

Operating Systems, Languages, Statistics, Pirates, and the Lone Wolf

Jerry Pournelle
c/o BYTE Publications
POB 372
Hancock, NH 03449

"People do strange things," said my mad friend Mac Lean. "They invent things like this new operating system, OS-1."

"You mean it doesn't work?"

"No, it works fine," he said. "And it's about as useful as a chocolate-covered wristwatch. Or maybe a triple hernia. If you like to play with operating systems, and God knows I do, OS-1 will give you hours of delight. But if you want to *use* it, you get hours of tedium."

"Why? Isn't it like Unix?"

"Well, yes, it is, sort of."

"But then why isn't OS-1 useful? Everyone likes Unix . . ."

"Do they? Well, maybe a lot of programmers do, as they ought to. I'm not so sure other users are going to like Unix all that much, but maybe they will. Besides, OS-1 isn't *quite* Unix. OS-1 has a tree-structured directory system, but there's no mechanism for finding a file in there unless you've kept lists. And you can't make lists. Although the 'SET TTY' command will set the screen width, it won't set the printer width, so you can't even list for hard copy unless you've got a 132-wide printout device. If you don't remember what's in those directories, you'll never find the files!"

"What, never?" I asked.

"Well, hardly ever. The idea is that you can have multiple directories, so a lot of different users can each have their own, right? But floppy disks are too small for that kind of structure. Look, your utilities occupy most of one disk, and your operating system and its directories take up another disk. On top of that, the OS is so big that you've only got about 32 K bytes of RAM left over. That's not enough to work in. The PL/I compiler can't do much in that. Whitesmiths' C compiler won't even start to work. Leor Zolman's [excellent!] BDS C compiler hasn't got room to breathe. What use is a Unix-like system that won't let you compile C programs?"

I still wasn't convinced. "Look," I said. "OS-1 is supposed to have all kinds of nifty features taken from Unix . . ."

"It almost does," my mad friend said. "The notion

behind the Unix system, with pipelines and all that groovy stuff, is great. Unix treats *everything* like a file, and you can build 'pipelines' from your directory to the device you want the file to go to, or between programs. But OS-1 doesn't do that. Instead, it has pseudopipelines, with intermediate file structures. Why do that? Better to use CP/M and a submit program than that. With OS-1 you just don't have enough RAM, and you have trouble keeping track of where you are, and the command strings are long and tedious if you want to look at other directories. They really tried hard, and you ought to give them an A for effort, but only about a C for usefulness."

"And if we go to 16-bit machines?" I asked. "Such as the 8086? Where we've got plenty of RAM to play with, and hard disks and fast access and . . ."

He shrugged. "Who knows? But I suspect that if you want a Unix-like system, you might as well have Unix and be done with it. Why compromise with something else?"

And on reflection I have to agree. OS-1 is a heroic effort, but it somehow just doesn't make it.

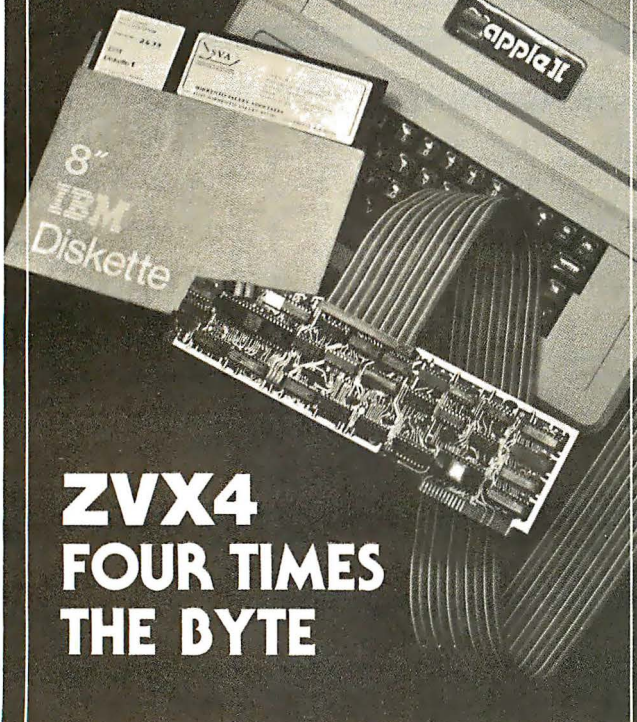
Future Operating Systems

So what *will* be the operating system for future micros? Will we, as Chris Morgan wrote in his recent editorial "The New 16-Bit Operating Systems, or, The Search for Benutzerfreundlichkeit" (June 1981 BYTE, page 6), "get it right the second time"? Or are we stuck with CP/M forever and aye?

Well—first, what does "stuck" mean? For all its problems—and Lord knows it has plenty—CP/M isn't all that bad, for *users*. Programming hackers really hate it, but true hackers hate almost anything they didn't grow up with. Users don't know some of the inconveniences of CP/M. Worse, most users don't know all its nifty features because of the wretched documentation for which Digital Research is notorious, but CP/M is fairly easy to learn and use, even for beginners. It gets the job done.

And now that Xerox has adopted CP/M for its much-

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User's Column

advertised systems, one conclusion is plain: any popular system of the future will have to be upward compatible with CP/M, because there's just so much good software running under CP/M. Digital Research did us all a good turn by coming up with something approaching a *standard* in this field. I remember when we had to use F-DOS.

And then there are the CP/M utilities. You don't have to understand CP/M, as long as someone else does. I've mentioned the CP/M User's Group (CPMUG) before; it's an outfit that distributes all kinds of nifty utilities, like COPY routines, and FAST (which speeds up CP/M 1.4), and the like. The problems with CPMUG are selectivity and updating: there are more than 50 disks in the

Items Reviewed

Workman & Associates

112 Marion Ave.
Pasadena, CA 91106

CP/M Disk Utilities	8-inch single-density disk	Disk I \$27.50 Disk II \$27.50
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Ecosoft

POB 68602
Indianapolis, IN 46268

Microstat	8-inch CP/M or 5-inch North Star disk	\$250
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Software Labs, Inc.

735 Loma Verde
Palo Alto, CA 94303

OS-1		price information unavailable
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Ashton-Tate

Suite 1510
3600 Wilshire Blvd.
Los Angeles, CA 90010

dBASE II	8-inch CP/M	\$700
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Lobo Drives International

354 South Fairview Ave.
Goleta, CA 93117

LX-80 (expansion interface for TRS-80)		price under \$1000 as tested
LDOS (operating system for TRS-80)		\$169

Digital Research

POB 579
Pacific Grove, CA 93950

PL/I-80 with LINK-80 linker		\$600
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Book Reviewed

Winston, P. H. and B. K. P. Horn.

LISP

Reading, MA: Addison-Wesley
Publishing Company, 1976

\$11.95

CPMUG library, most filled with junk, useless games, or obsolete versions of programs since updated.

There are other sources of utilities. Various user networks distribute all kinds of nifty programs—modem emulators, catalog programs, library routines, you name it. And these get revised all the time. So how could you tell which ones to use?

The answer is, you couldn't—until Barry Workman, of Workman & Associates, came along. Barry sifts through the CPMUG and other public-domain sources and puts together disks of utilities, which he'll sell for \$27.50 a disk. Right now he's got two such disks.

"Utility Disk One will always be the most useful CP/M utilities I can find," Workman says. "The latest and fastest copy routines, command-line processors, directory programs, a good modem program to use with The Source or Micronet or whatever. Comparators and filters, stuff like that. Ward Christenson's disk catalog utility, which is by itself worth more than the disk if you don't have it."

"How do you select the programs?"

"Mostly I ask people like you what you'd like to have."

The documentation on the Workman disks is adequate, generally better than what was on the CPMUG disks. At least it had better be: Barry, by supplying quantities of a wonderful liquor called slivovitz, which he finds in some unknown place, gets me to go over the stuff

for him. I do *not* rewrite it, but I do smooth out some of the ambiguities.

Workman's Utility Disk Two has Ward Christenson's disassembler, some comments on how disassemblers work, and instructions. It also has some other utilities probably more useful to programmers than users, although again Workman has tried to keep things simple and provide what he thinks will be most useful.

I can't list exactly what's on each of the disks, because that changes according to what Barry thinks is the most useful selection he can put together each month. He does try to send out the latest versions of the various utilities as he gets them.

The Workman utilities are public-domain programs, and almost all of them could be obtained by swapping with other people—for that matter, the only copyrighted materials on the Workman disks are some documentation files. The price may be just a bit steep, but Barry says he can't afford to produce the disks for less. He's selling them as a service; he won't get rich at \$27.50 per disk. If your time is valuable, the utilities are worth the price.

The Workman utility programs are for 8-inch soft-sectored, single-density CP/M systems only, the kind of stuff that my friend Ezekial, who happens to be a Cromemco Z-2, likes. But of course I have another computer. . . .

Lobo to the Rescue

It was at the West Coast Computer Faire. I was talking to Roger Billings, president of Lobo Drives International, about their hard disks.

"I'm in big trouble," I said.

"Why?"

"Here I am at the Faire. I'll be bringing home a lot of new software. Automated Simulations has some great new games. And when I get home my kids are going to kill me, because Ezekial is running fine, but *their* computer isn't. And my name is mud if I can't get that TRS-80 going again"

"What happens?" Roger asked.

"Won't boot. Drives spin, but the system won't come up."

"Hmm. Can we come see you next week?"

"Sure," I said, and promptly forgot the conversation, there being so much to see and do at the Faire. Precisely a week later I was talking on the telephone when the doorbell rang. Here at Chaos Manor that's a big deal. Dogs bark and madly skid on rugs to the door, followed by shouting boys trying to restrain the dogs. Anyone who waits for the door to open is *determined*.

Eventually I got off the phone to find Eliot Lane, Lobo's product engineering manager. He had a van outside. "I've come to fix up your TRS-80," he said.

And fix it up he did. The first step was to replace my Percom disk drives with two new Lobo drives. That turns out to be easy: Lobo drives have the cable connector on the back where you can get at it without taking out

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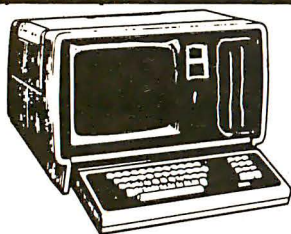
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User's Column

screws (and I wish the Percoms were built that way; it's bloody easy to have one of the power cables come loose inside the drive when you put it together after connecting the data cable). But when we tried booting the system, nothing happened. At least we knew it wasn't the fault of the Percoms, which had always worked well and still do, except for the inconvenient placement of those cable connectors.

Next we installed Lobo's LX-80 expansion interface to replace my TRS-80 interface. My TRS-80 Model I is one of the intermediate versions; in addition to the ribbon cable (with flat booster box) connecting the keyboard to the expansion interface, there's also a round cable—which makes it pretty crowded and hard to get at the RESET button. There's no connection for anything like that on Lobo's LX-80.

"Just ignore it," Eliot said. He proceeded to connect the LX-80. It didn't work, so we took apart the TRS-80 keyboard, and lo, there was a broken wire in the ribbon cable connecting the two halves of the system. Eliot soldered jumpers around the broken parts and tried again, and all worked fine.

It still does. We're now running the Lobo LX-80 with LDOS operating system, and both work splendidly. The disk drives are a pair of Lobo 5¼-inch and another pair of Lobo 8-inch; all four are running at double density and doing fine, and with this system you can move everything from small disks to big ones and back again, giving you a lot of storage.

Now, about the LX-80: this is an excellent product. It's well made, in a metal case, with precisely located components. The insides look professional, as opposed to the TRS-80 expansion interface with its jumpers and cut traces and soft plastics and such. The one I've got is the full-blown model, with two serial ports and a parallel port, and cable outlets for both 5¼- and 8-inch drives, and 32 K bytes of memory. There's an on-board PROM (programmable read-only memory) that brings the system up into LDOS. It supplies power for all the ports from a single wall plug that works through a positive action switch. There's a good pilot light. The LX-80 comes with documents that explain what's going on. It connects to your TRS-80 with a single cable and with no booster-box. You don't need the various kludges that Radio Shack threw in to keep its Model I working.

The LX-80 will reformat and run both 5¼- and 8-inch disks, at either single or double density. It will let you transfer files from single density to double density. It has an external data separator (which separates data signals from timing signals), so that you don't get the disk errors for which TRS-80s are notorious. (The TRS-80 system uses the data separator internal to the disk-controller chip; even Western Digital, which makes the chip, recommends that you don't do that.)

In other words, I like the Lobo LX-80.

The problem is that it's expensive; the model I tested would probably retail for just under \$1000. It's really bet-

ter than the computer it supports. Lobo was a bit late getting the LX-80 on the market. Most of the people who need one may already have a Radio Shack expansion interface, and now Percom will sell you a doubler to allow double-density operations and an external data separator to add to your Radio Shack interface. If you're using the TRS-80 Model I, and you're thinking about an expansion interface and disk drives, the LX-80 won't cost much more than the Radio Shack plus Percom's separator and doubler. And if you want quiet, trouble-free operation, if you want to be *sure* your expansion interface isn't giving you trouble, and you're willing to pay for that assurance, then the LX-80 is a very good way to go. Lobo builds quality products, and it stands behind them.

There's one more problem with the LX-80: it won't work with George Gardener's Omikron Mapper. The Mapper is a device for letting you run CP/M with a TRS-80 Model I; I reviewed the Mapper more than a year ago (see "Omikron TRS-80 Boards, NEWDOS+, and Sundry Other Matters," July 1980 BYTE, page 198), and I'm pleased to say ours has never given us any trouble. (True, the broken wires in my TRS-80 probably came from the flexing during installation and removal of the Mapper, but after all, I did that about 20 times in order to put in other stuff for test, so that hardly counts against Omikron.) There's no reason why the LX-80 and the Omikron Mapper *can't* work together; it's just that the

LX-80's PROM is geared to disable certain parts of the TRS-80, and to readdress some of the system's ports. A good software expert could make the two work together, and I think Lobo ought to consider doing that. The ability to convert the TRS-80 Model I for CP/M and still run regular TRS-80 stuff as well adds greatly to the computer's value.

Lobo's Disk Operating System

The TRS-80 used to drive me mad because of the operating system. I always used NEWDOS instead of Tandy's standard TRSDOS. Now there's LDOS, Lobo's disk operating system for the TRS-80 Model I. Although I still think it's needlessly complex, LDOS is now the best TRS-80 operating system going. It's a *lot* better than TRSDOS.

Although it was designed to work with the LX-80, LDOS will work fine with a TRS-80 Model I and a Radio Shack expansion interface. With LDOS you can run 40 tracks per drive if your disks can do that. (TRSDOS is limited to 35 tracks no matter what your disks are.) LDOS will also work with the Percom doubler and data separator. LDOS knows whether your disks are formatted for single or double density and stores the files accordingly. You don't need to keep track of that, or to use special commands.

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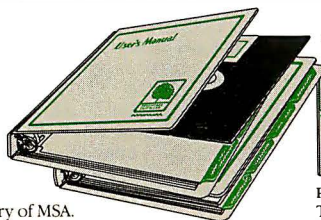
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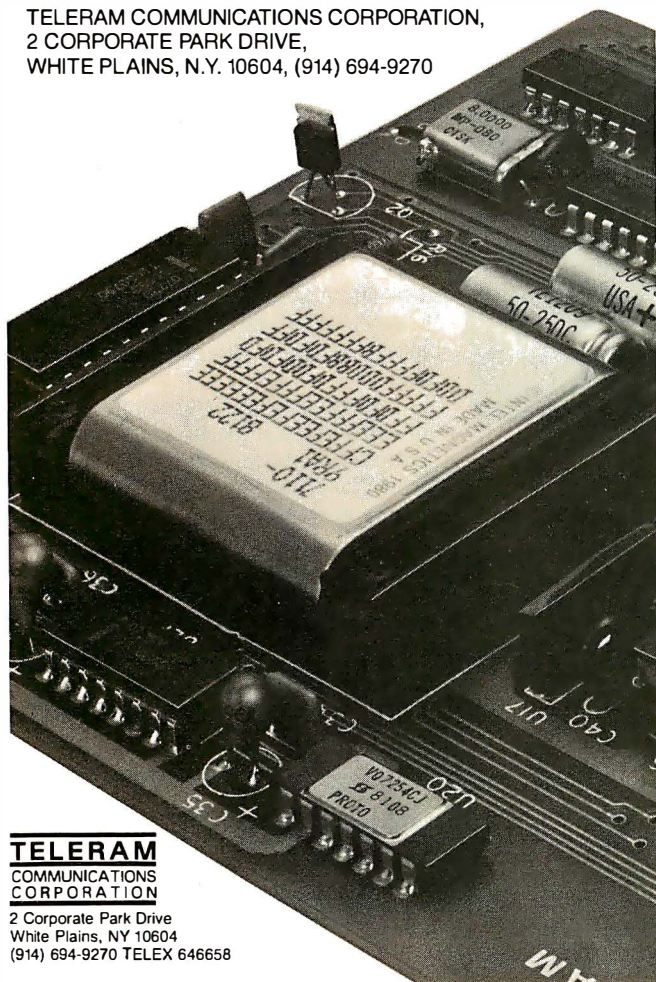
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A major feature is that files created with LDOS can be transferred from a TRS-80 Model I to a Model III, and they say you can get from a Model I to a Model II also, although I'm not sure how.

LDOS is superficially similar to TRSDOS. It has all the inanities about passwords and protection levels and such that TRSDOS sticks us with. Fortunately, though, with LDOS you can get rid of all that stuff—as you should. Anyone who trusts those “password” and “protection” systems should get his head examined. Any of those systems can be defeated by any half-competent programmer.

You get all kinds of utilities with LDOS: a debugger, a job-control language, and a patch to Microsoft (Tandy) BASIC that allows you to renumber selectively, use random-access files, step through a BASIC program one statement at a time, and cross-reference programs. There's also a spooler to allow printouts while you work on other programs.

The system is easier to use than TRSDOS, but you do have to learn it. The LDOS documentation is fairly clear, but dense in places; you really have to read through most of the document, then go back and start over. The usual hacker's way of plunging in and doing this and that while thumbing through the manual probably won't work—at least it didn't for me.

On the other hand, LDOS comes with a toll-free number that you can call to get help. I called it several times and found myself speaking to systems programmers who really know LDOS. They tended to think I was nuts—the answers to almost all the questions I had were right there in the manual (and if I'd read through the manual instead of jumping right in like any hacker, I'd have known that). They also tended to expect me to know more than I'd expect a typical user to know; but then I had an early copy of LDOS, and they hadn't had a lot of experience with naive questioners yet. By now I bet they know better.

The documentation is nothing to brag about, but it's adequate, provided that the reader is patient and will go through it twice. There are plenty of examples, most of them informative. It needs a good index and an analytical table of contents and a better introduction to the “philosophy” behind LDOS, but you can, with patience, learn the LDOS system from the manual. That beats the daylights out of some system manuals I know of.

One reason LDOS is complex is that it really is an operating system not just for the disks, but for the whole TRS-80. It has the ability to set logical devices, and trace programs, and do lots of neat things you don't associate with the TRS-80. LDOS with the LX-80 gives you a fairly powerful system, with a real monitor just like regular computers, and even with the Tandy interface you still get a lot more control over your machine than you get with either NEWDOS or TRSDOS.

As far as I can tell, you can run any programs under LDOS that you can run under TRSDOS, except for those

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programs that are artificially protected with goofy sectoring and other strange tricks to keep you from copying them. And anyone who uses such programs is, in my judgment, not doing the profession much of a favor to begin with. On that, more later.

The bottom line on LDOS is that I like it. It's kind to the user, and it's a fairly complete operating system. I still prefer to convert my TRS-80 Model I to CP/M, but I'll keep LDOS around to use when I'm running it as a TRS-80, since it will work on Omikron's Mapper if you get an LDOS patch from Omikron.

Code and Swash

"Do you read BYTE?" my mad friend asked.

"Stupid question. I *write* for BYTE."

"What's that got to do with reading it? Anyway, did you read the editorial on software piracy?" (See "How Can We Stop Software Piracy," by Chris Morgan, May 1981 BYTE, page 6.) I admitted that I had.

"What did you think of it?"

"Didn't think about it a lot"

"You should. It's dead wrong," Mac Lean said. "Look. Your editor, Chris Morgan, says that software piracy is a major problem"

"And it really isn't, for users," I mused.

"Well, it's sure going to be," Mac Lean said. "Because look what they're doing. Making programs complicated and uncopyable to 'protect' the publishers. What that really does is make the user's life impossible. Disks are fragile things. I've got to have copies of them. Suppose I have a brownout. Ever have that happen to you?"

I nodded. Once we had a power failure while I was copying a disk. It took Mac Lean and a program called SPAT and a *lot* of work to recover most of what was on either disk.

"And it's worse than that," Mac Lean said. "They worry about pirates, and the result is that the programs are fragile. They can't recover from mistakes, because instead of error traps they've put in some kind of 'security'."

And he's right. The more I think about "uncopyable" programs, the more I hate the idea. I wouldn't bet any part of my income on an "uncopyable" program — and I'm unlikely ever to recommend one in this column.

But, then, how do we protect the rights of programmers?

Rights to what? If you mean the right to several hundred bucks for a program, why should we protect that? I mean, if people can get that for a program, more power to them, but why is it my concern to help publishers get that much? I *want* the price of software to come down.

"But," I mused, "if the price comes down, will we still get good software?"

My mad friend chortled. "Ever meet a true hacker who didn't write software? True, they won't do adequate *documentation*, they never do no matter what you're paying, but try to stop them from writing programs."

And of course he has a point. There's another argument: that software takes a long time to write, maybe

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User's Column

months and months or even a year, so doesn't the programmer deserve high prices?

Well, it takes me a year or so to write a book, and I don't notice anyone getting \$400 per copy. And as for piracy, I even pay taxes to support public institutions whose purpose is to lend my books *free*. Yet I'm not starving, and neither are my publishers. The average paperback book sells about 40,000 copies, at perhaps \$2.25, and makes a little money for the publisher, the distributor, and the author. Nobody gets rich on that; the money is in best-sellers, which sell a million and more copies.

Or there's the textbook situation. Take Kernigan and Plauger's excellent *Software Tools* (Addison-Wesley, 1976), or Grogono's *Programming in Pascal* (Addison-Wesley, 1978), as examples. They sell for around \$15, and I suppose they sell 30,000 to 40,000 copies. Maybe more. Does anyone seriously contend that it's harder to write a good program than to write a good book? I've done both, and programs are easier, if a bit more tedious; there's more of the equivalent of reading galley proofs (we call it galley slavery) in programming than in writing. But both are hard work.

As to thefts: look, it's really in everyone's interest to bring the price of software down. The more good software—and by good, I mean stuff that ordinary people can use to do worthwhile things, programs that are self-instructing and have really good documentation—the more good software available at a reasonable price, the more machines will be sold, and the larger the software market will become—and I believe it's *already* approaching the book-buying market.

But, pleads the software developer, book publishers don't have to maintain their books; they don't have people telephoning with questions . . .

Two answers to that. First, if you make sure the software and its documents are right the first time, you shouldn't be getting those complaints. Book publishers don't depend on their customers to be an unpaid quality-control department. Second—why, the pirates *can't* call in with questions.

So my heart doesn't bleed for the publishers. After all, who steals software? Business people? Nonsense. Try selling a computer system to your local architect and then tell him you're furnishing him with stolen programs. Oh boy! No, there are two categories of thieves: hobbyists and shady systems houses. Let's look at them.

First the hobbyist. This poor joker is typically broke. The computer industry gets every nickel he has. Since he *couldn't* pay for what he steals, he wouldn't have bought the stolen program anyway. Furthermore, he'll spend the saved money on something else that's computer-related. Nobody is losing that much money, even in the case of the clubs where members line up and make copy after copy, because darn few of those present would ever buy \$500 programs. These people want programs to play with, not to sell, and probably not even to use.

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What are the alternatives? To preserve those \$500 price tags by making the programs unstable? Doggone it, that's precisely what some outfits have done. In an attempt to thwart pirates, they've made their software fragile. One database outfit has sent me *four separate copies* of its widely advertised program, each supposedly configured just for me. We have *yet* to make one work. I've given up on them.

Then there's what Mac Lean calls "Levitical Programming"; the first half of the manual is filled with "Thou Shalt Not" statements, and the licensing agreement is such that you have to be insane to give them your right name. This is professionalism?

Then too, if the software houses did decent documents, they'd make their pile selling those. Adam Osborne got rich giving away programs and selling books. So can anyone else. You just won't convince me that I ought to feel sorry for an outfit that can palm off some wretched document at \$30 and sell hundreds of copies of it at discounts that would set a major publisher's eyes gleaming with greed.

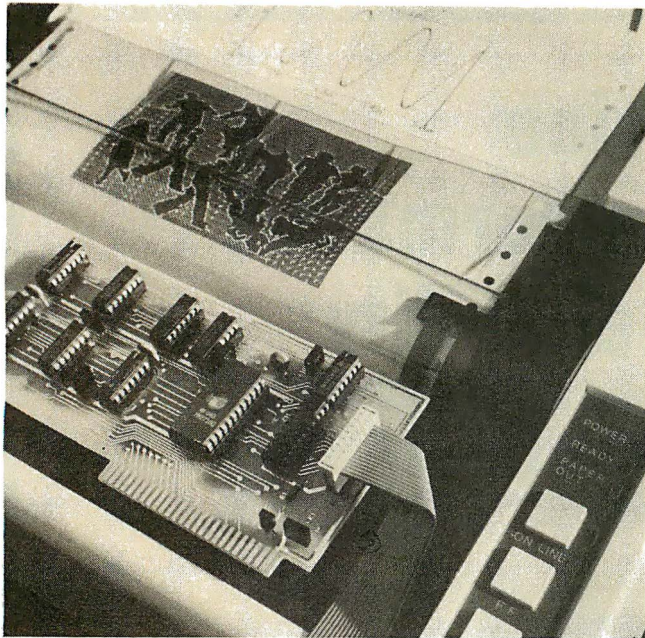
And that's the answer to the systems-house pirate, who, if the truth be known, isn't all that great a threat either. True, he does soak up legitimate profits. I know a writer who bought a system from a fly-by-night company and found that his WordStar and CP/M were pirated. But when he went back to demand satisfaction, the systems house was gone—as, indeed, such houses usually will be. If they're successful, they *have* to go legitimate eventually; there's just no way to keep their pirate acts secret forever. And if they're not successful, they just can't have stolen that much. (Oh, true, at the hideously inflated prices software publishers charge, the total dollar value is high; but in fact we're talking about fewer than a hundred copies at most, and many of those wouldn't have been sold, but could only be given away. Not everyone who takes low-priced software will pay a high price for it.)

But if the documentation were useful, well written, had lots of examples, and was professionally printed—which, coming with something that sells for hundreds of bucks, darn well *ought* to be the case, even though very few programming documents meet any of those criteria—then even the pirate software houses would have to buy the books.

The answer to software piracy, it seems to me, is about the same as the answer to book piracy: sell decent products at reasonable prices and write decent documentation for sale at prices competitive with the price of photocopying the book. And stop worrying so much about protecting \$500 and \$600 price tags, because it isn't in the interest of the user community for software prices to stay that high. Very few programs are worth that much.

PL/I-80

What is a program worth? Well, there's a legal maxim: "the value of a thing is what that thing will bring," which is to say that something's worth what people are willing



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to pay for it.

And you can bet that a program worth \$600 had better *work*, and do so with minimum effort, and have decent instructions that can be read by a human being.

And just how many of those are around?

There are a few. My mad friend is ecstatic about Digital Research's PL/I compiler, PL/I-80.

"No bugs. It runs. It does what it says it will do."

"How did you learn the language?" I asked.

"Well, you need Digital's documents, of course," he said. "And two or three standard references on PL/I, one of them certainly being the Joan Hughes book [*PL/I Programming: A Structured Approach*, John Wiley and Sons, 1979] that you mentioned last time."

"You do need other reference works, then?"

"Oh, yeah. As usual, Digital has encrypted its documents. But they're up to Digital's usual standards of clarity, meaning that you'll need a Swahili interpreter..."

Well, Mac Lean tends to exaggerate. They're not *that* bad. Not quite. It is true that Digital is a company that seems determined never to hire any writers, but its documents *are* complete, if confusing.

And Mac Lean remains as enamored of PL/I now as he was six weeks ago, which for him is quite a long time. I think we can safely add Digital's PL/I to the armory of good stuff—programs that work properly and are useful.

PL/I does have difficulties. There's no CASE (SWITCH) statement, which means you'll have far too many *if...then...else* statements; but everything necessary for rigidly structured code is in the language. The error reports are excellent. PL/I is not as fussy about declarations as Pascal. The language doesn't come out as compact as Pascal, and the programs don't run as fast, but they're easier to write. PL/I forgives quite a few errors.

There are other problems. The input/output is confusing, and worse, that's the part that you have to rely on Digital to tell you about. But you can learn it, and having done that, you're safe in programming with PL/I, because Digital is committed to support PL/I compilers for all its operating systems. You'll be able to transport your programs from your present micro to whatever machine—8086, Z8000, whatever—you eventually replace it with.

Thus, I'll stick my neck out this far: it's worth the time investment—a couple of weeks—to become mildly proficient in PL/I, always assuming that you're going to do some programming of your own, of course. If you're *strictly* a user, though, you're still safe in investing in PL/I programs, since you're probably guaranteed they'll be useful on the next generation of machines.

Digital PL/I also comes with a really groovy linker and library-management routine, allowing you to build up a raft of software tools that you can stick into other routines. The method for calling in outside procedures and passing them variables is straightforward, and again

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preserves maximum portability from machine to machine.

PL/I is a good language for learning structured program concepts, and the Digital implementation is much better than acceptable. Recommended.

Bilge and Circumstance

Now we come to dBASE II versus the bilge pumps.

First: dBASE II is what used to be called VULCAN. The original VULCAN programmer formed a partnership with Messrs. Ashton and Tate, and now Ashton-Tate markets it. I'm told my evaluation was crucial in the decision to rewrite and expand the documentation, but to keep the program (with some fixes).

My original evaluation of VULCAN was "infuriatingly excellent"; it was potentially a very useful program, but fatally flawed by the worst user instructions I'd ever seen.

I'm pleased to say that now it's not infuriating, just excellent. The flaws are (almost) all gone, the program documents have been rewritten and expanded until almost anyone can learn to use dBASE II, and VULCAN always was a darn good database program. I think it's overpriced at \$700, but apparently Ashton-Tate gets away with it. If any program is worth that price, dBASE II is.

dBASE II is a *relational database*. This is in contrast to tree-structured databases. Relational databases make a kind of matrix of data; you can then structure the data any way you want, examine relationships you hadn't realized were there, and in general play about with the data. Tree-structured systems of the CODASYL variety require you to do the structuring in advance, and woe to you if you get it wrong.

It's a bit hard to describe dBASE II, because it's very versatile and powerful. For instance, you can build a full accounting system from dBASE II, tailoring it to your needs, and it really would work. (I think you'd be better off buying an accounting system, but that's for another article.) You can put up libraries in dBASE II, and then take the same data and reorganize it by subject matter to make bibliographies. What dBASE II preserves are the *relationships* among the mass of data entered; the exact structure of the data can be changed at any time. This makes for a very powerful tool, one whose capabilities aren't entirely realized just yet.

And, dBASE II is now well documented. What they did was keep the old documentation, which was a really complete reference manual but sans examples or sane organization, and add, up front where it belongs, a complete new program-user's guide, done by someone just learning to use the VULCAN system. Thus you can go through the first set of documents and learn how to use dBASE II, after which you can use the second chunk as a handbook, which, once you actually understand dBASE II, isn't all that bad. (It remains, however, the most frustratingly miserable excuse for a way to *learn* a system that I've ever seen.)

Second, the bugs have been fixed. Not that there ever were many; VULCAN was always excellent, even if infuriating.

And finally, the program remains very powerful. dBASE II isn't just a means of storing and retrieving data. It contains what amounts to a whole data-handling language with the ability to do sorts and restructures, to copy data from one place to another, and to do conditional arithmetic. For example,

```
REPLACE ALL FOR (BILL:DATE <= 791031)
COST WITH COST*1.1
```

would be a command to search the database to find records that had BILL:DATE older than October 31, 1979 and for those records to replace the value of the variable COST by the current value plus ten percent.

Other forms of magic are possible. You have to study dBASE II; it can do things you wouldn't think of. But it's well worth the study. I'm using it to organize my files, by subject, type, date, date of last access, and drawer number, and also adding keywords; eventually I'll have this place organized, and this time for sure. (The last time I got this ambitious I was using VULCAN, and the documentation drove me to quit in disgust, but this time things seem to be going much better.) And my time wasn't wasted last year, since dBASE II can read the old

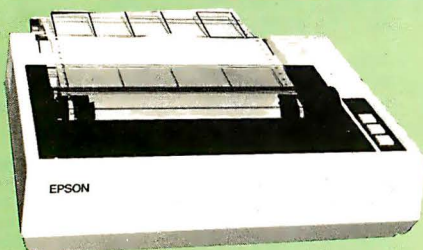
VULCAN files and then reshape them into the new system I've designed. What happens is that dBASE II copies the old records into new ones, ignoring any in the old database that aren't in the new structure; while if it finds variables in the new structure that weren't in the old records, it fills them with blanks, leaving room for you to enter the data at your leisure.

dBASE II, I'm pleased to say, makes no attempt to prevent you from making backup copies. Far from it: all through the documentation, you're urged to make a safety copy of both data and program, just in case. That advice is worth taking, given the relative costs of data-entry labor as opposed to floppy disks. I expect people will try to rip off the dBASE II software, given the price, but I guarantee they'll get zero use of it without a complete set of documents . . .

Statistical Analysis with Microstat

Microstat by Ecosoft. I don't care much for the house name—I'm growing weary of "ecology" names for software companies, since they make me think their products may contain significant portions of natural organic waste—but I can recommend the program, with warnings.

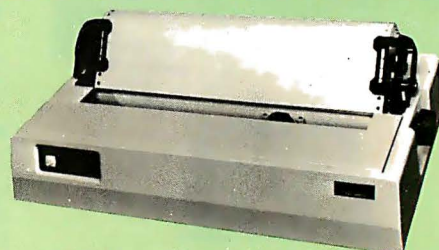
First warning: you, or someone you work with, better know quite a lot about statistics. Microstat will do some very sophisticated statistical analyses, but it will *not* tell



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you which of its many features you want to use.

On the other hand, you can make up your data files rather easily, then manipulate the daylight's out of them with Microstat's various routines; so you don't have to know in advance that you'll want to employ the Kolmogorov-Smirnov Two Group Test (whatever that is) in order to use it later.

I wish I'd had Microstat last fall. About a year ago I quit smoking and took up running (and yes, I'm still at running, and it's a year today since I last smoked). Like many new converts, I began reading the various running magazines, and one of them rates running shoes. It gave a fairly low rating to the shoes I like, and I got interested in why. (It shouldn't have; one of the measures was shoe weight, rank ordered to a *tenth of a gram*! I doubt the magazine has balances that sensitive, and a few drops of sweat would change the ratings.)

The magazine published its data—more or less—as well as its ratings, so I decided to do a fairly complete statistical analysis to see just how much confidence you could put in those ratings. (Not a lot, I concluded. Many of the measures are highly correlated and not sufficiently thought out.) I didn't have a decent stat program, so I had to write my own, based mostly on Paul Horst's matrix algebra routines I learned way back when. My routine will do a couple of things Microstat doesn't do, such as generate a new data file with the data entries transformed

to "Z" scores (in which the mean is 0 and the standard deviation is 1), and my system preserves a "name and comment" string field associated with each data case. But I'd still have been far better off using Microstat with its much more complete statistical analyses. The Microstat package has a data-entry routine with some elementary error-correction procedures, including an EDIT routine; I could have used that.

Microstat does what you'd expect: means, variances, correlation matrices, etc. It also does auto-correlation (a variable correlated with itself). It does analysis of variance, "Student's" T test, the F test, and various non-parametric tests such as chi-square. It tries different distributions and checks goodness of fit. About the only thing missing that I'd like to see is Chebyshev's criterion. But *note this well*: if this paragraph is meaningless to you, you will not understand Microstat's documentation. This is not a program intended for the casual "cookbook" stat user. It *has* everything the cookbook experimenter would need, but in a fairly intimidating context. In fact, Ecosoft (which seems to be some professors at a Midwestern university) would do well to write a simple-minded cookbook to accompany its programs.

On the other hand, if you do know a bit about statistics—if you've mastered something beyond the elementary textbooks—then Microstat can help you. It has a surprising number of features, and if you know what statistics you want, or can find someone to advise you on the math theory, the Microstat documentation is more than adequate to tell you how to use the program. Given that caveat, I recommend Microstat; but do be warned that the book is written with graduate-level experimental statistics students in mind.

Soothing the Savage LISPer

And finally we have a good book on LISP. I confess I'm slowly beginning to appreciate just how powerful the LISP programming language is, and I will now concede that anyone intending to make a career in computer science should become aware of the language. I'm still not convinced LISP can be learned without tutorial help, but certainly *LISP*, by Patrick Henry Winston and Berthold Klaus Paul Horn, will help. The book is intelligently written. There are a lot of examples; the most useful are given as exercises, which made me furious until I realized there were answers in the back of the book. It has a good table of contents.

I'm still not at all convinced that LISP programs will ever be comprehensible to anyone who doesn't spend a lot of time working with the language. The claims that they're easy to read and don't require comments are, in my view, just wrong and would only be made by a maniacal LISPer (and a lot of LISP users do tend to be maniacs, as witness the hate mail I get for not sufficiently praising the language).

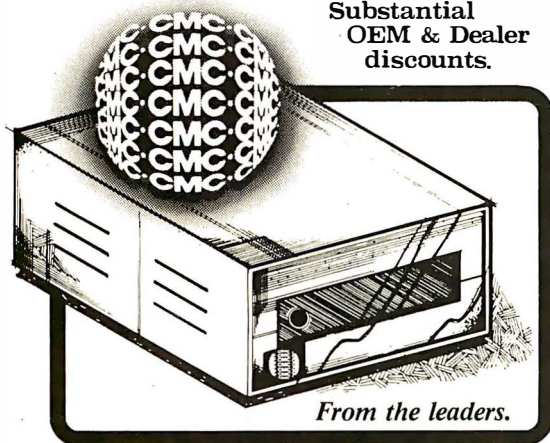
Anyway, the book is the best I've seen on the subject and tells a lot about LISP. ■

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