip Electronics	Parallel std; serial opt	Dot matrix	120 cps	5–17 cpi	3 lines (4K opt)	Friction and tractor std	6 months	229	Dot-addressable graphics
M 150/15	Blue Chip Electronics	Parallel std; serial opt	Dot matrix	130 cps	5–17 cpi	2K	Friction and tractor std	6 months	349	Dot-addressable graphics
HR-10	Brother International	Parallel and serial std	Daisywheel	12 cps	10–15 cpi and proportional	2K	Friction and tractor std	90 days	349	
HR-20	Brother International	Parallel and serial std	Daisywheel	22 cps	10–15 cpi and proportional	8K (16K opt)	Friction and tractor std; cut-sheet feeder opt	90 days	499	
M-1109	Brother International	Parallel and serial std	Dot matrix	25–100 cps	10 cpi	2K	Friction std; tractor opt	1 year	299	
M-1409	Brother International	Parallel std; serial opt	Dot matrix	45–180 cps	10–12 cpi and proportional	3K	Friction and tractor std; cut-sheet feeder opt	90 days	479	
Prowriter Jr.	C. Itoh	Parallel std; serial opt	Dot matrix	20–120 cps	10–17 cpi	1 line	Friction and tractor std	1 year	349	
Prowriter C-215XP	C. Itoh	Parallel std; serial opt	Dot matrix	45–180 cps	10–20 cpi	10K	Friction and tractor std	1 year	679	
Legend 808	CAL-ABCO	Parallel std	Dot matrix	50–100 cps	5–17 cpi	1 line	Friction and tractor std	90 days	199	Bit-image graphics
Legend 1080A	CAL-ABCO	Parallel std; serial opt	Dot matrix	70–140 cps	5–17 cpi	1 line std (4K opt)	Friction and tractor std	90 days	295	Five switch-selectable modes including NLQ
Legend 1380	CAL-ABCO	Parallel std; serial opt	Dot matrix	160 cps	5–17 cpi	2K std (4K opt)	Friction and tractor std	90 days	345	10" version of 1385
Legend 1385	CAL-ABCO	Parallel std; serial opt	Dot matrix	160 cps	5–17 cpi	2K (4K opt)	Friction and tractor std	90 days	395	
A-40	Canon USA	Parallel std	Dot matrix	27–140 cps	10 cpi	1.4K	Friction and tractor std	1 year	349	
A-50	Canon USA	Parallel std; serial opt	Dot matrix	34–180 cps	10 cpi	2K	Friction and tractor std; forms guide opt	1 year	499	Epson FX compatible
GLP II	Centronics	Parallel and serial std	Dot matrix	25–100 cps	5–17 cpi	N/A	cut-sheet and fan fold std	1 year	279	IBM PC block and pin-addressable graphics
Citizen 120D	Citizen America	Parallel std; serial opt	Dot matrix	50–100 cps	10–12 cpi	8K	Friction and tractor std; cut-sheet feeder opt	18 months	499	Can create own graphics
MPS 1000	Commodore Business Machines	Parallel and serial std	Dot matrix	20–100 cps	12–17 cpi	1K	Friction and tractor std	90 days	299.95	
MPS 1200	Commodore Business Machines	Two Commodore serial ports	Dot matrix	24–120 cps	5–20 cpi	2K	Friction and tractor std	90 days	299.95	Eight different graphics densities
FORTIS DX-21	Dynax	Parallel and serial std	Daisywheel	25 cps	10–15 cpi	16K	Friction std; cut-sheet feeder and tractor opt	90 days	499	
FORTIS DM2010	Dynax	Parallel std; serial opt	Dot matrix	50–200 cps	10–17 cpi	7K std (8K opt)	Friction and tractor std; cut-sheet feeder opt	90 days	459	Graphics capabilities; wide carriage model available for $559
DX 1500	Edwards-CPE	Parallel std	Daisywheel	14 cps	10–12 cpi and proportional	2K	Friction std; tractor and auto cut-sheet feeder opt	1 year	349	
DX 2000	Edwards-CPE	Parallel std	Daisywheel	20 cps	10–15 cpi and proportional	2K	Friction std; tractor opt	1 year	449	
DX 2500	Edwards-CPE	Parallel std; serial opt	Daisywheel	20 cps	10–15 cpi and proportional	2K	Friction std; tractor opt	1 year	499	
Thin Print 80P/80S	Edwards-CPE	Parallel or serial std	Thermal transfer dot matrix	40 cps	10–17 cpi	2K	Friction std	90 days	339	High-resolution graphics; portable (battery powered), AC adaptor included

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Model Name	Manufacturer/ Distributor	Compatibility	Print Technology	Speed	Pitch	Buffer	Feed Type	Warranty	Suggested Retail Price	Comments
Thin Print 100	Edwards-CPE	Parallel or serial std	Thermal transfer dot matrix	25–100 cps	10–17 cpi	2K	Friction std	90 days	299	
Thin Write 100	Edwards-CPE	Parallel and serial std	Dot matrix	25–100 cps	5–17 cpi	4K	Friction and pin std; tractor opt	90 days	479	
AP-80	Epson America	Apple exclusive	Dot matrix	15–75 cps	9–17 cpi	1K	Friction and tractor std; auto sheet feeder opt	1 year	379	
DX-10	Epson America	Parallel std	Daisywheel	10 cps	10–12 cpi	None	Friction std; tractor and cut-sheet feeder opt	1 year	299	
DX-20	Epson America	Diablo all purpose interface std	Daisywheel	20 cps	10–15 cpi	1K (7K opt)	Friction std; tractor and cut-sheet feeder opt	1 year	459	110 column
HS-80	Epson America	Parallel std	Ink jet	32–160 cps	5–20 cpi	1K	Friction std; auto cut-sheet feeder opt	1 year	499	
LX-86	Epson America	Parallel std	Dot matrix	16–120 cps	10–12 cpi	1K	Friction std; tractor and cut-sheet feeder opt	1 year	349	
Facit 4509	Facit	Parallel std	Dot matrix	70–120 cps	10–17 cpi and proportional	None	Tractor std	90 days	425	IBM compatible graphics
Facit 4510	Facit	Parallel and serial std	Dot matrix	70–120 cps	10–17 cpi and proportional	2K	Friction and tractor std	90 days	495	Block and pin-addressable graphics
GE 8100	General Electric	Commodore interface available	Thermal transfer (nonimpact dot matrix)	25–50 cps	24 cpi	2K	Friction std	2 years	259.95	Block graphics; special graphics characters
SP-1000	Hattori Seiko	Parallel or serial std	Dot matrix	20–100 cps	10–17 cpi and proportional	Varies with model	Friction and tractor std	2 years	299	Commodore/VIC version: $270
SP-1200AI	Hattori Seiko	Parallel std	Dot matrix, 9-pin	25–120 cps	10–17 cpi and proportional	2.3K std (8K opt)	Friction and tractor std	2 years	319	Graphics resolution up to 240 dpi
Microline 182	Okidata	Parallel and IBM std; serial opt	Dot matrix	30–120 cps	5–17 cpi	1 line	Friction and pin std	1 year	339	Serial version, $399
Microline 182 TTY	Okidata	Parallel and IBM std; serial opt	Dot matrix	30–120 cps	5–17 cpi	1 line	Friction and pin std	1 year	389	Designed for communications applications; serial version, $449
Microline 192+	Okidata	Parallel and IBM std	Dot matrix	40–200 cps	5–17 cpi	8K	Friction and pin std	1 year	499	Block and bit-image graphics
Okidata 120	Okidata	Commodore serial	Dot matrix	30–120 cps	5–17 cpi	1 line	Friction and pin std	1 year	269	All points addressable graphics; Commodore Special Graphics
Okimate 20	Okidata	Commodore interface available	Dot matrix	40–80 cps	5–17 cpi	8K	Friction and tractor std	90 days	268	High-resolution, all-points-addressable, bit-image graphics
KX-P1080I	Panasonic	Parallel std; serial opt	Dot matrix	24–120 cps	10–17 cpi	1K	Friction and tractor std	2 years	329	Enhanced IBM graphics; 9 pin
KX-P1091I	Panasonic	Parallel std; serial opt	Dot matrix	32–160 cps	10–17 cpi	1K (4K opt)	Friction and tractor std	2 years	429	IBM Proprinter compatible; word processing capabilities
KX-P3131	Panasonic	Parallel std; serial opt	Daisywheel	17 cps	N/A	6K (32K opt)	Friction std; tractor and auto cut-sheet feeder opt	2 years	419	Diablo 630 code compatible; color ribbons available
EXP 420	Silver-Reed	Parallel or serial std	Daisywheel	10 cps	10–12 cpi	None	Friction std	90 days	299.95	
Gemini II	Star Micronics	Commodore-specific	Dot matrix	30–120 cps	5–17 cpi	1 line	Tractor std	1 year	329	
NL-10	Star Micronics	Parallel std	Dot matrix	30–120 cps	5–17 cpi	1 line	Tractor std; cut-sheet feeders opt	1 year	319	Additional cost for interface
NP-10	Star Micronics	Parallel std	Dot matrix	25–100 cps	5–20 cpi	2K	Friction and tractor std	1 year	279	
NX-10	Star Micronics	Parallel std	Dot matrix	30–120 cps	5–10 cpi	5K	Friction and tractor std	1 year	349	Emulates IBM graphics printer
NX-10C	Star Micronics	Commodore serial std	Dot matrix	30–120 cps	5–17 cpi	1 line	Friction and tractor std	1 year	349	
Powertype	Star Micronics	Parallel std; serial opt	Daisywheel	18 cps	10–15 cpi and proportional	1 line	Friction std; tractor opt	180 days	499	
SD-10	Star Micronics	Parallel std; serial opt	Dot matrix	160 cps	5–17 cpi	2K	Friction and tractor std	1 year	449	Ultra-high-resolution bit-image graphics
STX-80	Star Micronics	Parallel std	Thermal transfer dot matrix	60 cps	5–11 cpi	1 line	Friction std	1 year	199	Dot-addressable, bit-image graphics
M-20P	TAB Products	Parallel std	Dot matrix	120 cps	10–15 cpi	1K	Friction std; pin tractor opt	90 days	299	Dot-addressable graphics
M-21S	TAB Products	Serial std	Dot matrix	120 cps	10–15 cpi	1K	Friction std; pin tractor opt	90 days	378	Dot-addressable graphics

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Model Name	Manufacturer/ Distributor	Compatibility	Print Technology	Speed	Pitch	Buffer	Feed Type	Warranty	Suggested Retail Price	Comments
M-22P	TAB Products	Parallel std	Dot matrix	160 cps	10–15 cpi	1K	Friction and pin std; tractor and cut-sheet feeder opt	90 days	499	Dot-addressable graphics
DMP 105	Tandy	Parallel and serial std	Dot matrix	80 cps	10–17 cpi and proportional	N/A	Friction and tractor std	90 days	199.95	Bit-image graphics
DMP 130	Tandy	Parallel and serial std	Dot matrix	100 cps	10–16 cpi	N/A	Friction and tractor std	90 days	349.95	Bit-image graphics
DWP 230	Tandy	Parallel and serial std	Daisywheel	20 cps	10–12 and proportional	N/A	Friction std; tractor opt	90 days	399.95	
IMP-24	Weigh-Tronix	Parallel or serial std	Dot matrix	16.8 cps	N/A	1 line	Friction std	90 days	135 (24 cpl) 150 (32 or 40 cpl)	Dot-addressable graphics

per inch (cpi) or characters per line (cpl). The pitch range for a printer often varies greatly, especially if it is capable of printing several types of fonts.

Buffer. A buffer is an area of memory in a printer that can store a fixed amount of text while the printer is working, freeing up the computer for other tasks. Most printers in the under-$500 price range still have rather small buffers, so if you'll be doing many long printing jobs, you may want to consider buying an add-on buffer.

Feed Type. *Friction-feed* printers grip the paper and move it around the platen much like a typewriter does, while *tractor-feed* printers grab the holes at the edge of continuous-feed paper with the tiny teeth at either edge of the platen. Many printer manufacturers sell add-on tractors that you can purchase if your original unit doesn't have one.

Suggested Retail Price. This is the price set by the manufacturer; you may well be able to find it at a lower price. It's advisable to shop around.

A full explanation of the graphics capabilities of each printer takes more space than we have available. If you plan to use your printer extensively for printing graphics, make sure it's capable of doing what you need before you buy.

For more information on any of the printers listed here, please contact:

Alphacom
2108 Bering Dr., Unit C
San Jose, CA 95131

Apple Computer
Customer Relations Department
20525 Mariani Avenue
Cupertino, CA 95014

Aprotek
1071-A Avenida Acaso
Camarillo, CA 93010

Blue Chip Electronics
2 W. Alameda Drive
Tempe, AZ 85282

Brother International
8 Corporate Place
Piscataway, NJ 08854

C. Itoh Digital Products
19750 S. Vermont Avenue
Suite 220
Torrance, CA 90502

CAL-ABCO
6041 Variel Avenue
Woodland Hill, CA 91367

Canon USA
System Division
One Canon Plaza
Lake Success, NY 11042

Centronics Data Computer
1 Wall Street
Hudson, NH 03051

Citizen America
2425 Colorado Avenue #300
Santa Monica, CA 90404

Commodore Business Machines
1200 Wilson Drive
West Chester, PA 19380

Dynax
6070 Rickenbacker Road
Commerce, CA 90040

Edwards-CPE
Manufacturers of Axiom Printers
1014 Griswold Avenue
San Fernando, CA 91340

Epson America
3415 Kashiwa Street
Torrance, CA 90505

Facit
9 Executive Park Drive
P.O. Box 334
Merrimack, NH 03054

General Electric
Electronics Park
Syracuse, NY 13221

Hattori Seiko Computer Peripherals
1111 Macarthur Boulevard
Mahwah, NJ 07430

Okidata
532 Fellowship Road
Mt. Laurel, NJ 08054

Panasonic
Computer Products Division
One Panasonic Way
Secaucus, NJ 07094

Silver-Reed America
19600 S. Vermont Avenue
Torrance, CA 90502

Star Micronics Peripheral Division
200 Park Avenue
Suite 2309
Pan Am Bldg.
New York, NY 10166

TAB Products
1400 Page Mill Road
Palo Alto, CA 94304

Tandy/Radio Shack
1800 One Tandy Center
Fort Worth, TX 76102

Weigh-Tronix
1000 N. Armstrong
Fairmont, MN 56031

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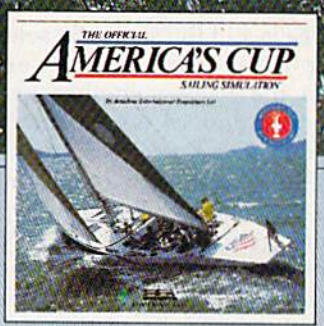

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Printing Commodore Graphics

Todd Heimarck, Assistant Editor

Printing graphics can be a tricky business. This article helps sort out the situation when you're working with various printing modes, printer interfaces, and non-Commodore printers. Several helpful programming examples are included.

Asterisks, ampersands, commas, and colons were mixed together to form a picture of Snoopy in the first widely popular piece of computer printer art. Where or when it started nobody knows, but the Snoopy program made its way around the country—on the business computers of the day—in the late 60s and early 70s.

Printer graphics are much more sophisticated now, but the basic idea is still the same. By selectively placing areas of light and dark on the page—whether individual pixel dots or whole characters—you can create a recognizable picture. The simplest programs, such as the character-based Snoopy program, are just a series of PRINT statements. More complex programs can execute a screen dump (an exact copy of the picture on a screen).

Printer Modes

In learning about printers and graphics, it's important to understand *modes* and how they work. The way a printer behaves depends on what mode it is in. Text mode prints letters, numbers, and other characters. Hi-res graphics mode puts dots on the paper.

To see an example of two different modes, try running the program below (for Commodore and Commodore-emulating printers only). Within the PRINT# statements, type the first letter of each word with the SHIFT key held down.

```
10 OPEN1,4
20 PRINT#1,"THIS IS A TEST"
30 PRINT#1:CLOSE1
40 OPEN1,4,7
50 PRINT#1,"THIS IS A TEST"
60 PRINT#1:CLOSE1
```

Note the difference between line 10 (**OPEN 1,4**) and line 30 (**OPEN 1,4,7**). The first number in the OPEN statement (1) is the logical file number, used later in the PRINT# and CLOSE statements. The second number (4) is the device number (printers for Commodore computers are almost always device 4). The final number (7), in line 30 only, is the secondary address.

The printout should look something like this:

```
THIS IS A TEST

This Is A Test
```

When the file is opened with no secondary address, or with a secondary address of 0, the unshifted letters print as capitals and shifted letters become graphics characters. This is uppercase/graphics mode, often called *graphics mode* in Commodore printer manuals (note: this is not the same as hi-res graphics mode, which will be discussed shortly). Opening the file with a secondary address of 7 puts the printer into uppercase/lowercase mode, where unshifted letters appear as lowercase and shifted letters print as capitals. Commodore calls this *business mode*.

The screen of a 64 or 128 also has two text modes: uppercase/lowercase and uppercase/graphics. The state of the computer has no relation to the state of the printer. The printer doesn't know what's happening on the computer screen; if you change screen modes or create some custom characters for the screen, it won't affect the way things are printed out. The short program above sent the same phrase—*This Is A Test*—twice, but the printer did two different things because *it* was in different text modes.

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Although the example uses secondary addresses to change from uppercase/graphics to uppercase/lowercase, a more common way of changing modes is to send special command characters:

```
10 OPEN1,4
20 PRINT#1,"THIS IS A TEST
30 PRINT#1,CHR$(17);"THIS I
   S A TEST"
40 PRINT#1,CHR$(145);"THIS
   {SPACE}IS A TEST"
50 PRINT#1:CLOSE1
```

The CHR$(17) is the cursor-down code when you print it to the screen. But when it's sent to a Commodore printer, it puts the printer in uppercase/lowercase mode. CHR$(145) is a cursor onscreen, but it's the command for uppercase/graphics on a printer.

In general, the characters 32–127 and 160–255 are printable (ASCII) characters, while the command codes fall in the range 0–31 and 128–159.

Text Graphics

On the 40-column screen of the 64 and 128, you have a choice of using uppercase/graphics mode or uppercase/lowercase. It's not possible to have both at once. This restriction doesn't apply to printers, however. You can switch freely between the two modes with CHR$(17) and CHR$(145). Each character can be printed in reverse as well, giving you a wide variety of useful graphics characters from which to choose.

The program below prints *This Is A Test* surrounded by a border made up of graphics characters. In line 40, the cursor-down character switches the printer into uppercase/lowercase mode and the cursor up sends it back to uppercase/graphics mode.

```
10 OPEN4,4
20 PRINT#4," [@][P][O][I]
   {RVS}[U][Y][T]{4 SPACES}
   [T][Y][U]{OFF}[I][O][P]
   [@]"
30 PRINT#4,"N{18 SPACES}M"
40 PRINT#4,"[G]{2 SPACES}
   {DOWN}THIS IS A TEST{UP}
   {2 SPACES}[M]"
50 PRINT#4,"L[18 @]@"
60 CLOSE4
```

There's an obvious problem, which you'll notice if you type it in and run the program. Between the lines, the printer has inserted some space:

```
This Is A Test
```

The space is not a mistake. Normally, you'd want some white space, to prevent characters on one line from perching right on top of the characters on the next line. But when you're printing graphics, the extra space isn't desirable.

If you have a Commodore 1525 or an MPS-801, -803, or -1000 printer, you can remove the space by adding a CHR$(8) to the end of each printed line. This puts the printer into hi-res graphics mode. When these printer models are in this mode, they print eight lines per inch (with no spacing between lines) instead of six lines per inch (with spacing). Since we're printing text, we want to change the spacing, but we don't want to print in hi-res mode, so it's necessary to add a CHR$(15) to the beginning of each line, to turn off the hi-res command.

But there is a shortcut available: The 26 codes from CHR$(1) to

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CHR$(26) correspond to CTRL-A through CTRL-Z. So, cursor up to the beginning of each string and insert a space just after the first quotation mark by pressing SHIFT and the INST/DEL key. Then hold down the CTRL key and press the letter *O*. You should see a reverse-O on the screen. Do the same at the end of the line, inserting the space just before the closing quotation mark and pressing CTRL-H. CTRL-O is the same as CHR$(15) and CTRL-H is the same as CHR$(8). The spacing is fixed.

If you have a 1526 or MPS-802, the CTRL-H/CTRL-O trick won't work. For one thing, these printers don't have a hi-res graphics mode. They can print characters only. To change the spacing, you need to add this line at the beginning of the program: OPEN 6,4,6: PRINT#6,CHR$(24): CLOSE 6. The 1526 and 802 use channel 6 (the second 6 in the OPEN statement) to receive line spacing commands. If there's still some space between lines, use a smaller number in the CHR$ function. If the lines seem to overlap, use a larger number.

Commodore printers also have a reverse mode, which is triggered by the RVS ON character, CHR$(18). Each letter is the same shape, but it prints white on black instead of black on white. There's also quote mode, which operates like quote mode on the screen. Pressing SHIFT–CLR/HOME usually clears the screen, but inside quotation marks it will appear as a reversed heart. Quote mode is useful when you're listing a program.

Third-Party Printers

If you own a non-Commodore printer, it may emulate a Commodore, in which case it has the two text modes (uppercase/lowercase and uppercase/graphics) plus a hi-res graphics mode. If it doesn't have Commodore emulation, you need an interface to connect the computer to the printer.

Most third-party printers don't support the two Commodore text modes; they have one or more character sets that include both letters and graphics characters. In addition, many have mathematical symbols, foreign characters, and the like. What looks like a circle or square on your computer screen may print out as the Greek letter omega.

A non-Commodore printer expects to receive text in true ASCII instead of Commodore ASCII. A CHR$(67), for example, is a capital C in standard ASCII, but it's a lowercase *c* in Commodore ASCII. The task of translating from one ASCII to the other is usually handled by the printer interface, although you can do the translation in software and put the interface into transparent mode.

Third-party printers usually have a variety of modes from which to choose. If you send a certain code, the printer enters italic mode. Send another and it starts underlining. Popular graphics features include italics, double-strike, superscripts, subscripts, underline, condensed characters, and others. Some printers offer additional character sets or even a section of memory that can hold custom characters you've designed.

Printer commands are usually ASCII characters in the range 0–31. There's usually one command to

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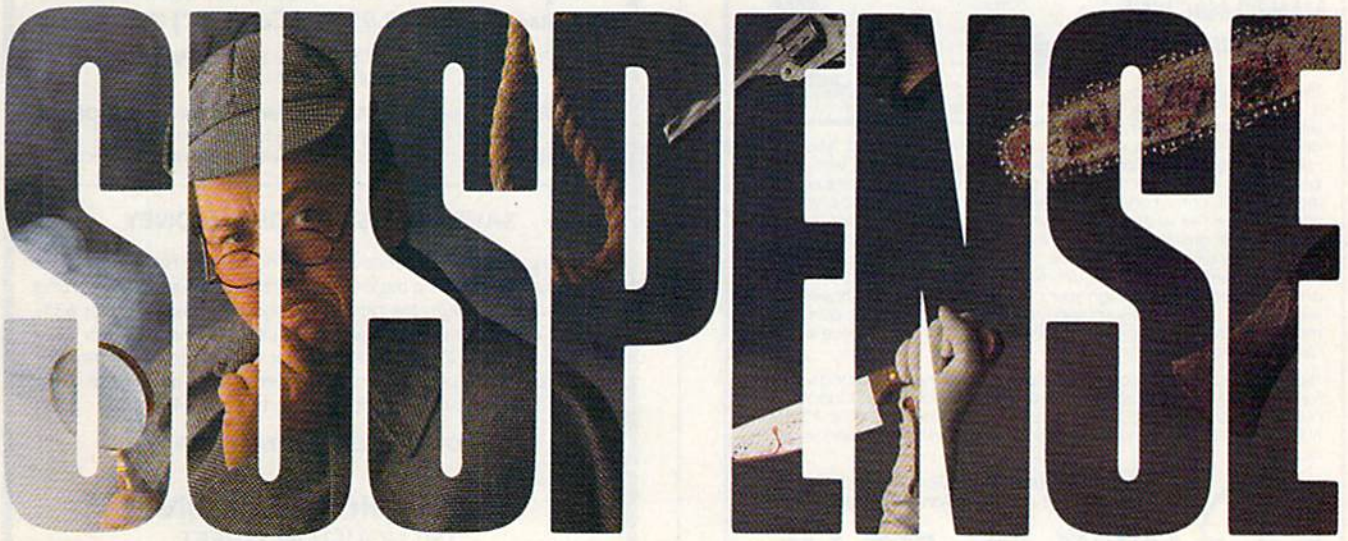

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turn on a given feature like italics and a second command to turn it off. The commands may be a single character—CHR$(15) to turn on condensed mode—or a series of codes—CHR$(27); CHR$(45); CHR$(1) to enable underlining. CHR$(27) is also called the *escape* character (ESC for short), and the group of commands that begin with a CHR$(27) are usually called *escape codes.*

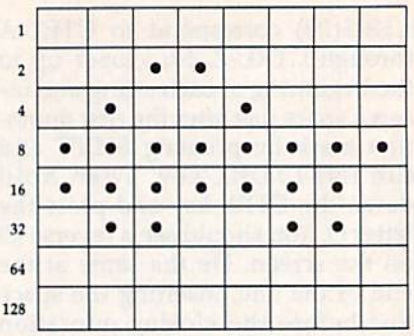
When you're sending the various characters to the printer, you should be aware what the interface is doing. Some interfaces use their own series of escape codes and will intercept any character 27 that comes along. To get past the interface, you may have to send CHR$(27) twice. The first one tells the interface that a command is coming; the second tells it that you really want to give a command to the printer instead of the interface. The translation between Commodore and true ASCII may also cause problems. If a certain printer mode is enabled by an ESC and a CHR$(67), the interface may convert the 67 to a 99, and you won't get the results you expected.

If you're having problems getting an interface and printer to print graphics, it doesn't hurt to experiment: You may have to send a string of commands to the printer or interface; it may help to use a specific secondary address in the OPEN statement; or you may have to open the printer or interface and change the setting of the DIP switches.

Printing Hi-Res Graphics

When you're printing text, a single byte is enough to describe the letter being printed. If you send a CHR$(67), the printer looks up the shape for the letter C and it takes care of printing the dots that make up that shape. The Commodore 1525 and MPS-801/-803 printers use a character matrix that's 5 dots wide and 7 dots high. A column of blank dots separates each letter from its neighbor on the 80-column page, so there are a total of 480 dot columns (6 × 80) available.

By sending a CHR$(8) to a Commodore printer, you put it into hi-res graphics mode. Suddenly the rules change. Each byte now represents a column of dots, which are numbered as follows:



1								
2			●	●				
4		●			●			
8	●	●	●	●	●	●	●	●
16	●	●	●	●	●	●	●	
32		●	●			●	●	
64								
128								
Total	152	168	186	154	156	184	184	136

There are seven printer pins that can either print a dot or leave it blank. In the first column, this figure has only two dots turned on (row 8 and row 16). Add them up (plus 128) to find the number you send to the printer. In this case, you'll send a CHR$(152). The second column adds up to 168; the third, 186, and so on.

To draw this picture of a car on a Commodore 1525 or MPS-801/-803 printer, you'd use a program like this:

```
10 OPEN 4,4: PRINT#4,CHR$(8);
20 FOR J = 1 TO 8
30 READ N: PRINT#4,CHR$(N);
40 NEXT
50 PRINT#4: PRINT#4: CLOSE 4
60 DATA 152, 168, 186, 154, 156, 184, 184,
   136
```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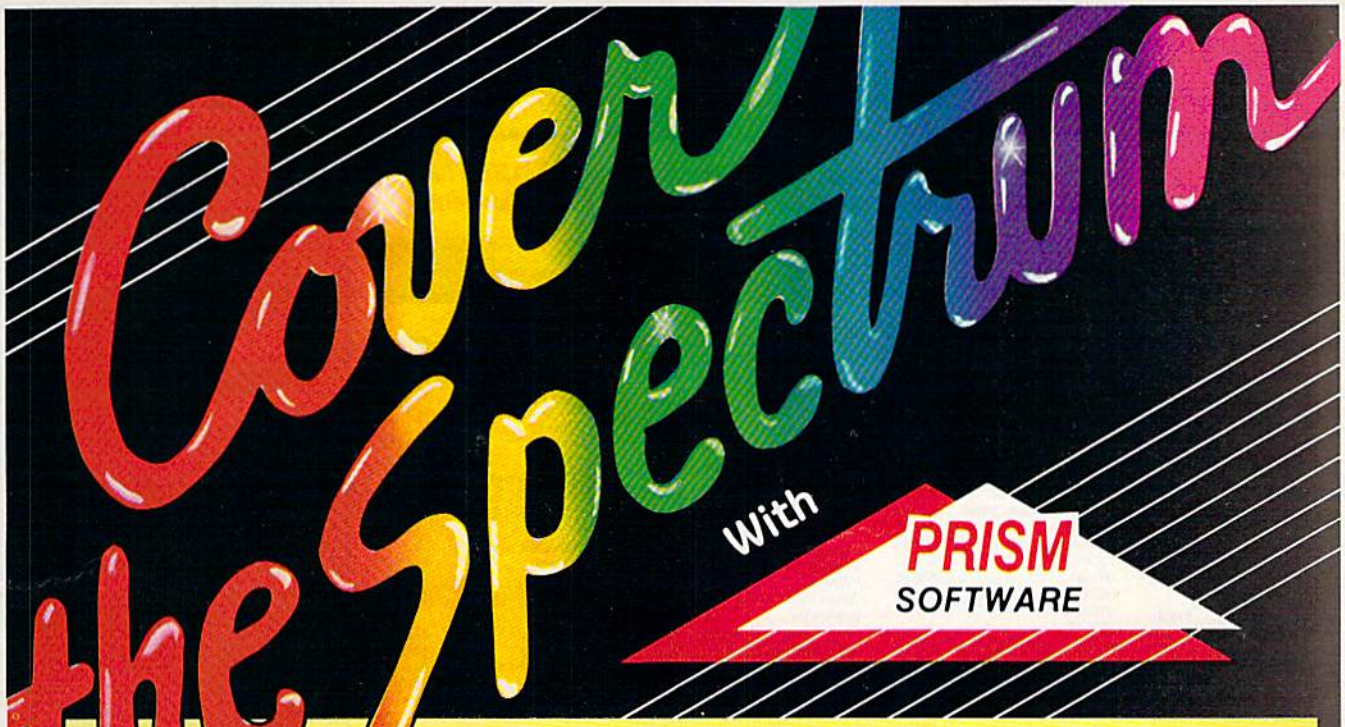

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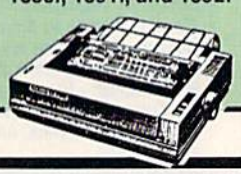

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If you have an interface that emulates Commodore printers, the program should work as listed. The 1526 and MPS-802 do not have a graphics mode, so they can't be used. For other printers, you may have to check your manual for details on how to enter hi-res graphics mode and how to figure out the CHR$ values to be sent.

There are a variety of commercial and public domain programs that use the printer's hi-res graphics mode to print out a high-resolution screen. You're not limited to hi-res screen dumps or small pictures of cars, however. One useful application is creating graphs.

The following program prints a typical stock-market graph, with a vertical line connecting the high and the low price for the day, and with a horizontal line indicating the closing price. This is not a real stock; the numbers have been invented. Start each DATA statement with a string to be printed—the date, for example—and follow it with the high, the low, and the closing price. The first DATA statement (line 500) should include two numbers that indicate the range of numbers; the graph will be scaled to this range. The last DATA statement should be the word *END*. The number of prices you include is limited only by the amount of memory available in your VIC, 64, Plus/4, 16, or 128 or the amount of paper in your printer.

To avoid fractions, the prices have all been multiplied by 8; thus, 40 is translated to 320, 40-1/8 is 321, and so on.

Lines 10–60 determine how many prices there are and if they're all within the given range. The numbers are then read again and scaled to the range. Line 170 does a dot-column tab to the low for the day, and lines 180–220 print the hi-res line.

Stock Charter

```
CH 10 READ LO,HI:R=440/(HI-LO)
GC 20 TL = 0
PS 30 READA$:IFA$="END"THEN70
RD 40 TL=TL+1
CQ 50 READSH,SL,SC:IF(SH>HI)OR
      (SL<LO)OR(SC<SL)OR(SC>SH
      )THEN260:REM ERROR MESSA
      GE
XE 60 GOTO30
RR 70 OPEN4,4
BP 80 RESTORE:READ LO,HI
GR 90 FORJ=1TOTL
PK 100 READ A$,SH,SL,SC
DR 110 P1=INT(39+(SL-LO)*R)
EF 120 P2=INT(39+(SC-LO)*R)
FD 130 P3=INT(39+(SH-LO)*R)
PA 140 HB=INT(P1/256):LB=P1-25
      6*HB
SR 150 PRINT#4,CHR$(15);A$;:RE
      M PRINT TEXT
PR 160 PRINT#4,CHR$(8);:REM HI
      -RES MODE
RB 170 PRINT#4,CHR$(27);CHR$(1
      6);CHR$(HB);CHR$(LB);
XA 180 IF P1=P2THEN 200
XM 190 FORK=1TO(P2-P1):PRINT#4
      ,CHR$(136);:NEXT
GB 200 PRINT#4,CHR$(190);
SF 210 IF P3=P2 THEN 230
XH 220 FORK=1TO(P3-P2):PRINT#4
      ,CHR$(136);:NEXT
MX 230 PRINT#4:PRINT#4
QF 240 NEXTJ
CA 250 PRINT#4,CHR$(15):CLOSE4
      :END
GA 260 PRINT"DATA FOR ";A$;" I
      S INCORRECT":END
DC 500 DATA 280,360
MA 510 DATA"04/06",332,328,330
AB 520 DATA"04/07",334,330,334
BC 530 DATA"04/08",334,332,332

EP 540 DATA"04/09",336,332,335
EE 550 DATA"04/10",337,335,336
MM 560 DATA"04/13",337,334,334
GJ 570 DATA"04/14",334,329,330
FP 580 DATA"04/15",332,320,321
XX 590 DATA"04/16",320,320,320
KD 600 DATA"04/17",322,318,320
JE 999 DATA"END"
```

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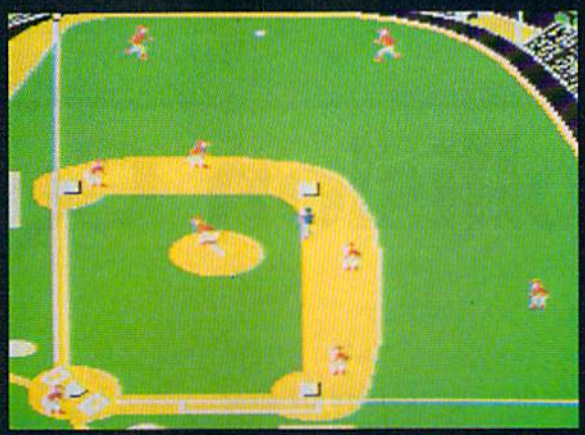

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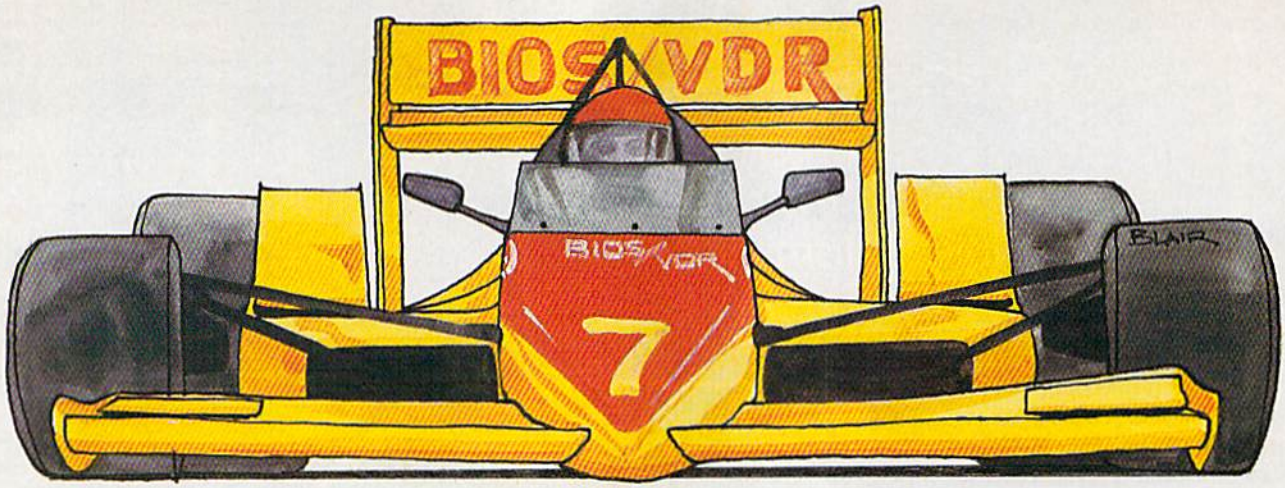


Collision Course

Mark Tuttle

This fast-paced game for the Commodore 64 drops you into the seat of a race car for a nerve-wracking driving experience. And your computer is not much help. A joystick is required.

Keep your mind and eyes on the road and watch your enemy carefully—you're driving under extremely hazardous road conditions in "Collision Course." Your goal in this game is to score points by driving over dots on the road, thus removing them. Unfortunately, the computer's driver has orders to stop you, and it knows only one way to do that—by crashing into you.

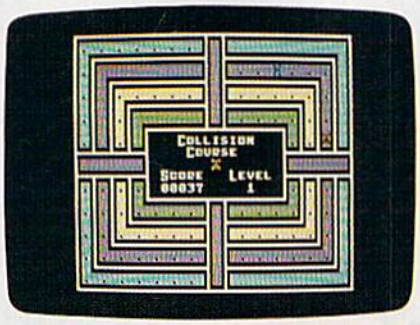
There are four lanes in Collision Course: cyan, purple, yellow, and green. There are also four intersections that link these lanes together. Your car (the red one) always travels counter-clockwise around the screen. The computer's blue car travels clockwise.

When the game begins, both cars start moving—and neither one has brakes. Fortunately, you control the intersections. The joystick can be pushed left or right to change the color of all four intersections. When a car reaches one of these junctures, it automatically moves into the lane colored the same as the intersection. For example, suppose your car is traveling along in the blue lane. You push the joystick until the intersections change to green. When your car reaches the intersection, it switches to the green lane. You shouldn't leave the intersections the same color for long—if you do, the computer's car will switch over into your lane as soon as it reaches the next intersection.

You can also control the speed of your car. Hold down the joystick fire button to move at high speed. You maintain this speed until you release the button. If you plan carefully, this feature should help you avoid some close calls.

Scoring

You start the game with three cars.



The player's red car is headed for a confrontation with the blue computer car.

Each collision costs you a car. Bonus cars are awarded after levels 2 and 5. You get 10 points per dot removed. If you remove all of the dots, you receive a bonus of 100 points multiplied by the number of the current level.

Beginning at level 4, the game becomes more difficult. Each dot removed is replaced by a plus sign. These plus signs must be removed before you can progress to the next level. To pause the game, press SHIFT or SHIFT–LOCK.

Typing It In

Collision Course is written in BASIC. It includes many DATA statements, which require accurate typing, so be sure to use the "Automatic Proofreader" program, found elsewhere in this issue, when you type it in. When you're finished typing in the program, save a copy to tape or disk. Before loading the program, three POKEs must be entered in immediate mode (these POKEs must be entered each time you load the program):

```
POKE 43,1:POKE 44,64:POKE 16384,0
```

After you've typed these POKEs and pressed RETURN, plug a joystick into port 2, load Collision Course, and type RUN. It takes about seven seconds to set up the game graphics. As soon as the game screen appears, you're ready to play.

See program listing on page 105.

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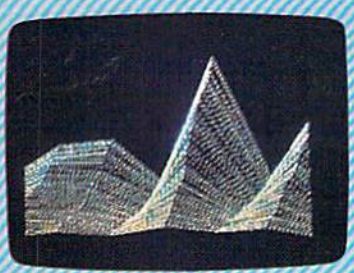

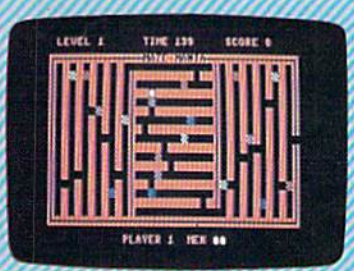

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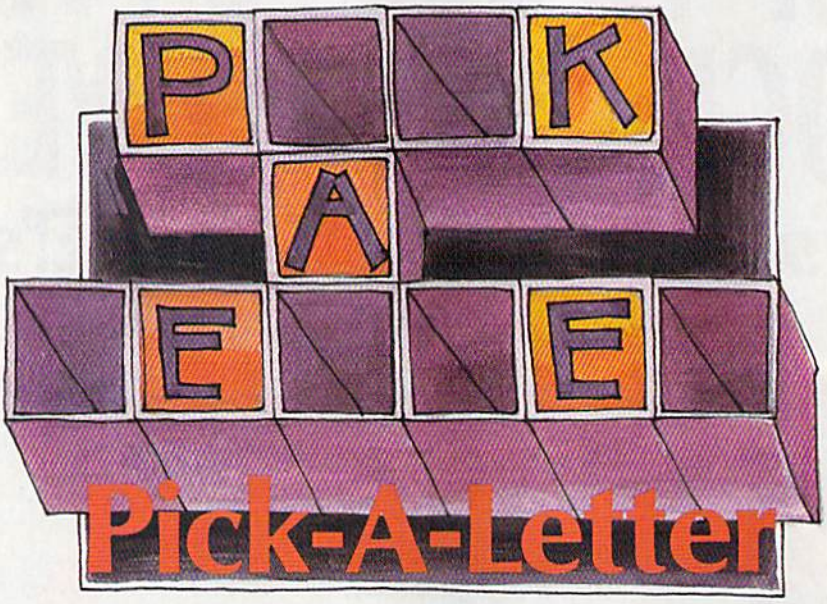

Michael Blackmon

This challenging word game is a pleasant change from fast-paced action games. And it's a game the whole family can enjoy. One, two, or three players can compete. For the Commodore 64, 128, Plus/4, and 16.

If you like word games, you're sure to like "Pick-A-Letter." This game is especially fun when played with family or friends. By combining the elements of strategy, word knowledge, and a little luck—good and bad—Pick-A-Letter can provide hours of entertainment. There are 90 puzzles included, sorted randomly at the start of each game. And when you've become familiar with these, it's easy to add new ones to the list.

Pick-A-Letter is loosely based on the game "Hangman," but it adds enough new features to be considered an entirely different game. As in Hangman, you must guess the letters in a word or phrase. But in Pick-A-Letter, it pays to consider carefully which letter to choose—you're playing for points now.

Pick-A-Letter is written in BASIC. Program 1 is for Commodore 64 and 128 computers (it can be used as is in either 64 or 128 mode). If you have a Plus/4 or 16, type in Program 1, but replace the first 14 lines with the ones listed in Program 2. Be sure to save a copy when you've finished typing. To play, load the program and type RUN.

Player 1 guesses the phrase in "Pick-A-Letter." The 21 points he's earned in this round will be added to his total score.

A Little Gambling

When Pick-A-Letter starts, you're asked for the number of players. Respond with a number in the range 1–3. Then choose the goal score. The first player to reach this goal is the winner.

The game screen now appears. The goal score is shown at the top of the screen. Below that is a table of scores, which shows the current score and total score for each player. The current score holds the points that the player accumulates during the current puzzle. When the puzzle is solved, the appropriate player's current score is added to his or her total score. Then all current scores are set to 0 for the next round.

The category name is shown below the score table. This and the configuration of the letters in the puzzle are your only clues.

In the middle of the screen is the point strip. Before you guess each letter, you must "spin" the arrow below this strip to find the point value for which you'll be playing. Near the bottom of the screen is indicated whose turn it is, the value of the bonus factor (which increases with each correct letter chosen), and the number of points that will be awarded for each appearance of the letter in the puzzle.

At the very bottom of the screen is a roster of all the incorrect letters which have been guessed. If any player guesses one of these letters again, that player loses a turn.

Press the space bar to start the arrow moving. After a while, it "winds down" and stops at a point value (a number 1–5) or a card symbol. If it stops at a point value, you'll get that many points (times the bonus factor) for each occurrence of your chosen letter in the

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hidden phrase. This is where some good strategy can pay off. If you're going to get only one point per letter on a turn and you suspect that there are, say, three *S*'s in the word or phrase, it would probably be wise to choose a different letter and save the *S* to earn more points later.

The bonus factor starts at 1, but it increases by 1 each time you correctly guess a letter. When you lose your turn, you also lose whatever bonus you've built up—you start back at 1 on your next turn.

The card symbols are special cases. If you land on a heart or diamond, you're in luck—you'll be playing for 15 or 20 points, respectively (not including your bonus). However, landing on a club or spade is unfavorable. In the first case, you lose your turn; in the second, you *also* lose all your current points.

If you think you know the answer to the puzzle, you can press RETURN and then type your guess; or you can keep guessing letters to build up your score. But remember that it sometimes doesn't pay to wait—you lose your turn if the arrow lands on a club or a spade.

When you guess the answer or complete the answer by filling in the last letter in the puzzle, your current score is added to your total score, and your opponents lose their current scores. If a player's total score surpasses the goal, the game ends with that player declared the winner.

Adding New Words

To add new words or phrases to the game, put them in a DATA statement among the words and phrases in the program. The format for the DATA statement is:

DATA category number,"puzzle"

The categories and corresponding numbers are as follows:

1. Phrase
2. Place
3. Person
4. Name
5. Object

When you've finished adding new puzzles—words and/or phrases—put the total number of puzzles in line 230 assigned to the variable NW.

See program listings on page 103.

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Whether you're building an argument or just hammering out a memo, any project looks better when you put it together in Writer's Workshop. The supercharger that powers your GEOS-equipped Commodore through even the most wrenching assignments.

Sharpen your skills. The first thing to do in the Workshop is plug into geoWrite 2.0, which contains all the brand new tools you need to hone any rough concept into a well-crafted document.

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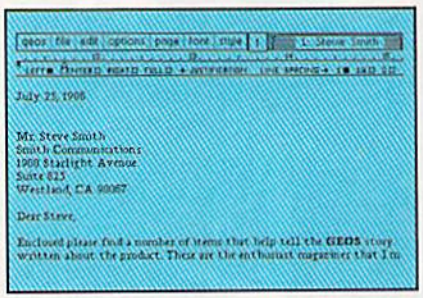
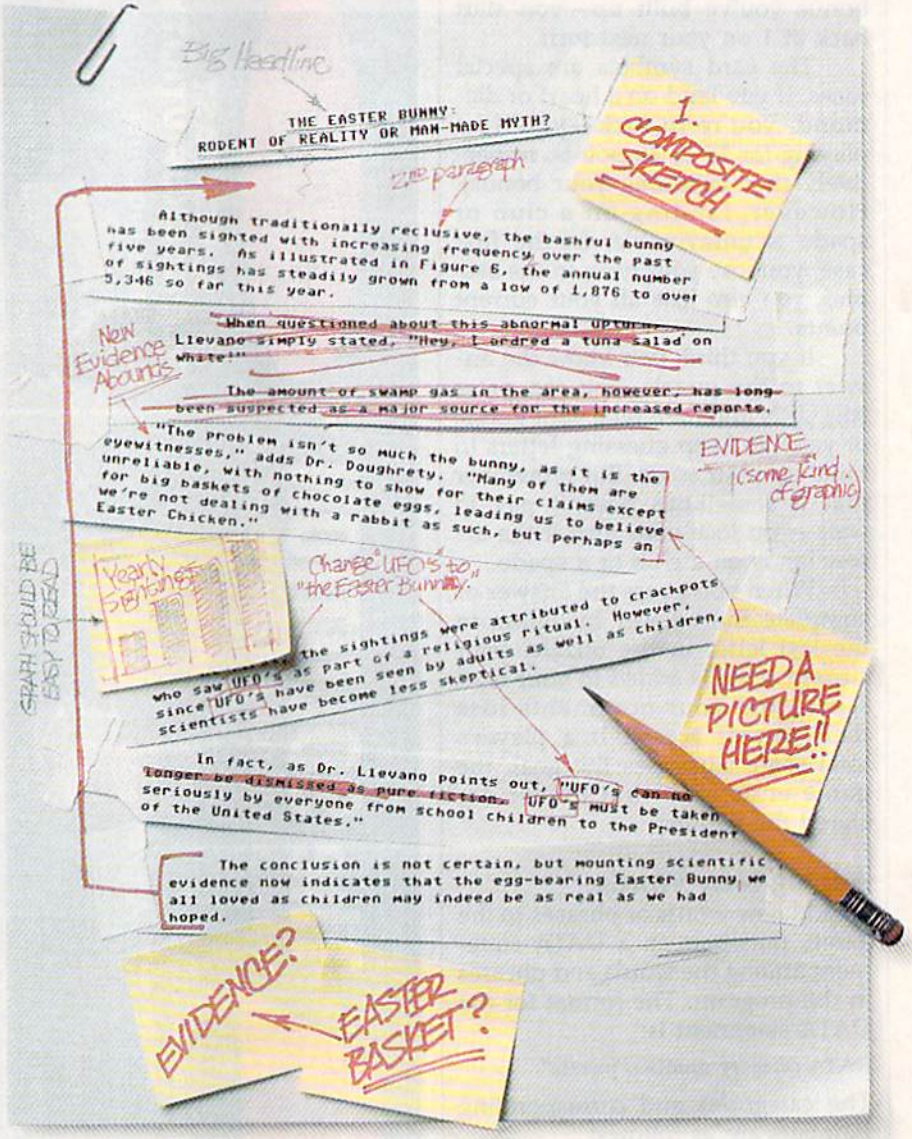


down formatting problems with variable vertical spacing and adjustable margins.

The Workshop cuts down on your manual labor, too. With one-stroke, "shortcut" keyboard commands. They keep your hands off the mouse so you can keep your mind on your work.

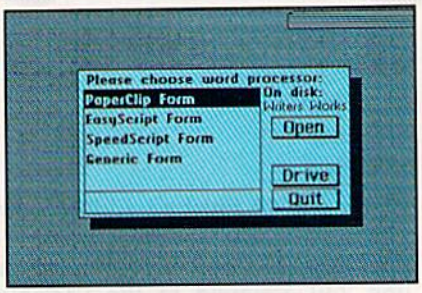
In fact, there's a complete set of heavy-duty accessories that not only strengthen your writing, but reinforce its structure, as well.



Replace old, worn-out parts. You can build anything with Writer's Workshop. And repair old stuff, too. Just decide which parts have to come out and which new ones go in.

Then hit the key and stand back.

Instantly, the "search and replace" drills through your old



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THE EASTER BUNNY:
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The conclusion is not certain, but mounting scientific evidence now indicates that the egg-bearing Easter Bunny[1] we all loved as children may indeed be as real as we had hoped.

Although traditionally reclusive, the bashful bunny has been sighted with increasing frequency, over the past five years. As illustrated in Figure 6, the annual number of sightings has steadily grown from a low of 1,876 in 1982 to over 5,346 so far this year.

1. The Easter Bunny, depicted by composite sketch.

A+ EXCELLENT!!

NEW EVIDENCE ABOUNDS

"The problem isn't so much the bunny, as it is the eyewitnesses," adds Dr. Dougherty. "Many of them are unreliable, with nothing to show for their claims except for big baskets of chocolate eggs[3], leading us to beleieve we're not dealing with a rabbit as such, but perhaps an Easter Chicken."

At first, the sightings were attributed to crackpots who saw The Easter Bunny as part of a religious ritual. However, since The Easter Bunny has been seen by adults as well as children, scientists have become less skeptical.

In fact, as Dr. Llevano points out, "The Easter Bunny must be taken seriously by everyone from school children to the President of the United States."

1982 1983 1984 1985

Figure 6: Increased sightings, 1982 to present.

Figure 4: Evidence submitted by Dr. Dougherty.

text, replacing worn-out words and phrases with your brand new ones.

For more serious cases, hand the job over to the Workshop's Text Grabber. It takes text from several word processors—like Paper Clip™—and lets you overhaul them with new GEOS fonts, formats and graphics.

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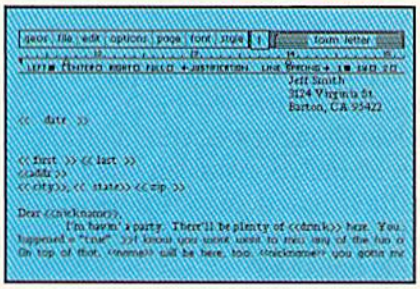

Jeff Smith
3124 Virginia St.
Barton, CA 92422

<< date >>

<< first >> << last >>
<< address >>
<< city >>, << state >> << zip >>

Dear <<nickname>>,

I'm havin' a party. There'll be plenty of <<drink>> here. You happened = "true" ... ya know you were used to mix any of the hot o On top of that, <<name>> will be here, too. <<nickname>> you gotta me

Of course, you don't want to keep good-looking documents like this to yourself. So we built in geoMerge. Which customizes your geoWrite form letters to people on your mailing lists.

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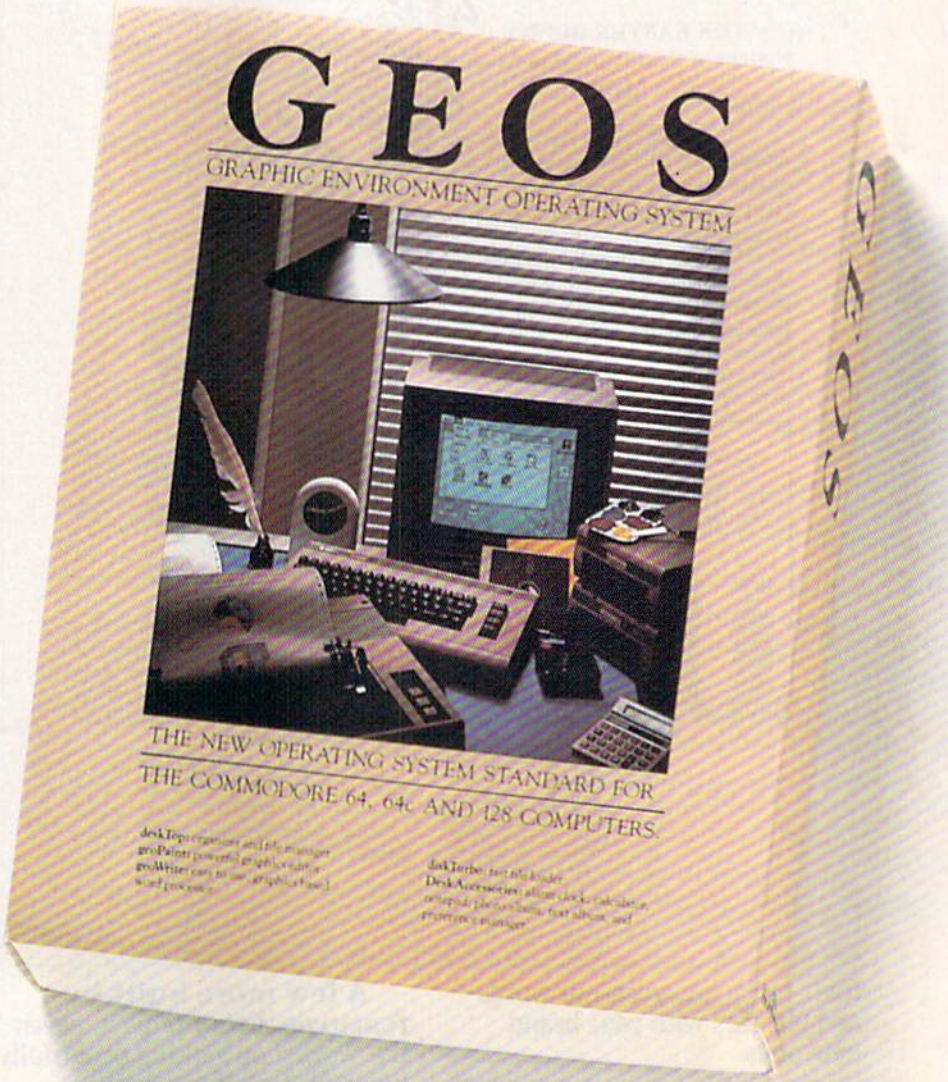

Not twice or three times as fast. But five to seven times faster than normal. Which lets you streak through files and documents at what seems like warp speed.

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The Desktop keeps your art and documents filed, and comes

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with all the accessories you need to keep you organized:

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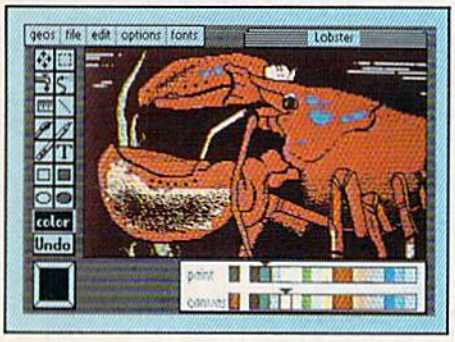

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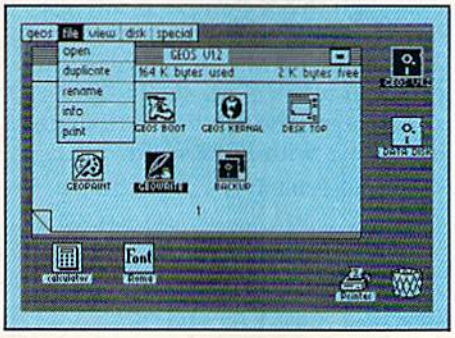

thing about a new universe is finding your way around. But with GEOS, you only need to remember two things:

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When GEOS offers you options, you just point to your answers and click your mouse or joystick.

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You want to write? Point and click.

You want to fill in that obtuse rhomboid with an air-brushed geometric pattern in a lighter shade of pink? Point and click.

Easy, huh? And in case you ever do make a mistake, GEOS backs you up with an "Undo" feature that undoes the very last command you entered.

Running out of space. With GEOS, that's hardly likely. Because there's endless space in the universe for new applications.

Unfortunately, there's only so much space in this ad.

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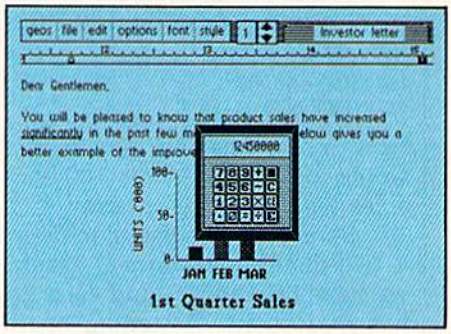

And if he looks at you like you're some kind of alien, well, just tell him Berkeley Softworks sent you.

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Replacing Arrays

Aaron Bratcher

If you've discovered a clever time-saving technique or a brief but effective programming shortcut, send it to "Hints & Tips," c/o COMPUTE!'S GAZETTE. *If we use it, we'll pay you $35. We regret that, due to the volume of items submitted, we cannot reply individually to submissions.*

Arrays are powerful structures that simplify programming immeasurably. Suppose that we had eight variables that we wanted to increment by one. Without arrays we'd have to do it this way:

```
100 A=A+1:B=B+1:C=C+1:D=D+1
110 E=E+1:F=F+1:G=G+1:H=H+1
```

With arrays, we can do it like this:

```
100 FOR N=1 TO 8
110 M(N)=M(N)+1
120 NEXT N
```

Now try to imagine how hard it would be to increment 100 variables without using an array.

Sometimes it's useful to define a two-dimensional array. Assume we have three boxes and each box has five books. Assuming everything has been initialized properly, we can find out how many pages are in the second book in the third box like this:

```
PRINT PG(3,2)
```

Array Problems

But there are two problems with arrays. The first problem is that some BASIC compilers allow only singly dimensioned arrays, or none at all. The second is that large arrays take up huge amounts of memory.

To tackle the first problem, let's see how we can convert from two-dimensional arrays to one-dimensional arrays.

Two dimensions	One dimension
BX=3:BK=5	BX=3:BK=5
DIM PG(BX,BK)	DIM PG(BX*BK+BK)
PG(1,5)=322	PG(1*BK+5)=322
PRINT PG(1,5)	PRINT PG(1*BK+5)

On the left is our pages array implemented as a two-dimensional array. On the right are equivalent one-dimensional statements.

A Complete Simulation

Although this technique is interesting, we're still using about the same amount of RAM. And what if the compiler won't allow single-dimension arrays? The solution is to simulate arrays with PEEKs and POKEs.

- Substitute POKE W*3+2+49152,5 for A(3,2)=5
- Substitute B=PEEK(W*3+2+49152) for B=A(3,2)
- Substitute POKE 7+49152,3 for M(7)=3
- Substitute N=PEEK(7+49152) for N=M(7)

In the above examples, W is one more than the number of Y elements in the array. We're stuffing our values into memory starting at 49152 in this example. You can use other areas if you're careful.

Whenever the array is on the left side of the equals sign, use POKE. When the array is on the right side, use PEEK. What if you have T(8)=T(3)? Use both a PEEK and a POKE:

```
POKE 8+49152,PEEK(3+49152)
```

Unfortunately, this technique works only if you're storing numbers 0–255 in the array. If that range is too small, you can have numbers in the range 0–65535 if you break the number up into two parts and store them into two different areas. We'll use 49152 and 51200:

```
HI=INT(NUM/256):LO=NUM-HI*256
POKE 7+49152,HI:POKE 7+51200,LO
```

and get them back like this:

```
PRINT PEEK(7+49152)*256+PEEK
  (7+51200)
```

An Example

Let's convert a short program from a two-dimensional array to an equivalent that uses PEEKs and POKEs. We'll generate 100 random integers in the range 0–100 and place them in a 10 × 10 array. Then we'll find the both the highest and lowest element. First, the standard way:

```
10 DIM A(10,10)
20 FOR J=1 TO 10
30 FOR I=1 TO 10
40 A(I,J)=INT(RND(0)*101)
45 PRINT A(I,J);
50 NEXT I
55 PRINT
60 NEXT J
70 MIN=A(1,1):MAX=MIN:II=1:
   IJ=1:AI=1:AJ=1
80 FOR I=1 TO 10
90 FOR J=1 TO 10
100 IF A(I,J)<MIN THEN MIN=
    A(I,J):II=I:IJ=J
110 IF A(I,J)>MAX THEN MAX=
    A(I,J):AI=I:AJ=J
120 NEXT J
130 NEXT I
140 PRINT "THE MINIMUM IS";
    MIN;". IT IS AT";II;","
    ;IJ
150 PRINT "THE MAXIMUM IS";
    MAX;". IT IS AT";AI;","
    ;AJ
```

Now, the converted program:

```
20 FOR J=1 TO 10
30 FOR I=1 TO 10
40 POKE 11*I+J+49152,INT(RN
   D(0)*101)
45 PRINT PEEK(11*I+J+49152)
   ;
50 NEXT I
55 PRINT
60 NEXT J
70 MIN=PEEK(11*1+1+49152):M
   AX=MIN:II=1:IJ=1:AI=1:AJ
   =1
80 FOR I=1 TO 10
90 FOR J=1 TO 10
100 IF PEEK(11*I+J+49152)<M
    IN THEN MIN=PEEK(11*I+J
    +49152):II=I:IJ=J
110 IF PEEK(11*I+J+49152)>M
    AX THEN MAX=PEEK(11*I+J
    +49152):AI=I:AJ=J
120 NEXT J
130 NEXT I
140 PRINT "THE MINIMUM IS";
    MIN;". IT IS AT";II;","
    ;IJ
150 PRINT "THE MAXIMUM IS";
    MAX;". IT IS AT";AI;","
    ;AJ
```


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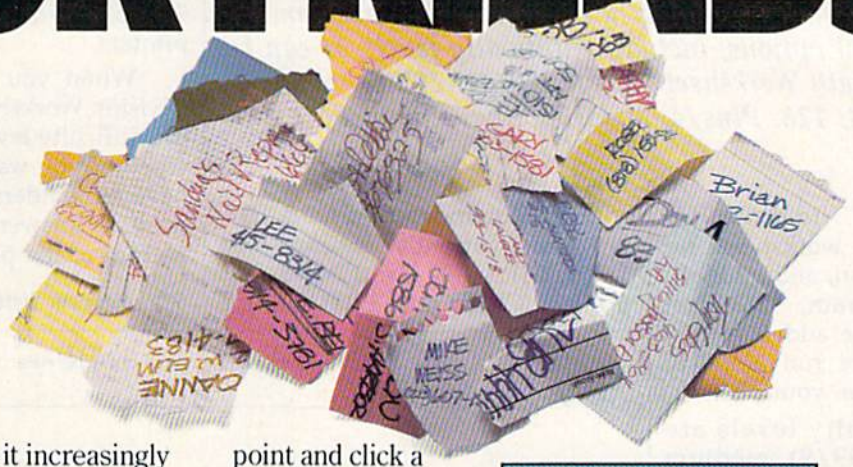
ARE YOU SEARCHING FOR FRIENDS?



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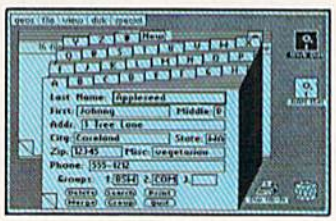

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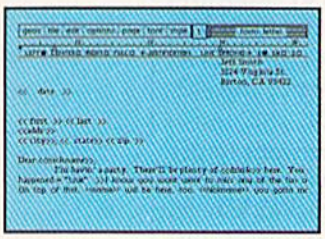

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Division Worksheet

Gerald Caron

Teachers and parents will appreciate this versatile program that offers several options, including difficulty levels. It can be merged with "Math Worksheet" (July 1986 GAZETTE) or used alone. For the 64, 128, Plus/4, and 16 with a Commodore printer.

"Math Worksheet," from the July 1986 issue, makes worksheets for addition, subtraction, and multiplication. This program, "Division Worksheet," can be added to that program or can be run alone to make worksheets on your printer.

Three difficulty levels are available: easy (99/9), medium (999/9), and hard (9999/99). The first number indicates the maximum size of the dividend; the second, that of the divisor.

First, decide if you want to use Division Worksheet by itself or in conjunction with Math Worksheet. If you want to use it by itself, just type in the listing of the program as it appears in the back of the magazine. Be sure to save a copy before you run it.

If you want to make Division Worksheet part of Math Worksheet, load Math Worksheet, type in the lines from the program listing, and then add these two lines:

```
CP 85 R=8:GOSUB 40:PRINT"{RVS}
      {WHT}D{YEL}{OFF}IVISION
      {SPACE}"F$
CA 125 IF K$="D" THEN 710
```

Be sure to save the updated program before running it.

Math Worksheet requires some modifications for some printers to print in double-wide characters. These changes can be found in "Bug-Swatter" in the January 1987 issue.

Division Worksheet works with all Commodore printers. The program is currently set to work on 1525, MPS-801, and MPS-803 printers. Change the PR=1 in line 710 to PR=0 for 1526 or MPS-802 printers.

When you run the program, Division Worksheet lets you choose the difficulty level of the problems, whether you want the problems to have remainders, and whether you want an answer key printed at the bottom of the page.

See program listing on page 97.

DIVISION PROBLEMS

NAME _____

33) 1782	93) 7440	46) 2392	94) 4512	2) 72	30) 1710
30) 210	18) 126	33) 33	48) 4368	24) 1104	59) 1593
22) 198	5) 350	48) 3696	17) 901	35) 3360	51) 153
78) 1092	30) 420	53) 3922	47) 2397	30) 2100	40) 4040
77) 4312	94) 6674	40) 3480	67) 2948	74) 1554	77) 4389
11) 1078	31) 1116	49) 2107	32) 2176	9) 756	52) 260
59) 5959	23) 69	28) 2716	69) 5520	45) 675	38) 2318
89) 6942	87) 5307	52) 2288	61) 488	33) 561	58) 4988
74) 6438	7) 364				

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Send typed additions, corrections, and deletions for this list to:

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Attn: Commodore User Groups

User Group Notes

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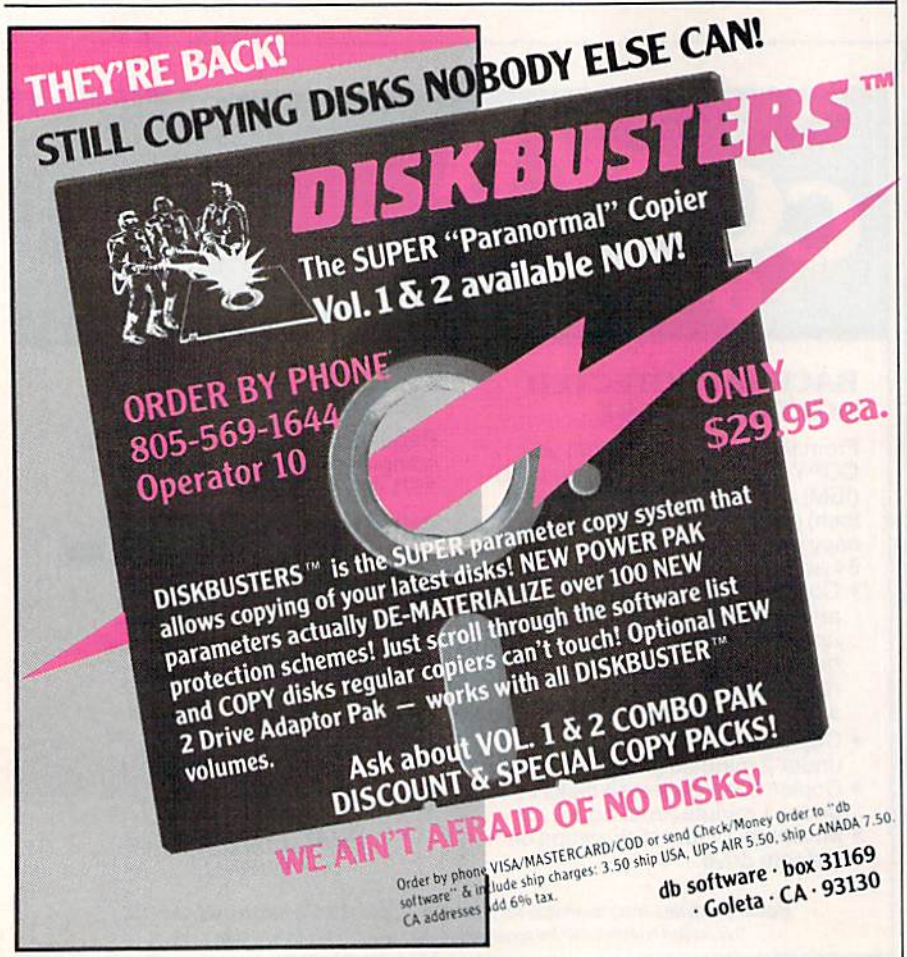

The **Commodore League of Riyadh (CLR)** has a new address: P.O. Box 16216, Riyadh, Saudi Arabia 11464.

New Listings

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Moreno Valley Commodore Users Group, P.O. Box 4594, Riverside, CA 92517

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North Colorado Commodore Users Group (NORCOCOM), 2138½ 10th St. Rd., Greeley, CO 80631

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Stueben County Commodore Users Group (SCCUG), P.O. Box 25, Pleasant Lake, IN 46779

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Commodore Users Therapy Group, 1309 N. Gorton Ave., Willmar, MN 56201

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Central New York Commodore Users Group (CNYCUG), 6887 Peck Rd., Syracuse, NY 13209

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Commodore Association of the Mid South, 3318 Keystone Ave., Memphis, TN 38128

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Commodore Group of Clarksburg, Rt. 1, Box 70-A, Clarksburg, WV 26301

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Brockville Commodore Users Group (BUG), 70 Park St., Brockville, Ont., Canada K6V 2G5

Chaleur Commodore User Group (CCUG), R. R. #1, Box 8, Bathurst, NB, Canada E2A 3Y5

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Frontenac Commodore Users Group (FCUG), P.O. Box 1773, Kingston, Ont., Canada K7L 5J6

The Renfrew Computer Club (RCC), R. R. #3, Calabogie, Ont., Canada K0J 1H0

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Baross Street Software Collector's Club (BSSCC), 1082 Budapest, Baross utca 88, Hungary

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Commodore Fan Club, Koji Sugimura, 2-1-10-1107 Higashi-Taishi Yao Osaka, Japan, 581

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bug-swatter

Modifications and Corrections

• Commodore 128 users will be unable to boot the December GAZETTE Disk according to the instructions on the disk sleeve. The boot sector that would automatically load and run the 128 menu on this disk was incorrectly copied before duplication. The menu can, however, be accessed simply by typing RUN "128 MENU" and pressing RETURN. An alternative is to make this into an autoboot disk. First copy the GAZETTE Disk to a blank, formatted disk. (You must copy the disk because the GAZETTE Disk is write-protected.) Then load the AUTOBOOT MAKER program on the 1571 Test/Demo Disk that came with your disk drive and run it. Follow the onscreen instructions and when prompted for a filename, enter 128 MENU.

• "Animation Player" (Program 3) from the article "Fill-64" (November) runs as listed, but the Proofreader checksum for line 180 is incorrect. The correct checksum is AX, not BG. Also, lines 200 and 210 are missing from the copy of Program 3 on the November GAZETTE Disk (they are correctly included in the magazine issue). To correct the file, load FILL.BOOT from the GAZETTE Disk and run it. This modifies BASIC so the Fill-64 commands work correctly. Next, load and run "The Automatic Proofreader" (PROOFREADER on the GAZETTE Disk). Now, load the file FILL/PLAYER and add the following lines:

```
AJ 200 DGET"WIRES":PLAY
JJ 210 DGET"CUBE":PLAY:PLAY:PL
       AY
```

The GAZETTE Disk is write protected so you will have to save the corrected version of Program 3 on another disk. To use Animation Player, copy the files FILL.BOOT, FILL 64, and FILL/DEMO from the directory (not menu) of the GAZETTE Disk onto the disk with your corrected copy of Program 3. (If you don't have a copy program, use MLX to copy the FILL 64 machine language file.) Next, load and run FILL.BOOT to move the top of BASIC down and install Fill-64. Now, load and run FILL/DEMO. The first time you run it, when the program asks whether you want to save the animations, you should answer *yes*. Now each time you load and run Animation Player, the animations will be loaded from the disk and redrawn very quickly.

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Sanitation Engineer

Fred Simon

Have you ever lost time waiting for your 64 to finish the tedious procedure of "garbage collection"? If so, you'll appreciate this machine language program that makes the clean-up at lightning speed.

"Sanitation Engineer" takes the snail out of your 64's garbage-collection procedure and replaces it with a rabbit. Before we take a look at garbage collection, let's see what the "garbage" is. Each time the BASIC interpreter encounters a new string variable definition, it builds the string character by character in the *string pool* at the top of free memory, normally working downward from location 40960. If a string variable definition is changed, the old string remains in memory as *garbage*. BASIC normally waits until all available free memory is filled before eliminating strings that are no longer used. The process of eliminating unused strings is called *garbage collection*. The BASIC function FRE(0) also causes garbage collection to be performed.

To accomplish garbage collection, BASIC first searches through the string variables to find the active string stored highest in memory. This string is copied to the top of available memory, overwriting any unused string that may be there. The routine continues until all active strings have been copied and all inactive strings have been overwritten. The length of time it takes to complete this task depends on the square of the number of strings.

To see garbage collection at work, try this program:

```
10 D=500:DIM X$(D)
20 FOR J=0 TO D:X$(J)=STR$(J):NEXT
30 PRINT"STARTING COLLECTION..."
40 T=TI:J=FRE(0)
50 PRINT(TI-T)/60" SECONDS"
```

Change the value of D in line 10 to see the effect of increasing the number of strings.

Timely Collection

Sanitation Engineer speeds up garbage collection by copying the string memory to a buffer area (the RAM underneath the Kernal ROM). Each active string can then be pulled out of the buffer and written to the clean string area. Sanitation Engineer uses the area of memory from 51744 to 52223 ($CA20–$CBFF) for the garbage collection routines. Thus, it can be used with the DOS Wedge and leaves 49152–51743 ($C000–$CA1F) free for other machine language routines.

Because the program is written entirely in machine language, it must be entered using the "MLX" machine language entry program found elsewhere in this issue. Be sure to read and understand the instructions for using MLX before you begin entering data. MLX will ask for a starting address and an ending address for the data you'll be entering. The correct values for Sanitation Engineer are as follows:

Starting address: CA20
Ending address: CBEF

After you've finished entering all the data for Sanitation Engineer, be sure to save a copy to disk or tape before leaving MLX.

Load the Sanitation Engineer program with a command of the form LOAD "*filename*",8,1 (for disk) or LOAD "*filename*",1,1 (for tape). Activate the program with SYS 51744. BASIC is moved from ROM to RAM and a few alterations are made to it. In addition, the READY. prompt is changed to READY! to remind you that BASIC has been modified. Press RUN/STOP–RESTORE to deactivate Sanitation Engineer. To reactivate it, type SYS 51744 again. Try Sanitation Engineer on the test program—you'll be amazed at the increase in garbage-collection speed. Here's a benchmark test for collecting 2000 strings:

Normal 64 garbage collection: 316.283 seconds

Sanitation Engineer collection: 0.650 seconds

See program listing on page 98.

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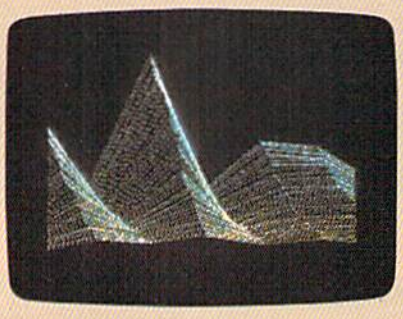

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Do you have a question or a problem? Have you discovered something that could help other Commodore users? We want to hear from you. Write to Gazette Feedback, COMPUTE!'s GAZETTE, P.O. Box 5406, Greensboro, NC 27403. We regret that due to the volume of mail received, we cannot respond individually to programming questions.

The Cursor Wraps Around

I have a programming problem I can't solve. When I run the enclosed program (which calculates bearing and distance from a latitude and longitude), I never know what kind of display I will end up with. Sample screen printouts are attached. Sometimes a blank line appears between two lines, but sometimes it does not. Am I the victim of a capricious 64?

Mark Todd

On first glance, this seems to be an unusual program because it's not acting predictably. There aren't any obvious bugs in the program; everything looks OK. And the program line that's acting strange is just a PRINT statement.

The screen line that's followed by an extra (blank) line looks like this: THE SHORT PATH BEARING IS 143.72 DEG. The line that's not followed by a blank line is the same, except that the number is 347.8 instead of 143.72. The only visible difference is that one has four numbers (plus a decimal point), while the other has five (plus the decimal point).

Counting the characters reveals that, allowing for spaces between the words, one line contains 39 characters and the other contains 40. And that's the source of the now predictable behavior. Although you don't see it when a program is running, there's a cursor that keeps track of where the next character should be printed. After 40 characters are printed, the cursor moves down to the next line, which ultimately becomes the blank line. But if 39 characters are printed, the cursor remains on the same line, and a new line is not opened up.

You can solve the problem by removing a character or two from the PRINT statement that occasionally prints 40 characters. Or add a semicolon after the PRINT and use the POS(0) function to check the current position of the cursor. If it's still on the same line, print an extra line.

A Better Way To Find Blocks Free

In the November GAZETTE you gave a sample program in response to a question about how much room is left on a disk. It works—I ran it on a half-full disk and it took 24 seconds and used up 1104 bytes of string storage.

There's no reason to read in the whole directory when all you want is the blocks free. The following program reads the same disk in three seconds and uses only 34 bytes of string storage:

```
10 Z$ = CHR$(0): OPEN 1,8,0,"$0:"
20 FOR I = 1 TO 18: GET#1, A$, B$:
   NEXT: CLOSE1
30 F = ASC(A$+Z$) + 256*(ASC(B$
   +Z$))
40 PRINT F;"BLOCKS FREE"
```

The colon in the filename is the key. It tells the drive to search the directory for a filename called " " (null string) and if not found, to report the disk name, ID, format, and blocks free.

Russell K. Prater

Thanks for the improved blocks-free program.

1571 Bugs

I've come across a problem with my 128 and 1571 that I haven't been able to fully understand. In the middle of reading a long series of relative files from disk, the computer will stop with a DEVICE NOT PRESENT error. This interruption has occurred as early as the fourth record or as late as the 430th. Sometimes it doesn't happen at all, although this is rare.

John Chaffey

There are several bugs in the 1571, one of which causes the DEVICE NOT PRESENT error you've encountered. We've seen this error occur with both relative and sequential files.

A list of 14 bugs has circulated on telecommunications services and in user-group newsletters. Notable problems include the following:

- *The save-with-replace command (SAVE-@ or DSAVE-@) still doesn't work correctly.*
- *In 1571 mode, locked files (marked with a less-than sign) will not load. They will load if the drive is in 1541 mode.*
- *If you validate the disk when it's in 1541 mode, it changes a byte on the disk to mark it as single-sided. See the June 1986 "Horizons" column for more details.*
- *When you're writing a data file and side 1 is full, the 1571 slows down, apparently because it updates the BAM after every sector is written. You'll hear the read/write head moving back and forth with a grinding sound when this happens. This does not affect saving program files on the second side of the disk.*

These problems, especially the DEVICE NOT PRESENT error, have affected some commercial database programs for the 128, especially programs that use relative files. One solution is to put the 1571 into 1541 mode (with OPEN 15,8,15, "U0>M0" followed by CLOSE15) before using relative files. Another solution would be to buy the upgrade ROM. See the next letter for details.

Upgrade News From Commodore

This may be of some help to your readers. By returning the old version of my CP/M disk to Commodore, I was able to obtain the latest version (December 1985). The turnaround was about one week.

Richard Marks

A source at Commodore verified that the latest version of the CP/M disk is available. Send the original CP/M disk you received, along with $5 to cover the costs of the new disk and shipping, to:

Commodore
Attn: Disk Exchange
1200 Wilson Drive
West Chester, PA 19380

Allow 4–6 weeks for delivery. If you use CP/M programs, it's a good idea to make a backup of both sides of the original disk before mailing it off.

Commodore is also working on and testing a new ROM chip for the 1571, to correct the bugs mentioned in the previous letter. The first batch will probably go into new 1571s, but as more are manufactured, they should be available from Commodore and Commodore dealers. The price has not yet been set.

Other new products that were mentioned include the 1581 disk drive, which

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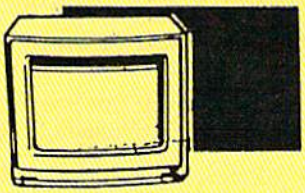

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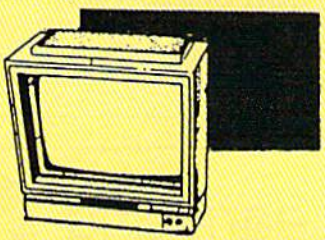

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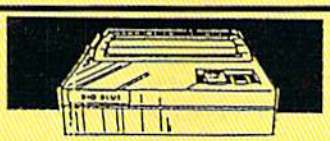

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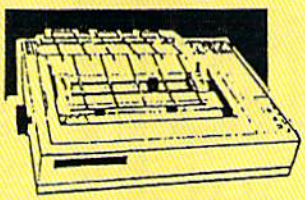

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uses 3½-inch disks, and the memory expander for the 64. Because of the power consumption of the expander, a 64 will require a new power supply in order to use it.

Fixing The Stars

In an astronomy magazine I subscribe to, I came across a program written for a CP/M BASIC. I was able to convert nearly all of the program to Commodore BASIC, except for one thing. This BASIC has a function called FIX. Here is an example of how it is used:

```
190 DEF FN LESS(X)=((X/360)-FIX
    (X/360))*360
```

How can I convert this line?

William Rosenzweig

The FIX function is similar to INT (the integer function). Both take a real number and return a whole number. INT is known as a floor function because the result is the nearest integer less than the real number. FIX, on the other hand, is a truncating function. It simply strips off the decimal part of the real number. These two functions are exactly the same when they're given a positive number. Both INT(11.13) and FIX(11.13) would come back with the number 11. The difference between the two shows up when you're dealing with negative numbers. INT(−1.5) rounds down to −2. FIX(−1.5), on the other hand, cuts off the fraction to give you a −1. If you're using both positive and negative numbers, you can define a function that performs FIX like this:

```
10 DEF FN FIX(X)=SGN(X)*INT(ABS(X))
```

Then, whenever you encounter a FIX in the program, you can replace it with FN FIX. The program line you asked about becomes:

```
190 DEF FN LESS(X)=((X/360)-FN FIX
    (X/360))*360
```

Be sure to define the FIX function before you use it.

Free Memory

I have a program that is too large to fit into memory, so I am using the FRE(0) function to check the size of memory. My plan is to save out my data when memory becomes full, then clear that memory out and start with more. Here is the line I'm using to check memory:

```
IF FRE(0)<900 THEN DX$="SORT":
   GOTO 4400
```

Can you help?

Harold R. Mortensen, Sr.

The FRE(0) function works a bit oddly on the 64—instead of numbers in the range 0–65535, it returns the values −32768–32767. The 128 is not subject to this quirk; FRE(0) and FRE(1) always return positive numbers. If there are more than 32767 bytes free in your 64, the number will be negative. When this happens, add the returned number to 65536 to find the positive number of bytes free. The following line sets the variable F to the true number of free bytes:

```
F=FRE(0):IF F<0 THEN F=65536+F
```

Since your program checks FRE(0) directly, negative numbers (which are always less than 900) throw off your logic.

128 Sprite Pointers

I have a 128 and need help with a programming problem. I'm writing a synthesizer patch program where I will use some *Doodle* screens for the hi-res. I use GRAPHIC 1:GRAPHIC 0 to allocate the high-resolution graphics area, then BLOAD"SCREEN", B0, P7168 and BLOAD "SPRITES", B0, P3584. When I turn on the graphic mode (GRAPHIC 1), move the sprites, and turn them on, the sprites are all jumbled up. If I type SPRDEF, the sprites are there. If I BLOAD the sprites without the *Doodle* picture, they work fine. What is the problem? I can't finish my program until I figure this out.

Wayne A. Dowell

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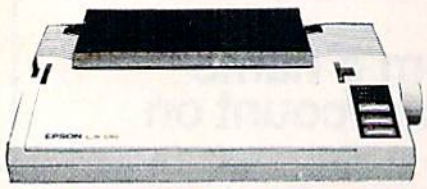

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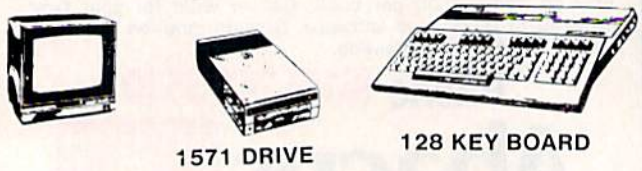

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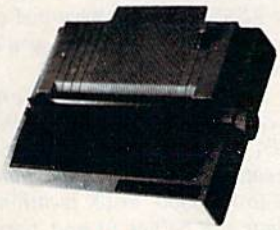

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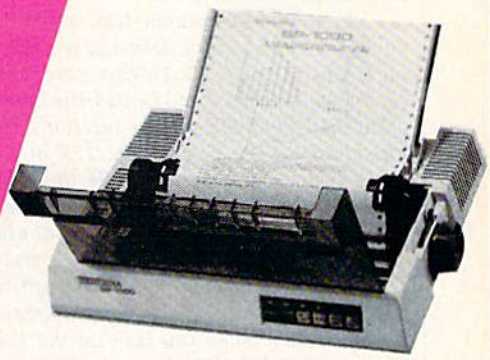

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program, the eight bytes that serve as sprite pointers. These sprite pointers tell the VIC chip where the sprites' shape data is located.

When the 40-column text screen is active, screen memory normally occupies locations 1024–2023. In this case, the sprite pointers are found just a little higher at 2040–2047 (these same locations are also used by the 64 and the 128 in 64 mode, by the way). You can PEEK these locations to find out where the sprite shapes are stored. PRINT PEEK(2040) should show you the value 56, which, when multiplied by 64, tells you that the first sprite shape starts at 3584. The eight pointers are initialized when you turn on the 128 (there are no default pointers in 64 mode; you have to POKE appropriate values yourself).

The initial GRAPHIC 1 statement causes screen memory to move to locations 7168–8167, followed by sprite pointers at 8184–8191. The first time a graphics area is allocated, the pointers from 2040–2047 are automatically copied to the new area at 8184. When the display is changed to high resolution, the 1000 bytes of screen memory become 1000 bytes of hi-res color memory.

With the hi-res screen in effect, memory looks like this:

7168–8167	*color memory*
8184–8191	*sprite pointers*
8192–16191	*bitmap (hi-res screen memory)*

Here's the problem: The sprite pointers are correct when you do the first GRAPHIC 1. But when you then BLOAD the Doodle *file, you're putting some unknown values into the pointers. Two solutions are possible. You can copy locations 2040–2047 to 8184–8191 within the program after the* Doodle *file is loaded. Or, better yet, type the following lines (in immediate mode) to fix the* Doodle *file:*

```
GRAPHIC1: GRAPHIC0
BLOAD "SCREEN", B0, P7168
FOR J = 0 TO 7: POKE 8184 + J, PEEK
  (2040+J): NEXT
BSAVE "NEWSCREEN", B0, P7168 TO
  P16191
```

The corrected sprite pointers are now included in the file called NEWSCREEN. In the future, when you BLOAD the hi-res screen, the sprites will act as they should.

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I am sure there is a way to POKE the proper pointer into memory. Can you help?

Tim Roeser

In the 128's BASIC 7.0, you can add a line number after RESTORE. If you wanted to reread the data starting at line 500, you'd just RESTORE 500.

The 64 doesn't have this option. However, locations 63–64 point to the current DATA line number and 65–66 point to its location in memory. If you plan to RESTORE to line 500, PEEK locations 63–66 and save the values in four variables just before you read the first item in 500. To RESTORE to 500, just POKE those values back into 63–66.

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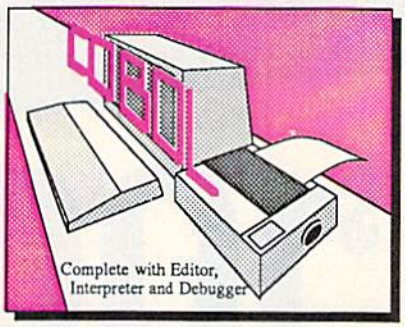

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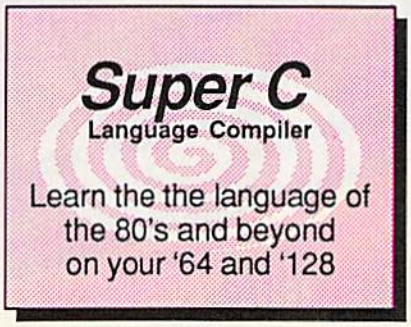

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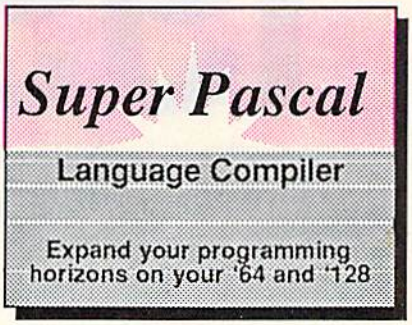

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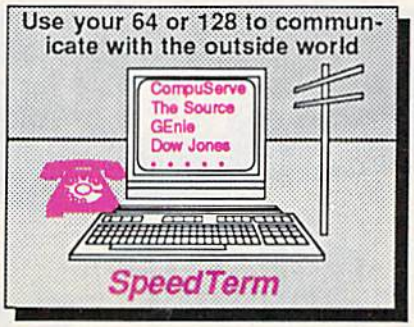

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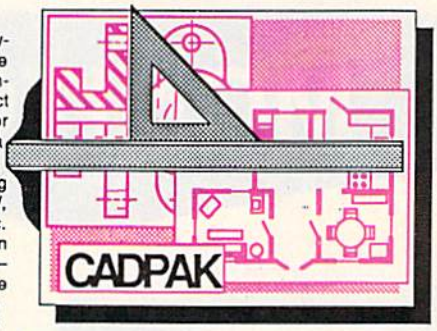

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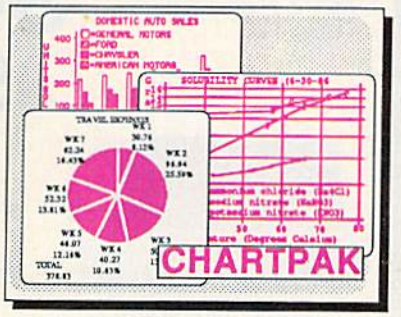

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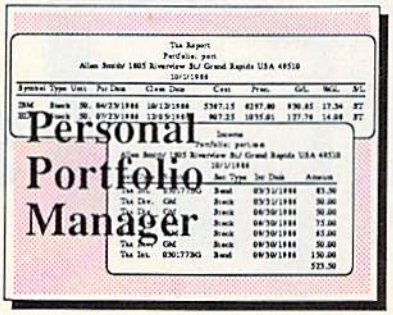

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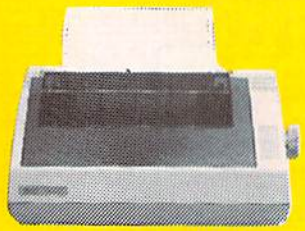

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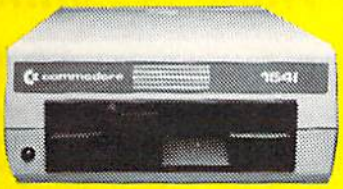

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Where In The World Is Carmen Sandiego?

They've struck again! Carmen Sandiego and her Villains' International League of Evil (V.I.L.E.) have made off with yet another priceless national treasure. Ordinary police are stumped. Interpol requests your help. You, Acme Detective Agency's newest rookie detective, are the next in a long line of crime-stopping experts to pit your wits against this nefarious organization.

Your resources include *The World Almanac and Book of Facts* (1986 version, supplied with the game), a compilation of police dossiers on the members of Carmen's gang, an Interpol map of VILE operational bases, and access to Interpol's crime computer.

The airlines are at your disposal to whisk you to any city your investigations suggest contains a lead. On arrival you'll be given a few facts about the country and shown three places where witnesses might be found. Once you've interviewed enough witnesses and assembled your facts, you'll determine your prime suspect. Interpol will gladly provide a warrant and backup.

Rounding up Carmen's gang can lead to promotions, recognition—even acceptance into the Detective Hall of Fame. But that's getting ahead of things. First, you have to solve *this* case, and you must hurry. Your time is limited, and a window at the top of your screen warns you of precious hours slipping by.

Where in the World Is Carmen Sandiego? for the Commodore 64 contains superior animated graphics, artistically rendered scenic illustrations, choice music and sound effects, and an ingenious game plan. Superficially, the goal of this program is to have fun solving the cases Interpol assigns you. Yet, incorporated into the program is another, *hidden*, goal. More about that shortly.

The computer screen is divided into windows. One monitors the time of day and your activity. A second window depicts location and travel. This may mean a drawing of a landmark of the country you're in; a picture of Interpol's computer, complete with "printout"; or a map of your flight between cities. A third window is for communication with witnesses, Interpol, or even the gang. A fourth window provides your main menu. The functions of the windows are all interrelated, so a change in any one is complemented by changes in others. It makes for a well-balanced, energetic display appropriate to the tension of tracking down criminals.

There are several cases to be solved in the game, for even as you put away one member of Carmen's gang, others are off perpetrating more foul deeds. If you solve a crime, you build your reputation, Interpol thanks you, and (based on your record) the agency may promote you. Solving enough crimes earns you entry into the Detective Hall of Fame.

The creators have taken the ingredients of an entertaining game and mixed them together to serve up something that educates as well.

Of course, putting together clues to solve a crime involves knowing what those clues mean. For instance, a witness tells you that he saw the suspect leave in a vehicle flying a white and blue flag. How can you make use of that information?

Here's where the *World Almanac and Book of Facts* comes in, and we gain some insight into the other purpose this program serves.

The *World Almanac* contains all kinds of information about other countries: major landmarks, currency, flags, flora, fauna, minerals. If you look in the book, you can find what countries have blue and white flags. Interpol's map and the information on the computer screen will tell you which cities your suspects could have flown to and what countries they're in. Put your information together and you know where to go next.

Statements by more witnesses

allow you to make further use of your resources in similar fashion. And what comes of all this information and research and travel? Besides tracking down Carmen and her gang, you're *learning*. And this takes several forms: geography information—countries, capitals, products, landmarks; reference book usage—practice in using the *World Almanac* to play this game helps familiarize you with using several reference materials; and reasoning ability—using your deductive powers to choose a suspect.

The package containing *Where in the World Is Carmen Sandiego?* mentions its educational aspect in only the modest statement that "Players are introduced to world geography in an exciting game situation." It focuses more attention on its entertainment value with "Game play combines the best elements of graphic adventures, trivia games, mysteries, and arcade animation." Both of these statements are true. The creators have taken the ingredients of an entertaining game and mixed them together to serve up something that educates as well. It's hard to decide where entertainment stops and learning begins with this program, for it does an excellent job of providing both in one package.

—David and Robin Minnick

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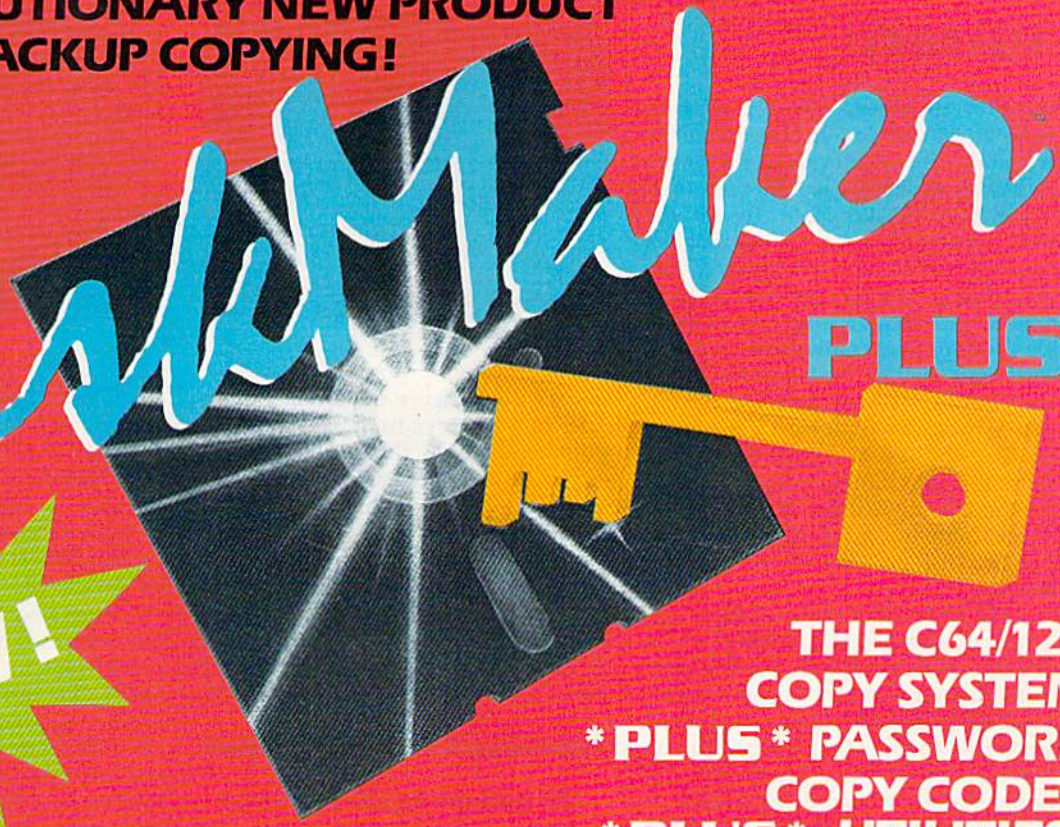

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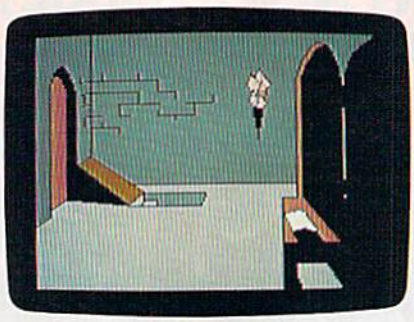
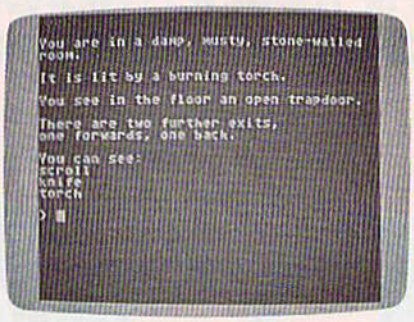
Macbeth





With the increasing number of computer adventure games based on literary works, it was inevitable that some ambitious designers would turn their attention to Shakespeare. By far the most venerated writer in the English language, Shakespeare combined brilliant characterization, the stuff of great drama, with suspense and excitement, the stuff of great adventure. Toss in witchcraft, battle, and regicide, as the Bard did in *Macbeth*, and you have a ready-made basis for an adventure game of the text-and-graphics variety. Oxford Digital Enterprises, through a program distributed by The Avalon Hill Game Company, gives us precisely that in a two-disk package for the Commodore 64.

Macbeth: The Computer Adventure is unique. First of all, it is actually four adventures, not just one. Second, your role is not confined to just one character. Third, the adventures vary from text-based to graphics-based, with one based solely on graphics. Fourth, the game rewards a sound knowledge of Shakespeare's plays. And finally, it fulfills its potential as an excellent teaching device.

Rather than place you in the role of Macbeth to reenact the entire play, the designers have chosen to split the play into four main sections. Each becomes a separate adventure, although the fourth section rewards the player who has successfully completed the first three.

The first adventure, covering the first four scenes of the play, casts you in the role of Macbeth himself, struggling to battle his way into prominence, then to uncover and translate a vital letter. Opening with an attractive graphic depiction of the witches in the play's first scene, Adventure 1 continues the graphics and screens throughout. Although not essential to the play of this adventure, the characters are well drawn and do much to set the medieval mood.

Adventure 2 is text oriented. Here you play the role of Lady Macbeth, planning for the arrival and murder of King Duncan. You have 45 minutes to figure out the domestic niceties of accommodating and feeding Duncan, and then only 15 minutes to convince your husband Macbeth to kill Duncan and assume the throne. To complicate the matter considerably, one of Duncan's people is a spy.

The most unusual adventure is the third. Here, as a helper of the three witches, you wander from room to room in an attempt to find the ingredients necessary to prepare Macbeth's hoped-for spell. Based entirely on graphics, Adventure 3 does away with the standard movement command and forces you to figure out from the pictures how to move from place to place. Commendable as this is, though, the technique has one major problem: The graphics are not detailed enough to make the choices clear. Furthermore, the help command (which exists in all the adventures) here reveals riddles, some of which are pretty obscure. I found Adventure 3 the most frustrating to play, but the graphics orientation makes the frustration worth enduring.

The manual begins by stating that "Shakespeare might turn in his grave at the very idea" of the project, but I doubt it. Macbeth *is a good effort, and one that the Bard himself would likely applaud.*

Adventure 4 represents Macbeth's attempt to stave off the final battle with Macduff. Another timed adventure, this section gives you 50 minutes to locate secret rooms and outwit the "Shakespeare Master." All the while you are in danger from the approaching army of Macduff, from a spreading fire, and from your own sense of panic. The timing heightens the adventure's tension, and it is far from easy to solve.

For experienced adventure gamers, *Macbeth* takes some getting used to. The parser—the portion of the program that interprets your typed commands—is small, and it can be frustrating. A good point, though, is that the parser demands—at certain points—Shakespearean wording, terms found in the play itself. Furthermore, there is no Save Game feature. With adventures 2 and 4 operating in realtime, occupying only 60 minutes and 50 minutes respectively, this is hardly a problem. But for the first adventure it would be very handy, if only to bypass the lengthy opening sequence.

Finally, I suspect that several players will find fault with the designer's demand that they actually know Shakespeare's text. A good edition of the play is included with the game, though, so this objection is easily answered. The answer comes, in fact, on the disk itself.

After you have finished the four adventures, and you know the text, you'll want to try the optional interviews. One interview asks you to play the role of Macbeth; the other, that of Lady Macbeth. In each, you are asked questions that test your knowledge of the play's content, themes, and particularly, your character. The questions range widely in difficulty, congratulating you if you are correct and guiding you to the proper scene in the text if you are wrong. Like the help command in the adventures, the interviews make full use of your understanding of Shakespeare's play.

Like the play itself, *Macbeth: The Computer Adventure* has a broad appeal. An exciting game, it will attract gamers who do not want to immerse themselves in a never-ending adventure. Playgoers will want to see what a home computer could possibly contribute to the mystique of an immortal play. And English teachers, especially those teaching high school, will find the game an excellent complement to the study of the play.

The manual begins by stating that "Shakespeare might turn in his grave at the very idea" of the project, but I doubt it. *Macbeth* is a good effort, and one that the Bard himself would likely applaud. Shakespeare blended innovation with tradition, and that is what this game is all about.

—*Neil Randall*

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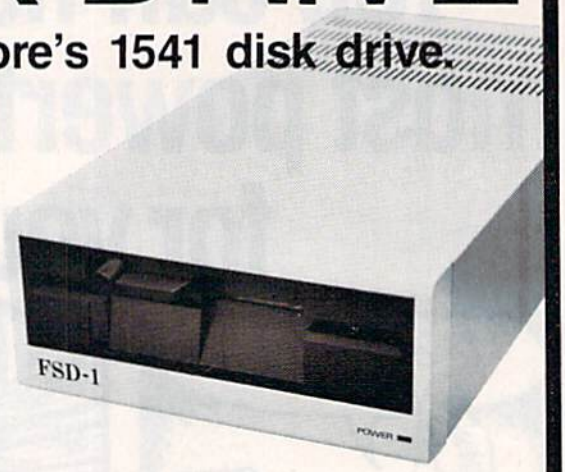

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PaperClip II

Probably the first thing you'll realize about *PaperClip II* is that it is more than a word processor. It is also a spelling checker, a telecommunications program, and a rudimentary database.

Yet the folks at Batteries Included did not stop there: Realizing that everyone does not own an 80-column RGB monitor, they include in the package their 128 monochrome adapter, which will give an 80-column monochrome display on monitors such as the Commodore 1702; and they also include an introductory subscription to CompuServe (so the telecommunications program shouldn't go to waste).

On a less happy note—from this reviewer's point-of-view—they also give you a dongle (a software key in the form of a small box that fits in one of the joystick ports), without which the program will not run. Don't lose it.

After the *PaperClip II* disk self-boots, the default mode is 80 columns × 23 lines in monochrome (white on black). Pressing F2 toggles in a pop-up menu of screen options that allow you to change the color of text and background as well as to set colors for emphasized text such as boldface, underline, and italics, or combinations of those. These settings can be saved to your working disk and thus become the new default display.

PaperClip II is a "post-formatting" word processor, using commands embedded within the text. While this adds power and speed, it means that you do not see your document as it will look when printed. For that, you must use the video preview option, which will show you your document down to the last footer and page number. Invoking this function also provides you with a count of the words in your document, a count of page numbers, chapter numbers, and a version number.

Because it is post-formatting, you can format your document at any time, before or after writing it. *PaperClip II* uses what we commonly call dot commands, but in this case they are checkmarks. Pressing the British pound sign puts a checkmark on your page, and what follows that can be either a command such as *lm15:rm15* (to set your left and right margins) or, if preceded by *cm:*, a comment line—a reminder which stays in the file, but which is not printed out.

In moving and deleting text, words, or blocks, *PaperClip II* is rather conventional, and the command sequences are easily remembered. These same moves will work on columns of text and columns of numbers.

Columns of text may also be sorted, and up to 16 fields may be defined for a sort. This gives the word processor some of the qualities of a database, for this kind of power would allow you to sort a conventional name-and-address list down to the finest detail. Create such a file and save it in sequential format, and you'll be able to use it with the mail-merge functions of *PaperClip II* to create your own form letters.

For columns of numbers, *PaperClip II* supports decimal tabs as an entity separate from the usual text tabs, making it easy to align numbers by decimal point. In addition to this, columns of numbers may be totaled by highlighting the column as if you were going to move it (negative numbers in the column should be preceded by a minus sign).

...better than most contemporary word processors...it also has a spelling checker with a 38,000 word dictionary that will accept new additions.

If these things were all that *PaperClip II* could do, it would still be better than most contemporary word processors. But it also has a spelling checker with a 38,000-word dictionary that will accept new additions. Should you need a larger dictionary, it is recommended that you copy *Spellpak* to a disk formatted in the 1571 drive, delete the printer files, and use that entire disk for a dictionary. In this way, you should have space for about 100,000 words. Like everything else in the program, checking spelling is fast. Though the maximum file size for *PaperClip II* is 999 lines, most documents will be checked in less than a minute.

Because the entire *PaperClip II* program is resident in memory, there is no need for disk access while it is being used. Once the program has been loaded, you may remove the *PaperClip II* disk and insert the *Spellpak* disk, keeping it ready for future use, or insert the formatted disk on which you'll save your data. *PaperClip II* is flexible.

It is also flexible in being able to work with either one or two disk drives, through a pop-up configuration window. In working with multiple drives, your choices include two single drives or a dual-drive unit. With two drives, I find it convenient to keep *Spellpak* in device 8 and the data disk in device 9. In this way, I feel as if I'm ready for anything.

There is yet more to *PaperClip II*: Burst routines are written to the disk in order to take advantage of the fast-load capabilities of the 1571 disk drive. (Because these will not work with the 1541, a separate fast-load routine helps those of you who have that drive—and *PaperClip II* can determine whether it's being used in a 1541 or a 1571 drive.) Though the loading of the program seems to take a while, you'll be impressed whenever you load a file you've created. Speaking of speed, we should also mention the cursor travel. In horizontal or vertical scrolling, it is probably just a bit faster than anything else you've seen. This makes other options faster: If you suddenly decide you should insert text near the top of the document, you can get there before you forget what you wanted to say.

For telecommunications, *PaperClip II* allows you to enter that mode from the word processor by pressing the No Scroll key. Once that is done, pressing F1 triggers a pop-up window in which you can select baud rate, parity, word length, stop bits, and all the other things that go into the making and using of a terminal program. With baud rates from 50 to 9600; XON/XOFF handshake; XMODEM, XMODEM CRC, and Punter protocols; full and half duplexing; and support for half a dozen popular modems, the *PaperClip II* terminal program is good enough to stand alone.

Printer files included on both sides of the disk cover almost every printer you've ever heard about. Should your particular printer by some chance not be included, you can write your own custom printer file and save it as a separate file. Before jumping into this, check your printer manual carefully and make certain it contains the required information. You are also advised that this is tedious work and that it may be easier to modify an existing file than to start one from scratch. However, most popular printers are already covered by *PaperClip II* anyway.

A word of warning: You may have to experiment to find the proper printer file. I use a Panasonic 1092 with the PIP interface, and, with every other program I've tried, it perfectly emulates the Commodore 1525 printer. Not so here. After 30 minutes of desperate experiments, the one that worked was the file for the Commodore MPS-1000—but in the IBM mode.

Printing options are set in the File Options window, the same window used for disk drive selection. Once you know these are correct, you may go back to the Screen Options window—where you set the colors—and save the entire configuration to your working copy of *PaperClip II*. While *PCII* supports boldface, italics, underlining, and super- and subscripting, it should be

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noted that the usefulness of these is dependent upon your printer/interface combination.

Like the program itself, the documentation goes to great lengths to be complete: There is a slim tutorial volume, the reading of which is designed to get you up-and-running almost immediately; a thicker reference volume which is to be used as various needs arise; and, since *PaperClip II* was being refined almost until the moment of release, a pamphlet of errata. In addition to this, you may find a "read.me" document on the disk itself that will apprise you of any changes made since the errata document was printed.

As I said at the outset, *PaperClip II* is extremely impressive, so much so that I may cast aside my fear of losing dongles.

—Ervin Bobo

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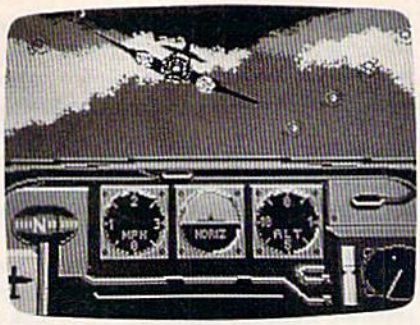
Ace Of Aces

Ace of Aces is not just a flight simulator. In fact, the skills necessary for successfully flying the missions in most computer flight simulators are not even needed for *Ace of Aces*. That doesn't mean that this Commodore 64 game is a snap. You'll probably find your hands full in the hostile skies flying missions over Europe during World War II.

... you'll notice that one of the other pilots in the briefing room is smoking a pipe, and the smoke drifts lazily toward the ceiling. And that's only the beginning. The graphic detail is superb on every screen.

As with other games from Accolade, you expect spectacular graphics and attention to detail, and that's just what you get through the various mission scenarios of *Ace of Aces*. Even on the opening screen, where you choose to fly a real mission or a practice mission, the high-resolution graphics go beyond what you might expect. As the Group Captain offers you a choice of flying a practice mission or taking to the skies for the real thing, you'll notice



that one of the other pilots in the briefing room is smoking a pipe, and the smoke drifts lazily toward the ceiling. And that's only the beginning. The graphic detail is superb on every screen.

Select the practice mission, and you'll be at the controls of a Mosquito fighter plane over the English Channel. Your mission: to seek out and destroy enemy aircraft, then return to your home base. Once you've practiced enough to become familiar with the characteristics of the aircraft, you can begin flying missions as you progress up the ladder to become the ace of aces. A word of warning: The real Mosquito was a notoriously sluggish and unresponsive aircraft. So it is in *Ace of Aces*.

You may choose to fly one of the missions offered by the Group Captain: defend London against V-1 Rockets, shoot down the bombers before they reach their targets, stop the P.O.W. train (before it reaches Berlin) and free the P.O.W.'s, or bomb the U-boats preparing for attacks in the North Atlantic.

Each scenario begins with a report from CID (Central Intelligence Division). The exact position of enemy targets is given, along with information on weather conditions, recommended weapons, and target sequence. After your intelligence briefing, the Mission Map is displayed, followed by the Bombardier's View of an empty bomb bay. You load the weapons and extra fuel to be carried for each mission. Should you carry rockets and cannon ammunition, keeping your Mosquito light and maneuverable? Or would it be better to arm with the heavier bombs to prepare for a bombing run?

Take the controls. Don't worry about takeoffs and landings. Each of the scenarios begins with your plane in flight over the English Channel. Each ends as you fly over your home base—that is, if you are fortunate enough to return to your home base. And don't get the idea it's going to be easy.

You still must control your aircraft. Looking to the front, you get a display of some of your instruments: the compass, airspeed indicator, artificial horizon, altimeter, radar, and intercom. Looking out either side window allows you to examine the flight engineer's instruments: fire-extinguisher controls, landing gear, trim adjust, flaps, throttle, boost, and other necessary gauges.

Check your position by selecting the Navigator's View. Your map reflects the information provided by intelligence sources, including the location of targets, enemy strengths, strategies, and destinations. Check the map often. You'll find the information changing, and a storm could pop up at any time to further disorient you.

Eventually, you'll encounter enemy fighters. You see spinning propellers and changing perspective as you try to position your plane for the kill. The Mosquito is sluggish, so take your time and watch your radar. Don't let them get behind you. To make matters more difficult, you'll probably be diving in and out of nearby cloud banks.

Finally, get the enemy plane in your sights and fire. A hit is rewarded with an explosion as the enemy plane disappears. Watch your fuel reserves and ammunition. Be sure you have enough fuel to return to your base to fly again.

You'll find enough of a challenge in *Ace of Aces* to keep you coming back for more, and the excellent graphics will have you wondering what comes next. To become the ace of aces, you must successfully complete each of the four kinds of missions. As your ability increases, save your high scores after each one. This is a game that certainly could become one of your favorites.

—George Miller

Accolade Software
20863 Stevens Creek Blvd.
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$29.95

Transformers: Battle To Save The Earth

"Transformers! More Than Meets the Eye!" Any fan of Hasbro's colorful, shape-changing robots—immensely popular items in the worlds of toys and cartoons—knows that phrase. In this unique Commodore 64 arcade-style game from Activision, Transformers have entered the world of software.

For those unfamiliar with the history of Transformers, this program provides a slide show narrated by an invisible "historian." You can skip this and go right to game play, but this presentation, one of several clever program features, is something you won't want to miss. Basically, the Decepticons (the bad guys) are out to deplete the Earth's energy sources and use them for their own evil purposes. The Autobots

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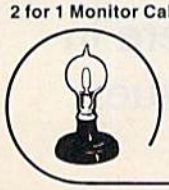

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(the good guys) are trying to stop them. You're in charge of the Autobots.

The screen which provides you with your basic information is the map. It tells you where the Autobots are, where they're headed, and where there is trouble. Based on this information, you deploy your Autobots, either individually or in preset patterns. When deployed singly, the robots transform *onscreen* and drive off to their destinations.

The transformations are authentic. The Autobots are good likenesses of their TV prototypes, and any youngsters who happen to be in the vicinity will probably jump up and down with excitement as they watch them transform.

There's a fascination in watching the robots transform to vehicles and back. And there's a feeling of being linked to the world the cartoon Transformers inhabit.

After sending out the Autobots, you connect your view screen and controls to a particular robot to do battle. Here's where real strategy enters in. Each robot is endowed with different abilities, a list of which can be reviewed onscreen. These talents help you determine which robot to shoot with and which one to send where.

On the scene of battle, you look out at the action, crosshairs at the ready. Decepticons swarm about, changing back and forth from robots to fighter planes and trying to conduct their evil ploys to steal the Earth's energy. As they succeed, their score mounts. As your Autobots thwart their plans, your score climbs. Whenever an Autobot takes a hit, realistic cracks appear on its view screen. If it is put out of commission, the view screen turns gray behind the cracks, and the robot must be sent to base for repair. You switch connections to another robot to continue battle.

At the end, the historian speaks again. In our game, it was to tell us that we failed to defeat the Decepticons—but there's always encouragement that we are still needed to continue the fight, followed by an onscreen hint to help us the next time.

The action can be furious. Surrounded by the never-ending, up-tempo version of the Transformers' musical theme, you must scheme and type instructions to deploy your Autobots strategically, connect to their view screens, and then use a little eye-hand coordination to shoot down the Decepticons with the joystick. There's a fascination in watching the robots transform to vehicles and back. And there's a feeling of being linked to the world the cartoon Transformers inhabit.

Arcade-lovers will enjoy the action and strategy, and, of course, little kids will enjoy the Transformer connection. Eight- to twelve-year-olds will probably enjoy both. However, because of the level of strategy involved, *Transformers*' biggest appeal will be to families where an older child or adult can do the playing cheered on by the younger Transformer fans.

Activision has taken a highly popular concept and story line and melded it with great shoot-em-up game play, applied the best audio and graphics techniques, and come up with a real winner: *Transformers*—more than meets the eye.

—David and Robin Minnick

Activision
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All programs listed in this magazine are available on the GAZETTE Disk. See details elsewhere in this issue.

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MAGIC MENU

Combined on this plug-in cartridge are 5 great programs creating a user-friendly machine from your Commodore 64 (or C-128 in the C-64 mode).

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MetaBASIC

The Programmer's Assistant

"MetaBASIC" for the Commodore 64 is probably the most popular programming utility we've ever published in the GAZETTE. *So popular, in fact, that we're publishing it again for those who may have missed it in the April 1985 issue. If you already have the program, you'll want to try "MetaBASIC Plus," which adds 11 valuable, new commands. In addition, the version of MetaBASIC published here includes some minor modifications to the original. And for Commodore 128 owners, we've included "MetaBASIC 128." Originally published in* COMPUTE!'s First Book Of Commodore 128, *the version appearing here includes some modifications and corrections, courtesy of Jim Butterfield.*

You've bought your first car and it runs well. But when you take it out on the highway, you're dismayed to find that it won't go faster than 45 miles per hour. What do you do?

If you take it to your favorite mechanic, he might give you three options: Remove the engine and replace it with a brand-new one. Or add some fancy turbo-charging fuel-injected doohickeys to the engine you already have. Or, without adding anything, you could tune it up, using a special machine that measures the engine's performance.

A BASIC Tuneup

You can add new programming commands to your 128 or 64 in three similar ways. The first is to toss out BASIC and create a whole new language (a more powerful engine) based on your ideas of what a programming language should do.

The second method, a language extension, keeps BASIC, but adds some new programming commands. You keep the BASIC engine, but add some additional parts which make it work faster or more efficiently.

The third way is like a tuneup which doesn't change the engine. You add direct-mode commands for debugging. This is not a new language or even an extension of BASIC, it's more properly called a *development system* or *writing/debugging tool.* The new commands you add cannot be used inside a program—they work only in immediate mode.

New languages and extensions have several advantages. But they also have a major drawback: You have to load the language or extension *before* you load the main program, or the program just won't work.

The nice thing about a development system like "MetaBASIC" is that it's there when you need it, during the time you're writing and tuning up a program. But once you've finished the program, you don't need MetaBASIC to run it—you can disconnect the tuneup machine.

Following are two versions of MetaBASIC—one for the 64, the other for the 128. Also, if you're using "MetaBASIC 64," be sure to read "MetaBASIC Plus" on page 77. "MetaBASIC 128" appears on page 79.

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MetaBASIC 64

Kevin Mykytyn

This utility will change the way you program. It adds 32 new debugging and testing commands to Commodore 64 BASIC, working by itself or in conjunction with a machine language monitor/assembler.

An Introduction To MetaBASIC 64

"MetaBASIC 64" commands use English mnemonics, so you don't have to memorize a lot of SYS numbers. And if you forget the new words, you can either refer back to this article or type HELP.

BASIC programmers have 12 new commands at their fingertips. For writing programs, AUTO, KEY, and UNNEW are available. You can use CHANGE, DELETE, FIND, RENUM, and VCHANGE to examine and alter programs. And DUMP, SPEED, TRACE, and TROFF help during debugging sessions. If you're writing in machine language, you can use some of the BASIC problem solvers, as well as MEMORY, MONITOR, NUMBER, and @. To control MetaBASIC 64, you have DEFAULT, HELP, INT, and QUIT. Disk commands include BSAVE, CAT, DLIST, ERR, MERGE, READ, RESAVE, SCRATCH, SEND, and START. Finally, there's LLIST if you have a printer, and TERMINAL if you have a modem.

Special Notes

Always type NEW after loading MetaBASIC 64. One feature that works automatically is LIST Pause. When you're listing a program, hold down CTRL, SHIFT, or the Commodore key to temporarily halt it. RUN/STOP–RESTORE is available in both program mode and direct mode. But if you want to interrupt any of the utilities like RENUM, use the RUN/STOP key by itself (not RUN/STOP–RESTORE).

The commands work only in direct mode; you cannot add them to programs. Also, you're limited to one MetaBASIC command per line (although you can still use multistatement lines inside your programs). Unlike ordinary BASIC commands, there are no abbreviations. You must type out the entire MetaBASIC 64 command. If it seems to be working incorrectly, make sure the syntax is correct.

Machine language (ML) programmers should remember that MetaBASIC 64 occupies memory locations $9000–$9FFF. The 4K which begins at $C000 is available for programs like *Micromon* or for your own ML programs. Be sure to load and run MetaBASIC 64 *before* loading any other programs.

Typing It In

MetaBASIC 64 is written entirely in machine language, and "MLX," the machine language entry program found elsewhere in this issue, is required to type it in. If you don't already have a copy of MLX for the 64, type it in and save it to tape or disk. Then, load MLX and run it. You'll first be asked for a starting address and an ending address for the data you'll be entering. For MetaBASIC 64, use the following values:

Starting address: 9000
Ending address: 9F67

Next, following the MLX instructions, enter the data for MetaBASIC 64 and save a copy.

To use MetaBASIC 64, follow these steps:

1. Load the program with a command of the form LOAD"METABASIC 64",8,1 (for disk) or LOAD"METABASIC 64",1,1 (for tape). Of course, you should replace METABASIC 64 with whatever name you used when you saved the MetaBASIC data
2. Type NEW
3. Activate the program with SYS 36864 (or SYS 9*4096)

The program uses 4K at the top of BASIC memory (which leaves you with 35K for your programs). The first thing it does is move the top-of-BASIC pointer down to protect itself from variables. After the SYS, it may seem that nothing has changed. But MetaBASIC 64 is active, and you now have 32 new commands to help you write and debug programs.

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MetaBASIC 64 Commands

Here's an alphabetical list of the new commands and how to use them, with examples. In the descriptions of syntax, MetaBASIC 64 commands and mandatory parameters appear in boldface. String parameters appear in *italics*. Optional parameters appear in normal printing.

If something is described as a disk command, it won't work unless you have a disk drive. However, some of the ML programming aids can be useful in BASIC and vice versa.

@

Use: ML programming (see also MEMORY)
Syntax: **@ starting address, number**, number...

This works like POKE, except it allows you to put a series of numbers into consecutive memory locations. For example, if you want to change border and background colors to white, you would use @53280,1,1. The first 1 goes into 53280, the second into 53281. If you add more numbers, separated by commas, they are POKEd into the next locations: 53282, 53283, and so on.

You can also use this in conjunction with MEMORY. First, display the contents of a series of locations using MEMORY. Then change the information there by putting @ before each line you want to change. Cursor over to the numbers you want to change, change them, and press RETURN.

AUTO

Use: BASIC programming
Syntax: **AUTO** starting line number, increment

AUTO can take some of the drudgery out of writing a program. It automatically numbers a program, starting at the first number and incrementing by the second. Separate the numbers with a comma. If you do not specify a starting line number or increment, numbering will start at 5 and increment by 5 for each additional line. If you specify only a starting line number, then that value will also be used for the increment. After you press RETURN over a line, the next number is automatically printed. The current line number can be changed by using the INST/DEL (delete) key and replacing it with another number.

Press RUN/STOP to escape from AUTO.

Example: **AUTO 100,10** starts at 100 and numbers by 10.

BSAVE

Use: disk command (see also RESAVE)
Syntax: **BSAVE *"filename"*, starting address, ending address + 1**

BSAVE (Binary SAVE) saves a chunk of memory to disk, from the starting address to the ending address. Put the program name inside quotation marks and use commas to separate the name, starting address, and ending address. It's important that you add one to the actual ending address. You can use this command to make backups of machine language programs, as long as you know the starting and ending addresses. BSAVE can also function to save sections of screen memory, custom character sets, or high-resolution screens.

The numbers should be in decimal. If you need to translate from hexadecimal to decimal, see NUMBER (below).

After you BSAVE the contents of an area of memory to disk, you can load the data back in with LOAD *"filename"*,8,1.

Example: **BSAVE"METABASIC 64",36864,40805** makes a backup of MetaBASIC 64. To copy the first five lines of screen memory (locations 1024–1223) to disk, **BSAVE "SCREEN",1024,1224**. Screen memory does not include color information—that is stored in color memory and would have to be handled separately.

CAT

Use: disk command (see also DLIST, READ)
Syntax: **CAT**

Anytime you want to look at the entire disk directory, use CAT (for CATalog). The BASIC program currently in memory will remain undisturbed. To see specific portions of the directory, see DLIST.

CHANGE

Use: BASIC programming (see also FIND, VCHANGE)
Syntax: **CHANGE @*old string*@*new string*@**, starting line, ending line
CHANGE @*"old string"*@*"new string"*@, starting line, ending line

CHANGE searches through the program in memory, changing every occurrence of the old string to the new one. The strings can be up to 30 characters long, and must be bracketed by the commercial at sign (@). All lines in which changes are made are listed to the screen.

The first format will change BASIC keywords and variable names. The second format should be used to change strings. If you omit the line numbers, CHANGE affects the whole program. If you want to change only one section, add the starting and ending line numbers, marked off by commas.

Example: **CHANGE @X@QQ@, 1,200** changes the variable X to QQ in lines 1–200. To change the name Charles to John throughout the program, **CHANGE @"CHARLES"@ "JOHN"@**.

DEFAULT

Use: MetaBASIC 64 command (see also INT, QUIT)
Syntax: **DEFAULT** border color, background color, text color, device number

When you press RUN/STOP–RESTORE, the screen always reverts to the default colors of light blue characters on a dark blue screen. And several commands like LOAD and SAVE default to tape. DEFAULT lets you change these values to whatever you prefer.

If you have a disk drive, you can change the device number to 8. If you have a second drive addressed as device 9 that you want to use for SAVEs, change the default to 9. If your 64 is hooked up to a black-and-white TV, change the character and background colors to a more readable combination.

Note: If you change the default device number to 1 (tape), you will be unable to use any of the new MetaBASIC disk commands. To disable the DEFAULT device number setting and go back to normal, use the MONITOR command below. Also, the TERMINAL command will not operate properly after DEFAULT has been used to change the device number. If you use DEFAULT, be sure to issue a MONITOR command before trying to use the TERMINAL command.

Example: **DEFAULT 1,1,0,8** changes the border and background colors to white, the character color to black, and the device number to 8. If you press RUN/STOP–RESTORE, you'll see black characters on a white background. And you'll be able to save to disk by typing just SAVE*"filename"* (without adding a ,8).

DELETE

Use: BASIC programming
Syntax: **DELETE starting line–ending line**

DELETE removes a range of lines from your program. Separate the starting line number from the ending number with a dash (–). Use this command with extreme caution, since it is impossible to recover deleted program lines.

Example: **DELETE 200–250** erases all lines with line numbers in the range 200–250, including lines 200 and 250.

DLIST

Use: disk command (see also CAT, READ)
Syntax: **DLIST *"filename"***

This command lists a BASIC program from disk to the screen, without affecting what's currently in memory. The program name must be enclosed in

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quotation marks. DLIST enables you to look at a program before using MERGE or SCRATCH.

It also allows you to read portions of the directory. DLIST "$0:A*" displays all disk files beginning with the letter A.

Example: **DLIST "BASICPROGRAM"** reads the file named BASICPROGRAM from disk and lists it to the screen.

DUMP
Use: BASIC programming
Syntax: **DUMP**

Use DUMP to examine the current values of all nonarray variables in a program. If the program is running, press RUN/STOP and type DUMP. To resume, type CONT.

ERR
Use: disk command
Syntax: **ERR**

ERR reads the disk drive error channel and displays the DOS error number and error message from the drive. Use it when the red light on the disk drive starts blinking to determine what caused the problem.

FIND
Use: BASIC programming (see also CHANGE, VCHANGE)
Syntax: **FIND @*string*@**, starting line, ending line
FIND @"*string*"@, starting line, ending line

This allows you to find any word, variable, or other string within a program. Each line containing the search string is listed to the screen. If you wish to search just one section of the program, add the starting and ending line numbers, separated by commas.

If you're trying to find BASIC keywords (like PRINT or REM), use the first format. It also works for variables and numbers. The second format should be used when you're looking for strings or items inside quotation marks.

Example: **FIND @A=@** searches for lines where variable A is defined.

HELP
Use: MetaBASIC 64 command
Syntax: **HELP**

Whenever you're unsure of the commands available in MetaBASIC 64, type HELP for a complete list.

INT
Use: MetaBASIC 64 command (see also DEFAULT, QUIT)
Syntax: **INT**

Some features of MetaBASIC 64 are interrupt-driven. If you reset the interrupts (with the MONITOR command), the function keys and the SPEED function may no longer work. INT puts the MetaBASIC interrupts back in place.

KEY
Use: BASIC programming (see also INT)
Syntax: **KEY key number, "*command or string*"**

This command adds a lot of flexibility to MetaBASIC 64, allowing you to define each of the eight function keys as a different command or string. (However, due to a minor bug in MetaBASIC, any definition you assign to the f8 key will be garbled whenever you use the RENUM command.) The command, up to ten letters in length for each key, must be inside quotation marks. There are two special characters: The back arrow acts as a carriage return, so you don't have to press RETURN after BASIC commands. Also, the apostrophe (SHIFT-7) counts as a double quotation mark.

Using KEY, you can load other utilities you may own and SYS to them with a tap of a function key. Or you can do a one-key RUN or LIST. If you want to permanently define the function keys and screen/text colors, you can use KEY and DEFAULT to set up the desired configuration, then save a copy of your customized version of MetaBASIC using BSAVE "METABASIC",36864,40960. The definitions will be saved along with the program.

If the interrupts are accidentally reset, you'll have to use the INT command to reenable the KEY function.

Examples:

KEY 1,"{CLR}LIST100-←" clears the screen and lists from line 100 on whenever you press f1 (the back arrow means RETURN will happen automatically). You can also abbreviate LIST with L SHIFT-I.

KEY 7,"DATA" could be useful with automatic line numbering (see AUTO) if you're writing a program with a lot of DATA statements. After entering a line, press RETURN and you'll see the next line number. Then press f7, and the word DATA automatically appears.

KEY 2,"VERIFY"'*'←" defines f2 to print VERIFY"*" plus a RETURN (note the apostrophes have been changed to quotation marks). If you've used DEFAULT to change the device number to 8, pressing f2 will automatically verify the program most recently saved to disk.

LLIST
Use: printer command
Syntax: **LLIST** starting line–ending line

This command lists a program, but the listing is sent to a printer rather than to the screen. Line numbers are optional. The syntax for LLIST is identical to the regular LIST. As written, LLIST does the equivalent of OPEN 4,4,4 to open a file for output to the printer. Some printers may require a different secondary address (the last number in the OPEN statement)—OPEN 4,4,7, for example. To change the secondary address, POKE the desired value into location 40341. If you are using a printer with a different device number (5, for example) or a plotter (device 6), you can change the device number for LLIST by POKEing the desired value into location 40339. To make the changes permanent, follow the instructions for saving a new copy of MetaBASIC given above in the discussion of the KEY command.

Example: **LLIST 10–20** to list lines 10–20 to the printer.

MEMORY
Use: ML programming (see also @)
Syntax: **MEMORY starting address–ending address**

You can examine any section of memory with this command. Use decimal numbers (not hex) for the starting and ending addresses. The values in memory are displayed, six bytes per line, in decimal. In addition, the equivalent ASCII characters are printed in reverse to the right (if there's no corresponding ASCII character, a period is printed).

If you omit the ending address, MEMORY 43 for example, you'll see the contents of two bytes (43 and 44). This makes it easier to look at two byte pointers—like 43 and 44 which point to the beginning of BASIC memory.

To change memory, you can use the @ command, described above.

Example: Enter **MEMORY 41374–41474** and you'll see the first few error messages in BASIC ROM (note that the ASCII value of the last character is always added to 128). Or, load a BASIC program, and type **MEMORY 2048–2148** to see how programs are stored in memory.

MERGE
Use: disk command
Syntax: **MERGE "*program name*"**

MERGE reads a program from disk, lists each line to the screen, and adds the line to the program in memory. If the programs have common line numbers, the program on disk takes precedence. Say both programs contain a line 250. The line 250 from the disk program will replace line 250 in memory.

Before using this command, you may want to use DLIST to make sure you're merging the right program. And if there are conflicting line numbers, you can use RENUM to renumber one of the two programs. If you want to merge just part of one program, use DELETE to eliminate the unwanted lines.

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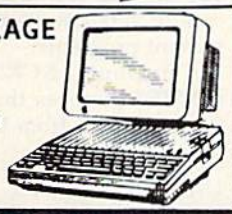

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MONITOR
Use: ML programming (see also INT)
Syntax: **MONITOR**

If you have a machine language monitor in memory, you can enter it with MONITOR (providing it is enabled when a BRK instruction is executed). To use MetaBASIC 64 with a monitor, you must load MetaBASIC 64, type NEW, and activate the program with SYS 36864. Next, load the monitor, type NEW, and SYS to the starting address for the monitor (which will set up the BRK vector to point to the monitor).

MONITOR does several other things, as well. It changes border, background, and text colors back to their default values (light blue on dark blue). It also resets the default device number and sets interrupts to normal, which disables the function-key definitions (see KEY) and SPEED command. You can get them back with the INT command.

NUMBER
Use: ML programming
Syntax: **NUMBER $hexadecimal number**
NUMBER decimal number

NUMBER allows you to convert back and forth between decimal and hexadecimal (hex). Put a dollar sign ($) in front of hex numbers. In addition, the number is displayed in low-byte/high-byte format (in decimal) and in binary (preceded by a percent sign).

Examples:
NUMBER $100
256
0 1
%100000000

NUMBER 34
$22
34 0
%100010

QUIT
Use: MetaBASIC 64 command
Syntax: **QUIT**

This resets all vectors and disables all MetaBASIC 64 commands. The one thing it does *not* do is restore the top-of-memory pointer. MetaBASIC 64 is still protected from BASIC. Reactivate MetaBASIC with SYS 36864 or SYS 9*4096.

READ
Use: disk command (see also CAT, DLIST)
Syntax: **READ *"sequential filename"***

READ allows you to examine sequential disk files. The information in the file is displayed to the screen, without altering whatever program is in memory.

In the rare case that you want to use the BASIC READ statement in direct mode (to see if all DATA statements have been read, for example), you can precede it with a colon.

RENUM
Use: BASIC programming
Syntax: **RENUM** starting line, increment

This command renumbers the entire BASIC program in memory (you can't renumber just part of the program). The first line of the renumbered program will be given the specified starting line number. If you omit the starting line number, the renumbered program will begin with line 10. The increment value specifies how much the starting value will be incremented for each succeeding line. If no increment value is provided, the value defaults to 10.

In addition to renumbering BASIC lines, all references in GOTOs, GOSUBs, ON-GOTOs, ON-GOSUBs, IF-THENs, and so forth are taken care of. One word of caution: GOTO is covered, but GO TO (with a space in the middle) is not. Use FIND before renumbering to look for occurrences of GO TO.

Example: **RENUM 100,20** renumbers a program, starting at line 100, counting up by 20s.

RESAVE
Use: disk command (see also BSAVE)
Syntax: **RESAVE *"filename"***

The save-with-replace disk command (SAVE "@:*filename*") first saves the program and then scratches the older version, so there must always be enough free space on the disk for the new version of the program. This can cause problems if you don't have enough available space. The save-with-replace command is also sometimes unreliable and should be avoided.

RESAVE reverses the order—first it scratches the old version of your program from disk, and then does a regular SAVE, solving both of the above problems.

SCRATCH
Use: disk command
Syntax: **SCRATCH *"filename"***

SCRATCH does the same thing as OPEN 15,8,15: PRINT#15,"S0:*filename*": CLOSE 15, but it's easier to type. It scratches a file from the disk. If you have just inserted the disk into the drive, it's a good idea to initialize it first (see SEND). You can use wildcards to scratch more than one program—SCRATCH "A*" will get rid of all files beginning with the letter *A*. However, you should use such commands with care to avoid accidentally deleting important programs.

Example: **SCRATCH "SPACEGAME"** removes the program named SPACEGAME from the disk.

SEND
Use: disk command
Syntax: **SEND *"command string"***

This is a convenient way to send disk commands to channel 15. SEND"I0" initializes the drive, SEND"V0" validates the disk, SEND "R0:*newname*=*oldname*" renames a disk file, and so on. For more information about disk commands, see the 1541 user's manual.

SPEED
Use: BASIC programming
Syntax: **SPEED number**

SPEED changes the rate at which the 64 prints to the screen. The number supplied with the command must be in the range 0–255. The higher the number, the slower the printing speed. Try typing SPEED 255 (the slowest you can make it) and then list a program. You can get back to normal with SPEED 0. If it doesn't work, try using INT (see above) to correct the interrupts.

SPEED is useful when you're using the TRACE command.

START
Use: disk command
Syntax: **START *"filename"***

If you forget where a machine language program begins, put the disk in the drive and use this command. This can help when you have forgotten the SYS that starts a program. If this command returns the value 2049, the file you are checking is probably BASIC rather than machine language (or it at least has a single line of BASIC, like *SpeedScript*).

Example: **START "METABASIC 64"** should display 36864 on the screen.

TERMINAL
Use: modem command
Syntax: **TERMINAL**

If you own a Commodore modem (and it's plugged into your 64), TERMINAL transforms your computer into a 300 baud "dumb" terminal you can use to talk to standard-ASCII bulletin boards or information services like CompuServe. You can't change any of the default parameters, nor can you upload or download text or programs.

To return to BASIC, press the £ (English pound) key; do not press RUN/STOP–RESTORE. A note of caution: Memory locations 52736–53247 ($CE00–$CFFF) are used for buffers, so any program in this area will be overwritten.

TRACE
Use: BASIC programming (see also TROFF)
Syntax: **TRACE**

If you're debugging a BASIC program, TRACE helps you see what's happening. As each line is executed, its line number is printed on the screen. Use the SHIFT or CTRL keys to temporarily halt the program. SPEED controls the speed of execution, and TROFF turns off TRACE.

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TROFF
Use: BASIC programming (see also TRACE)
Syntax: **TROFF**

This command turns off the TRACE function.

UNNEW
Use: BASIC programming
Syntax: **UNNEW**

You may never need this command, but it's nice to have it available. If you accidentally type NEW and you want to retrieve the program, use UNNEW to get it back.

VCHANGE
Use: BASIC programming (see also CHANGE, FIND)
Syntax: **VCHANGE @*old string*-@*new string*@**, starting line, ending line

VCHANGE @"*old string*-"@"*new string*"@, starting line, ending line

VCHANGE (Verify CHANGE) works just like CHANGE (see above), except you get to choose whether or not each change is made. Each line containing the old string is displayed, with each occurrence of the string marked with a filled-in circle. If you press Y, the change is made. Press N if you want to skip to the next occurrence of the old string.

See program listing on page 99.

MetaBASIC Plus

John Brox Shadle

"MetaBASIC Plus" is a companion program to "MetaBASIC 64." It adds 11 new commands and modifies HELP to print the new MetaBASIC Plus commands in addition to the original MetaBASIC commands. To create MetaBASIC Plus, you must have a working copy of MetaBASIC 64. If you don't already have a copy, see the "MetaBASIC 64" article on the preceding pages. After you've entered MetaBASIC 64, return to this article for instructions for adding the enhanced commands.

Creating MetaBASIC Plus

MetaBASIC Plus is a collection of routines to add new commands to MetaBASIC 64. Like the original program, the MetaBASIC Plus routines are written in machine language and must be entered using the "MLX" machine language entry program found elsewhere in this issue. When you run MLX, you'll be asked for a starting address and an ending address for the data you'll be entering. For MetaBASIC Plus, use the following values:

Starting address: 8936
Ending address: 8F15

After you've entered all the data for MetaBASIC Plus and saved a copy, you're ready to create a new copy of MetaBASIC that includes the additional commands. Follow these steps carefully:

1. Load MetaBASIC 64 using a command of the form LOAD "METABASIC 64",8,1 (for tape, use ,1,1 instead).
2. Load MetaBASIC Plus using a command of the form LOAD "METABASIC PLUS",8,1 (again, use ,1,1 for tape).
3. Enter a NEW command to reset memory pointers.
4. Type SYS 35126 and press RETURN. This calls a short (19-byte) routine at the beginning of MetaBASIC Plus which patches MetaBASIC Plus into the original MetaBASIC and activates the combined programs.

Now you're ready to save a copy of the new version of MetaBASIC, which has the additional MetaBASIC Plus commands. Before doing so, however, you might want to use the KEY command to set up some default function-key definitions that will be enabled whenever you activate the new MetaBASIC. When you're ready to save a new copy to disk, simply use a command of the form

```
BSAVE "METABASIC+",35145,40960
```

For tape, the procedure is a bit more complicated. Use the following statements:

```
POKE 43,73: POKE 44,137: POKE 45,0:
  POKE 46,160: SAVE "METABASIC+"
  ,1,1
```

Once you've saved a copy of the combined file, load and activate the new version of MetaBASIC just like you did the old version, with LOAD "METABASIC+",8,1 (or ,1,1) and SYS 36864 (or SYS 9*4096).

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MetaBASIC Plus Commands

Here's a rundown on the new commands.

CURSORFREE
Use: BASIC programming (see also CURSORPRINT)
Syntax: **CURSORFREE**

Disables quote mode until the CURSORPRINT command is given or until RUN/STOP–RESTORE is pressed.

CURSORPRINT
Use: BASIC programming (see also CURSORFREE)
Syntax: **CURSORPRINT**

Re-establishes quote mode, reversing the effect of the CURSORFREE command.

END
Use: BASIC programming
Syntax: **END**

Prints the last memory location used by the BASIC program currently in memory.

FREEMEM
Use: BASIC programming
Syntax: **FREEMEM**

Prints the number of bytes available without performing any garbage collection.

MAKEDATA
Use: BASIC programming
Syntax: **MAKEDATA starting address, ending address**

Converts the contents of the specified area of memory into DATA statements. Any BASIC program in memory will be erased by this statement. MAKEDATA can convert a maximum of 4352 bytes. The DATA statements created will be numbered starting at line zero, and will include 17 data items per line. After creating the DATA statements, you can use the MetaBASIC RENUM command to renumber the lines, then use the MERGE command to add the DATA lines to another program.

POINTER
Use: BASIC programming
Syntax: **POINTER address**

This is especially useful for checking BASIC's pointers. This command does the equivalent of PRINT PEEK(address) +256*PEEK(address + 1).

RESET
Use: MetaBASIC Plus command
Syntax: **RESET**

Turns off MetaBASIC Plus. This is the same as MetaBASIC 64's QUIT, except that all of the memory used by MetaBASIC is deallocated. MetaBASIC can be turned back on (with SYS 36864 or SYS 9*4096) if no files have been loaded and no new strings have been created.

SCREEN
Use: printer command
Syntax: **SCREEN**

Performs a screen dump, sending whatever is on the screen to the printer. This works in normal text mode only and will not dump screens with redefined characters or high-resolution bit-mapped screens.

The SCREEN command routine does the equivalent of OPEN 1,4,255. Some printers may require a different secondary address—7 is common. To change the secondary address used by SCREEN, POKE location 35369 with the desired secondary address value, then BSAVE a new copy of MetaBASIC using the command in the instructions above. If you want to change the device number used by SCREEN to a value other than 4, POKE the desired value into location 35367 and BSAVE a new copy.

SUPERPEEK
Use: ML or BASIC programming
Syntax: **SUPERPEEK starting address, number**

Creates a window at the top of the screen which shows the contents of an area of memory as decimal values. The display begins with the starting address and includes the specified number of bytes (the number value must be no larger than 50). If you run a BASIC or machine language program while the SUPERPEEK window is active, the memory contents will continue to be displayed as the program runs. Thus, you can see if the program changes the contents of any of the displayed locations. Press RUN/STOP to see the character code equivalents of the numbers. The INT command turns off SUPERPEEK.

TRAP
Use: BASIC programming (see also UNTRAP)
Syntax: **TRAP**

Turns on extended error analysis. When an error occurs during a program RUN, the line causing the error is listed, with the word *ERROR* in reverse video at the point where the error occured. Error trapping doesn't work in direct mode; it only functions within a program. Use UNTRAP to turn off extended error analysis.

UNTRAP
Use: BASIC programming (see also TRAP)
Syntax: **UNTRAP**

Disables extended error analysis to cancel the effect to the TRAP command.

See program listing on page 101.

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MetaBASIC 128

Kevin Mykytyn

"MetaBASIC 128," will change the way you program. It adds 11 new debugging and testing commands to BASIC 7.0—and these commands are instantly at your fingertips for programming sessions.

Using MetaBASIC 128

MetaBASIC 128 commands use English mnemonics, so you don't have to memorize a lot of SYS numbers. Once MetaBASIC 128 is active, you'll have these 11 additional commands: AID, CHANGE, DEFAULT, DLIST, FIND, MERGE, QUIT, READ, RESAVE, START, and UNNEW.

The commands work only in direct mode; you cannot add them to programs. Also, you're limited to one MetaBASIC command per line (although you can still use multistatement lines inside your programs). Unlike ordinary BASIC commands, there are no abbreviations. You must type out the entire MetaBASIC 128 command. If you wish to stop the execution of a command, press the RUN/STOP key (*not* RUN/STOP–RESTORE). If it seems to be working incorrectly, make sure the syntax is correct.

Machine language programmers should remember that MetaBASIC 128 occupies memory locations $1300–$18BF (4864–6335) and uses zero-page locations $FB–$FE (251–254) and $AC–$AF (172–175).

Typing It In

MetaBASIC 128 is written entirely in machine language, and "MLX," the machine language entry program found elsewhere in this issue, is required to type it in. Be sure to read and understand MLX before typing in MetaBASIC 128. After loading and running MLX, you'll be asked for a starting and ending address. The correct values for MetaBASIC 128 are:

Starting address: 1300
Ending address: 188F

Next, following the MLX instructions, type in MetaBASIC 128 and save a copy.

To use MetaBASIC 128, follow these steps:

1. For disk, load the program with a statement of the form BLOAD "METABASIC128". For tape, use LOAD"METABASIC128",1,1. After a tape load, you must also type NEW to reset memory pointers.
2. Type SYS 4864 to activate MetaBASIC 128.

After the SYS, it may seem that nothing has changed. But MetaBASIC 128 is active, and you now have 11 new commands to help you write and debug programs.

MetaBASIC 128 Commands

Here's an alphabetical list of the new commands and how to use them, with examples. MetaBASIC 128 commands and mandatory parameters appear in boldface. String parameters appear in italics. Optional parameters appear in normal print.

If something is described as a disk command, it won't work unless you have a disk drive. However, some of the ML programming aids can be useful in BASIC, and vice versa.

AID

Syntax: **AID**

Lists all available MetaBASIC 128 commands.

CHANGE

Syntax: **CHANGE @***old string***@***new string***@**, starting line, ending line
CHANGE @*old string***@***new string***@**, starting line
CHANGE @*old string***@***new string***@**,,ending line
CHANGE /*old string***/***new string***/**, starting line, ending line
CHANGE /*old string***/***new string***/**, starting line
CHANGE /*old string***/***new string***/**,,ending line

See also FIND.

CHANGE searches through the program in memory, changing every occurrence of the old string to the new one. The strings can be up to 30 characters

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long and must be bracketed by the commercial at sign (@) or the slash (/). All lines in which changes are made are listed to the screen. The format with @ is the tokenized form and should be used to change BASIC commands and variable names. The ASCII form (the slash format) is useful when you want to change a word in a string without changing keywords. For example:

CHANGE /PRINT/WRITE/

changes all occurrences of the word *PRINT* within quotation marks without changing any PRINT statements.

Use the slash format to change anything inside quotation marks or after a REM statement; use the at sign format to change anything not inside quotation marks or after a REM statement. Remember that mathematical operators within programs such as +, −, *, /, >, <, and = are stored as tokens, not characters, so you must use the @ format when searching for one of these.

If you omit the line numbers, CHANGE affects the whole program. If you want to change only one section, add the starting and ending line numbers, marked off by commas.

Example: **CHANGE @X@QQ@ „200** changes the variable X to QQ in all lines up to and including 200. To change the name Charles to John throughout the program, **CHANGE /CHARLES/JOHN/**.

DEFAULT
Syntax: **DEFAULT border color, background color, text color**

See also QUIT.

When you press RUN/STOP–RESTORE, the screen reverts to the default colors light green and black. DEFAULT lets you change these values to whatever you prefer. If your 128 is hooked up to a black-and-white TV, change the character and background colors to a more readable combination. The border- and background-color changes affect only the 40-column screen; the text-color change affects both the 40- and 80-column displays.

To disable DEFAULT (and go back to normal colors), use the QUIT command.

Example: **DEFAULT 1,1,0** changes border and background to white, and characters to black. If you press RUN/STOP–RESTORE, you'll see black characters on a white background.

DLIST
Syntax: **DLIST** *"filename"*

See also READ.

This command lists a BASIC program from disk to the screen without affecting what's currently in memory. The program name must be enclosed in quotation marks. DLIST enables you to look at a program before using MERGE or SCRATCH.

Example: **DLIST "BASICPROGRAM"** reads the program file named BASICPROGRAM from disk and lists it to the screen.

FIND
Syntax: **FIND @*string*@**, starting line, ending line
FIND @*string*@, starting line
FIND @*string*@„ ending line
FIND /*string*/, starting line, ending line
FIND /*string*/, starting line
FIND /*string*/„ ending line

See also CHANGE.

This allows you to find any word, variable, or other string within a program. Each line containing the search string is listed to the screen. If you wish to search just one section of the program, add the starting and ending line numbers, separated by commas.

If you're trying to find BASIC keywords (like PRINT or REM), use the first format with the @ symbols. It also works for variables and numbers. The second format should be used when you're looking for strings or items inside quotation marks.

Example: **FIND @A=@** searches for lines where variable A is defined.

MERGE
Syntax: **MERGE** *"program name"*

MERGE reads a program from disk, lists each line to the screen, and adds the line to the program in memory. If the programs have common line numbers, the program on disk takes precedence. Say both programs contain a line 250. The line 250 from the disk program will replace line 250 in memory.

Before using this command, you may want to use DLIST to make sure you're merging the right program. And if there are conflicting line numbers, you can use RENUMBER to renumber one of the two programs. If you want to merge just part of one program, use DELETE to eliminate the unwanted lines.

QUIT
Syntax: **QUIT**

This resets all vectors and disables all MetaBASIC commands. MetaBASIC is still protected from BASIC. Reactivate MetaBASIC with SYS 4864.

READ
Syntax: **READ** *"filename"*

See also DLIST.

READ allows you to examine sequential disk files. The information in the file is displayed to the screen, without altering whatever program is in memory.

In the rare case that you want to use the BASIC READ statement in direct mode (to see if all DATA statements have been read, for example), you can precede it with a colon to distinguish it from MetaBASIC 128's READ command.

RESAVE
Syntax: **RESAVE** *"filename"*

The save-with-replace disk command (SAVE "@0:*filename*") first saves the new version of the program and then scratches the older version, so there must always be enough free space on the disk for both versions. Thus, the command can cause problems if you don't have enough available disk space for the new version. The save-with-replace command also has other problems and is best avoided.

RESAVE reverses the order—first it scratches the old version of your program from disk, and then it does a regular SAVE, solving both of the above problems.

START
Syntax: **START** *"filename"*

If you forget where a machine language program begins, put the disk in the drive and use this command. This can help when you have forgotten the SYS that starts a program. If the command returns a value of 7169, the program is probably BASIC or a machine language program with a single BASIC line so that it starts with RUN rather than SYS.

Example: **START "METABASIC128"** should display 4864 on the screen.

UNNEW
Syntax: **UNNEW**

You may never need this command, but it's nice to have it available. If you accidentally type NEW and you want to retrieve the program, use UNNEW to get it back.

See program listing on page 102.

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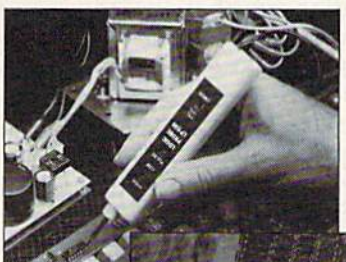

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Mastering 128 Sound And Music

Part 5

D. C. Holmes

In this final series installment, the author gives some advice on different methods of transcribing music that is written for more than three voices. Included is a program that demonstrates the unique sound of each method.

Throughout this series, I've tried to emphasize the simplicity with which the 128 can be programmed to play music with the statements in BASIC 7.0. I hope that those of you who had previously avoided the SID chip have now begun to add music to your programs. Whether it's a snippet of a tune to accompany a sprite animation, or a longer work to accompany your title screen, music adds a professional touch to your programs.

Back in the November 1986 issue, I discussed in detail the process of translating a song from sheet music to character strings for the PLAY statement. In a piece such as the Bach minuet, where there are only two or three notes playing at a time, the task of deciding which notes to play with each voice is fairly straightforward—you have enough voices to play every note that's written. But this isn't true for a work such as Moussorgsky's "The Great Gate of Kiev," which starts out as shown in "Full Score."

These four bars illustrate one of the greatest challenges in arranging music for the 128. You have eight notes to play, but only three voices with which to play them. How do you decide which notes to play and which to leave out? *COMPUTE!'s 128 Programmer's Guide* offers this good advice (page 193):

> *If any chord (vertically aligned set of notes) contains a note that is doubled—played in more than one octave at once—chances are you can eliminate one of the doubled notes without serious damage to the music.*

Using this rule simplifies our selection of notes, but we are still left with some choices. Some of the chords contain eight notes, and most of the notes are doubled, some more than once—so which octave of the doubled note do you use? Even after the doubled notes are eliminated, some chords will still contain more than three notes—so which of these notes do we eliminate? There are no clearcut answers to these questions. Many different combinations are possible, and each sounds a little bit different from the others. This is where you exercise your personal style as an arranger.

In this month's program, "Kiev," I've tried to illustrate several different approaches to arranging the same tune. While these are all based on the same music, each version has a unique sound. You might like one arrangement better than another, or feel that one style lends itself more to the effect you wish to create in your programs, but no one orchestration technique works best for all applications. These are all reasonable approaches to the problem of which notes to play and which to eliminate.

Generally speaking, you should never eliminate the notes that carry the melody. One of the simplest 128 arrangements of "The Great Gate of Kiev" is one where voice 1 plays the melody (in this case, the highest written note in the score), voice 3 plays the lowest written note in the score, and voice 2 fills the chord with the highest remaining note which doesn't double voice 1 or voice 3. Thus the first four bars look like "Arrangement 1." This is the arrangement played when you press the 1 key.

In any musical ensemble, the bass instruments usually play the *tonic* note of a chord (E♭ is the tonic note of the E♭ chord, B♭ is the tonic note of the B♭ chord, and so on), or the *fifth* of the chord (the note four steps above the tonic—B♭ for the E♭ chord, F for the B♭ chord, and so on). In the second arrangement, this is the part I've given to voice 3. Voice 1 again plays the melody, and voice 2 fills the chord with the highest remaining note which doesn't double voice 1 or voice 3. I think that this sounds stronger than the first arrangement, but of course, any such judgment is purely subjective. Decide for yourself how you think the difference sounds. The first four bars are in "Arrangement 2." This is the arrangement played when you press 2.

One of the most frequently used arranging techniques for 64 games and educational software is one in which voice 1 plays the melody and voice 2 plays the same rhythm, using the next highest note in the score. This gives a "tight" sound, perhaps not as full as the previous two examples. In Arrangement 3, voices 1 and 2 play the two highest notes in the score, and voice 3 fills the chord with the lowest remaining note which doesn't double voice 1 or voice 2. The first four bars are in "Arrangement 3." This is the arrangement played when you press 3.

The first three arrangements have been basically *choral* orchestrations—a progression of chords, without any runs or moving notes. When the orchestra plays "The Great Gate of Kiev," the driving

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beat is provided by the percussion section. We can make drum and cymbal sounds with the SID chip, but we have to tie up one or more voices to play them simultaneously with the chords, and most times I just don't want to "waste" a voice on a drum line. The final two examples illustrate a couple of solutions to this dilemma, using voices to play the necessary harmonic notes and supply the beat at the same time.

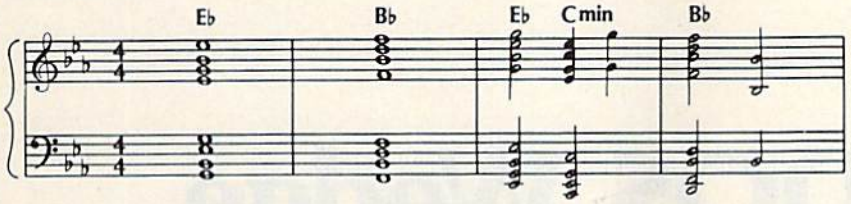
Arrangement 4 takes the third arrangement this one step further: voices 1 and 2 again play the two highest notes in the score, but voice 3 not only fills the chords; it also supplies the beat with a running bass countermelody. (See "Arrangement 4.") This is the arrangement played when you press 4.

Another pattern commonly used in 64 software is what I call the "oompah" pattern. Voice 1 carries the melody, and voices 2 and 3 play a bass-chord-bass-chord line. This is the style I used in "American Patrol" in October. Voices 2 and 3 provide the harmonic fill, as well as the beat. The first four bars look like "Arrangement 5." This is the arrangement played when you press 5 (my apologies to Moussorgsky for this one!).

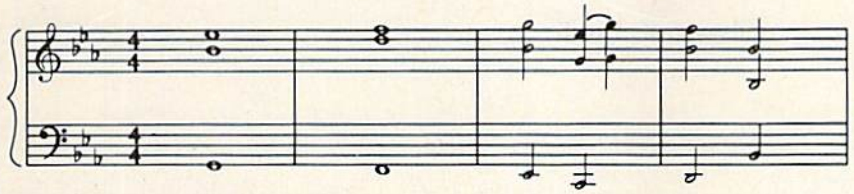
These examples should give you some guidelines to use as you transcribe standard sheet music or your own original compositions to computer language.

See program listing on page 97.

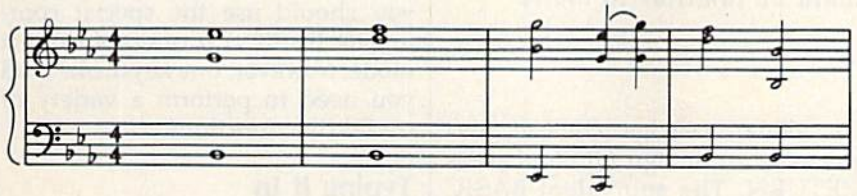
Full Score



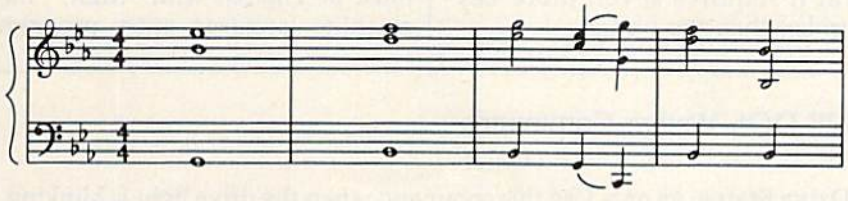
Arrangement 1



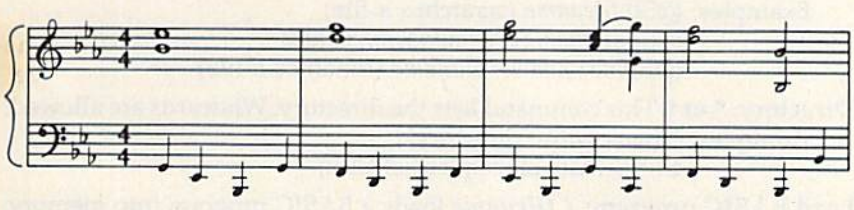
Arrangement 2



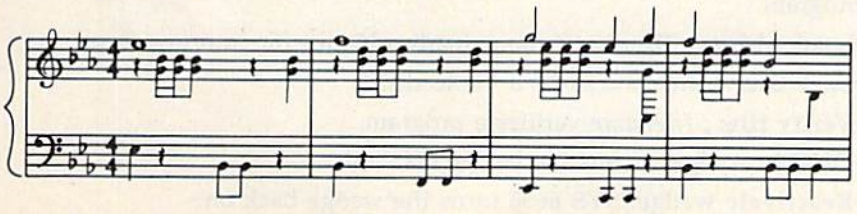
Arrangement 3



Arrangement 4



Arrangement 5



Gazette Disk Bonus

Editor's Note: To bring together most of the techniques discussed over the past five issues in this series, the author has written a Commodore 128 version of Tchaikovsky's 1812 Overture. *Because of its considerable length, we are prohibited by space from publishing the program in the magazine. However, it will appear on this month's* Gazette Disk. *The author offers these comments about the* 1812 Overture: *"This was an ideal piece to use in conjunction with this article—there are several main melodic themes introduced and repeated throughout the work. But the theme is never repeated in quite the same form—the accompaniment styles are varied, the melody may be carried in a different voice each time you hear it, and other general embellishments make this classic an extravaganza. Keep your ears open for examples of the different arranging styles. Just as some music lovers sit in the audience with the orchestral score in their lap to follow along, it may be instructional for you to print out the listing and follow it as you run this program."*

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128 DOS Wedge

Shawn K. Smith

This utility makes it easier for 128 users to communicate with their disk drive—the 1541 or 1571. Similar to DOS wedges for the VIC and 64, its commands should be familiar to many Commodore owners.

Commodore disk drives are intelligent peripherals. They have their own RAM, ROM, and CPU. The computer gives commands to the disk drive, and the drive decides how to carry them out.

Unfortunately, the interface between the user and disk drive isn't always friendly. To aid owners of the VIC and 64 (and the 128 in 64 mode), Commodore supplies the VIC-20 Wedge and the C-64 Wedge on the *Test/Demo* disk that comes with the 1541 disk drive. Unfortunately, no wedge has been made available for the Commodore 128. Of course, BASIC 7.0 has new disk commands, but these are longer than the DOS wedge equivalents and are unfamiliar to people who have previously used the wedge on the 64 or VIC.

Simple And Efficient

To demonstrate the efficiency of the DOS wedge, let's look at a quick example. Assume that the light on your disk drive is blinking, and you want to read the error channel. Without the wedge, you must type this (in BASIC 2.0):

```
10 OPEN1,8,15:INPUT#1,E,D$,T$,
   S$:CLOSE1:PRINT E;D$;T$;S$
```

With the wedge activated, simply type an at sign (@) and press RETURN. The equivalent BASIC 7.0 command is PRINT DS$. This is preferable to the BASIC 2.0 version, but it requires seven more keystrokes than the wedge.

"128 DOS Wedge" works only in direct mode. If you need to access the drive from within a program, you should use the special commands BASIC 7.0 offers. In direct mode, however, one keystroke is all you need to perform a variety of useful disk functions.

Typing It In

Because 128 DOS Wedge is written entirely in machine language, it must be entered with "MLX," the machine language entry program

128 DOS Wedge Commands

•**Drive Status: @ or >** Use this command when the drive light is blinking.

•**Send Command: @*command* or >*command*** This sends a command to the disk drive.

Examples: @S0:*filename* (scratches a file)
@S0:*filename1,filename2,filename3*
@R0:*newname=oldname* (renames a file)

•**Directory: * or $** This command lists the directory. Wildcards are allowed.

Examples: * (lists entire directory)
$*=S (lists all sequential files)

•**Load BASIC program: / *filename*** loads a BASIC program into memory.

•**Load and run BASIC program: ↑ *filename*** loads and runs a BASIC program.

•**Load a binary file: % *filename*** loads a binary file into memory.

•**Save file: ← *filename*** saves a file to disk.

•**Verify file: ; *filename*** verifies a program.

•**Disable wedge: !** turns the wedge off.

•**Reactivate wedge: SYS 6656** turns the wedge back on.

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found elsewhere in this issue. Be sure to read and understand the instructions for using MLX before you begin entering the data for 128 DOS Wedge. When you run MLX, you'll be asked for a starting address and an ending address for the data you'll be entering. The correct values for 128 DOS wedge are:

Starting address: 1A00
Ending address: 1AEF

After you finish typing in the data, be sure to save a copy before you leave MLX. When you're ready to use the wedge program, you can load and execute it using:

```
BLOAD"filename":SYS 6656
```

or

```
BOOT "filename"
```

Substitute the filename you used when you saved the 128 DOS Wedge data for *filename* in the commands above.

With the wedge in memory, you can save a copy of it to another disk with this statement:

```
BSAVE"filename",P6656 TO P6896
```

Now, with 128 DOS Wedge loaded and activated, you have a powerful disk management system. (See the table for a list of available commands and explanations.)

128 DOS Wedge is stored in the free RAM area at locations $1A00–1AED, so it doesn't interfere with BASIC. However, any other ML program or data stored in this area will cause conflicts. The program also uses the RS-232 input buffer (at $0C00) for analyzing command strings.

If you need to disable the wedge, use the ! command. The wedge can be reactivated with SYS 6656.

Following is a list of 128 DOS Wedge default settings.

- All loads, saves, verifies, and directory listings are directed to device 8 (U8), drive 0 (D0).
- All disk commands (@ or >) default to device 8. The drive number (if applicable) should be supplied by you.
- The % command loads a file beginning at the address from which it was saved. If you want to load a binary file into a bank other than zero, use BASIC's BLOAD command instead.

See program listing on page 99.

Data Formatting On The 64

Daniel G. Flanagan

These short programs offer some useful data-formatting techniques for rounding and right-justification of numbers.

If you've ever had a program tell you "Your payments will be $37.983745," you know how useful formatting routines can be. Some BASICs, including BASIC 7.0 in the Commodore 128, have a PRINT USING statement that allows you to format output in any form you like. The Commodore 64's BASIC 2.0 doesn't have the PRINT USING statement, but you can add subroutines for custom formatting. The routines included here can be used in your programs to round and right-justify your numbers.

The standard technique used to round floating-point data to two decimal places is

```
N=INT(V*100+.5)/100
```

where V holds the floating-point number. This works, but trailing zeros are lost in the process. For example, performing this operation on 127.1002 yields 127.1 instead of 127.10.

To solve this problem, a statement similar to the following is often added:

```
N$=STR$(N+(.001*SGN(N)))
N$=LEFT$(N$,LEN(N$)-1)
```

This procedure nearly always works. But a case in which it fails is the number 837.149. The result is 837.15100. The computer makes this strange mistake because it does math in a different number base than we do. It's really an error of translation. To avoid this problem, I devised a routine which uses string manipulation instead of arithmetic operations to fix the decimal format.

Rounding It Right

The subroutine in "Demo 1" (Program 1) rounds numbers correctly. The program produces a series of random floating-point numbers in the range −1000 to +1000 and passes them to the subroutine for formatting. The raw and formatted values are printed side by side for your inspection. This subroutine processes numbers in the range −9999999.99 to +9999999.99.

To use this subroutine in your own programs, add lines 5000–5090 to the end of your program. Then, at the beginning of the program, add a line which defines the three constants like this:

```
10 C1=.5:C2=1:C3=100
```

Then, set the variable V to the number that you want rounded. Enter the subroutine with GOSUB 5000. When the control returns to the main program, the formatted number is in the string variable N$.

Aligning Columns

We've solved the rounding problem, but our columns are still ragged. "Demo 2" (Program 2) prints out 80 random numbers in nice, neat columns on your screen or printer. The rounding routine begins at line 5000, and the right-justification is done in line 580.

See program listings on page 99.

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BASIC for beginners

The IF-THEN Statement

Larry Cotton

Last month we left off with a program that prints diagonal character patterns on your screen. Here's a quick explanation of that program:

Lines 10 and 40 both clear the screen. Line 20 defines S$ as one space. In line 30, the user is asked to type some characters, which are stored in the computer as C$.

Lines 50–90 contain two nested FOR-NEXT loops. The first one is the T loop, which forms C$ from whatever the user typed plus a space (S$) and prints the result. The second one, on the inside, is the D loop—it's a simple time-delay loop which slows down the printing of the diagonal pattern. Line 100 contains a GOTO, which we haven't discussed yet—it just sends control back to line 100 over and over until you press the RUN/STOP key. This technique keeps the word READY and the cursor from showing.

Look closely at line 50. When C$ is typed in, it consists of up to 16 characters. But as the program goes through the T loop 23 times, a space (S$) is added to C$ each time, which places the message progressively further from the left edge of the screen, forming the diagonal pattern. For those who must have a name for everything (and I'm one of them), adding strings is called *concatenation*.

Well, the subject for this month isn't strings, so let's take our first look at the BASIC statement IF-THEN, which ranks right up there with FOR-NEXT in usage. We'll also mention GOTO (again) and END.

IF-THEN gives BASIC the power to make decisions: IF such and such a condition exists, THEN do something. Here's a simple case:

```
10 A=5
20 IF A=5 THEN PRINT "YEP"
30 IF A=6 THEN PRINT "NOPE"
```

You don't need to type the spaces in these program lines, but they do make the statements easier to read. Each THEN and the following BASIC statement (like PRINT "YEP") must be on the same line as its corresponding IF.

When you run this program, the variable A is given a value of 5 in line 10. Then an IF is encountered in line 20. The computer looks up the value of A. It's 5, so the word YEP is printed on the screen. Control then goes to line 30, where another IF is encountered and the value of A is compared with 6. Since it's not 6, NOPE doesn't get printed.

IF-THEN can also be used to test strings.

```
10 A$="COMMODORE": B$="NOT
   COMMODORE"
20 IF A$="COMMODORE" THEN
   PRINT A$
30 IF A$="APPLE" THEN PRINT B$
```

Before you run the program, try to guess what it does.

It's very common to see IF-THEN used in conjunction with an INPUT statement.

```
10 PRINT "GIVE ME A NUMBER FROM
   1 TO 3"
20 INPUT N
30 IF N=1 THEN PRINT "GOOD
   NUMBER"
40 IF N=2 THEN PRINT "GOOD
   NUMBER"
50 IF N=3 THEN PRINT "GOOD
   NUMBER"
```

Each time you run this, the message GOOD NUMBER is printed only if you type in a 1, 2, or 3. If you type any other number, the program doesn't print anything. Here's why: In line 20, N is given a value by the user. In line 30 this value is compared to 1. If N is 1, the computer continues along this line and follows the instructions to print the message. If it's anything else, the computer jumps immediately to the next line. It doesn't see the THEN *or any of the rest of the line.*

Of course, when an IF test is passed and the THEN statement is executed, the program doesn't stop there. It continues to the next line.

Here's another example to study:

```
10 F$="FIVE":S$="SIX"
20 PRINT "PRESS 5 OR 6":INPUT A
30 IF A=5 THEN PRINT F$: IF A=6
   THEN PRINT S$
```

Run this program. When asked, press the 5 key. F$ (the word FIVE) will be printed. Run the program again and press 6. SIX (S$) still doesn't get printed even though there's a test for it in the second part of line 20. The computer failed the IF test (IF A=5) at the beginning of line 20 so it skipped the rest of the line. To test for both 5 and 6, you must place them on separate program lines:

```
10 F$="FIVE":S$="SIX"
20 PRINT "PRESS 5 OR 6":INPUT A
30 IF A=5 THEN PRINT F$
40 IF A=6 THEN PRINT S$
```

IF-THEN can be used to send control to a certain line number. As you know, a BASIC program's flow is normally in increasing line number order—10, 20, 30, 40, and so forth. But sometimes you need to alter that flow depending on the result of a comparison. Various tests can be made besides equality (=), such as less than (<), greater than (>), not equal to (<>), less than or equal to (<=), or greater than or equal to (>=). These characters are all on your computer's keyboard. We'll cover these in a later column in more detail; let's discuss only a couple of them here.

Say that we want the user to type in numbers in the range 1–5. Use an IF-THEN to evaluate the input:

```
10 PRINT "TYPE A NUMBER FROM 1
   TO 5":INPUT N
20 IF N<1 THEN 10
30 IF N>5 THEN 10
40 PRINT "GOOD NUMBER!"
```

Each time you run this, try typing various numbers inside and outside the range 1–5. Each number you type is evaluated in line 20 to see if

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it's less than one. If it is, THEN sends control of the program back to 10, which prints the beginning message again. Lines 30 and 40 aren't executed.

If N is greater than 1, the THEN statement in line 20 is never seen—the computer skips to the next line (30), which evaluates whether the number you typed is greater than 5. If it's 6 or more, THEN sends control back to line 10; line 40 isn't used.

Finally, if the number you typed is in the range 1–5, control is sent to line 40, which prints GOOD NUMBER!

Another way to evaluate whether a number falls within a certain range is like this:

```
10 INPUT "WHAT'S A NUMBER FROM
   1 TO 5";N
20 IF N>0 THEN IF N<6 THEN PRINT
   "GOOD NUMBER":END
30 GOTO 10
```

Three new concepts are illustrated here: the double IF-THEN statement and the BASIC statements GOTO and END. Line 10 gets the number N from the user. Line 20 first checks to see if it's greater than 1; if so, the first THEN is executed—flow continues on that line and the next IF is evaluated—whether or not the number is less than 6. If it is, the next THEN is executed—the message "GOOD NUMBER" gets printed and the program ENDs. END is used to stop a program so that it won't execute any further statements.

If at any point either of the IF-THEN tests fails (the number falls outside of range), the rest of line 20 is skipped (including END); control goes (programmers often say it "falls through") to line 30, which brings us to the GOTO.

The GOTO Statement

GOTO is a BASIC statement which simply sends control to another line. In this case, we ask for a certain range of numbers. If we don't get it, we want the beginning message to be repeated, so we send control back to line 10 with GOTO 10.

Here's one way to start a quiz program:

```
10 INPUT"WHO IS THE PRESIDENT
   OF THE U.S.";R$
```

We now have several choices for line 20:

```
20 IF R$<>"REAGAN" THEN GOTO 10
```

or:

```
20 IF R$<>"REAGAN" THEN 10
```

or:

```
20 IF R$<>"REAGAN" GOTO 10
```

Note that in the third option, the word *THEN* isn't even used. In all options we're using the <> (not equal to) sign, even though there are other ways to do this (try to think of a few). All responses except "REAGAN" are rejected, including "Reagan", "REGAN", and "RONALD REAGAN".

Line 30 can be a "stroker," like:

```
30 PRINT "RIGHT!"
```

The program then can carry on with more questions.

Different program-flow directions can be specified, depending on the user's response to an INPUT. One way to handle the end of computer games is:

```
100 INPUT "DO YOU WANT TO PLAY
    AGAIN (Y/N)";A$
110 IF A$="Y" THEN 130
120 IF A$="N" THEN PRINT
    "GOODBYE!":END
130 (program continues here)
```

If the user's answer to the printed message (A$) is affirmative (he or she types Y and presses RETURN), the IF test in line 110 is passed; THEN sends control to line 130, where the program continues. If the answer is negative (the user types N followed by RETURN), the IF test in line 110 is failed, and control falls through to line 120. The IF test in this line is passed and THEN takes over—the ending message gets printed and the program ends. The rest of the program isn't used.

There are many other uses for IF-THEN, some of which we'll explore next month.

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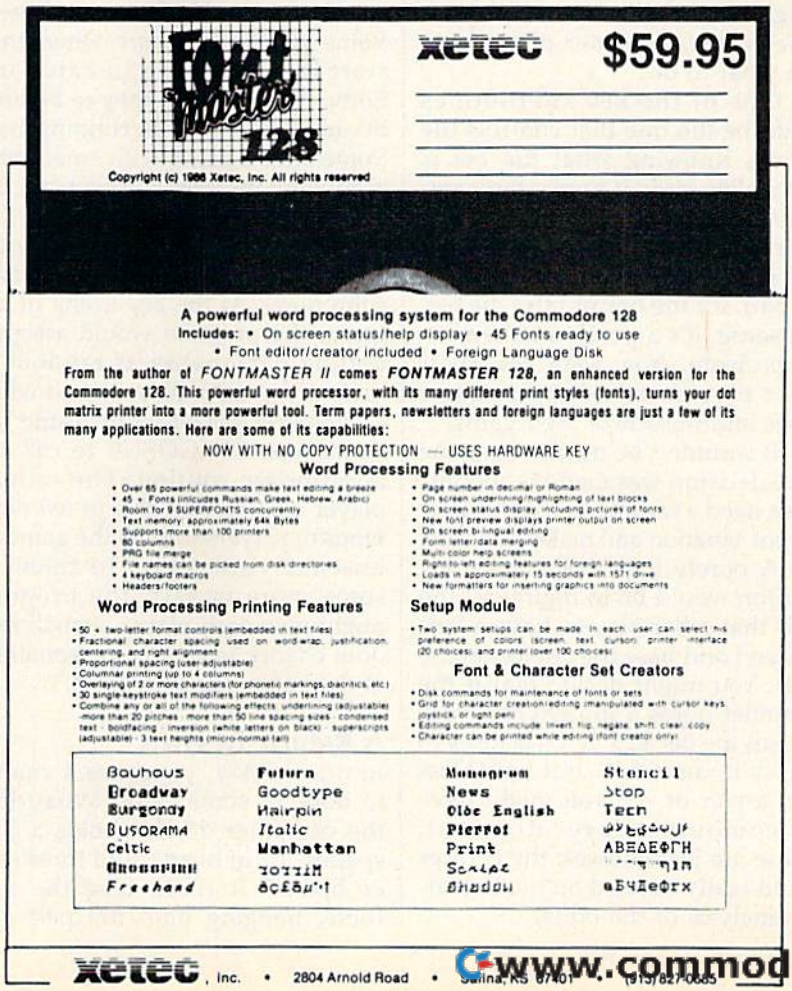

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Art Or Science?

Todd Heimarck
Assistant Editor

Is programming an art or a science? There are convincing arguments for both views. Creatively written games please and amuse us as a painting or novel might. On the other hand, you'd probably not describe as artistic a program that calculates mortgage payments. It might be easy to use or well constructed, but it's not art.

Let's look at an imaginary program and compare the artistic approach to the more logical or scientific approach.

A Smart Poker Player

Say you're writing a draw-poker program that pits one human player against three computer players. How do the computer players decide what to do?

One of the key subroutines would be the one that controls the betting. Knowing what the bet is and which cards it holds, the computer player can make one of three choices: Drop out of the hand (and lose what money it already has in the pot), see the bet, or raise the bet. In a sense, it's a purely mathematical problem. You want the computer players to minimize their losses and maximize their gains.

It wouldn't be much of a game if the decision was made randomly, so we need a routine that judges the current situation and makes a choice.

A purely logical and scientific solution would be to figure out the odds that other players have a better hand and base the choice on the odds. You might decide that if the computer holds a straight or better, it raises the bet $25. If it has three of a kind, it raises $10. If it holds less than a pair of 9's, you might have the computer player drop out. (These are just guesses; the choices would really depend on mathematical analysis of the odds).

The problem with fixed rules is that the human will pick up the pattern very quickly. A raise of $10 means the computer has three of a kind, a raise of $25 means a straight, and so on. That's far too easy to figure out.

So let's throw in a random bluff, a 1-in-10 chance that the computer will become more bold or more timid on a given hand. It's still not a very interesting game, because there's a recognizable pattern. If the bet telegraphs the hand, you might as well be looking over the computer's shoulder at the cards.

It appears that the logical approach has some flaws. How do real poker players bet? Well, some stay in almost every hand, never dropping. Others proceed cautiously, with a rare bluff now and then. Some people bet *more* when they start losing, trying to catch up. Some bet *less* when they're behind, because their luck is running bad. Some start a game with small bets, gradually increasing them as the game proceeds.

Many different personalities could be invented, each with its own subroutine. At the beginning of the game, the program would assign a betting personality at random to each of the three players, and when a computer player's turn came up, would use ON-GOSUB to call the appropriate routine. The human player wouldn't be able to tell what kinds of players were in the game, at least not right away. To throw in some more variety, the program might give each player a small random chance to change personalities at the beginning of a hand.

A Return To Logic

In draw poker, you have a chance to trade in some cards. What does the computer do if it holds a 2 of spades, a 2 of hearts, and three other hearts? It could take the safe route, hanging onto the pair and drawing three more cards, or it could be adventurous and keep the four hearts, breaking up the pair, hoping to draw one more heart to fill out the flush.

Those aren't the only possibilities. If two of the hearts are a jack and a queen, you could discard the other three cards and go for a straight flush. This might sound like a silly idea, but the program has no way of judging which moves are worthwhile. It seems that we need a way of deciding which discards are worth considering. And that means calculating the odds.

Keeping the jack and queen might produce a big hand (a straight flush), but the odds are overwhelmingly against that possibility. Keeping the 2's guarantees at least a pair, with some chances for a better hand. Going for the flush will succeed only about 19 percent of the time, but if the right card is drawn, the hand has an excellent chance of winning.

The mathematical approach is too predictable when it comes to setting a bet, but it seems to be the best way to decide which cards to keep or throw.

So is programming an art or a science? It's apparently a little of both. The poker program we've invented needs some creative betting strategies (from conservative to reckless), but logical strategies for deciding which cards to hold.

It would be interesting to perform an experiment (now we're back to being scientific). You can change the game so that there are four computer players, each with a different personality and strategy. Each starts with $1000. After a few hundred hands, check to see which players are winning and which are losing.

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machine language for beginners

Richard Mansfield
Senior Editor

From time to time in this column, we address questions sent in by readers. If there's something you would like answered, send a letter to ML Mailbag,* COMPUTE!'s GAZETTE, *324 W. Wendover, Greensboro, NC 27408.

Something Simple

Like many others who want to learn machine language, I have gone through the available books and followed your column, and I am totally lost (which means other readers are lost, too).

When learning BASIC, we first learn something simple, like this:

```
10 PRINT "THE QUICK BROWN FOX
   JUMPED"
```

And this program can be understood and run. I would appreciate your comments on this.

Agreed, the first step into machine language is a big step. Yet, though there are a number of things to learn at first, it all soon becomes quite clear.

It is important, I think, for beginners to use a full-featured assembler. Many otherwise needlessly awkward ML (machine language) programming techniques are greatly simplified with such an assembler. Here's how you would program your example using the LADS assembler from my *Second Book of Machine Language*:

```
5 *= 864;                    TELL THE ASSEMBLER WHERE TO PUT YOUR ML PROGRAM
6 .O;                        CAUSE THE RESULTS TO ASSEMBLE IN MEMORY AT ADDRESS 864
10 LDY #0;                   SET THE Y REGISTER TO ZERO SO IT CAN INDEX THE MESSAGE
20 LOOP LDA MESSAGE,Y;       PICK OFF EACH CHARACTER WITHIN THE MESSAGE
30 BEQ FINISH;               IF CHARACTER IS ZERO, QUIT
40 JSR $FFD2;                PRINT IT ON SCREEN
50 INY;                      RAISE THE INDEX
60 JMP LOOP;                 RETURN TO PICK OFF THE NEXT CHARACTER
70 FINISH RTS;               RETURN TO BASIC MODE
80 MESSAGE .BYTE "THE QUICK BROWN FOX JUMPED"
90 .BYTE 0;                  THIS IS THE ZERO CHARACTER THAT ENDS THE MESSAGE
```

At first, this looks like more complication than it's worth. After all, in BASIC, you just type PRINT. But most professional programs are written in ML for two fundamental reasons: The programmer gains extraordinary control over what his or her program will do, and ML runs at astoundingly fast speeds. Most programmers agree that ML is worth the extra time it takes to learn and program.

To run the above program, you assemble it, type SYS 864, and voilà.

Why Use A Full Assembler?

Why would someone want an assembler or disassembler, plus a monitor, when a monitor includes both the assembler and disassembler? Why not just use a monitor alone?

The assembler built into a monitor is a stripped-down version; it includes only the barest essentials. If you are writing an ML program larger than a few lines long, you'll quickly run up against serious inconveniences. The most cumbersome problem is that such a simple assembler has no provision for branching forward in the program. And forward branching is a very common thing.

The problem is that no *labels* are allowed in a monitor assembler. So, if you need, for example, to jump to a subroutine not yet written, you cannot know what the address of this future subroutine will be. Labels offer a solution to this and other problems.

Here's how you'd use a label in a full-featured assembler:

```
JSR JOYSTICK
LDA # 5
etc.
```

and then later on you can write the joystick routine, labeling it with the name JOYSTICK:

```
JOYSTICK LDA #12
etc.
RTS
```

Because the routine is named JOYSTICK, your assembler will automatically replace the word *JOYSTICK* following the earlier JSR with the correct address of your subroutine. Loops, branching, and IF-THEN constructs are all far easier to write when you can give names instead of addresses to the targets.

Full-featured assemblers also assist in other ways. Many offer sophisticated error checking which warns the programmer of many kinds of mistakes, not merely of simple typos. You can use arithmetic within arguments so that addressing consecutive blocks of bytes is simplified. You can enter characters and messages in English, rather than having to translate each character into an ASCII code number. *Dis*assemblers, by contrast, are all pretty much the same.

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Lights! Computers! Action!

Fred D'Ignazio
Associate Editor

Two weeks ago, Janet Mort, superintendent for the Saanich School District in British Columbia, Canada, was on her way to an important meeting at the district office with her assistant superintendent, Michael Ryan. Suddenly Janet shouted, "Michael! Stop the car!"

Startled, he screeched the car to a halt. He turned to Janet, who pointed out the car window. About a hundred feet from the road, Michael saw several of the school district's leading teachers whooping and hollering, and running across a meadow. They were led by Gordon Waugh, the principal of Saanich's Greenglade Elementary School. In Gordon's mouth was a small tree branch, festooned with pine cones and needles. One of the running teachers spotted the parked car and the two astonished school administrators and cried, "Get down! They see us!" At once, the entire group of teachers dropped to the ground and began crawling through the bushes.

Janet shook her head, smiled at Michael, and shouted to the teachers, "If our taxpayers find out about this, they'll be asking you some pretty tough questions!"

The teachers grinned sheepishly, then held a hurried conference in the middle of the meadow. "C'mon!" cried Gordon, the principal. "Let's head to the airport!"

The group ran off into the woods, heading cross-country toward the Victoria airport. They were followed by a lone teacher who captured her comrades' remarkable antics on a small, portable video camera, as they plowed through the underbrush and leaped over ditches and logs.

Bringing The Real World Into The Classroom

Gordon and his fellow teachers were participants in a two-day intensive workshop I conducted for the Saanich School District. I trained over 20 teachers on how to use a personal computer to enhance educational videos produced for classroom use. My mandate to the teachers was: Use video to bring the real world into your classroom. You can't afford to take your kids to every location or event in the community. But you can go there yourself with your camera and bring it back to the classroom on videotape. Teacher videos can spice up lessons in nearly all subject areas.

Then once the video is shot, you can combine the basic video with educational computer programs on the subject. You can plug the video cable into the back of the computer and record the computer's picture screen directly onto videotape. You can use computer graphics programs to create title screens and special effects. And you can record music on the videotape with an electronic keyboard so your videos will look and sound more professional. All this can be done with low-cost equipment intended for home and classroom use.

When I told the teachers to be creative and bring the real world into the classroom, I never imagined how enthused they would become. They grouped themselves into three production teams, and in the two days of the workshop they created three movies from scenes they shot with portable camcorders all over Vancouver Island: in the woods, at the Victoria airport (on the runway), on the beach, and at a local fish market. One team, determined to create a video entitled "The Foggy Day," spent over an hour chasing the morning fog as it rolled across the island. Another team went to their homes, rummaged through their attics, and shot their "Romance-Suspense-Mystery" video on the beach, with one of the teachers dressed in a nineteenth-century Victorian costume. One of the most beautiful videos, a video poem about changing seasons, was shot entirely in the backyard of Greenglade Elementary School, where we held the workshop. Team members shot spider webs glistening with morning dew; old, gnarled logs; wild flowers; and wooden fence posts; and added a beautiful melody which one of the teachers composed on a little Casio SK-1 keyboard.

At the end of the workshop we held a "film festival" for teachers and principals from all over the Saanich district. One team was unable to decide which shots to cut from its video to edit it down to the two-minute limit, so they showed two videos simultaneously on two TV screens and called it "stereo television." Two teams weren't able to add a soundtrack onto videotape, so they borrowed the school piano and a fourth-grader, and had her play a live accompaniment to their "silent" movie.

Everything Came Together

Right before the film festival, the teachers and their projects were in utter chaos. Teachers were making last-second dubs, copying computer screens onto videotape, playing music on musical keyboards, plugging and unplugging cables, and crying and shouting in frustration and impatience.

Then, suddenly and miraculously, everything came together.

It was thrilling to watch the teachers' reactions. After we had shown the videos, and I had the teams stand to receive the applause of the audience, I could feel the teachers' pride and sense of accomplishment as a powerful, tangible thing. They had done it all themselves.

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How To Type In *COMPUTE!'s GAZETTE* Programs

Each month, COMPUTE!'s GAZETTE publishes programs for the Commodore 128, 64, Plus/4, 16, and VIC-20. 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 corresponding article. This can save time and eliminate any questions which might arise after you begin typing.

We frequently publish two programs designed to make typing easier: The Automatic Proofreader, and MLX, designed for entering machine language programs.

When entering a BASIC program, be especially careful with DATA statements as they are extremely sensitive to errors. A mistyped number in a DATA statement can cause your machine to "lock up" (you'll have no control over the computer). If this happens, the only recourse is to turn your computer off then back on, erasing whatever was in memory. So be sure to *save a copy of your program before you run it.* If your computer crashes, you can always reload the program and look for the error.

Special Characters

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

The most common type of control characters in our listings appear as words within braces: {DOWN} 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 underlined key enclosed in braces (for example, {8 A}), type the key as many times as indicated (in our example, enter eight SHIFTed A's).

If a key is enclosed in special brackets, [ ], hold down the Commodore 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, {A} means to press CTRL-A.

The Quote Mode

Although you can move the cursor around the screen with the CRSR keys, often a programmer will want to move the cursor under program control. This is seen in examples such as {LEFT} and {HOME} in the program listings. The only way the computer can tell the difference between direct and programmed cursor control is *the quote mode.*

Once you press the quote key, you're in quote mode. This mode can be confusing if you mistype a character and cursor left to change it. You'll see a reverse video character (a graphics symbol for cursor left). In this case, you can use the DELete key to back up and edit the line. Type another quote and you're out of quote mode. If things really get confusing, you can exit quote mode simply by pressing RETURN. Then just cursor up to the mistyped line and fix it.

When You Read:	Press:	See:
{CLR}	SHIFT + CLR/HOME	
{HOME}	CLR/HOME	
{UP}	SHIFT + ↑ CRSR ↓	
{DOWN}	↑ CRSR ↓	
{LEFT}	SHIFT + ← CRSR →	
{RIGHT}	← CRSR →	
{RVS}	CTRL + 9	
{OFF}	CTRL + 0	
{BLK}	CTRL + 1	
{WHT}	CTRL + 2	
{RED}	CTRL + 3	
{CYN}	CTRL + 4	

When You Read:	Press:	See:
{PUR}	CTRL + 5	
{GRN}	CTRL + 6	
{BLU}	CTRL + 7	
{YEL}	CTRL + 8	
{ F1 }	f1	
{ F2 }	SHIFT + f1	
{ F3 }	f3	
{ F4 }	SHIFT + f3	
{ F5 }	f5	
{ F6 }	SHIFT + f5	
{ F7 }	f7	
{ F8 }	SHIFT + f7	

When You Read:	Press:	See:
←	←	
↑	SHIFT + ↑	

For Commodore 64 Only

[1]	COMMODORE + 1	
[2]	COMMODORE + 2	
[3]	COMMODORE + 3	
[4]	COMMODORE + 4	
[5]	COMMODORE + 5	
[6]	COMMODORE + 6	
[7]	COMMODORE + 7	
[8]	COMMODORE + 8	

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The Automatic Proofreader

Philip I. Nelson, Assistant Editor

"The Automatic Proofreader" helps you type in program listings for the 128, 64, Plus/4, 16, and VIC-20 and prevents nearly every kind of typing mistake.

Type in the Proofreader *exactly* as listed. Since the program can't check itself, type carefully to avoid mistakes. Don't omit any lines, even if they contain unfamiliar commands. After finishing, save a copy or two on disk or tape before running it. This is important because the Proofreader erases the BASIC portion of itself when you run it, leaving only the machine language portion in memory.

Next, type RUN and press RETURN. After announcing which computer it's running on, the Proofreader displays the message "Proofreader Active". Now you're ready to type in a BASIC program.

Every time you finish typing a line and press RETURN, the Proofreader displays a two-letter checksum in the upper-left corner of the screen. Compare this result with the two-letter checksum printed to the left of the line in the program listing. If the letters match, it's almost certain the line was typed correctly. If the letters don't match, check for your mistake and correct the line.

The Proofreader ignores spaces not enclosed in quotes, so you can omit or add spaces between keywords and still see a matching checksum. However, since spaces inside quotes are almost always significant, the Proofreader pays attention to them. For example, **10 PRINT"THIS IS BASIC"** will generate a different checksum than **10 PRINT"THIS ISBA SIC"**.

A common typing error is transposition—typing two successive characters in the wrong order, like PIRNT instead of PRINT or 64378 instead of 64738. The Proofreader is sensitive to the *position* of each character within the line and thus catches transposition errors.

The Proofreader does *not* accept keyword abbreviations (for example, ? instead of PRINT). If you prefer to use abbreviations, you can still check the line by LISTing it after typing it in, moving the cursor back to the line, and pressing RETURN. LISTing the line substitutes the full keyword for the abbreviation and allows the Proofreader to work properly. The same technique works for rechecking programs you've already typed in.

If you're using the Proofreader on the Commodore 128, Plus/4, or 16, *do not perform any GRAPHIC commands while the Proofreader is active.* When you perform a command like GRAPHIC 1, the computer moves everything at the start of BASIC program space—including the Proofreader—to another memory area, causing the Proofreader to crash. The same thing happens if you *run* any program with a GRAPHIC command while the Proofreader is in memory.

Though the Proofreader doesn't interfere with other BASIC operations, it's a good idea to disable it before running another program. However, the Proofreader is purposely difficult to dislodge: It's not affected by tape or disk operations, or by pressing RUN/STOP–RESTORE. The simplest way to disable it is to turn the computer off then on. A gentler method is to SYS to the computer's built-in reset routine (SYS 65341 for the 128, 64738 for the 64, 65526 for the Plus/4 and 16, and 64802 for the VIC). These reset routines erase any program in memory, so be sure to save the program you're typing in before entering the SYS command.

If you own a Commodore 64, you may already have wondered whether the Proofreader works with other programming utilities like "MetaBASIC." The answer is generally yes, *if you're using a 64 and activate the Proofreader after installing the other utility.* For example, first load and activate MetaBASIC, then load and run the Proofreader.

When using the Proofreader with another utility, you should disable *both* programs before running a BASIC program. While the Proofreader seems unaffected by most utilities, there's no way to promise that it will work with any and every combination of utilities you might want to use. The more utilities activated, the more fragile the system becomes.

The New Automatic Proofreader

```
10 VEC=PEEK(772)+256*PEEK(773)
   :LO=43:HI=44
20 PRINT "AUTOMATIC PROOFREADE
   R FOR ";:IF VEC=42364 THEN
   {SPACE}PRINT "C-64"
30 IF VEC=50556 THEN PRINT "VI
   C-20"
40 IF VEC=35158 THEN GRAPHIC C
   LR:PRINT "PLUS/4 & 16"
50 IF VEC=17165 THEN LO=45:HI=
   46:GRAPHIC CLR:PRINT"128"
60 SA=(PEEK(LO)+256*PEEK(HI))+
   6:ADR=SA
70 FOR J=0 TO 166:READ BYT:POK
   E ADR,BYT:ADR=ADR+1:CHK=CHK
   +BYT:NEXT
80 IF CHK<>20570 THEN PRINT "*
   ERROR* CHECK TYPING IN DATA
    STATEMENTS":END
90 FOR J=1 TO 5:READ RF,LF,HF:
   RS=SA+RF:HB=INT(RS/256):LB=
   RS-(256*HB)
100 CHK=CHK+RF+LF+HF:POKE SA+L
   F,LB:POKE SA+HF,HB:NEXT
110 IF CHK<>22054 THEN PRINT "
   *ERROR* RELOAD PROGRAM AND
   {SPACE}CHECK FINAL LINE":EN
   D
120 POKE SA+149,PEEK(772):POKE
    SA+150,PEEK(773)
130 IF VEC=17165 THEN POKE SA+
   14,22:POKE SA+18,23:POKESA+
   29,224:POKESA+139,224
140 PRINT CHR$(147);CHR$(17);"
   PROOFREADER ACTIVE":SYS SA
150 POKE HI,PEEK(HI)+1:POKE (P
   EEK(LO)+256*PEEK(HI))-1,0:N
   EW
160 DATA 120,169,73,141,4,3,16
   9,3,141,5,3
170 DATA 88,96,165,20,133,167,
   165,21,133,168,169
180 DATA 0,141,0,255,162,31,18
   1,199,157,227,3
190 DATA 202,16,248,169,19,32,
   210,255,169,18,32
200 DATA 210,255,160,0,132,180
   ,132,176,136,230,180
210 DATA 200,185,0,2,240,46,20
   1,34,208,8,72
220 DATA 165,176,73,255,133,17
   6,104,72,201,32,208
230 DATA 7,165,176,208,3,104,2
   08,226,104,166,180
240 DATA 24,165,167,121,0,2,13
   3,167,165,168,105
250 DATA 0,133,168,202,208,239
   ,240,202,165,167,69
260 DATA 168,72,41,15,168,185,
   211,3,32,210,255
270 DATA 104,74,74,74,74,168,1
   85,211,3,32,210
280 DATA 255,162,31,189,227,3,
   149,199,202,16,248
290 DATA 169,146,32,210,255,76
   ,86,137,65,66,67
300 DATA 68,69,70,71,72,74,75,
   77,80,81,82,83,88
310 DATA 13,2,7,167,31,32,151,
   116,117,151,128,129,167,136
   ,137
```


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MLX Machine Language Entry Program For Commodore 64 and 128

Ottis R. Cowper, Technical Editor

"MLX" is a labor-saving utility that allows almost fail-safe entry of machine language programs. Included are versions for the Commodore 64 and 128.

Type in and save some copies of whichever version of MLX is appropriate for your computer (you'll want to use it to enter future ML programs from COMPUTE!'s GAZETTE). Program 1 is for the Commodore 64, and Program 2 is for the 128 (128 MLX can also be used to enter Commodore 64 ML programs for use in 64 mode). When you're ready to enter an ML program, load and run MLX. It asks you for a starting address and an ending address. These addresses appear in the article accompanying the MLX-format program listing you're typing.

If you're unfamiliar with machine language, the addresses (and all other values you enter in MLX) may appear strange. Instead of the usual decimal numbers you're accustomed to, these numbers are in *hexadecimal*—a base 16 numbering system commonly used by ML programmers. Hexadecimal—hex for short—includes the numerals 0–9 and the letters A–F. But don't worry—even if you know nothing about ML or hex, you should have no trouble using MLX.

After you enter the starting and ending addresses, you'll be offered the option of clearing the workspace. Choose this option if you're starting to enter a new listing. If you're continuing a listing that's partially typed from a previous session, don't choose this option.

A functions menu will appear. The first option in the menu is ENTER DATA. If you're just starting to type in a program, pick this. Press the E key, and type the first number in the first line of the program listing. If you've already typed in part of a program, type the line number where you left off typing at the end of the previous session (be sure to load the partially completed program before you resume entry). In any case, make sure the address you enter corresponds to the address of a line in the listing you are entering. Otherwise, you'll be unable to enter the data correctly. If you pressed E by mistake, you can return to the command menu by pressing RETURN alone when asked for the address. (You can get back to the menu from most options by pressing RETURN with no other input.)

Entering A Listing

Once you're in Enter mode, MLX prints the address for each program line for you. You then type in all nine numbers on that line, beginning with the first two-digit number after the colon (:). Each line represents eight data bytes and a checksum. Although an MLX-format listing appears similar to the "hex dump" listings from a machine language monitor program, the extra checksum number on the end allows MLX to check your typing. (Commodore 128 users *can* enter the data from an MLX listing using the built-in monitor if the rightmost column of data is omitted, but we recommend against it. It's much easier to let MLX do the proofreading and error checking for you.)

When you enter a line, MLX recalculates the checksum from the eight bytes and the address and compares this value to the number from the ninth column. If the values match, you'll hear a bell tone, the data will be added to the workspace area, and the prompt for the next line of data will appear. But if MLX detects a typing error, you'll hear a low buzz and see an error message. The line will then be redisplayed for editing.

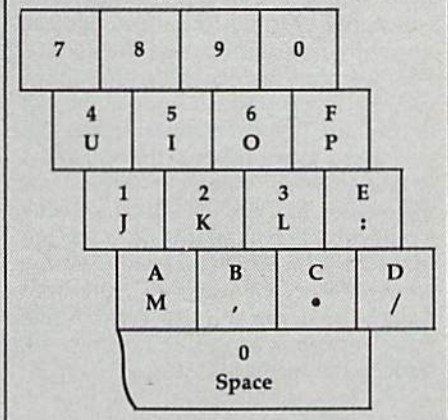
Invalid Characters Banned

Only a few keys are active while you're entering data, so you may have to unlearn some habits. You *do not* type spaces between the columns; MLX automatically inserts these for you. You *do not* press RETURN after typing the last number in a line; MLX automatically enters and checks the line after you type the last digit.

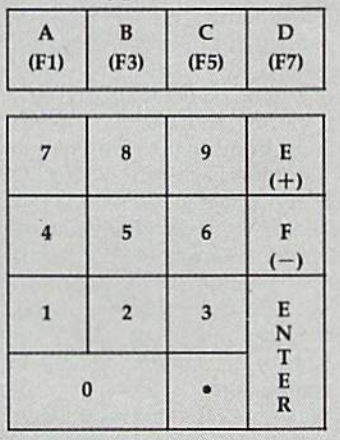
Only the numerals 0–9 and the letters A–F can be typed in. If you press any other key (with some exceptions noted below), you'll hear a warning buzz. To simplify typing, 128 MLX redefines the function keys and + and − keys on the numeric keypad so that you can enter data one-handed. (The 64 version incorporates the keypad modification from the March 1986 "Bug-Swatter" column, lines 485–487.) In either case, the keypad is active only while entering data. Addresses must be entered with the normal letter and number keys. The figures below show the keypad configurations for each version.

MLX checks for transposed characters. If you're supposed to type in A0 and instead enter 0A, MLX will catch your mistake. There is one error that can slip past MLX: Because of the checksum formula used, MLX won't notice if you accidentally type FF in place of 00, and vice versa. And there's a very slim chance that you could garble a line and still end up with a combination of characters that adds up to the proper checksum. However, these mistakes should not occur if you take reasonable care while entering data.

64 MLX Keypad



128 MLX Keypad



Editing Features

To correct typing mistakes before finishing a line, use the INST/DEL key to delete the character to the left of the cursor. (The cursor-left key also deletes.) If you mess up a line really badly, press CLR/HOME to start the line over. The RETURN key is also active, but only before any data is typed on a line. Pressing RETURN at this point returns you to the command menu. After you type a character of data, MLX disables RETURN until the cursor returns to the start of a line. Remember, you can press CLR/HOME to quickly get to a line

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number prompt.

More editing features are available when correcting lines in which MLX has detected an error. To make corrections in a line that MLX has redisplayed for editing, compare the line on the screen with the one printed in the listing, then move the cursor to the mistake and type the correct key. The cursor left and right keys provide the normal cursor controls. (The INST/DEL key now works as an alternative cursor-left key.) You cannot move left beyond the first character in the line. If you try to move beyond the rightmost character, you'll reenter the line. During editing, RETURN is active; pressing it tells MLX to recheck the line. You can press the CLR/HOME key to clear the entire line if you want to start from scratch, or if you want to get to a line number prompt to use RETURN to get back to the menu.

Display Data

The second menu choice, DISPLAY DATA, examines memory and shows the contents in the same format as the program listing (including the checksum). When you press D, MLX asks you for a starting address. Be sure that the starting address you give corresponds to a line number in the listing. Otherwise, the checksum display will be meaningless. MLX displays program lines until it reaches the end of the program, at which point the menu is redisplayed. You can pause the display by pressing the space bar. (MLX finishes printing the current line before halting.) Press space again to restart the display. To break out of the display and get back to the menu before the ending address is reached, press RETURN.

Other Menu Options

Two more menu selections let you save programs and load them back into the computer. These are SAVE FILE and LOAD FILE; their operation is quite straightforward. When you press S or L, MLX asks you for the filename. You'll then be asked to press either D or T to select disk or tape.

You'll notice the disk drive starting and stopping several times during a load or save (save only for the 128 version). Don't panic; this is normal behavior. MLX opens and reads from or writes to the file instead of using the usual LOAD and SAVE commands (128 MLX makes use of BLOAD). Disk users should also note that the drive prefix 0: is automatically added to the filename (line 750 in 64 MLX), so this should *not* be included when entering the name. This also precludes the use of @ for Save-with-Replace, so remember to give each version you save a different name. The 128 version makes up for this by giving you the option of scratching the existing file if you want to reuse a filename.

Remember that MLX saves the entire workspace area from the starting address to the ending address, so the save or load may take longer than you might expect if you've entered only a small amount of data from a long listing. When saving a partially completed listing, make sure to note the address where you stopped typing so you'll know where to resume entry when you reload.

MLX reports the standard disk or tape error messages if any problems are detected during the save or load. (Tape users should bear in mind that Commodore computers are never able to detect errors during a save to tape.) MLX also has three special load error messages: INCORRECT STARTING ADDRESS, which means the file you're trying to load does not have the starting address you specified when you ran MLX; LOAD ENDED AT *address*, which means the file you're trying to load ends before the ending address you specified when you started MLX; and TRUNCATED AT ENDING ADDRESS, which means the file you're trying to load extends beyond the ending address you specified when you started MLX. If you see one of these messages and feel certain that you've loaded the right file, exit and rerun MLX, being careful to enter the correct starting and ending addresses.

The 128 version also has a CATALOG DISK option so you can view the contents of the disk directory before saving or loading.

The QUIT menu option has the obvious effect—it stops MLX and enters BASIC. The RUN/STOP key is disabled, so the Q option lets you exit the program without turning off the computer. (Of course, RUN/STOP-RESTORE also gets you out.) You'll be asked for verification; press Y to exit to BASIC, or any other key to return to the menu. After quitting, you can type RUN again and reenter MLX without losing your data, as long as you don't use the clear workspace option.

The Finished Product

When you've finished typing all the data for an ML program and saved your work, you're ready to see the results. The instructions for loading and using the finished product vary from program to program. Some ML programs are designed to be loaded and run like BASIC programs, so all you need to type is LOAD *"filename"*,8 for disk (DLOAD *"filename"* on the 128) or LOAD *"filename"* for tape, and then RUN. Such programs will usually have a starting address of 0801 for the 64 or 1C01 for the 128. Other programs must be reloaded to specific addresses with a command such as LOAD *"filename"*,8,1 for disk (BLOAD *"filename"* on the 128) or LOAD *"filename"*,1,1 for tape, then started with a SYS to a particular memory address. On the Commodore 64, the most common starting address for such programs is 49152, which corresponds to MLX address C000. In either case, you should always refer to the article which accompanies the ML listing for information on loading and running the program.

An Ounce Of Prevention

By the time you finish typing in the data for a long ML program, you may have several hours invested in the project. Don't take chances—use our "Automatic Proofreader" to type the new MLX, and then test your copy *thoroughly* before first using it to enter any significant amount of data. Make sure all the menu options work as they should. Enter fragments of the program starting at several different addresses, then use the Display option to verify that the data has been entered correctly. And be sure to test the Save and Load options several times to ensure that you can recall your work from disk or tape. Don't let a simple typing error in the new MLX cost you several nights of hard work.

Program 1: MLX For Commodore 64

```
SS 10 REM VERSION 1.1: LINES 8
      30,950 MODIFIED, LINES 4
      85-487 ADDED
EK 100 POKE 56,50:CLR:DIM IN$,
      I,J,A,B,A$,B$,A(7),N$
DM 110 C4=48:C6=16:C7=7:Z2=2:Z
      4=254:Z5=255:Z6=256:Z7=
      127
CJ 120 FA=PEEK(45)+Z6*PEEK(46)
      :BS=PEEK(55)+Z6*PEEK(56
      ):H$="0123456789ABCDEF"
SB 130 R$=CHR$(13):L$="{LEFT}"
      :S$=" ":D$=CHR$(20):Z$=
      CHR$(0):T$="{13 RIGHT}"
CQ 140 SD=54272:FOR I=SD TO SD
      +23:POKE I,0:NEXT:POKE
      {SPACE}SD+24,15:POKE 78
      8,52
FC 150 PRINT"{CLR}"CHR$(142)CH
      R$(8):POKE 53280,15:POK
      E 53281,15
EJ 160 PRINT T$" {RED}{RVS}
      {2 SPACES}{8 @}
      {2 SPACES}"SPC(28)"
      {2 SPACES}{OFF}{BLU} ML
      X II {RED}{RVS}
      {2 SPACES}"SPC(28)"
      {12 SPACES}{BLU}"
FR 170 PRINT"{3 DOWN}
      {3 SPACES}COMPUTE!'S MA
      CHINE LANGUAGE EDITOR
      {3 DOWN}"
JB 180 PRINT"{BLK}STARTING ADD
```


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```
      RESS[4]";:GOSUB300:SA=AD:GOSUB1040:IF F THEN180
GF 190 PRINT"{BLK}{2 SPACES}ENDING ADDRESS[4]";:GOSUB300:EA=AD:GOSUB1030:IF {SPACE}F THEN190
KR 200 INPUT"{3 DOWN}{BLK}CLEAR WORKSPACE [Y/N][4]";A$:IF LEFT$(A$,1)<>"Y"THEN220
PG 210 PRINT"{2 DOWN}{BLU}WORKING...";:FORI=BS TO BS+EA-SA+7:POKE I,0:NEXT:PRINT"DONE"
DR 220 PRINTTAB(10)"{2 DOWN}{BLK}{RVS} MLX COMMAND {SPACE}MENU {DOWN}[4]":PRINT T$"{RVS}E{OFF}NTER DATA"
BD 230 PRINT T$"{RVS}D{OFF}ISPLAY DATA":PRINT T$"{RVS}L{OFF}OAD FILE"
JS 240 PRINT T$"{RVS}S{OFF}AVE FILE":PRINT T$"{RVS}Q{OFF}UIT{2 DOWN}{BLK}"
JH 250 GET A$:IF A$=N$ THEN250
HK 260 A=0:FOR I=1 TO 5:IF A$=MID$("EDLSQ",I,1)THEN A=I:I=5
FD 270 NEXT:ON A GOTO420,610,690,700,280:GOSUB1060:GOTO250
EJ 280 PRINT"{RVS} QUIT ":INPUT"{DOWN}[4]ARE YOU SURE [Y/N]";A$:IF LEFT$(A$,1)<>"Y"THEN220
EM 290 POKE SD+24,0:END
JX 300 IN$=N$:AD=0:INPUTIN$:IF LEN(IN$)<>4THENRETURN
KF 310 B$=IN$:GOSUB320:AD=A:B$=MID$(IN$,3):GOSUB320:AD=AD*256+A:RETURN
PP 320 A=0:FOR J=1 TO 2:A$=MID$(B$,J,1):B=ASC(A$)-C4+(A$>"@")*C7:A=A*C6+B
JA 330 IF B<0 OR B>15 THEN AD=0:A=-1:J=2
GX 340 NEXT:RETURN
CH 350 B=INT(A/C6):PRINT MID$(H$,B+1,1);:B=A-B*C6:PRINT MID$(H$,B+1,1);:RETURN
RR 360 A=INT(AD/Z6):GOSUB350:A=AD-A*Z6:GOSUB350:PRINT":";
BE 370 CK=INT(AD/Z6):CK=AD-Z4*CK+Z5*(CK>Z7):GOTO390
PX 380 CK=CK*Z2+Z5*(CK>Z7)+A
JC 390 CK=CK+Z5*(CK>Z5):RETURN
QS 400 PRINT"{DOWN}STARTING AT [4]";:GOSUB300:IF IN$<>N$ THEN GOSUB1030:IF F {SPACE}THEN400
EX 410 RETURN
HD 420 PRINT"{RVS} ENTER DATA {SPACE}":GOSUB400:IF IN$=N$ THEN220
JK 430 OPEN3,3:PRINT
SK 440 POKE198,0:GOSUB360:IF F THEN PRINT IN$:PRINT"{UP}{5 RIGHT}";
GC 450 FOR I=0 TO 24 STEP 3:B$=S$:FOR J=1 TO 2:IF F THEN B$=MID$(IN$,I+J,1)
HA 460 PRINT"{RVS}"B$L$;:IF I<24THEN PRINT"{OFF}";
HD 470 GET A$:IF A$=N$ THEN470
FK 480 IF(A$>"/"ANDA$<":")OR(A$>"@"ANDA$<"G")THEN540
GS 485 A=-(A$="M")-2*(A$=",")-3*(A$=".")-4*(A$="/")-5*(A$="J")-6*(A$="K")
FX 486 A=A-7*(A$="L")-8*(A$=":")-9*(A$="U")-10*(A$="I")-11*(A$="O")-12*(A$="P")
CM 487 A=A-13*(A$=S$):IF A THEN A$=MID$("ABCD123E456F0",A,1):GOTO 540
MP 490 IF A$=R$ AND((I=0)AND(J=1)OR F)THEN PRINT B$;:J=2:NEXT:I=24:GOTO550
KC 500 IF A$="{HOME}" THEN PRINT B$:J=2:NEXT:I=24:NEXT:F=0:GOTO440
MX 510 IF(A$="{RIGHT}")ANDF THENPRINT B$L$;:GOTO540
GK 520 IF A$<>L$ AND A$<>D$ OR((I=0)AND(J=1))THEN GOSUB1060:GOTO470
HG 530 A$=L$+S$+L$:PRINT B$L$;:J=2-J:IF J THEN PRINT {SPACE}L$;:I=I-3
QS 540 PRINT A$;:NEXT J:PRINT {SPACE}S$;
PM 550 NEXT I:PRINT:PRINT"{UP}{5 RIGHT}";:INPUT#3,IN$:IF IN$=N$ THEN CLOSE3:GOTO220
QC 560 FOR I=1 TO 25 STEP3:B$=MID$(IN$,I):GOSUB320:IF I<25 THEN GOSUB380:A(I/3)=A
PK 570 NEXT:IF A<>CK THEN GOSUB1060:PRINT"{BLK}{RVS}{SPACE}ERROR: REENTER LINE [4]";F=1:GOTO440
HJ 580 GOSUB1080:B=BS+AD-SA:FOR I=0 TO 7:POKE B+I,A(I):NEXT
QQ 590 AD=AD+8:IF AD>EA THEN CLOSE3:PRINT"{DOWN}{BLU}** END OF ENTRY **{BLK}{2 DOWN}":GOTO700
GQ 600 F=0:GOTO440
QA 610 PRINT"{CLR}{DOWN}{RVS}{SPACE}DISPLAY DATA ":GOSUB400:IF IN$=N$ THEN220
RJ 620 PRINT"{DOWN}{BLU}PRESS: {RVS}SPACE{OFF} TO PAUSE, {RVS}RETURN{OFF} TO BREAK[4]{DOWN}"
KS 630 GOSUB360:B=BS+AD-SA:FOR I=BTO B+7:A=PEEK(I):GOSUB350:GOSUB380:PRINT S$;
CC 640 NEXT:PRINT"{RVS}";:A=CK:GOSUB350:PRINT
KH 650 F=1:AD=AD+8:IF AD>EA THENPRINT"{DOWN}{BLU}** END OF DATA **":GOTO220
KC 660 GET A$:IF A$=R$ THEN GOSUB1080:GOTO220
EQ 670 IF A$=S$ THEN F=F+1:GOSUB1080
AD 680 ONFGOTO630,660,630
CM 690 PRINT"{DOWN}{RVS} LOAD {SPACE}DATA ":OP=1:GOTO710
PC 700 PRINT"{DOWN}{RVS} SAVE {SPACE}FILE ":OP=0
RX 710 IN$=N$:INPUT"{DOWN}FILENAME[4]";IN$:IF IN$=N$ {SPACE}THEN220
PR 720 F=0:PRINT"{DOWN}{BLK}{RVS}T{OFF}APE OR {RVS}D{OFF}ISK: [4]";
FP 730 GET A$:IF A$="T"THEN PRINT"T{DOWN}":GOTO880
HQ 740 IF A$<>"D"THEN730
HH 750 PRINT"D{DOWN}":OPEN15,8,15,"I0:":B=EA-SA:IN$="0:"+IN$:IF OP THEN810
SQ 760 OPEN 1,8,8,IN$+",P,W":GOSUB860:IF A THEN220
FJ 770 AH=INT(SA/256):AL=SA-(AH*256):PRINT#1,CHR$(AL);CHR$(AH);
PE 780 FOR I=0 TO B:PRINT#1,CHR$(PEEK(BS+I));:IF ST THEN800
FC 790 NEXT:CLOSE1:CLOSE15:GOTO940
GS 800 GOSUB1060:PRINT"{DOWN}{BLK}ERROR DURING SAVE:[4]":GOSUB860:GOTO220
MA 810 OPEN 1,8,8,IN$+",P,R":GOSUB860:IF A THEN220
GE 820 GET#1,A$,B$:AD=ASC(A$+Z$)+256*ASC(B$+Z$):IF AD<>SA THEN F=1:GOTO850
RX 830 FOR I=0 TO B:GET#1,A$:POKE BS+I,ASC(A$+Z$):IF(I<>B)AND ST THEN F=2:AD=I:I=B
FA 840 NEXT:IF ST<>64 THEN F=3
FQ 850 CLOSE1:CLOSE15:ON ABS(F>0)+1 GOTO960,970
SA 860 INPUT#15,A,A$:IF A THEN CLOSE1:CLOSE15:GOSUB1060:PRINT"{RVS}ERROR: "A$
GQ 870 RETURN
EJ 880 POKE183,PEEK(FA+2):POKE187,PEEK(FA+3):POKE188,PEEK(FA+4):IFOP=0THEN920
HJ 890 SYS 63466:IF(PEEK(783)AND1)THEN GOSUB1060:PRINT"{DOWN}{RVS} FILE NOT {SPACE}FOUND ":GOTO690
CS 900 AD=PEEK(829)+256*PEEK(830):IF AD<>SA THEN F=1:GOTO970
SC 910 A=PEEK(831)+256*PEEK(832)-1:F=F-2*(A<EA)-3*(A>EA):AD=A-AD:GOTO930
KM 920 A=SA:B=EA+1:GOSUB1010:POKE780,3:SYS 63338
JF 930 A=BS:B=BS+(EA-SA)+1:GOSUB1010:ON OP GOTO950:SYS 63591
AE 940 GOSUB1080:PRINT"{BLU}** SAVE COMPLETED **":GOTO220
XP 950 POKE147,0:SYS 63562:IF {SPACE}ST>0 THEN970
FR 960 GOSUB1080:PRINT"{BLU}** LOAD COMPLETED **":GOTO220
DP 970 GOSUB1060:PRINT"{BLK}{RVS}ERROR DURING LOAD: {DOWN}[4]":ON F GOSUB980,990,1000:GOTO220
PP 980 PRINT"INCORRECT STARTING ADDRESS (";:GOSUB360:PRINT")":RETURN
GR 990 PRINT"LOAD ENDED AT ";:AD=SA+AD:GOSUB360:PRINTD$:RETURN
FD 1000 PRINT"TRUNCATED AT ENDING ADDRESS":RETURN
RX 1010 AH=INT(A/256):AL=A-(AH*256):POKE193,AL:POKE194,AH
FF 1020 AH=INT(B/256):AL=B-(AH*256):POKE174,AL:POKE175,AH:RETURN
FX 1030 IF AD<SA OR AD>EA THEN1050
HA 1040 IF(AD>511 AND AD<40960
```


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```
)OR(AD>49151 AND AD<53
248)THEN GOSUB1080:F=0
:RETURN
HC 1050 GOSUB1060:PRINT"{RVS}
{SPACE}INVALID ADDRESS
{DOWN}{BLK}":F=1:RETU
RN
AR 1060 POKE SD+5,31:POKE SD+6
,208:POKE SD,240:POKE
{SPACE}SD+1,4:POKE SD+
4,33
DX 1070 FOR S=1 TO 100:NEXT:GO
TO1090
PF 1080 POKE SD+5,8:POKE SD+6,
240:POKE SD,0:POKE SD+
1,90:POKE SD+4,17
AC 1090 FOR S=1 TO 100:NEXT:PO
KE SD+4,0:POKE SD,0:PO
KE SD+1,0:RETURN
```

Program 2: MLX For Commodore 128

```
AE 100 TRAP 960:POKE 4627,128:
DIM NL$,A(7)
XP 110 Z2=2:Z4=254:Z5=255:Z6=2
56:Z7=127:BS=256*PEEK(4
627):EA=65280
FB 120 BE$=CHR$(7):RT$=CHR$(13
):DL$=CHR$(20):SP$=CHR$
(32):LF$=CHR$(157)
KE 130 DEF FNHB(A)=INT(A/256):
DEF FNLB(A)=A-FNHB(A)*2
56:DEF FNAD(A)=PEEK(A)+
256*PEEK(A+1)
JB 140 KEY 1,"A":KEY 3,"B":KEY
5,"C":KEY 7,"D":VOL 15
:IF RGR(0)=5 THEN FAST
FJ 150 PRINT"{CLR}"CHR$(142);C
HR$(8):COLOR 0,15:COLOR
4,15:COLOR 6,15
GQ 160 PRINT TAB(12)"{RED}
{RVS}{2 SPACES}{9 @}
{2 SPACES}"RT$;TAB(12)"
{RVS}{2 SPACES}{OFF}
{BLU} 128 MLX {RED}
{RVS}{2 SPACES}"RT$;TAB
(12)"{RVS}{13 SPACES}
{BLU}"
FE 170 PRINT"{2 DOWN}
{3 SPACES}COMPUTE!'S MA
CHINE LANGUAGE EDITOR
{2 DOWN}"
DK 180 PRINT"{BLK}STARTING ADD
RESS{4}";:GOSUB 260:IF
{SPACE}AD THEN SA=AD:EL
SE 180
FH 190 PRINT"{BLK}{2 SPACES}EN
DING ADDRESS{4}";:GOSUB
260:IF AD THEN EA=AD:E
LSE 190
MF 200 PRINT"{DOWN}{BLK}CLEAR
{SPACE}WORKSPACE [Y/N]?
{4}":GETKEY A$:IF A$<>"
Y" THEN 220
QH 210 PRINT"{DOWN}{BLU}WORKIN
G...";:BANK 0:FOR A=BS
{SPACE}TO BS+(EA-SA)+7:
POKE A,0:NEXT A:PRINT"D
ONE"
DC 220 PRINT TAB(10)"{DOWN}
{BLK}{RVS} MLX COMMAND
{SPACE}MENU {4}{DOWN}":
PRINT TAB(13)"{RVS}E
{OFF}NTER DATA"RT$;TAB(
13)"{RVS}D{OFF}ISPLAY D
ATA"RT$;TAB(13)"{RVS}L
{OFF}OAD FILE"
HB 230 PRINT TAB(13)"{RVS}S
{OFF}AVE FILE"RT$;TAB(1
3)"{RVS}C{OFF}ATALOG DI
SK"RT$;TAB(13)"{RVS}Q
{OFF}UIT{DOWN}{BLK}"
AP 240 GETKEY A$:A=INSTR("EDLS
CQ",A$):ON A GOTO 340,5
50,640,650,930,940:GOSU
B 950:GOTO 240
SX 250 PRINT"STARTING AT";:GOS
UB 260:IF(AD<>0)OR(A$=N
L$)THEN RETURN:ELSE 250
BG 260 A$=NL$:INPUT A$:IF LEN(
A$)=4 THEN AD=DEC(A$)
PP 270 IF AD=0 THEN BEGIN:IF A
$<>NL$ THEN 300:ELSE RE
TURN:BEND
MA 280 IF AD<SA OR AD>EA THEN
{SPACE}300
PM 290 IF AD>511 AND AD<65280
{SPACE}THEN PRINT BE$;:
RETURN
SQ 300 GOSUB 950:PRINT"{RVS} I
NVALID ADDRESS {DOWN}
{BLK}":AD=0:RETURN
RD 310 CK=FNHB(AD):CK=AD-Z4*CK
+Z5*(CK>Z7):GOTO 330
DD 320 CK=CK*Z2+Z5*(CK>Z7)+A
AH 330 CK=CK+Z5*(CK>Z5):RETURN
QD 340 PRINT BE$;"{RVS} ENTER
{SPACE}DATA ":GOSUB 250
:IF A$=NL$ THEN 220
JA 350 BANK 0:PRINT:F=0:OPEN 3
,3
BR 360 GOSUB 310:PRINT HEX$(AD
)+":";:IF F THEN PRINT
{SPACE}L$:PRINT"{UP}
{5 RIGHT}";
QA 370 FOR I=0 TO 24 STEP 3:B$
=SP$:FOR J=1 TO 2:IF F
{SPACE}THEN B$=MID$(L$,
I+J,1)
PS 380 PRINT"{RVS}"B$+LF$;:IF
{SPACE}I<24 THEN PRINT"
{OFF}";
RC 390 GETKEY A$:IF (A$>"/" AN
D A$<":") OR(A$>"@" AND
A$<"G") THEN 470
AC 400 IF A$="+" THEN A$="E":G
OTO 470
QB 410 IF A$="-" THEN A$="F":G
OTO 470
FB 420 IF A$=RT$ AND ((I=0) AN
D (J=1) OR F) THEN PRIN
T B$;:J=2:NEXT:I=24:GOT
O 480
RD 430 IF A$="{HOME}" THEN PRI
NT B$:J=2:NEXT:I=24:NEX
T:F=0:GOTO 360
XB 440 IF (A$="{RIGHT}") AND F
THEN PRINT B$+LF$;:GOT
O 470
JP 450 IF A$<>LF$ AND A$<>DL$
{SPACE}OR ((I=0) AND (J
=1)) THEN GOSUB 950:GOT
O 390
PS 460 A$=LF$+SP$+LF$:PRINT B$
+LF$;:J=2-J:IF J THEN P
RINT LF$;:I=I-3
GB 470 PRINT A$;:NEXT J:PRINT
{SPACE}SP$;
HA 480 NEXT I:PRINT:PRINT"{UP}
{5 RIGHT}";:L$="
{27 SPACES}"
DP 490 FOR I=1 TO 25 STEP 3:GE
T#3,A$,B$:IF A$=SP$ THE
N I=25:NEXT:CLOSE 3:GOT
O 220
BA 500 A$=A$+B$:A=DEC(A$):MID$
(L$,I,2)=A$:IF I<25 THE
N GOSUB 320:A(I/3)=A:GE
T#3,A$
AR 510 NEXT I:IF A<>CK THEN GO
SUB 950:PRINT:PRINT"
{RVS} ERROR: REENTER LI
NE ":F=1:GOTO 360
DX 520 PRINT BE$:B=BS+AD-SA:FO
R I=0 TO 7:POKE B+I,A(I
):NEXT I
XB 530 F=0:AD=AD+8:IF AD<=EA T
HEN 360
CA 540 CLOSE 3:PRINT"{DOWN}
{BLU}** END OF ENTRY **
{BLK}{2 DOWN}":GOTO 650
MC 550 PRINT BE$;"{CLR}{DOWN}
{RVS} DISPLAY DATA ":GO
SUB 250:IF A$=NL$ THEN
{SPACE}220
JF 560 BANK 0:PRINT"{DOWN}
{BLU}PRESS: {RVS}SPACE
{OFF} TO PAUSE, {RVS}RE
TURN{OFF} TO BREAK{4}
{DOWN}"
XA 570 PRINT HEX$(AD)+":";:GOS
UB 310:B=BS+AD-SA
DJ 580 FOR I=B TO B+7:A=PEEK(I
):PRINT RIGHT$(HEX$(A),
2);SP$;:GOSUB 320:NEXT
{SPACE}I
XB 590 PRINT"{RVS}";RIGHT$(HEX
$(CK),2)
GR 600 F=1:AD=AD+8:IF AD>EA TH
EN PRINT"{BLU}** END OF
DATA **":GOTO 220
EB 610 GET A$:IF A$=RT$ THEN P
RINT BE$:GOTO 220
QK 620 IF A$=SP$ THEN F=F+1:PR
INT BE$;
XS 630 ON F GOTO 570,610,570
RF 640 PRINT BE$"{DOWN}{RVS} L
OAD DATA ":OP=1:GOTO 66
0
BP 650 PRINT BE$"{DOWN}{RVS} S
AVE FILE ":OP=0
DM 660 F=0:F$=NL$:INPUT"FILENA
ME{4}";F$:IF F$=NL$ THE
N 220
RF 670 PRINT"{DOWN}{BLK}{RVS}T
{OFF}APE OR {RVS}D{OFF}
ISK: {4}";
SQ 680 GETKEY A$:IF A$="T" THE
N 850:ELSE IF A$<>"D" T
HEN 680
SP 690 PRINT"DISK{DOWN}":IF OP
THEN 760
EG 700 DOPEN#1,(F$+",P"),W:IF
{SPACE}DS THEN A$=DS$:G
OTO 740
JH 710 BANK 0:POKE BS-2,FNLB(S
A):POKE BS-1,FNHB(SA):P
RINT"SAVING ";F$:PRINT
MC 720 FOR A=BS-2 TO BS+EA-SA:
PRINT#1,CHR$(PEEK(A));:
IF ST THEN A$="DISK WRI
TE ERROR":GOTO 750
GC 730 NEXT A:CLOSE 1:PRINT"
{BLU}** SAVE COMPLETED
{SPACE}WITHOUT ERRORS *
*":GOTO 220
RA 740 IF DS=63 THEN BEGIN:CLO
SE 1:INPUT"{BLK}REPLACE
EXISTING FILE [Y/N]{4}
";A$:IF A$="Y" THEN SCR
ATCH(F$):PRINT:GOTO 700
:ELSE PRINT"{BLK}":GOTO
660:BEND
GA 750 CLOSE 1:GOSUB 950:PRINT
"{BLK}{RVS} ERROR DURIN
G SAVE: {4}":PRINT A$:G
OTO 220
FD 760 DOPEN#1,(F$+",P"):IF DS
THEN A$=DS$:F=4:CLOSE
{SPACE}1:GOTO 790
```


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```
PX 770 GET#1,A$,B$:CLOSE 1:AD=
       ASC(A$)+256*ASC(B$):IF
       {SPACE}AD<>SA THEN F=1:
       GOTO 790
KB 780 PRINT"LOADING ";F$:PRIN
       T:BLOAD(F$),B0,P(BS):AD
       =SA+FNAD(174)-BS-1:F=-2
       *(AD<EA)-3*(AD>EA)
RQ 790 IF F THEN 800:ELSE PRIN
       T"{BLU}** LOAD COMPLETE
       D WITHOUT ERRORS **":GO
       TO 220
ER 800 GOSUB 950:PRINT"{BLK}
       {RVS} ERROR DURING LOAD
       : [4]":ON F GOSUB 810,8
       20,830,840:GOTO220
QJ 810 PRINT"INCORRECT STARTIN
       G ADDRESS (";HEX$(AD);"
       )":RETURN
DP 820 PRINT"LOAD ENDED AT ";H
       EX$(AD):RETURN
EB 830 PRINT"TRUNCATED AT ENDI
       NG ADDRESS ("HEX$(EA)")
       ":RETURN
FP 840 PRINT"DISK ERROR ";A$:R
       ETURN
KS 850 PRINT"TAPE":AD=POINTER(
       F$):BANK 1:A=PEEK(AD):A
       L=PEEK(AD+1):AH=PEEK(AD
       +2)
XX 860 BANK 15:SYS DEC("FF68")
       ,0,1:SYS DEC("FFBA"),1,
       1,0:SYS DEC("FFBD"),A,A
       L,AH:SYS DEC("FF90"),12
       8:IF OP THEN 890
FG 870 PRINT:A=SA:B=EA+1:GOSUB
        920:SYS DEC("E919"),3:
       PRINT"SAVING ";F$
AB 880 A=BS:B=BS+(EA-SA)+1:GOS
       UB 920:SYS DEC("EA18"):
       PRINT"{DOWN}{BLU}** TAP
       E SAVE COMPLETED **":GO
       TO 220
CP 890 SYS DEC("E99A"):PRINT:I
       F PEEK(2816)=5 THEN GOS
       UB 950:PRINT"{DOWN}
       {BLK}{RVS} FILE NOT FOU
       ND ":GOTO 220
GQ 900 PRINT"LOADING ...{DOWN}
       ":AD=FNAD(2817):IF AD<>
       SA THEN F=1:GOTO 800:EL
       SE AD=FNAD(2819)-1:F=-2
       *(AD<EA)-3*(AD>EA)
JD 910 A=BS:B=BS+(EA-SA)+1:GOS
       UB 920:SYS DEC("E9FB"):
       IF ST>0 THEN 800:ELSE 7
       90
XB 920 POKE193,FNLB(A):POKE194
       ,FNHB(A):POKE 174,FNLB(
       B):POKE 175,FNHB(B):RET
       URN
CP 930 CATALOG:PRINT"{DOWN}
       {BLU}** PRESS ANY KEY F
       OR MENU **":GETKEY A$:G
       OTO 220
MM 940 PRINT BE$"{RVS} QUIT
       [4]";RT$;"ARE YOU SURE
       {SPACE}[Y/N]?":GETKEY A
       $:IF A$<>"Y" THEN 220:E
       LSE PRINT"{CLR}":BANK 1
       5:END
JE 950 SOUND 1,500,10:RETURN
AF 960 IF ER=14 AND EL=260 THE
       N RESUME 300
MK 970 IF ER=14 AND EL=500 THE
       N RESUME NEXT
KJ 980 IF ER=4 AND EL=780 THEN
        F=4:A$=DS$:RESUME 800
DQ 990 IF ER=30 THEN RESUME:EL
       SE PRINT ERR$(ER);" ERR
       OR IN LINE";EL
```

Division Worksheet

Article on page 42.

```
CR 710 DIM X(50),Y(50),Z(50),R
       (50):SP$="{7 SPACES}":P
       R=1:REM SET PR=0 FOR 15
       26, 802
XE 720 PRINT"{CLR}{RVS}DIVISIO
       N{OFF}":PRINT
JX 730 PRINT"ENTER A {RVS}1
       {OFF} FOR UP TO 99/9":P
       RINTTAB(8)"{RVS}2{OFF}
       {SPACE}FOR UP TO 999/9"
HR 740 PRINTTAB(8)"{RVS}3{OFF}
        FOR UP TO 9999/99:";
XQ 750 INPUTA:IFA<1ORA>3THEN72
       0
QG 760 XL=99:ZL=102:IFA=1THENX
       L=9:ZL=12
HM 770 IFA=2THENXL=9:ZL=112
GD 780 INPUT"{2 DOWN}REMAINDER
       S (Y/N)";R$:IFR$<>"N"AN
       DR$<>"Y"THEN780
XS 790 INPUT"{2 DOWN}ANSWERS (
       Y/N)";A$:IFA$<>"N"ANDA$
       <>"Y"THEN790
RK 800 PRINT"{DOWN}GENERATING
       {SPACE}PROBLEMS...":FOR
       I=1TO50
RS 810 X(I)=INT(RND(0)*XL)+1:Z
       (I)=INT(RND(0)*ZL)
SA 820 R(I)=0:IFR$="Y"THENR(I)
       =INT(RND(0)*X(I))
KF 830 Y(I)=X(I)*Z(I)+R(I):IFY
       (I)>XL*(ZL-1)THEN810
AR 840 IFI=1THEN870
EK 850 FORJ=1TOI-1:IFX(I)=X(J)
       ANDY(I)=Y(J)ANDR(I)=R(J
       )THENJ=I-1:NEXTJ:GOTO81
       0
AQ 860 NEXTJ
QR 870 NEXTI
CH 880 PRINT"{DOWN}POSITION PR
       INTHEAD ABOUT 1/8 INCH"
FS 890 PRINT"BELOW PAPER PERFO
       RATION."
CD 900 PRINT"{DOWN}PRESS {RVS}
       ANY KEY{OFF} TO START P
       RINTING"
HF 910 GETK$:IFK$=""THEN910
FK 920 OPEN4,4
RX 930 PRINT#4,CHR$(14)"
       {12 SPACES}DIVISION PRO
       BLEMS":REM 14 IS DOUBLE
        WIDE
JG 940 PRINT#4,:PRINT#4,CHR$(1
       4)"NAME[30 @]"
EB 950 FORI=1TO3:PRINT#4,:NEXT
       I
SX 960 PRINT#4,CHR$(15):REM RE
       TURN TO NORMAL WIDTH
FF 970 FORJ=0TO8:LM=6
PF 980 IFPR=0THENOPEN6,4,6:PRI
       NT#6,CHR$(22):CLOSE6:RE
       M 1526,802
QB 990 FORI=1TO6:IFJ=8ANDI=3TH
       EN1010
MB 1000 PRINT#4,SPC(LM)"[A]***
       ***";:NEXTI
EC 1010 PRINT#4,CHR$(8):REM GR
       APHICS MODE
CG 1020 FORI=1TO6:IFJ=8ANDI=3T
       HENI=6:GOTO1070
KM 1030 X$=STR$(X(J*6+I)):Y$=S
       TR$(Y(I+J*6)):X=LEN(X$
       ):Y=LEN(Y$)
SD 1040 XS=6-X:YS=5-Y
MA 1050 PRINT#4,CHR$(15);:REM
       {SPACE}RETURN TO NORMA
       L MODE
RF 1060 PRINT#4,SPC(XS)X$CHR$(
       221)Y$SPC(YS)" ";
BX 1070 NEXTI
AR 1080 IFPR=0THENPRINT#4:OPEN
       6,4,6:PRINT#6,CHR$(36)
       :CLOSE6:REM FOR 1526,
       {SPACE}802
SP 1090 IFJ<>8THENFORI=1TOPR+4
       :PRINT#4,:NEXTI
FS 1100 NEXTJ
AG 1110 IFA$<>"Y"THENEND
CR 1120 FORI=1TO2:PRINT#4:NEXT
       I:FORJ=0TO8:PRINT#4,"
       {4 SPACES}";:FORI=1TO6
PM 1130 IFJ=8ANDI=3THENI=6:GOT
       O1180
FB 1140 Z$=LEFT$(SP$,4-LEN(STR
       $(Z(J*6+I))))+STR$(Z(J
       *6+I))
MP 1150 RR$=LEFT$(SP$,4-LEN(ST
       R$(R(J*6+I))))+STR$(R(
       J*6+I))
QX 1160 PRINT#4,Z$" ";:IFR$="Y
       "THENPRINT#4,"R"RR$;"
       {SPACE}";
DH 1170 IFR$<>"Y"THENPRINT#4,S
       P$;
AK 1180 NEXTI:PRINT#4:NEXTJ
DE 1190 PRINT#4:CLOSE4
GF 1200 PRINT"{DOWN}PRESS
       {RVS} R {OFF} TO DO AN
       OTHER WORKSHEET"
CE 1210 PRINT"{DOWN}PRESS
       {RVS} Q {OFF} TO QUIT
SK 1220 GET K$:IF K$="R" THEN
       {SPACE}RUN
HX 1230 IF K$="Q" THEN END
PQ 1240 GOTO1220
```

Mastering 128 Sound And Music

Article on page 82.

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

Kiev

```
JB 10 REM KIEV
GD 20 PRINT"{CLR}{TAB} THE GRE
      AT GATE OF KIEV"
RP 30 PRINT"{2 TAB}{3 SPACES}B
      Y"
QG 40 PRINT"{TAB}MODEST P. MOU
      SSORGSKY
RR 50 PRINT"{DOWN} {RVS}WHICH
      {SPACE}ARRANGEMENT DO YO
      U WANT TO PLAY?"
FF 60 PRINT"{DOWN} {RVS}1{OFF}
       VOICE 1 - MELODY"
XG 70 PRINT"{3 SPACES}VOICE 3
      {SPACE}- LOWEST NOTE IN
      {SPACE}SCORE"
MD 80 PRINT"{3 SPACES}VOICE 2
      {SPACE}- FILL CHORD"
GC 90 PRINT"{DOWN} {RVS}2{OFF}
       VOICE 1 - MELODY"
GB 100 PRINT"{3 SPACES}VOICE 3
       - TONIC NOTE (OR 5TH)"
JJ 110 PRINT"{3 SPACES}VOICE 2
       - FILL CHORD"
```

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```
XE 120 PRINT"{DOWN} {RVS}3
       {OFF} VOICES 1 & 2 - TO
       P 2 NOTES IN SCORE"
DP 130 PRINT"{3 SPACES}VOICE 3
        - FILL CHORD"
CM 140 PRINT"{DOWN} {RVS}4
       {OFF} VOICES 1 & 2 - TO
       P 2 NOTES IN SCORE"
AS 150 PRINT"{3 SPACES}VOICE 3
        - BASS LINE COUNTERMEL
       ODY"
KD 160 PRINT"{DOWN} {RVS}5
       {OFF} VOICE 1 - MELODY"
FC 170 PRINT"{3 SPACES}VOICES
       {SPACE}2 & 3 - OOMPAH P
       ATTERN"
DK 180 TEMPO 10
QC 190 VOL 8
FG 200 ENVELOPE 0,3,0,15,0,1
DK 210 ENVELOPE 1,2,13,6,0,1
AX 220 PLAY"V1T0X0V2T0X0V3T1X0
       "
XR 230 GETKEY X$
AG 240 IF VAL(X$)>5 OR VAL(X$)
       <1 THEN GOTO 230
MF 250 ON VAL(X$) GOSUB 420,53
       0,640,750,860
JB 260 PRINT USING"{DOWN}
       {7 SPACES}{RVS}NOW PLAY
       ING:{OFF} ARRANGEMENT #
       ";X$
XS 270 GOSUB 310
RQ 280 PRINT "{UP}{35 SPACES}
       {2 UP}"
HF 290 GOTO 230
HJ 300 END
EK 310 G$=E$
PP 320 H$=F$
JM 330 I$=A$
XP 340 J$=B$
GQ 350 K$=C$
RS 360 L$=D$
XF 370 PLAY A$:PLAY B$:PLAY C$
       :PLAY D$
CC 380 PLAY E$:PLAY F$:PLAY G$
       :PLAY H$
BX 390 PLAY I$:PLAY J$:PLAY K$
       :PLAY L$
DR 400 PLAY M$:PLAY N$:PLAY O$
       :PLAY P$
EX 410 RETURN
AG 420 A$="V3O2WGV2O44W$BV1O5W
       $E"
MR 430 B$="V1O5WFV2O4W$BV3O2WF
       "
ME 440 C$="V3O2H$EV2O4H$BV1O5H
       GQ$EV2O4HGV3O2HCV1O5QG"
CJ 450 D$="V1O5HFV2O4H$BV3O2HD
       H$BV2O3H$BV1O4H$B"
SR 460 E$="V1O5QGV2O4H$BV3O2H$
       EV1O5Q$BQFV2O4H$BV3O2QD
       QCV1O5Q$E"
RF 470 F$="V1O5HDV2O2HGV3O1H$B
       HGV2O2H$EV1O4H$B"
AH 480 M$="V1O6Q$EV2O5W$AV3O3Q
       CQCV1O6Q$EQDV3O2Q$BQGV1
       O5Q$B"
EA 490 N$="V1O6QCV2O5W$EV3O2Q$
       AQ$AV1O6QCO5Q$AV3O2QFQ$
       AV1O6QC"
MA 500 O$="V1O5H$BV2O5.H$EV3O2
       HGQFV1O5Q$AQGV3O2Q$E"
CC 510 P$="V3O3WFV2O4W$AV1O5WF
       "
EG 520 RETURN
XH 530 A$="V3O2W$BV2O4WGV1O5W$
       E"
AS 540 B$="V1O5WFV2WDV3O2W$B"
RR 550 C$="V3O2H$EV2O4H$BV1O5H
       GQ$EV2O4HGV3O2HCV1O5QG"
BH 560 D$="V1O5HFV2HDV3O2H$BH$
       BV2O3H$BV1O4H$B"
HB 570 E$="V1O5QGV2O4H$BV3O2H$
       EV1O5Q$BQFV2O3QDV3O2H$B
       V2O3QCV1O5Q$E"
PP 580 F$="V1O5HDV2O4H$BV3O2HG
       H$EV2O4HGV1O4H$B"
RP 590 M$="V1O6Q$EV2O4QCV3O3H$
       AV2O4QCV1O6Q$EQDV2O3Q$B
       V3O3H$EV2QGV1O5Q$B"
JH 600 N$="V1O6QCV2O3W$EV3O2Q$
       AQ$AV1O6QCO5Q$AV3O2QFQ$
       AV1O6QC"
AQ 610 O$="V1O5H$BV3O3.H$EV2HG
       QFV1O5Q$AQGV2O3Q$E"
RK 620 P$="V2O4W$AV3WCV1O5WF"
DR 630 RETURN
SX 640 A$="V3O2WGV2O4W$BV1O5W$
       E"
AH 650 B$="V1O5WFV2WDV3O2W$B"
CF 660 C$="V3O2H$BV2O5H$EV1O5H
       GQ$EV2QCV3O2QGQCV2O4QGV
       1O5QG"
DQ 670 D$="V1O5HFV2HDV3O2H$BH$
       BV2O3H$BV1O4H$B"
CH 680 E$="V1O5QGV2Q$EV3O2Q$BQ
       $EV2O4Q$BV1O5Q$BQFV2O4H
       $BV3O2QDQCV1O5Q$E"
JC 690 F$="V1O5HDV2O4H$BV3O2HG
       H$EV2O4HGV1O4H$B"
AM 700 M$="V1O6Q$EV3O3QCV2O5H$
       AV3O3QCV1O6Q$EQDV3O2Q$B
       V2O5H$AV3O2QGV1O5Q$B"
MQ 710 N$="V1O6QCV2O5W$EV3O2Q$
       AQ$AV1O6QCO5Q$AV3O2QFQ$
       AV1O6QC"
MF 720 O$="V1O5H$BV2.H$EV3O2HG
       QFV1O5Q$AQGV3O2Q$E"
PJ 730 P$="V3O3W$AV2O5WCV1O5WF
       "
RF 740 RETURN
GF 750 A$="V3O2QGV2O4W$BV1O5W$
       EV3O2Q$EO1Q$BO2QG"
RE 760 B$="V1O5WFV2WDV3O2QFQDO
       1Q$BO2QF"
EQ 770 C$="V3O2Q$EV2O5H$EV1O5H
       GV3O1Q$BO2QGV1O5Q$EV2QC
       O4QGV3O2QCV1O5QG"
PE 780 D$="V1O5HFV2HDV3O2QFQDO
       1Q$BV2O3H$BV1O4H$BV3O2Q
       $B"
FS 790 E$="V1O5QGV2Q$EV3O2Q$BQ
       $EV2O4Q$BV1O5Q$BQFV2O4H
       $BV3O2QDQCV1O5Q$E"
BP 800 F$="V1O5HDV2O4H$BV3O1Q$
       BO2QGQ$EV2O4HGV1O4H$BV3
       O2QG"
AD 810 M$="V1O6Q$EV3O3QCV2O5H$
       AV3O3QCV1O6Q$EQDV3O2Q$B
       V2O5H$AV3O2QGV1O5Q$B"
FE 820 N$="V1O6QCV2O5W$EV3O2Q$
       AQ$AV1O6QCO5Q$AV3O2QFQ$
       AV1O6QC"
FM 830 O$="V1O5H$BV2.H$EV3O2QG
       O3QGQFV1O5Q$AQGV3O3Q$E"
XD 840 P$="V3O3QFV2O5WCV1O5WFV
       3O3QCO2Q$AO3QC"
SM 850 RETURN
AR 860 A$="V1O5W$EV3O3Q$EO4SGV
       2S$BS$BV3SGIGV2I$BV3O2I
       $BI$BO4QGV2Q$B"
RG 870 B$="V3O2Q$BV1O5WFV3O4S$
       BV2O5SDSDV3O4S$BI$BV2O5
       IDV3O2IFIFO4Q$BV2O5QD"
HF 880 C$="V3O2Q$EV1O5HGV3O4S$
       BV2O5S$ES$EV3O4S$BI$BV2
       O5I$EV3O2ICV1O5Q$EV3O2I
       CV1O5QGV3O3QCV2O4QG"
EC 890 D$="V3O2Q$BV1O5HFV3O4S$
       BV2O5SDSDV3O4S$BI$BV2O5
       IDV3O2I$BV1O4H$BV3O2I$B
       Q$BV2O3Q$B"
SQ 900 E$="V3O2Q$EV1O5QGQ$BV3O
       3S$EV2O4S$BS$BV3O3S$EI$
       EV2O4I$BV3O2I$BV1O5QFV3
       O2I$BO3QCV2O4Q$EV1O5Q$E
       "
SJ 910 F$="V1O5HDV3O2QGSGV2O4S
       $BS$BV3O2SGIGV2O4I$BV3O
       2I$EV1O4H$BV3O2I$EQ$EV2
       O4QG"
DA 920 M$="V3O3Q$AV1O6Q$EQ$EV3
       O4SCV2O5S$AS$AV3O4SCICV
       2O5I$AV3O3I$EV1O6QDV3O3
       I$EQGV2O5Q$AV1Q$B"
DP 930 N$="V1O6QCV3O2Q$AO3S$AV
       1O6QCV2O5S$ES$EV3O3S$AI
       $AV2O5I$EV3O2IFV1O5Q$AV
       3O2IFO3Q$AV2O5Q$EV1O6QC
       "
DE 940 O$="V1O5H$BV3O3Q$ESGV2O
       5S$ES$EV3O3SGIGV2O5I$EV
       3O2IFV1O5Q$AV3O2IFO3Q$E
       V2O4QGV1O5QG"
MQ 950 P$="V1O5WFV3O3QFO4S$AV2
       O5SCSCV3O4S$AI$AV2O5ICV
       3O4ICICQ$AV2O5QC"
SD 960 RETURN
```

Power BASIC:
Sanitation Engineer

See instructions in article on page 46 before typing in.

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

```
CA20:A9 37 85 01 A9 A0 85 03 F6
CA28:A0 00 84 02 B1 02 91 02 79
CA30:88 D0 F9 E6 03 A5 03 C9 6A
CA38:C0 D0 F1 A9 36 85 01 A9 AE
CA40:05 8D 8F B7 A9 21 8D 7D 93
CA48:A3 A2 02 BD 55 CA 9D 26 AB
CA50:B5 CA 10 F7 60 4C 58 CA A4
CA58:A9 00 8D EE CB A9 0F 85 0C
CA60:FA A9 E0 85 F9 A5 34 8D AE
CA68:EF CB 38 E5 32 C9 13 90 BD
CA70:16 E9 03 85 FA A5 32 69 80
CA78:00 85 F9 A5 38 E5 34 69 34
CA80:01 C5 FA B0 02 85 FA A5 34
CA88:38 8D F1 CB A5 37 8D F0 AE
CA90:CB 85 33 18 F0 01 38 AD FE
CA98:F1 CB 85 34 E9 00 85 FB 64
CAA0:69 00 85 FC A5 32 69 01 35
CAA8:85 FE A5 2D E9 06 85 5F 1A
CAB0:A5 2E E9 00 85 60 A5 2F 0A
CAB8:85 FD A5 FB CD EF CB 90 5B
CAC0:38 E5 FA 85 F8 A5 34 E5 50
CAC8:FB E5 F8 49 FF 69 02 C5 F8
CAD0:F8 90 02 A5 F8 CD EF CB 4C
CAD8:B0 05 AD EF CB E9 00 85 48
CAE0:FB 20 89 CB A6 30 20 FA 9B
CAE8:CA B0 09 20 2E CB A5 FB 1B
CAF0:85 FC 90 B6 A2 10 4C 3A 2E
CAF8:A4 60 18 A5 5F 69 07 85 8A
CB00:5F 90 02 E6 60 45 2F D0 61
CB08:04 E4 60 F0 1F A0 00 B1 23
CB10:5F C8 51 5F 10 E4 B1 5F 80
CB18:10 E0 A0 04 B1 5F C5 FB D6
CB20:90 D9 C5 FC B0 D4 20 A9 C1
CB28:CB 90 D0 60 18 60 A5 FD 75
CB30:85 5F 86 60 45 31 D0 04 CD
CB38:E4 32 B0 F0 A0 02 B1 5F C3
CB40:65 5F 85 FD C8 B1 5F 65 24
CB48:60 AA A0 00 B1 5F C8 51 BC
```


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```
CB50:5F 10 DB A0 04 B1 5F 0A D0
CB58:69 05 65 5F 85 5F 90 02 55
CB60:E6 60 A0 02 B1 5F C5 FB 4A
CB68:90 0B C5 FC B0 06 20 A9 1B
CB70:CB 90 02 60 18 A9 03 65 2B
CB78:5F 85 5F 90 02 E6 60 C5 48
CB80:FD D0 DF E4 60 D0 DB F0 84
CB88:A5 A5 F8 85 4F A5 F9 85 5E
CB90:59 A0 00 84 4E 84 58 A6 21
CB98:FA E8 B1 4E 91 58 C8 D0 53
CBA0:F9 E6 59 E6 4F CA D0 F2 C2
CBA8:60 48 78 A9 35 85 01 68 56
CBB0:C5 F8 90 05 E5 F8 18 65 74
CBB8:F9 85 4F 88 B1 5F 85 4E 85
CBC0:88 38 A5 33 F1 5F 85 33 DD
CBC8:C8 91 5F A5 34 E9 00 85 3E
CBD0:34 C8 91 5F 88 88 B1 5F 06
CBD8:F0 09 A8 88 B1 4E 91 33 E5
CBE0:98 D0 F8 A9 36 85 01 58 D4
CBE8:18 A5 FE E5 34 60 00 00 57
```

128 DOS Wedge

See instructions in article on page 84 before typing in.

```
1A00:AD 04 03 AE 05 03 8D C8 6F
1A08:1A 8E C9 1A A9 23 A2 1A 01
1A10:8D 04 03 8E 05 03 60 AD F7
1A18:C8 1A AE C9 1A 20 10 1A 35
1A20:4C 37 4D AD 00 02 A0 09 1F
1A28:D9 DE 1A F0 06 88 10 F8 BE
1A30:6C C8 1A 98 0A 48 20 6D B8
1A38:1A 68 A8 B9 CB 1A 48 B9 55
1A40:CA 1A 48 60 8A F0 20 A2 6A
1A48:03 A0 0C 20 BD FF A2 00 DC
1A50:20 68 FF A9 0F A2 08 A8 05
1A58:20 BA FF 20 C0 FF A9 0F B5
1A60:38 20 C3 FF 4C 37 4D A2 AD
1A68:E8 A0 1A D0 4F A2 FF 20 AE
1A70:80 03 F0 11 C9 22 F0 04 91
1A78:E8 9D 03 0C C8 B1 3D F0 22
1A80:04 C9 22 D0 F3 E8 A9 00 11
1A88:9D 03 0C 8D 00 FF 85 7A 2C
1A90:60 8A D0 08 8D 04 0C A9 70
1A98:2A 8D 03 0C A0 EE 2C A0 20
1AA0:F0 2C A0 8A 2C A0 EF A2 7B
1AA8:20 D0 07 A0 11 2C A0 14 9A
1AB0:A2 FE 8E 00 0C 8C 01 0C 68
1AB8:A2 00 A0 0C 86 3D 84 3E 83
1AC0:A9 22 8D 02 0C 4C DC 4D BC
1AC8:00 00 43 1A 43 1A 90 1A C4
1AD0:90 1A 9E 1A AA 1A A4 1A 6A
1AD8:A1 1A AD 1A 16 1A 40 3E 93
1AE0:24 2A 2F 25 5F 5E 3B 21 F5
1AE8:99 44 53 24 00 00 00 00 A7
```

Data Formatting On The 64

Article on page 85.

Program 1: Demo 1

```
HC 400 PRINT"{CLR}";
JK 410 C1=.5:C2=1:C3=100:PN=10
       00:NN=-1000
QX 420 PRINTSPC(6)"RAW DATA"SP
       C(7)"FORMATTED DATA"
JK 430 PRINTSPC(6)"{8 T}"SPC(7
       )"{14 T}"
AK 440 FORI=1TO20
FX 450 S=RND(-TI)
KM 460 V=(NN-PN+C2)*RND(1)+PN
FA 470 GOSUB5000
BE 480 PRINTSPC(4)V;TAB(24)N$
HA 490 NEXT
FH 500 POKE198,0
MX 510 PRINTSPC(10)"{DOWN}HIT
       {SPACE}A KEY FOR MORE"
XA 520 GETK$:IFK$=""THEN520
MD 530 GOTO400
CH 4999 REM *** DECIMAL FORMAT
        ROUTINE ***
RB 5000 N$=STR$(INT(V*C3+C1)/C
        3)
RS 5010 LO=LEN(N$)
ER 5020 FORJ=2TOLO
RE 5030 IFMID$(N$,J,1)="."THEN
        FR=LO-J:J=LO
AR 5040 NEXT
FF 5050 ONFR+C2GOTO5070,5080,5
        090
CA 5060 N$=LEFT$(N$,LO-FR+2):G
        OTO5090
PE 5070 N$=N$+".00":RETURN
EK 5080 N$=N$+"0"
SS 5090 FR=0:RETURN
```

Program 2: Demo 2

```
EQ 400 DIMN$(80)
JK 410 C1=.5:C2=1:C3=100:PN=10
       00:NN=-1000
EP 420 PRINT"{CLR}PRINTER? (Y/
       N) ";
GH 430 GETA$:IFA$=""THEN430
HX 440 DE=3:IFA$="Y"THENDE=4
QX 450 OPENDE,DE
DX 460 PRINT"{CLR}GENERATING R
       ANDOM DATA #"
EE 470 FORX=1TO80
SB 480 S=RND(-TI)
GE 490 V=(NN-PN+C2)*RND(1)+PN
GD 500 GOSUB5000
QX 510 PRINT"{HOME}"SPC(24)X
MG 520 N$(X)=N$
AC 530 NEXT
KH 540 A=1:B=4
AH 550 FORY=1TO20
SK 560 PRINT#DE
GS 570 FORI=ATOB
DK 580 PRINT#DE,SPC(9-LEN(N$(I
       )))N$(I);
JH 590 NEXT
QA 600 A=A+4
GB 610 B=B+4
KJ 620 NEXT
EF 630 PRINT#DE:CLOSEDE
BE 640 PRINTSPC(10)"{DOWN}HIT
       {SPACE}A KEY FOR MORE"
SG 650 GETK$:IFK$=""THEN650
XR 660 GOTO420
CH 4999 REM *** DECIMAL FORMAT
        ROUTINE ***
RB 5000 N$=STR$(INT(V*C3+C1)/C
        3)
RS 5010 LO=LEN(N$)
ER 5020 FORJ=2TOLO
RE 5030 IFMID$(N$,J,1)="."THEN
        FR=LO-J:J=LO
AR 5040 NEXT
FF 5050 ONFR+C2GOTO5070,5080,5
        090
CA 5060 N$=LEFT$(N$,LO-FR+2):G
        OTO5090
PE 5070 N$=N$+".00":RETURN
EK 5080 N$=N$+"0"
SS 5090 FR=0:RETURN
```

MetaBASIC 64

See instructions in article on page 70 before typing in.

```
9000:4C C2 91 45 01 08 00 00 A6
9008:FF FF 00 01 00 00 01 00 3B
9010:00 00 C7 08 00 0C 0C 42 35
9018:06 00 00 04 04 0F 00 00 D8
9020:00 00 00 00 00 A9 01 2C 16
9028:A9 00 8D 24 90 20 92 91 CD
9030:A9 45 8D 28 03 A9 91 8D 1B
9038:29 03 AD 1D 90 85 B7 86 C6
9040:BB 84 BC A0 02 A9 00 99 52
9048:56 02 88 10 FA A9 08 85 3B
9050:BA A9 60 85 B9 20 6C 90 55
9058:90 15 A9 02 20 C3 FF A9 16
9060:0F 20 C3 FF 20 E7 FF A2 CC
9068:05 6C 00 03 20 D5 F3 A5 3D
9070:BA 20 B4 FF A5 B9 20 96 78
9078:FF A9 98 8D 00 03 A9 90 DF
9080:8D 01 03 A9 2C 8D 02 03 42
9088:A9 91 8D 03 03 20 A5 FF A8
9090:20 50 91 B0 48 20 A5 FF 21
9098:20 A5 FF 8D 17 90 20 A5 EC
90A0:FF 0D 17 90 F0 37 20 A5 3B
90A8:FF 85 14 8D 17 90 20 A5 67
90B0:FF 85 15 8D 18 90 AD 24 31
90B8:90 D0 04 A0 01 D0 02 A0 D0
90C0:FF C8 20 A5 FF 99 00 02 DA
90C8:D0 F7 20 3C 91 20 89 91 C9
90D0:98 18 69 05 A8 AD 24 90 96
90D8:F0 2D 4C A2 A4 20 AB FF 6E
90E0:20 42 F6 20 E7 FF A9 83 99
90E8:8D 02 03 A9 A4 8D 03 03 B0
90F0:A9 8B 8D 00 03 A9 E3 8D 8F
90F8:01 03 A9 ED 8D 28 03 A9 2C
9100:F6 8D 29 03 4C 37 9E 20 F3
9108:21 9F AE 17 90 AD 18 90 E6
9110:20 CD BD A9 00 85 5F A9 87
9118:02 85 60 A9 00 85 49 A9 96
9120:56 8D 00 02 A9 02 8D 01 63
9128:02 4C ED A6 AD 17 90 85 F7
9130:14 AD 18 90 85 15 20 13 A8
9138:A6 4C C9 A6 48 A5 CB C9 9F
9140:3F F0 9A 68 60 48 A5 CB 54
9148:C9 3F F0 91 68 4C ED F6 9E
9150:8D 12 90 18 A5 90 F0 2D D0
9158:20 21 9F A9 0F A2 08 A8 1E
9160:20 BA FF A9 00 20 BD FF D8
9168:20 C0 FF A2 0F 20 C6 FF 7C
9170:20 CF FF 48 20 D2 FF 68 D0
9178:C9 0D D0 F4 A9 0F 20 C3 BA
9180:FF 20 CC FF 38 AD 12 90 72
9188:60 A0 FF C8 B9 00 02 D0 33
9190:FA 60 20 79 00 C9 00 F0 FC
9198:27 20 73 00 90 08 C9 22 20
91A0:F0 04 38 4C B5 91 20 9E DB
91A8:AD A5 0D D0 09 20 9B BC 77
91B0:A5 64 A4 65 18 60 20 82 AF
91B8:B7 8D 1D 90 A6 22 A4 23 F1
91C0:38 60 78 A9 EB 8D 04 03 62
91C8:A9 91 8D 05 03 A9 41 8D F5
91D0:14 03 A9 93 8D 15 03 20 14
91D8:3E 94 58 A5 38 C9 90 90 40
91E0:07 A9 90 85 38 20 5C A6 FD
91E8:4C 37 9E A2 FF E8 BD 00 1D
91F0:02 C9 20 F0 F8 A0 FF 8D 72
91F8:17 90 C8 C0 E0 B0 4F D9 33
9200:51 92 D0 18 8C 18 90 8E 82
9208:19 90 E8 C8 B9 51 92 30 EF
9210:1D DD 00 02 F0 F4 AC 18 28
9218:90 AE 19 90 C8 C0 E0 B0 19
9220:2D B9 51 92 10 F6 AD 17 6C
9228:90 C8 C8 4C FA 91 8E 1B FB
9230:90 86 7A E8 BD 00 02 F0 FF
9238:04 C9 41 B0 11 C8 B9 51 75
9240:92 8D 4C 92 C8 B9 51 92 27
9248:8D 4D 92 4C 27 9F 4C 7C 6B
9250:A5 41 55 54 CF 15 98 42 CE
9258:53 41 56 C5 27 9F 43 41 1E
9260:D4 2F 93 43 48 41 4E 47 8D
9268:C5 D4 9B 44 45 46 41 55 78
9270:4C D4 F2 93 44 45 4C 45 9D
9278:54 C5 B6 94 44 4C 49 53 92
9280:D4 28 90 44 55 4D D0 57 49
9288:97 45 52 D2 38 94 46 49 2C
9290:4E C4 C8 9B 48 45 4C D0 A1
9298:EE 9D 49 4E D4 C2 91 4B CA
92A0:45 D9 95 93 4C 4C 49 53 44
92A8:D4 90 9D 4D 45 4D 4F 52 35
92B0:D9 39 95 4D 45 52 47 C5 60
92B8:25 90 4D 4F 4E 49 54 4F C2
92C0:D2 04 96 4E 55 4D 42 45 B1
92C8:D2 A6 96 51 55 49 D4 01 63
92D0:96 52 45 41 C4 67 94 52 D1
92D8:45 4E 55 CD 00 99 52 45 0C
92E0:53 41 56 C5 0E 96 53 43 DB
```

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```
92E8:52 41 54 43 C8 05 96 53 21
92F0:45 4E C4 19 96 53 50 45 5E
92F8:45 C4 E5 9D 53 54 41 52 49
9300:D4 6A 94 54 45 52 4D 49 5B
9308:4E 41 CC 40 9E 54 52 41 70
9310:43 C5 AE 98 54 52 4F 46 7A
9318:C6 F3 98 55 4E 4E 45 D7 16
9320:9B 96 56 43 48 41 4E 47 E4
9328:C5 BC 9B 40 A0 D0 93 A0 E8
9330:01 B9 3D 93 91 7A C8 C0 EF
9338:04 D0 F6 4C 28 90 22 24 25
9340:00 A5 CB CD 0E 90 F0 4A 06
9348:8D 0E 90 C9 03 D0 04 A9 75
9350:07 D0 08 C9 04 90 3B C9 6F
9358:07 B0 37 38 E9 04 0A 0A 17
9360:0A 0A 0A AE 8D 02 F0 03 94
9368:18 69 10 A8 A2 00 B9 61 6C
9370:9F C9 5F D0 02 A9 0D C9 6D
9378:27 D0 08 A5 D4 49 01 85 16
9380:D4 A9 22 C9 00 F0 09 9D D0
9388:77 02 E8 C8 E0 0A D0 DE 45
9390:86 C6 4C 31 EA 20 92 91 D7
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93A8:FB A9 9F 69 00 85 FC 20 F2
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98D0:AD 1F 90 C5 3A D0 02 F0 19
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99A0:B1 BC C9 20 F0 F9 AC 0F EE
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9A60:FF B9 00 00 99 00 00 88 59
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9A80:93 8D 9B 9A A5 94 8D 9D 38
9A88:9A A5 95 8D 9E 9A A6 B5 62
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9AA8:EE 9E 9A E0 00 F0 07 CA FA
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9AC8:90 85 B8 AD 07 90 85 B9 D8
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9AD8:85 FE A0 00 B1 FD 85 A7 DC
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9B70:0F 98 38 65 FB 85 2D A5 A8
9B78:FC 69 00 85 2E 60 A2 00 19
9B80:C8 D0 E5 E6 FC D0 E1 A2 0D
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9C30:90 90 02 B0 32 C8 B1 BC F5
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9CA8:03 AD 03 90 A4 B4 91 BC 10
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9E40:A9 00 85 F7 A9 CE 85 F8 0F
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9F28:92 91 20 BD FF 20 92 91 2C
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9F40:C0 FF 20 50 91 B0 09 A9 F3
9F48:FB A6 65 A4 64 20 D8 FF 7B
9F50:A9 02 20 C3 FF 4C 37 9E 63
9F58:A9 01 85 D4 A5 2D 85 FB 93
9F60:60 5F 00 00 00 00 00 00 A7
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See instructions in article on page 77 before typing in.

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8976:41 4B 45 44 41 54 C1 9F 68
897E:8C 00 43 55 52 53 4F 52 66
8986:46 52 45 C5 D5 8D 00 43 7E
898E:55 52 53 4F 52 50 52 49 02
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89CE:00 02 C9 20 F0 F8 8D E7 0C
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89DE:B9 4E 89 D0 03 4C EB 91 53
89E6:C9 42 D0 ED E8 C8 B9 4E 94
89EE:89 30 08 DD 00 02 F0 F4 90
89F6:4C CA 89 C8 B9 4E 89 8D 48
89FE:0A 8A C8 B9 4E 89 8D 0B 2D
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8AB6:90 02 A0 32 8C 1B 8B 8C 40
8ABE:FD 8A AD 14 03 C9 25 D0 C6
8AC6:0A AD 15 03 C9 8B D0 03 40
8ACE:4C DD 8A AD 14 03 8D CD 43
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8ADE:A1 8A AE A0 8A 86 C7 20 65
8AE6:CD BD A9 0D 20 D2 FF 18 BC
8AEE:AD A0 8A 69 07 8D A0 8A 25
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8AFE:E9 07 8D FD 8A B0 D8 78 9D
8B06:A9 25 8D 14 03 A9 8B 8D 91
8B0E:15 03 A9 91 8D 3F 8B A9 E8
8B16:00 8D 40 8B A9 06 8D 38 0A
8B1E:8B 58 A2 80 4C 37 9E A2 8C
8B26:04 8E AE 8B A2 FF A0 05 CC
8B2E:A9 00 8D A8 8B 8D AD 8B CF
8B36:E8 E0 06 90 03 4C CC 8B 32
8B3E:BD 91 00 8D 77 8B 8D 4E C4
8B46:8B A5 CB C9 3F D0 24 A9 D1
8B4E:00 C9 20 B0 03 4C 6A 8B 90
8B56:C9 60 90 03 4C 6A 8B C9 99
8B5E:40 B0 03 4C 6C 8B 38 E9 D2
8B66:40 4C 6C 8B A9 20 09 80 57
8B6E:4C 73 8B A9 20 20 AC 8B FA
8B76:A9 00 C9 64 90 08 E9 64 BE
8B7E:EE A8 8B 4C 78 8B 20 A4 44
8B86:8B C9 0A 90 08 E9 0A EE 0B
8B8E:A8 8B 4C 87 8B 20 A4 8B 90
8B96:8D A8 8B 20 A4 8B A9 20 D8
8B9E:20 AC 8B 4C 36 8B 8D CA EC
8BA6:8B A9 00 18 69 30 99 00 AE
8BAE:04 C8 C0 28 D0 10 A0 05 A1
8BB6:18 AD AD 8B 69 28 8D AD 68
8BBE:8B 90 03 EE AE 8B A9 00 06
8BC6:8D A8 8B A9 00 60 4C 41 36
8BCE:93 EA EA A9 E3 8D 00 03 BA
8BD6:A9 8B 8D 01 03 A9 00 8D B3
8BDE:ED 8B 4C 37 9E A5 3A C9 96
8BE6:FF D0 03 4C 8B E3 A9 00 96
8BEE:D0 4B E0 80 F0 F5 8E 5C 3E
8BF6:8C A5 39 85 14 A5 3A 85 6E
8BFE:15 20 13 A6 A5 5F 85 9B C6
8C06:A5 60 85 9C A0 03 8C 3C EA
8C0E:8C 38 A5 7A E5 9B 8D 3F CF
8C16:8C A9 0D 8D ED 8B 20 D2 0B
8C1E:FF 20 D2 FF A5 3A 85 62 1D
8C26:A5 39 85 63 A2 90 38 20 2F
8C2E:49 BC 20 DF BD 20 1E AB 73
8C36:A9 20 20 D2 FF A0 63 C8 6F
8C3E:C0 63 D0 03 20 60 8C B1 28
8C46:9B 8D 52 8C F0 0A 8C 3C A8
8C4E:8C A0 FF A9 63 4C 1A A7 98
8C56:A9 00 8D ED 8B A2 63 4C CE
8C5E:8B E3 A9 6B 8C 6D 8C A0 F5
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8C66:A3 84 C7 20 1E AB A0 63 B1
8C6E:A9 00 85 C7 60 A9 8B 8D D7
8C76:00 03 A9 E3 8D 01 03 4C 86
8C7E:37 9E 20 D2 FF AD 86 02 D1
8C86:A0 FA 99 00 D8 99 FA D8 DD
8C8E:99 F4 D9 99 EE DA 88 D0 4B
8C96:F1 60 8D 01 03 6C 02 03 53
8C9E:02 20 92 91 84 FB 8C 32 8B
8CA6:8D 85 FC 8D 33 8D 20 92 03
8CAE:91 84 FD 85 FE 38 A5 FD EB
8CB6:E5 FB 8D 5C 8D A5 FE E5 20
8CBE:FC 8D 6A 8D AD 6A 8D C9 DB
8CC6:11 90 05 A2 0E 6C 00 03 7C
8CCE:A9 00 8D BC 8D 8D 16 8D 96
8CD6:8D B7 8D A9 08 8D BD 8D 70
8CDE:A9 4C 8D F9 8C A9 08 8D D9
8CE6:FE 8C A2 00 8A 20 BB 8D D0
8CEE:AD BC 8D 85 FB AD BD 8D B7
8CF6:85 FC A9 B4 20 BB 8D A9 47
8CFE:18 20 BB 8D A0 00 18 AD 5F
8D06:F9 8C 69 4B 8D F9 8C AD 3E
8D0E:FE 8C 69 00 8D FE 8C A9 24
8D16:3A 20 BB 8D A9 00 20 BB EF
8D1E:8D EE 16 8D A9 83 20 BB AE
8D26:8D A9 20 20 BB 8D A9 20 FF
8D2E:20 BB 8D AD 32 8D C9 64 94
8D36:90 08 E9 64 EE B7 8D 4C DC
8D3E:34 8D 20 B3 8D C9 0A 90 4E
8D46:08 E9 0A EE B7 8D 4C 43 DF
8D4E:8D 20 B3 8D 8D B7 8D 20 0E
8D56:B3 8D CE 5C 8D A9 B7 C9 9A
8D5E:FF D0 03 CE 6A 8D AD 5C 3C
8D66:8D D0 07 A9 01 D0 03 4C 95
8D6E:8A 8D EE 32 8D AD 32 8D 48
8D76:D0 03 EE 33 8D E0 4B 90 E2
8D7E:03 4C E8 8C A9 2C 20 BB 0E
8D86:8D 4C 31 8D A9 00 20 BB C3
8D8E:8D AD BC 8D A0 00 91 FB 70
8D96:AD BD 8D C8 91 FB A9 00 06
8D9E:20 BB 8D A9 00 20 BB 8D 8A
8DA6:AD BC 8D 85 2D AD BD 8D FA
8DAE:85 2E 4C 37 9E 8D D0 8D 6F
8DB6:A9 00 18 69 30 8D A9 1B 66
8DBE:EE BC 8D AC BC 8D D0 03 BD
8DC6:EE BD 8D A0 00 8C B7 8D B3
8DCE:E8 A9 09 60 AF AF AD 78 FF
8DD6:AD 8F 02 C9 FA D0 03 4C F6
8DDE:52 8E 8D 0B 8E AD 90 02 77
8DE6:8D 0C 8E A9 FA 8D 8F 02 67
8DEE:A9 8D 8D 90 02 8D 07 8E DF
8DF6:58 4C 52 8E A5 CB F0 3C FE
8DFE:C9 02 F0 0B C9 07 F0 07 A1
8E06:A9 2C F0 1D 4C 48 EB A5 F3
8E0E:D4 D0 07 A5 D8 D0 1E 4C 97
8E16:0A 8E A5 D4 8D 2D 8E A9 C5
8E1E:00 8D 07 8E 85 D4 4C 0A 8A
8E26:8E A9 2C 8D 07 8E A9 00 19
8E2E:85 D4 4C 0A 8E A9 00 85 0E
8E36:D8 4C 0A 8E A9 00 8D 2D 92
8E3E:8E 85 D4 4C 0A 8E 78 AD 8C
8E46:0B 8E 8D 8F 02 AD 0C 8E A4
8E4E:8D 90 02 58 A2 80 6C 00 0C
8E56:03 02 02 A9 93 20 80 8C FA
8E5E:A0 FF A2 00 8E 92 8E 8E 8A
8E66:BD 8E A9 04 8D BE 8E C8 C8
8E6E:B9 4E 89 D0 FA C8 B9 4E F6
8E76:89 D0 0B A9 05 85 D6 A9 1E
8E7E:00 85 FB 4C FB 9D 10 2D E4
8E86:C9 A0 D0 02 A9 60 29 7F 8B
8E8E:20 B9 8E A9 00 D0 08 A2 8C
8E96:14 8E 92 8E 4C 6D 8E A2 74
8E9E:00 8E 92 8E 18 AD BD 8E 1C
8EA6:69 28 90 03 EE BE 8E 8D E1
8EAE:BD 8E 4C 6D 8E 20 B9 8E A5
8EB6:4C 73 8E 38 E9 40 9D F0 A8
8EBE:04 E8 60 AF A5 2E A6 2D 7F
8EC6:85 62 86 63 4C F2 8E 38 C9
8ECE:A5 33 E5 31 85 63 A5 34 94
8ED6:E5 32 85 62 4C F2 8E 20 B5
8EDE:92 91 84 FB 85 FC A0 00 5B
8EE6:B1 FB 85 63 C8 B1 FB 85 4D
8EEE:62 4C F2 8E A2 90 38 20 7F
8EF6:49 BC 20 DF BD 20 1E AB 40
8EFE:A2 80 6C 00 03 A9 00 85 5F
8F06:37 A9 A0 85 38 20 5C A6 39
8F0E:20 53 E4 00 00 00 00 00 AE
```

MetaBASIC 128

See instructions in article on page 79 before typing in.

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

```
1300:4C 15 13 4C 4F 4F 4C 32 3B
1308:8E 4C E8 4D 4C A0 50 4C 4C
1310:E5 50 4C 64 50 A2 2A A0 0F
1318:13 D0 04 A2 0D A0 43 8E A6
1320:04 03 8C 05 03 A2 80 6C FA
1328:00 03 AD 00 FF 8D 93 18 3A
1330:A9 00 8D 00 FF A9 EC 8D EA
1338:28 03 A9 17 8D 29 03 A9 9A
1340:0F A8 A2 08 20 BA FF 20 F8
1348:E6 17 A9 00 20 BD FF 20 F4
1350:C0 FF A2 00 8E 94 18 A0 C2
1358:FF C8 B9 00 02 F0 3D C9 FF
1360:20 F0 F6 DD AB 13 D0 28 03
1368:C8 E8 BD AB 13 29 7F D9 B5
1370:00 02 D0 1C BD AB 13 10 C5
1378:EF AD 94 18 0A AA 8C 95 BF
1380:18 84 3D A9 02 85 3E BD 76
1388:E3 13 48 BD E2 13 48 60 9E
1390:E8 BD AB 13 10 FA E8 EE 6E
1398:94 18 10 BB 18 A9 0F 20 72
13A0:C3 FF AD 93 18 8D 00 FF 8E
13A8:4C 0D 43 41 49 C4 43 48 E0
13B0:41 4E 47 C5 44 45 46 41 55
13B8:55 4C D4 44 4C 49 53 D4 7E
13C0:46 49 4E C4 4D 45 52 47 DD
13C8:C5 51 55 49 D4 52 45 41 21
13D0:C4 52 45 53 41 56 C5 53 0E
13D8:54 41 52 D4 55 4E 4E 45 D6
13E0:D7 00 F7 13 46 14 10 14 D9
13E8:64 16 43 14 61 16 1A 13 1B
13F0:0E 17 20 17 99 17 B3 17 01
13F8:A0 FF D0 0C 08 29 7F 20 4E
1400:D2 FF 28 10 03 20 0A 17 5B
1408:C8 B9 AE 13 D0 EE 4C BC A1
1410:17 20 79 18 8E 88 18 20 63
1418:79 18 8E 87 18 20 79 18 99
1420:8E 89 18 A9 30 8D 00 0A 51
1428:A9 14 8D 01 0A 4C BC 17 FD
1430:AD 87 18 8D 21 D0 AD 88 1D
1438:18 8D 20 D0 AD 89 18 85 2A
1440:F1 4C 03 40 A9 00 2C A9 28
1448:FF 8D 97 18 20 21 16 A2 9C
1450:FF 20 41 16 AD 97 18 F0 F6
1458:03 20 44 16 A9 FF 85 47 93
1460:85 48 A5 2D 85 FC A5 2E 7E
1468:85 FD 20 72 18 90 17 20 4F
1470:12 13 A5 61 85 FC A5 62 FE
1478:85 FD 20 86 03 20 75 18 EA
1480:90 04 86 47 85 48 A0 00 C5
1488:8D 01 FF 8C 92 18 B1 FC D5
1490:8D 94 18 C8 B1 FC 0D 94 64
1498:18 D0 2E 4C BC 17 AD 92 BB
14A0:18 F0 17 8C 92 18 A5 FC F9
14A8:85 61 A5 FD 85 62 8D 03 54
14B0:FF 20 0F 13 8D 01 FF AC 11
14B8:92 18 C8 18 98 65 FC 85 A4
14C0:FC A5 FD 69 00 85 FD 90 C9
14C8:BD C8 B1 FC 85 16 C8 B1 CF
14D0:FC 85 17 A5 47 C5 16 A5 39
14D8:48 E5 17 90 BE A2 00 C8 D3
14E0:B1 FC F0 BA DD 99 18 D0 41
14E8:F4 8C 98 18 C8 E8 BD 99 42
14F0:18 F0 09 D1 FC F0 F5 AC E3
14F8:98 18 D0 E1 8C 94 18 EE 81
1500:92 18 AD 97 18 D0 05 AC 63
1508:98 18 D0 D1 18 AD 94 18 74
1510:65 FC 8D 8A 18 A5 FD 69 43
1518:00 8D 8B 18 18 AD 98 18 59
1520:65 FC 8D 8E 18 A5 FD 69 93
1528:00 8D 8F 18 18 AD 8E 18 D5
1530:6D 91 18 8D 8E 18 AD 8F 11
1538:18 69 00 8D 8F 18 20 8E 4D
1540:15 38 AD 8E 18 ED 8A 18 47
1548:8D 8E 18 AD 8F 18 ED 8B FE
1550:18 8D 8F 18 18 AD 10 12 07
1558:6D 8E 18 8D 10 12 AD 11 ED
1560:12 6D 8F 18 8D 11 12 A2 D9
1568:FF E8 BD 99 18 D0 FA AC C4
1570:98 18 88 E8 C8 BD 99 18 15
1578:F0 04 91 FC D0 F5 88 8D 1B
1580:03 FF 20 03 13 8D 01 FF 31
1588:AC 98 18 4C DD 14 38 AD 54
1590:10 12 ED 8A 18 8D 8C 18 D5
1598:AD 11 12 ED 8B 18 8D 8D 64
15A0:18 38 AD 8A 18 ED 8E 18 F0
15A8:8D 94 18 AD 8B 18 ED 8F C4
15B0:18 0D 94 18 D0 01 60 B0 3A
15B8:37 AE 8D 18 18 8A 6D 8B AE
15C0:18 8D DD 15 AD 8A 18 8D BC
15C8:DC 15 18 8A 6D 8F 18 8D B9
15D0:E0 15 AD 8E 18 8D DF 15 1B
15D8:E8 A0 FF B9 FF FF 99 FF 6E
15E0:FF 88 C0 FF D0 F5 CE DD 1F
15E8:15 CE E0 15 CA D0 EA 60 8E
15F0:AD 8A 18 8D 0F 16 AD 8B 28
15F8:18 8D 10 16 AD 8E 18 8D 5B
1600:12 16 AD 8F 18 8D 13 16 9C
1608:AE 8D 18 E8 A0 00 B9 FF F8
1610:FF 99 FF FF C8 D0 F7 EE 0B
1618:10 16 EE 13 16 CA D0 EE 4D
1620:60 EE 95 18 AC 95 18 B9 12
1628:00 02 F0 12 C9 20 F0 F1 B6
1630:85 FC C9 2F F0 07 C9 40 02
1638:D0 04 20 0D 43 60 4C FD D4
1640:17 AC 95 18 A9 FF 8D 91 51
1648:18 C8 E8 B9 00 02 F0 EE 44
1650:9D 99 18 EE 91 18 C5 FC 19
1658:D0 EF 84 3D A9 00 9D 99 6F
1660:18 60 A9 00 2C A9 FF 8D 7B
1668:97 18 A0 00 20 30 18 20 8C
1670:E4 FF 20 E4 FF 20 E4 FF AB
1678:8D 94 18 20 E4 FF 0D 94 6B
1680:18 D0 03 4C BC 17 A0 02 97
1688:A9 02 8D 01 02 20 E4 FF 26
1690:99 14 00 99 00 02 C8 C0 82
1698:04 D0 F2 88 C8 20 E4 FF 72
16A0:99 00 02 C9 00 D0 F5 8C 32
16A8:00 02 A2 02 C8 99 00 02 78
16B0:CA D0 F9 A9 00 85 61 A9 D2
16B8:02 85 62 38 20 0F 13 AD 28
16C0:97 18 D0 B1 A9 04 85 3D 99
16C8:A9 02 85 3E A2 DD A0 16 C2
16D0:20 EA 16 38 AD 00 02 E9 69
16D8:03 A8 4C 09 13 EE 20 D0 30
16E0:20 FD 16 A9 00 8D 00 FF 30
16E8:F0 8B AD 02 03 8D 95 18 D7
16F0:AD 03 03 8D 96 18 8E 02 22
16F8:03 8C 03 03 60 AD 95 18 57
1700:8D 02 03 AD 96 18 8D 03 E3
1708:03 60 A9 0D 4C D2 FF A0 24
1710:02 20 30 18 20 E4 FF 20 83
1718:D2 FF A4 90 F0 F6 4C BC 06
1720:17 A2 0F 20 C9 FF 20 0B FF
1728:18 AC 95 18 8A 38 6D 95 67
1730:18 AA A9 00 9D 00 02 A2 DD
1738:02 BD 81 17 99 00 02 88 D1
1740:CA 10 F6 AE 95 18 CA CA 0F
1748:A9 02 20 84 17 20 CC FF EA
1750:AD 96 18 AE 95 18 E8 A0 68
1758:02 20 BD FF 20 E6 17 A0 B2
1760:02 20 DF 17 A2 01 B5 2D B6
1768:95 FC CA 10 F9 A9 FC AE 1A
1770:10 12 AC 11 12 20 D8 FF 94
1778:20 4F 18 20 0A 17 4C BC 91
1780:17 53 30 3A 85 FD 98 48 56
1788:86 FC A0 00 B1 FC D0 03 73
1790:68 A8 60 20 D2 FF C8 4C 9F
1798:8C 17 A0 02 20 30 18 20 19
17A0:E4 FF 8D 95 18 20 E4 FF 57
17A8:AE 95 18 20 06 13 20 0A 5F
17B0:17 4C BC 17 A0 01 98 91 52
17B8:2D 20 03 13 A9 00 8D 00 7F
17C0:FF 20 F2 17 20 CC FF A9 A4
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17C8:02 20 C3 FF A9 0F 20 C3 06
17D0:FF 20 0A 17 AD 93 18 8D 33
17D8:00 FF A2 80 6C 00 03 A9 76
17E0:02 A2 08 4C BA FF A9 00 A7
17E8:AA 4C 68 FF 20 6E F6 F0 26
17F0:CB 60 A9 6E 8D 28 03 A9 F5
17F8:F6 8D 29 03 60 18 A9 0F 21
1800:20 C3 FF 20 F2 17 A2 0B 77
1808:6C 00 03 AC 95 18 C8 B9 F1
1810:00 02 F0 E9 C9 22 D0 F6 EC
1818:8C 95 18 A2 FF C8 E8 B9 CF
1820:00 02 F0 04 C9 22 D0 F5 9D
1828:CA 30 D2 E8 8E 96 18 60 12
1830:20 DF 17 20 E6 17 20 0B 2C
1838:18 8A AE 95 18 E8 A0 02 ED
1840:20 BD FF 20 C0 FF 20 4F 87
1848:18 A2 02 20 C6 FF 60 A2 09
1850:0F 20 C6 FF 20 E4 FF C9 47
1858:30 D0 0D 20 E4 FF C9 0D 40
1860:D0 F9 4C CC FF 20 E4 FF 18
1868:20 D2 FF C9 0D D0 F6 4C DF
1870:BC 17 20 80 03 C9 2C D0 39
1878:0C 20 80 03 20 0C 13 A6 F4
1880:16 A5 17 38 60 18 60 00 AF
1888:00 00 00 00 00 00 00 00 B8
```

Pick-A-Letter

Article on page 34.

Program 1: Pick-A-Letter—64 And 128 Version

```
SM 10 BO=53280:AC=53281:SC=1024:S=54272
HQ 20 FORI=1TO9:READH(I),L(I):NEXT
MG 30 DATA 79,191,84,125,89,131,94,214,100,121,106,115,112,199,119,124,126,151
CJ 40 GOSUB50:POKES+24,15:GOTO150
PS 50 FORG1=STOS+23:POKEG1,0:NEXT:RETURN
JR 60 FORJ=B1TOT1STEPS1:POKES,L(J):POKES+1,H(J):NEXT:RETURN
MM 70 POKES+5,31:POKES+6,208:POKES,240:POKES+1,4:POKES+4,33:POKES+24,15:GOTO90
DJ 80 POKES+5,8:POKES+6,240:POKES,0:POKES+1,90:POKES+4,17
QE 90 FORH=1TO100:NEXT:GOSUB50:RETURN
KF 100 GOSUB50:POKES,120:POKES+1,105:POKES+5,128:POKES+6,128:POKES+4,33
HQ 110 POKES+24,15:FORX5=105TO62STEP-1:FORU2=1TO30:NEXTU2:POKES+1,X5:NEXTX5
RG 120 POKES,232:POKES+1,3:FORL=1TO100:NEXT:GOSUB50:RETURN
FK 130 POKES+24,15:POKES+5,128:POKES+6,32:POKES,64:POKES+1,156:POKES+4,17
GJ 140 FORL=1TO25:NEXT:POKES+4,16:RETURN
XM 150 PRINT"{CLR}"CHR$(159);:POKEBO,11-(AL=1)*38:POKEAC,11-(AL=1)*38
CG 160 FORG=1TO11:READA,B:POKEA+SC,B:GOSUB80:POKEA+S+SC,10
QG 170 FORJ=1TO100:NEXT
MR 180 NEXT
GG 190 DATA 418,1,415,3,421,5,424,5,414,9
MJ 200 DATA 416,11,420,12,413,16,425,18
PP 210 DATA 422,20,423,20
HK 220 PRINT"{14 DOWN}{2 RIGHT}PLEASE WAIT WHILE PUZZLES ARE SORTED"
PX 230 NW=90:DIM P$(NW),P(NW),P%(NW):QQ=1
CC 240 FORG=1TONW:READ P(G),P$(G):NEXT
CH 250 GOSUB980
KE 260 FORG=1TO3:BB(G)=1000:NEXT
MP 270 PRINT"{8}{CLR}{2 DOWN}"
JH 280 PRINT"HOW MANY PLAYERS {SPACE}(1 TO 3)?"
RH 290 GETQ$:IFQ$=""THEN290
KX 300 IF Q$="1"THEN NP=1:GOTO340
AK 310 IF Q$="2"THEN NP=2:GOTO340
HM 320 IF Q$="3"THEN NP=3:GOTO340
RM 330 GOTO280
AM 340 PRINT"{DOWN}PLEASE ENTER WINNING SCORE (1000 IS A{3 SPACES}MEDIUM LENGTH GAME)":INPUTWS
GQ 350 CP=0:FORG=1TONP:C(G)=0:T(G)=0:B(G)=1:NEXT:J=0
MJ 360 R$(1)="PHRASE{2 SPACES}":R$(2)="PLACE{3 SPACES}":R$(3)="PERSON ":R$(4)="NAME{4 SPACES}"
RA 370 R$(5)="OBJECT{2 SPACES}":X=611+SC:D=0
MX 380 UL$="":RL$=""
RX 390 REM DRAW SCREEN
JS 400 POKEBO,11-(AL=1)*38:POKEAC,11-(AL=1)*38
PA 410 PRINT"{CLR}"CHR$(5);
BA 420 PRINTTAB(10)"{DOWN}{BLK}PICK-A-LETTER {8}";WS:PRINT
RF 430 PRINT"{BLK}SCORES{2 SPACES}-{8}";
BH 440 FORG=1TONP
BH 450 PRINT"{8} PLAYER"G;
AS 460 NEXT
SX 470 PRINT:PRINT"{BLK}CURRENT -{8}"
EF 480 PRINT"{BLK}TOTAL{3 SPACES}-{8}"
GJ 490 PRINT"{DOWN}{BLK}CATEGORY:{8}"
SA 500 PRINT"{DOWN}{BLK}PUZZLE:{8}"
RA 510 PRINT"{DOWN}{BLK}"
QB 520 FORG=1TO39:PRINT"{O}";:NEXT
DE 530 PRINT" {J}{BLK}X{BLK}-{YEL}5{BLK}-{YEL}3{BLK}-{YEL}2{BLK}-{3}S{BLK}-{YEL}4{BLK}-{YEL}1{BLK}-{YEL}4{BLK}-A-{YEL}2{BLK}-{YEL}3{BLK}-{YEL}5{BLK}-{YEL}1{BLK}-X-{YEL}3{BLK}-{YEL}5{BLK}-{YEL}2{BLK}";
KD 540 PRINT"-{YEL}4{BLK}-{3}Z{BLK}{L}";
JQ 550 PRINT"{BLK}";:FORG=1TO39:PRINT"{U}";:NEXT
AH 560 PRINT"{2 DOWN}{BLK}{RIGHT}CURRENT PLAYER: {SPACE}{RVS}{8}PLAYER "
CJ 570 PRINT"{BLK}BONUS FACTOR = {8}"
AB 580 PRINT"{4 SPACES}{BLK}POINTS PER CORRECT LETTER {8}"
HB 590 PRINT"{2 DOWN}"
PG 600 PRINT"{BLK}USED LETTERS :{8}"
AX 610 FORG=SC+S+600TOSC+S+638:POKEG,13:NEXT
CH 620 POKEX,30
RA 630 REM MAIN LOOP
FJ 640 NN=0:CD$=P$(P%(QQ)):CC=P(P%(QQ)):QQ=QQ+1:IFQQ>NWTHENQQ=1
SD 650 NV=0:FORG=1TOLEN(CD$)
FJ 660 IF MID$(CD$,G,1)<>" "THEN NV=NV+1
PX 670 NEXTG
RX 680 PRINT"{HOME}{7 DOWN}{10 RIGHT}"R$(CC)
PQ 690 PRINT"{DOWN}"SPC(8);
QM 700 FORG=1TO LEN(CD$):B$=MID$(CD$,G,1):IFB$=" "THENPRINT" ";:GOTO740
KX 710 IF B$="-"THENPRINT"-";:GOTO740
ME 720 IF B$="'"THENPRINT"'";:GOTO740
BH 730 PRINT"{CYN}Q";
FD 740 NEXTG
DG 750 FORG=1TONP:C(G)=0:NEXT
DF 760 FORG=LEN(CD$)TO29:PRINT" ";:NEXT
BF 770 CP=CP+1:IFCP>NPTHENCP=1
GB 780 PRINT"{HOME}";:FORG=1TO17:PRINT"{DOWN}";:NEXT:PRINTTAB(22)"{8}{RVS}"CP
BH 790 PRINTTAB(14)"{3 SPACES}{3 LEFT}"B(CP):PRINT"{4 SPACES}{UP}"
RX 800 IF B(CP)=1THENPRINT"{2 DOWN}{3}PRESS SPACE {SPACE}BAR TO START SCORE POINTER {OFF}":GOTO820
JX 810 PRINT"{2 DOWN}{3}START {SPACE}POINTER OR PRESS RETURN TO ANSWER{OFF}"
QK 820 GETZ$:IFZ$=""THEN820
QM 830 IFASC(Z$)=13 THEN860
JG 840 IFZ$=" "THENGOSUB1040:GOTO890
SP 850 GOTO820
SX 860 GOTO1290
BM 870 IF PP=1 THENPP=0:GOTO630
HS 880 GOTO770
BK 890 IFD=1THEND=0:GOTO770
AM 900 PRINT"{DOWN}{3}ENTER YOUR LETTER{22 SPACES}{OFF}{8}";
HF 910 GETK$:IFK$=""THEN910
DE 920 IF ASC(K$)<65ORASC(K$)>90THEN910
GA 930 FORD=1TO20:PRINT"{LEFT}";:NEXT:PRINTK$:GOSUB1480:IFUR=1THEN1560
CR 940 GOSUB1180:IFN=0THENB(CP)=1:GOTO770
EA 950 IFZX=1THENZX=0:GOTO870
PA 960 B(CP)=B(CP)+1:PRINT"{HOME}{17 DOWN}{13 RIGHT}":GOTO790
SB 970 PRINT"{8}"
FP 980 R=RND(-TI/101)
XS 990 FORJ=1TONW:P%(J)=J:NEXT
PM 1000 FORJ=1TO5:FORK=1TONW:L=P%(INT(RND(1)*20+1))
PQ 1010 TEMP=P%(K):P%(K)=P%(L):P%(L)=TEMP
RJ 1020 NEXTK,J
SB 1030 RETURN
XP 1040 Y=INT(RND(0)*20)+20
BJ 1050 FORG=1TOY
JX 1060 GOSUB1130
AQ 1070 POKEX,32:X=X+2:IFX=SC+639THENX=SC+601
DH 1080 POKEX,30:FORW=1TOG:NEX
```

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```
        TW
KX 1090 NEXTG
QM 1100 V=PEEK(X-80)
KA 1110 IFV=83THENPL=10*B(CP):
        GOTO1160
AG 1120 IFV=90THENPL=15*B(CP):
        GOTO1160
AC 1130 IFV=65THEND=1:C(CP)=0:
        N=0:B(CP)=1:GOSUB1250:
        GOSUB100:RETURN
CR 1140 IFV=88THEND=1:GOSUB70:
        GOSUB70:B(CP)=1:RETURN
MB 1150 PL=(V-48)*B(CP)
PJ 1160 PRINT"{8}{3 UP}
        {3 SPACES}{3 LEFT}"PL
AP 1170 RETURN
FS 1180 N=0:PRINT"{HOME}
        {9 DOWN}{8 RIGHT}";
HP 1190 FORG=1TOLEN(CD$)
FX 1200 IFMID$(CD$,G,1)=K$THEN
        N=N+1:GOSUB80:PRINTK$;
        :GOTO1220
DP 1210 PRINT"{RIGHT}";
PE 1220 NEXTG
GK 1230 C(CP)=C(CP)+PL*N
DF 1240 GOSUB1630:GOSUB1250:RE
        TURN
HP 1250 PRINT"{HOME}{4 DOWN}
        {RIGHT}";
MQ 1260 PRINTTAB(10*CP)"{8}
        {4 SPACES}{4 LEFT}"C(C
        P);
SR 1270 NN=NN+N:IFNN=NVTHENGOS
        UB1340:ZX=1
CA 1280 RETURN
XE 1290 PRINT"{HOME}";:FORG=1T
        O21:PRINT"{DOWN}";:NEX
        T:FORG=1TO39:PRINT" ";
        :NEXT
XJ 1300 FORG=1TO39:PRINT"
        {LEFT}";:NEXT:INPUT "A
        NSWER";A$
EQ 1310 IFA$=CD$THEN1340
XD 1320 C(CP)=C(CP)-10:IFC(CP)
        <0THENC(CP)=0
RS 1330 GOSUB70:GOSUB1250:GOTO
        870
PC 1340 PRINT"{HOME}{9 DOWN}
        {8 RIGHT}"CD$
SJ 1350 BC=8
SP 1360 FORG=1TO5:GOSUB80
GA 1370 POKEBO,BC-1:BC=BC-1
BG 1380 NEXT:POKEBO,11-(AL=1)*
        38
FG 1390 T(CP)=T(CP)+C(CP)
PD 1400 FORG=1TONP:B(G)=1:NEXT
PS 1410 PRINT"{HOME}{5 DOWN}
        {RIGHT}";
FH 1420 PRINTTAB(10*CP)"{8}
        {4 SPACES}{4 LEFT}"T(C
        P);
MH 1430 PRINT"{HOME}{4 DOWN}
        {RIGHT}";
CE 1440 PRINTTAB(10):FORG=1TO2
        9:PRINT" ";:NEXT
QM 1450 UL$="":RL$="":GOSUB169
        0:PP=1
HE 1460 IF T(CP)>=WSTHENGOTO17
        10
SX 1470 GOTO870
MA 1480 U=LEN(UL$):R=LEN(RL$)
CE 1490 IFR=0THEN1520
AB 1500 FORG=1TOR:IFK$=MID$(RL
        $,G,1)THENUR=1:RETURN
RG 1510 NEXTG
EF 1520 IFU=0THENRETURN
HX 1530 FORG=1TOU:IFK$=MID$(UL
        $,G,1)THENUR=1:RETURN
EP 1540 NEXTG
ED 1550 RETURN
DE 1560 PRINT"{HOME}";:FORG=1T
        O21:PRINT"{DOWN}";:NEX
        T:FORG=1TO39:PRINT" ";
        :NEXT
GK 1570 FORG=1TO39:PRINT"
        {LEFT}";:NEXT
HX 1580 GOSUB70
HH 1590 PRINT"{YEL}THAT LETTER
         HAS BEEN USED";
FP 1600 FORI=1TO750:NEXT
GG 1610 FORG=1TO25:PRINT"
        {LEFT}";:NEXT:PRINT"
        {8}{2 UP}";
CE 1620 UR=0:GOTO770
CC 1630 IFN=0THEN1650
PP 1640 RL$=RL$+K$:RETURN
BF 1650 UL$=UL$+K$:GOSUB70
QK 1660 PRINT"{HOME}";:FORG=1T
        O23:PRINT"{DOWN}";:NEX
        T
QC 1670 PRINT"{14 RIGHT}"UL$
KP 1680 RETURN
HP 1690 PRINT"{HOME}";:FORG=1T
        O23:PRINT"{DOWN}";:NEX
        T
DX 1700 PRINT"{14 RIGHT}
        {20 SPACES}":RETURN
AP 1710 IFAL=0THENPOKE54296,12
DA 1720 POKEAC,6:PRINTCHR$(5);
FK 1730 IFAL=0THENPOKES+24,10:
        POKES+5,128:POKES+6,12
        8:POKES+4,33
AR 1740 FORI5=1TO3:B1=1:T1=9:S
        1=1:GOSUB60:B1=9:T1=1:
        S1=-1:GOSUB60:NEXTI5
QE 1750 IFAL=0THENPOKES+4,32
QR 1760 PRINT"{CLR}{YEL}
        {2 DOWN}THE WINNER IS
        {SPACE}PLAYER"CP;:PRIN
        T"WITH "T(CP)"POINTS"
GG 1770 FORG=1TO40:PRINT"{I}";
        :NEXT:PRINT
PD 1780 FORG=1TONP-1
EE 1790 CP=CP+1:IFCP>NPTHENCP=
        1
PE 1800 PRINT"{DOWN}PLAYER"CP"
        ACCUMULATED -"T(CP)"PO
        INTS"
DC 1810 NEXT
FB 1820 FORI=1TO1000:NEXT
CC 1830 PRINT"{5 DOWN}WOULD YO
        U LIKE TO PLAY AGAIN (
        Y/N) ?{8}"
GA 1840 GETPA$:IFPA$=""THEN184
        0
QQ 1850 IFASC(PA$)=78THENPRINT
        "{CLR}":END
CX 1860 IFASC(PA$)=89THEN260
SK 1870 DATA 1,"IN THE GOOD OL
        D DAYS"
RC 1880 DATA 1,"IN THE STILL O
        F THE NIGHT"
JA 1890 DATA 1,"ALL FOR ONE AN
        D ONE FOR ALL"
PP 1900 DATA 1,"I TOLD YOU SO"
GK 1910 DATA 2,"WRIGLEY FIELD"
CB 1920 DATA 1,"LOOKING FOR A
        {SPACE}WAY OUT"
RC 1930 DATA 2,"SALT LAKE CITY
        "
SF 1940 DATA 1,"TO BE OR NOT T
        O BE"
MG 1950 DATA 1,"ONCE IN A BLUE
         MOON"
KX 1960 DATA 2,"HONOLULU"
CF 1970 DATA 2,"SILICON VALLEY
        "
MF 1980 DATA 3,"MAILMAN"
FD 1990 DATA 3,"NEXT DOOR NEIG
        HBOR"
CR 2000 DATA 1,"TAKE IT OR LEA
        VE IT"
MR 2010 DATA 3,"DAVID AND GOLI
        ATH"
QJ 2020 DATA 2,"LONDON ENGLAND
        "
RB 2030 DATA 2,"SAN ANTONIO TE
        XAS"
HK 2040 DATA 2,"NIAGARA FALLS"
FK 2050 DATA 2,"YELLOWSTONE NA
        TIONAL PARK"
PD 2060 DATA 2,"NEVER-NEVER LA
        ND"
XG 2070 DATA 2,"ON TOP OF OLD
        {SPACE}SMOKEY"
AC 2080 DATA 3,"PROFESSIONAL A
        THLETE"
PD 2090 DATA 2,"DISTRICT OF CO
        LUMBIA"
GS 2100 DATA 2,"WHITE HOUSE"
RH 2110 DATA 2,"SOMEWHERE OVER
         THE RAINBOW"
KJ 2120 DATA 3,"PRESIDENT OF T
        HE UNITED STATES"
BQ 2130 DATA 3,"HUNCHBACK OF N
        OTRE DAME"
QE 2140 DATA 3,"KEEPER OF THE
        {SPACE}KEYS"
KD 2150 DATA 3,"MAN IN THE MOO
        N"
HX 2160 DATA 3,"BIRDMAN OF ALC
        ATRAZ"
CM 2170 DATA 3,"QUEEN OF ENGLA
        ND"
CX 2180 DATA 3,"ROOKIE OF THE
        {SPACE}YEAR"
GX 2190 DATA 3,"CHIMNEY SWEEP"
HF 2200 DATA 3,"ACADEMY AWARD
        {SPACE}NOMINEE"
BC 2210 DATA 3,"MISS AMERICA"
GM 2220 DATA 4,"BABE RUTH"
JE 2230 DATA 4,"WHISTLER'S MOT
        HER"
CS 2240 DATA 4,"THE LAST OF TH
        E MOHICANS"
JQ 2250 DATA 4,"PONCE DE LEON"
HP 2260 DATA 4,"GEORGE WASHING
        TON"
DG 2270 DATA 4,"GONE WITH THE
        {SPACE}WIND"
FA 2280 DATA 4,"ELIZABETH TAYL
        OR"
BE 2290 DATA 4,"FRANKLIN DELAN
        O ROOSEVELT"
CR 2300 DATA 3,"SUPERMAN"
XB 2310 DATA 4,"ROMEO AND JULI
        ET"
JR 2320 DATA 5,"BICYCLE BUILT
        {SPACE}FOR TWO"
GK 2330 DATA 5,"HIGH-TOP SHOES
        "
SM 2340 DATA 5,"A YELLOW SUBMA
        RINE"
HJ 2350 DATA 5,"LONDON BRIDGE"
SP 2360 DATA 5,"VIDEO CASSETTE
         RECORDER"
KK 2370 DATA 1,"GONE FISHING"
BH 2380 DATA 1,"ON THE FIRST D
        AY OF CHRISTMAS"
KM 2390 DATA 1,"BE MY VALENTIN
        E"
KH 2400 DATA 5,"XYLOPHONE"
CR 2410 DATA 2,"MEXICO CITY"
GR 2420 DATA 1,"RETURN TO SEND
        ER"
RF 2430 DATA 1,"TAKE IT TO THE
         LIMIT"
XG 2440 DATA 4,"A CHRISTMAS CA
        ROL"
SC 2450 DATA 2,"MISSISSIPPI RI
        VER"
QC 2460 DATA 3,"CHAMPIONSHIP S
        WIMMER"
KJ 2470 DATA 4,"HOWARD COSELL"
RS 2480 DATA 2,"TRANQUILITY BA
        SE"
```


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```
QK 2490 DATA 2,"THE HALLS OF M
        ONTEZUMA"
AG 2500 DATA 4,"MUHAMMAD ALI"
GA 2510 DATA 4,"JOE DIMAGGIO"
AS 2520 DATA 4,"WASHINGTON MON
        UMENT"
KR 2530 DATA 4,"GOLDEN GATE BR
        IDGE"
AD 2540 DATA 4,"ALCATRAZ"
HD 2550 DATA 4,"YOSEMITE NATIO
        NAL PARK"
QQ 2560 DATA 5,"COMPUTER PRINT
        OUT"
SF 2570 DATA 5,"COLLEGE TEXTBO
        OK"
FF 2580 DATA 5,"TOOTHPICK"
DM 2590 DATA 1,"HANDLE WITH CA
        RE"
ME 2600 DATA 5,"DIGITAL WATCH"
XC 2610 DATA 5,"CANDLE OPERA"
EG 2620 DATA 5,"KITCHEN SINK"
BD 2630 DATA 1,"DO UNTO OTHERS
        "
CK 2640 DATA 5,"TEDDY BEAR"
JC 2650 DATA 5,"TELEPHONE BOOK
        "
AD 2660 DATA 3,"PROM QUEEN"
FC 2670 DATA 5,"BASEBALL GLOVE
        "
FH 2680 DATA 5,"WEATHER VANE"
PJ 2690 DATA 5,"LIMOUSINE"
DM 2700 DATA 5,"TELEPHONE POLE
        "
CH 2710 DATA 3,"CONSTRUCTION W
        ORKER"
DB 2720 DATA 4,"JACK NICKLAUS"
PQ 2730 DATA 2,"THE NORTH POLE
        "
SG 2740 DATA 1,"TOMORROW IS AN
        OTHER DAY"
RB 2750 DATA 1,"THE CREAM OF T
        HE CROP"
RD 2760 DATA 1,"THE EARLY BIRD
         GETS THE WORM"
```

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

Program 2: Modifications For Plus/4 And 16

```
GM 10 BO=65305:AC=65301:SC=307
      2:S=-1024:AL=1
EA 20 FORI=1TO10:READH(I):NEXT
BG 30 DATA 967,971,974,976,979
      ,982,984,986,988,990
XP 40 VOL8:GOTO150
JB 50 REM (DELETE LINE 50)
XS 60 FORJ=B1TOT1STEPS1:SOUND2
      ,H(J),5:NEXT:RETURN
HG 70 SOUND2,7,20:RETURN
AK 80 SOUND1,944,15:FORH=1TO10
      0:NEXT:RETURN
JM 90 REM (DELETE LINE 90)
HC 100 FORI=990TO924STEP-3:SOU
       ND1,I,4:NEXTI:FORJ=1TO1
       00:NEXTJ:SOUND2,10,20:R
       ETURN
CC 110 REM (DELETE LINE 110)
DA 120 REM (DELETE LINE 120)
JA 130 SOUND1,990,6:FORI=1TO30
       :NEXT:RETURN
BE 140 REM (DELETE LINE 140)
```

Collision Course

Article on page 32.

```
DG 10 POKE 53280,0:POKE 53281,
      0:A$=" : : : : :"
SC 20 PRINT"{CLR}{13}{2 SPACES}
      UCCI{DOWN}{4 LEFT}BUIB
      {DOWN}{5 LEFT} BBBB
      {DOWN}{4 LEFT}BBJK{DOWN}
      {4 LEFT}BB{2 SPACES}UCCI
      UI{2 SPACES}UI{2 SPACES}
      UCCIUCCI";
KD 30 PRINT"UCCIUCCIUI
      {6 SPACES}BB{2 SPACES}BU
      IBBB{2 SPACES}BB
      {2 SPACES}JIUKBUIBJIUKBU
      IBBJCI{4 SPACES}BB
      {2 SPACES}BBBBBB";
HS 40 PRINT"{2 SPACES}BB
      {3 SPACES}BB BBJK BB BBB
      BB{2 SPACES}B{4 SPACES}B
      BUIBBBBBB{2 SPACES}BB
      {3 SPACES}BB J{E}{R}I BB
       BBBBB{2 SPACES}B
      {2 SPACES}";
XG 50 PRINT"{2 SPACES}BBBBBBBB
      BB{2 SPACES}BB{3 SPACES}
      BB UIBB BB BBBBBUIB
      {4 SPACES}BJKBBJKBBJCIBJ
      CIUKJIBJKBU";
JA 60 PRINT"KJIBJKBBBBB
      {4 SPACES}JCCKJCCKJCCKJC
      CKJCCKJCCKJCCKJCCKJKJK
      {10 SPACES}";
QR 70 PRINT"UCCI{DOWN}{4 LEFT}
      BUIB{DOWN}{4 LEFT}BBBB
      {DOWN}{4 LEFT}BBJK{DOWN}
      {4 LEFT}BB{2 SPACES}UCCI
      UIUIUI{2 SPACES}UCCIUCCI
      {3 SPACES}";
RA 80 PRINTSPC(12)" BB
      {2 SPACES}BUIBBBBBBJCIBU
      IBBUCK"SPC(16)"BB
      {2 SPACES}BBBBBBBBBUCKBB
      JKBB{2 SPACES}";
CF 90 PRINTSPC(16)"BBUIBBBBBBB
      BBB{2 SPACES}J{E}{R}IBJI
      "SPC(17)"BBBBBBBBBBBBB
      {2 SPACES}UIBBBUK
      {3 SPACES}";
HD 100 PRINTSPC(14)"BJKBBJKBBJ
       KBBB{2 SPACES}BJKBBJCI"
       SPC(16)"JCCKJCCKJCCKJK
       {2 SPACES}JCCKJCCK"
GA 110 PRINTSPC(13)"{DOWN}{8}P
       LEASE WAIT{13}{HOME}"
SM 120 FOR L=54272 TO 54295:PO
       KE L,0:NEXT:POKE 54276,
       64:POKE 54283,32
GP 130 FOR T=0 TO 255:POKE 163
       84-256+T,0:NEXT
XX 140 FOR K=0 TO 3:FOR T=0 TO
        7:READ D:POKE 16384-25
       6+Z,D:Z=Z+3:NEXT:Z=Z+40
       :NEXT
BC 150 ML$="{I}"+CHR$(8)+"{X}<
       "+CHR$(3)+"{2}XJ"+CHR$(
       16)+CHR$(248)+"L{B}{T}"
       :POKE 835,0
MS 160 POKE 53272,PEEK(53272)A
       ND 240 OR 12
CK 170 POKE 836,208:POKE 830,0
       :POKE 831,216:POKE 828,
       0:POKE 829,56:POKE 5633
       4,0
MM 180 POKE 1,51:ML$=ML$:SYS(P
       EEK(51)+256*PEEK(52)):P
       OKE 1,55:POKE 56334,1
HD 190 FOR I=12568 TO 12759:RE
       AD J:POKE I,J:NEXT:IF P
       EEK(49152)=124 THEN 220
CQ 200 FOR I=49152 TO 52199:RE
       AD A:POKE I,A:CS=CS+A:N
       EXT
EM 210 IF CS<>211178 THEN PRIN
       T"ERROR IN DATA":STOP
AA 220 LV=1:CARS=3:FOR T=0 TO
       {SPACE}8:POKE 1024-16+T
       ,0:NEXT:POKE 171,238:PO
       KE 830,LV
DS 230 SYS 49831:POKE 1607,LV+
       48
QA 240 PRINT"{HOME}{12 DOWN}"T
       AB(20-CA)MID$(A$,2,2*CA
       ):SYS 49887
AP 250 IF PEEK(838)=1 THEN 320
DQ 260 LV=LV+1:POKE 830,LV:POK
       E 171,PEEK(171)+2:POKE
       {SPACE}54276,0:GOSUB 46
       0
FP 270 GOSUB 400:PRINT"
       {3 LEFT}LEVEL COMPLETED
       ":FOR X=1 TO 2000:NEXT
FX 280 POKE 1010,PEEK(1010)+LV
       -1
CD 290 GOSUB 400:PRINT"
       {3 LEFT} BONUS OF"(LV-1
       )*100"{LEFT}{2 SPACES}"
       :FOR X=1 TO 2000:NEXT
GX 300 IF LV=3 OR LV=6 THEN CA
       =CA+1:GOSUB 500
AF 310 GOTO 230
MB 320 GOSUB 410:CAR=CAR-1
AQ 330 GOSUB 400:PRINT"
       {11 SPACES}"
SF 340 PRINT"{HOME}{12 DOWN}"T
       AB(20-CA)MID$(A$,2,2*CA
       )
FF 350 IF CAR>0 THEN 380
CC 360 POKE 53269,0:GOSUB 400:
       PRINT"GAME OVER":FOR X=
       1 TO 2000:NEXT
BA 370 GOSUB 400:PRINT"PRESS F
       IRE":WAIT 56320,16,16:G
       OTO 220
DE 380 POKE 53269,0:TM=TI:SYS
       {SPACE}49897:IF TM+8>TI
        THEN 380
SR 390 GOTO 250
PG 400 PRINT"{HOME}{12 DOWN}"S
       PC(15);:RETURN
DB 410 POKE 53251,PEEK(53249):
       POKE 54276,0:POKE 54292
       ,240:POKE 54290,129
GG 420 POKE 54287,10:GOSUB430:
       POKE 54287,0:RETURN
RR 430 FOR Z=1 TO 20:POKE 5326
       5,PEEK(53265) AND 248 O
       R RND(1)*8
SQ 440 POKE 53270,PEEK(53270)A
       ND240 OR RND(1)*8:NEXT:
       POKE 53265,27:POKE 5327
       0,200
FC 450 RETURN
AR 460 FOR L=54272 TO 54295:PO
       KE L,0:NEXT:POKE 54296,
       15:POKE 54277,8
QP 470 POKE 54278,255:POKE 542
       76,23:FOR Z=1 TO 10:POK
       E 54287,Z*2:FOR F=1 TO
       {SPACE}10
RX 480 POKE 54273,10:NEXT F,Z:
       POKE 54278,15:POKE 5427
       6,64:POKE 54283,32:RETU
       RN
EG 490 POKE 54276,64:POKE 5428
       3,32:RETURN
GJ 500 FOR Z=1TO4:GOSUB 400:PR
       INT"{2 LEFT}{2 SPACES}B
       ONUS CAR ":FOR X=1 TO 3
       00:NEXT
XD 510 GOSUB400:PRINT"{2 LEFT}
       {12 SPACES}":FOR X=1 TO
```

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      300:NEXT:NEXT:RETURN
HC 520 DATA 195,255,219,24,60,
       255,255,195,231
HR 530 DATA 231,114,126,126,11
       4,231,231,195,255,255,6
       0,24,219,255,195,231
DR 540 DATA 231,78,126,126,78,
       231,231,0,96,96,96,96,1
       26,0,0,0,0,126,102,96,102
EM 550 DATA 126,0,0,0,126,96,1
       20,96,126,0,0,0,126,102
       ,102,102,126,0,0,0,126
AA 560 DATA 102,102,120,108,0,
       0,126,102,96,126,6,102,
       126,0,0,102,102,102,102
MB 570 DATA 60,0,0,0,102,102,1
       02,60,24,0,0,126,102,96
       ,96,96,102,126,0,0,60
FF 580 DATA 24,24,24,60,0,0,0,
       118,126,126,110,102,0,0
       ,0,0,0,24,24,0,0,0,0,60
GF 590 DATA 96,60,6,124,0,0,0,
       60,102,110,118,102,60,0
       ,0,24,56,24,24,24,126
BK 600 DATA 0,0,62,102,12,48,9
       6,126,0,0,126,6,28,6,6,
       124,0,0,102,102,102
SG 610 DATA 127,6,6,0,0,126,96
       ,124,6,102,60,0,0,60,96
       ,124,102,102,60,0,0
KK 620 DATA 126,102,12,24,24,2
       4,0,0,60,102,60,102,102
       ,60,0
GE 630 DATA 0,60,102,62,6,102,
       60,0,195,255,219,24,60,
       255,255,195
QP 640 REM *** ML DATA ***
FJ 650 DATA 124,178,52,114,5,7
       ,4,3,132,194,44,98,234,
       234,234,234
XQ 660 DATA 140,210,36,82,234,
       234,234,234,148,226,28,
       66,234,234,234,234
GJ 670 DATA 165,162,41,7,208,5
       3,162,0,142,2,220,173,0
       ,220,41,4
RF 680 DATA 208,3,206,64,3,173
       ,0,220,41,8,208,3,238,6
       4,3,173
BF 690 DATA 0,220,41,16,240,13
       ,169,1,141,65,3,169,1,1
       41,1,212
BD 700 DATA 56,176,8,142,65,3,
       169,2,141,1,212,202,142
       ,2,220,173
RS 710 DATA 64,3,41,3,141,64,3
       ,162,0,160,0,134,2,174,
       64,3
MM 720 DATA 189,4,192,166,2,15
       7,228,217,157,252,217,1
       53,99,216,153,147
HB 730 DATA 218,152,24,105,40,
       168,232,224,7,208,224,1
       65,179,240,3,56
XQ 740 DATA 233,80,133,179,141
       ,8,212,169,1,141,25,208
       ,173,13,220,41
QG 750 DATA 1,240,3,76,49,234,
       76,188,254,162,0,138,15
       7,64,3,232
AA 760 DATA 224,128,208,248,16
       9,226,141,120,3,169,226
       ,141,121,3,169,84
CF 770 DATA 141,112,3,169,92,1
       41,113,3,169,192,141,0,
       212,169,6,141
EH 780 DATA 39,208,141,97,3,16
       9,3,141,96,3,169,128,14
       1,105,3,169
RE 790 DATA 3,141,88,3,169,3,1
       41,89,3,169,27,141,17,2
       08,169,127
AX 800 DATA 141,13,220,169,32,
       141,20,3,169,192,141,21
       ,3,169,129,141
EF 810 DATA 26,208,169,3,141,2
       1,208,169,3,141,64,3,16
       9,0,141,32
EC 820 DATA 208,141,33,208,169
       ,15,141,24,212,169,240,
       141,13,212,141,6
JP 830 DATA 212,169,33,141,11,
       212,169,65,141,4,212,16
       9,9,141,3,212
FR 840 DATA 141,40,208,96,188,
       112,3,189,96,3,201,1,20
       8,1,200,201
BM 850 DATA 3,208,1,136,152,15
       7,112,3,188,120,3,189,9
       6,3,208,1
SB 860 DATA 136,201,2,208,1,20
       0,152,157,120,3,222,80,
       3,96,254,96
GD 870 DATA 3,189,104,3,240,6,
       222,96,3,222,96,3,189,9
       6,3,41
AQ 880 DATA 3,157,96,3,32,52,1
       93,96,162,0,189,112,3,2
       40,80,224
MM 890 DATA 1,208,6,173,66,3,2
       08,71,234,32,52,193,189
       ,88,3,10
CG 900 DATA 10,10,168,189,96,3
       ,41,1,201,1,208,22,189,
       112,3,217
JA 910 DATA 0,192,208,3,32,94,
       193,189,112,3,217,2,192
       ,208,3,32
RF 920 DATA 94,193,189,96,3,41
       ,1,208,22,189,120,3,217
       ,1,192,208
SF 930 DATA 3,32,94,193,189,12
       0,3,217,3,192,208,3,32,
       94,193,232
GJ 940 DATA 224,2,208,166,96,1
       62,0,134,255,169,1,133,
       254,160,0,189
QA 950 DATA 112,3,24,10,153,0,
       208,144,6,165,254,5,255
       ,133,255,189
BP 960 DATA 120,3,153,1,208,6,
       254,189,96,3,24,105,252
       ,157,248,7
SG 970 DATA 232,200,200,224,8,
       208,216,165,255,141,16,
       208,96,76,148,194
SS 980 DATA 162,0,189,112,3,24
       0,246,189,96,3,41,1,208
       ,58,189,120
PM 990 DATA 3,201,146,240,4,20
       1,147,208,47,160,146,20
       1,146,208,2,160
KS 1000 DATA 147,152,157,120,3
        ,173,64,3,157,88,3,10,
        10,10,188,96
KA 1010 DATA 3,208,3,24,105,2,
        188,104,3,240,2,73,2,1
        68,185,0
QQ 1020 DATA 192,157,112,3,56,
        176,61,234,189,112,3,2
        01,87,240,4,201
PJ 1030 DATA 88,208,49,160,87,
        201,87,208,2,160,88,15
        2,157,112,3,173
JC 1040 DATA 64,3,10,10,10,188
        ,96,3,192,1,208,3,24,1
        05,2,188
MB 1050 DATA 104,3,240,2,73,2,
        168,200,185,0,192,157,
        120,3,173,64
FQ 1060 DATA 3,157,88,3,232,22
        4,1,208,6,173,66,3,240
        ,5,232,224
MX 1070 DATA 2,240,3,76,18,194
        ,96,162,0,189,232,195,
        157,0,4,189
AJ 1080 DATA 232,196,157,0,5,1
        89,232,197,157,0,6,189
        ,216,198,157,240
SS 1090 DATA 6,189,232,199,157
        ,0,216,189,232,200,157
        ,0,217,189,232,201
DX 1100 DATA 157,0,218,189,216
        ,202,157,240,218,232,2
        24,0,208,203,96,169
FM 1110 DATA 0,141,63,3,169,24
        0,141,60,3,32,169,192,
        234,234,166,171
XF 1120 DATA 160,0,200,208,253
        ,232,208,248,162,0,173
        ,65,3,240,11,173
SP 1130 DATA 66,3,73,1,141,66,
        3,56,176,3,142,66,3,32
        ,120,193
SF 1140 DATA 32,213,193,32,16,
        194,76,42,195,173,141,
        2,208,251,165,203
FA 1150 DATA 201,2,208,202,169
        ,12,141,33,208,0,169,4
        ,133,175,169,0
MA 1160 DATA 133,174,173,121,3
        ,56,233,49,74,74,74,16
        8,192,0,240,15
CH 1170 DATA 24,165,174,105,40
        ,133,174,144,2,230,175
        ,136,208,242,173,113
RP 1180 DATA 3,56,233,12,74,74
        ,24,101,174,133,174,14
        4,2,230,175,197
QG 1190 DATA 170,240,51,160,0,
        177,174,201,174,176,18
        ,201,171,208,36,169
FQ 1200 DATA 160,145,174,238,6
        3,3,238,244,3,169,176,
        133,179,208,23,174
PA 1210 DATA 62,3,169,160,224,
        4,144,2,169,171,145,17
        4,238,244,3,238
JA 1220 DATA 63,3,169,240,133,
        179,165,174,133,170,16
        2,0,189,240,3,201
XH 1230 DATA 10,144,11,254,239
        ,3,233,10,157,240,3,56
        ,176,238,24,105
MP 1240 DATA 48,157,61,6,232,2
        24,5,208,227,173,30,20
        8,41,3,201,3
FC 1250 DATA 208,9,173,63,3,24
        0,4,238,70,3,96,173,63
        ,3,201,1
MB 1260 DATA 176,6,238,60,3,20
        8,13,96,201,128,208,8,
        173,62,3,201
QP 1270 DATA 4,176,1,96,76,25,
        195,43,32,32,32,32,32,
        32,32,32
KJ 1280 DATA 32,32,32,32,32,32
        ,32,32,32,32,32,32,32,
        32,32,32
MK 1290 DATA 32,32,32,32,32,32
        ,32,32,32,32,32,32,32,
        32,32,32
KJ 1300 DATA 32,32,32,112,67,6
        7,67,67,67,67,67,67,67
        ,67,67,67
JJ 1310 DATA 67,67,114,67,114,
        67,67,67,67,67,67,67,6
        7,67,67,67
PG 1320 DATA 67,67,67,110,32,3
        2,32,32,32,32,32,66,17
        4,160,174,160
RK 1330 DATA 174,160,174,160,1
        74,160,174,160,174,160
        ,66,160,66,160,174,160
AG 1340 DATA 174,160,174,160,1
        74,160,174,160,174,160
        ,174,66,32,32,32,32
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FH 1350 DATA 32,32,32,66,160,1
        12,67,67,67,67,67,67,6
        7,67,67,67
FE 1360 DATA 67,67,115,160,107
        ,67,67,67,67,67,67,67,
        67,67,67,67
FC 1370 DATA 67,110,160,66,32,
        32,32,32,32,32,32,66,1
        74,66,174,160
MB 1380 DATA 174,160,174,160,1
        74,160,174,160,174,160
        ,66,224,66,160,174,160
PR 1390 DATA 174,160,174,160,1
        74,160,174,160,174,66,
        174,66,32,32,32,32
FC 1400 DATA 32,32,32,66,160,6
        6,160,112,67,67,67,67,
        67,67,67,67
CK 1410 DATA 67,67,115,224,107
        ,67,67,67,67,67,67,67,
        67,67,67,110
QX 1420 DATA 160,66,160,66,32,
        32,32,32,32,32,32,66,1
        74,66,174,66
XD 1430 DATA 174,160,174,160,1
        74,160,174,160,174,160
        ,66,224,66,160,174,160
CK 1440 DATA 174,160,174,160,1
        74,160,174,66,174,66,1
        74,66,32,32,32,32
RJ 1450 DATA 32,32,32,66,160,6
        6,160,66,224,112,67,67
        ,67,67,67,67
GC 1460 DATA 67,67,115,224,107
        ,67,67,67,67,67,67,67,
        67,110,160,66
RP 1470 DATA 160,66,160,66,32,
        32,32,32,32,32,32,66,1
        74,66,174,66
HS 1480 DATA 174,66,174,160,17
        4,160,174,160,174,160,
        66,224,66,160,174,160
JC 1490 DATA 174,160,174,160,1
        74,66,174,66,174,66,17
        4,66,32,32,32,32
JJ 1500 DATA 32,32,32,66,160,6
        6,160,66,160,66,160,11
        2,67,67,67,67
GH 1510 DATA 67,67,113,67,113,
        67,67,67,67,67,67,110,
        160,66,160,66
HF 1520 DATA 160,66,160,66,32,
        32,32,32,32,32,32,66,1
        74,66,174,66
BE 1530 DATA 174,66,174,66,32,
        32,32,43,38,35,35,44,4
        7,44,38,45
FM 1540 DATA 32,32,32,66,174,6
        6,174,66,174,66,174,66
        ,32,32,32,32
HH 1550 DATA 32,32,32,107,67,1
        13,67,113,67,113,67,11
        5,32,32,32,32
RD 1560 DATA 43,38,41,39,47,37
        ,32,32,32,32,32,107,67
        ,113,67,113
XR 1570 DATA 67,113,67,115,32,
        32,32,32,32,32,32,66,1
        60,160,160,160
RE 1580 DATA 160,160,160,66,32
        ,32,32,32,32,32,32,32,
        32,32,32,32
QC 1590 DATA 32,32,32,66,160,1
        60,160,160,160,160,160
        ,66,32,32,32,32
KR 1600 DATA 32,32,32,107,67,1
        14,67,114,67,114,67,11
        5,32,40,36,38
BG 1610 DATA 39,37,32,32,32,12
        ,37,42,37,35,32,107,67
        ,114,67,114
JA 1620 DATA 67,114,67,115,32,
        32,32,32,32,32,32,66,1
        74,66,174,66
MA 1630 DATA 174,66,174,66,32,
        48,48,48,48,32,32,3
        2,32,32,49
SD 1640 DATA 32,32,32,66,174,6
        6,174,66,174,66,174,66
        ,32,32,32,32
SG 1650 DATA 32,32,32,66,160,6
        6,160,66,224,66,224,10
        9,67,67,67,67
AK 1660 DATA 67,67,114,67,114,
        67,67,67,67,67,67,125,
        160,66,160,66
AX 1670 DATA 160,66,160,66,32,
        32,32,32,32,32,32,66,1
        74,66,174,66
AH 1680 DATA 174,66,174,160,17
        4,160,174,160,174,160,
        66,160,66,160,174,160
RX 1690 DATA 174,160,174,160,1
        74,66,174,66,174,66,17
        4,66,32,32,32,32
DP 1700 DATA 32,32,32,66,160,6
        6,160,66,224,109,67,67
        ,67,67,67,67
XC 1710 DATA 67,67,115,160,107
        ,67,67,67,67,67,67,67,
        67,125,160,66
PJ 1720 DATA 160,66,160,66,32,
        32,32,32,32,32,32,66,1
        74,66,174,66
EA 1730 DATA 174,160,174,160,1
        74,160,174,160,174,160
        ,66,160,66,160,174,160
BM 1740 DATA 174,160,174,160,1
        74,160,174,66,174,66,1
        74,66,32,32,32,32
HS 1750 DATA 32,32,32,66,160,6
        6,160,109,67,67,67,67,
        67,67,67,67
DM 1760 DATA 67,67,115,224,107
        ,67,67,67,67,67,67,67,
        67,67,67,125
KF 1770 DATA 160,66,160,66,32,
        32,32,32,32,32,32,66,1
        74,66,174,160
EJ 1780 DATA 174,160,174,160,1
        74,160,174,160,174,160
        ,66,224,66,160,174,160
BP 1790 DATA 174,160,174,160,1
        74,160,174,160,174,66,
        174,66,32,32,32,32
PQ 1800 DATA 32,32,32,66,160,1
        09,67,67,67,67,67,67,6
        7,67,67,67
SM 1810 DATA 67,67,115,224,107
        ,67,67,67,67,67,67,67,
        67,67,67,67
RM 1820 DATA 67,125,160,66,32,
        32,32,32,32,32,32,66,1
        74,160,174,160
BM 1830 DATA 174,160,174,160,1
        74,160,174,160,174,160
        ,66,224,66,160,174,160
QH 1840 DATA 174,160,174,160,1
        74,160,174,160,174,160
        ,174,66,32,32,32,32
EQ 1850 DATA 32,32,32,109,67,6
        7,67,67,67,67,67,67,67
        ,67,67,67
QJ 1860 DATA 67,67,113,67,113,
        67,67,67,67,67,67,67,6
        7,67,67,67
RQ 1870 DATA 67,67,67,125,32,3
        2,32,32,32,32,32,32,32
        ,32,32,32
MC 1880 DATA 32,32,32,32,32,32
        ,32,32,32,32,32,32,32,
        32,32,32
KD 1890 DATA 32,32,32,32,32,32
        ,32,32,32,32,32,32,32,
        32,32,32
GB 1900 DATA 0,0,0,0,0,0,0,0,2
        55,255,255,255,255,255
        ,255,255
XK 1910 DATA 255,255,255,255,2
        55,255,223,0,0,0,0,0,0
        ,0,0,0
BB 1920 DATA 0,0,0,0,0,0,0,0,0,0
        ,0,0,0,0,0,0,0,0
QA 1930 DATA 0,0,0,0,0,0,0,0,0,0
        ,0,0,0,0,0,0,0,0,2,2,2,1
        ,1,1,1,1,1,1,1,1,1,1,1
        ,1
QR 1940 DATA 1,1,1,1,1,1,1,1,1,1
        ,1,1,1,1,1,1,1,1,1,1,1
        ,1,1,1,1,1,1,1,1,1,3,3,3
        ,3
CP 1950 DATA 3,3,3,3,3,3,3,3,3,3
        ,3,1,7,1,3,3,3,3,3,3,3
        ,3,3,3,3,3,3,3,1,1,1,1
        ,1
PS 1960 DATA 1,1,1,1,3,1,1,1,1,1
        ,1,1,1,1,1,1,1,1,1,1,7
        ,1,1,1,1,1,1,1,1,1,1,1
        ,1
RS 1970 DATA 1,1,3,1,1,1,1,1,1,1
        ,1,1,1,3,1,4,4,4,4,4,4
        ,4,4,4,4,4,4,4,1,7,1,4,4
        ,4
FQ 1980 DATA 4,4,4,4,4,4,4,4,4,4
        ,1,3,1,1,1,1,1,1,1,1,1,1
        ,3,1,4,1,1,1,1,1,1,1,1,1
        ,1
XH 1990 DATA 1,1,1,7,1,1,1,1,1,1
        ,1,1,1,1,1,1,1,1,4,1,3,1
        ,1,1,1,1,1,1,1,1,1,3,1,4
        ,1
QJ 2000 DATA 7,7,7,7,7,7,7,7,7,7
        ,7,1,7,1,7,7,7,7,7,7,7,7
        ,7,7,7,1,4,1,3,1,1,1,1,1
        ,1
CG 2010 DATA 1,1,1,1,3,1,4,1,7,1
        ,1,1,1,1,1,1,1,1,1,1,7
        ,1,1,1,1,1,1,1,1,1,1,1,7
        ,1
EQ 2020 DATA 4,1,3,1,1,1,1,1,1,1
        ,1,1,1,3,1,4,1,7,1,5,5
        ,5,5,5,5,5,5,1,7,1,5,5
        ,5
KK 2030 DATA 5,5,5,5,5,1,7,1,4,1
        ,1,3,1,1,1,1,1,1,1,1,1,1
        ,3,1,4,1,7,1,5,1,1,1,1,1
        ,1
CG 2040 DATA 1,1,1,1,1,1,1,1,1,1
        ,1,1,1,5,1,7,1,4,1,3,1
        ,1,1,1,1,1,1,1,1,1,3,1,4
        ,1
QA 2050 DATA 7,1,5,1,1,1,1,1,1,1
        ,1,1,1,1,1,1,1,1,1,1,1,1
        ,5,1,7,1,4,1,3,1,1,1,1,1
        ,1
FK 2060 DATA 1,1,1,1,1,1,1,1,1,1
        ,1,1,1,1,1,1,1,1,1,1,1,1
        ,1,1,1,1,1,1,1,1,1,1,1,1
        ,1
AC 2070 DATA 1,1,1,1,1,1,1,1,1,1
        ,1,1,1,7,7,7,7,7,7,7,1
        ,1,1,1,1,1,1,1,1,1,1,1,1
        ,1
BX 2080 DATA 1,1,1,1,7,7,7,7,7,7
        ,7,7,1,1,1,1,1,1,1,1,1,1
        ,1,1,1,1,1,1,1,1,1,1,1,1
        ,1
MB 2090 DATA 1,1,1,1,1,1,1,1,1,1
        ,1,1,1,1,1,1,1,1,1,1,1,1
        ,1,1,1,1,1,1,1,1,3,1,4
        ,1
KC 2100 DATA 7,1,5,1,1,1,1,1,1,1
        ,1,1,1,1,1,1,1,1,1,1,1,1
        ,5,1,7,1,4,1,3,1,1,1,1,1
        ,1
XF 2110 DATA 1,1,1,1,3,1,4,1,7
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```
         ,1,5,1,1,1,1,1,1,1,1,1,1
         ,1,1,1,1,1,1,1,1,1,5,1,7
         ,1
MH 2120  DATA 4,1,3,1,1,1,1,1,1
         ,1,1,1,3,1,4,1,7,1,5,5
         ,5,5,5,5,5,5,1,7,1,5,5
         ,5
ED 2130  DATA 5,5,5,5,5,1,7,1,4
         ,1,3,1,1,1,1,1,1,1,1,1
         ,3,1,4,1,7,1,1,1,1,1,1
         ,1
GC 2140  DATA 1,1,1,7,1,1,1,1,1
         ,1,1,1,1,1,7,1,4,1,3,1
         ,1,1,1,1,1,1,1,1,3,1,4
         ,1
CS 2150  DATA 7,7,7,7,7,7,7,7,7
         ,7,1,7,1,7,7,7,7,7,7,7
         ,7,7,7,1,4,1,3,1,1,1,1
         ,1
CX 2160  DATA 1,1,1,1,3,1,4,1,1
         ,1,1,1,1,1,1,1,1,1,1,7
         ,1,1,1,1,I,1,1,1,1,1,1
         ,1
KD 2170  DATA 4,1,3,1,1,1,1,1,1
         ,1,1,1,3,1,4,4,4,4,4,4
         ,4,4,4,4,4,4,1,7,1,4,4
         ,4
PS 2180  DATA 4,4,4,4,4,4,4,4,4
         ,1,3,1,1,1,1,1,1,1,1,1
         ,3,1,1,1,1,1,1,1,1,1,1
         ,1
BH 2190  DATA 1,1,1,7,1,1,1,1,1
         ,1,1,1,1,1,1,1,1,1,3,1
         ,1,1,1,1,1,1,1,1,1,3,3,3
         ,3
RQ 2200  DATA 3,3,3,3,3,3,3,3,3
         ,3,1,7,1,3,3,3,3,3,3,3
         ,3,3,3,3,3,3,3,3,1,1,1,1
         ,1
CA 2210  DATA 1,1,1,1,1,1,1,1,1
         ,1,1,1,1,1,1,1,1,1,1,1
         ,1,1,1,1,1,1,1,1,1,1,1
         ,1
BQ 2220  DATA 1,1,1,1,0,0,0,0,0
         ,0,0,0,0,0,0,0,0,0,0,0
         ,0,0,0,0,0,0,0,0,0,0,0
         ,0
AC 2230  DATA 0,0,0,0,0,0,0,0,0
         ,0,0,0,0,0,0,0,0,13,11,7
         ,10,11,2,7,9,12,12,0,9
KS 2240  DATA 10,10,5,3,1,3,2,8
         ,5,13,10,0
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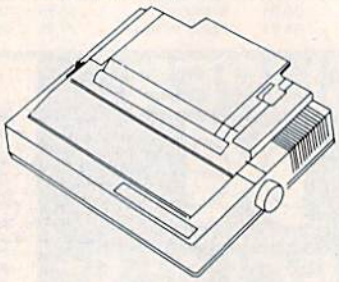

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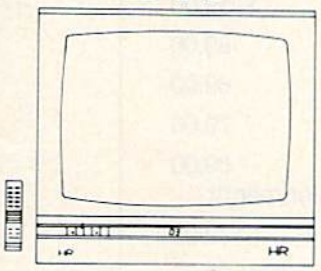

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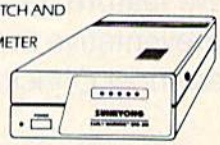

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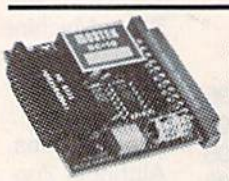

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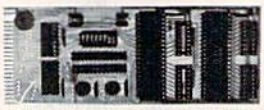

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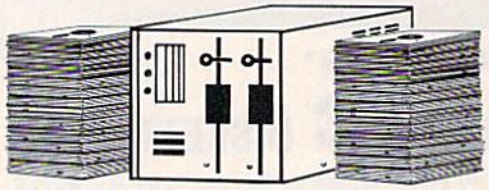

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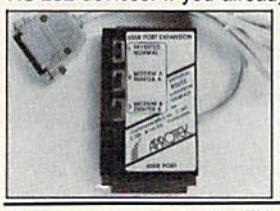

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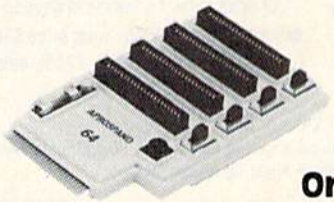

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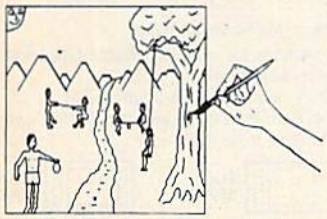

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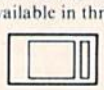 Plus $59.95

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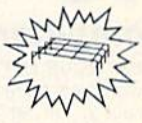

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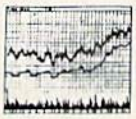

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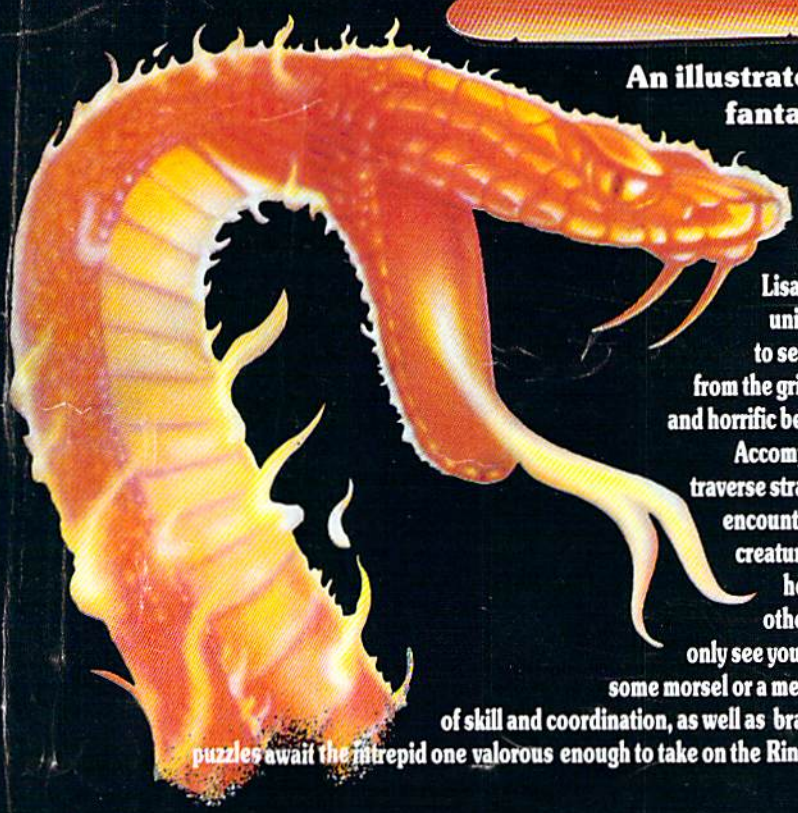

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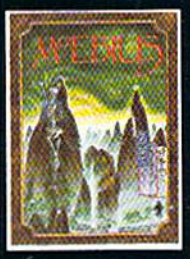

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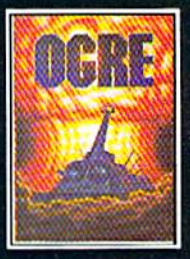

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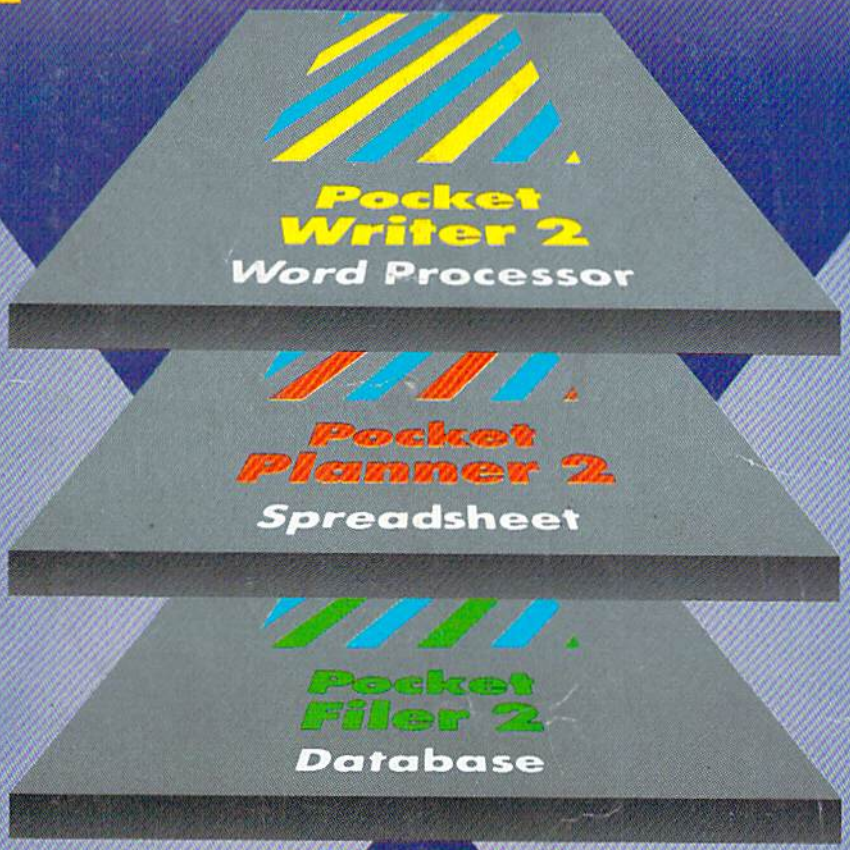

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