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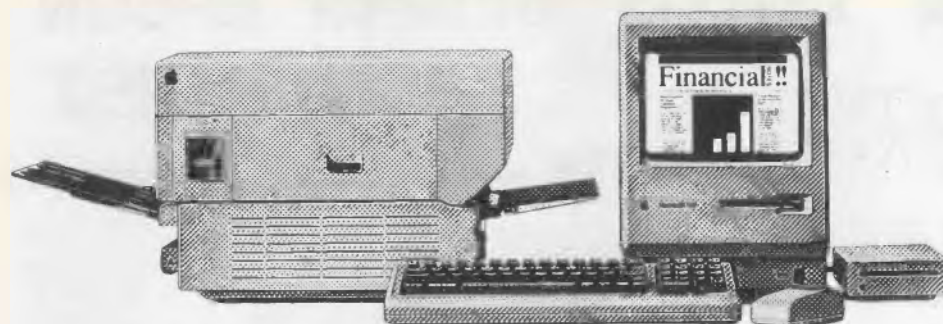
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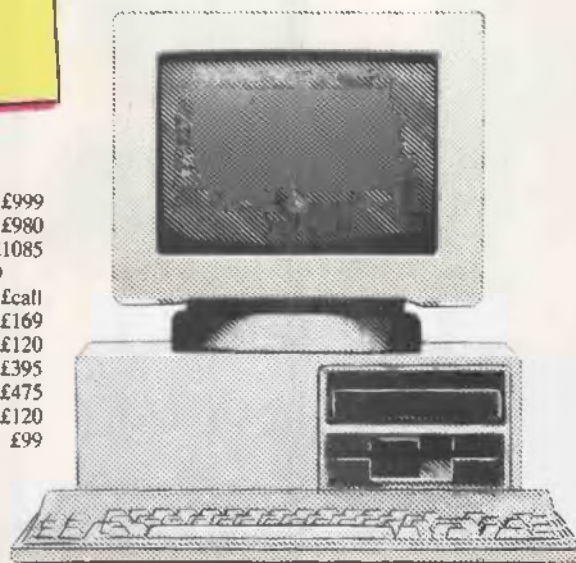
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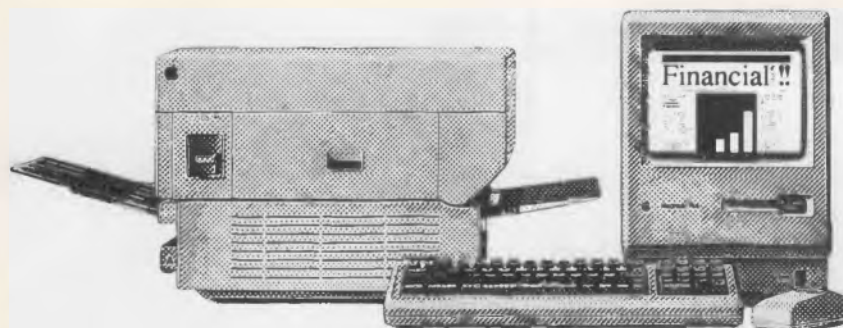
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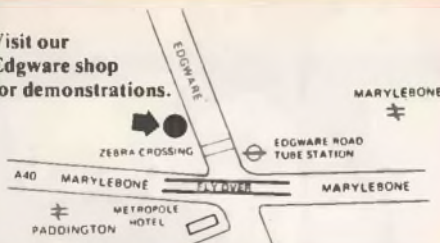
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80 col 140 cps NLQ 2K buffer EPSON compatible.

£229 (a)

TAXAN KP910

As KP810 with 156 col.

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SEIKOSHA BP5420AI

High speed robust printer designed for heavy duty use. 420 cps draft, 140 cps NLQ, Parallel & Serial Interface as standard. Options selectable from front console. IBM PC/Epson FX compatible. 18k buffer as standard.

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80 col 120 cps & NLQ high performance low cost printer EPSON compatible, Centronics i/face, friction & tractor as standard.

£159 (a)

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80 col 120 cps draft & 30 cps NLQ with many innovative features incl no dip switches. All options from front console/software. Plug in interface cartridge. EPSON compatible, IBM or std Centronics interface.

£209 (a)

£39 (a)

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EPSON JX80

80 column 4 colour printer.

£420 (a)

INTEGREX Inkjet

80 col 40 cps/2400 dot/sec 36 colour palette double density image mode, IBM compatible, several fonts, centronics interface.

£549 (a)

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CANON PJ1080 Colour Printer.

£409 (a)

BROTHER HR15

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JUKI 6100 Daisy Wheel Printer.

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TSB64 with 64K Buffer (Parallel).

£199 (b)

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32K buffer fits into most Epson printers. Easy to instal.

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(All lines are switched).

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3 computers to one printer	£69 (c)	£65 (c)
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MIRACLE WS4000 V21/23. (Hayes Compatible, Intelligent, Auto Dial/Auto Answer).

£149 (b)

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MIRACLE WS3024

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*£70 (c)

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Philips 7502 Green. £75 (a)

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Taxan KX1201G Green. £87 (a)

Taxan KX1203A Amber. £96 (a)

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Philips 7513. £99 (a)

Taxan KX1212G Green. £120 (a)

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Taxan Super Vision II 12" £279 (a)

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(25 way D)

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* AMSTRAD 8512	£499	*
* AMSTRAD CPS Interface	£69	*
* APRICOT F2/F10	£POA	*
* APRICOT Xi-FD/HD	£POA	*

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Epson FX105 160 cps NLQ	£429
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Q.M.S. K-I-S-S Laser	£1800

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CANON PRINTERS

Canon Pw1080A 160 cps 80 Col	£240
Canon Pw1156A 160 cps 132 Col	£345
Canon PJ1080A Colour	£433
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Canon A55 180 cps 156 Col NLQ	£415

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- * Colour is standard feature. *
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OKI 2350 Ser. 350 cps	£1810
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OKI 2410 Ser. 350 cps NLQ	£1935
OTC 700 700 cps Triple Head	£1995

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Mannesmann MT-85	£325
Epson HI-80 Plotter A4 Size	£375
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SSDD	38.00	35.00	29.50
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DSDD 40	15.80	15.40	14.80
SSDD 80	15.80	15.40	14.80
DSDD 80	20.50	20.10	18.60

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DC300XLHD	450'	17.3	25.50	24.00
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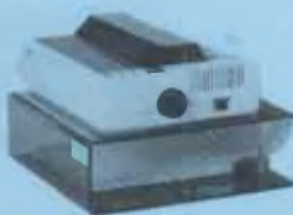


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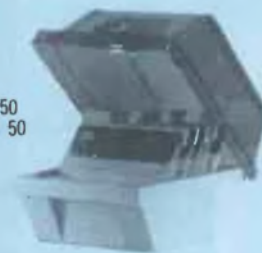
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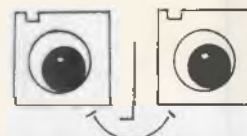
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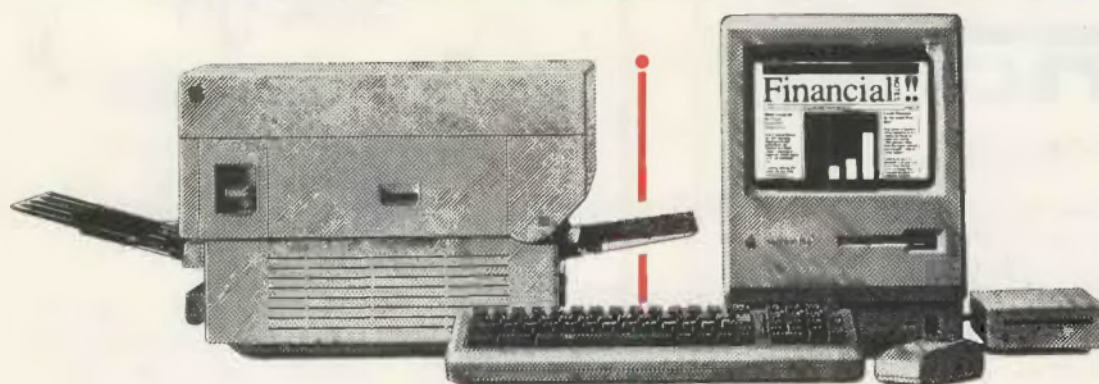
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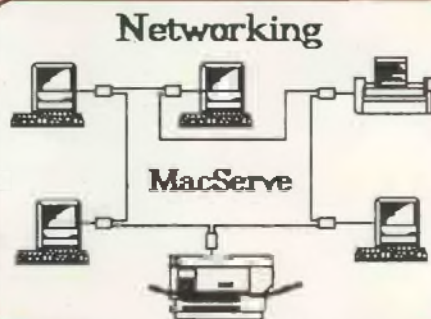
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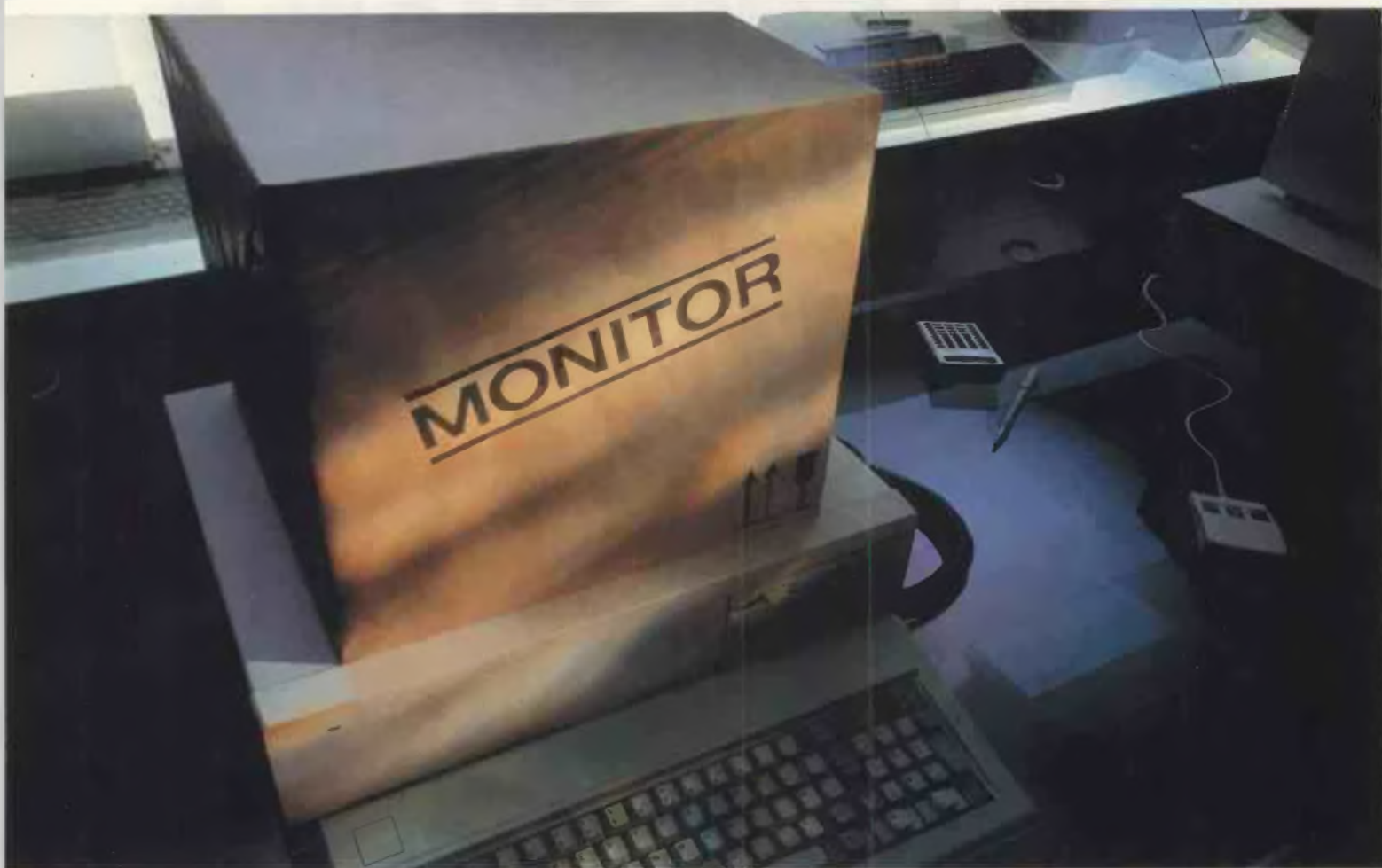
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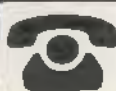
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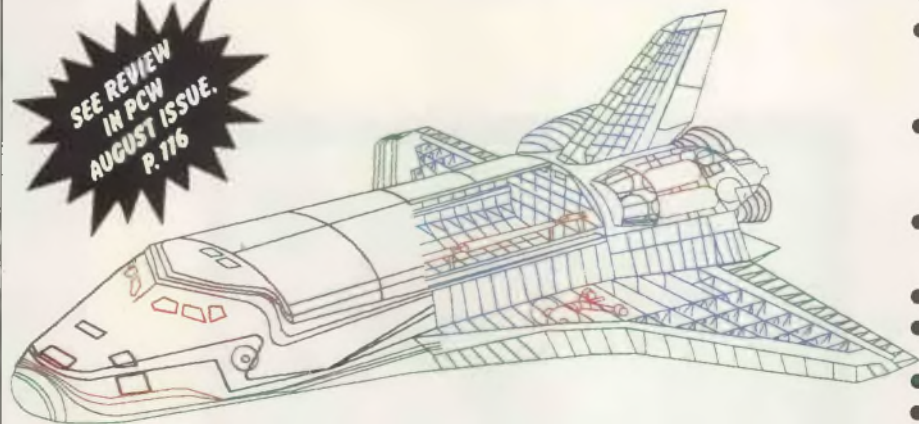
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IN PCW
AUGUST ISSUE,
P. 116



- Replaces a plotter – EOgraph is a vector-to-raster converter providing high resolution output on a low-cost matrix printer.
- Intelligent printer interface – enables you to print year-end Lotus pie charts, for example, while returning your computer for more productive use in seconds.
- Frees your PC for normal use while printing – allows you to re-boot the PC into different programs.
- Spools mixed text and graphics.
- Supports Epson RX, FX, JX or compatibles.
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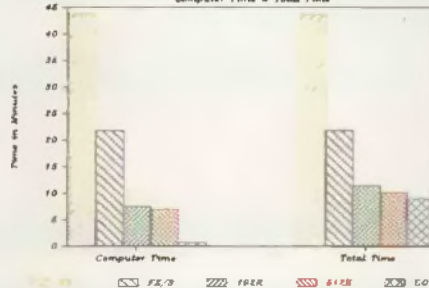
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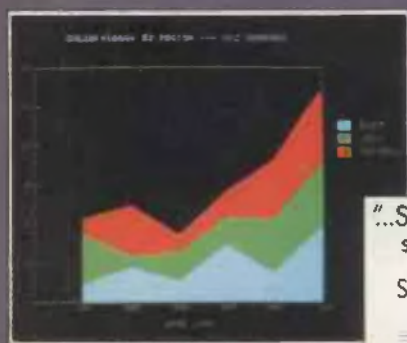
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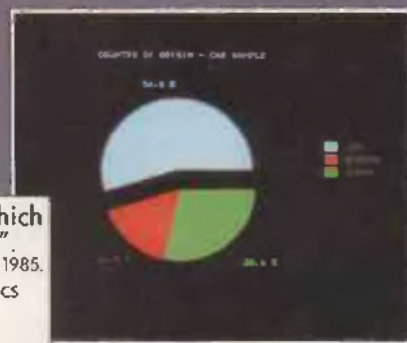
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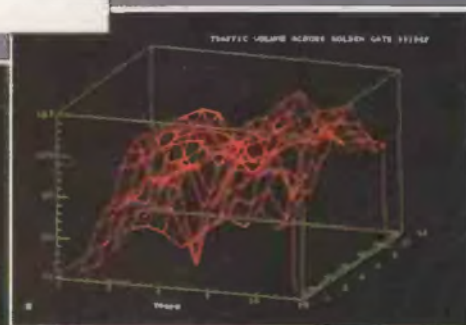
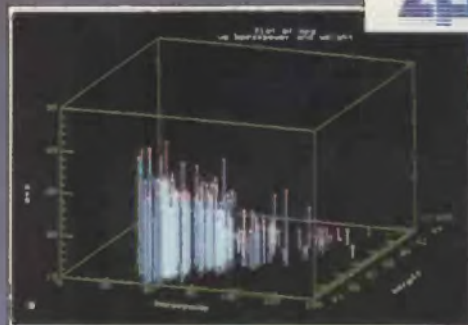
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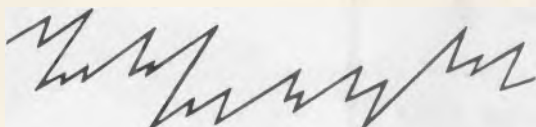
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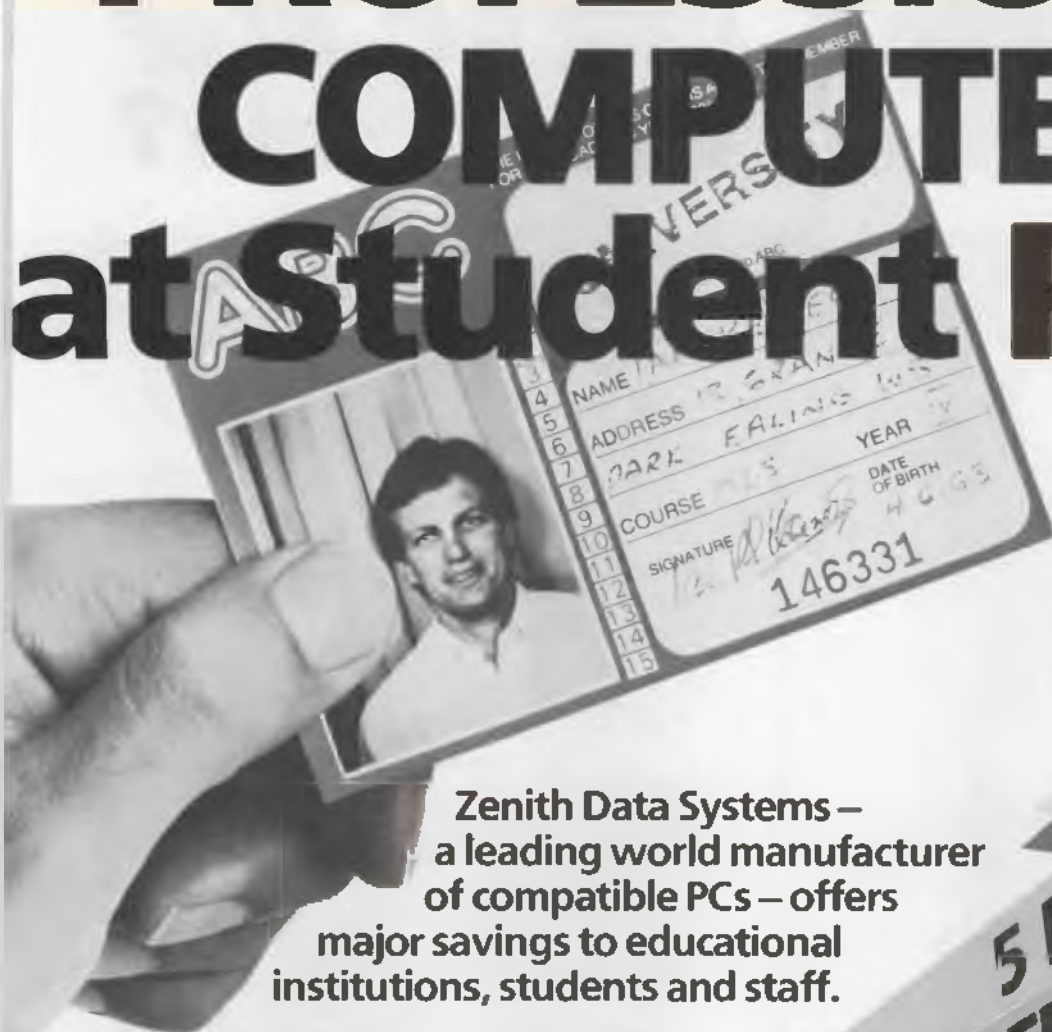
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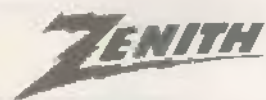
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35 Components

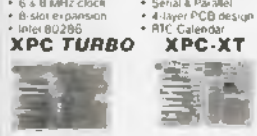
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Motherboards
XAT TURBO XT-SBC



- RTC Calendar
- 6 & 8 MHz clock
- Serial & Parallel
- 8 slot expansion
- Intel 80286
- RTC Calendar

XPC TURBO XPC-XT



- 4.77 & 6.67 MHz
- 4 layer PCB design
- 8 slot expansion
- up to 640K Memory
- 8088-2 processor
- Standard 4.77 MHz
- up to 640K memory
- 8 slot expansion
- standard 8088 CPU
- 8087 socket available

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XT 135 watt XT 150 watt



- 135w switching
- Whisper Fan
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- 5V 15A - 5V 5A
- 12V 4.2A - 12V 5A
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AT 200 watt XTC 135

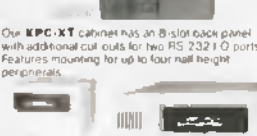


- 200 Watt power
- Exterior AC switch
- 4 DC power conn.
- 5V 20A - 5V 5A
- 12V 7.7A - 12V 5A
- 12V 4A - 12V 5A
- Rear Mount
- Rear On/Off switch
- extra AC outlets
- 5V 15A - 5V 5A
- 5V 15A - 5V 5A
- 12V 4A - 12V 5A

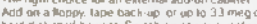
Cabinets



The **XT jr.** cabinet is only 3" x 16.5" x 15" yet it will hold a standard XT compatible motherboard. Includes a switching power supply. Front panel cut-out for a half-height floppy or hard disk.



Our **XPC-XT** cabinet has an 8 slot back panel with additional cut-outs for two RS 232 C ports. Features mounting for up to four half-height peripherals.

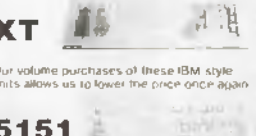


The right choice for an external add-on cabinet! Add on a floppy, tape back-up or up to 3.3 meg of hard disk (half-height). Switching power supply is included.

Keyboards



AT
 This Keyboard is standard equipment with all of our **XAT** systems, but the layout is so well liked we're offering it here.



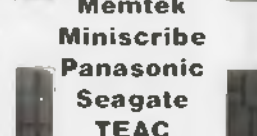
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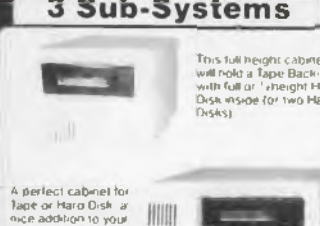
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Memtek
Miniscribe
Panasonic
Seagate
TEAC
Tulin



3 Sub-Systems



This full height cabinet will hold a Tape Back-up with full or 1/2 height Hard Disk inside (for two Hard Disks).

A perfect cabinet for Tape or Hard Disk or once addition to your PC.

Choose from single 1/2 height, dual 1/2 height or 1/2 height with full height base. All Sub-systems include controllers, cables, software, and manuals.

3 Networks



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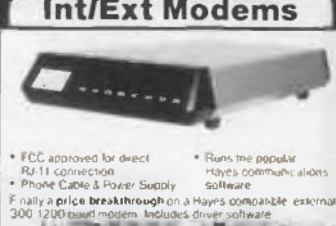
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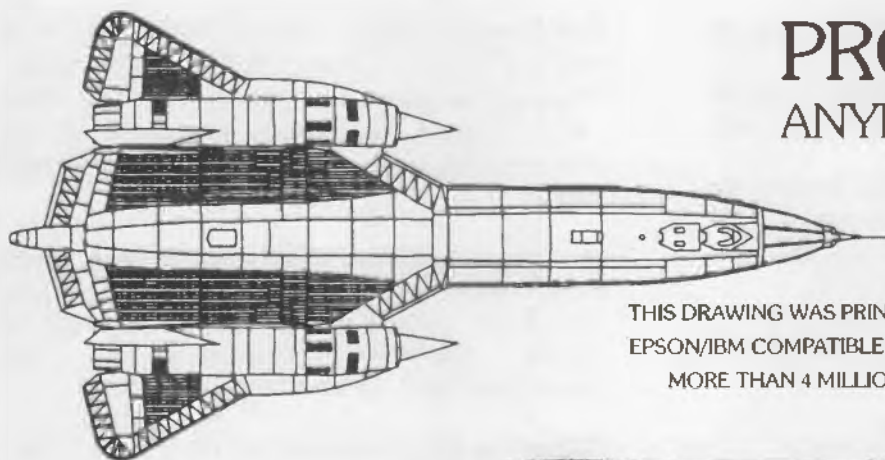
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§ Available from Commodore.
† Available from Atari.
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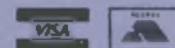
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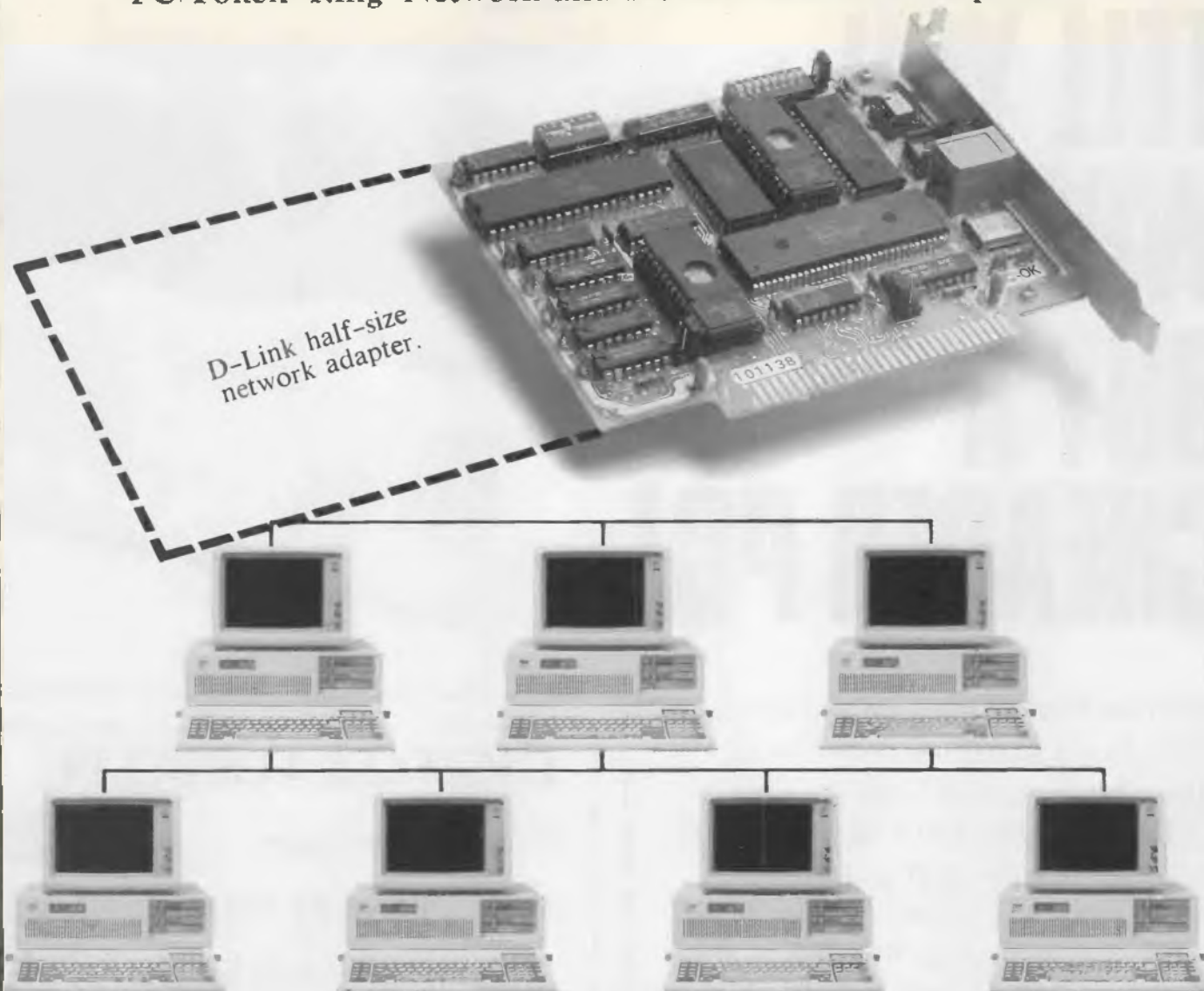


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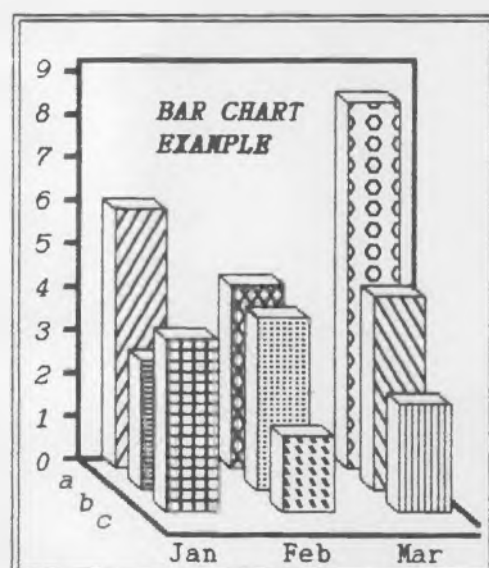
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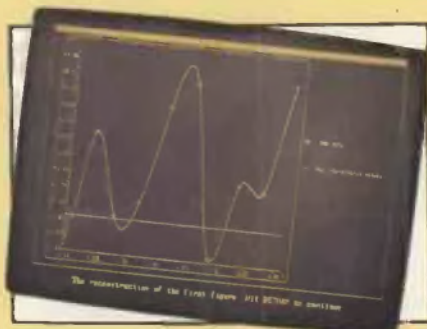
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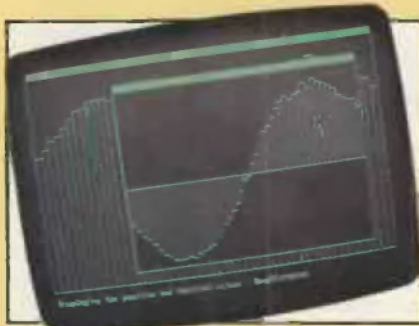
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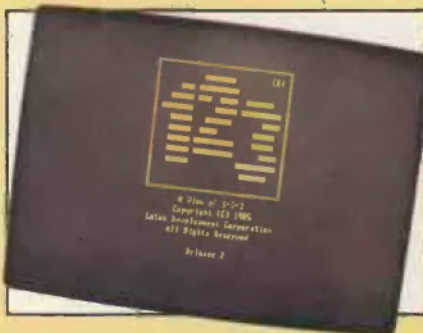
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Rumours that Guy Kewney designed, single-handedly, the Amstrad PC and the 464 are not (quite) true. In this month's news review, he sets the record straight.

Amstrad secrets

Contrary to rumour, I did not design either the Amstrad 464 or the new Amstrad PC.

This particular piece of gossip wouldn't normally have reached my own ears, but for the rage of a faithful reader who wrote to me to explain what I'd got wrong in both machines.

Like all really interesting falsehoods, it contains enough basis for one to understand the confusion: I did provide a consulting service to Amstrad on both machines, and quite possibly, the design was (slightly) modified as a result of my comments.

The details of this sordid bit of commercialism are simple: Amstrad called me in to do a preview of what I would be likely to say in the event of doing a Benchtest. 'If you were testing this machine, for PCW, what are the things you would criticise it for?' was the way Alan Sugar summed up his request.

For the record, on the 464, the home computer, I suggested two changes. First, I suggested the inclusion of a modem; second, I suggested that the machine should be announced with a disk drive. I still think that the first idea was a good one which would have resulted in Amstrad dominating the communications market, which would now be five times as big as it is.

On the PC, I suggested the necessary (impossible) alterations to the design that would allow the machine to accept an EGA card. I was also able to discover one or two (trivial) flaws in the design which were easily repaired, but would have prevented users from plugging in one or two expansion cards: Amstrad ignored my suggestion that a version should be announced with a built-in printer mechanism.

So now you know. And for the sordidly curious, I might add that I was paid my

standard consulting rates for one day's work, plus the offer of an early start on the official testing process — which is why PCW has a full Benchtest in this issue. And if you want to know what it costs to hire me for a day, I can only repeat my warning about all over-priced commodities: if you have to ask the price, you can't afford it. (*Oh, I dunno. We think £10 a day is quite reasonable — Ed*)

Caveat Amstrad

Since Benchtesting the Amstrad PC (see page 128, this issue), I have discovered — don't call it a drawback, but an irritation — about the design, concerning parallel output, and related to the problems the new machine has with graphics.

In the same way as, with graphics, the Amstrad PC can't disable its own graphics circuits to allow add-in EGA cards to function, it turns out that it can't disable its internal parallel port if another one is added.

As you might have expected, this can cause problems when you plug-in cheap memory boards that include a parallel port, and so far, the solution appears to be the simple one of avoiding such boards. Or get the dealer to test them first, if you really can't resist the price.

All sorts of pop-ups

The Sage Deskset solves a disk organisation problem which I hope you have never experienced.

All my readers — I am sure — are thoroughly organised administrative whizzes, without one scatty, untidy or absent-minded individual among you. That being so, not one of you has ever been doing something with a PC and suddenly been confronted with an unlabelled diskette, and an urgent need to create a file on it, or read one off it.

There are some programs

which regard this as an acceptable problem. While running these programs, you can examine the disk, somehow, and find out: a) what it actually is; and b) how much space is left; or even c) whether the file you really want is on it already.

But I've lost count of the number of programs which won't allow this. They expect you to work with a little FiloFax notebook of all the directories and filenames you have ever created.

With a particular part of the Sage Deskset, you can, at any time, press ALT and U (for Utilities) and you can read the directory, change directories, rename files, log-in new disks, and generally do emergency housekeeping.

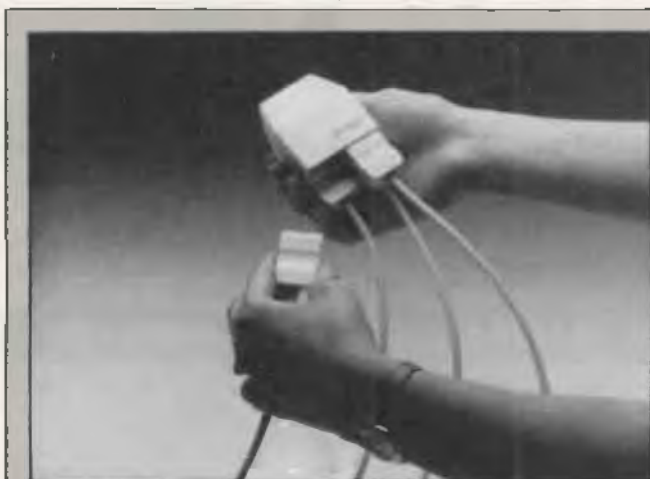
This handy little program takes up around 29k of memory — which is to say, virtually nothing — and I'll keep it, after I review and return the rest of the Sage Deskset.

The rest of the package is, by comparison, fairly unessential RAM-resident software. Some of it is pretty good, but the real beauty of it is that you don't have to use it.

There's a little word processor. It obeys basic WordStar directions, and theoretically offers a maximum document size of 18k (experiment shows it actually restricts you to 9000 bytes). There's an alarm clock which takes 16k; a calculator which takes 10k; a complex financial calculator which takes around 35k; a date-stamper which takes around 25k; a program for dialling phone numbers which uses 20k or so; and a quite extraordinary option called Pop-up Anything which lets you run other programs, as long as they take less than 192k.

All these (bar Pop-up Anything) are functions which, by and large, you can get on existing RAM-resident programs.

Sidekick, for example, will happily edit text and dial numbers, and also has a nifty calculator and appointment scheduler. Spotlight has the DOS utility, but Spotlight takes up a lot



Some people have got quite excited about this plug into which you plug four other plugs.

My own advice is that this is £10.90 you should think about spending. True, you can plug four devices into one wall socket with it. But, unfortunately, should you want to plug the monitor into some other computer, somewhere else in the building, you'll find that the little sub-plug won't fit into any socket other than the multi-one. So it may beat wiring four devices into one plug, but it doesn't beat a nice four-socket multi-plug of conventional design.

Details from Misco Computer Supplies on (0344) 54333.

of memory, and you have to use all its other pieces as well.

Personally, I have no need for a pop-up word processor; I use the pop-up outliner, PC Outline. Someone with Sidekick would probably feel the same. But we both need a pop-up DOS utility. Other combinations of features and missing features could be postulated. With Sage Deskset you can fill in the missing blank, because each pop-up program is available on its own, with or without its fellows.

As it's the pop-up DOS that attracts me most, I tested it most thoroughly, and found it to be a noticeable improvement on standard DOS commands.

For example, in addition to the DIR command, there's XDIR, which shows the first few ASCII codes in the file.

Then there's the ability to PRINT, as if with the DOS utility but with additional features allowing you to set printer attributes such as bold, emphasised, condensed, and so on.

Changing directories is a feature with an extra. You can change permanently, possibly causing confusion to your main applications. But you also have the option to change temporarily, just in order to perform some local function, with the knowledge that when you drop back out of pop-up DOS, the original directory will be recalled for your application. The system actually warns you, when you return, that you've changed directories, and asks if you wish to return.

Unfortunately, you can't format disks. You need Pop-up Anything to do that, and that's one of several unguaranteeable features of the entire Deskset.

Most of them aren't crucial. Hopefully, Sagesoft will be able to fix (or explain) the dialler, which dials the number OK, but won't let you talk to it. And hopefully, one day, the company will come up with a version that lets us use non-Hayes modem commands. Or with a modem that doesn't have Hayes DIP switches. What's the use of the instruction to set 'switch one up, and switch 6 down' on a modem without switches? The only Hayes modem I know that actually has the switches is Hayes' own brand, and that isn't a market leader in the UK, is it?

For some reason, there's no such program as Pop-modem, despite its appearance in my preliminary copy of the



This is the WS4000 in its simplest form — a modem from Miracle to do just 300bps and 1200/75 speeds.

This machine is essentially the WS3000, but in component form. The 3000 requires you to know which version you want. The 4000 allows you to buy the basic form, and add new speeds. But it works out more expensive to buy the simplest 4000 and upgrade it to the full V22 bis spec, than to buy the full V22 bis machine in 3000 form.

The 4000 starts at £150.

documentation.

But in general, I'm happy with these programs, with their nice features — the ability to invoke the programs with different keys, for example, if they perform other functions in your favourite software. Or the choice of foreground and background colours.

Just wait until Sagesoft advertises a UK version, that's all.

Typing lessons

A whole new generation of executives, having bought the Amstrad PCW range, have just discovered that they can't type.

But in the style that matches the PCW's built-in word processor, Locoscript, is Computer One's new Typing Tutor. It costs £30, so if you don't like it, it still isn't the end of the world, and you've got a spare diskette...

Details on (0223) 862616.

Forth tongues

Of consuming interest to those who try to advance the state of the programming art to new frontiers, will be the November conference in California, called the Forth Modification laboratory, FORML.

The conference is a 'forum for sharing and discussing new proposals to enhance the Forth computer language.'

That sounds great, but you have to be warned that one of the organisers is the Forth Interest Group, or FIG. This notoriously conservative body has resisted any changes and improvements beyond the obvious, so far, to the point where Chuck Moore, inventor of the language, can barely bring himself to speak politely about the group.

This year, FIG is trying to 'extend Forth towards the 1987 standard.'

The venue is the Asilomar conference grounds in Pacific Grove, south of Santa Cruz, and the dates are November 28-30.

Registration details from FIG at PO Box 8231, San Jose, California 95155.

Getting in touch

A new software importer: the Technical Support team in the computer science department of the Polytechnic of Wales has produced a group of enterprising experts 'dedicated to a policy of selling and supporting quality software for £100 or less.'

The Amstrad PCW and the IBM PC are the two machine families covered, and the product range announced so far includes an interesting list of software utilities — a £60 C compiler for the IBM, for example; a £50 data compressor for the same machine; and for the PCW, a Modula-2 development system including compiler, assembler, linker and integrated editor, for £50.

Details on (0222) 882334. And don't be shy about passing on your impressions

of this software in our letters column if you try it out. The company calls itself In Touch.

Mirror image

There are only two things I don't like about a communications program, called Mirror, which runs on the PC. One is that it won't do viewdata communications, and the other is that it has an unfortunate clash with Sidekick.

In every other respect, I can now use Mirror instead of my previous comms package, Crosstalk XVI version 5.3, and do things that Crosstalk just can't do.

The main things that I like about Mirror are concurrency and memory residence.

The program is now permanently loaded on my M24, and not only 'pops up' into view every time I press both shift keys, but carries on running in the background, sending and receiving information, while I get on with my creating job. Writing, that is.

It is possible, for example, to program Mirror with a 'script file' to wake up every five minutes — whatever else may be happening — and check a certain disk. If it finds a file called 'REVIEW.PRN' it will then dial Packet SwitchStream, log-on to Telecom Gold, and send mail to a particular mailbox (PCW's editorial mailbox). It will then log off.

All I have to do, is to tell my text program (PC Outline) to create a file called REVIEW.PRN from the text I've written so far, and my news column disappears down the line without my having to think about it. In instalments. I can keep typing.

Even if it didn't do this, I'd still use it, instead of Crosstalk, for the simple reason that Crosstalk can't stay memory-resident. And if Crosstalk could do that, I'd still prefer Mirror, because Mirror knows about MS-DOS directories.

Ask Crosstalk to transmit a file in C:\TEXT directory, and it will not find it, because Crosstalk isn't in that directory. Mirror will.

So I'm a bit annoyed to discover that the authors of Crosstalk are suing the authors of Mirror, for breach of copyright. Their grounds: the Mirror log-on screen looks very similar, and it obeys the same commands.

Frankly, I'm sceptical about the chances of the suit

succeeding. Precedent in America, say the Mirror authors, is heavily on their side. I have to agree. And Mirror goes so much further than Crosstalk that you couldn't call it a copy.

Mirror is being sold at an introductory £49 by MDP Ltd in Bath, on (0225) 60491.

A slight technical hitch

There's no stopping a promotional launch in mid-stream, and that fact is the only possible reason I can imagine why Comart has announced its Quad multi-user micro (see Benchtest, PCW September).

In an office where I occasionally work, make tea and chat on the telephone, the publicity officials installed a system to impress us.

'Until now,' they said, 'multi-user micros have had to be configured (programmed) by dealers on installation, to suit users' initial needs, and then reconfigured as more users were added to the system.'

True, we said. 'Now,' they said triumphantly, 'a new multi-user system from Comart, called Quad, requires no configuration at any time; either on delivery, or at any later date.'

Go on, install it, we said. It was described as 'plug-in and go' equipment, and

that's what they did. They plugged it in, it failed to run our software, and they went. 'Don't switch it off,' they said on their way out, apparently in search of The Latest Version of the Operating Software.

At £5000 for a complete four-user, multi-tasking system, including terminals, keyboards and cables, it probably is, as Comart's Roger Howarth put it, possible to compare it favourably (in terms of cost per application) with four networked PCs.

However, I shall take the liberty of waiting another month or so, before I go so far as to suggest it is a better bargain.

Really, it would have been better for Comart to have phoned up and said: 'We've lost our screwdriver,' and postponed the installation, I suppose — but the show must go on.

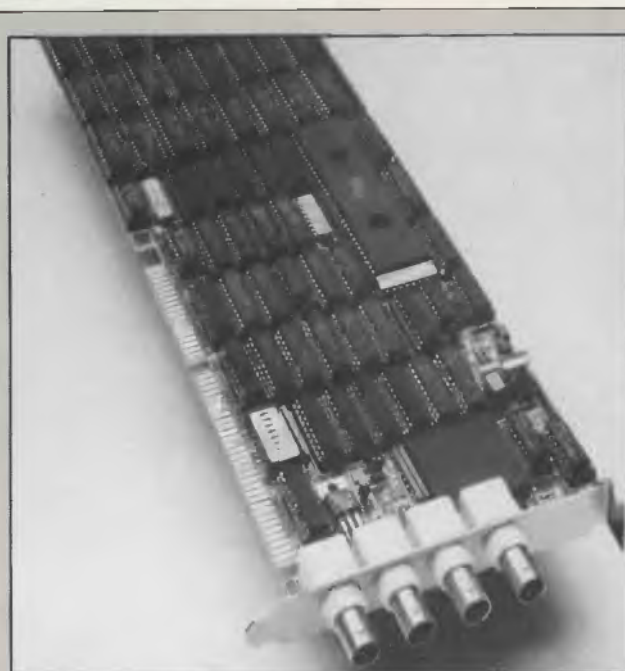
Dealer failures

There's supposed to be a mystery about the number of large chains of computer dealers, all of whom are going bust.

There is no mystery, as anyone who has a car could easily tell you.

If, on buying a car from a large distributor, you took the car back and complained of a knocking noise in the engine, you would expect to meet a mechanic.

On buying a computer from a large distributor, if



Don't ask for pixel counts, price, or software details. It is sufficient to know that the man who designed this graphics board is Graham Rowan, who was founder of 10 Research (which produced the Pluto graphics products).

Rowan now has a new company, Real World Graphics, and this £2000 board is its first product. It has 1408 by 1024 visible resolution, and a drawing speed comparable with the Amiga, at over a million pixels per second. It fits into the 8-bit IBM PC/XT bus, and also onto the 16-bit AT-style bus, and distributor White Orchard claims that it works with CAD packages like Ormus 11. If, like me, you've never heard of Ormus 11, phone White Orchard on (0438) 315415.

you enter the shop and complain of a clunking noise from the disk, you will meet a sales executive.

With the car mechanic, it will quickly become apparent that mechanics know more about the events under a car bonnet than drivers.

With the computer sales executive, it will equally quickly become clear that you, having read no more than the manual, are an experienced, expert and well-informed person, by comparison with the underqualified salesman standing in the smart shop.

You can recognise these stores very easily. Go in, and ask them who does their maintenance. They will say: 'Dictaphone' or 'Ansaphone' or 'Mister Fixit', or some other impressive firm of earpiece sanitisers. Leave the store immediately, and buy your computer from DictaFix, or whoever.

This simple logic has been followed by enough buyers of personal computers to provide ample explanation of

why so many smartly-decorated stores are closing down. The only mystery is why the proprietors of these useless, parasitic consumers of shopfitting artefacts are in the least mystified by their problems.

Poor maintenance

When Lotus announced its Version 2 of Lotus 1-2-3, it turned out not to do some things the way the original spreadsheet did.

The company has now released version 2.01, which doesn't insist that you follow Symphony conventions, and works with ordinary 1-2-3 data files.

This is called a 'maintenance release' of the program, and details are available through knowledgeable dealers, or Lotus itself on (0753) 840281.



The difference between these 5in diskettes and normal ones is the extra slot on the left-hand side, which allows you to put the diskette into a drive upside down.

Don't do it on machines that use both sides of a disk! On single-sided machines, however, it gives twice as much capacity. The price of £10 for 10 is justified by the need for special envelopes which allow the diskette to spin in both directions without abrading.

Details from Zonefour on (01) 523 2059.

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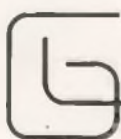
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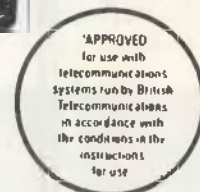
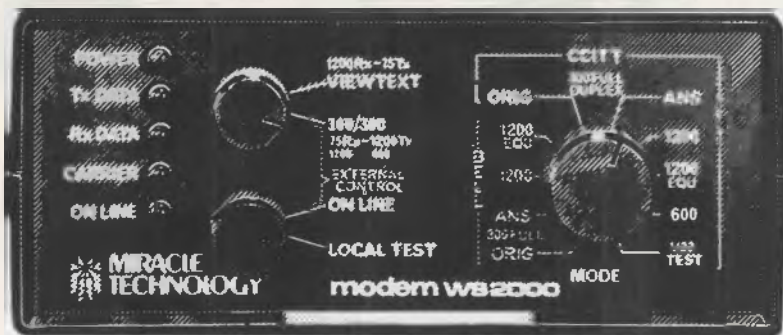
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SIG software

The conservative, measured tones traditionally used in PCW to assess a new machine shouldn't be confused with lack of enthusiasm. The effect of the new Amstrad PC on the software market will be astonishing, and all the big software producers, from Microsoft to Ashton-Tate, are producing special new programs.

Back in the budget world, however, there are something like 3000 free programs available already, for the IBM PC and clones, from the PC Special Interest Group library, PC-SIG.

These are now available in the UK, through International Software Distributors, at a cost of £4 per disk.

The trick is finding out what programs are available, and which disk, out of the 500 in the library, contains the ones you want.

To do this, contact ISD for its catalogue and quarterly newsletter. The address is ISD UK, 2b Pembroke Road, Baldock, Herts SG7 6DB, and in emergency, the phone number is (0462) 893080.

Vicom on the PC

Apart from Datasoft's established Datatalk, the only really universal PC comms packages are Comm+, and the new Vicom from AM Technology — all three of which are able to do Prestel comms as well as ordinary modem duplex work.

I'm excluding special-purpose programs like ChipChat, which come complete with special-purpose modems.

Vicom was originally available only for the Apple Macintosh. On the PC family of machines, it doesn't have the advantage of the Mac's excellent abilities to draw and redraw windows, and is, by comparison, clumsy.

On the other hand, if you have an EGA card, you get colour graphics, say the authors. I don't have an EGA, so I wouldn't know. They also say it needs a 512k machine, which sounds alarmingly greedy. And those of us with Olivetti M24 machines, who can't use EGA cards, really ought to be sent evaluation copies, AM Technology, or there's no



The only possible reason for a printer buffer capable of holding 256k of data is that you simply can't build it any smaller.

Micro Control Systems has launched an Epson buffer with this capacity, at £189. You print into the buffer, lightning fast, and then carry on with your normal work. The buffer slowly empties itself onto the page.

The problem is memory chips: if you use 256kbit RAM chips, you can have no less than 256k of storage.

MCS also does a 128k buffer, but that uses smaller chips and is less profitable for the company, being sold at £149.

Details on (0602) 391204.

way we can say what will happen, is there?

Vicom PC costs £160. You can try contacting AM Technology on (01) 937 0002, but I haven't had a lot of luck with that. If you already have comms software, you can contact the company on Telecom Gold, system 83:jn1203.

386 potential

Faster than the 80286, the new Intel 80386 chip now being installed in Compaq's newest micro should be capable of changing the face of desktop computing.

Following the Compaq launch (at press time, I didn't have full details) we can look forward to seeing similar machines from Apollo, Corvus, and other people who up till now have followed the Motorola family of chips, but who now think they need to join the Intel bandwagon.

And after that, we can expect European companies like Philips, Olivetti and (eventually) Apricot to follow suit.

The question of just how much it will actually change things, is not easy to answer.

At first, all the new chip will do is run four times as fast as the 80286, but doing exactly the same programs. That's about 20 times the speed of the original IBM PC.

But when IBM produces a machine based on the 80386, say the wise men, then it will have a new Microsoft-written operating system, capable of running DOS programs and Unix programs together, capable of taking micros into the realm of minicomputers, and capable of making new types of programs.

It's easy to say. Technically, it's all possible.

The 80386 has the ability to address 32 bits' worth of memory — that's four gigabytes, over four thousand million words of data and program. It has the ability to keep two programs running on the same machine, and the ability to keep them from interfering with each other, which the 80286 can only do if correctly programmed. And it has the speed.

Initially, however, the only operating system that takes advantage of all this potential is Unix, version 5.3.

This isn't the moment to provoke a shouting match between programming hooligans from the pro and anti-Unix ends of the world. If Unix is really the only way we can find to cope with multi-tasking on a single-user machine, then Unix will be used for multi-tasking on the new generation. If IBM's is the only alternative, then it will also be used.

But the next real advance

in computing power is waiting for a different approach to computing, not just a bigger operating system on a faster chip.

Looking at things like Alan Kay's attempts to create 'software agents' inside applications, like Inmos's attempt to generate computing ideas that process themselves rather than waiting for a central machine to grind through, you can get a good idea of what the potential really is.

And more clearly than that, you can see that the potential is not for 1987, nor for 1990, but for 1995.

In the meantime, computing might occasionally look a little dull. If it depresses you, try thinking of what's going on today as though it were a cocoon.

Inside, apparently dead, is the chrysalis of new ideas, changing from crawling caterpillar to colourful butterfly.

And just hope that some Archeopteryx doesn't happen along and swallow it before it hatches.

Scooping up the pieces

Fortunately for my last shreds of credibility, Martin Langley's startling claim to be selling IBM clones with authentic IBM ROM BIOS chips inside was not reported last month in 'Newsprint' without some scepticism.

Fortunately, because it was a load of Hokum Kokum.

Langley now claims that it was all a trick, an exercise in experimental media manipulation, an example of the credulity of human beings, and proof of his extraordinary cleverness. He doesn't import IBM clones, and Hoki Koki doesn't exist. In fact, he doesn't even have a job.

My colleagues have informed me that they have had enough of me, sitting back in my chair with a copy of PCW in my hands, smugly reciting the relevant bits of last month's column (which compared Langley's news to an April Fool joke). They point out, correctly, that I did say I was starting to believe he did sell computers. And they suggest I go and soak my head, in the hope that it will shrink, at least

sufficiently for me to get out the door.

The technical term, in case anyone asks you, for being the only writer to cover a vital aspect of a news story, is 'scoop'. Feel free to quote me.

Simple maths

Assuming that you had been given a formula to work out how many turns you need for a transformer coil, or the angle needed for the main strut of a hang glider, or even something 'simple' like $Y = \sin(2 \cdot X + 4) + X$, how would you use a computer to solve it?

The answer, according to Flite Software, is you buy Equals 22, an equation processor.

It is touted as doing simultaneous linear equations, as being able to backsolve, and as being able to do curve-fitting problems, transferring its data into WordStar and Lotus 1-2-3.

All you need, then, is the address in Letterkenny, Co Donegal, Ireland, which is Pearse Road; the phone number, which is 353 74 23023; and the price, which is £200, and you should be satisfied.

And if you don't think that's particularly clever, you have obviously never tried solving mathematical equations with a computer.

Micro switchboard

I have been telling people for ages that you need a micro to do boring things like switching. Until, that is, you have a micro or two or three, plus a couple of different printers, modems, disks, terminals, and so on, and want to reconnect them. Then, you no longer need a micro to do the switching, but a nice, clear switchboard — like the Inmac Quick Patch. Ironical, I know.

Details on (0344) 424333.

Multi-card system

That well-known CP/M database, CardBox, has now been upgraded again by its authors, Business Simulations, to work as a multi-user system.

Cardbox was Caxton Software's first product, but it failed to negotiate rights to Cardbox Plus, which Business Simulations published on its own.

This version, the company says, allows any number of people to work on the same database at the same time. It runs under any network with MS Net or PC Network.

Details on (0892 86) 3105.



For £3000 you can now read typed documents into your IBM PC or compatible at something like 20 times the speed of a copy typist. The scanner, from Dest Corporation, is called PC Scan and comes with Test Pac software and a half-slot SCSI interface board. The scanner reads a page at a time, converting the text into a combination of ASCII codes and formatting characters which are sent directly into the word processor currently in use. Each page, which can measure from 5ins square to 8½ins by 14ins, takes up to 25 seconds to read.

The Text Pac software recognises 16 popular typefaces, including common dot-matrix formats and proportional spacing. The package simulates keyboard entry to Displaywrite 3, Multimate, Samna, WordStar, Word Perfect and Word. Its 'universal' mode can be used with many other packages. The main limitations are that it cannot read typeset material, some older typefaces or graphic information.

Graphics capabilities are expected by the end of the year, and several third-party companies are expected to start producing software to handle additional fonts. Lexisystems of Frome has set up a 25-dealer network to serve the UK.

Lexisystems can be found on (0373) 61446.



You've seen, at exhibitions, devices for feeding portraits of the visitors into the memory of a computer. This is something different.

This is a device for looking down a microscope, and feeding the image into the computer.

The product is the OFAI (M) microscope image analysis package, and it comes from Oxford Framestore Applications, 'a young company specialising in image acquisition and analysis,' according to its founder, Dr Chris Edwards.

The product doesn't just feed a microscope image into the computer: it also includes sophisticated software for measuring features in the image, altering grey-scale mapping, and generally manipulating details.

Full information on Wantage (02357) 66078.

Amiga planner

A serious business application for the new Amiga: Grafox has announced a new version of its Logistix spreadsheet and time-planning package.

The MS-DOS version, Release 1.1, now costs £395. Intriguingly, the Amiga version, just launched, sells for £245.

As one of the first spreadsheets for the new machine, Logistix can be expected to sell well, in percentage terms. In real terms, it depends on how many Amigas are sold. That depends on Commodore getting its act together in this country, something which

I'm assured we can expect an announcement on in the next few weeks.

Grafox has appointed Precision Software as distributor for the Amiga version of Logistix, but for full details, Grafox is available on (0865) 516281.

Miracles don't happen

The news that sci-fi author Christopher Priest is marketing a spelling checker for the Amstrad PCW and an indexing program for that machine's Locoscript program, raised hopes of miracles. Could it be that Priest and his fellow-author

David Langford, actually wrote books on a PCW with Locoscript?

No, it couldn't be. 'Our interest in the PCW is purely professional,' confessed the literary figure when his 'software professional' disguise was penetrated. 'We actually write on an Apricot, using SuperWriter.'

But his indexing program, AnsibleIndex, costs £50 (including VAT) and the spelling checker costs £20 including VAT, and details are available on (0672) 62576; or write to Ansible Information, 94 London Road, Reading, Berks RG1 5AU. (An Ansible, by the way, is another SF device, an instantaneous trans-galactic communications device not limited by light-speed (or anything else) and invented by Ursula Le Guin. The company, however, is real.)

Amigados for all

Not mentioned by Metacomco in its long list of impressive software for 68000 computers, is the most impressive one of all — its operating system for the Commodore Amiga.

At the PCW Show, the Bristol-based software house announced Lisp (an artificial intelligence language), BCPL, and Metacomco Make (a utility) for the Atari ST. And it also announced a Pascal compiler for the Amiga, plus an Amiga version of Lisp.

However, Amigados, under another name, is what Metacomco is now preparing to sell to machine designers.

In essence, Amigados is the Cambridge-derived Tripos operating system with a few extensions. What makes it clever is its ability to run several programs together without them interfering with each other, and what makes it saleable, Metacomco hopes, is the fact that it can be adapted for a new computer in a matter of weeks.

Should you be interested in programming 68000



Now that Epson has effectively made the letter-quality LQ1500 (a matrix printer) obsolete by launching the LQ800 and 1000 models, it has had to find a new top-of-the-range model. This is it, the LQ2500, at a staggering £1000 plus VAT. Well, for the money, it's fast (up to 270 characters per second) and easier to control than most printers. It has an LCD screen to display printer status, so you can program things like fonts, line spacing, column width, and so on.

systems such as the QL, the Atari ST, or the Amiga, King is a name to remember. His book on 68000 assembly is in the final process of republication. And Metacomco has assemblers, editors, linkers, and the like, as well as the licence for Lattice's C compilers.

Details on (0272) 428781.

In the bag

I've distributed something like 300 copies of a 'shareware' program called PC Outline, only to discover that it may no longer be shareware.

The program was mentioned (favourably) as an outline processor in this column in June. It was launched at the West Coast Faire by John Friend of Softworks. Bill Poel of New Star (UK) thought he had the UK rights, and was planning to give sample 'test only' copies away with New Word 3, or sell them for £60.

But John Friend has sold the program, development rights and shareware registrations to a company called Brown Bag Software,

famous for its promotion of a Sidekick competitor called Home Base.

Brown Bag's Sandy Schupper has told everybody that whatever deal they may have had with Softworks is history, and Softworks can think again if it imagines it has any commercial rights over it. And he says it is now a legitimate commercial product, not shareware, costing \$89.95.

I'm afraid I'm not equipped, legally, to advise anybody who has received the shareware version, what to do. On the face of it, I think Brown Bag has a legitimate claim to the \$60 registration fee mentioned in the program. And certainly, Brown Bag seems to imagine it has bought the money that will come in from shareware distribution, from people who register with that company, rather than with Softworks.

On the other hand, it isn't yet clear what you get by registering. John Friend sold the package because: 'What I like to do is write great code, but what I was doing was running the shareware business, answering the phone, updating the list, and just running the company.' He has not yet decided whether he will work on upgrading and supporting PC Outline, or go away and produce something quite different. And valuable though I find the program, I have to concede that there are bugs in it which I'd like to see fixed.

Those who want to know what to do right now,

contact Sandy Schupper in California, on (408) 559 4545. Otherwise, just wait until he gets in touch with me — which he is bound to do, as I'm a registered user — to explain the new situation.

Optical illusion

Don't be put off buying the Kempston mouse for the IBM PC by the description of it as 'optically encoded'.

Normally, optical mice are devices that slide over a mirror, counting little lines by shining a light down onto the mirror, and watching it flicker. Some people don't like this, because it means you can't use the mouse without the mirror.

In the case of Kempston's £100 job, however, the optical encoding refers to the way the device measures the rotation of a mechanical tracker ball. This is normally rolling along inside the mouse, like a wheel, and turning wheels which touch it. Frictional mice occasionally get dirty, and stick.

Kempston also does an optically encoded mouse for all the Amstrad 8-bit machines.

Details on (0234) 219106.

Watch out! — shady software about

A lot of software producers are panicking about the Amstrad PC, because they think people might be reluctant to spend £600 on a software package to run on a £400 machine.

This says a lot for their intelligence, especially when they recognise the market's requirement for £50 packages. But they wish to continue to make £575 profit rather than the £25 profit they'd make on a £50 package. Tricky.

Inspiration, they say: let's produce a version that runs only on the Amstrad, and which doesn't do quite so much. No-one will be able to use it on ordinary, full-price PCs, and we'll keep our high-margin stuff.

Watch out for products like Compsort's Delta database with only 1000 records, or — well, I'm compiling a list. Let me know what you find in this crippled software line, will you?

END

PCW Job Spot — Staff Writer

If you've ever wanted to work for PCW as well as read it, now's your chance. We're looking for a full-time Staff Writer to cover the business application of micros. The right candidate should have a detailed knowledge of current business hardware and software, plus some experience of small to medium-sized business practice. Some writing experience is necessary.

Apply in writing to: The Editor, PCW, VNU House, 32-34 Broadwick Street, London W1A 2HG.



David Ahl reports on the Software Engineering Institute which has been set up to create and modify new software, plus the rest of this month's American news.

Fuel for the fire

If computers represent the engines driving the most important technological revolution in history, then software is the fuel. Therein lies a paradox: as software fuels this revolution, it also impedes it and threatens to explode it. Software has proliferated faster than computing experts' understanding of it; and society's increasing dependence on software has caused a wide array of intractable problems, not only in computing but also in law, economics, management and education.

Recognising this problem, Carnegie-Mellon University's new Software Engineering Institute (SEI) was established to mount a broad-based attack on the software crisis. Funded by the Department of Defence and supported by corporations, universities and government agencies, the SEI will serve as a catalyst to a larger effort among these groups to:

- 1) develop new tools and technologies for creating and modifying software; and
- 2) accelerate the transition of these tools from development to practice.

Underlying the projects at the SEI is the so-called 'software factory' concept, which is already in use in Japan in prototype form. A software factory is a continuously evolving software development environment in which software project managers standardise, measure and analyse literally all the activities that are involved in building software projects — from the very basic design of what the software is intended to do, through integration, to components testing, deployment, evaluation and even modification in the field.

Only through this preservation of 'corporate memory' can the software specialists fully exploit what they learn — for example, by reusing a section of code in particular, and the know-how acquired during the project in general.

SEI technical projects are intended to increase both management and technical control of large-scale software engineering products, and to provide technology intensive support for all aspects of software engineering. The SEI will also be establishing requirements and developing modules for a university-level software engineering curriculum, and working to find solutions for legal licensing and protection of software. Stay tuned.

IBM strategy

With the growing success of the IBM PC clones, reportedly inching up to 25 per cent of the market from 10 per cent a year ago, IBM is fighting back. Its first move was an 18 per cent price cut in July. Currently, many clones only undercut IBM's prices by about 15 per cent, and some of these makers will have trouble making a profit if they must lower their prices another 18 per cent or so.

But some clone makers still have a tremendous advantage over IBM, which buys 70 per cent of the components of the PC from outside the company.

It is to combat these clone makers that IBM is considering a proprietary operating system for the new 80386-based PC. The system would be able to run existing PC software, but to get the full benefit from it you would have to use specially-written software which — surprise — would not run on rival systems.

Another area in which IBM intends to distance itself from clone makers is in PC-to-mainframe communication. IBM knows its own big machines best, and clones won't be able to copy the IBM hook-ups fully or immediately. IBM initially lost ground in this market by

not offering a 3270 board for the PC; instead, the company offered the 3270 PC which has not sold well. Now, responsibility for the 3270 PC has been taken from the Communications Products Division and given to the Entry Systems Division (marketers of the PC itself), a move that will probably result in IBM offering more 3270 options on the PC and phasing out the 3270 PC.

This move will also lead to the development of applications which execute partly on the mainframe and partly on the PC. This is a major undertaking and it isn't likely that clone makers will be able to duplicate it easily.

In the fast lane

In late 1984, the Penske Racing Team installed two Computervision CAD/CAM systems at its design and testing facilities in Poole and Northamptonshire, England. At Poole, these high-resolution colour systems are used to create 3-D chassis models that allow analysis of stress points, deformation, suspension geometry and component interference. The systems are also used to produce accurate scale models for wind tunnel testing.

The first results of this work led to completely redesigned wings, flaps, airfoils and underchassis on Penske's Indianapolis-type cars in the 1985 season. These cars won both the 1985 Indianapolis 500 and the CART (Championship Auto Racing Teams) National Championship.

Additional computer analysis was done on the 1986 cars, specifically in body design, and the kinematics and dynamics of the suspension.

Mid-way through the 1986 season, the Penske PC-15 car driven by Danny Sullivan was running second and Rick Mear's PC-15 was running seventh — not bad for brand new computer-designed cars.

Random bits

The Computerland BC 88, the

company's PC clone, uses an old idea from the earliest S-100 bus personal computers: it has no motherboard. The base unit is just a box with a plug-in bus and a 150-watt power supply. You can plug in any processor board (8086, 80826, and so on), controllers, display drivers and peripherals you want. Best of all, its modular design means that it will never be obsolete...

Centronics Printer Corp has made its long-awaited entry into the non-impact printer market with a low-end (\$2495) laser printer, the PagePrinter-8. Using a 68000 chip and a Sharp engine, it prints eight pages per minute with a resolution of 300 dots per inch...

Quarterly profit at IBM was down 7.7 per cent on a 7.3 per cent increase in revenue to \$12.3 billion... Sparked by strong Macintosh sales, Apple's sales increased 20 per cent in the spring quarter with earnings up correspondingly...

MicroPro software (WordStar, Easy, and so on) is now being distributed by an interactive videodisk system made by Instant Software Generation. In the store, the customer can view a brief video presentation outlining the highlights of the product, and, if desired, explore it further and have it

copied onto a floppy disk right on the spot. Four pilot systems are now in operation... MicroPro is also, in cooperation with Island Graphics, developing Prism, a desktop publishing product due for release by the end of the year...

Keyword Office Technologies of Alberta, Canada has introduced Keyword Softpak (\$449) for the IBM PC and compatibles, which allows users to interchange documents created by different word processing systems. A multi-window, menu-based user interface guides the user through the process... Microsoft Corp has released QuickBasic 2.0, a Basic compiler with many advanced features such as multi-line IF statements, alphanumeric labels, interactive error detection and correction, and an interactive editor.

END

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systems, including CP/M. The grand total is something over 600 software titles covering all categories — accounts, programming languages, word processors, communications, graphics, CAD/CAM and scores of vertical applications.

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STF lacks software, to prove him wrong.



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LETTERS



T-time

With reference to the (entirely justified) rantings of Mr Kewney in respect of 'A Mess DOS' (PCW, August) and the inferences drawn with regard to the Strategic Defence Initiative, if one makes allowance for the typographical omission which seems to plague every reference to it by its popular name, the Start Wars programme can be seen as eminently suited to its purpose.

M Radmore, Hemel Hempstead, Herts

A good point, not to mention a long sentence.

Star turn

As a practising astrologer, programmer and co-editor of the *Investment Cycles Report*, which is Britain's only astrologically-based newsletter, I would like to put my oar in with regard to recent correspondence.

Mr Couttie ('It's in the stars', Letters, May) is quite right in stating that the vernal point used by astrologers does not correspond with the Aries constellation. It was never intended to. Astrologers, from the Babylonians onward, use the (changing) intersection of the Ecliptic and the Equator at the Spring Equinox as the starting point for the signs of the Zodiac. To be unaware of this could indicate a basic lack of knowledge of the subject.

Another correspondent suggests that astrology has never been used for prediction. Oh, really? In the last issue of our report we suggested that Wall Street could experience 'an unsettling effect'... in business confidence in general' on 7 July. Did it or didn't it? A 60-point drop on

the day unsettled a lot of people, I can tell you! In the issue before, we said that platinum would make a major move on 10/11 June. On the 10th it climbed higher than at any point for three years. No-one else predicted this with such accuracy. There is much more, but it would be construed as advertising.

M Hardy, London

Hallelujah!

Well, I've waited and waited, and thought it about time to give an update on the response to my challenge to computerate astrologers to show that astrology programs are more useful than a Basic listing '10 GOTO 10'.

To accept the challenge, which covered character analysis or predictions, one would have to be confident that astrology worked.

One gentleman, from Denmark, agreed tentatively to accept. I have replied, offering to have a test set up in the UK at a university department and, as a double check, in Denmark. As yet he has not replied to the proposals.

Otherwise, despite a few puffs of hot air, not one single astrologer or astrology software company (who must, surely, read PCW) has had the courage to take up the challenge.

Three conclusions can be drawn from this:

First, there is hardly a single PCW reader daft enough to waste his or her computer time and talents on astrology. This suggests that PCW readers are an extremely sensible, intelligent lot.

Second, those PCW readers who are astrologers lose their confidence in their art when faced with a put-up or pay-up proposition.

Third, companies producing software for astrology know the users are wasting their time. A point worth remembering.

Although these points should be of interest to anyone concerned with

astrology, they are likely to be wasted on the gullible. After all, anyone who uses purported examples of alchemy, levitation and fakery (Hey, John Laidlaw, where is your cash? Better still, where's the logic?) from far enough in the past to be safely unverifiable is hardly likely to let the truth get in the way.

Never mind the facts, just feel those miracles!

Bob Couttie, Forbidden Knowledge, Ilford, Essex

British disease

Your Kuwait correspondent ('Letters', PCW, June) who is having trouble with Memotech, and whose job it is to try and persuade the people of Kuwait to 'Buy British', really ought to know by now that he is wasting his time; especially as far as the computer field is concerned.

Unless one is actually resident in Britain, my experience is that no-one is the slightest bit interested. I have, over the last four or five months, sent off requests for price lists, and so on, for various software and hardware, to close to a dozen different companies in England: the only one who ever answered was ICL. Compare that with what happened when, in a spirit of scientific enquiry, I wrote to six American companies enquiring about software for the Apple: I got three replies by return of post, and two more a few days later.

The same problem appears to apply to things actually bought in Britain. As I seem to remember a previous correspondent in France found out with Apricot, as soon as one crosses the Channel, nobody wants to know. I recently bought a disk interface for my humble Beeb from Solidisk which I fitted, or attempted to fit, myself. It doesn't work. Now I am quite prepared to admit that the fault is with me, but since Solidisk resolutely refuses to even acknowledge my letters requesting help and guidance, I have no way of knowing. The end result is

that I am left with a load of electronic components which are of no use to me, a debit on my bank account... and a very firm intention not to buy anything from Solidisk or indeed anyone in Britain again. I can't anyway: no-one will send me details of pricing or postage.

Time for a new definition of the 'British disease'? **A C Everard, Riyadh, Saudi Arabia**

We called Solidisk who tells us it has a backlog of thousands of unanswered letters. The company has a 16-line switchboard, connecting to 11 technicians who, apparently, spend nearly all their time answering telephone enquiries. 'We have to fit the letters in between the phone calls,' said Tony Lee, who's in charge of these technicians. 'It's hopeless,' he added. So now you know. The best way to get any sense out of Solidisk would appear to be to telephone. We should warn you that its telephone system queues calls, which can leave you hanging on, rather expensively. Perhaps a polite request for your money back might be in order. The only trouble is... you'd have to write. Pathetic, isn't it?

Intelligent reply

I wanted to bang off a short, sharp reply when I read David Levy's introduction to artificial intelligence (PCW, June), but because he goes into such detail, I felt I had to. Sorry about this, but as one who'd like to see intelligent machines about the planet — and who paid good money to read 'Wise moves' — I take exception to just about every single word written.

Without looking it up I suggest that his dictionary equates intelligence with perception, but there are dangerous differences between levels of perception. It seems to me that David Levy has blundered straight into one, because the entire thrust of all the detailed examples in his argument

deal with accomplishment, which is largely irrelevant, and ignore real understanding.

To say that a thing, or person, demonstrates any real intellectual prowess because it or he or she responds correctly to a given situation, on or off the chess board, is nonsense. All that has been demonstrated is the ability to respond correctly, as when a push on a button causes a doorbell to ring.

Intelligence will be demonstrated by the ability not to recognise, but to explain the situation, the response, and the relationship between them.

It might be reasonable to assume that chess masters are highly intelligent, but may we not also assume that either of the two programs mentioned would at the same level of play show a higher consistent success rate than its creator, because it is not prone to his human errors? But you will not then conclude that it is more intelligent.

It is in developing his argument from the spurious premise of the intelligent chess programs that Levy wanders way off the track. Quote: '... a human who plays chess well, composes music, writes poems, or can prove theorems in logic, must be intelligent,' we are told, but it is really only the proving of theorems which counts.

Chess, as we have seen, music, sadly, and, even, as we are later shown in 'Woman, why do you create your face ...', something akin to poetry can be programmed, but verbiage is not poetry and there is all the difference in the world between being able to solve problems and being able to prove theorems.

The Turing test is a nonsense since it will happily 'prove' that the machine is as intelligent as its creator, which we know is not the case. That a given subject thinks the machine understands her well, proves nothing.

Many aspects of intelligence should be distinguished, but the ability to achieve an impressive result takes us back onto spurious ground — unless perhaps you will have that he is more intelligent who can whang a welly farther.

Leaving aside the effect of the infinite monkeys typing

Shakespeare on the degree to which creativity measures intelligence, let us follow Levy's 1978 championships.

However beautiful the result, the test for intelligence is not whether one machine can beat another, but whether either of them can explain how the result was achieved — or even the basic rules of the game. I suggest that neither can.

Since I'm not allowing the Turing test, the Pflieger deception also fails and we move on to popularity — a great test of truth as every FlatEarther could have told us centuries before there were such machines.

There are many measures of creative art but if the selected poetry readers had been of significant numbers, or qualified to judge, we would still be left with the simple fact that the program did nothing more than follow strict rules laid down by its creator.

Up to this point the issue has been obscured by the question of *impressive* results, when *meaningful* results should have been our object.

As it happens I do think there is a lot of point to research into the 'machine mind', but we will have achieved artificial intelligence only when the artefact can respond in a fashion not predictable within the initial constraints of its programming — when, in fact, it can modify its own programming, as well as its knowledge, through either experience or inspired thought.

If, however, the search is really for that which Levy describes, then the seekers must have been reading a very strange dictionary. Rob Goodwin, Harpenden, Herts

Guy, Guy, Guy...

I was most amused by Guy Kewney's comments on 'A Mess DOS' ('Newsprint', PCW, August) but find it difficult to sympathise with his problems, or his conclusions.

I, too, have been using MS-DOS for several years. I have even been known to train clients in its use; in my experience, a modicum of common sense can make a colossal difference to the results obtained — an observation which is equally true of every other aspect of

computing.

Taking each of Guy's points in turn, it seems unduly harsh to claim that MS-DOS 'sabotages' the GEM mouse. MS-DOS was around long before GEM, and the failure of GEM to integrate properly is surely down to Digital Research rather than to Microsoft. Using the same reasoning, the dangers of 'FORMAT' when using the Xitan shell suggest that it is Xitan which is at fault. Any user planning on formatting a disk will either have used this command before, and know the correct syntax, or will not have used it before, and should look it up in the manual. Anyone who issues a command to a computer with no idea of how it operates deserves all they get.

I was surprised to hear of a Microsoft program called 'ST' or 'PQ'. I take it that this was nothing to do with MS-DOS, since I can find no two-digit commands in my DOS manual and only one two-digit sub-command ('IF') which is *blatantly self-explanatory*.

Guy's prose really begins to soar when he reaches the subject of 'RMDIR', an innocuous enough command. My MS-DOS manual is for the IBM PC version 2.1, and being a simple sort I normally start with the 'Contents' page, rather than the 'Index'. The list of DOS commands fills exactly one page, and gives 40 commands. Each abbreviation is followed by a plain English translation in the format: RMDIR (Remove Directory) Command ... 2-132. With just 40 commands to check, I don't see that you need to know this in advance.

Even if I did not want to look for 'Delete Directory' or 'Directory, Delete' in the Index, my Index gives me (on the same page and in the same column) 'deleting a directory 5-10' and 'directory, remove 2-132'. Look up either command, and it will tell you that the directory must be empty if the instruction is to work. The syntax for both commands is clear, and is a million miles away from a 'DHSS claim form'. Guy's complaints yet again say nothing about MS-DOS, but speak volumes about Olivetti documentation.

Moving on to the creation of a file called 'FRED' when there is already a directory

called 'FRED', surely all this proves is that Microsoft feels no need to state the obvious. To consider this a fault of MS-DOS is quite ridiculous; I have direct experience of nearly a dozen types of DOS and none of them will allow you to do this unless the file is created inside a sub-directory.

I should stress that I have no connection with Microsoft, nor have I any particular reason to take up the defence of the product. But I do feel that, if you are going to criticise MS-DOS, you should make an effort to do so on better grounds than Guy Kewney's. When I am training a client in the use of MS-DOS, I normally start by saying: 'This is going to be easier than it looks,' and the client usually agrees with me by the end of their lesson. An over-critical and badly-reasoned article such as Mr Kewney's doesn't help me in my job, nor does it help the thousands of users across the country who have little choice but to use MS-DOS.

If only to show that I have nothing against Guy personally, I will finish this letter by stating my complete agreement with his comment on the Star Wars software — I wonder what the response time is for 'software support' after a program crash in geostationary orbit? The whole concept is about as practical as Britain spending £10 billion (minimum) on the Trident, so as to help reduce the dangers of nuclear war. All we need now is to place Clive Sinclair in charge of the Ministry of Defence.

Jack Nicole, Interpute Ltd, Watford, Herts

Sir Clive tells us he doesn't want the job, thanks all the same.

Hitachi help

HICUPS is an independent user group for the Hitachi MBE16002 PC, and as a founder member I know that there are a number of people with this computer who have written to Dixons complaining about the manner in which the machine was sold. After a number of letters, without acknowledgement, I have to let it be known that it would seem that this company is not interested in supporting what it sells to people, and loses all interest in you as a customer as soon as you part with your money.

The company buys up stocks of various things from manufacturers looking for an outlet to dump their old and outdated stock, so, apart from the almost total lack of knowledge of these systems, the salesmen just repeat the advertised claims. In the case of the Hitachi PC, the claim was 'compatibility with the IBM PC'. A powerful selling aid indeed (it certainly fooled me).

If anyone has one of these computers, HICUPS will help them with memory expansion, software and peripherals. Meanwhile, Dixons still refuses to discuss my (or anyone else's) legitimate claim of misrepresentation. **B C Ainge, 16 Nine Acres Road, Cuxton, Kent ME2 1EL**

TI-99 help

I was very surprised, so much so that I had to blink twice to check that I was not imagining it, when I saw 'Texas D-I-Y' in Computer Answers in the June issue. I had long expected never to see mention of the TI-99/4a again in your magazine. All credit to you for helping small as well as large computer users.

Naturally, being an active 99'er, I was not too happy with your term 'obsolete', but quite understand your view. Maybe *obsolete*, but certainly far from extinct. TI still provides servicing, and software and hardware are not only still being produced but also still being developed, both in the US and in Europe. A new computer, which is upwardly compatible and which will also run PC software, is in pre-production.

One result of TI's withdrawal is that the remnant army has become a close knit community. Your list of suggested contacts was a commendable effort, but is sadly a little out of date — one is active, one is extinct, and one I have never heard of. The main user group in the UK is now TI99/4a Exchange, 40 Barrhill, Patcham, Brighton, Sussex BN1 8UF. It took over where TIHOME left off, after the latter's demise, and publishes a very good quarterly magazine, as well as maintaining a substantial software library and organising twice yearly nationwide user shows. Oxford TI Users, which you quote, is run by a long standing TI stalwart, publishing a monthly, more

technical magazine, and now holding the old TIHOME software library.

Retailers are: Arcade Hardware, 211 Horton Road, Fallowfield, Manchester M14 7QE; Parco Electronics, 2 Devonshire Court, Heathpark, Honiton, Devon EX14 8SB, which also publishes a bimonthly magazine; and newcomer New Day, Jerrard Close, Honiton, Devon EX14 8EF, which also publishes a tape-disk magazine. Finally, Stephen Shaw of 10 Alstone Road, Stockport, Cheshire SK4 5AH, holds a very extensive disk library of public domain and Freeware software.

The above-mentioned sources also detail the many US sources still active. Another result of TI's withdrawal is that most TI software is now available for a fraction of its original cost — arcade game modules previously costing £25 are still available and now cost only £5 (new).

So for those who still wish to 99'er, the scene is far from dead. In fact, there is so much material available that I cannot keep up with it. **John R R Bingham, Norway**

Cryptic comments

Andrew Simpson is absolutely right in his suggestion for eliminating the bottleneck in my Enigma program ('Enigma variations', PCW, May). My first thought on seeing his letter (August, PCW) was to say: Why didn't I think of that? The only excuse I can come up with is that I was too close to the problem (yes, I know that sounds like a lame excuse but it was the best I could think of). Seriously though, I would suggest that anyone experimenting with the program should incorporate Andrew's ideas.

Andrew may be interested to know that I have been spending my time writing an assembly language cipher program (ULTRA) which is based closely on the Enigma method but with some of the bad points of Enigma removed. In particular, the self-inverse feature of Enigma, a major weakness, has been removed by the use of separate input and output plugboards. I have also included a few nice touches such as word-wrapping of plain text and formatting cipher text into four character blocks. Although ULTRA is not yet



finished, the speed improvement, even without the inclusion of Andrew's technique, is surprisingly large — the program will encipher 1024 characters in two seconds!

For any readers who are working on cracking the challenge text included with my article or who have already done so, then they will be able to decipher the following piece of cipher text which was enciphered using the same machine setting: IHEFMCEVMPNUPVPLLLG ZKU*LCLHYKBBM. It is the title of a Latin text produced by the early Christian Church.

Of course, writing a decryption program is more difficult than writing a cipher program, but if anyone can come up with a decent program, then I'm sure many readers would be interested in the method used. **Colin J Davies, Liverpool**
We suggest you think of another name for your cipher program since *Business Simulations* already markets an encryption/decryption system called *Ultralock*.

PCW8256 angled text

My article on GSX Graphics with the Amstrad PCW8256 ('Graphic Design', PCW, May) omitted to describe how to select the different directions in which text may be printed. The required SET function is listed in Table 1 of the article and needs CONTROL%(0) set to 13 and CONTROL%(1) to 0. It also requires three values to be passed to GSX in the array PAR.IN% and they are rather complicated. If the four allowed text directions are denoted by a variable 'u' which can take the values 1,2,3 or 4, then the following assignments

are needed:

```
PAR.IN%(0) = (u-1)*900
PAR.IN%(1) = 100*(u MOD
2)*(2-u)
PAR.IN%(2) = 100*(1-u
MOD 2)*(3-u)
```

I shall not attempt to justify these expressions, but if they are entered as shown and followed by a CALL to GSX as described in the article, they will allow any of the four directions to be chosen.

R S Gilmore, Bristol

Out for the count

I trust you will agree that in mathematics, above all other disciplines, accuracy is of the greatest importance: Mike James's article (PCW, August) contained a whopping great howler, where he explains the 'real' numbers. They are indeed 'uncountable' in a strictly defined mathematical sense, but his statement that their '... most important property is that given two real numbers, there is always a third that lies between them' does not imply uncountability. The quoted property is shared by the so-called rational numbers (= 'common fractions') which are countable, as any competent mathematician would confirm.

One says that the set of all rational numbers is *dense*, cf *Mathematical Analysis*, by T M Apostol (Addison-Wesley Publ Co Inc 1974) on p68. For a demonstration of countability (or denumerability) see *What is Mathematics?* by R Courant & H Robbins, OUP, 1941, p79. The next three pages give Cantor's famous proof that the *real* numbers are not denumerable — that is, they are uncountable and also dense.

Ed Rosenstiel, London

END



BANKS' STATEMENT

System crash

Martin Banks is perturbed that we may be placing our very lives in jeopardy through over-reliance on the computer.

Now, this is something about which I don't know too much in terms of specific details. But I know this guy who goes flying quite a bit, who should know more than me.

Anyway, this guy says that he knows someone else who flies the big jets — you know the type of thing I mean, all wings and engines and three hundred seats with no leg-room. These are beasts which really demand no flying skills at all, these days. As this guy said to me about the subject, it is now possible to fly one of these brutes from London to somewhere interesting by simply pushing six buttons.

Two of those, not surprisingly, are START and STOP.

I reckon I could do that, so I suggested to this guy that maybe I should apply for the job of airline pilot. After all, said I, if I can drive a computer keyboard to write stuff like this, I have definably proved that I can push buttons. QED. I am ideally suited and fully trained for the task.

It was then that he pointed out a small, very minor, problem. Not only did I not have a pilot's licence, I have never even flown a plane. I tried to protest that this was not necessary as planes were now controlled by computers, I just had to say when to start and stop ... even I could manage that, surely?

That was the easy part, I was told, but what would I do if the computer went wrong and the plane was in high-speed negative elevation mode? My suggestion of combining a rapid scan of the manuals with a lethal mixture of incantations to the goddesses and large gins didn't rate highly as a probable solution to such a problem.

At this point I started to think about the problem just a little. It seemed, or so I was informed, that the way modern big jet airlines are flown these days is by computer. The pilot sits there and pushes a few buttons to make sure it starts, makes some course corrections en route, lands and eventually stops. The pilot's prime responsibilities come down to some relatively easy functions, taxiing the beast around the airport and getting it lined up on the

runway, ready for take-off.

After that, the job is simply to monitor the operation of the onboard computers and be there, with lots of expensive training predominantly going to waste, waiting and watching, just in case.

It was then that the thought struck me: *this*, as they say in all the best movies, *just ain't right*.

I have in my time flown a good many miles (at someone else's expense, usually) and the thought that I have been sitting somewhere seven miles above the ice floes of the North Atlantic while some somnolent pilot just might be forgetting to stay awake long enough to watch the computer have a funny turn, is just a trifle unnerving.

I am not sure that this is the way that computers should be used, mainly because it seems to be turning things upside down and back to front. It is a classic example of how we are making much of computers and their capabilities, and ending up putting all the reliance on them for our own responsibilities.

Up there in the aeroplane it is the computer that is doing the work, and the human being that is doing the monitoring — just making sure that things are going along OK and ready to take over should it prove necessary. Think about that for a second. It can be argued that this is completely the wrong way of doing things. What if the computer that is controlling the plane decides to go all peculiar just as the pilot nods off from terminal boredom?

In practice, it should be the other way round. Being complete morons, computers haven't got the intelligence (even of the artificial kind) to become bored, so surely, then, tenacity should be utilised to monitor the human being at the controls, rather than the other way round. I have no objection to the computer having the capability of flying the plane should it need to as a back-up to the pilot. I just worry about the idea of the main back-up system being someone who might have a totally numbed brain from nine hours of doing nothing but sitting.

This philosophy of putting so

much reliance on computers to do everything for us is starting to appear everywhere, especially as the idea of expert systems catches on. Now, as I have said before in these columns, I quite fancy the idea of expert systems; they are a great way of capturing and utilising precious knowledge.

One of the ways in which such systems can learn, of course, is by actually observing an expert doing a job. In the aeroplane, for example, the system could be programmed to learn what the pilot does and how. Certainly they are already being programmed to fly a plane, but can they be programmed to deal with all emergencies? The answer is probably no, which explains why the human has to monitor the computer.

In the office, the 'umble PC is already proven as a great boon in any number of ways, but do we actually want it to do our jobs for us? I suppose that when it comes to working out an enormous spreadsheet the answer is probably yes, but that is relatively trivial in the great scheme of what things might be like in the future. A spreadsheet works on much the same principle as using computers to help fly a plane in a 'fly-by-wire' system.

Would we want the computer to not only enter the data into our spreadsheet, but choose which numbers should get the privilege? This is like having a word processor that actually does the writing. (OK, OK, there's no need to comment about that being a good idea. But just think, if the damned thing can write, it can also read, which might mean that eventually it might not require us at all.)

All this is to pose the basic question: are we actually using all this wonderful technology we have created in the right way? It would seem that, having discovered that we can produce something that can do a particular job, we then abdicate from that responsibility ourselves. Taken to its logical absurdity, we may well eventually invent ourselves out of life, which doesn't seem to be the best use we can make of the best tool we've made.

END



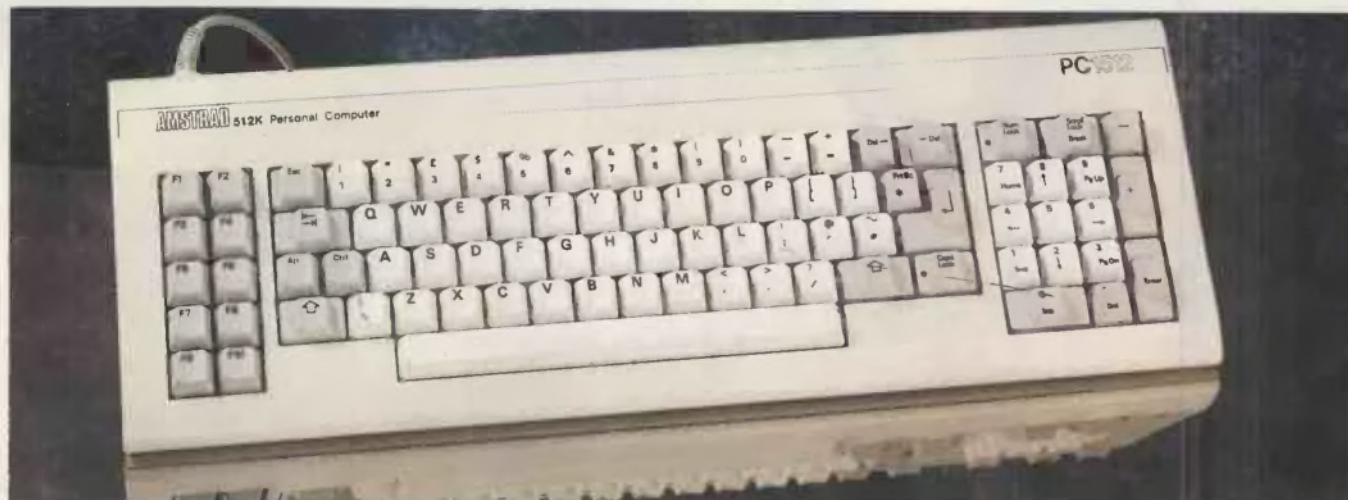


BENCHTEST

Amstrad PC1512

*If there's such a thing as the perfect PC clone, this is it.
Fast, inexpensive and from a company with apparent 'staying power',
the Amstrad PC could be all you'll ever need. Guy Kewney loves it.*





This is not a standard, cheap Amstrad bubble keyboard; the keys are mounted in solid plastic with springs

There's only one clear reason why someone who wants a micro to run IBM software might not want to buy an Amstrad PC1512. It's the same reason why they might not buy an Olivetti M24: the thing will not work with an enhanced graphics adaptor, an EGA. If you don't know what an EGA is, it probably isn't going to bother you, and all you need to know is the price.

For the rest, the PC1512 is probably the most important British micro to appear this year.

It's a calculated gamble from Alan Sugar, designed to go for a new market — the big-business buyers of PCs — with a machine that appeals to their cost-consciousness. It's also designed to steal as few sales as possible from Sugar's very successful bread-and-butter machine, the PCW8256.

The PC1512 was code-named AIRO, an acronym invented by Sugar himself with his usual subtle, indirect and obscure sense of humour. It stands for Amstrad IBM Rip-Off, and that fits, because it's a neat catalogue of what everybody always wanted in an IBM-standard box.

It goes faster than the IBM, it's smaller, has better onscreen colours, and includes, as standard, functions which have to be added (and paid

for) separately on normal IBM-style machines.

And at a starting price of £460 including VAT (or £399 without), many people who always wanted a PC can now afford a very nice one.

However, before you skip to the 'Conclusion' section at the end of this Benchtest, it would be as well to pay some attention to the details. This machine is not a conventional PC clone. And perhaps more to the point, so much idle speculation has been wasted on it by people who knew nothing about it, that the chances are very strong that you have some pre-conceived notions about what it is, and what is in it.

Here, for the first time, are the full facts.

In outline, the Amstrad PC is a very fast machine with most IBM PC functions built-in. Its minimal configuration is an Intel 8086 chip, a single 360k disk, 512k of memory, and serial and parallel ports built-in.

The price also includes a paper-white monochrome screen with colour and grey-scale graphics circuitry built into the main board, three expansion slots, a mouse and a keyboard.

Software supplied includes two operating systems: MS DOS 3.2 and Digital Research's DOS Plus, with the

graphics environment driven by GEM, the Digital Research product (graphics environment manager). Also supplied is a new, and very fast and powerful, version of Basic from Locomotive Software, Basic-2. The only applications program supplied is GEM Paint.

Whatever you may have read, however, there is *no* word processing program. There is *no* built-in printer. Sidekick is *not* included. It will *not* run Locoscript (the word processor on the Amstrad PCW). And it does *not* use the V20 processor which runs Intel 8080 code as well as 8088 code.

A colour version of the machine is available, a twin-disk version is available, and a hard disk version is nearly ready, too.

Hardware

There's nothing astonishing about the appearance of the machine, except the mouse attached. At the front, there's space for two floppy disks, or one floppy and one hard disk, side by side. That makes the box a bit narrower than most PCs.

There's a choice of colour, or paper-white monochrome monitor. The mono monitor is very much nicer than a green screen and is a graphics display. Anyone who wants



From left to right: two sockets for the monitor cables, and the parallel and serial ports respectively

BENCHTEST

a green, text-only screen will have to buy a standard video card and a standard green monitor, and plug them in separately.

The monitor is purpose-built, with a steep slope down the back to prevent people putting bits of paper up there. Just as well, because the monitor also encloses the main heat generator — the system power supply, exactly as in the first Amstrad home computers. The on/off push-button is on the monitor, at the right back, next to the intensity controls. The advantage of this remote power supply becomes obvious when you come to upgrade.

As there's no mains power in the system box, the EEC laws governing safety don't apply as they do on standard PCs. You can open the box and plug cards in with one hand. EEC rules dictate that you must use two hands if mains power is present.

As a result, Amstrad has been able to put the expansion bus inside at the back, but with a little snap-off lid, so that the normal chore of opening the system to plug in cards is a doddle. On standard PCs, it involves screwdrivers, fingernail chippings, pinched flesh and blasphemy. On the Amstrad, you might have more trouble than you get putting batteries into a Walkman, but that's only because add-in cards are a blessed nuisance to get right. However, there's no obvious reason to plug cards in, because most of the things which people plug into PCs are already there, built into the (amazingly small) main circuit board.

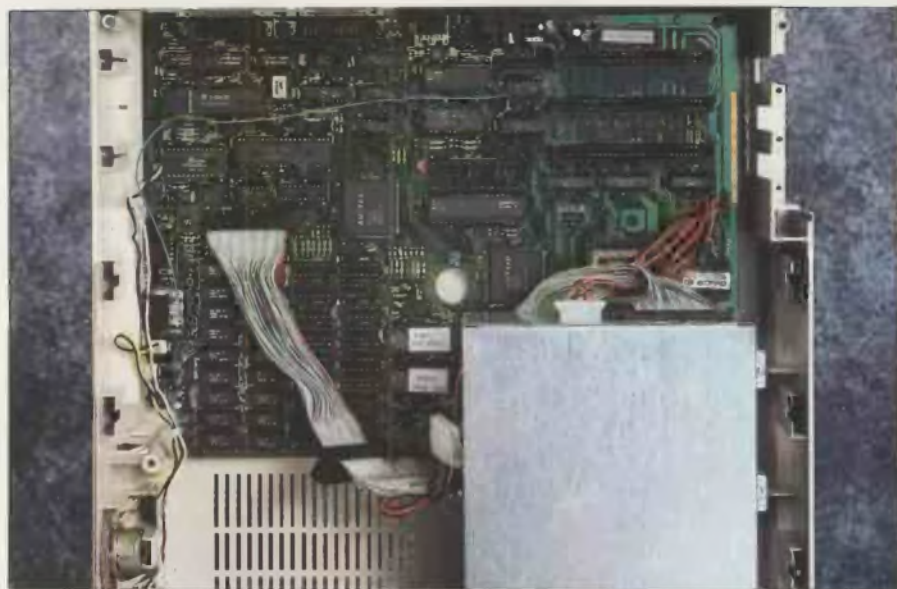
At the back are the two sockets which connect to cables from the monitor. One brings power, the other takes the video signal. Next to those are the serial and parallel ports for the modem and the printer (usually).

On the left-hand side of the main box is the socket for the keyboard, half-way back. Next to that is the mouse plug. I would have preferred it to be on the other side — but what the heck. And on the back of the

computer keyboard.

Next to the joystick is a little volume control. This PC is (astor-nishingly!) the only one which has the ability to make a really audible BEEP! as well as the feebler 'meep!' of the standard machine — and can even be turned down to inaudibility. Don't turn it all the way up, or you'll have a heart attack.

The keyboard opens up by snap fittings, which means that with little effort you can swap keys around.



The PC1512 contains very few chips; these imitate the 'tricks' of the IBM

keyboard is a joystick socket.

This joystick, by the way, is not the joystick required by many American games for the PC, but one for future British authors to use. Unlike analogue joysticks, this one imitates the

The mechanism of the keyboard is painfully, elegantly simple: two layers of plastic have white circles painted between them. The keys push conductive foil on the top down the fraction of a millimetre needed to connect the top and bottom sheets.

This is not the standard cheap Amstrad bubble keyboard, although it feels very similar. The keys are mounted in solid plastic, with springs. You can type fast and accurately on it. There are a couple of extra keys, which WordStar and Lotus users will like, and other people will probably ignore — a Delete Forward key (generating control-G) and a second Enter key on the numeric keypad.

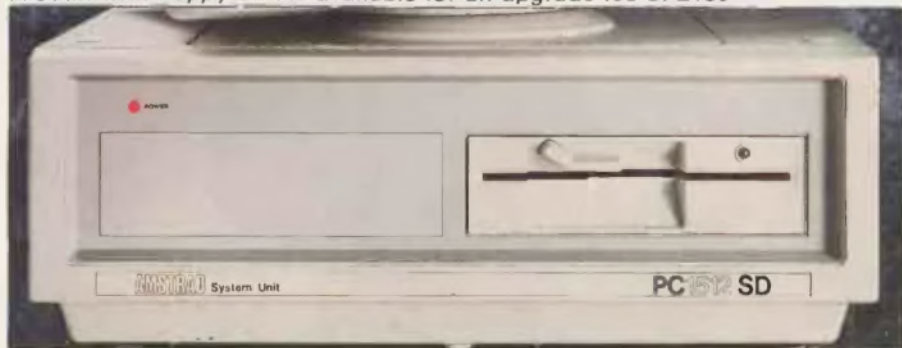
The keyboard plug is not standard IBM format, and only accepts Amstrad keyboards. Should you require a special-purpose keyboard, one that normally replaces the standard IBM unit, you'll be stuck until someone recognises your need and produces an Amstrad version.

The mouse is fine. It has two buttons, and once Amstrad's version of MS-DOS is loaded, it works like a Microsoft mouse. It worked under PC-DOS with Microsoft's standard IBM mouse drivers, too.

Underneath the monitor, recessed into the main system area, is a sock-



A 5 1/4in twin floppy unit is available for an upgrade fee of £150



The standard unit contains a single floppy disk drive unit

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et for ordinary pen-cell batteries to drive a real-time clock. This machine always knows the date and time, and when you last used it. Together with this is a battery-powered memory chip which remembers several important facts about how you like the system to be.

I have to report that, at the time of testing, the colour display was not good. I'm going to assume that, because the engineers at Amstrad noticed the problem, they have been working on it since, and that yellow will show as yellow, not bleached-out white. But don't buy a colour system without having a look at something that shows up these colours. Without the yellow, there isn't much difference between green and blue.

The machine is driven, exactly as

'The PC1512 includes very few chips, most of them logic arrays doing the job of 20 IBM board chips. That's why the machine is cheap. The effect of these chips is to imitate all the tricks of the original IBM...'

in the standard Olivetti M24, by an Intel 8086 running at 8MHz. The difference between the 8088 (in the IBM and exact clones) and the 8086 is the data bus. All programs run identically, but the 8086 is substantially faster. It does require some clever logic to produce a standard IBM expansion bus, but Amstrad has managed this.

The PC1512 includes very few chips, most of them logic arrays doing the job of 20 IBM board chips. That's why the machine is cheap.

The effect of these special chips is to imitate all the tricks of the original IBM. It's an absolute, cast-iron certainty that there are some tricks the designers didn't know about, and which will make the machine behave differently, in strange circumstances, from the standard IBM.

The trouble with building an expandable system is that you have to decide whether the circuitry on the main board is doing the work, or whether there is something plugged into the bus trying to do the same thing.

Generally, the trick is done electronically by having a switch which can point in one of two directions, and is simple. However, Amstrad has saved some space on its chips by not tri-stating every circuit on the main board. This does cause one serious problem — it cannot accommodate

an enhanced graphics adaptor.

The motherboard of the Amstrad PC produces a 16-colour, grey-scale graphics output. Bright colours are shown correctly on the colour monitor, and as bright grey on the paper-white monitor.

This circuitry is rather nicer than standard IBM colour graphics cards. For most users today, it will exceed their expectations. It isn't as nice as the Olivetti screen, using the standard IBM pixel count, but otherwise, it's pretty good.

There are two reasons why. Firstly, as on the Olivetti, it isn't possible to disable the standard colour graphics output. The system produces the signal and won't stop. And secondly, the 8086, running at 8MHz clock speed, doesn't produce the scan-line timings that the EGA card is looking for on a 4.77MHz 8088 system. Even if you produced a board that didn't have the colour graphics output (only possible on a totally new design) the EGA graphics card still wouldn't work.

When Amstrad designed the machine, there wasn't any good reason to worry about this. The EGA card is slow — pitifully so. Even when working properly, as one disgruntled user recently complained, 'it works as though it's broken.' As little as a year ago, no-one used it, no software addressed it, and it cost a fortune — well over £1500 if you include the special high-speed scan monitor needed.

These days it suddenly looks different, with the EGA system being the most-installed add-on in the US and booming over here. It's too late for Amstrad to produce a new design, and the current design can't be upgraded. At the price, I suspect that many people who thought they needed EGA suddenly realise that it isn't essential. But if you *must* have an EGA display, you don't buy an Amstrad. It's that simple.

The comms ports are also built-in, but no-one ever gets worked up about replacing these. Add-on cards provide extra comms ports and don't replace the existing circuitry, so the fact that they can't is irrelevant.

The system has 512k on the motherboard, but the standard Lotus/Intel Extended Memory System has been tested on it, and takes it up to whatever limits the various expansion boards allow. I didn't test it with the AST RAMpage system, however.

Amstrad says that extra chips can be plugged into the motherboard to bring it up to 640k, but this should be done only by Amstrad or one of its dealers. Apparently, it's easy to blow up your new RAM unless you get the motherboard adjustments

just right.

A Mountain 20Mbyte drivecard was kindly supplied by P&P Micros, was plugged into the standard bus and worked. So did a Tandon plug-in card, though this had to be installed in the central bus slot. Amstrad assures me that generally, these useful add-ons only fail to work when they rely on a crude software system that does its timing based on a 4.77MHz clock. There are very few such add-ons, since many manufacturers these days go faster than the IBM clock.

A single floppy system can be upgraded to a twin floppy for a standard £150 fee, on-site or at a store, with the current best bet being that Dictaphone will be the field upgrade agents. At press time, upgrade to hard disk was still being priced.

'... It's an absolute cast-iron certainty that there are some tricks the designers didn't know about, and which will make the machine behave differently, in strange circumstances, from the standard IBM.'

Testing a machine like this on a network is not within the scope of these single-user Benchtests. However, Amstrad assures me that plug-in network cards do work correctly, and since the company hopes for large sales to corporate customers, I believe that it is taking this requirement seriously.

As indicated above, the keyboard has a non-standard connector and doesn't behave, electrically, as if it were a simple IBM keyboard replacement. I don't know why, but if you need to take a special keyboard used in your company and plug it into your clones, you can't use this one. But then, the same applies to most clones.

As the system comes with GEM, it made sense to supply a mouse. Sensibly, this appears to work in all respects as if it were a normal, bus-mounted Microsoft mouse. Inevitably, there's the risk that someone has written a program which requires a genuine Microsoft bus mouse with the interrupts changed, but I don't know of one.

System software

The machine works perfectly well under MS-DOS and PC-DOS. You can use GEM under MS-DOS. As Alan Sugar has included DOS Plus, a rival system from Digital Research which

THE AMSTRAD PC 1512

(IBM PC compatible)

For dealer applications/O.E.M. volume enquiries
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Tel 0902 43913

is mainly designed to imitate MS-DOS, I can only assume that he got it free when he bought GEM from Digital Research. I'm afraid I'm not going to stand up and say how wonderful GEM is. For someone who has never seen a mouse and graphics, it's probably OK, but for someone used to the far more sophisticated and friendly Macintosh WIMP interface, it's a bit of a giggle. However, you do need GEM to run Basic-2.

There are some advantages to running GEM. The 'desktop' on which programs appear as pieces of code and files appear as pieces of paper, means that you can arrange for files marked .TXT to look for WordStar (say) if someone points at them. But by far the most obvious effect of running GEM is that you suddenly have no memory.

On a 512k machine with Basic-2, plus the GEM fonts plus the operating system plus the clock, calculator and notepad that can pop up from the desktop, with memory for four windows, a request for 64k of data will be met with the discovery that there is only 40k available. On a 640k machine, the printer fonts can be added — and that's your entire memory full. Don't try loading Sidekick.

I feel that GEM will be great for making dumb shop assistants look like skilled salesmen, and I suggest that you quietly put your GEM disks in a safe place until you want to use Basic-2.

Loading GEM for the first time is a long-drawn-out nightmare, automated in such a way that I guarantee you get it wrong.

The latest version of Microsoft's operating system has been enhanced on the Amstrad to include the mouse drivers, and the ability to read the real-time clock and system specifications.

With the normal DOS programs, such as FORMAT and CHKDSK, and so on, there's one called NVR.EXE — Non-Volatile RAM executive. This

allows you to change: the size of the RAM-disk; the keyboard codes for several keys; the colour and size of the start-up screen; the set-up for the serial port; the joystick buttons; the number of disks; and the way the mouse moves.

The most important is the RAM-disk. With a single-floppy system, this becomes drive c: (the third drive!) because the first drive is both a: and b: under MS-DOS.

The first thing that the Amstrad PC is set up to do, under both operating systems, when it starts up, is to load a program called COMMAND.COM into RAM-disk.

This is necessary due to the real risk of using a DOS Plus diskette when the system is running MS-DOS, or vice versa. As both versions of COMMAND.COM have the same

'The Amstrad PC's only serious defect is its inability to accept EGA high-resolution graphics cards. Most of us simply don't need EGA cards — or at least, not yet ...'

name, and because many programs overwrite it during execution and reload it afterwards, an incorrect version of COMMAND.COM 'would tend to be a disappointment to you,' as one systems designer laconically put it.

The RAM-disk is set at 34k at the factory.

All that is by way of saying that the only unusual things about MS-DOS on this machine are the things designed to cope with co-existence with DOS Plus, or the mouse.

There's a neat improvement, too. On this version, if you forget to format a disk with /S (putting system tracks on, so that it can be used to

boot up the system) you can add them afterwards. Quite often, surprisingly, you can't on normal MS-DOS systems.

The specially-commissioned version of Basic supplied to Amstrad by Locomotive Software is incredibly fast, and a great deal more powerful than the standard GW-Basic supplied by Microsoft. Amstrad doesn't provide GW-Basic, but it works OK if you buy it from Microsoft. Just about any version seems to be fine. Unfortunately, the version of Basic-2 provided free with the Amstrad isn't quite as good as the version which Locomotive is selling separately for PC users.

There are two main differences between Microsoft Basic and Locomotive Basic-2 (apart from the fact that Locomotive's version goes at least twice as fast). Firstly, Basic-2 uses GEM (enhanced and improved) to do complex window management, graphics, turtle graphics and mouse controls. And secondly, it's very much more sensible and straightforward in the way it handles disk files and database work.

The full list of Basic keywords is included in the program. The interesting thing to look for is the list of MS-DOS commands — DIR, MKDIR, RMDIR, RD, DELETE, DEL, and so on.

The points of most interest to Basic experts are the file and flow-control commands. Compare them with a list of standard ones, and buy the extra manual available from Amstrad, and you'll be amazed.

I'm not an expert Basic programmer, so I took one along to help analyse its capabilities. She had just written a complex database application in Locomotive's Mallard Basic, as supplied with the PCW8256, which is much more powerful than Microsoft's version, but Basic-2 made her very excited indeed.

Applications software

Supplied free with the system is GEM Paint. Included in the utilities is a nice little screen-based text editor called RPED, Roland Perry's Editor. It's great for making new batch files, config.sys files, and so on. Frankly, I'd rather have that than Paint, but some people love it (Paint, that is).

Benchmarks: The standard GW-Basic Benchmarks ran nearly three times faster on the Amstrad PC than on the IBM PC. This doesn't test disk speed, mouse handling or graphics.

Running the tests on the Amstrad, using Locomotive's new Basic-2, the timings shown in the Benchmarks box made the PC1512 look (on paper) faster than the Apricot Xen. It only goes to show how hard it is to

Benchmarks

	Amstrad PC1512	Apricot Xen	IBM PC
BM1	0.22	0.3	1.5
BM2	0.82	1.1	5.2
BM3	2.03	2.7	12.1
BM4	2.03	2.7	12.6
BM5	2.25	2.9	13.6
BM6	4.23	5.2	23.5
BM7	7.63	7.9	37.4
BM8	6.28	8.3	35.0
Average	3.18	3.89	17.61

Compare Benchmarks 7 & 8!

All timings in seconds. For a full listing of the Benchmark programs, see page 185, January 1985 issue

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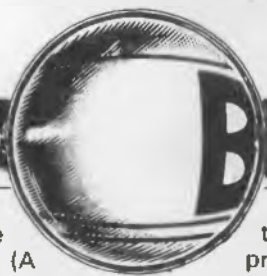


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BENCHTEST

prove anything using the traditional Benchmarks. (A new set of Benchmarks has been prepared by our deputy editor, Nick Walker, to test new machines — see the article on page 148 of this issue.)

Don't expect the Amstrad PC1512 to run Lotus sorts at five times the speed of a standard PC. To quote Locomotive's Richard Clayton:

'Running the standard Benchmarks on the Amstrad, using standard Basic, gives much the expected results for an 8MHz 8086 machine.

'But it's usual to Benchmark machines using the Basic shipped with the machine. Looking down the list of machines so far tested, the only personal computer that runs faster is the 12MHz Pinnacle — a multi-user 68000 machine.

'There should be no confusion about what these results really mean. The PCW Basic Benchmarks test a hardware and software combination. The Amstrad PC1512 is a fast machine, and Basic-2 is a fast Basic.'

Documentation

My pre-production version of the manual wasn't much of a guide to

the real thing. Amstrad staff are proud of it, and pointed out various nice features. On the other hand, outside experts tell me that they see the thing as a splendid publishing opportunity, and propose to launch their own superior products forthwith.

I found it confusing, never really knowing whether a command was for MS-DOS or DOS Plus. There are differences. And I think there ought to be more information on Basic-2.

I'd say that the standard of MS-DOS manual-writing is pretty low, and that this is an unusually good example of the art. That doesn't contradict either point of view.

Prices

The minimal Amstrad costs £399 plus VAT. That includes a paper-white monitor, a single diskette, 512k, two operating systems, GEM, a mouse, a keyboard and manuals.

A 'standard' PC configuration should be defined as an expandable two-floppy system with serial and parallel cards, a colour graphics card, 512k, a keyboard, a mono display and DOS. On the Amstrad, that will

cost you £499 plus VAT, and provides as extra: DOS Plus, GEM, GEM Paint, a mouse, a real-time clock, desktop GEM programs, and a central processor running roughly twice as fast as the standard model.

A colour system with two diskettes costs £649 plus VAT. If you want a hard disk system, add £300 plus VAT to the minimal configuration for a 10Mbytes drive and £400 plus VAT for 20Mbytes.

A version of WordStar will be sold with the system for £70, and a version of the SuperCalc 3 spreadsheet at the same price.

Conclusion

For the life of me, I can't suggest why you'd want any other version of the standard PC, now that this machine is available. The Amstrad PC's only serious defect is its inability to accept EGA high-resolution graphics cards. And it would be nice to clarify, for potential buyers, the importance of this fact. Unfortunately, there's no way to be sure what the future will bring.

For people who want this, today, the choice is easy — don't buy the Amstrad. There are now cheap AT lookalikes on the market at £2000, including EGA card, screen and 640k. Those machines, with the 80286 chip, clearly will run faster than the Amstrad — and frankly, to run EGA graphics, you really do need a very fast machine.

Most of us simply don't need EGA cards — or at least, not yet, and not for another year or so. There simply isn't any program which is a big-selling essential which *must* have EGA to run, so Amstrad probably won't lose sales.

Do remember that Alan Sugar doesn't run a charity, however. He's now convinced that the EGA capability is something he will need one day, and his record on such matters was clearly shown when he launched the CPC6128 and dumped the older CPC664 straight out the window, to cries of rage from users who wouldn't have bought a 664 if they'd realised the 128 was coming, hot on its heels.

That's the only doubt in my mind. The machine is fast, easier to use than any other PC, cheaper than anything with the same specification, and comes from a company now regarded as a good survival bet.

Because the Amstrad PC has a mouse built-in, software will be written for it that uses the mouse. Because it's cheap, cheap software will be sold for it. Because it's expandable, it will sell into areas where Amstrad 8-bit machines won't go. What more could you want?

END

Technical specifications

CPU:	8086 running at 8MHz, switchable to 4.77MHz
ROM:	32k
RAM:	512k expandable to 640k on-board
Keyboard:	Detachable 83-key, full-stroke keyboard
Mass storage:	One 360k, 5¼in disk drive. Additional hard and floppy disk model available
Size:	System unit: 15ins x 14.5ins x 5ins; monitor 11ins x 14ins x 11.5ins; keyboard 6ins x 18ins x 2ins
Weight:	18lbs
I/O:	Three PC expansion slots: mouse port; 25-way RS232 comms port; Centronics printer port
DOS:	DOS Plus; MS-DOS 3.2; GEM windowing environment
Bundled software:	GEM Paint, Basic-2
Power:	240V A/C

In perspective

Well, it's happened at last. We now have an IBM PC clone at such a low cost, it's hard to imagine anyone bettering it. And, unlike many other clone builders, Amstrad is a substantial company and unlikely to disappear overnight. Add the software companies' sudden enthusiasm for low prices and you have a formula for a successful product.

If you are planning to buy an Amstrad PC for business purposes, you must be aware that buying the machine is only part of the story. You may have, quite rightly, saved a few pounds on the purchase price of your hardware and software, but you must remember that staff training (or your own learning), data loading and good old-fashioned mistakes can be time-consuming and costly.

With its range of options spanning paper-white to colour screens, single-floppy to 20Mbyte hard disk systems, you will be hard pushed ... no, you will find it impossible ... to find better value for money.



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It's all in the mind

Do-it-yourself 'thought control' needn't be an expensive, complicated business. Geoff Bains shows you how to construct your own GSR monitor for the BBC Micro.

Although the Mindlink concept is about the most exciting idea in computing today, you don't have to put thousands of pounds into research to have a go yourself. It's possible for a humble home computer to be equipped to respond to 'thought control' for just pocket money.

For a computer to measure the resistance of your skin, and so measure Galvanic Skin Response (GSR), it must have some means of measuring varying voltages. Resistance is not directly detectable; it can only be measured by observing its effect on an electric current. This, of course, calls for an analogue-to-digital converter, and the only home computer equipped as standard with one of these is the BBC Micro. This machine still requires a little in the way of interfacing to measure GSR, but this is easily attempted by anyone with just a little experience of soldering.

The circuit

The circuit is a simple one, based around an 'op amp' — a single chip amplifier with a very high voltage gain (see Fig 1(a)). This is used to measure the voltage drop across two

probes in contact with your skin. The voltage drop is directly proportional to the resistance of the skin between the two probes (Ohm's law: $V=IR$). As your muscular tension increases, the resistance between the probes decreases and the voltage at the output of the circuit increases. This voltage is fed to the Beeb's analogue channel one for processing.

If all this sounds a little dangerous, don't worry. The voltage applied to your skin is only about 0.6 volts. This is obtained from the Beeb's own five-volt supply and maintained constant by the forward-biased diode.

The 0.6-volt drop is divided between two resistances. The first is the skin resistance along with R1, and the second is a variable resistor (R2) used to adjust sensitivity of the GSR monitor. The other components keep the circuit stable, adjust the overall gain of the circuit to produce suitable signals for the BBC Micro's analogue port, and filter out unwanted signals. The preset resistor is used to zero the whole device.

Parts required

There are quite a few parts required

to make the GSR monitor, but these are all easily obtainable and not very expensive. At current prices, the whole device should cost you less than £8. Fig 2 shows the part numbers used by Maplin Electronic Supplies. All the parts needed are available from Maplin by mail order if you can't obtain them from a local component shop.

Construction

The GSR monitor is made on a piece of stripboard so that its construction can be attempted by anyone with a little practical skill. The circuit is comparatively simple so you should have few problems.

First, cut the stripboard to size with a sharp knife. You should use a piece 10 strips wide and 31 holes long. The track cuts on the stripboard's copper side should now be made. It's a good idea to mark the positions of all the track cuts on the board before you start, and then check the whole pattern carefully against the diagram.

There's a special tool available to cut the copper tracks (a 'spot face cutter' — Maplin code FL25C) but a 1/4in drill bit will do the job just as

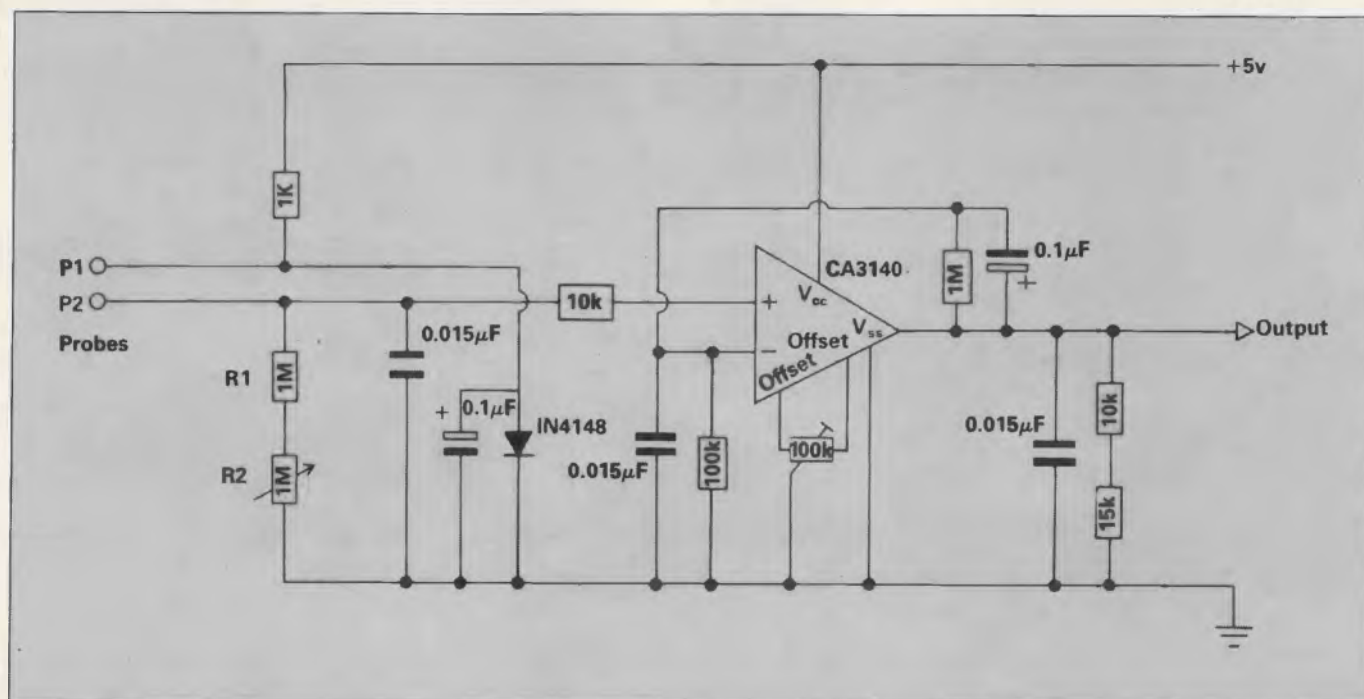
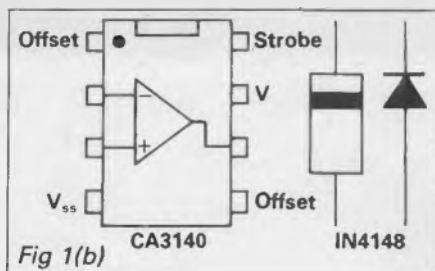


Fig 1(a) The GSR monitor circuit: all it takes is a little practical skill



well. Simply turn the drill bit in the stripboard holes indicated on the diagram to drill away the copper strip around the hole. Make sure that the copper is entirely removed and the connection totally broken — but don't be over-enthusiastic and drill right through the board!

You can now start to solder the components in place. All the components sit on the non-copper side of the board with their leads through the holes, soldered onto the copper strips. Again, it's a good idea to mark the positions of the components on the board and check your board against the diagram before you start soldering.

Solder the chip socket in place first and then the plain wire links. Now solder all the resistors, the preset, and the five capacitors in place. Note that the two 0.1- μ F capacitors must be inserted the right way around. The lead marked '+' must correspond with the '+' on the diagram. These components are quite hardy and can take a little abuse from the soldering iron.

However, the diode cannot be treated in the same way, and care should be taken to insert this the right way around and keep it reasonably cool.

The chip can now be plugged into its socket. This must go in the right way around too — see the position of the notch in Fig 3.

Use a few inches of the insulated cable to connect up the variable resistor as shown. Three more short wires should then be soldered to the D-connector plug. The rest of the figure eight wire is used to connect the probes. One end of this connects to the board and at the other end you will need some kind of connectors to your skin. A most effective means is to solder a washer or similar metal disc to each of the wires and glue each to a few inches of Velcro strip. The strips can then be wound around a finger, making a good and constant connection to your skin.

It's a good idea to fit the board into a case of some kind. The box suggested in Fig 2 need not be used — any plastic box will do. Mount the D-connector plug in the side of the box, with the two bolts 2.75cm from the base of the box. This will enable the box to sit firm and level on the table-top when plugged into the BBC. Now you can drill a half-inch hole in

Quantity	Description	Maplin code
Semiconductors		
1	CA3140 op amp	QH29G
1	1N4148 diode	QL80B
Resistors		
1	1-Mohm linear potentiometer	FW08J
1	100-Kohm sub-min vertical preset	WR74R
2	1-Mohm 0.6-watt resistor	M1M
1	100-Kohm 0.6-watt resistor	M100K
1	15-Kohm 0.6-watt resistor	M15K
2	10-Kohm 0.6-watt resistor	M10K
1	1-Kohm 0.6-watt resistor	M1K
Capacitors		
3	0.015- μ F polyester capacitor	BX71N
2	0.1- μ F Tantalum capacitor	WW54J
Connectors		
1	Eight-pin DIL socket	BL17T
1	15-way D-connector plug	BK58N
1m	Two-core figure eight cable	XR39N
1	Reel 22swg tinned wire	BL14Q
1	24-strip x 50-hole stripboard	FL07H
Hardware		
1	MB2 plastic box 100 x 76 x 41mm	LH21X
1	Knob	RW90X
2	M3 9mm screw	LR57M
2	M3 nut	BF58N
1	Strip of self-adhesive pads	HB22Y

Fig 2 Parts list

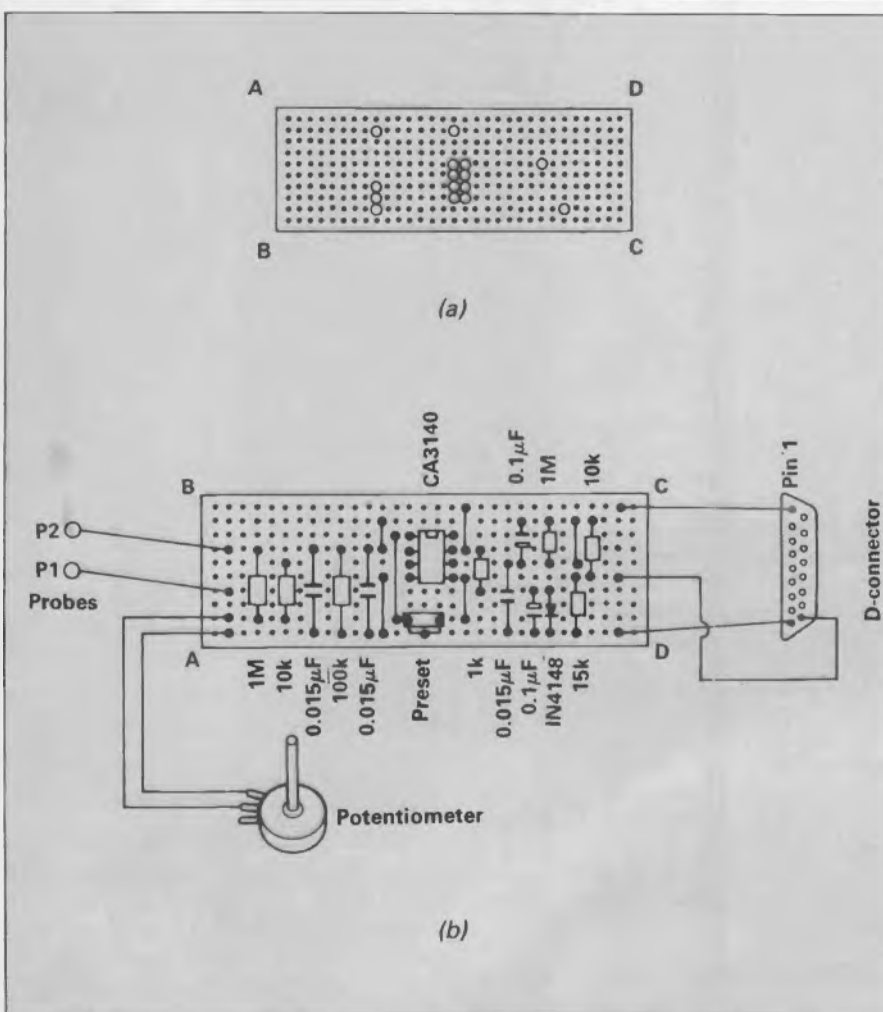


Fig 3(a) Track cuts (copper side); (b) layout & wiring (non-copper side)

the top of the box to mount the potentiometer, and another small hole to take out the probe wires. Stick the board in the box with a couple of adhesive pads.

Before you screw the lid onto the box, the GSR monitor should be adjusted. Turn the preset resistor and the variable resistor fully clockwise, plug the monitor into your Beeb and run program one (Fig 4). Now turn the preset anticlockwise in small stages until the trace just starts to rise off the base of the screen. You can now put the box together and start to use your GSR monitor.

In use

Program one not only sets up the GSR monitor, but also helps the user become accustomed to using it. The program displays a continuously updated graph of the resistance between the probes on the screen of your Beeb. Adjust the variable resistor to put the trace in the centre of the screen. After about half an hour, you'll find that you can control the direction of the trace. Relaxing will bring the trace down and increasing your anxiety/excitement will take the trace up the screen.

You may sometimes experience problems with interference in the form of a constant sine wave superimposed on top of your GSR trace. This can be eliminated by making especially good contact with the probe P2 — lick the probe before applying it to your skin. The resistance around probe P1 is still measured correctly and can be used for GSR control.

Another problem is that your skin GSR will respond to a stimulus only after about two seconds, and the response will take around 10 seconds to fade. So, a much better measure of emotional state is the rate of change of skin resistance. Program two (Fig 5) will produce a graph of this. A simple method of determining rate is used: two readings are taken and the trace is produced according to the difference between them. Taking many more readings would achieve a better control; however, a machine code program is called for here, for speed.

Rather than just produce graphs, the GSR monitor can be used to control programs in the same way as the keyboard, joystick or mouse. You can convert any Basic program controlled by a joystick, for example, to operate under GSR control by inserting a control routine such as that used in program two, instead of the joystick routine.

Conclusion

This GSR monitor and the programs given here are far from perfect solu-

```

10 REM PROGRAM ONE
20 REM GSR DISPLAY
30 :
40 MODE0
110 Y%=0
120 REPEAT
130   CLS
140   MOVE 0,20:DRAW 1279,20
150   MOVE 0,Y%
160   FOR X%=0 TO 1280 STEP 2
170     Y%=FNgsr
180     DRAW X%,Y%
190   NEXT
200   UNTIL FALSE
210 END
220 :
1000 DEF FNgsr
1010 AZ=ADVAL(1)
1020 BZ=20+1000*AZ/&FFFF
1030 =B%

```

Fig 4 Program one

```

10 REM PROGRAM TWO
20 REM GSR RATE DISPLAY
30 :
100 MODE0
110 Y%=500
120 REPEAT
130   CLS
140   MOVE 0,Y%
150   FOR X%=0 TO 1280 STEP 4
160     Y%=Y%+FNrate
170     DRAW X%,Y%
180   NEXT
190   UNTIL FALSE
200 END
210 :
1000 DEF FNrate
1010 AZ=ADVAL(1) DIV 10
1020 TZ=TIME+15:REPEAT UNTIL TIME>TZ
1030 BZ=ADVAL(1) DIV 10
1040 CZ=SGN(BZ-AZ)
1050 =CZ*4

```

Fig 5 Program two

tions. Much more complex software and more expensive hardware is needed for serious applications, and even then the experts would not be truly successful. However, although telepathic word processors may be some way off yet, even simple equip-

ment like the GSR monitor described here, combined with a little perseverance, will give you a taste of the power of Mindlink quite literally 'at your fingertips'.

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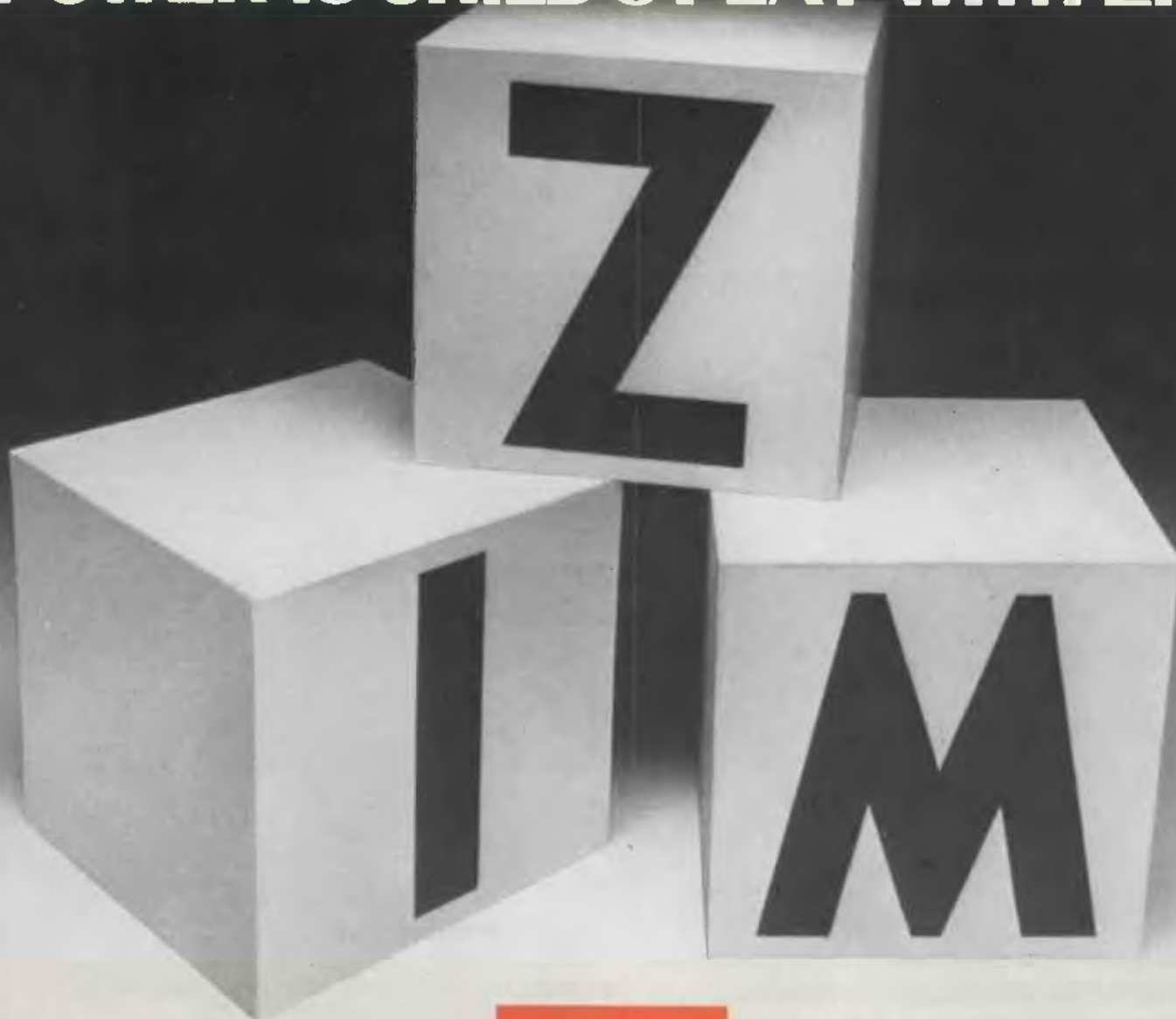
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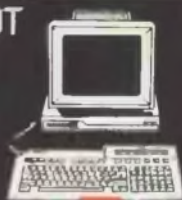
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Sord M680 UX

Sord's cautious re-emergence under the wings of Toshiba has resulted in a solid, powerful Unix machine which uses the new-standard VME bus and a full 32-bit processor. But, as Unix is still 'out on a limb', marketing may be a problem. Peter Jackson reports.



The rise, fall and prospective new rise of Sord would be an old, old story in the US or the UK, where growing too fast, crashing equally fast, and being bailed out by a big conglomerate happens in every industry every day.

The difference is that Sord is a Japanese company, and such things just don't happen in Japan — at least, not until they happened to Sord's founder Takayoshi Shiina. At one time Sord, founded in 1980 and named from the first two letters of SOft and the last two letters of haRD, was the fastest-growing company in Japan, not just in computing but in any industry. A factory in Ireland, and a UK office, were set up to handle a similar rate of growth in Europe. Then the growth collapsed, and Sord had to be rescued last year by the giant Toshiba, which now has a controlling stake.

Understandably more cautious these days, Sord is picking its way into the multi-user market and has designated the UK — with a London office still in place — as its world centre for Unix. And the main vehicle for Sord's prospective multi-user Unix business is the M680 UX, also called the Unibox.

This machine is a development of Sord's experience with its first system built around the Motorola 68000 processor, the M68, which was launched in 1983. That was a single-user system, running Digital Research's CP/M-68k rather than Unix, but even then the company was offering a set of plug-in modules to add different processors — notably a Z80 and an 8088 — to allow the use of other industry-standard operating systems like CP/M-80 and MS-DOS.

The M680 UX, though, has a different philosophy. Like the HM Systems' Minstrel machine (reviewed in the July issue of PCW), it is built around a standard bus structure with a set of processor, memory and interface boards plugged in, and with a selection of hard and floppy disk drives. But here the standard bus is not that old favourite S100, but the more recent VME. And although the basic machine has been around for a year, the latest system reviewed here has one major advantage over its predecessor — the main processor board now contains a full 32-bit processor in the shape of Motorola's 68020.

The VME standard bus is less well-known in the consumer micro market than the S100 bus, mainly because the latter was in at the start of personal computing. The first PC, the MITS Altair, was built around a bus that metamorphosed into S100 and eventually became the official IEEE 696 standard.

However, VME is better known in the sub-consumer world of micro-



The system unit is configured for two users

processor development systems and other nuts-and-bolts digital systems. Motorola's own development systems, designed to help micro-processor engineers develop software for the 68000 family, are built around the VME bus or its big brother, the Versabus.

Looking at the structure of the VME bus, its connection with the 68000 is clear. In its basic form, the VME connector has 96 pins arranged in three parallel rows, rather than the double-sided edge connector of S100-style systems, and of those pins 24 are for memory addressing and 16 are for data. This matches exactly with the original 68000 chip's pin-out, giving full 16-bit data transfers rather than the 8-bit transfers of the 8088 in the IBM PC, and direct addressing of 16Mbytes (24 pins gives 2^{24} different addresses, or 16,777,216 distinct storage locations).

In addition to this, there's an extra standard in the VME family called VME Extended, or VMX. This extends both the address and data buses to 32 bits, using a second 96-pin connector, and offers full 32-bit data transfers and direct addressing of 4,294,967,296 memory locations — 4 gigabytes.

With the two connectors, using the 32-bit VME/X bus needs circuit boards double the size of the normal VME standard. So, instead of being considerably smaller than S100 boards, the double-size VME boards used in the M680 UX are comparable in size at 233.35 x 160mm.

The main advantage of the VME standard is that it can handle full 32-bit microprocessor boards at the kind of clock speeds now becoming available. The S100 standard is only rated to 6MHz, although some manufacturers are pushing it up to 10MHz, and

Sord for one is driving the VME bus in the M680 UX at 16MHz with its 68020 board.

Hardware

The M680 UX surrounds its VME bus structure with a lumpen metal case similar in size to a cat's travelling basket or a large toolbox. As the system is meant to be Unix-driven and multi-user, there are few concessions to ergonomic desktop design, and most owners will want to store the thing under a table out of the way.

A spring-loaded front panel opens to reveal a 5 $\frac{1}{4}$ in floppy drive and the front bezel of a full-height Winchester drive, both drives mounted vertically, and also reveals the main power switch. The back panel has, aside from the external connectors on the VME boards, just a couple of sockets: one for mains power in, and the other for 100V power out to drive a CRT.

The five VME slots are accessible from the rear of the machine, and in the standard configuration of the M680 UX these contain, from left to right: the 682 processor board; the FHC external storage control board; the MEM2 RAM board; and the S101 serial interface board. The fifth slot is empty in this minimum configuration.

The 682 board is dominated by the large, square chip carrier of the 68020 at its dead centre. The processor runs at 16MHz, although there are signs that earlier versions of the board ran the chip at 12.5MHz; there is an empty space on the board next to the 32MHz crystal where the earlier 25MHz crystal went.

The 68020 has only recently become available at its planned 16.67MHz speed, after earlier excursions at the slower speed.

BENCHTEST

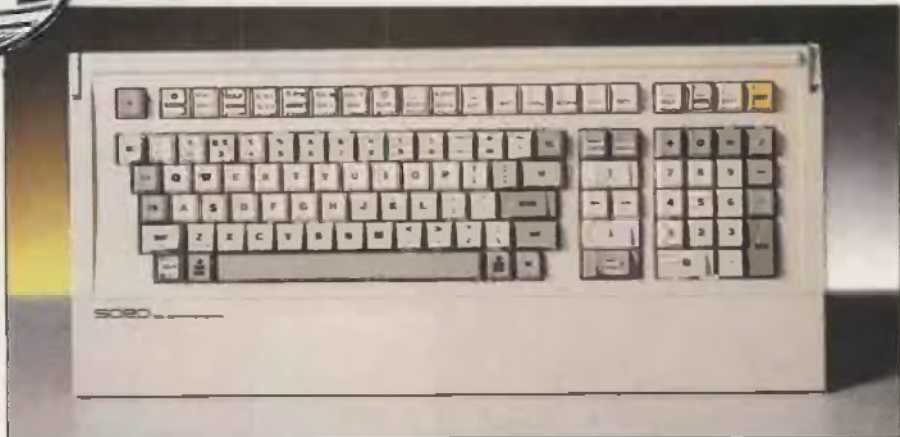
As this is PCW's first look at a 68020-based machine, it's worth digressing slightly into an explanation of why this processor is important — beside that 16MHz speed and full 32-bit data and address buses, of course.

It may not seem much of a jump up from the original 68000, which had a 32-bit internal architecture all along, to the 68020 with enough pins to handle 32-bit transfers from the outside world. But the interim product, the 68010 used in the AT&T Unix PC, showed the way Motorola was moving. The most important feature of the 68010 over the 68000 was the provision of virtual memory management on the processor chip, rather than outside it in a separate memory manager chip. With this feature, the 68010 can pause in mid-instruction when a program tries to access a memory location outside the physical address space of the computer, then switch the required area of storage in from disk and carry on processing as though nothing had happened. All this is done without user intervention, and the programmer's job is eased.

The 68020 takes the 68000's architecture, meaning that programs in 68000 machine code will run unchanged; it takes the virtual memory features of the 68010; and then it adds some new features of its own.

Firstly, a lump of on-chip cache means that instructions can be 'pre-fetched' from memory and queued up for the processing unit, and this is done in the background so that the processor is not kept idle and waiting for its next instruction. Secondly, the 68020 has dynamic bus sizing to help the designer hook it up to 16-bit or even 8-bit peripheral chips; internal hardware senses the width of the data port, and synchronises data transfers in eight, 16 or 32-bit lumps. Thirdly, the new chip has a real co-processor interface to link it with up to eight peripheral processors handling floating-point, graphics, or other specialised operations, which can be run in parallel with the main chip. The co-processors are called into action using things called 'F-line operations': when the 68020 receives one of these, it knows that a co-processor is needed to complete the instruction, and the F-line tells it which co-processor to call.

Perhaps most important, the 68020's instruction set has been extended to meet the needs of today's system designers and high-level language programmers. New security instructions have been included to keep data apart in multi-processor systems, and 32-bit multiply and divide with 64-bit answers are also in-



Sord encourages 'lazy' typing — note the keyboard's palm rest!

cluded. At a higher level, the chip supports the 'module' style of program structure, typified by Niklaus Wirth's Modula-2 programming language. Modules are subroutines written in high-level languages and given different levels of access and protection, and the 68020 can directly handle the calling and running of modules according to the access priorities programmed in.

With that virtual memory support built into the chip, Sord does not need to include a memory management chip on its 682 board. There's an empty space on the board next to the 68020, but from its size and shape it's clear that the Motorola 68851 floating-point unit — analogous to the 8087 co-processor in the IBM PC — is intended to fill the hole. The only other major things on the board are the 32k of bootstrap ROM, the Zilog 8536 CIO timer, and a neat single-in-line package holding the battery that backs up the real-time clock.

The next board along is the FHC, the Floppy Hard Controller for external devices. This board, built around the Hitachi HD68450 direct memory access (DMA) controller, allows the connection of external 5¼in or 8in floppy drives and tape streamers for Winchester back-up. The board did not look quite finished; a piggy-back board full of TTL chips was plugged into a single-chip socket to form the phase-locked loop circuit for the floppy disk interface, and a gate array can be expected to replace this in the near future.

The last two boards are straightforward: one a RAM board storing up to 2Mbytes with 1Mbyte fitted as standard; and one a serial I/O board with two RS232C ports running at speeds from 75 to 19,200 baud.

Opening up the M680 UX case, a simple matter of unscrewing eight screws and lifting the top half off like the bonnet of a vintage car, revealed what little there was beside the VME motherboard and its plugged-in com-

puter power. The full-height 20Mbyte, 5¼in Winchester drive, and the half-height 1.2Mbyte, 5¼in floppy drive are both, not surprisingly, made by Sord's new owner Toshiba, and are mounted at the front end of the case. At the back is the VME card cage and the mains power supply box, and the controller board for the internal disk drives is mounted vertically to one side. There are two noisy 3in fans, one in the back panel and one blowing vertically down through the card cage. And that's about it.

Naturally, any multi-user system needs terminals, and the review machine came with a single Sord-built RT-2X intelligent terminal, which Sord calls a 'general terminal'. This can be configured by plugging different neatly-packaged ROM cartridges into a slot on the back, but the cartridge included was the basic one that makes the RT-2X behave like any old terminal.

As terminals go, the RT-2X looks rather old-fashioned. It has a system box of its own complete with cooling fan, and this box is bigger than many computers' entire system units. The monitor is a solid, 80 × 25 model with an unusual yellow phosphor rather than amber or green, and there are two serial ports, a non-standard printer interface, and a light-pen port on the back of the system unit.

The terminal configuration is done in software using a special 'SS' set-up key to bring up menus of display and interface features, but this was only necessary for information; the terminal came correctly configured for connection to the M680 UX at 9600 baud.

The separate keyboard was a hefty unit with, oddly these days, a palm rest. Palm rests seem to have been discontinued in the US in an attempt to discipline typists into non-lazy habits, but many non-disciplined computer users — including this one — find them useful and restful for long sessions.



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The layout is fairly conventional for a terminal, with a separate cursor key cluster between the numeric pad and the main qwerty section, and a row of 21 function keys along the top. Two of these special keys are the 'SS' key already mentioned and a reset key, and on the review machine the others came fitted with sticky labels denoting standard word processing functions. These keys are readily programmable for other functions, though.

The one glaring problem with the board is that there's no obvious 'pipeline' key ('|'); this is important in Unix as the operator that channels the input and output of files to and from other files. More on this later.

Starting the system is simple enough; power-on the CRT and the terminal system box, then open the front panel of the main box and turn the mains on. What happens then is pure Unix.

System software

Well, not quite pure. The first time in the review, a combination of ROM software in the terminal and ROM software in the M680 UX produced a prompt on-screen suggesting that the bootstrap firmware had done its job. And then there was silence, waiting for the hard disk drive to boot into Unix.

Which it never did. Apparently there's a way of setting the system to autoboot from the hard disk, but from the skimpy documentation in the slender user guide — a combination of cartoon silliness and thorough hardware schematics — it wasn't clear how.

However, the system can also be booted manually by typing B followed by a number: 0 means the internal floppy; 1 means the internal hard disk; and 2 means an external hard disk. Other optional parameters to the B command are the number of the physical drive from 0 to 3, and the block offset of the hard disk partition.

Having discovered this, the boot sequence could start. Various cryptic messages flashed up, including confirmation of the 68020/1Mbyte RAM/twin serial port configuration of the machine, and then, obviously having polled the serial ports to check what was connected, the machine put up a message saying: 'INIT:SINGLE USER MODE' followed by a prompt.

Considering the flak that CP/M and MS-DOS have had over the years for the A which confronts new users, Unix deserves more criticism than it gets for the # or \$ it comes up with at start-up. In fact, it was rather confusing during the review: I was expecting a \$ prompt, got a £, and

eventually managed to reconfigure the terminal character set to get a #.

And instantly, here we are in the depths of Unix. The difference between a \$ prompt and a # prompt is an enormous one, and is to do with access, priorities, and the number of users attached to the system. The idea of priorities and access management is an inherent part of Unix, and the Sord implementation of System V is no exception. AT&T may have put a friendly windowing front-end over System V on its Unix PC, but it's jealously keeping that product to itself, and Sord is left to put out the raw meat.

In single-user mode, the user of the M680 UX is what is called a 'super-user' or 'root' in Unix parlance, and super-users get the # prompt. Once there, they can, in the words of one Unix text, 'do almost anything conceivable to the system or the file structure... {and} can, by making a tiny mistake, destroy the entire file system, cripple it so the operating system will not run, and make a general mess of the system.' That mess could include wiping the system program files so that even the programs which could repair the damage would not run. It's super-user status that attracts those evilly-inclined mainframe hackers, while ordinary user status, the kind that gives you the \$ prompt and limited access to files, is attractive to few.

Even as a super-user, Unix is intimidating if you haven't met it before; but then, so is MS-DOS. And if you're already an MS-DOS user, then there are features in Unix that will seem strangely familiar. It's worth explaining why.

The obvious reason for the similarity is that Microsoft has its own version of Unix, called Xenix, and that MS-DOS version 2.0 was designed from the start to bring single-user MS-DOS closer to Microsoft's multi-user offering. Therefore, various Unix-like features such as hierarchical directories, output indirection and batch processing were added to MS-DOS version 1 and appear in all later versions from 2.0 up. Even the commands and operator symbols are the same: cd for change directory, md for make directory, greater than and less than symbols to redirect file output, path names, and so on.

There's no need for an experienced MS-DOS user to get lost in Unix, except for one big factor — there are no disk volumes as such, and no drives A:, B: and C:. There are file systems instead, and these need to be mounted to be used, just like disk volumes.

As everywhere with Unix, that

needs some more explanation. Everything in Unix is a file, including input/output and storage devices like disk drives, terminals and keyboards, and when you boot the system, the Unix 'kernel' is loaded with details of a minimum set of files (including devices) needed to run the system at all. When you first boot and get the # prompt, typing the Unix equivalent of DIR—ls—will list the files and directories in the root directory of that minimum file set. All the files, sub-directories and sub-sub-directories from that root can be accessed in the usual MS-DOS-style way. But there may be other file systems on the system somewhere, on a separate disk drive perhaps, and to get at these you have to mount them onto your minimum root.

Examining the contents of a directory with ls (and another handy command, pwd, will tell you which directory you are currently in, including the path from the root directory) will bring another feeling of *déjà vu*. There are two directories, and... in every Unix directory, just as there are in every MS-DOS 2.xx directory and up. These are the codenames for the parent and child directories, the next ones up and down in the hierarchical tree, and can be used as in MS-DOS to switch between directories at the same level on the tree without having to go back to the root first. The pathnames now familiar from MS-DOS had their origin in Unix, and the only major difference in using them on the original is that the separator is an ordinary slash, /, rather than the MS-DOS backslash.

When you switch the Unix system from single-user to multi-user operation, a batch program — or 'shell' in Unix-speak — called *etc/rc* is run to mount a particular set of file systems on the single-user root. Naturally, the files can be run, read from or written to by the \$-prompt which is set by the super-user or system administrator.

Multi-tasking, the simultaneous running of programs, is inherent in Unix and is very easy to set up. For instance, if you have a big program to compile, all you need to type is 'CC filename&', followed by return; this will start the C compiler present in all Unix systems going on the file called 'filename', put a new 'process' number onscreen, and then return to the & or # prompt where you can start another background program, or process, running if you like. The number of processes you can have running at once is set by the hardware rather than Unix, and a warning comes up if you start getting into trouble with process numbers or more physical problems like lack of

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RAM or disk space.

In general, Unix need not be as daunting for the first-time user as it seems. The MS-DOS-like features mean that it's possible to get going without having to learn more than a couple of Unix's own peculiar commands, and unless you are a skilled programmer — in which case delving into paths, pipelines and input/output indirection should be an irresistible challenge — it should not be necessary to do more than that to run commercial applications.

But (there's always a but) someone on the system has to do the super-user job and be the system administrator. Someone has to understand Unix to maintain the multi-user operation properly, and learning that job from scratch is not simple. Unix is enormously powerful and flexible, but those same qualities make it dangerous in unskilled hands; particularly since Unix itself assumes you know what you are doing and doesn't question any of your actions. There is very little plain English in Unix's messages to its users, and there's much confusion.

Various manufacturers have tried to get round this by putting a front-end onto Unix, like a super-shell to surround the command-line interpreter shell, and even AT&T has felt it necessary to do that on its Unix PC. One of the Unix porting specialists in the UK, Root Computers, has also produced a front-end called RootMap

to help users navigate the choppy waters of the operating system.

To sum up, Unix System V in its raw form, as supplied by Sord on the M680 UX, does the difficult things like multi-tasking with a breathtaking ease, and makes the simple things like getting a full and understandable file directory more difficult and obscure than necessary.

Applications software

No applications software was supplied on the M680 UX — or at least, I couldn't find it in the hierarchical jungle — apart from applications like C compilers and childish games like Mastermind (oddly called Moo here) and Hunt the Wumpus. However, good Unix packages like Redwood's Uniplex integrated suite and Tetra's accounting packages are readily available these days. There isn't, perhaps, enough variety; but more Unix machines out on the streets will help. The falling prices of multi-user systems with the power to run Unix successfully, like the M680 UX, and the Comart Quad and the Jarogate Sprite (Benchtested in PCW, September), should also help to spread the multi-tasking gospel.

Performance

Obviously there was no Basic available on the machine, not when C is built-in and Fortran 77 is the next choice, so no Benchmarks could be taken. But the response was fast on

things like sorting file contents and directors, and anything containing a 16MHz 68020 would have trouble going slow. Of course, the acid test will be when several users each have several processor-and disk-hungry processes running simultaneously, and we'll have to wait for an exhibition demo to see that properly.

Documentation

As I've stated, the slim and cheaply-produced *User Guide* veers desperately between a cartoon character telling you not to drop fag-ash on your floppies, and an in-depth account of system administration and user accounting for big multi-user systems. However, there's enough information, just about, to get up and running.

And then there's the Unix System V manual, run through the Sord mill in Japan. The most charitable word to describe this is 'thorough'; like most MS-DOS reference manuals, it consists almost solely of command specifications, descriptions, options, and examples of use. Good if you want to check a detail, useless if you can't remember which command you need to search a file for a pattern of characters ('grep'? Surely not). Around two thirds of the two-inch-thick manual is made up of descriptions of system calls and various subroutines for programmers to call, drawing to mind Unix's history as a software developer's environment. Worthy, but not illuminating, and prospective users would be better advised to invest in a set of Unix textbooks for the beginner.

Prices

A Sord M680 UX system with a 68020 processor, 1Mbyte of RAM, two serial ports and no terminal will cost £3950.

Unix System V costs £1150, and an RT-2X terminal costs £1890.

Conclusion

There's no doubt that Sord has put together a solid and well-built machine that may look old-fashioned but has all the power of 1986 technology inside it. The problem for the reborn company will be the marketing of the machine. If it's to be a commercial system with first-time Unix users unpacking it and getting going themselves, then Sord had better think again. If it's to be a low-priced entry point to Unix, with hand-holding systems houses installing the applications and giving detailed training in system management, then the M680 UX should be a contender. For C programmers and operating system tinkerers, the M680 UX will be like Aladdin's Cave. **END**

Technical specifications

Processor:	Motorola 68020, 16MHz
RAM:	1Mbyte, expandable to 3Mbytes
ROM:	32k bootstrap loader
Mass storage:	One 5¼in floppy drive, 1.2Mbytes; One 5¼in Winchester drive, 20Mbytes
I/O:	Two RS232C ports, 75 to 19,200 baud
Terminal:	RT-2X, yellow phosphor, two serial ports, one parallel port, one light pen interface
Operating system:	Unix System V

In perspective

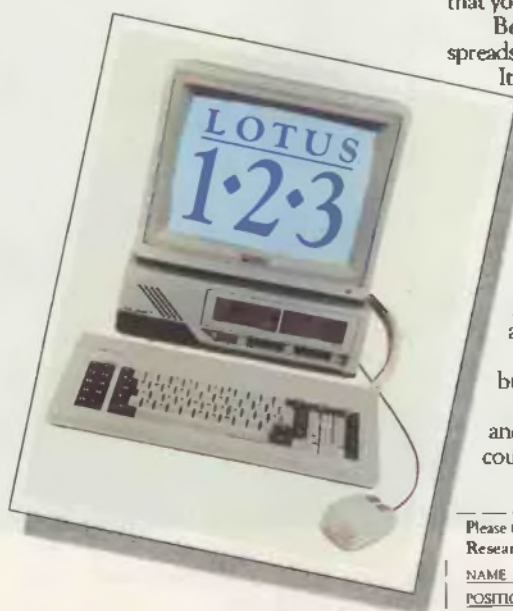
It's hard to put the M680 UX into context, since a machine this powerful and this cheap doesn't appear every day. Perhaps the best comparison would be with an IBM PC/AT running Xenix with three users, and the 68020 beats that out of sight on performance grounds. The forthcoming rush of systems built around the Intel iAPX 386 chip — BIOS writer Award's UK distributor already has one from Corvus — would give the 68020/Unix combination a better run for its money.

The problem, as ever, is to know whether Unix really will be the next multi-user, multi-tasking standard, and whether the applications will end up in a more attractive form. Remember, CP/M programs started out as terminal-based applications and the 1-2-3s we are seeing now developed out of that background. All we need is an industry standard and more and more powerful hardware, and that could happen to Unix too.

At least we know the hardware is on the way, and the M680 UX is riding the wave.



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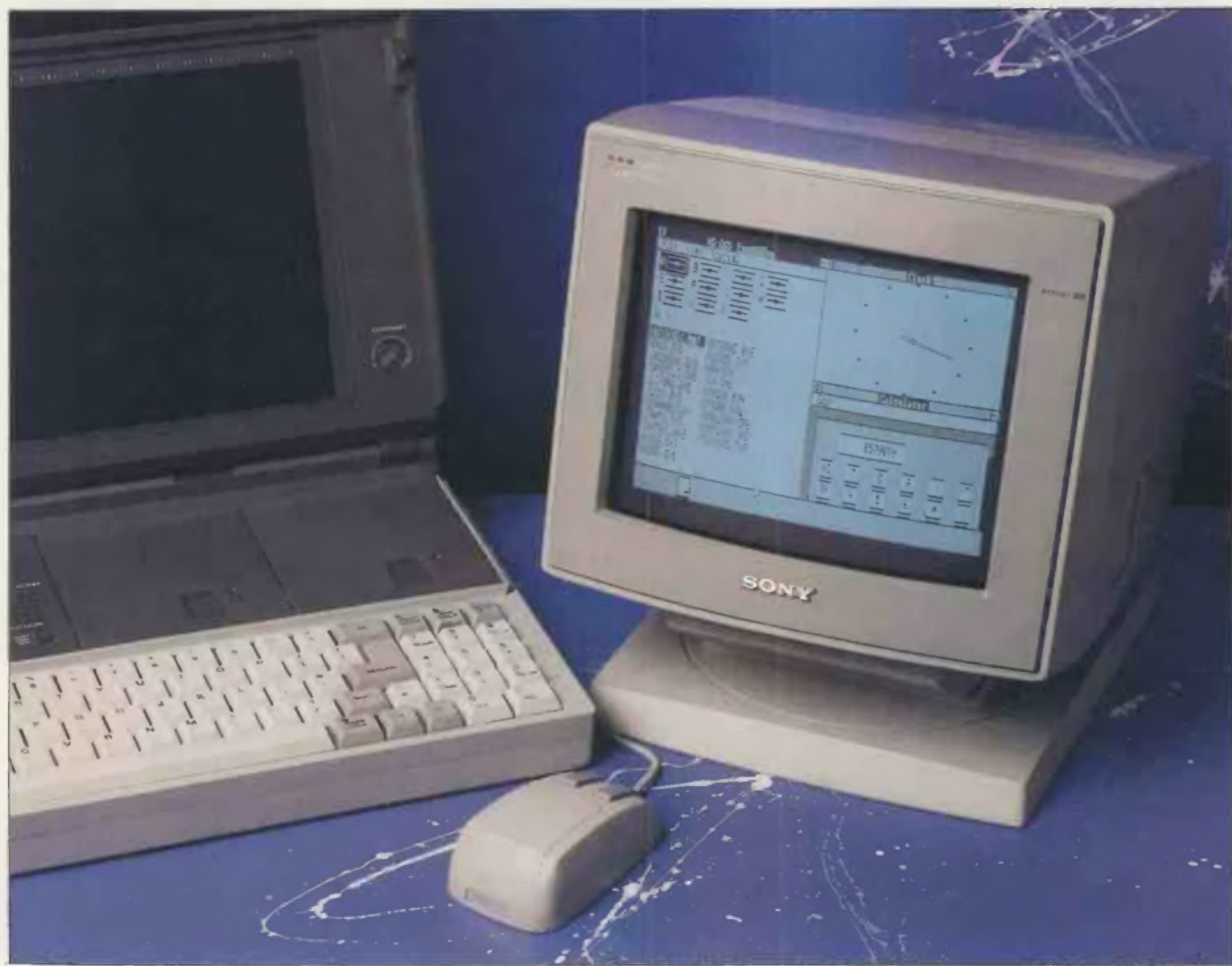
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Sony SMC-210

You may be tempted to ask what Sony is playing at by launching a run-of-the-mill, IBM-compatible desktop PC. Marketed as 'its first business computer', Peter Jackson feels the company has some serious explaining to do.



If any Japanese company were going to make a splash in the IBM-compatible PC market, the smart money would not have been on Sony.

Like some Hewlett-Packard of consumer electronics, Sony has a reputation for high-quality, innovative products that have always been priced and specified above the herd. The Walkman, the Watchman and

the Compact Diskman may have set standards, but it is other manufacturers in Hong Kong, Taiwan and Korea who have had and will get the volume sales.

The history of the company's previous computer products — a strange video-interfaced home machine, the SMC-770, and an overpriced MSX system called the Hit Bit — would have convinced most

manufacturers that micros were things to steer clear of, and for a long time now it has looked as though Sony's main activity in the micro business would be to supply its 3½in floppy drives and disks to everybody else.

So the SMC-210 is something of a surprise. It is an IBM-compatible PC in a market full of compatibles, and is priced around the mark set by its

competition. More, Sony is marketing the system as its 'first business computer' and is sounding serious about such necessary evils as appointing distributors and dealers, and arranging software and other support. The Sony name still has an upmarket ring to it, and its first venture into the PC market is worth a look.

Hardware

Although the SMC-210 will be seen as part of the PC-clone horde from the Far East, it would not be a Sony product if it did not have some original, if not unusual, features. Within the limits of the IBM industry standard, Sony has done various things with the machine to make it stand out — or buck the market, depending on your point of view.

First is the overall shape of the system unit. The SMC-210 is an almost-featureless wedge at first sight, in typical computer-industry dull grey with a dark grey band showing where the hinged lid meets the main body. The size of the case seems to indicate that the machine is intended to fit in a businessperson's briefcase; but the weight of the unit, at around 12lbs, seems to indicate that the briefcase would need to be pretty tough. A briefcase is necessary though, since there is no carrying handle anywhere on the machine despite its obvious pretensions to portability, and no cover for the exposed interface ports either.

Releasing the hinged lid involves operating two neat catches at the thin end of the wedge, and opening it reveals the keyboard and raises the LCD display built into the lid. As the lid rises, a metal panel at the rear slides back as part of a mechanism to ensure that the lid lies flush when closed.

Above the keyboard are the twin 3½in floppy drives, double-sided units that hold 720k each (the ones that Atari calls 1Mbyte drives). These are of the pop-up style first seen here on the Kaypro 2000 lapheld, and are raised into operating position by sliding catches on their tops.

Unusually, Sony has solved the normal lapheld function key problem by putting the 10 standard IBM PC keys in two columns of five to the left of the drives and above the main part of the keyboard. This keeps the function key pattern the same as that of the PC, meaning that existing PC users will not have to learn a new layout, but there seems no reason for the odd positioning. Putting these keys to the left of the main keyboard in IBM style would not have added much to the size of the box, and it looks as though this decision was taken to make sure that the unit was briefcase-sized. Considering that the machine is mains-only, this looks like a strange criterion to adopt.



The SMC-210's software runs as well on the LCD as it does on the CRT

The main keyboard itself has some strange features too. One column of the standard IBM PC numeric pad has gone, to help fit the necessary 83 keys in an area around an inch narrower than the same area on the PC keyboard, and the keys have been relocated. The PrtScr key replaces the SysReq reset key, which disappears, and the plus and minus keys migrate to the right of the space bar. Heavy users of the PC numeric pad will hate the Sony version violently. Strangest of all, the Escape key can now be found at the extreme top left of the Sony keyboard rather than the right, and the tilde key normally in the top left position on the PC now appears incongruously by the numeric cluster. Most PC users will hate that too.

Inside, the SMC-210 is a pretty standard set of IBM-compatible hardware. The processor is an 80C88, the CMOS version of the 8088 in the IBM PC, and runs at the same 4.77MHz clock rate as the standard IBM chip. There is 128k of RAM on the main board, along with 16k of ROM containing the ROM part of the BIOS (basic input/output system) and some diagnostic software, and 16k of video RAM. Also built-in, rather than optional as they are on the PC, are various interfaces. On the back panel are composite and RGB video outputs with standard phono and 9-way D connectors respectively; a serial mouse port using an unusual 13-way DIN socket; one RS232C and one

Centronics parallel printer port, using standard PC-type 25-way D connectors; another 25-way D to handle an optional, external 5¼in floppy drive; and a complex 60-way D connector bringing most of the standard IBM expansion bus signals out to the outside world. This last is due to hook-up to a Sony expansion box holding a 20Mbytes Winchester drive and three spare PC-compatible expansion slots, but the box is not yet available.

The final interface designed into the machine is sadly only available in the US and Japan. The system is intended to come with a built-in 300 baud auto-dialling direct-connect modem, and sockets are provided for a telephone cable and handset in the left-hand side of the box. On the review machine these were covered by a thin plastic panel, and removing this revealed that all the modem hardware had been removed. The British Approvals Board for Telecommunications has a lot to answer for.

Unfortunately a lot of this hardware specification had to be taken on trust or on testing, since when Sony says there are no user-serviceable parts inside the case, it means precisely that. Attempting to dismantle the machine involves the removal of dozens of screws in the right order, and getting down to the motherboard would involve the removal of everything else from the moulded system case. Not easy to get right, and easy to get catastrophically wrong; in the interests of continued



testing, I let it rest.

Readily accessible, though, was the limited expansion space inside the case. A hinged metal panel forming the rear part of the machine's top when the lid is closed opens easily to reveal a narrow PCB with 16 RAM chip sockets, the LCD cable socket, and two banks of DIP switches for system configuration.

That is all there is by way of expansion, and in the UK Sony is, in any case, filling up all those RAM spaces with 256kbit chips before shipping. Combined with the 128k on the motherboard, this brings the SMC-210 RAM up to the MS-DOS maximum of 640k. In the machine's original form the sockets could be filled with 64kbit chips to expand total memory to 256k, but that has now become academic thanks to falling chip prices.

The floppy drives, naturally enough, are Sony 3½in double-sided 80-track units holding, when format-

'Like some Hewlett-Packard of consumer electronics, Sony has a reputation for high-quality, innovative products that have always been priced and specified above the herd.'

ted, 720k each. This is the format now legitimised on IBM's PC Convertible, and used on every other PC-compatible fitted with 3½in drives, but you feel that Sony would have used it even if it had been the only company doing so. As with the RAM capacity, the standard machine in the UK has been enhanced and now includes two drives as standard. The original machine could be bought with one.

Sliding a catch on top of a drive springs a lid up to reveal the disk slot, and after inserting a disk, the lid has to be pushed down again for the drive to operate. One read/write head is left in the drive base when the lid is raised, while the other is built into the lid itself. This type of drive can be disconcerting, since the sound and vibration of the spinning disk and moving heads come from the bowels of the machine, and can sound ominously as though the drive is shaking itself to bits.

However, there were no disk errors at all during the test period, apart from one very temporary failure to find a sector.

The external 5¼in floppy drive supplied with the review system was a stock Cumana unit with its own power supply and lead, plugging straight into the appropriate port on the back of the SMC-210. The format, naturally, was IBM's standard 360k to allow software on 5¼in disks to be used or transferred to 3½in disks.

The disk allocations depend on the settings of the DIP switches under the metal lid; normally the 3½in floppy drives are A and B, while the external 5¼in floppy is C and D, but this can be reversed by setting the appropriate switch combination. This can be handy if copy-protected software in 5¼in format needs to find a key disk in drive A and nowhere else, but the main purpose is to allow external booting from the hard disk in the expansion unit (when available).

Other switch settings determine the display format and type, with 40-column and 80-column options on both CRT and LCD displays along with an option to use a permanent boldface character set. This last setting is intended to make the LCD screen easier to read, and overrides any setting of boldface by applications software. Unfortunately, the LCD and CRT screens cannot both be running at the same time, since another DIP switch determines which screen is to be used.

The external CRT supplied for review was a Sony Trinitron analogue RGB monitor on a tilt-and-swivel stand, which plugged directly into the back panel and was reminiscent of the Sony monitors badged up and supplied for ACT's ill-fated F range of low-end machines.

Also supplied was a Sony mouse, which plugged straight into the socket provided. Considering the unusual Sony mouse port it is unlikely that other mice, excluding those that hook into the serial port, can be used. The Sony mouse, in any case, is identical in size, shape and operation to the Microsoft mouse, although it has a rubber ball rather than Microsoft's unpleasant metal ball-bearing.

System software

The operating system supplied with the SMC-210 is MS-DOS 2.11, with all the utilities and extras normally supplied by Microsoft. This comes up following the ROM-based diagnostic program run at power-on, which includes a mercifully-brief RAM test — brief even with the full 640k installed. The IBM-compatible BIOS appears to have been written by Sony itself, since the common copyright mes-

sage from Phoenix or Award fails to appear at boot-time.

GWBasic version 2.02 and Microsoft Windows are also supplied, and that's what you get for the basic price. On the review machine though, Microsoft Windows was provided along with a variety of utilities and front-ends. The latter included Gazelle Systems' QDos and Windmill Software's PCBoss, both directory and file managers for MS-DOS, and Amber Systems' Sidekick-style set of pop-up utilities, Homebase (reviewed in the August issue). All worked well, and as advertised.

Applications software

Apart from the standard PC packages available in 3½in format, such as Lotus' 1-2-3 and Symphony, and Ashton-Tate's dBaseIII and Framework, the external 5¼in drive allowed several well- and ill-behaved PC packages to be tested on the machine. GEM would have run even-

'The overall impression is of a solid piece of machinery that does the job it was built to do, but could have its ergonomics improved to make it more attractive.'

tually, after copying all the files across from 5¼in to 3½in disks, if it hadn't been for Digital Research's old software-protection prejudice against non-IBM hardware. Word Perfect version 4.1 ran with no problems, once the drive letters had been sorted out to allow the package to find its ancillary files. The Powerbase and TAS+ databases ran. Even Borland's Sidekick, not noted for its good behaviour on non-IBM hardware, ran perfectly on both the CRT and LCD, only requiring some colour adjustments to make the highlighting visible on the LCD screen. The only problems were with Interface Technologies' SDS-XP Modula-2 compiler, which continually bombed out with a failure to find a keymap resource, and with old versions of Software Publishing's pfs: range of integrated software, which seemed to have trouble in producing visible screen colour combinations on the CRT screen.

As with all compatibles, particularly one whose physical structure is so far from the IBM PC, it's worth checking that the software you want to run will actually work.

In use

Setting up this composite system for use was not simple. Unlike IBM's PC Convertible or the original idea for the Apple IIc, the LCD screen cannot easily be unclipped when the CRT monitor is in use, although a non-LCD version of the SMC-210 is available. And as we have seen, the LCD and CRT cannot both be used simultaneously. So, the CRT monitor has to be placed to one side to be in clear sight, particularly considering the lowness of the tilt-and-swivel stand compared with the height of the Sony's wedge; the 5¼in floppy drive has to go to one side to be easily accessible; and the mouse has to be to one side to be handy to the hand. In the end, the system takes up more desk room than the equivalent IBM PC, with a more uncomfortable posture forced on the user.

In use the keyboard felt very light and very flat, with no real stepping of key rows. Since there is no way to tilt the system unit in use short of putting a book under the back, the keyboard is reminiscent of those on lapheld machines, and will not suit many touch-typists.

The LCD display is, however, a remarkable piece of work. It is one of the large square models which emerged first on the Data General One, but has been much improved over that machine's version. The main difference is its speed, even in its full bit-mapped resolution of 640 x 204 dots; I never really believed I would see Microsoft Windows running as well and as quickly on an LCD as it did on a normal monitor, but the Sony convinced me. All the software tested ran on the LCD as well as on the CRT, with tones replacing colours where necessary, and there was no degradation in performance. Compared with early laphelds like the eight-line Epson PX-8, it is rocket-propelled.

However, the usual visibility trouble with LCDs cropped up again. Without backlighting, which I personally find distracting, this is always going to be a problem in brightly-lit rooms where the contrast dwindles. The Sony screen's visibility is acceptable, but no more, and that is a pity.

The colour monitor, though, is as excellent as you would expect. The character set looks a trifle odd with permanent boldface characters selected, but the colours are bright and clean, and the resolution is sharp up to the SMC-210's maximum of 640 x 210. This resolution is, strangely, only available in monochrome, thanks to the limited amount of video RAM, and so Windows does not appear in its coloured glory. Naturally, at its lower four-colour resolution, the Sony monitor performs well in mimicking the IBM colour graphics adaptor display. One

unusual thing about the monitor is that the display is so flat that it actually looks concave, an optical illusion caused by the expectation of a convex look.

The overall impression is of a solid piece of machinery that does the job it was built to do, but could have its ergonomics improved to make it more attractive.

Prices

The Sony SMC-210 with 640k, an LCD and two 3½in floppy drives costs £1995 (this price includes MS-DOS 2.11, Basic and Microsoft Windows). The mouse costs £165 extra.

There are three monitors available: a 9in unit, £581; a 12in unit, £581; and a 14in unit, £499. The expansion box costs £595; the 5¼in floppy drive costs £225; and the 20Mbytes hard disk costs £429.

Conclusion

If it didn't sound so awful, the one machine to compare with the SMC-210 would be the Apricot Portable. Sony seems to be falling between two stools with its new machine; it is shaped like a lapheld, has the LCD and compact floppy drives of a

lapheld, and even has the space limitations and squashed-up keyboard of a lapheld. But it is mains powered, and works best hooked up to hefty external kit like the RGB monitor and the very useful external floppy drive.

Although the selection of interfaces provided as standard is good, and the performance, according to standard PC Benchmarks, is almost iden-

'Within the limits of the IBM industry standard, Sony has done various things with the machine to make it stand out . . .

tical to that of the basic PC, there is nothing outstanding about the SMC-210. It is comparable, if not with the much-maligned Portable, then with the lukewarmly-received PC Convertible.

That is hard to say when Sony's reputation is considered, but it has to be faced. The company will have an uphill job with its new baby, unless it builds a compact disk and head-phone add-on . . .

END

Technical specifications

Processor:	80C88, 4.77MHz
RAM:	640k
Video RAM:	16k
ROM:	24k, including character generator
Mass storage:	Twin 3½in floppy drives, 720k formatted
Display:	80 x 25, 40 x 25, or 640 x 204 on LCD display
Interfaces:	Mouse, external floppy drive, RS232C, Centronics parallel, expansion bus, analogue RGB, composite video
Keyboard:	83 keys
Mouse:	Microsoft-compatible, supplied as standard
Weight:	12lbs
Options:	9in RGB monitor, 640 x 210; External 5¼in floppy drive, 360k; Expansion box, with 20Mbytes hard disk and three IBM-compatible expansion slots

In perspective

The SMC-210 is well-made, and well-designed as a piece of consumer equipment. But doubts remain about its specification and its position in the market. It will compete with upmarket laphelds like the Toshiba 2100 and the Kaypro 2000, but offers nothing new except a wider variety of interface options, and does not have battery power to excuse the presence of the LCD.

Is it a lapheld? Is it a portable at all, despite the lack of a handle? If it is a desktop, why is the LCD not removable, and not capable of running usefully in parallel with the CRT? Why is there so little internal expansion available, and why is all there is taken up by memory that could have gone on the motherboard?

Sony should have asked itself these questions, since it is certain the customers will. And some of the elderly features of design — notably the lack of memory and the lowish screen resolutions — make it look as though Sony has been sitting on this machine for quite a while, trying to figure out what to do with it.

But the system with the LCD removed, and with an RGB monitor, makes a good, compact, and very compatible desktop computer. Now, if Sony were to put the hardware into a separate system box, keyboard and monitor configuration, and added some PC slots, it really might get somewhere . . . but that wouldn't be Sony's way.



SCREENTEST

A La Carte

A La Carte serves as a windows-based data management system for people who require basic office functions. It also has some rather unusual 'quirks', as Kathy Lang discovered.

Max file size	One mil rec
Max no fields	NS
Max digits	Eight
Special disk format?	
Link to ASCII files?	YV
Fixed rec structure?	Y
Amend rec structure?	CO
Link data files?	Y
No sort fields	One (UL)
Max key length (chars, fields)	NS, one
Data validation	N
Unique keys	Op
Store calculated data	NP
Store selectn criteria	P
† criterion/field?	Y
Browsing methods	AF
Reference manual+	**
Reference card+	N
Hotline?	F
Max record size (chars)	NS (screen 99*99)
Max field size	NS
Max prime key length	NS
File size fixed?	N
Data types	N,C,D,T
Fixed record length stored?	Y
No data files open	UL
No keys	One
Subsidiary indexes kept up-to-date?	NA
Screen formatting	P
Report formatting	P,I
Totals & statistics	N
Combining criteria	A,O
Wild code selection?	SW
Interaction methods	M,LT
Tutorial guide+	**
Online Help+	**

For a full explanation of abbreviations, see 'Database dossier', page 188, January 1985 issue

Fig 2 Features and constraints

There seems to be a growing trend in the market for data management systems to be powerful and sophisticated, but not necessarily very easy to use. A La Carte, a new product from a small British company, Clasma, is aimed squarely at those who want an easy system which will provide basic office facilities, not just for data management, but for word processing, diary and other 'desktop' facilities too. These features are provided through a series of windows, controlled by menus and function keys — Fig 1 shows the main menu. It's possible to display a document, one or a list of record cards, a diary page and a simple calculator onscreen at the same time, 'flip' between them, and cut and paste data between windows. You can also port information between the modules, in a limited way at present but with greater flexibility promised.

A La Carte runs on the IBM PC and the Apricot; a multi-user version is available, providing file and record locking on a variety of networks using the Netbios of DOS version 3.1. Other programs can be run from within A La Carte, making it possible to use the system as an umbrella to protect the naive user from what Guy Kewney calls 'A Mess Dos'. But is it really possible to provide a full-feature data management system in this fashion?

In this Screentest I'll concentrate on trying to answer that question, but references to the word processing and diary facilities are included where appropriate.

Constraints

The main features and constraints of A La Carte are shown in Fig 2; unlike most conventional systems, there are

no explicit limits on field length, but each record must lie within a window, maximum size 99 lines of 99 columns. In practice, you would want to keep records smaller than that, in order to show them conveniently within screen windows. Data types allowed are text, numeric, date and time. Several alternative date formats and display modes are provided.

File creation & indexing

Creating an A La Carte 'record card' is a simple, one-stage process. You use 'paint-a-screen' techniques to design the layout of the window containing the record card, and use the Create key (a function key) to prompt the creation of each field. The adjacent caption is assumed to be the field name by default (though you can change this if you wish), a useful time-saver. A variety of options is available at field creation, depending on the field type — those for text and numeric data are shown in Figs 3 and 4 respectively. They include some unusual features, such as the ability to increment a field from the value in the preceding record. There are no facilities for calculated fields. The length of a field is specified on the field definition screen, but it can also be altered with the cursor keys when you return to the data display window.

When the structure of a file has been set up, and data entered into it, the facilities for altering its structure without destroying the data are very limited, and do not extend to adding extra fields. To do this, you must create a new record template, and import into it the data from the original form. Nor does there seem to be a way to copy the structure of the original form for amendment.

The first field in the record card is automatically indexed, and at present you cannot index on any others, though Clasma has plans for extensions in this area.

Data entry & updating

Information is entered through the window designed during the file creation process. When records have been created, they can be retrieved for editing in two ways. You can recall any record by entering all or part of its key value. The file can then be browsed in entry order, or in order of the most recent sort or selection. Or you can set up selection criteria, as described under 'Selection & sorting'; a list of those retrieved is then displayed in a separate window, and you can choose which to show as individual records, or scroll through the list, or make a further selection from the current subset. When a record is retrieved, you can request a 'history' display, showing the date of creation, last editing and last viewing — A La Carte is full of thoughtful and unusual features like that.

In addition to entering data interactively, which also applies in word processing and diary modes, you can transfer information between any two windows by 'cutting' data from one area and pasting it in another.

There are at present no facilities directly aimed at updating a batch of records automatically, but with care you could build such a capability from A La Carte's macro facility.

Screen display

Within the data management system, records are displayed either using the record card format, or as a list. I couldn't find a way to choose which fields were displayed in the list, but I suspect this to be a defect of the manual rather than the software.

Printed reports

A 'quick print' feature allows you to print the contents of a window, including an individual record card, directly. Otherwise, report formats are created using the word processor, and then printed under the control of a print file. This allows you to print just a single 'report', normally a word-processed document, or to print the format once for every record in a cardfile or for a selection of records. Records may be printed sorted in the most recent sort order. Repeated formats include 'fill' fields, to provide both conventional report formats and a true mail-merge facility. While A La Carte does provide facilities for connecting related sets of records onscreen, there doesn't seem to be any way to produce reports based on data from more than one record file. And at present, report formats, including word-processed documents, are limited to 99 lines (though a report may, of

BM1	Time to add one new record	3 secs
BM2	Time to select record by primary key	3secs
BM3	Time to select record by secondary key	NP
BM4	Time to access 20 records from 1000 sequentially on three character field (same field as in BM2 key)	Inst/5 secs
BM5	Time to access record using wild code	2mins 4secs+
BM6	Time to index 1000 records on three-character field	NP
BM7	Time to sort 1000 records on five-character field	3mins 37secs
BM8	Time to calculate on one field per record and store result in record	NP
BM9	Time to total three fields over 1000 records	NP
BM10	Time to add one new field to each of 1000 records	NP as tested

Time to import a file of 1000 records: 14mins 43secs

Notes: NT=Not Tested; NP=Not Possible; +=including scrolling.
Where two times are given, first is access to first record, second is access to each subsequent record

Benchmark times recorded on an IBM/PC-XT/H

course, be much longer, since it may contain at least one line for each record in the card file).

Selection & sorting

Individual records may be selected through the key field; an unusual aspect of A La Carte is that you don't need to specify the file to look in for the index value. If there are several matches for the same value, you can scroll through to find the one you want — the list shows the file from which each instance comes. Although it is limited to the key field in each set of records, this facility could nevertheless provide a useful way to bring to your attention connections you had forgotten about or never known! The files to be searched are limited to those in the same masterfile group: initially, all files are in the same group, but you can set up others, and choose into which masterfile a card file is grouped.

Selections on non-key fields require you to set up a set of selection criteria. These can use the normal relational operators, may include wild codes anywhere in the comparison text, and be connected with AND or OR. These criteria are not normally saved, though you could store them using the macro facility.

When a set of records has been selected, you can execute a further selection to produce a further subset.

All or part of a file may be sorted on a single field. On subsequent sorts, data is disturbed only where necessary, so it's possible to build a multi-field sort by the (tedious) process of carrying out one sort for each field on which the file is to be ordered.

Calculation

Probably the greatest weakness of A La Carte at the moment is its lack of calculation facilities: you can't even total a field across all records. Clasma

has plans to provide some basic numeric features soon, but the product is clearly aimed at record-keeping applications rather than ever having any pretensions to heavy number-crunching.

Multiple files

The method of connecting related sets of records in A La Carte is beguilingly simple. Suppose you have a stock record card containing the name of the supplier, which is the key field in a separate file of suppliers' names and addresses. You just move the cursor to the supplier name field, press the Show (function) key, and the correct name and address record is displayed. Links can be made between any pair of records in the same masterfile, using a field which is the key to the target file. The process does not, of course, operate in reverse, unless the same field is the key in both files. (This approach is at once neat and easy to understand, and a source of some problems in Clasma's plans for extending the indexing capabilities, since the potential links could then be considerable, with consequent dangers both of slow response and of saturating the user with too much information.)

Tailoring

A La Carte provides a 'learn' facility, whereby you can create a macro that consists of a set of stored key sequences. Macros are normally activated by pressing the Macro key and then entering the macro name, but you can also change the assignment of one or more of the function keys to make them execute macros instead.

Another function key allows you to execute DOS commands and other programs from within A La Carte. There are indications in the manual that it's also possible to set up menus for users, thus making A La



SCREENTEST

Carte potentially capable of protecting the user entirely from DOS (the package certainly includes the ability to prevent users exiting to DOS), but this feature isn't documented.

Security

A version of A La Carte is available for networks, and some rudimentary password facilities are included to protect data from prying eyes.

Links with outside

Files can be imported into A La Carte from dBasell, or in ASCII comma-delimited format. The A La Carte record card format must be set up first, and fields are then read-in on a simple one-to-one basis. This is often the Achilles' heel of a data management system, but A La Carte's simple system works perfectly, if a little on the slow side — but it isn't something most people do very often.

Other features

The word processing module of A La Carte is quite basic, but none the less effective for that. You can set up a ruler with tabs and indents; both embed characters in the text, rather than being implemented with spaces as in WordStar, so the format changes when the ruler is altered. Simple editing facilities are provided, including block deletion, search and replace, and cut and paste a word, sentence, paragraph or page. Text can be emboldened, underlined and centred (these attributes are shown onscreen). There are no table facilities beyond tabs, nor any goodies such as a spelling checker — the module is clearly intended to com-

plement the data handling by providing simple letter-writing, plus a facility for designing reports and merging documents containing references to cardfile data.

A La Carte's diary facilities are at present rather limited, too. You can display each month onscreen, and enter a small amount of text into each day displayed, as well as into the month heading. Extra notes can be attached to each day as well; on a multi-user system, notes can be attached to the diaries of others. You can go directly to individual days or months, or you can search for particular text in a diary note, so it's possible to find, say, when you made an appointment with a particular individual even if you can't remember the day. And you can set the alarm, to go off either when a diary entry is activated (say, at 11 o'clock for an appointment at that time) or at a time set manually. (However, since MS-DOS doesn't provide true multi-tasking, the alarm won't ring while you are running another program under A La Carte).

You can link to the diary from a cardfile record. If the record shows a date within the range of the diary, moving the cursor to that field and pressing a function key moves you to

that date in the diary. But you can't, at present, move in the opposite direction — say, to display the details of the person with whom you are having lunch today. This improvement is likely to be provided quite soon.

A La Carte also provides a simple calculator facility, and you can cut and paste between it and other modules if necessary.

User image

The essence of using A La Carte is the window. Windows are used for everything — to display records and documents, to show menus, error messages, onscreen help, prompts — any situation in which A La Carte has to show the user some distinct data or control information. Application windows, and some A La Carte menu and prompt windows, can be sized, moved and displayed in a selection of colours. This is in the main achieved by pressing the Services key (a function key) to show yet another window, giving access to a variety of control options including those for manipulating windows; windows can be moved with the cursor keys used together with Ctrl. After using the Macintosh and GEM a lot, I usually find it hard to go back to being without the mouse for handling windows and pull-down (in this case, overlaid) menus, but it didn't cause as much pain as usual in A La Carte, where these features have been thoughtfully implemented.

Function keys are also used extensively, to allow you to move around within A La Carte without a lot of typing of commands. On the IBM PC, all 10 function keys, plus their shifted versions, are used, plus the cursor pad, while on the Apricot the function keys, the microscreen keys and the cursor pad meet the same needs. A keyboard template is provided. Sensible provision of function keys has to a large extent avoided the bane of menu-driven systems, which is the need to press an 'exit' key many times to return to the top level of menus. There's also an Undo key, which provides an 'abort' function in a variety of situations.

On the whole, I found A La Carte easy and pleasant to use. The only 'usability' feature I missed was the ability to expand a window to cover the whole screen: a record card, for example, has its maximum size set when it is created, and I could find no way to expand this subsequently. If you make it too big to begin with, then it obscures other windows in its normal mode, and must be reduced in size each time you want to see it alongside material from other application windows (such as another

Package	Cost (£)	Summary
A La Carte	395/595	Windows-based package covering data management, basic word processing including mail-merge, diary, calculator, and so on. Very easy to use, lots of neat touches. Can link records, retrieve on one key, macros: multi-user versions. No calculations at present
PC Promise	175	Powerful file and screen handling, using variable-length records. Allows design of tailored systems including screen help and error messages. Very easy to use (selection a bit clumsy). Selection, reporting not very powerful. Excellent value, British product
Perfect Filer II	149.95	An easy-to-use package for handling text information such as names and addresses, with good report and label formatting. Lack of calculations, and need to have editor or WP to construct formats, are serious drawbacks. WP & spreadsheet in same family
Q&A	250	Flat-file-with-lists, adequate searching, good indexing and data checking, screen and batch updating, good columnar reporting, large records and fields allowed. Includes word processor with mail-merge, also 'natural language' interface of limited value

Comparison of similar data management packages

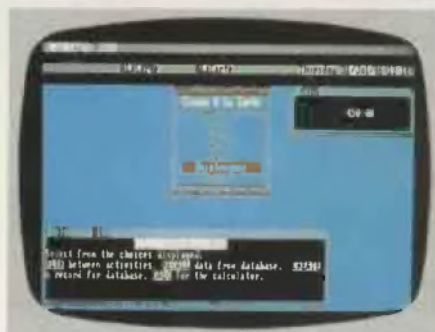


Fig 1 The A La Carte main menu

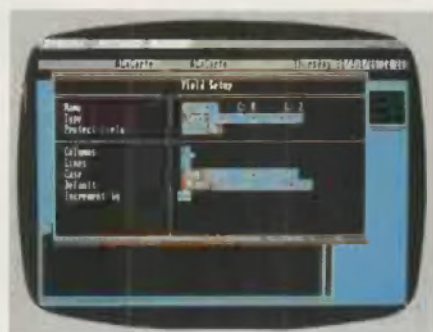


Fig 3 Defining a text field



Fig 4 Defining a numeric field

record card, or the diary). And if you make it a sensible size initially, you can't expand it to cover other current windows to reduce the distraction of other displays peeping out around the edges of your current work area. (You can, of course, get the window displayed on an otherwise virtually blank screen by closing all the other windows, but that's highly inconvenient.)

A La Carte has a number of other helpful control features. For example, all the function keys can be re-assigned to sequences of your choice. Data is automatically saved at regular intervals, and you can control the length of that interval.

When all current data has been saved, the word 'safe' appears at the top of the screen (I would have liked 'not safe' shown as well — but some people are just greedy). You can also deliberately save all data at any time by pressing a single function key, and then resume working without interruption.

A separate time delay, also under your control, governs more drastic action of your choice, ranging from turning down the brightness on the screen to save the CRT display, to obliging you to re-enter your password when you resume work. As A La Carte is intended to be used as an 'umbrella' product, which you would sensibly leave running all day, this would be a very useful protection, especially in a multi-user environment.

All in all, A La Carte is one of the

least 'bossy' packages I've seen, giving you a good range of controls over its use. And apart from a few minor quibbles, I found its user image helpful and appropriate. The main area of difficulty is the rather terse nature of some of the onscreen help, which is also not as context-sensitive as I would have liked. And the documentation leaves rather more to be desired.

Documentation

A La Carte comes with a slim, ring-bound manual, with just one chapter devoted to a short tutorial based on example files supplied with the package. The problems lie not so much in what is documented, but in finding what you want — the index is almost useless — and in the complete absence of some material. (On the whole, if I have to choose between comprehensiveness and comprehensibility, I'd opt for the former, but I'd rather have both, plus fast access to the right information). In part, this is due to the fact that A La Carte is still developing fast, and it's hard to keep the documentation up to the same level if you use a conventional approach. (I'm a fan of true top-down design myself, in which you start software development with at least an outline of the user documentation, but that's another story.) And a really helpful feature would be the provision of a 'road map', to show clearly the links between menus and function keys, and what features are provided where.

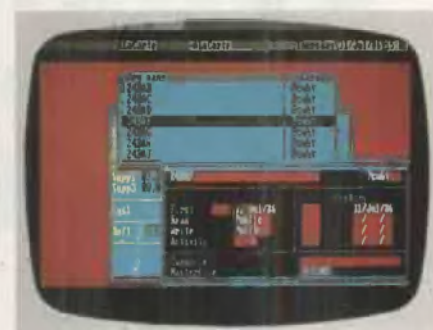


Fig 5 History of a record card

On the plus side, the material that is documented is easy to understand, and at least the manual isn't two feet thick — from talking to clients, I know that many of the excellent and well-produced tomes from larger software houses go unread, because their sheer bulk is so intimidating.

Conclusion

In its current stage of development, A La Carte is a useful product for people with essentially 'automated card index' applications, who also want to be able to carry out basic office functions such as simple word processing (letters, mainly) and diaries, and to use the package as an umbrella to provide a total environment for naive users. The absence of any calculation facilities within A La Carte's data management module would be a serious drawback for some; other promised enhancements, such as the ability to recall record cards from the diary, would enhance its power dramatically. The user image is good, though the documentation is incomplete.

A La Carte is a greedy program, running in 384k but needing 512k to work sensibly, using the ability to run other DOS programs from within the package, and at its best when run on a hard disk. (Though with hard-disk clones around the £1200 mark, perhaps that's no longer a problem.) It's a bit pricey for single-user systems, but the multi-user version, at £595 for the first and £145 for every subsequent workstation, is more realistically priced. I suspect it will be most popular as a means of hiding the nastiness of the operating system and the network from naive users, as well as providing them with basic office facilities. **END**

Summary

Supplier:	Clasma
Telephone:	(01) 994 4394
Cost:	£395/595
Systems:	PC,MS
Version reviewed:	1.5
Type:	N,S
Features:	Data management covers data entry including time fields, one-key or sequential retrieval, related records, 'learn' macros. Reports and letters through word processor (can also be used for letters and short documents). Diary, calculator. Multi-user versions
Drawbacks:	No calculation facilities. One key only per record
Ease of use:	Very good, especially for novices. Some limitations on sizing and movement of windows. Manual rather terse



Commodore Amiga & Sidecar

Following its launch in 1985, the Amiga has matured into a machine with an impressive technical specification. And, with the help of the impressive Sidecar, IBM compatibility comes to Commodore. Nick Walker assesses the capabilities of this potentially world-beating combination.

The Commodore Amiga is a truly wonderful machine. After a week spent playing with it, that's the conclusion most people come to. However, the Amiga purchaser will probably want to do more than play, and will certainly spend a good deal longer than a week with the machine.

After a lengthy wait, the Amiga is now available in volume in the UK. With a complete system selling for around £1600, it's very much in the business PC market, and must prove itself alongside machines such as the Apple Macintosh and the best IBM PC clones.

The Amiga was Benchtested in PCW in August 1985, but many things have transpired since then, and we thought it necessary to return to this interesting machine. In this review I'll approach the Amiga with regard to its suitability as a small-business machine.

In addition to a second look at the Amiga, I've also taken the opportunity of looking at a new peripheral for the Amiga — Sidecar. This is a plug-in box from Commodore that gives the Amiga IBM PC compatibility.

Hardware

The Amiga comes in a neat-looking

cream box which is big enough to look the part yet small enough to fit comfortably on a desk. You may laugh at the concept of a computer being 'big enough', but I'm firmly convinced that size is part of the reason for the IBM PC's success. Users with no technical knowledge, and many purchasers of business computers, still see size as synonymous with power.

The Amiga's collection of ports is comprehensive and includes a Centronics parallel printer port, an RS232C serial port, stereo audio output, a parallel disk interface, an RGB, and composite and modulated TV output. A two-button mouse plugs into one of two nine-pin D sockets on the side of the machine. Two Atari-style joysticks can also be used, providing the software is suitably configured.

Two means of system expansion are provided. At the front of the machine there's a removable panel that can take a 256k RAM expansion. The right-hand side houses the major expansion interface — an extension of the system bus. From this you can hang additional memory, a hard disk, a video frame grabber and also Sidecar, but I am disappointed that this is just an edge connector and not a proper socket.

The keyboard is separate and includes cursor keys, 10 function keys and a separate numeric keypad. It's a quality full-travel unit suitable for reasonably fast typing, though not in the IBM class. The inclusion of 10 function keys suggests that perhaps some credence was paid to the IBM PC in the Amiga's design; closer in-





A mono IBM PC window

spection reveals that this probably was the case, though there are some omissions such as 'Scroll Lock'.

One Sony-style 3½in drive is built-in, a second can be attached via the disk interface port and two more daisy-chained onto this, provided they have their own power supplies.

The display provided with the Amiga is now bundled with the system at no extra cost. It's a very high-quality unit with excellent resolution and colour definition; when you take the quality of this unit into consideration, the price of the Amiga seems reasonable.

The Amiga's is the sixth monitor I have seen this year to incorporate the Scart/Peritel socket; anyone who has yet to come across this — beware. The idea of a universal socket which takes all types of video signal is wonderful. Unfortunately, somewhere along the way, something has gone badly wrong. All six monitors are incompatible with each other. The Amiga monitor is no exception, and I couldn't get it to work with any of my existing Scart leads; neither would the Amiga's lead work with any other than the Amiga monitor.

The Amiga's processor is a Motorola 68000 running at 8MHz. Readers with some knowledge of the Amiga will know that this processor alone, although powerful, isn't responsible for the Amiga's reputation for power. Three custom chips named Denise, Agnus and Paula considerably enhance the capabilities of the machine. Denise handles display animation and sprites; Agnus deals with animation graphics; and Paula is a peripheral scheduler and interrupt handler which also takes a lot of the disk control work.

The most publicised function of these chips is that of a bit blitter. A bit blitter is a fast way of manipulating bit-maps; basically, it's a device which copies one chunk of memory to another using DMA (direct memory access). True — only a few simple logical operations can be applied, but this is all that's needed for the Amiga's many graphic animation procedures.

When the Amiga was first announced, the impression was given that the blitter was a general-purpose device capable of manipulat-



Flight Simulator in a window

ing any array of memory. After hearing of its capabilities, many software developers dreamed of ways which this blitter could be used in other applications such as matrix manipulation or spreadsheet recalculation. Unfortunately the Amiga's blitter is really just a graphics device; it acts on a block of up to 512k of memory that is hard-wired into the Amiga's memory map as the video RAM.

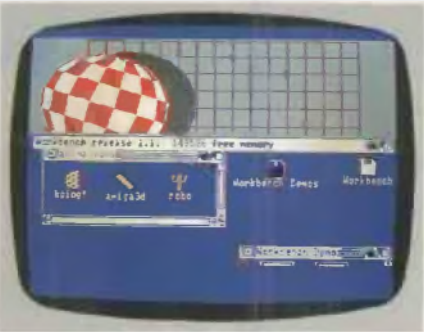
Agnus is for the most part responsible for the blitter, but this is not all the Amiga is capable of graphically. Denise and Agnus combined gives the most flexible system of sprites ever seen on a PC. For a detailed description of their operation, I refer readers to the Amiga Benchtest of August 1985.

Paula's *pièce de resistance* is sound generation, although it also handles the disk control aspects of the Amiga; its sound capabilities rival those of the Fairlight sound synthesiser. Paula can digitise any sound that's fed to the Amiga and reproduce it, either exactly or after internal manipulation. The best example I've seen of this is an early demonstration I witnessed. The Amiga digitised the sound of a milk bottle smashing, then the 1812 Overture was played using the transformed milk bottle sound as the lead 'instrument'.

Sidecar

Sidecar is a dull-looking cream box that attaches to the bus extension on the side of the Amiga. My initial impressions were not favourable, as three aspects of this box struck me as decidedly unattractive even before I had switched it on.

Firstly, there's the physical problems that occur in trying to connect Sidecar to the Amiga. In order to have Sidecar flush with the front of the Amiga, it's necessary to cover the joystick ports. To overcome this, Sidecar has two female nine-pin sockets whose only function is to bend the signal to the front of Sidecar. Trying to connect Sidecar is, therefore, very awkward, as you have to connect both the joystick ports and the bus extension — more than once I was in danger of breaking the PCB on the bus extension. Once installed the connection is by no means secure: there's no holding



The multi-tasking workbench

catch, and any small movement of the unit could result in the disconnection of the two units.

The second problem comes from the physical size of the system once Sidecar is connected. The total unit is wider than an IBM PC/AT and doesn't really sit comfortably on a desk.

One final criticism of Sidecar's design is that there's no continuation of the bus extension. Add a Sidecar to your Amiga and that's it — no other bus extension peripherals can be used. Most manufacturers, even at the Sinclair Spectrum level, continue to incorporate the bus extension in their systems so that other peripherals can be added.

No additional power lead is required when adding Sidecar. The three-pin power lead of the Amiga plugs into the back of Sidecar, and a power-out lead then supplies power to the computer. This is a simple way to provide the extra power that an IBM clone needs, without using a second power socket.

One internal 5¼in disk drive is included in Sidecar; another can be plugged in via the disk drive expansion at the rear. There are no other visible expansion facilities on Sidecar, although there is a facility to expand the Amiga's memory by up to 2Mbytes within the Sidecar box. This additional memory expansion is completely independent of the memory that is supplied for Sidecar's operation.

Sidecar's architecture is very much that of an ordinary PC-compatible — an Intel 8088 processor running at 4.77MHz and with 256k of RAM. Internal memory can be expanded to 640k, the upper limit of MS-DOS on an IBM clone. An empty socket on the PCB can take the 8087 maths co-processor.

Sidecar's keyboard input comes via the Amiga keyboard, and it's here that the greatest amount of incompatibility will occur. Most keystrokes can be generated, though in many cases it's a matter of trial and error as the keys are obviously not marked. I did, however, find it impossible to generate the '+' and '-' which normally reside at the far right of a PC keyboard. It's impossible to expand or contract a frame when using Ashton-Tate's Framework, so this



package is unusable.

The RS232 serial port and the Centronics parallel printer port of the Amiga are directly mapped onto Sidecar's architecture. This raises the interesting question of what happens when the two computers are running simultaneously and both want to access the same port? Currently, whichever system gets the port first, holds it until it's finished. Apparently, there's a new version of the ROM BIOS that will initiate a printer queue on the Amiga side; additionally, there will be a utility to enable you to lock the printer port for exclusive Sidecar use.

When data has to be passed between the two computers, it is transmitted via 128k of dual-ported memory which is attached to the Amiga's expansion bus. By using interrupts and semaphores (a form of software lock that stops simultaneous access of the same area of memory) to manage communications, both systems can operate completely independently of each other, with no noticeable degradation in performance.

The video portion of Sidecar is mapped directly into the dual-ported memory. As this mapping is transparent, the video display is compatible with applications which use the ROM BIOS and applications which work directly with the video memory. Meanwhile, software running on the Amiga can use the data contained in this memory to create windows that emulate IBM PC-compatible displays. The software provided with Sidecar emulates both the monochrome and colour graphics adaptors of standard Amiga windows. As the two adaptors use different portions of the interface memory, both displays can be emulated at the same time.

Sidecar provides three IBM PC-type expansion slots (Commodore will be offering a 20Mbytes hard disk-on-a-card to fit into one of these slots).

This hard disk, or any PC hard disk for that matter, can be partitioned, using MS-DOS in such a way as to offer hard disk storage for both the PC and the Amiga. Disk data is transferred directly from the hard disk controller to the interface memory by means of a DMA (direct memory access) device; when the Amiga accesses the hard disk, there's no loss of performance.

The internal 5¼in disk drive has a formatted capacity of 360k. An additional 5¼in disk drive, or a 3½in Amiga disk drive, can be attached via a drive extension connector on the back of Sidecar. The 3½in drive has a total formatted capacity of 720k. Using this drive, it's possible to access all IBM PC programs distributed on 3½in disk and transfer existing (non copy-protected) programs to 3½in disk.

It's good to see that the Amiga's disk drives are 'dumb' drives containing no machine-specific intelligence, unlike previous Commodore disk drives. The same external drive can be used as an Amiga drive or an IBM drive, as all the disk control information is on the relevant machine. Using a 765 disk controller (the same controller as used on the IBM PC), even copy-protected programs on 3½in disk can be run on Sidecar.

Most expansion cards I tried in Sidecar worked faultlessly. However, graphics cards, and cards which offer parallel and serial ports, cause conflicts with the existing capabilities of Sidecar. Rarely will the machine crash, but it does act very unpredictably with such cards installed. The only real problem here will be with users who want EGA (Enhanced Graphics Adaptor) abilities. A year

ago I would have dismissed this as a minority appeal, but with the decreasing cost of EGA hardware, there aren't many packages which only operate at their best when using an EGA. If you want this facility, your only hope will be to pester Commodore into writing an Amiga emulation — the Amiga is more than adequately qualified.

System software

The Amiga's software is a specially customised version of the system used on the Cambridge Ring Network. This operating system, originally called Tripos, was transferred to the Amiga for Commodore by the Bristol-based software house Metacomco. On the Amiga it is now, of course, known as AmigaDos.

The great advantage of this system is that it offers simple multi-tasking, so it's possible to run applications simultaneously. For example, it's quite possible to activate the printer, run a new application and continue your work. The printer will merrily churn away in the background as you work.

I call AmigaDos 'simple' not as a criticism, but as a compliment. In around 65k of object code, Metacomco has produced not only a multi-tasking operating system, but also a Macintosh-like WIMPs (windows, icons, mice and pull-down menus) environment — compare this with the likes of Windows or GEM (GEM isn't even multi-tasking) which gobble around 180k. AmigaDos also seems remarkably robust, probably because it has been running for several years on Cambridge Ring systems.

At present, the operating system is held on a disk called Kickstart. Eventually, it is intended for it to be in ROM. Owners of the non-ROM Amiga won't be able to upgrade to the ROM version as their machine has no sockets for the chips, but this isn't as bad as it sounds, as the early Amiga has a special bank of RAM for the operating system so it doesn't use any user memory. Once the operating system has been loaded, the Amiga write-protects this area of RAM, so if the Reset switch is pressed there's no need to reload Kickstart. The early disk-based Atari ST machines didn't have this capability.

After booting the Amiga with Kickstart, you'll be prompted for the workbench disk; this disk holds the code for the Amiga workbench, or desktop, called Intuition, which has also been designed by Metacomco. In operation, the desktop is very like that of the Apple Macintosh and in some respects improves on the Mac's interface. For example, the



Sidecar: unattractive perhaps, but it brings IBM compatibility to Commodore

two-button mouse uses the left button to select and the right button to operate, allowing you to pull down a menu and make more than one selection without the menu disappearing.

One aspect of Intuition I particularly liked was the 'memory meter' at the right-hand side of the menu bar. This indicates the amount of memory that is available to the user at any one time; you can decide whether you have sufficient memory to launch a new application while others are running.

Windowing systems such as Intuition are, to my mind, by far the most understandable interface for multi-tasking. Earlier multi-tasking operating systems such as Concurrent PC-DOS used switchable full screens, which meant you could only see one application at a time. With a windowing system, you can see the printer queue decreasing and the spreadsheet calculating as you merrily beaver away on another application.

Multi-user systems such as the Cambridge Ring have to have sophisticated security to protect the users from each other. I had been hoping that AmigaDos had inherited some of this security to protect its tasks, but sadly this isn't the case. If one task crashes, it will more than likely bring the whole system down with it. It's true that a crash on any other micro will bring down the whole system, but when you're running many tasks there's potentially so much more data to be lost. To be fair to Metacomco, it would be practically impossible to have this kind of security on the open architecture of the Motorola 68000. We just have to hope that rumours of an Amiga which will use the 68020 are true, as this chip has this type of task security built-in.

The logical operation of Intuition is excellent, and yet the more time I spent using it, the more I came to dislike it because of one thing — the screen design. The screen used for the desktop is decidedly low-resolution, and consequently the characters and icons are chunky and home computer-like. There is a control panel application which lets you set the colours to something less garish, but this can't compensate for the low resolution.

As it stands, I couldn't work comfortably with Intuition for more than half an hour. As far as I know there are no plans to blow the desktop into ROM, so presumably it would be possible to re-write Intuition with a better desktop. Please do so, Commodore; this simple change would make the machine much nicer to use.

In theory, it isn't necessary to use the desktop display, and for certain applications such as program development I find a desktop a real

hindrance. Early versions of the Amiga include a program which allows you to run a command-line interpreter of the kind found on MS-DOS and CP/M machines; sadly, this has been dropped on the final version, and is now only available at extra cost.

For a machine with such powerful supporting chips, the Amiga's performance in terms of raw computing power is not as spectacular as you might expect. An IBM PC/AT running Windows isn't much slower in the operation of its desktop and when running applications such as the notepad or a word processor. The exception to this is, of course, graphics applications; when it comes to animation, the Amiga can perform in seconds what would take the IBM hours (if the IBM was capable of it at all). Disk drive access in particular is very slow, due to the use of a disk organisation system presumably inherited from the Cambridge Ring. To be fair, the disk system is very flexible and offers a high degree of security — with a fast hard-disk, it would be excellent.

Several software packages have to be added to the workbench disk in order to boot Sidecar into full operation. During system power-up, the Amiga executes its normal bootstrap procedure. While this is happening, the PC performs an internal diagnostic program and then waits for the Amiga to tell it to proceed. After the Amiga has placed a copy of its PC interface code in the interface memory, it issues a signal to the PC to continue start-up. This allows the PC to install its local copy of the 8088 interface code. Once this has been done, inter-process communication is ready to run. All this is transparent to the user; all that is seen are two prompts — 'Looking for expansion system' and 'Installing expansion system'.

When Sidecar has booted up, there are two extra icons on the Amiga workbench labelled 'PC Monochrome' and 'PC Colour'. The default screen is monochrome, so the first thing to do is expand the monochrome PC screen by double-clicking on the icon. An ordinary Amiga window will be created, in which will be the prompt for the date that comes from MS-DOS booting. (All PC software is run from the monochrome screen, even if it's colour software.) After initiating a colour PC application, expanding the 'Colour PC' icon will open a colour screen containing the application.

I can't claim to have tried Sidecar truly extensively for compatibility, but I did try about 50 IBM programs, including Microsoft Flight Simulator, Lotus 1-2-3, GEM, Windows and SideKick — all except one (a public domain game called Bricks) ran OK. (There was also the problem with

Framework, as mentioned earlier, due to keyboard incompatibility.)

The interface between the Amiga and the PC is interrupt-driven. Both computers have system software which implements an interrupt handler, a function dispatcher, and the memory manager of the dual-ported interface memory. When a function is required by the other system, it's requested via an interrupt which may be generated under software or hardware control. The interrupt handler receives the interrupt and then dispatches information to the appropriate function. The hardware-encoded interrupts dispatch information required to emulate the PC display in standard Amiga windows, and for the PC to be able to use the Amiga's serial and parallel ports.

It's possible for custom software-defined software interrupts to be added to the system, allowing programs on either side of the interface to communicate with the other side in any way they please. This includes code execution by the other CPU, and full access to the functions of the operating system. For example, the PC can create a task in the Amiga's multi-tasking environment and then instruct the Amiga to add it to its task scheduler. To facilitate this flexible interface between programs, both interface drivers include routines to mutually administer the interface memory.

All function interrupts come in pairs. When a function is requested by one of the CPUs, an interrupt is generated. When the request has been satisfied, an acknowledgement is sent back using the same interrupt. Consequently, each CPU can issue a function request and then continue

Benchmarks

Old PCW Benchmarks

	Amiga	Sidecar
BM1	0.7	1.4
BM2	2.0	4.7
BM3	4.5	10.3
BM4	4.9	10.9
BM5	5.6	11.6
BM6	10.4	20.9
BM7	7.8	32.6
BM8	11.3	34.3

All timings in seconds. For a full listing of the old Benchmark programs, see page 185, January 1985 issue.

New PCW Benchmarks

	Amiga running AmigaBasic	Sidecar running GWBasic
intmath	1.7	6.0
realmath	2.7	7.9
triglof	6.7	44.7
textscrn	150.3	96.7
grafscrn	25.0	47.1
store	32.7	18.0



with other processing until the requested function is acknowledged. This allows asynchronous operation of both systems.

Both the monochrome and colour display capabilities of the PC are emulated in Amiga windows. The user activates a monochrome or colour display program from the Amiga workbench, after which the display is managed automatically. Whereas the PC monochrome monitor has only one display mode, the PC colour display is capable of many modes which change under application control. When these modes change on the PC, the Sidecar video emulator changes the display automatically. All PC graphics modes are emulated in real time on the Amiga. Text displays are full 80-column by 25-line, and the PC's special intensified and underlined text characters are supported.

The video emulation is totally PC-compatible. As the emulator gets its data directly from the PC display memory, it doesn't matter what tricks or shortcut applications are used to create their PC displays. All the displays I tried, including windowing system pop-up programs, were faithfully reproduced on the Amiga.

The emulation window comes with a complement of menu functions which allow the user to modify and control the PC display in ways that are unavailable to PC owners. New features include capabilities such as the ability to modify the PC display's colours, and the ability to mimic multi-tasking displays by opening multiple windows into the video display, and then freezing the information contained on one page by simply switching to another page. Also,

an auxiliary tool is provided which allows a real-time rendition of the PC clock to be displayed in a small Amiga window.

After modifying the emulation environment, the user can save the current set-up and have it recreated automatically the next time Sidecar is used.

Applications software

Although Commodore doesn't like comparisons of the Atari ST and the Amiga, both machines were released at approximately the same time and both are 68000-based personal computers. It's obvious, when comparing the number of applications for the ST with the number available for the Amiga, that the Amiga is lagging behind.

I'm still waiting for a decent word processor, database or spreadsheet for the Amiga. As you might expect, software is available in one area — graphics. Packages such as Deluxe Paint and Deluxe Video from Electronic Arts are setting new standards for the use of the Amiga as a creative image manipulator. There's also a good range of system development software, including a C compiler, Lisp, a Modula-2 compiler and a programmer's toolkit.

There are a number of small packages which are bundled with the Amiga, including a clock, a notepad, a calculator and a psychedelic demo that should appeal to Jeff Minter fans. The only application that you

could call in any way 'major' is Amiga Basic.

Documentation

The Amiga comes with a beautifully produced 275-page manual, containing lots of colour pictures and nice, clear, lucid descriptions. The problem is that it doesn't tell you much. After reading this manual, you'll be left with the impression that the Amiga is no more special than an IBM PC running GEM. What the manual needs is a section detailing the capabilities of the Amiga, and a section going some way into explaining the technicalities of the system. It does, however, include a decent index, pin-outs of all the sockets, and a good Basic reference section.

To be fair to Commodore, there's an excellent range of seven manuals which detail all aspects of the system. These manuals are available at extra cost.

Prices

The basic Amiga system costs £1475 for a 256k system with a colour monitor; with a second disk drive, the cost is £1675. At the time of writing, no price was available for Sidecar, and it was a tough job to prise an approximation out of Commodore. After considerable hassle from a source who didn't want to be quoted, I got a very rough quote of £750.

Conclusion

So the Amiga is a wonderful machine; the question is, what do you do with it? The Amiga is in danger of repeating history and going the way of the Atari 800. The Atari 800 was launched as a rival for the Apple II which was selling as the small-business system of the day. Unfortunately, the public latched on to the 800's graphics and sound capabilities, and bought the machine as a top-quality games console.

I remain unconvinced that the Amiga has sold in any numbers to anyone other than the richest home computer users, and hacker types who are overwhelmed by the machine's technical specifications. Commodore's current strategy is to sell the machine into vertical markets such as design — what a shame.

Sidecar is a truly excellent IBM-compatible peripheral for the Amiga, and it's obvious that a lot of thought has gone into making something more than just a bolt-on IBM clone. However, with Amstrad's launch of a 512k IBM clone at £399 including monitor (see Benchtest, page 128), it's going to be very difficult to justify the price of Sidecar unless Commodore settles on something around £250.

END

Technical specifications

Amiga	
Processor:	Motorola 68000 running at 8MHz
ROM:	192k
RAM:	256k minimum, expandable to 512k internally or 8Mbytes externally
Mass storage:	Internal 800k, 3½in floppy; external 3½in, 5¼in and hard disks available
Keyboard:	89-key full-stroke
Size:	4.75ins x 17.5ins x 13ins (system unit)
I/O:	Serial, parallel, video out and in, stereo sound, two joystick ports
DOS:	AmigaDos (a version of Tripos)
Bundled software:	Basic, desk accessories
Sidecar	
Processor:	Intel 8088 running 4.77MHz
ROM:	32k
RAM:	256k expandable to 640k internally
Mass storage:	Internal 5¼in, 360k drive; external 5¼in and 3½in disks, and 20Mbytes hard card available
Keyboard:	Uses the Amiga's
Size:	16.5ins x 10ins x 6.5ins
I/O:	Second disk port; uses ports on the Amiga
DOS:	MS-DOS 2.2

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SwyftWare

Apple 11e and 11c users can soften the blows dealt by these micros' operating systems with the help of the multi-faceted Swyftware environment. But quality suffers for quantity, as Stephen Applebaum discovered.

SwyftWare is a package designed by Jef Raskin to run on the Apple 11e and 11c micros. Its purpose is to screen users from the horrors of the computer's operating system, by providing a complete and friendly environment in which word processing, arithmetical calculations, information retrieval, communications and Basic programming are linked together, and can be accessed at the touch of a button, without leaving SwyftWare. There are in fact 10 buttons, but don't worry about that now. Just be sure that SwyftWare can do a lot, while expecting very little of you.

This Checkout isn't the first time SwyftWare has been mentioned in the pages of PCW. Guy Kewney ('Newsprint', June) has already enthused over its multifarious facets and speed, and even alluded to it being the presage for a new era in data processing.

There are two versions of SwyftWare. One, for both the Apple 11e and 11c, is disk-based and comes as a package containing two disks, a 141-page manual, and 10 peel-off-n-stick-on labels; the latter being for the keys Raskin has designated as having special functions. (Apple 11e owners note: your computer must be equipped with an 80-column card before being able to use SwyftWare).

The second version of SwyftWare is compatible with Apple 11es only, as it comes on a card, the so-called SwyftCard, with SwyftWare in ROM.

Word processing

SwyftWare's word processor is a long way from the likes of WordStar, and closer in operation to Wordwise and View for the BBC, both of which use control characters to format text onscreen and set-up the system for printing. The same goes for SwyftWare, although with this program the results are much more instant.

Where SwyftWare's word processor really comes into its own is with

'LEAP' and 'CREEP', two forms of cursor movement that have been introduced to obviate the need for either a mouse or cursor keys. Both LEAP and CREEP are activated via two of the 10 special function keys mentioned earlier, in this case the two apple keys lying to the immediate right and left of the space bar on the Apple keyboard. The open apple key, the one on the right, is labelled 'LEAP forward', while the left-hand one, the solid apple key, is marked 'LEAP backward'.

LEAPing is the ability to jump through vast amounts of text very quickly. When you perform a LEAP, you'll obviously have some particular landing position or target in mind; SwyftWare lets you select a target character to mark where the LEAP will end.

To leap forward, you hold down the right-hand apple key, then quickly tap the character that will constitute the target. Almost instantly, the cursor disappears before re-emerging at the nearest instance of the target character.

If you're not satisfied with the result of the leap, you can undo it by changing the target to something not appearing in the text, before letting go of the LEAP key. The manual suggests 'xxx'.

The leap just described is accurate in that it will go to the first instance of a character. A more precise method, avoiding spurious targets, is to input a combination of letters, so the cursor will jump to a specific word. You needn't type the whole word, just the first two letters. For instance, say the word you wanted to leap to was 'SwyftWare'; your target pattern would be 'sw' or 'swy'. Once again the leap ends at the nearest instance of the target, but as a pattern is likely to be duplicated elsewhere, there is little possibility of a leap being completed unsatisfactorily. And it doesn't matter whether you

use upper or lower-case letters in your target pattern — SwyftWare can find any combination.

The characters you use in a target pattern must be in the set of characters recognised by SwyftWare. There are 97 in all, which include all the letters of the alphabet (upper and lower-case), the numbers 0 to 9, various punctuation marks, special symbols such as '@', '%', '&', 'o', and space, return and page.

The advantage of SwyftWare identifying things like a full-stop and space means you can select either as a target character, and leap from sentence to sentence. Also, as paragraphs are generally separated by two returns, they can be leaped between too.

CREEPING is the second, and somewhat less interesting, mode of cursor movement. Instead of allowing you to bound across vast areas of text, 'CREEP' enables you to move from character to character.

LEAPing and CREEPing are both useful and effective ways of skittering about a document's contents quickly, and are especially useful editing facilities.

SwyftWare's cursor has two parts: a highlight, and a simple cursor. The former is used for preparing text for deletion, whereas the latter simply tells you where the next character to be typed will go. If both of these are on the same character, text to the right will be deleted when the DELETE key is pressed. The opposite is true when they're split. Similarly, large chunks of text can be deleted by holding down both apple keys simultaneously, so extending the highlight across a group of characters rather than just one. Pressing the DELETE key clears any highlighted text.

Highlighted text need not be deleted, but can be lifted and inserted elsewhere using the INSERT command. INSERT is found on the front

of the 'A' key, and is accessed by pressing it in conjunction with CTRL/USE FRONT. A piece of text can be inserted as often as you like, being erased from memory only when you select another slice of the document.

When a document has been edited to your satisfaction, you'll no doubt want to format it. To make things easy, SwyftWare has nine control codes to change different aspects of the way your document is laid out; these control codes take the form of two letters and a % sign. A control character on its own can't make any changes to the way text is disposed, but must be activated by the CALC command. CALC is a factotum function that does everything from initialising control codes to simple calculations to storing often-used phrases.

As a means of performing calculations, CALC is little more than a simple calculator. However, it does enable you to perform arithmetical calculations even when word processing. All you have to do is type a sum in the following format: ?3+2; highlight it, then press CALC together with USE FRONT. The answer appears and the sum, which remains highlighted, can be erased with Delete.

Because SwyftWare is an environment and not a word processor *per se*, you can write and execute Basic programs even while you're writing text. There is no difference between writing a program in SwyftWare or outside it. But rather than just running a program with the command RUN, as you'd expect to be able to do, you once again use the CALC function after having highlighted the whole program. The program listing remains highlighted when it has finished running to allow deletion.

No word processor gives you the freedom to write and execute Basic programs, but instead leaves you having to exit it after having saved your text. The only similar program I know of is one that runs on the Macintosh, the Switcher, which allows you to open several windows, each of which contains a different function. That is, one might let you paint with MacPaint, another write text, another write Basic programs, and so on. None, however, are as quick and easy to use as SwyftWare.

CALC and INSERT are both functions activated via the USE FRONT key. Two further functions are PRINT and DISK.

PRINT, as you'd expect, is used to output text to a printer. Like most of the other commands, PRINT operates on highlighted text, giving you the ability to print as much or as little as you like. However, jumping from the beginning to the end of a document outputs it all. Unfortunately, the one thing PRINT can't do is automatically overcome the disparity in specifica-



Highlighted text

tions of different manufacturers' printers. But don't despair: the set-up routines for 60 popular printers have been included in the SwyftWare manual, so you shouldn't have too many problems getting your printer to work.

DISK is an unusual function in that it loads and saves text, as well as formats your disks. Formatting is a tiresome procedure, as you have to wait for the computer to format your disk before being able to write to it. SwyftWare avoids that by actually formatting at the same time as it writes; thus a new disk can be used straight from the box.

The DISK command not only loads SwyftWare files. Any Apple program can be loaded and run, though you must reset the system before going back into SwyftWare. A point worth mentioning here is that SwyftWare files cannot be read under ProDOS and vice versa, unless they have been converted to one or the other format using a conversion program supplied with the SwyftWare package. To perform a conversion you must have either an Apple 11e with two disk drives, an Apple 11e with a single disk drive and extended 80-column card, or an Apple 11c.

Communications

The text you produce with SwyftWare might very well be for a letter. Many people are becoming attuned to electronic communication, whereby they send their 'mail' down the telephone line to another computer. If you have a modem and a serial card, you can do the same using SwyftWare's SEND command. And you're not confined to 'talking' to other SwyftWare users: you can communicate with virtually any online system.

Like all SwyftWare's functions, SEND can be operated without having to leave the SwyftWare environment. But before you can do anything, you will need to prepare the system to communicate. For a 'friendly' package, SwyftWare's communications functions are somewhat hard to access.

Firstly, you need to make sure that all the DIP-switches on the serial card are correctly set. Then you have to do the same for the modem. Now you can get down to sending your text, but not until you've made sure



A Basic program within SwyftWare

your system is communicating at the correct baud rate. Both these things can be done via CALCed control characters. For instance, to put a return at the end of every line you type LE%=29 (CALC), while the baud rate is set with SE%.

The computer dials with the command ATDP, followed by the number. Highlighting ATDP and the LE% and SE% functions, and pressing SEND, puts you online.

One of the most effective parts of SwyftWare's communications software is the ability to edit text while it is being received. As SwyftWare is a complete environment, incoming text isn't shunted off into a separate file, from where it has to be loaded later.

Lax security is a problem that has put many people off going online. In this respect, SwyftWare is very secure. Even if you leave your system turned on, with an auto-answer modem attached, other people can only leave messages, not access data. Only by pressing CTRL E, to which SwyftWare will reply 'SwyftCard 1131', can anyone even discover whether your system is working.

The least impressive of SwyftWare's capabilities is information retrieval, which is little more than a jumped-up search function involving LEAP. Text retrieval, in the context of SwyftWare, is being able to LEAP to a particular name, number, or whatever, in a list of many.

Conclusion

At first sight, SwyftWare is an impressive package which does a lot. There aren't many systems that let you perform word processing and simple calculations, write and execute programs, and communicate via a modem, all from the same environment. However, although SwyftWare can do so much, it only does it at a very basic level. Its word processing power is inferior to a dedicated program, while information retrieval is just a simple search.

What SwyftWare does offer, though, is an easy and simple introduction to computers which will no doubt be invaluable to computer novices, as well as to home users who don't want to spend a lot of money on several different packages, only half of whose functions he or she will use.

END

New tricks for old mice

Dick Pountain explains how you can integrate the mouse with your applications by programming it to emulate the keyboard, using the Microsoft mouse as his example.

The mouse is rapidly progressing from being an avant-garde accessory, redolent of the research lab, to a widely used pointing device for ordinary PC users. If you doubt this, consider the fact that all the new mass-market 68000-based PCs (the Macintosh, Atari ST and Amiga) come with a mouse as standard fitting, as does the new Amstrad PC clone reviewed in this issue (see the Benchtest on page 128). What's more, any owner of an IBM PC or clone can purchase one of a choice of mice, as surveyed in PCW recently (see August issue, page 122).

There has been much debate about the utility of mice in non-graphic applications with opinions ranging, as is usual in personal computing, from drooling enthusiasm to outright hatred. I fail squarely in the middle of this debate. I've been using the Microsoft mouse for more than two years now on IBM PCs, and as a result have been able to form what I hope is a balanced opinion.

The fact that the Microsoft mouse is an afterthought for the PC, and is not directly supported by the operating system, is not a bad thing. You can program the mouse to emulate the keyboard in more or less sophisticated ways using Microsoft software, which means that you can choose at what level to integrate the mouse with your applications.

My own experience has been that I started out by using large numbers of pull-down menus in an attempt to 'mousify' all the commands of my main applications (which, for a technical writer, means mainly word processors and programming systems). Over time, however, I became more and more irritated by layers of pull-down menus, and found myself strip-

ping away features one by one until I had a set of minimal commands that could be assigned to the mouse buttons alone.

Eventually I discovered that the only functions I really wanted to use the mouse for were moving through text rapidly (as a substitute for the cursor keys), and selecting blocks of text for moving, cutting and pasting, or whatever. For these purposes I find the mouse absolutely indispensable; going back to using the cursor keys would be as traumatic as returning to cassette instead of disk. For all the other commands, function keys are much faster and more convenient than the mouse (assuming, of course, that the application you're using is well-designed).

After passing through this minimalist phase, I discovered one more thing that I wanted to do with the mouse, namely to draw diagrams. In the sort of technical writing I do, it's frequently necessary to illustrate a point using a simple block diagram. I'm not talking here about great works of art with air-brushed shading, but merely boxes, joined by lines, containing text.

At one time I would have had to draw such boxes separately using a pen and ruler. Later it became possible to use box graphics characters (such as those on the IBM PC and many other computers), but it was an awkward and time-consuming business to design them with the cursor keys. What I wanted was the ability to design and draw diagrams straight into my text, using my ordinary word processor, immediately the thought occurred, just as if they were ordinary words. I've achieved this in a modest but effective way using the Microsoft mouse.

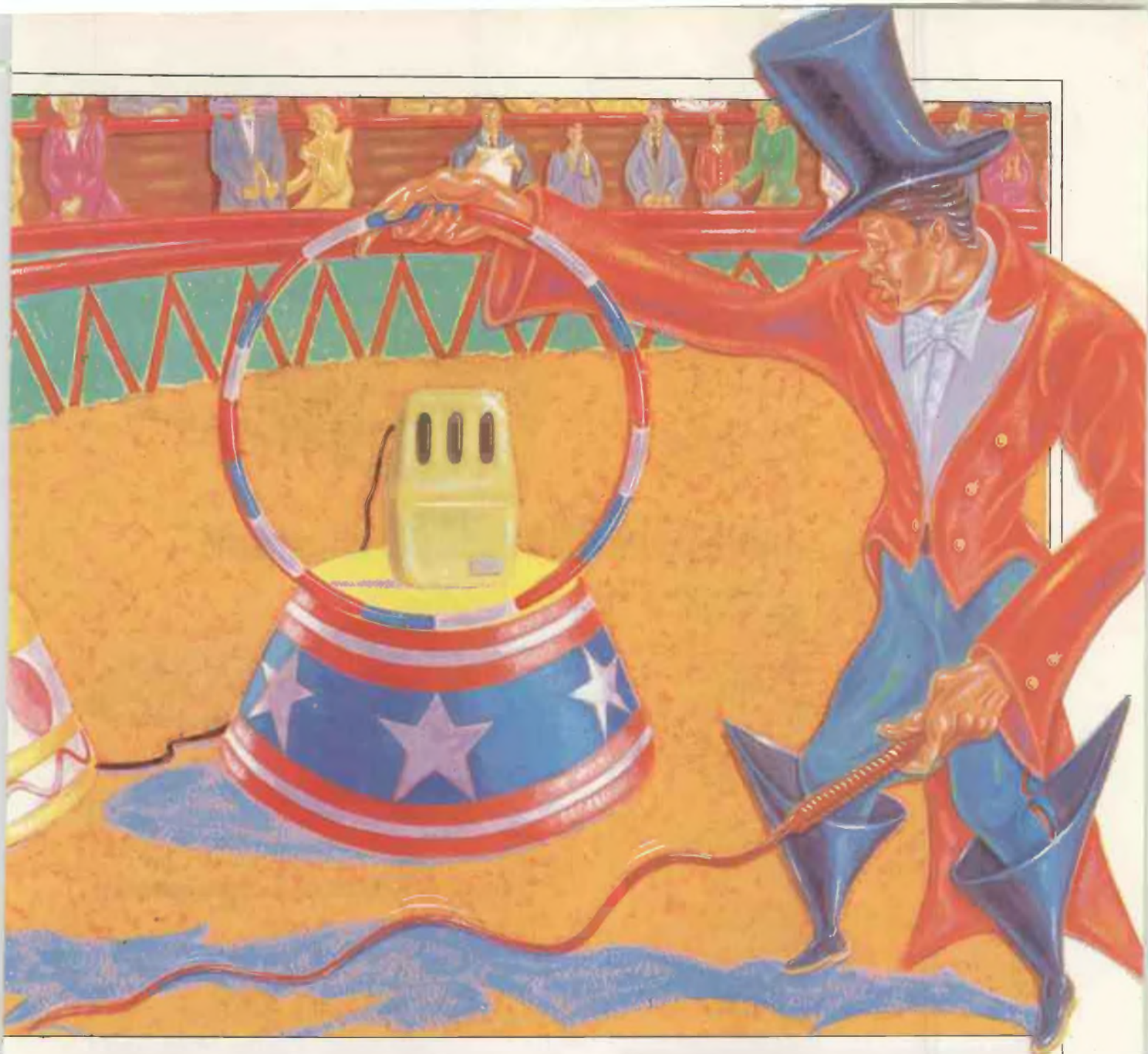


MAKEMENU

The Microsoft mouse comes in two versions, one of which plugs into a serial port, the other using an interface board which plugs into an expansion slot. In both cases the mouse is coupled to PC-DOS by driver software which has to be loaded when you boot the computer. Under DOS 1 this meant running a program called MOUSE.COM, while under DOS 2 and 3 it requires a `DEVICE=MOUSE.SYS` statement to be put into the CONFIG.SYS file which loads external device drivers.

In neither case will this make your programs respond to the mouse unless they were designed to use it, and very few are (those are mostly CAD and drawing programs). All that MOUSE.SYS does is to put in place the software links that enable the mouse position and status to be read via DOS. Actually doing the reading is another matter.

For the minority of people who



write their own applications, mouse support can be included by reading the mouse directly. Microsoft supplies a library which can be linked to programs written in the company's C, Pascal, Fortran and compiled Basic, and many other languages like Borland International's Turbo Pascal now support the Microsoft and other mice. You can also read the mouse directly from interpreted Basic, and from assembler programs by using software interrupt 51. The mouse can be programmed in either the text or graphics mode of the PC. In text mode cursor movement will be in units of one character position, and the cursor will be a normal flashing block. In graphics mode the cursor moves smoothly by single pixels, and you can program fancy cursors (such as arrows, hourglasses, crosses and little hands) as on the Macintosh or in GEM. However, this article is not about programming the mouse at this level (the *Microsoft Mouse*

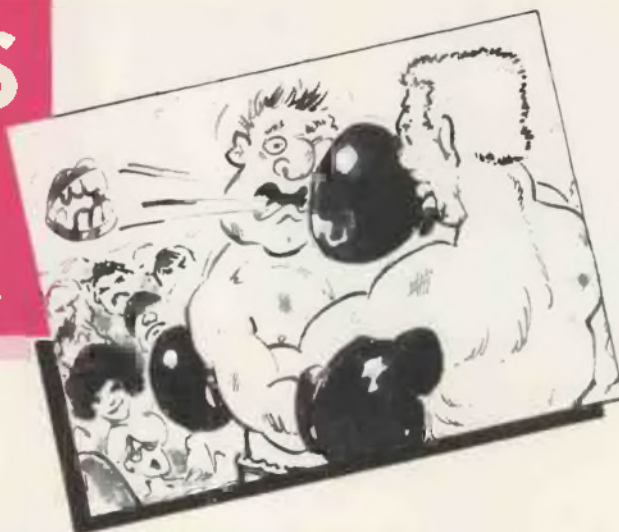
Manual covers it reasonably well).

For the vast majority of people who use packaged applications, there is a relatively easy way to integrate the mouse with software that was not designed to use it. Microsoft supplies with the mouse two programs, called MAKEMENU.EXE and MENU.COM, which enable you to write programs in a high-level Mouse Menu 'language' that makes the mouse emulate keystrokes typed at the keyboard and provides a very easy way to build pull-down menus. Such programs only work, of course, in text mode; a keystroke on the IBM PC produces a character code, not a graphic object. This is fine since all the most popular PC applications, such as spreadsheets, word processors and databases, run in text mode. The exceptions are drawing programs and programs written to support the GEM or MS-Windows environments, and these should have mouse support already built-in.

MAKEMENU is actually a special-purpose macro-assembler which accepts a Mouse Menu source program, written as an ordinary text file using a word processor, and turns it into a machine code program. MENU.COM then loads such a program and makes it stay resident, even when an application is loaded on top of it; it sits in the background reading the mouse, and translating its movements and button presses into the required keystrokes. Any application running on top of the mouse program thinks that it is receiving commands from the keyboard.

Since all applications programs are ultimately controlled by keystrokes, you can in principle do everything with the mouse, given sufficient menus. What I want to examine here are the design decisions and performance considerations that are needed to use MAKEMENU effectively. There isn't room, or the need, to describe the Mouse Menu language

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PROGRAMMING

in full; Microsoft's manual does that well enough. Suffice it to say that it has a very simple structure with no provision for looping, the only form of control being a jump to a label. However, some of the keyword commands are extremely powerful — for example, creating a whole pull-down menu, complete with all the cursor movements necessary to make selections from it.

Simple movement

The simplest possible mouse program is one to merely make the mouse move the cursor. Even here, though, there is a design decision to make. The first mouse program I wrote was to drive WordStar, and without thinking I chose to make the mouse movements emulate the WordStar cursor movement commands 'E', 'S', 'D' and 'X'. It worked after a fashion, but of course it did not work with any other program which used different control codes, thus forcing me to write a different program for every application I used.

The obvious (in hindsight) choice is to make the mouse emulate the IBM arrow cursor keys themselves. The mouse will then drive the cursor in any program which recognises the arrow keys, which nowadays should mean every sensible program (see Program 1).

In Program 1 I have left out the actions to be performed by the button presses, hence the three empty commas at the start. Anything written after a semicolon is comment and is ignored by MAKEMENU.

The actions to be performed are specified by giving them a name or label. For example, when the mouse is moved to the right, the action 'right' is performed. The action 'right' is defined as being TYPE 0,77, and



Fig 1 A simple block diagram courtesy of the mouse

```

BEGIN      ,,,left,right,up,down,4,8

left:      TYPE 0,75      ; left arrow key
right:     TYPE 0,77      ; right arrow key
up:        TYPE 0,72      ; up arrow key
down:      TYPE 0,80      ; down arrow key
  
```

BEGIN is the Mouse Menu statement which assigns the initial actions to the mouse, and every program must begin with one. The full syntax is:

```

BEGIN <left button>,<right button>,<both buttons>,<left
move>,<right move>,<up move>,<down move>,<horizontal
resolution>,<vertical resolution>
  
```

Program 1

0,77 is the extended ASCII code for the right arrow key of the IBM

'... I find the mouse absolutely indispensable; going back to using the cursor keys would be as traumatic as returning to cassette instead of disk.'

keyboard (many IBM special keys send two characters when pressed). You can look up these codes in

appendix G of the Basica manual.

Horizontal and vertical resolution control the 'gearing' of the mouse in each direction; that is, how far the cursor moves for a given mouse movement. Smaller numbers mean higher gearing, hence faster cursor movement. Choosing the right gearing is a matter of personal taste and the performance of your application, and must be found by experiment. The gearing 4,8 in Program 1 is rather fast and is what I use for the PC-Write word processor which is very quick. In contrast WordStar's character input routine is very slow, and a gearing of 16,32 would be more appropriate; otherwise the cursor will lag very far behind the mouse movement, and the PC's input buffer will overflow with a cacophony of beeping.

I find that for text editing it's best to use a faster horizontal than vertical gearing (hence 4,8) as this reduces the tendency of the cursor to flip unwantedly onto the line above or below the one you're moving along.

Many word processors, WordStar included, are less than ideal for mouse control because they don't fill the area beyond the end of a line, or between multiply spaced lines, with space characters. You can tell if yours is one of these by seeing what happens when the cursor is moved one space beyond the end of a screen line. In WordStar it will flip instantly down to the beginning of the next line. This will drive you barmy when you use the mouse; whenever you accidentally 'mouse' too near either margin, the cursor is suddenly teleported to the opposite



PROGRAMMING

margin, while moving through a double-spaced document becomes a nightmare of wildly oscillating cursor movements. I solved this problem at a stroke, abandoning WordStar for PC-Write (though there were many additional reasons to do so).

To actually run Program 1, write it into a plain ASCII file (for example, a WordStar non-document file) called MYMENU.DEF. Then run MAKEMENU, and when it asks for a filename, tell it MYMENU. MAKEMENU will assemble the program (assuming you have made no typing mistakes) into a new file called MYMENU.MNU. The program is installed by typing MENU MYMENU (you will eventually want to put this command into AUTOEXEC.BAT so that the mouse program is installed when you boot up). The mouse will now emulate the pressing of the four arrow keys. Only the .MNU file is executable, and the .DEF file could be deleted (assuming you never want to alter the program). The mouse program can be disabled at any time by typing MENU OFF from the DOS prompt, and re-enabled by simply typing MENU.

Selection

Program 1 completely ignores button presses, which is rather a waste. The question is — what do we make them do? In my minimalist phase, all I wanted was for them to mark a text block. So in WordStar one could, for example, make the left button perform 'KB and the right button perform 'KK. This is open to the previously raised objection that it becomes meaningless inside other applications. An alternative favoured by some is to make the buttons produce keystrokes that are used a lot, such as ESC and CR.

I chose to make the buttons emulate two of the IBM function keys,

```
BEGIN bmark,emark,,left,right,up,down,4,8
```

```
bmark: TYPE 0,64      ; F6 key
emark:  TYPE 0,63      ; F5 key
left:   TYPE 0,75      ; left arrow key
right:  TYPE 0,77      ; right arrow key
up:     TYPE 0,72      ; up arrow key
down:   TYPE 0,80      ; down arrow key
```

Program 2

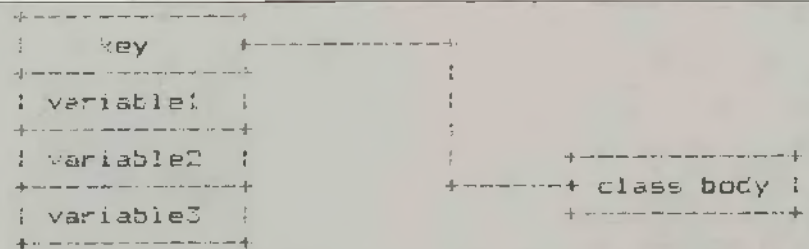


Fig 2 The crude block diagram. Not pretty perhaps, but serviceable

because I discovered that all the applications I use regularly are highly user-configurable (perhaps that's why I use them), so I could install them all to use these two function keys in equivalent ways and thus use the same mouse program for all. I chose F5 and F6 and set these up to perform block marking in PC-Write, Side-Kick's Notepad, the Turbo Pascal editor, PC-Forth and PC-Outline. The revised program is shown in Program 2.

This leaves only one control unaccounted for, namely the pressing of both buttons together, and any extra functions will have to be accessed through this.

Simple drawing

My first diagram-drawing program was very simple indeed. It didn't use the IBM extended graphics characters, for three reasons. Firstly, at that time I found them very inconvenient to print on my Epson printer. Secondly, there are too many charac-

ters (with all the corners and joints) to select from without using a large menu. Thirdly, and the clincher, I need to send my text via a modem using Telecom's PSS service, and 8-bit IBM graphics characters do not travel well (they tend to emerge as ordinary alphabetic characters).

Accordingly I chose to use crude 'dotty' boxes built from the hyphen character '-', the vertical bar character '|', and the plus sign '+' for corners. The result is shown in Fig 2.

In a graphics-based drawing program like Macpaint, you hold the button down to draw. This doesn't work with a character-based Microsoft mouse program as only the actual button press event can be detected, not the state of being held down or released.

Another attractive design feature would have been to draw boxes merely by pointing to the diagonally opposite corners; for example, top left and bottom right. Unfortunately the Mouse Menu language has no commands for reading the current screen cursor position, or for looping, and so this avenue is barred.

I found the most effective solution was to make mouse movement itself do the drawing; moving to the left draws a line to the left, and so on, the mouse leaving a trail like a turtle. Obviously you need to be able to switch this trail off to move to another location without drawing, and so I made the right button toggle between drawing and simply moving. The left button merely types a '+' sign to make the corners. In this way I can draw a whole diagram controlled only by the buttons, with no menus required.

Now, of course, there are two different mouse modes. In the normal mode, the mouse moves the cursor and the buttons select blocks of

```
BEGIN bmark,emark,switchmode,,left,right,up,down,4,8
```

```
bmark: TYPE 0,64      ; F6
emark:  TYPE 0,63      ; F5
left:   TYPE 0,75      ; go left
right:  TYPE 0,77      ; go right
up:     TYPE 0,72      ; go up
down:   TYPE 0,80      ; go down
```

```
; create mode switch menu
```

```
switchmode: MENL "DRAW MODE",1,67,inverse
             OPTION "ON",draw
             OPTION "OFF",restore
             MENL
```

```
restore: ASSIGN bmark,emark,switchmode,,left,right,up,down,4,8
draw:     ASSIGN plus,move,switchmode,drawl,drawr,drawu,drawd,8,12
move:     ASSIGN plus,draw,switchmode,,left,right,up,down,4,8
```

```
plus: TYPE 43,0,75      ; type +, go left
drawl: TYPE 0,75,45,0,75 ; go left, type -, go left
drawr: TYPE 0,77,45,0,75 ; go right, type -, go left
drawu: TYPE 0,72,124,0,75 ; go up, type |, go left
drawd: TYPE 0,80,124,0,75 ; go down, type |, go left
```

Program 3

text; in the drawing mode, moving the mouse draws lines. To switch between these modes a small menu is advisable, just to give visual proof that the switch has happened. Switching is achieved by pressing both mouse buttons together, and selecting an option from the menu (see Program 3).

In Program 3 I used the simpler of Microsoft's automatic menu-creating facilities. The structure MENU...MEND creates a pull-down menu called DRAW MODE, with the two options ON and OFF. It appears at screen row 1, column 67 in reverse video - that is, black on white. (NB Be very careful when using MENU...MEND not to leave any spaces between the option text and the comma which separates it from its action; for example, OPTION 'ON' , draw. If you do, MAKEMENU will fail to see the action and the option will have no effect; an undocumented 'feature' which caused me hours of fun).

The actions caused by choosing options ON and OFF are defined in the statements 'restore' and 'draw' which use the ASSIGN command. ASSIGN works exactly like BEGIN but inside a program rather than at its beginning; in other words, it reassigns the functions of the mouse.

● 'restore' does exactly the same as BEGIN, setting the mouse back to its original functions.

● 'draw' sets the mouse movements to produce dashed lines. Note that as well as typing the '-' and '|' characters, some cursor movements are needed to keep the motion consistent. Typing a character normally advances the cursor one place to the right and we have to undo this motion with a 'go left' character.

● 'move' allows you to move without drawing, and is toggled by the right button (because 'draw' calls 'move' and vice versa).

To draw effectively with this program, some conditions need to be met. Your word processor must be set to Overwrite rather than Insert mode, otherwise a nasty tangle results. Similarly, automatic reformatting, if you have it, must be switched off. Finally, you need something to draw on. As pointed out earlier, editors like WordStar do not actually fill a gap in the text with spaces. What looks like a gap on the screen is a 'black hole' consisting only of invisible newline characters at the left margin, and the cursor cannot enter it. With editors of this kind you will need to create a 'canvas' of real space characters (as produced by the spacebar) to draw on. The simplest way to do this is to create a special file which contains, say, 30 lines of spaces, and import this into your document (for example, with 'KR') whenever you want to make a diagram. This is another good reason to

```
BEGIN bmark,emark,dron,left,right,up,down,4,8

bmark: TYPE 0,64 ; as above
emark: TYPE 0,63
left: TYPE 0,75
right: TYPE 0,77
up: TYPE 0,72
down: TYPE 0,80

dron: MENU "DRAW MODE",1,67,inverse
      OPTION "DASH",draw
      OPTION "GRAPH",graf
      MEND

droff: MENU "DRAW MODE",1,67,inverse
      OPTION "OFF",restore
      MEND

draw: ASSIGN plus,move,droff,drawl,drawr,drawu,drawd,8,12
move: ASSIGN plus,draw,droff,left,right,up,down,4,8

plus: TYPE 43,0,75 ; as above
drawl: TYPE 0,75,45,0,75
drawr: TYPE 0,77,45,0,75
drawu: TYPE 0,72,124,0,75
drawd: TYPE 0,80,124,0,75

graf: ASSIGN cornmenu,gmove,droff,grafl,grafir,grafu,grafd,8,12
gmove: ASSIGN cornmenu,graf,droff,left,right,up,down,4,8

grafl: TYPE 0,75,196,0,75 ; go left, type -, go left
grafir: TYPE 0,77,196,0,75 ; go right, type -, go left
grafu: TYPE 0,72,179,0,75 ; go up, type |, go left
grafd: TYPE 0,80,179,0,75 ; go down, type |, go left

restore: ASSIGN tmark,emark,dron,left,right,up,down,4,8

cornmenu: POPUP 12,58,inverse2
          TEXT " "
          TEXT "H"
          TEXT "L"
          SELECT 1,1,1,corner1
          SELECT 1,3,1,corner2
          SELECT 3,3,1,corner3
          SELECT 3,1,1,corner4
          SELECT 2,3,1,corner5
          SELECT 2,1,1,corner6
          SELECT 3,2,1,corner7
          SELECT 1,2,1,corner8
          SELECT 2,2,1,corner9
          PEND

corner1: TYPE 218,0,75 ; after typing one of these corner or
corner2: TYPE 191,0,75 ; junction characters, the cursor
corner3: TYPE 217,0,75 ; remains in the same place.
corner4: TYPE 192,0,75
corner5: TYPE 180,0,75
corner6: TYPE 195,0,75
corner7: TYPE 193,0,75
corner8: TYPE 194,0,75
corner9: TYPE 197,0,75
```

Program 4

prefer editors such as PC-Write which fill with spaces.

Drawing with graphics characters

Eventually I succumbed to the desire to draw diagrams with IBM graphics characters as well as dashed lines (largely because I found a convenient way to print them). The program for this is rather more complex than the last (see Program 4). Just to draw single boxes you need 11 different characters (horizontal and vertical line segments, four corners and five junctions) and if you wanted the double lines too, the number escalates tremendously. Obviously these cannot all be accommodated on two buttons, and so a menu becomes necessary.

Playing with nasty, long, thin pull-down menus convinced me that they were much too difficult to select from accurately, and I decided the most elegant solution was to fit the nine corner and junction characters together to make a window-pane

shaped 'menu':



Any of the nine characters can be chosen from this 'menu' by moving no more than four places. The Mouse Menu language's POPUP...PEND structure creates such multi-column menus very simply. As before, mouse movement draws horizontal and vertical lines, but now the left button summons the window-pane menu to choose the proper corner or junction character.

The DRAW MODE menu now offers a choice of two drawing modes, and a second menu is summoned from either mode to switch drawing off.

Enormously complex mouse-driven systems can be created with the Mouse Menu language, and if you pay sufficient attention to the ergonomics they can be made easy to use without a mess of menus. My latest creation allows me to 'paint' in four shades of grey tone as well as drawing boxes, but I'll spare you that one for now!

END

Righting wrongs

In the fourth part of his series on data structures, Mike James examines the detection and correction of errors in programming.

This is part four of a six-part series on programming methods and the creation of programs. Parts one, two and three appeared in the July, August and September issues respectively, copies of which are available from PCW Back Issues.

When you start to write a program, the last thing on your mind is the possibility of making mistakes — until a mistake is discovered, it's usually unthinkable! We all program as if perfection was not only possible, but the norm, and this is the programmer's cardinal sin. Errors are natural, and although they are each individually avoidable, it's very nearly a certainty that some parts of any program will have to be labelled as incorrect for one reason or another. Therefore, *en masse*, errors are not avoidable.

Of course, if you're thinking in terms of errors as nothing more than spelling mistakes (syntax errors in the jargon), you may be surprised by the assertion that errors are unavoidable because this particular class of error is easy to stamp out. But this is nothing more than saying that a piece of written text is correct because it has been processed by a spelling package — it can be correctly spelt, but can still be mostly nonsense. It's important to distinguish between simple errors of syntax and errors of meaning, expression and specification.

The current state of the art is that we have a fairly standard set of methods for testing and correcting programs, which have been in use for some time, and we are now turning our attention towards the more difficult problem of writing programs which are better at coping with the inevitable errors that they contain. Since the SDI (Star Wars) initiative, the whole subject of fault-tolerant programs has become much more urgent. It's proposed that a gigantic program should be written that, by the very nature of the situation it deals with — that is, a nuclear war — cannot be fully tested. In the future, our continuing existence may de-

pend on the success of fault-tolerant programming.

Making errors

One of the most difficult questions to answer is: 'How do programming errors arise?' Programmers always start with the good intention of making no errors, but there are a number of important ways in which they are fallible and these give rise to distinctly different types of errors:

- (1) Syntax errors — these are simple spelling mistakes produced by mistyping or a misinterpretation of the programming language manual.
- (2) Run-time errors — these are errors that only become apparent when the program is active. Run-time errors can occur because of

'The most common method of bug location is the "just looking method". A print-out is obtained, and the programmer sits and looks at it ...'

some unforeseen, and hence unanticipated for, condition or because of the type of inputs a program is presented with.

- (3) Specification errors — these are failures of a program to meet its specification. In other words, the program may, in the usual sense, work, but it doesn't do what it was intended to do. It's possible to have a complete specification error where the program solves the wrong problem, but the shortcomings of a program are usually only partial.

Of the three types of errors, run-time errors are the most varied and the most difficult to characterise. They are also potentially the most devastating, occurring at any time during the life of the program and with consequences which range from having to re-key a few commands to

a complete failure or crash. For these reasons, run-time errors are currently the most important.

Before moving on to the subject of fault-tolerant programming, it's worth recounting current testing and debugging methods.

Debugging methods

It's important to distinguish between knowing that there is an error in a program, and knowing *where* it is: that is, bug detection as distinct from bug location. Bug detection is generally called 'testing', and it's a phase of program development that is usually under-valued. Another problem is that testing is about proving that your program *doesn't* work, but most programmers test programs to prove that they *do* work! Even if you're prepared to attack your program in the spirit of making it fail, there's always the psychological barrier against showing that the product of your own intellect is, in fact, flawed. This is the main reason why some people are better at testing than others, and why it's better to use someone other than the person who wrote the program to test it.

To test a program fully, it's necessary to supply data that will take it through every possible route, and this is difficult. The number of routes through even a smallish program is enormous. Not only do you have to ensure that every route has been tested, you also have to test the program's response to extreme data values. Of course, the trap in this simple idea is in the word 'extreme', because what is extreme data depends on the situation: often included in the extreme data category are large numbers, negative numbers, zero, character data, control characters, and so on. But what constitutes appropriate test data relies on the judgement of the programmer to choose data that is likely to cause the program to malfunction — remember, the purpose of testing is to show that the program *doesn't* work.

It's usual for testing to proceed as the program is developed — stepwise testing is a natural partner to stepwise refinement (see last



month's article) — but there's still a need for a final testing phase. Step-wise testing picks up problems as the program is being developed; final testing makes sure that the program is fit to be used. Although it sounds as though we know how to test a program, this is only a theoretical certainty; in practice, testing is still a matter of judgement about how best to use the limited time available.

When you have determined that there's a bug in a program, the next step is to locate it. The most common method of bug location is the 'just looking method'. A print-out is obtained, and the programmer sits and looks at it for a few minutes. This is a very effective method for a great many simple bugs. Indeed, often the bug becomes obvious in the time it takes for the printer to produce the listing! (This is one of the main reasons that most printer listings are thrown in the bin almost as soon as they are produced. Printing a program out is one of the standard plays used by programmers to give the impression and the comforting feeling that something is happening while they stand about and think for a few moments!) The trouble with just looking is that it's often the only debugging method a programmer knows, and it's a property of the method that if it's going to work, it works in, at most, a few minutes.

There's no point in staring at a listing into the small hours of the night, cup of coffee in hand. Such tales of all-night debugging sessions are often an indication that the programmer involved knows little of logical fault finding.

Debugging is an activity that is just as logical as programming, and it's based on gathering observations about how the program is working and comparing this with information about how the program *should* work. This 'predict and compare' method has been in use as long as there have been programmers to create bugs. There are only two things that determine the behaviour of a program: the path taken through the statements; and the values stored in the variables. If you can predict the path through the program and the

values of the variables at each point, then by comparing these with the actual route that is taken through the program and the actual values of the variables, the bug can be located at the first place that there's a discrepancy between prediction and reality.

This procedure is simple in principle, but in practice there's the problem of gathering data on how the program works. This was partially solved many years ago by the first assembly language programmer by careful use of *breakpointing*. A breakpoint is a temporary halt instruction which allows the programmer to verify the program's behaviour so far. Ideally, a breakpoint instruction should print a message indicating where it is, and allow the programmer to examine the contents of variables before restarting the program.

The nearest thing Basic has to a breakpoint is the *Stop* command, which will usually print a message to the effect 'Stopped at line xx' and will also usually allow direct printing of variables. Where the *STOP* instruction sometimes lets you down is in the way it allows a restart. Some versions of Basic have a *CONTINUE* command; in others, you have to use an explicit *GOTO* instruction to get things moving again. (The BBC Basic *STOP* command doesn't even allow you to restart successfully using a *GOTO* because it forgets all about any incomplete *FOR* loops, procedures, and so on, so negating its usefulness as a breakpoint command.) Although breakpointing is the fundamental method of debugging, there are now many sophisticated debugging aids that will run a program, trace the path taken and print diagnostic information. However, no matter how sophisticated a debug package you are using, the principle of predict and compare is still the basis of locating a bug.

The law of bugs

It's naive to assume that you can remove all the bugs from a program, no matter how much time you're prepared to devote to effective testing and debugging procedures. Although the perfect program is a logical possibility, it's a practical improbability. Bugs tend to die out slowly rather than give up *en masse* under pressure of debugging methods; this observation may seem unreasonable, but it's undeniable. Even programs which have been in use for long periods of time (10 years, say) still reveal previously undiscovered bugs. As you might expect, the time interval between such bug discoveries does increase with the life of a program, but the severity of such bugs does not decrease. It's still possible — and common — to discover fairly major bugs which cause the program to fail completely after a long and otherwise useful life.

'Bugs should be reduced to an acceptable level, but it's better to admit that zero bugs is an impossible goal and try to find ways of dealing with ones left in a finished program.'

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Such long-term bugs are generally concerned with the coincidence of events, each of which is quite rare. For example, it might be that an operating system has been successfully tested with three users logged-on for many years, but it's only when three users log-on at precisely the same moment that a bug which crashes the whole system is revealed!

Another type of bug which tends to show late in the life of a program is the bug which occurs often but which usually has only a small effect.

Inside information: flags

The most common use of a variable is to hold the result or raw material of a calculation or other data manipulation: that is, variables generally hold data values which the program works on. There is, however, another use for variables that is often ignored, especially by beginners. A *flag* is a variable that is used to indicate the state of some part of the program or of some external event. For example, a subroutine can return a flag variable, ERROR, which will be set to zero if no error occurred, and one if an error of any kind occurred. Flag variables are special because the only legal operations on a flag are to set or reset it, and to test it within an IF statement. In this sense, flags are message carriers within a program. There are two-state flags which can only be in one of two states: yes/no, on/off, stop/go, and so on. Two-state flags are easy to use if their values are either true or false — that is, the values the system uses to represent the result of a true or false condition. Such flags are called Boolean or logical flags, and they make testing very easy. For example, if ERROR is a logical flag that's true when there's an error, you can write:

```
IF ERROR THEN GOSUB error handler
```

There are also multi-valued flags which can be used to indicate which of a number of possible states the program is in. For example, ERRORTYPE is a multi-valued flag if it records a number which indicates the type of error that has occurred. In more sophisticated multi-tasking applications, flags are transformed into an advanced data type called semaphores which are nothing more than flags with restrictions on how and when they can be set and reset. Don't be fooled into thinking there's anything much more complicated than a simple flag!

For example, a word processor might contain a bug which causes the loss of a character on the boundary of a storage block — for example, every 32k characters. Normally, the loss of one character in 32k isn't noticeable, but if that character happens to be a text formatting command, then the error is easily spotted as the remainder of the document will be incorrectly formatted.

All of this is not an excuse for not trying to eliminate bugs from a program. Bugs should be reduced to an acceptable level, but it's better to

'Programmers always start with the good intention of making no errors, but there are a number of important ways in which they are fallible ...'

admit that zero bugs is an impossible goal and try to find ways of dealing with the ones left in a finished program.

Exceptions

Given that you have applied sufficient effort to debugging, the only thing that you can do to improve your programs is to incorporate lines of code that are designed to cope with errors. The trouble with this idea is that if you could anticipate the exact nature of the errors and hence cope with them, you could alter your program to eliminate them. It seems that we have an impossible task, but there are ways of writing programs which guard against things going wrong, even if you aren't sure of the whys and wherefores of what might go wrong. This is called *defensive programming* and there are many varieties. For example, at the start of each subroutine, you might state certain logical relationships which have to hold between the variables before the subroutine is executed. This, of course, avoids the question of what should happen when an inconsistency is detected, and this is the really difficult part of fault-tolerant programming.

These days, the most-used method of defensive programming is based on the idea of an *exception*. An exception is an unusual condition that arises during the execution of a subroutine. Once an exception has been detected, control is passed to an *exception handler*, a chunk of program designed to do the right thing when

the exception is detected. For example, the expression A/B can only cause a problem in one of three ways: either the result is too small or too big to be represented; or B is zero and the division cannot be performed. In non-tolerant systems these correspond to 'underflow', 'overflow' and 'division by zero' errors, and these are usually fatal — that is, they cause the program to stop running.

In newer languages such as Ada, such errors can be made to cause an appropriate exception handler to take control rather than crash the program. Notice that none of this implies that we know the deeper reason why A/B isn't computable — for example, that a user has typed an inappropriate value or a hardware failure has occurred. It's enough to detect the immediate problem that would normally result in the termination of the program. What the exception handler should do is, of course, a different question, and this does depend on the role that the calculation which caused the error plays in the rest of the program. It might be enough to print an appropriate message and then return to some earlier point of the program, or it might be absolutely essential to stop the program from continuing.

Most versions of Basic contain a primitive exception-handling statement — ON ERROR GOTO or ON ERROR GOSUB. This statement causes the transfer of control to a subroutine should any error occur while the program is running. Most Basic programmers use this statement once at the start of a program to cause all errors to transfer control to a single, all-powerful error-handling routine. This is, in fact, not the best way to organise things — it's too complicated to deal with all possible errors in one routine. It's much better to follow the example of Ada and guard each subroutine with its own exception handler. That is, instead of having one ON ERROR statement at the start of a program, each subroutine should start with an ON ERROR statement which names an error-handling routine for the type of error that might be expected from that subroutine. For example, if a subroutine is concerned with opening a file, then its error handler should deal with the possibility of 'No such file', 'Disk error', and so on, and not so much with arithmetic errors.

The introduction of exceptions and exception handlers effectively extends the principle of modular programming to make it fault-tolerant. In fault-tolerant modular programming, each module is composed of two

parts: the part that does the normal work; and the exception handler. Unfortunately, exceptions are more difficult to handle than this simple-minded approach suggests.

Structure disruption

In the same way that many high-level languages inherited the primitive constructs of the underlying assembly language, so exception handling is modelled on the hardware concept of an *interrupt*. An interrupt is a transfer of control without an explicit transfer statement at the point in the program from which control has been transferred. Usually, an interrupt is a transfer of control, initiated by the hardware, from any

'We all program as if perfection was not only possible, but the norm, and this is the programmer's cardinal sin.'

point in the program to a specially-written interrupt handler. In the same way, an exception is a transfer of control, without an explicit transfer statement, to an exception handler.

It has long been known that interrupts are difficult to work with due to the way that they ignore the hierarchical structure of the program, and exceptions are just as difficult for the same reason.

Some programmers argue that exceptions are an unnecessary idea because they can be replaced by explicit conditions for the execution of a statement that might cause an error. For example, instead of worrying about division by zero exceptions, you could program every piece of arithmetic as:

```
IF B<>0 THEN C=A/B ELSE error handler
```

The trouble with this is that it ignores the fact that errors generally disrupt the structure of a program. For example, if you are deep down in the hierarchy and a divide by zero error occurs within a subroutine, there's generally no point in going on with the subroutine, nor with RETURNing and continuing with the subroutine that called it, and so on, back up to the top-most level. When an exception occurs, it usually requires an out-of-the-ordinary sequence of events and hence a different sequence of subroutine calls to correct it.

It's this structure disruption that makes an exception an exception and not something that's part of the normal operation of the program.

Currently, we build programs considering only their expected operation, and this is reflected in the hierarchy of subroutines built up by top-down structured programming; when something goes wrong, this hierarchy is totally inappropriate, and the best we can hope for is a restart at another point in the hierarchy. For example, if division by zero is encountered in a subroutine, then there's no point in ending the subroutine normally and allowing control to pass through the hierarchy in the usual way, because the subsequent subroutines are probably going to make use of the result produced by the subroutine which has the error. Instead, what is needed is a restart at some earlier point in the hierarchy, perhaps at a subroutine that reads in the data which the subroutine with the divide by zero error uses.

The usual way of transferring control to an earlier point in the hierarchy is by way of a GOTO statement that ignores the structure of the program and transfers control back to the top-most level of the hierarchy — this is often referred to as a 'long GOTO statement'. In many versions of Basic, this long GOTO is achieved by use of the RESUME command to exit an error-handling routine. The use of the long GOTO statement is clearly against the principles of struc-

tured programming, but the only alternative is to build-in tests following every subroutine call that will detect an error and automatically return to the next level up, so automatically returning control all the way back up to the top of the hierarchy. For example:

```
start of subroutine
GOSUB 2000
IF ERROR THEN RETURN
rest of subroutine
```

This kind of programming is tedious and complicated, and there's something to be said for recognising and making clear a situation that disrupts the normal structure of the program. The fact that error conditions disrupt the natural structure of a program has led many a programmer to claim that structured programming is itself inadequate. This is not the case. For the most part, the structure of a program should reflect its normal operation, but when something goes wrong it should be possible to make transfers that ignore its structure. It now seems clear that this is necessary, but the best way to do it is far from clear. Exceptions (and exception handling) is the best method we have at the moment, but it doesn't seem good enough to make Star Wars software sufficiently fault-tolerant to be trustworthy.

Next month: repetition

END

Answer to creative challenge three

If you sit down and write a program to draw a face as one long list of instructions, you'll be doing a great deal of unnecessary work; and when it comes to changing from rectangles to circles, the amount of work involved makes it almost easier to start from scratch. The best solution is to write a program using a subroutine structure that reflects the structure of the object which you are trying to draw. For example, at the top-most level of the hierarchy:

```
GOSUB 1000: REM DRAW FACE OUTLINE
GOSUB 2000: REM DRAW EYES
GOSUB 3000: REM DRAW MOUTH
GOSUB 4000: REM DRAW EARS
END
```

The subroutines at the next level — that is, 1000, 2000, 3000 and 4000, should in the same way call other subroutines to draw their specified 'sub-object'. For example, subroutine 1000 might be something like:

```
1000 REM DRAW FACE OUTLINE
1010 X=50:Y=50:GOSUB 5000:REM DRAW RECTANGLE
1020 RETURN
```

Subroutine 5000 is a 'low-level' subroutine which actually does some work — that is, it draws a rectangle. Notice the use of X and Y as input parameters. Constructing the program in this way makes it easier to complete, and easier to modify and re-use. For example, to convert to a face drawn using circles, it should only be necessary to alter the definition of subroutine 5000 — usually a matter of one or two lines of code.

Creative challenge four

This month's creative challenge can be posed as: 'How do you stop a program?' Given that you are convinced that you should use top-down structured programming to construct a program, what is the proper way of bringing a program to a halt if the condition that stops the program is detected by a subroutine very low down in the hierarchy? For example, if you are writing a games program and have a subroutine 9000 which asks the user 'Another Game Y/N', what should this subroutine do if the answer is N?

In the nick of time

It's eight years since the original PCW Benchmarks were devised, so we felt it was high time new Benchmarks were created to accommodate modern trends in hardware and programming languages. Nick Walker presents the definitive, but very flexible, PCW Benchmarks.

intmath:

```
declare three integer variables X, Y and I
  assign X equal to 0 and Y equal to 9
  write 'Start' to screen
  repeat 1000 times using I as the loop variable:
    assign X equal to X+Y-Y*Y/Y (use integer divide if provided)
  write 'Finish' and X to screen (final X value should be 0)
```

realmath:

```
declare two real variables X and Y
declare an integer variable I
assign X equal to 0 and Y equal to 9.9
write 'Start' to screen
repeat 1000 times using I as the loop variable:
  assign X equal to X+Y-Y*Y/Y
write 'Finish' and X to screen (final X value should be 0)
```

trilog:

```
declare two real variables X and Y
declare an integer variable I
write 'Start' to screen
assign X equal to 0 and Y equal to 9.9
repeat 1000 times using I as the loop variable:
  assign X equal to Cos(Sin(ArcTan(Log(Y))))
write 'Finish' and X to screen (final X value should be 1000)
```

textscrn:

```
declare an integer variable I
write 'Start' to screen
repeat 1000 times using I as the loop variable:
  write '1234567890qwertyuiop' and I to screen
write 'Finish' to screen
```

grafscrn:

```
declare integer variable I and J
write 'Start' to screen
repeat 100 times using X as the loop variable:
  repeat 100 times using Y as the loop variable:
    plot pixel at screen position (X,Y)
print 'Finish' to screen
```

store:

```
declare an integer variable I
write 'Start' to screen
create a disk file 'Test'
open 'Test' for input
repeat 1000 times using I as the loop variable:
  write the record '1234567890qwertyuiop' to 'Test'
close 'Test'
delete 'Test'
write 'Finish' to screen
```

Fig 1 English description of new Benchmarks

Ever since PCW started back in February 1978, we've been testing machines with a set of Basic programs designed to test the speed at which certain routines are carried out. The original Basic Benchmarks, which were designed by the defunct US magazine *Kilobaud*, were created to provide an objective measure to evaluate the performance of the system and, more importantly, to provide comparison with other similar machines.

The original PCW Benchmarks were created at a time when a good home computer contained 8k of RAM, 8k of ROM, a cassette tape interface and, if you were extremely lucky, some primitive form of screen output. The only common thing you could rely on was that practically all the machines had a version of Basic on tape or in ROM. It isn't surprising, therefore, that the Benchmarks were written in Basic and made no attempt to access any I/O.

It's a credit to these original PCW Benchmarks that they have survived eight years of the micro business. It's rare even now that a machine doesn't have a version of Basic available, though it's certainly not unknown. However, it's true that these Benchmarks are considerably less relevant today than they were. The machines tested now spend most of their time running applications that typically use a disk drive interactively, and address both the text and graphic modes of a screen. It's rare that any of these applications are written in Basic.

The original Benchmarks have provided a standard for eight years, and a vast amount of data is now available. The time has come to create new Benchmarks that are more relevant to the operations a micro might spend its life performing.

Design criteria

One of the reasons for the success of

the original PCW Benchmarks was that they were short and understandable. Users of any machine, even if it wasn't Benchtested in PCW, could type-in the Benchmarks and get a measure of how fast the machine is compared to its rivals. In a review of SDS Modula-2 (PCW, August) I made a call for suggestions as to what form the new Benchmarks should take. Among the letters received were a number calling for a 'complete system test' consisting of a vast amount of compiled code which would extensively test the whole system. While I agree that such a test would give a more accurate basis for comparison, it would severely limit the number of users able to run the test. Therefore, the new Benchmarks are of a similar length to the old.

The old Benchmark timings are usually ascribed to a particular machine when it would be more correct to refer them to a machine and dialect of Basic used. For example, an IBM PC running the latest version of GWBasic is noticeably quicker than an IBM PC running BasicA, which explains why all the IBM clones are quicker than the original.

To overcome this, the new Benchmarks have been specified in a language-independent form. This makes them capable of comparing different versions of the same language in a language review, or capable of testing the speed of a machine when compared with a rival machine running the same language.

Having decided that the Benchmarks should be short and language-independent, by far the most difficult decision was determining which features the Benchmarks should test. After much consideration, the following were chosen:

(1) Two separate Benchmarks to test integer and real arithmetic. Integer arithmetic gives a good indication of the general processor speed, whereas real arithmetic speed depends on the quality of algorithms in the software, unless a floating-point chip is used.

(2) A separate Benchmark to test logarithmic and trigonometric functions, as these are primarily of interest to scientific users and certain heavy number-crunching business applications.

(3) Two separate Benchmarks to test the speed of text and graphics screen I/O. The graphics screen I/O test should use nothing more complex than Plot (x,y) to enable it to be run on as many machines and languages as possible.

(4) Some test of disk speed was required; this proved the most difficult to design as disk speed is affected by so many factors. For example, an old hard disk will perform more slowly than a new one, due to file fragmentation. The Benchmark we chose

	IntMath	RealMath	TrigLog	TextScrn	GrafScrn	Store
IBM PC running Turbo Pascal	0.18	4.0	56.4	76.4	5.0	4.9
IBM PC running BasicA	6.2	8.2	47.0	100.0	49.0	17.2
IBM PC running PC Forth	0.3	-	-	67.0	2.4	1.9
Atari ST running ST Basic	1.5	1.9	7.9	44.8	22.7	9.9
Atari ST running Megamax C	0.16	1.1	7.9	39.6	7.7	7.1
Commodore Amiga Basic	1.7	2.7	6.7	150.3	25.0	32.7
Citadel BasicA	1.8	2.1	7.9	50.5	10.8	4.8
Citadel PC Forth	0.07	-	-	33.6	-	0.9

Notes: The IBM PC used an external Ampex hard disk with an Xebec controller; both the Amiga and the ST used the internal 1Mbyte floppy

Fig 2 Table of results

does not attempt to overcome these problems, but it's simple and our subsequent experiments proved it to be a reasonable index when compared with far more complex disk test procedures. Most users don't start with fresh disks every morning, and the aim of these Benchmarks is to reflect real world usage, albeit at the cost of strict scientific comparability.

The new Benchmarks

There are six Benchmarks:

- IntMath: tests integer mathematics speed
- RealMath: tests real mathematics speed
- TrigLog: tests speed of trigonometric and logarithmic functions
- TextScrn: tests screen I/O with a text screen
- GrafScrn: tests screen I/O with a graphics screen
- Store: tests disk I/O

Fig 1 lists the Benchmarks in English. Although they bear a resemblance to the Benchmarks published in the aforementioned SDS Modula-2 review, they are improved thanks to the letters I received from PCW readers and the contributions of my colleagues here at PCW.

When translating the Benchmarks into a different language or dialect, try to produce code that closely matches the structure of the English description. Don't use quick and dirty short-cuts to gain a few tenths of a second, as this is just misleading. A good rule of thumb is that for every line of the English description, there should be one or more corresponding lines in the code. If you can't relate each line on this one-to-one or one-to-many basis, take a second look at your source code.

It's quite possible that some languages will be unable to run some of the Benchmarks. Don't resort to convoluted tricks in this case; a blank conveys as much information as a timing, namely that this language is

a poor choice for the task.

Finally, there will be no average figure. The average figure of the original Benchmarks was totally meaningless and the most abused by manufacturers. With only six Benchmarks it isn't difficult to assimilate all the necessary information, if that's what you want to do.

The advantage of the new Benchmarks is their flexibility. They can compare different machines running the same language; different languages on the same machine; and the same language on the same machine in different environments. For example, you could run TextScrn on a GEM-based computer in different-sized windows, or with different numbers of windows open.

Conclusion

To make these Benchmarks work, we need to gather as much information as possible about current hardware and software. In the coming months, PCW will test as many machines as possible and publish the results periodically. However, there's no way that we can cover all the machines and all the languages, which is where you can help. If you run these new Benchmarks on your machine, please send us the results, complete with source code, and help us make them as successful as the original Benchmarks.

I'd like to think of the Benchmarks as frozen, but if you have any serious objection to them as presented in this article, please let me know. Next month, we'll turn our attention to the problem of devising a scheme for the compatibility of IBM PC clones.

Due to lack of space, we were unable to feature example Benchmarks in BasicA, Turbo Pascal and PC Forth for the IBM PC. These Benchmarks will be published in the November issue. **END**

Truth tests

Human beings assess the authenticity or not of a statement by using their own experience and judgement together with the rules of deduction. But how does a computer emulate the human process of sorting out truth from untruth? David Levy is your guide.

Knowing whether some particular statement is true or false is an essential element in most areas of decision making. An obvious example is computer programming — consider just how often a program contains code which is equivalent to: *if such and such is true then do whatever*.

Often we know the veracity of a statement or can discover it merely by looking in the right place. If we want to know whether the statement 'the sun is shining' is true or false, we only have to look and see. But life is not always so simple. Sometimes we need to deduce or prove the truth from one or more known premises, and while this may not be a difficult task for an intelligent person, it can be a highly complex one for a computer program. Consider a court of law, for example, where the objective is to ascertain the truth from the evidence. The judge and jury may deliberate for days or even weeks in their attempts to decide the truth, so can we really expect that a computer program might one day be able to do their work and provide a verdict a few seconds after digesting the premises?

Proof is an area that has always fascinated a significant proportion of the AI fraternity, and in some areas of mathematics, notably geometry and logic, computer programs have shown themselves to be rather adept at theorem proving. One of the earliest examples was the 'Geometry Theorem Machine', first described by Gerlertner in 1959, which could prove theorems considered quite difficult by an average secondary school pupil. Quite recently we have seen a computer proof of the famous 'Four Colour Problem' (prove that using only four colours, it is possible to colour any map so that no two adjacent countries have the same colour).

The Geometry Theorem Machine

This was not a machine but a prog-

ram running on an IBM 704 computer. In the early spring of 1959 it proved its first theorem in elementary Euclidean geometry, and subsequently it discovered proofs to numerous problems found in school text books. Its 'knowledge' consisted of a number of rules or theorems on such subjects as parallel lines, the congruence of triangles, and the equality and inequality of segments and angles, and it employed heuristic methods to guide it towards proof sequences that had a high probability of leading to a proof of the original theorem.

The reason why heuristic methods are needed in theorem proving can be seen from a comparison between the proof process and the search of a game tree. Starting from the root of the tree (that is, the situation in which certain premises are given), the program could apply each of its known rules or axioms (which correspond to the legal moves in a game tree) to this root situation, thereby creating new situations (that is, new nodes on the tree). This process could then be repeated, so that at each stage of the search process every possible axiom would be applied to every existing unexamined node in the tree. Eventually a proof would be found (provided that one exists), because eventually the program would have generated a tree so big that it contained one path (that is, one variation) which converted the root situation into a proof.

The problem with the above approach is similar to the problem of trying to make the perfect move in a chess game by examining every legal move to a great depth. The tree gets too big too soon and the program's available thinking time is rapidly exhausted. An heuristic approach to theorem proving drastically limits the size of the tree, by selecting only those axioms which appear most likely to lead to a successful proof. (In fact, Gerlertner's program employed a graph as its

data structure rather than a tree. I have used the tree as a simplification because readers of this series will already be familiar with tree-related concepts.)

The Geometry Theorem Machine worked backwards from the desired theorem, so that every sequence it considered was known to end with a proof of the desired theorem. Most of these sequences will be false, but by using heuristic methods to recognise their falsity, these sequences could be immediately rejected, allowing the pruning of the irrelevant parts of the proof tree. Consider the flow diagram shown in Fig 1 which explains how the heuristic methods were applied.

● **1 Scan diagram** With every theorem that needs to be proved, there is a diagram which is scanned by the program so that three lists can be constructed — one containing every segment in the diagram, one containing every angle and one containing every triangle. Each item on a list is attached to a sublist which describes that item.

● **2 Set up initial conditions** The premises are placed on a list of established formulae, and the conclusion is put on the tree as a subgoal. If this subgoal is achieved, then the program has proved the theorem.

● **3 Expand definitions** Certain definitions are added to the list of established formulae.

● **4 Choose generating subgoal** The program selects a subgoal which it wants to establish. Selecting a subgoal is analogous to a game-playing program selecting which position on the game tree should next be expanded.

● **5 Generate lower subgoals** Appropriate axioms and theorems are chosen from the list of premises and, by working backwards, a set of lower subgoals is established such that if any one of these subgoals is achieved, then the parent subgoal is established. If the parent subgoal has been labelled 'provisionally fruitful',



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the program tries various geometric constructions.

● **6 Discard unwanted lower subgoals** The program rejects any of the newly created subgoals which are seen from the diagram to be obviously not valid. If it finds any newly created subgoals which are the same as or equivalent to any subgoals already on the tree, it rejects those deepest in the tree as being achieved with more steps than necessary.

● **7 Is the generating (parent) subgoal established?** If any newly created subgoal is established by virtue of the fact that it is on the list of established formulae (or if it can be assumed from the diagram) then the parent subgoal is established, otherwise:

● **8 Add acceptable lower subgoals (if any exist) to the tree** The program adds acceptable non-redundant lower subgoals to the tree and chooses a new subgoal from which further subgoals may be generated. If there are no acceptable lower subgoals

and a geometric construction is possible in the diagram, then the parent subgoal is marked as 'provisionally fruitless'. If a construction is not possible or if the program has tried and failed to find one, the parent subgoal is marked 'fruitless'.

● **9 Are there any parallel subgoals to be established?** If the parent subgoal is established it is added to the list of established formulae, together with all of the higher subgoals on the tree which are established as a direct result. If there are no parallel subgoals (sibling subgoals are said to be 'parallel' if it is necessary to establish all of them in order to establish the parent subgoal) remaining to be established, the program realises that it has found a proof of the theorem and prints it out.

● **10 Failure** If at any time the program discovers that every unexamined subgoal on the tree is fruitless, the program admits that it has failed to find a proof of the theorem.

Most of the intelligence in Gerlertner's program resided in blocks 4, 5

and 6 of the flow diagram, where subgoals are chosen, generated and discarded. He discovered that a linear increase in the number of points in the original diagram would lead to an exponential increase in the complexity of the proof process, and it was, therefore, essential to employ powerful heuristics.

Clearly it is desirable to be able to select those subgoals that have the greatest chance of leading to a proof, just as in a game tree it is desirable to select those moves which have the greatest chance of being correct. Two specific heuristics were used to achieve this aim. The first would recognise subgoals that could usually be established in one step, such as geometric identities. The second was a scoring function, analogous to those used in game-playing and problem-solving programs, which assigned a score to each subgoal according to how close or far it appeared to be from the premises. Adding these two heuristics not only speeded up the proving process, it also resulted in the program finding shorter (that is, more elegant) proofs.

Proving theorems in logic

The Geometry Theorem Machine is an excellent example of simple proof techniques being used in a specialised environment, that of Euclidean geometry. To be of more general use, a proving program must be able to cope with a wide range of problem environments, and for this reason much of the work on computerised proof has concentrated on mathematical logic. (The laws of logic are sufficiently general that they may be fitted to any problem-solving domain.)

In the mid 1950s Newell, Shaw and Simon devised a program called the Logic Theory Machine, whose task was to prove theorems in elementary symbolic logic. This system of logic is founded on expressions built from combinations of basic symbols. Five of these expressions are taken as axioms, and there are rules by which new theorems may be inferred from the axioms and from other theorems. The system of axioms, definitions and rules employed in the Logic Theory Machine was exactly that used in *Principia Mathematica* by Whitehead and Russell, one of the outstanding 20th century books on mathematics. These are:

if (p is true or p is true) then p is true
if p is true then (q is true or p is true)
if (p is true or q is true) then (q is true or p is true)
if [p is true or (q is true or r is true)] then [q is true or (p is true or r is true)]

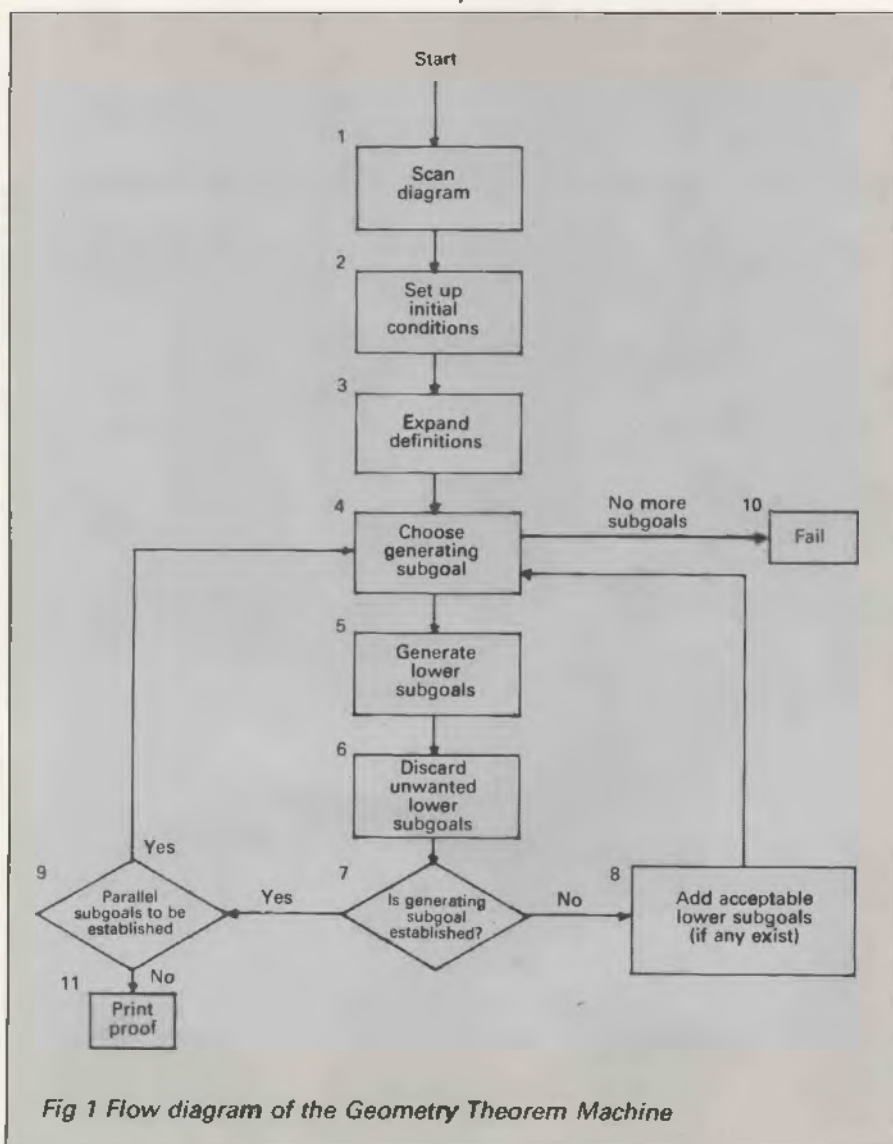


Fig 1 Flow diagram of the Geometry Theorem Machine

true)]
 if (if p is true then q is true) then (if (r is true or p is true) then (r is true or q is true))

The Logic Theory Machine was given a number of true theorems, and three rules that could be used to infer new theorems:

(a) The rule of 'substitution':

Any expression may be substituted for any variable in any theorem, provided that the substitution is made throughout the theorem wherever that variable appears. For example, in the second axiom, if we replace the variable 'p is true' by the expression 'p is true or q is true', we get the new theorem:

if (p is true or q is true) then (q is true or (p is true or q is true))

(b) The rule of 'replacement':

Words such as 'or' and 'implies' may be replaced by their definitions, and vice versa.

By definition, 'if p is true then q is true' is equivalent to 'if not-p is true or q is true', so that if 'p' means 'this is a ball' and 'q' means 'this is round' we can see that the theorem:

'if this is a ball then this is round' is equivalent to

'this is not a ball or this is round' because if the expression 'this is not a ball' is false, then clearly this is a ball, and therefore it is round.

As an example of replacement we can replace 'if p is true then' by 'if not-p is true or' in the second axiom, and we get the new theorem:

if p is true then (q is true or p is true)

(c) The rule of 'detachment':

If 'A is true' is a theorem (that is, it is true), and if

'if A is true then B is true' is a theorem (that is, it is also true), then

'B is true' is also a theorem (that is, it too is true).

For example, if the following is a theorem:

if *[if (p is true or p is true) then p is true]* then (if p is true then p is true)

then since the expression between the two asterisks is known to be true (it is the first axiom) we have the new theorem:

if p is true then p is true

The Logic Theory Machine at work

In essence the method is similar to the tree expansion method described for the Geometry Theorem Machine. A crude way to prove a theorem is what Newell, Shaw and Simon called the 'British Museum Algorithm'. Make the theorem the root of a tree and then apply all the possible substitutions, replacements and detachments, each of which would create a new node on the tree. Each of these nodes could then have applied to all the possible substitutions, replacements and detachments, and so on.

Eventually, if the program did not run out of time or memory, it would create a node which corresponded to one of its known theorems, and it would then produce a proof of the original theorem by traversing, in reverse order, the steps from the newly created node (corresponding to an existing theorem) back up to the root of the tree.

Obviously this brute force approach will exhaust the available computation time and computer memory for all but the very simplest of theorems. Using this method, and being allowed three iterations (which created proofs for 42 new theorems), the Logic Theory Machine was only able to solve one of the 60 or more theorems in Chapter 2 of *Principia Mathematica*. Three more proofs were achieved after two further iterations (that is, within the first 115 new theorems), one more within the next two iterations (that is, the first 246 new theorems), and one more within the first 1000 new theorems. In order to avoid creating useless theorems, the program therefore needs some heuristics to enable it to select which substitutions, replacements and detachments should be applied, and other heuristics to determine the nodes on the tree to which they should be applied.

A powerful heuristic employed by the program is called 'chaining'. If the program encounters a theorem of the form:

if A is true then B is true

which it needs to prove, it searches for an axiom or theorem of the form:

if A is true then Z is true

and if it finds one, it knows that it can prove the previous theorem by proving the theorem:

if Z is true then B is true

When a new problem is presented to the Logic Theory Machine, it first tries substitution, using all the axioms and theorems that it has been told to assume and which are already stored in its theorem list. If substitution fails, the program tries detachment, and as each new subproblem is created by a successful detachment, an attempt is made to prove the new subproblem by the substitution method. If substitution still does not work, the subproblem is added to a subproblem list.

If detachment fails for all the theorems in the theorem list, the same cycle is repeated with chaining — try to create a subproblem; try to prove it by substitution; if unsuccessful, put the new subproblem on the list. If substitution ever succeeds with a single subproblem, the original theorem is proved.

If these methods have been tried on the original problem and no proof has been found, the next untried subproblem is taken from the subproblem list and the same methods are applied to this subproblem. This

process continues until a proof is found, or until no more subproblems remain on the list, or until time or memory is exhausted.

In order to determine which theorems on the list should be tried for substitution, replacement and detachment, the program employs a type of evaluation function called the 'similarity test'. Two logic expressions are said to be similar if both their left-hand sides look alike and both their right-hand sides look alike. (There is a more rigorous definition of similarity employed in the program.) For example:

if p is true then (q is true or p is true)

and

if r is true then (if m is true then r is true)

are similar, because the expressions between each pair of asterisks are of exactly the same form, and the expressions to the right of each right-hand asterisk are similar because (if m is true then r is true) is similar to (not-q is true or r is true), as we have seen in the example of replacement given above. The similarity test reduces substantially the number of substitutions, replacements and detachments attempted at each node, in some cases by a factor of 10.

Although the Logic Theory Machine was one of the forerunners in the field of automatic theorem proving, it was able to prove 38 out of the 52 theorems in Chapter 2 of *Principia Mathematica*. During the three decades that followed this pioneering work of Newell, Shaw and Simon, theorem proving has become one of the most prominent areas of AI research. There is now a plan at McGill University, Montreal, to hold the first 'World Theorem Proving Championship', in which programs will be awarded points for successfully proving a number of test theorems in elementary logic. This idea was conceived by Professor Monty Newborn, who was one of the organisers of the very first computer chess tournament (held in New York in 1970), and if the world of computer chess is anything to go by, such an event might provide the stimulus for the creation of programs that can perform at the level of a mathematics PhD.

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END



SCREENTEST

Turbo Prolog

When Borland 'Turboed' Pascal, it transformed the language into a respectable and widely used software development tool. Will the company do the same for Prolog? Mike Liardet finds out.

For the whole of the seventies and the early part of the eighties, Prolog was an obscure programming language, closely confined to the Artificial Intelligence laboratories of Europe. It broke out of academe about three years ago when Logic Programming Associates, a UK company, launched a mass-market version of Prolog for micros. Since then, several more micro versions of Prolog have become available, and interest in the language has greatly accelerated, especially because of its central role in the development of expert systems.

Only in the last year has Prolog crossed the Atlantic, and now a number of major US software companies have developed, or are developing, their own Prolog products. Most notable among these companies is Arity, which is an offshoot of Lotus Development Corporation and Borland International, producers of the widely acclaimed SideKick and Turbo Pascal.

In this review I'll examine Borland's version of Prolog, not unexpectedly named Turbo Prolog. Like all Borland products, it is for the IBM PC, is very modestly priced, is extensively advertised, and has a very high-standard overall presentation.

Turbo Prolog, like Turbo Pascal, offers a completely integrated environment for creating, running and debugging programs. It's worth emphasising that, although Prolog is traditionally an interpreted language, Turbo Prolog is in fact a compiler and not an interpreter. This means that, other things being equal, Turbo Prolog programs can be expected to run faster than their interpreted brethren. At the same time, the integrated environment takes care of most of the inconveniences normally

encountered when working with a compiled language.

First impressions

Turbo Prolog is billed as a 'lightning-fast development system for your IBM PC, AT, XT, PCjr or compatible'. Therefore, it should be expected to work on any of the IBM range of PCs, plus all the close clones. Like all Prologs, it has a fair appetite for RAM memory, and needs at least 384k.

Turbo Prolog comprises a 200-page paperback manual with two IBM PC disks. The disks contain the Prolog system plus a large number of example programs. In line with all of Borland's products, neither disk is copy-protected, and the manual contains the most sensible and understandable software licence agreement I have yet encountered ('... treat this software just like a book ...').

To get started with Turbo Prolog, simply transfer it to a working disk and then type 'PROLOG'. It isn't necessary to first use an installation facility, but there's a 'Set-up' option within Turbo Prolog which can optionally be used to alter some of its features — screen colours, window sizes, and so on. It was only after I had been using the product for some time that I began to use Set-up to tune the system to my preferences. The only Set-up option that I wished I had used immediately concerned 'synchronisation of the colour graphics adaptor'. With synchronisation 'off', the screen display and windowing works considerably faster.

Once past the copyright screen, the user is presented with the layout shown in Fig 1, with the screen divided into six main areas. The long, thin box at the top contains the main menu options. They work in the

familiar pull-down fashion, with options selected by the arrow keys or the initial letter (the 'Options' option has just been selected in Fig 1). The four large boxes in the middle of the screen are the Editor, Dialog (sic), Message and Trace display windows. These windows will contain, respectively, the Prolog program text, input and output while it's running, system messages from Turbo Prolog, and trace diagnostic information. The bottom line of the screen is reserved as a command line, giving instructions to the user.

In order to gain confidence with any software, it's useful to get started with a quick and simple exercise. The Turbo Prolog manual does this with a very simple 'Hello there' program, which can be typed-in in just a few seconds, and compiled and run just as quickly. Firstly, the 'Edit' option is selected. This enables the text of the program to be entered, and it appears in the 'Editor' window as it is typed. Pressing Escape exits from the editor and returns to the main menu, where the 'Run' option compiles and runs the program. The program's output appears in the Dialog window and the progress of the compilation is logged in the Message window. The final display, after creating and running a simple 'Hello there' program, is shown in Fig 2.

Turbo Prolog's development environment includes an editor, a compiler and debugging facilities. The environment also allows itself to be reconfigured in various ways. I'll deal with each of these different aspects of the development environment in turn.

The editor

Turbo Prolog's editor is very similar



Fig 1 Default screen layout

to the WordStar-like editors in some of Borland's other products. Accordingly, anyone used to WordStar, SideKick or Turbo Pascal *et al* should feel instantly at home. In addition, WordStar buffs will spot a number of welcome improvements, such as a rub-out key that works correctly, no pauses for disk access, improved screen layout, and optional automatic indenting of the program code.

The editor operates only within the Editor window. In its initial state, this window is too small for easy viewing of larger programs, even though it can be scrolled left and right as well as up and down over the program text. The solution to this problem is to resize the window. This can be done fairly quickly, and it can easily be made to fill the whole screen if necessary.

The editor is a screen editor, working on the WYSIWYG (what you see is what you get) principle. There is a flashing 'cursor' which indicates the current action point where all modifications and insertions take effect. The arrow keys can be used to move the cursor one character or line at a time, and there are a number of other keystrokes which cause the cursor to travel greater distances in one go: across a word, to the end of a line, up or down several lines, to the top or bottom of the text, and so on.

Since the editor is not for word processing, but is used to create program text, there is no automatic word-wrap, and the editor simply scrolls the text sideways if a long line is entered. Curiously, this rarely happens in Prolog — the conciseness of the language normally results in fairly short lines of code.

There's a full range of special commands to move blocks of text, search or search-and-replace, and so on. There's also an online Help facility and an auxiliary edit buffer. This enables two files to be edited simultaneously — a feature which can be useful when the main program file calls upon external 'include' files.

The editor has no macro facility and can't be used to apply global changes to a sequence of files. I would count these as the only significant omissions from an otherwise excellent program-editing environ-



Fig 2 A successful first program

ment. These features would be very useful when applying drastic surgery to a suite of program text files, and without them the user must spend more time (and care) at the keyboard; but for much of the time, these are rarely missed.

Running and compiling

When the Prolog program has been created in the editor, it can be run immediately by selecting the 'Run' option in the main menu. No other

```
Goal: Member (X, [], 99, 33, 41)
X = 99
X = 33
3 Solutions
Goal:
```

Fig 3 Symptoms of a faulty member definition

formalities are needed. For example, library linking and the specification of filenames are either irrelevant or taken care of automatically.

Running a program involves compilation into executable code, but this is not immediately obvious to the user since the Run option performs at such speed. This is partly a consequence of no disk access being needed at any time; the source code, compiler and resulting executable code all being in RAM memory. As a rough guide to Turbo Prolog's performance, a fairly substantial 300-line program was compiled and up and running in just 11 seconds (on my fairly pedestrian 4MHz XT-compatible).

If the compilation detects any errors in the program, a message is displayed, and the system drops back into the editor at the point where the error was encountered. Normally, the required correction is fairly close to this point, and once the changes have been made, Run can be restarted before leaving the editor, using a special editor keystroke. Borland describes the compiler as 'incremental' but it doesn't appear to be possible to use it incrementally. In particular, following a minor error correction, the whole compilation must restart from scratch; this is not such a disadvan-



Fig 4 During the Trace facility

tage, given the speed of recompilation.

Sometimes it's convenient to break a program up into smaller files, and then the main file can contain an 'include' directive which tells the compiler to read a file from disk at that point. The editor capacity is limited to 64k of text, so it's mandatory to use this form of organisation on larger programs.

The 'include' directive is one of a number of compiler directives available. Other directives can be used to suppress warning messages, generate code to perform tracing diagnostics, perform special checks, and to display an analysis of the code generated, and so on.

When a program has been completed, it's useful if it can be converted to be stand-alone, runnable directly from DOS and without the need to first invoke Turbo Prolog. The main menu 'Compile' command can be used to achieve this. It can be used to compile either to an object file or to an executable file direct. It's also possible to link Turbo Prolog object code with object code from other languages including Pascal, C, Fortran and assembler.

The manual has full instructions on calling conventions and protocols. Ironically, it isn't (yet) possible to link with Turbo Pascal, which uses a non-standard object-file format. Evidently, Borland is working on that one.

Debugging and tracing

The simplest method for debugging a Turbo Prolog program is to omit the 'goals' directive from the source code. If the goals directive is present, it acts rather like an autoexec batch file in PC-DOS and seizes control as soon as the program is compiled. Without it, Turbo Prolog enters a 'command mode' where it asks the user what to do, and he can then type in a request to execute any part of the program. Therefore, if the main program doesn't work, then progressively lower and lower-level modules can be attempted until the offender is identified.

In Prolog it's easy to write programs that can generate many alternative answers (using backtracking), and from command mode, all possible answers are shown. For example,



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Fig 3 shows the dialogue while debugging a faulty 'member' definition. The goal is to find (all) values for X which are members of the list [1,99,33,4]. Since only three have been found, when we would expect four, we can deduce that the definition of 'member' is wrong.

For complex debugging requirements, there's a facility to trace the execution of the program. The 'trace' directive must be included at the top of the source file, and optionally, to avoid tracing everything, it can restrict the parts of the program to be traced.

A particularly helpful feature of Turbo Prolog's tracing is that the program text displayed in the edit window is kept in synchronisation with the trace — it isn't necessary to fumble around with program listings while using it.

'... several more micro versions of Prolog have become available, and interest in the language has greatly accelerated ...'

Unfortunately it can be very difficult to understand a trace of a Prolog program, and this has nothing to do with Turbo Prolog *per se*. It's because Prolog's flow of execution can become very complex. In conventional languages, a procedure is called and then returns, and a simple trace facility can just display the procedure's variable values on entry and on exit. In Prolog, a procedure (actually called a 'predicate') call can also fail, and this will cause a previously successful return value for another predicate to be undone and retried (this is called 'backtracking'). Turbo Prolog's 'trace' flags each of the four possibilities (call, return, fail and redo), but it can take some effort to follow (see Fig 4).

Like most tracing facilities, Turbo Prolog's can be overly verbose. To cut down the verbosity, a 'short trace' directive can be used instead, and tracing can be switched on or off under program control, but it can still be difficult to keep the amount of

information down to readable proportions. Also, it would be easier to comprehend the trace output if it were indented to indicate depth of procedure call. This applies particularly during recursion.

Set-up

Turbo Prolog's 'Set-up' option enables the user to tailor the Prolog environment to his preference. For example, the default window layout is quite suitable for getting started with Turbo Prolog, but is inappropriate for more complicated tasks. This is because all the windows are too small. The user can use Set-up to move and expand the windows, allowing them all to overlap if required, and then permanently record this new arrangement in a configuration file.

It's also possible to change the colours of the windows, and set up default disk and directory locations for the various types of file that Turbo Prolog deals with. And, as I have already mentioned, the display speed can be considerably enhanced by using Set-up with display adaptor synchronisation switched off.

In comparison with conventional languages, Prolog consumes a lot of stack space during program execution. Turbo Prolog attempts to minimise the problem by eliminating tail recursion, but it's possible to set-up the system with a larger stack. The maximum size is 64k.

Turbo Prolog

'Prolog' is an acronym for 'PROgramming in LOGic'. Historically, it's based on formal mathematical logic, but most users simply regard it as a powerful programming language which enables knowledge, thoughts and reasoning on a problem to be encoded directly into the computer.

It's very easy to apply Prolog to non-algorithmic problem domains, where the steps from problem speci-

fication to solution can only be reached by trial and error. Like any other programming language, Prolog could be used universally, but due to its special features it lends itself greatly to many non-numerical applications: expert systems, natural language understanding, problem-solving, graph traversing, database reasoning, and so on.

Before Turbo Prolog, most versions of the language attempted to closely emulate the pioneering implementation developed on a DEC System 10 at Edinburgh University in the mid-seventies — referred to as the Edinburgh/DEC-10 standard.

While the core of a Turbo Prolog program looks just like Edinburgh Prolog, it has a number of features which deviate further than most other implementations of Prolog. This has subjected it to a fair amount

'Turbo Prolog, like Turbo Pascal, offers a completely integrated environment for creating, running and debugging programs.'

of criticism from some members of the UK Prolog community (who cannot necessarily be counted as impartial). I'll present some of these points as I elaborate further on the language, but to put the issue in perspective: in some cases, Edinburgh Prolog programs might prove difficult to convert to Turbo, but conversion from Turbo to Edinburgh should generally be comparatively straightforward.

General features

Prolog programs are built out of statements called 'clauses', and clauses are built out of predicates, variables and other kinds of term. Turbo Prolog follows all the Edinburgh conventions for clauses, predicates and variables, and a Turbo clause looks just like an Edinburgh one.

Turbo Prolog arithmetic and other expressions can be written in the usual $\text{cos}(X*10+Y) := Z*U$ notation, as used by all the common languages. In this respect, both Edinburgh and Turbo Prolog contrast with the very early Prolog implementations where a cumbersome Lisp-like syntax had to be used. Edinburgh Prolog introduced the more readable form, with an 'operator facility' which automatically converts the familiar notation into Prolog's internal representation. At the same

```
domains
    intlist = integer*
predicates
    member(integer,intlist).
clauses
    member(Num,[Num:_ _]):-!.
    member(Num,[_:_Tail]):-member(Num,Tail)
```

Fig 5 Definition of a member — Turbo style

time, this operator facility was put at the disposal of the user so that he could create his own operators. This enables Edinburgh Prolog programs to have statements such as 'john is the father of mary' instead of 'is the father of(john,mary)'.

For some reason, and in spite of allowing the full normal range of arithmetic operators, Turbo Prolog doesn't have this facility. Obviously this may cause some problems in converting existing programs to Turbo Prolog, but it has no effect on the scope and power of the language.

Prolog's special pattern-matching algorithm, which is absolutely fundamental to the operation of the language, is known as 'unification'; as far as I can tell (and contrary to a widely held belief), Turbo Prolog does fully implement unification. The only exceptional point about its unification is that, in some unusual circumstances, it's necessary to make a

'... I would have preferred more flexibility with implementation of lists, and the ability to declare types of mixed constants.'

special 'reference' declaration. Turbo Prolog always spots when this is necessary, so the issue is best ignored until a warning is given. When the single word 'reference' is inserted at the appropriate place, the unification performs normally.

A further point on the subject of unification is that in an attempt to maximise the efficiency of the unification process, most Prologs omit a special check (called an 'occurs check'). Very rarely, this can result in infinite loops in the underlying data structure. Turbo Prolog appears to have this check, and so it can be argued that Turbo Prolog has a more complete unification algorithm than some other Prologs. However, if any readers can demonstrate any flaws in Turbo Prolog's unification, I would be interested to hear from them.

Directives

The use of most of Turbo Prolog's compiler directives is entirely optional, but there are also two directives, 'domain' and 'predicate', which are mandatory. These two directives have stirred up a fair degree of controversy among existing Prolog users because they enforce type declarations in the language. For example, in Turbo Prolog, a member predicate (which determines whether an element is in a list) must be defined as in Fig 5. In standard Prolog only the clauses — that is, the last two lines

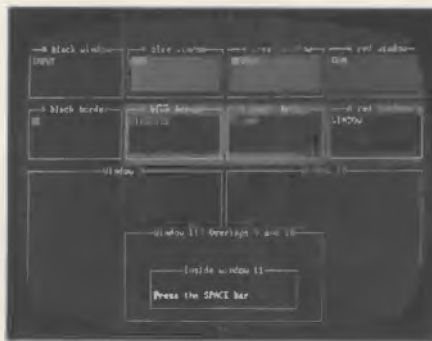


Fig 6 A windows demonstration

of Fig 5 — need be supplied.

Apart from involving the user in some extra thought and typing, there are a number of consequences — some positive, some negative — which arise from the Turbo Prolog methodology:

- Predicates cannot simply be blindly used wherever necessary. For example, the member predicate, as given here, can only be applied to lists of numbers, and for any other usage the declarations must be extended or changed. Within a given application, it's possible to declare it so that it will apply to virtually anything, but there's no concise way to do this.

- Many more programmer errors are detected at compile time, where they are easily identified, rather than at run time, where they are not. In most cases Turbo Prolog will instantly spot if a predicate is used with the wrong number of arguments, or arguments in the wrong order, and so on. I have found this feature to be a great advantage.

- Different types of object (for example, numbers and symbols) can't be mixed within a list (although they can be mixed within any of the other data structures). Lists of lists are permitted, but they must all be to the same depth of nesting. Many existing Prolog programs used mixed-type lists, and these will be difficult to convert to Turbo Prolog.

- The declarations have some considerable value as comments, but not being optional, the programmer is

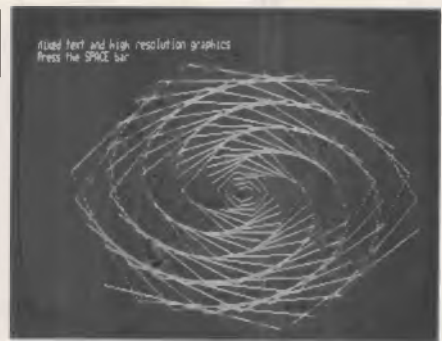


Fig 7 Using the graphics predicates

one who was reared on Edinburgh Prolog) I found that the advantages of the domains/predicates declarations just outweighed the disadvantages. They will inevitably make it harder to convert existing software, but for new programs, the enhanced checking and execution speeds are well worth having.

'... WordStar buffs will spot a number of improvements, such as a rub-out key that works correctly and no pauses for disk access ...'

Built-in predicates

Where most programming languages are supplied with libraries to handle file operations, input and output, and so on, Prolog has built-in predicates (or BIPs).

Turbo Prolog has a library of about 100 built-in predicates, in addition to its extensive arithmetic capabilities. These fall broadly into the categories of screen and file I/O, windowing facilities, turtle graphics, database facilities, and miscellaneous programming tools.

There's a surprising depth and power in most of the facilities. Taking graphics and windowing, it was very easy to create the demonstra-

	Benchmark Test		
	grey-100	queens-6	300-liner
Compilation time (approximate, in seconds)	1	2	11
Logical Inferences per second (LIPS)	2711	337	1726

Fig 8 Benchmark timings

forced to include them.

- The execution speed is considerably faster, as type-checking is done at compile time, not at run time.

In general, I would have preferred more flexibility with Turbo Prolog's implementation of lists, and the ability to declare types of mixed constants. But overall (and I speak as

tions shown Figs 6 and 7.

Rather more limited are the database facilities. In Edinburgh Prolog it's possible to 'assert' or 'retract' complete Prolog clauses into a database. This allows Prolog to dynamically create its own executable programs, as well as the more mundane activity of maintaining a database of

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facts. In Turbo Prolog, only simple facts (a restricted form of a clause) can be asserted or retracted in the database.

Many of the special programming tools, available in Edinburgh Prolog, are missing from Turbo Prolog. These tools can be used to manipulate the language — a feature that's quite common in AI languages, but almost unknown elsewhere. For those in the know, 'decomposition', 'bagof' and 'call' are but a few of the BIPs not supported by Turbo Prolog.

Turbo Prolog has all the usual arithmetic capabilities, operating on both integers or floating point (IEEE eight-byte) quantities. Logical comparisons, transcendental functions and bit manipulators are all included. The logical comparators can also operate on strings and symbols, as well as numbers. One surprising omission is that there's no exponentiation, but this can be implemented using the other functions.

Benchmarks

Some performance Benchmarks were run in order to obtain a measure of the efficiency of the Turbo Prolog compiler and of the code generated

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by it. The Benchmarks, which test processing power only, were performed using a NEC V-20 processor at 4.77MHz.

The Benchmark results are summarised in Fig 8. They give Turbo Prolog's compilation times and the run-time performance for each of three programs. The compilation times were measured by stop watch, and are approximate. The run-time performances are measured in logical inferences per second (LIPS). When Prolog is running it spends virtually all its time making logical inferences, so this is a highly relevant point of comparison between Prologs. (Note that due to the enormous possible variations in complexity between logical inferences, this measure, on the same Prolog, can vary greatly between different applications.)

Two of the Benchmarks have been

widely used to test Prolog in the past. These are nrev-100, a deliberately inefficient program to reverse a 100-element list, and queens-6, a program to solve the puzzle of placing six queens, all in safe positions, on a six-by-six chess board. Apart from the usual objection about the artificiality of Benchmarks, these Benchmarks in particular have become so well-known that Prolog compiler writers may now be 'tuning' their own compilers specifically to perform well with them. In an attempt to counteract both these objections, I also Benchmarked a more real-world 300-line program of my own devising.

Turbo Prolog's compilation performance is truly amazing, and it should not be overlooked that for the times given, there's no further overhead for linking, and so on. In comparison with its 11 seconds for the 300-liner, most other language compilers would take several minutes to complete a compilation and link of a 300-line program. The execution speed of the compiled code is also highly impressive, comparing with about 100 LIPS for nrev-100 on a typical interpreted Prolog.

Conclusion

Prolog has at last come of age on personal computers. Firstly, implementations of the language have become sufficiently refined, and PCs have become sufficiently big and powerful, for it now to be usable on full-scale practical applications. And secondly, obvious PC application areas now exist for which the language is tailor-made. The building of expert systems is at the forefront of these applications, but natural-language interfaces and intelligent databases are close behind.

An astute marketing organisation such as Borland must obviously have recognised the signs, and put its full weight into an excellent and comprehensive implementation of Prolog. Not only that, but it has priced the package at a typical Borland price — just £69.95.

The only fly in the ointment is that the Turbo Prolog language itself deviates quite markedly from the Edinburgh/DEC-10 unofficial Prolog standard. This could cause some especial difficulties with the conversion of existing Prolog programs to Turbo (but not the other way round). Of course, all this is unlikely to be an issue with Borland's target market, who will be coming to Prolog for the first time.

Turbo Prolog is available in the UK from Altor Computer, tel: (041) 226 4211, and Bristol Micro Traders, tel: (0272) 279499. **END**



'I used to write software until I got replaced by a younger know-all.'

CPL primer

When you use Telecom Gold you are connected to a sophisticated minicomputer. Robert Schifreen explains how you can write programs in the computer's language to customise your own mailbox or invent totally new commands and facilities.

Telecom Gold and Prestel both run on large minicomputers. In the case of Prestel you are connected to a GEC 4190 system, while Telecom Gold uses a network of Prime 750 machines. MicroLink, TTNS and PCW Online all share the Telecom Gold computers, so everything here is also relevant to those systems.

One difference between Prestel and Gold is what happens when you dial up. With Prestel your call is intercepted by the software that runs the viewdata system, so you can only log into Prestel and can't harness any of the other facilities that the GEC machine can provide.

With Telecom Gold, the picture is completely different. When you have logged in, you get a '>' prompt. The prompt is the system prompt of the Prime 750 computer. When you type 'MAIL', you are simply running an electronic mail program. Because, with Telecom Gold, you are actually at the operating system's prompt, you can write and run your own programs on the Prime, and store them in your mailbox. The first part of this article describes how to do just that. It is an introduction to the CPL language and tells you how to actually enter a program and run it.

The second part is a summary of all of CPL's commands and functions. It is impossible to give a complete description of every one here, but if you want to know more, send me a mailbox and I will mail you a couple of longer programs to play around with.

Where example Gold commands are given here, they start on their own line and begin with the '>' character. This is the Telecom Gold prompt, which normally appears automatically on your terminal — *do not type the '>' character when entering the examples.*

Getting started

The operating system used on Telecom Gold is called Primos. Running under Primos, you would normally have access to a number of lan-

guages including Basic, Fortran, Cobol and PMA (the Prime Macro Assembler). However, the Gold system is set up so that the average user cannot access these languages. There is, though, one language that is available to any user on Telecom Gold called CPL, or Command Procedure Language. CPL is the Prime equivalent of the batch control language in MS-DOS; however, it is much more powerful than a simple batch processing language. You can write complex programs to make using Telecom Gold easier, or even add new facilities to the system. And because Telecom Gold is a multi-user system, you can use the mail facility to swap CPL programs with friends or colleagues.

CPL is a high-level, interpreted language. It does not give you direct access to the memory of the computer, therefore it is 'safe' enough for Telecom Gold to allow any user to access it.

A CPL program consists of a number of program lines held in an ASCII file. Each line of the file contains one CPL command. The CPL program lines can be in upper or lower case. The name of the file holding the program must end with .CPL.

CPL command lines can consist of Primos commands (for example, Mail, USERS, DATE, TIME) or true CPL commands. All CPL commands must be preceded with an ampersand; for example, &GOTO GET_LINE.

Once a program has been written and stored in a file on Gold, you run it by typing:

```
>CPL filename
```

Providing the program you have written does not have the same name as an existing Telecom Gold command, you can run it just by typing its name, without the .CPL part. So, if your program was called NEWMAIL.CPL, you could just type:

```
>NEWMAIL
```

at the prompt to run your program.

If you are writing a CPL program from scratch, you can use a word

processor to prepare it and then upload it to Telecom Gold. However, you will probably need to use the Gold Editor (called ED) to debug your program if there is an error.

As well as being able to send and receive mail, your Telecom Gold mailbox contains a file area, just like a floppy disk in a computer. You can store as many files as you like in this area, *but it will cost you.* (CPL costs nothing to use except online time, but you are billed for storage.)

To get a list of the files in your file area, type:

```
>F
```

at the prompt.

The display will look something like this:

```
C_ID          001 01/04/86 17:48
  ASC D W R
TEST1.CPL     003 02/09/85 19:22
  ASC D W R d w
*MAILSAVE*   002 04/01/84 12:20
  ASC D W R
```

For each entry, you get:

- the name of the file.
- its size, in 2k blocks.
- the date and time it was created or last edited.
- its type. ASC means it is an ASCII file that can be viewed with the TY command. There are many other file types that Gold may use.
- the file's attributes. These control the access to the file both by the person whose mailbox the file is in, and by other users of Gold.

Even if you have not put any files in your mailbox yourself, you may find one or two in there when you type F. One useful file is C_ID. This is just like the AUTOEXEC.BAT file in MS-DOS, and contains commands that are automatically executed each time you log in. If you are a MicroLink member, you will have been given a C_ID file to identify you as a MicroLink member and give you access to its main menu.

To display the contents of a file, use the TY command. For example:

```
>TY TEST.CPL
```

will type the contents of a file called TEST.CPL. Note that you must use

TY and not the full word TYPE.

To copy a file — for example, to make a back-up before you alter a program — type

>FCOPY filename newfile

For example:

>FCOPY PROG.CPL PROG.BAK

to create a back-up of a program called PROG.CPL.

To delete a file, type:

>DELETE filename

Using the editor

At some time you will need to use Telecom Gold's online editor. This allows you to create a file in your file area by typing it at the keyboard, or to edit an existing one. If you have not used the editor before, type:

>INFO ED

for details. To get you started, here are some of the most useful commands.

To start the editor and create a new file, type:

>ED

To edit an existing file, type:

>ED filename

Once you are in the editor, you will either be in EDIT or INPUT mode. In EDIT mode, you can issue commands to the editor. In INPUT mode, anything that you type is added to the file being edited.

To swap between INPUT and EDIT mode, press RETURN on its own. The system will tell you which mode you are in whenever it changes. To insert a blank line, enter just a space and then press RETURN.

When you are in EDIT mode, the most useful commands are:

- t — return to the top of the file
- p — print the line being edited
- p* — print every line of the file
- p5 — print the next five lines, starting from the line being edited
- b — move to the bottom of the file
- d — delete the line being edited
- c/xx/yy — change string xx to yy
- save filename — saves the file being edited

Swapping programs

You can use the mail system on Gold to swap CPL files among friends. You need to copy a file from your file area into a letter so that you can send the letter to someone. To do this, use the '.L' command.

When entering the text of a letter, typing '.L filename' will load the specified file into the letter. For example, to send a copy of a program called GAME.CPL to mailbox MAG90141 you would type:

>MAIL SEND MAG90141

Subject: HERE'S A PROGRAM FOR YOU

Text:

Here is a CPL game that I wrote. What do you think?

.L GAME.CPL (load the file into the message)

24 lines loaded (this message

printed by Gold)

.s (send the message).

Sent.

>

If someone sends you a CPL program like this, you will want to save it in your own file area. When you read the message and get to the 'ACTION REQUIRED' prompt, type SAVE TEXT filename.CPL to save the text of the message in the specified file in your mailbox. You can then edit or run it.

Errors

If a CPL program crashes, nothing too serious happens. The CPL interpreter will give a reasonable (often fairly lengthy) explanation of what went wrong, and the program will stop executing. You will have to edit the file and fix the bug, then rerun the program.

If the program gets stuck in an infinite loop, you can usually break out by typing Ctrl-P twice, if you are logged in via PSS, or Ctrl-P followed by B if you are using the London direct-dial numbers.

If you are using files in a program, and that program crashes, type >CLOSE -ALL to ensure that there are no files left open after the crash.

Variables

The best way to learn CPL is to experiment with the sample programs (see Table 1), and to try out new commands from the summary that follows. However, the way that variables are handled is very different from Basic and just about any other language, so I will explain this first.

There is no difference between string and numeric variables. To assign a value to a variable, you use the CPL &SET_VAR command like this:

&SET_VAR A : = 10

which sets the value of variable A to 10. Note that &SET_VAR is a CPL command, so it must be preceded by an ampersand (&). Note also that you use a colon followed by an equals sign when assigning values to variables.

You could just as easily have said: &SET_VAR A : = 'HELLO THERE' which sets the variable A to the string HELLO THERE.

CPL uses the apostrophe as quotes. You only need to put quotes round a string if it contains spaces.

To get the value of a variable, you enclose it in per cent signs. For example, the command TYPE %A% would print the value of variable A. Note that TYPE is a Primos command, not a CPL one, so no ampersand is necessary. Remember also that the examples here are CPL program examples, so you will get an error message if you try them by just typing the commands at the prompt. You will have to put them in a file and run them with the CPL com-

mand.

For comparisons, don't use a colon with the equals sign. For example:

&IF %A% = 10 &THEN TYPE

'VARIABLE A IS EQUAL TO 10'

To combine string variables, follow these examples:

In Basic: A\$ = B\$ + C\$

In CPL: &SET_VAR A : =

%B% %C%

In Basic: A\$ = B\$ + "TEST"

In CPL: &SET_VAR A : = %B%TEST

Sharing programs

If the company you work for uses Telecom Gold, you may want to write a CPL program and allow all the staff to use it. This would mean having to put a copy of the program in every user's mailbox. This is obviously not a good idea, as it is expensive in terms of storage and makes it difficult to update the program.

The way round the problem is as follows. Suppose you have written a program called NEWMAIL.CPL and it is stored in your mailbox, which is MAG90141. You would like any MAG user to be able to access the program from your mailbox. The following method will achieve that. It means that anyone can run the program, even though it is stored in your box. And because there is only one master copy of the program, you can easily update it.

Using the above as an example, log-in to your mailbox (containing the program) and type >PROTECT NEWMAIL.CPL 7 1

What this does is to set up the read/write attributes on the file so that *anyone* can read it (or run it), but only you can edit it or delete it.

You must also make sure that you have no non-owner password on your mailbox. Do this by typing >PASSWD -LONG and following the prompts. When the computer asks you for a non-owner password, just press RETURN to specify that you don't want one. In order to run the program, a user only has to log into their mailbox and type >CPL MAG90141>NEWMAIL. If you want to re-protect the file so that only you can actually use it, type >PROTECT NEWMAIL.CPL 7 0.

CPL is slow. When there are more than around 10 users on the system, it's even slower, so don't expect your program to run as fast as it would in Basic. To make a CPL program run as fast as possible, there are a couple of points to watch:

- Keep the program as short as possible. Don't include any blank lines and, if you must include comments, put them at the end of existing lines instead of giving each comment a line of its own.

- Put the most frequently used parts of the program at the top. This

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makes it faster for the CPL interpreter to find them.

You can include characters in your program whose ASCII code cannot normally be obtained from the keyboard. To specify such a character, use the '^' sign followed by a three-digit ASCII code expressed in octal. You must also add 200 (octal) to the value. To make the user's terminal beep (by sending it a CTRL-G character), you use TYPE ^207.

CPL commands

Now you have learnt the Basics, here is the list of commands available in CPL. These have been grouped to enable you to find the command that best suits your needs.

Remember that this section con-

tains only commands, not functions. Commands are statements that tell the computer to do something, whereas functions ask the computer to do a calculation and return a value. CPL functions follow this list of commands.

In the following explanations, parameters that are underlined should not be entered literally — instead, you should enter a value of your choice.

ARGUMENTS The full command line that is used to start a CPL program may be recovered by that program. For example, suppose you are writing a program called DISPLAY.CPL that will display the first five lines of a file. Asking the user to

run the program and then for the program to ask the name of the file that was to be displayed, would be a long-winded way of doing it. The best way is for the user to be able to type:

>DISPLAY filename

at the prompt, and the DISPLAY program would then recover the parameter that was typed after the name of the program. The &ARGS command is used to do this.

Syntax: &ARGS variable

Example: &ARGS file

Effect: Takes the next argument from the command line that was used to start the program, and puts it in the specified variable name.

Syntax: &ARGS variable:REST

Effect: Puts all remaining arguments from the command line (those that have not already been recovered with the command explained above) into the specified variable.

Here are a couple of programs for you to enter. The first is a simple one that will ask you for a number and then double it. The second is slightly more complicated. It will find out the mailbox numbers of everyone in your account group (for example, MAG, EPS, PCW, DTB) who is online, and send them a message asking if they would like to chat with you.

When you enter the program, change the line that defines the message string, so that it refers to your own mailbox and name. You will notice that the short form of &SET_VAR, &S, is used in these examples.

```
/* This is a simple program that asks you for a number
/* and will then double it.
$S a := [response] /* get number
$S b := [calc 2 * %a] /* double it
type The number you entered was %a
type Twice %a is %b
$return
```

Program 1

```
/* INVITE.CPL - sends a message to all users online in your
/* account group, asking if they want to chat.
/* By Robert Schifreen mbx: 72:MAG90141
/* To use: enter the file into your mailbox and call
/* it INVITE.CPL. Then just type INVITE to run it.
/* Change the message string to what you want.
/* Define message string
$S msg := 'Hello there. Wanna chat to MAG90141?'
$if [exists tempfile] $then delete tempfile
$S person := [before [after [pathname *] ] ] /* get ID of user
comp -ntty /* turn off screen display
comp tempfile /* send output to a file called tempfile
online /* do an ONLINE command to display users online
type All Done
comp -p /* stop sending output to tempfile
comp -tty /* turn display back on
/*
/* There now exists a file that contains the list of users
/* currently online. We must extract each mailbox number from
/* the list. Then send a message to each user with the MESSAGE
/* command.
/*
$S unit := [open_file tempfile st -mode r]
$label readmore
$S u := [read_file %unit% st]
$if [trim %u%] = 'All Done' $then $goto alldone
$label nextone
$S d := [before %u% ' ']
$S u := [after %u% %d%]
$S u := [trim %u%]
$if [null %d%] $then $goto readmore
$if %d% = %person% $then $goto nextone /* don't send message to myself
comp -ntty
$S data message %d%
$S msg%
$end
comp -tty
$goto nextone
$label alldone
close tempfile
type Message sent to:
ty tempfile
delete tempfile
```

Program 2

BRANCHING CPL programs don't have line numbers. If you want to use the &GOTO command, which jumps to a specified part of the program, you need a &LABEL command to identify the part of the program that you want to jump to.

Syntax: &GOTO labelname

Effect: Jumps to the part of the program identified by the specified labelname and continues execution from there.

Example: &GOTO printmenu

Syntax: &LABEL labelname

Effect: This statement, which must appear on its own line, is used as a marker for a subsequent &GOTO command. It has no other effect.

Example: &LABEL printmenu

COMMENTS If a line of a CPL program contains the characters '/*', then the remainder of that line is regarded as a comment and is not executed by the CPL interpreter. This is exactly the same as a REM statement in Basic.

ENDING THE PROGRAM

When the last line of a program is reached, the program is assumed to have ended and you will return to the prompt. The exception to this is that subroutines must end properly with a &RETURN command. If they don't, and the program finishes, an error message will be produced.

The proper way to end a program is also with the &RETURN command. This can appear anywhere in the program although, as I have said, it's not required if the last line of the program really is the end.

Syntax: &RETURN

Effect: Ends the program, just like the END statement in Basic.

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INPUT Input is via the RESPONSE and QUERY functions. These are explained in the section on functions.

LOOPS All CPL loops start with various forms of the &DO command and end with an &END command. All program lines between the &DO and &END are executed a number of times, according to the type of loop. **FOR/NEXT** — the CPL equivalent of the Basic FOR/NEXT loop is:

Basic: FOR X = 1 TO 10 ... NEXT X

CPL: &DO X := 1 &TO 10 ... &END

Basic: FOR Y = 7 TO 49 STEP 2

CPL: &DO Y := 7 &TO 49 &BY 2

DO WHILE — an example of a DO WHILE loop is:

&DO &WHILE %X% < 20 ... &END

This will execute the statements between the &DO and &END statements repeatedly while the value of variable X is less than 20.

DO UNTIL — an example is:

&DO &UNTIL %J% = 'HELLO' ... &END

which executes the statements between the &DO and &END commands until the value of variable J is 'HELLO'.

DO LIST This very useful command is a variant of a FOR/NEXT type loop. There is no equivalent in Basic.

Example: &DO X &LIST 1 2 4 6 9 ... &END

This goes through the loop five times. On each time round the loop, x will have the value 1, then 2, then 4, 6 and finally 9. Unlike Basic, it is perfectly acceptable in CPL to use a &GOTO to exit from the middle of a loop. However, you can't jump into a loop from outside. You can nest loops as deeply as you wish.

OUTPUT Output to the terminal uses the TYPE command. This is a Primos command, so it doesn't have an ampersand in front. (For output to a file, see the section below on 'File handling'.)

In the following examples, the variable T has the value 10 and the variable H has the value 'HELLO'.

TYPE T prints a letter T

TYPE %T% prints 10, which is the value of variable T

TYPE 'T is %T%' prints T is %T%. The per cent signs are printed literally because the string is in quotes.

TYPE T is %T% prints T is 10

TYPE %H% TO YOU prints HELLO TO YOU

TYPE %T% %T% %T% prints 101010

PRIMOS COMMANDS Single-line Primos commands (like TYPE) can be included in a CPL program. The computer knows that they are not CPL commands as they do not start with an ampersand. You can pass input to a Primos command.

For example, you could enter the mail system and send a message under the control of CPL. The command to do this is:

&DATA command

parameters

&AND

This enters the specified Primos command. The lines following the &DATA command are counted as input to the command, and not as CPL or Primos commands.

The following program asks the user for a string, then sends the string in a mail item to the user's own mailbox.

&s a := [response 'Enter a string']

&data mail

send

me

A message

%a%

.s

&end

The commands above are passed one at a time to the MAIL system, each time it requests input. As each command is executed it will be displayed on the screen, but this can be eliminated with a COMO -NTTY command. Instead of including every command to the MAIL system in a &DATA ... &END command, you can instruct the program to pass execution to the user's terminal, with the &TTY command. For example, the following program sends a message to MAG90141, which the user types in, but the subject is automatically supplied before handing over to the user to enter the message.

&data mail

send

mag90141

Here is a message

&tty

&end

SUBROUTINES CPL has a facility for defining and executing subroutines, similar to Basic's GOSUB ... RETURN statements. The lines of code that make up the subroutine should start with a &ROUTINE command and end with a &RETURN command. Each subroutine must have a unique name, which follows the &ROUTINE command in the same way that a name follows a &LABEL command.

For example: &ROUTINE PART1

To call a subroutine, the &CALL command is used, followed by the name of the subroutine you want to call.

TESTING FOR CONDITIONS

The &IF ... &THEN command, just as in Basic, is used to test for conditions. For example:

&IF %A% = 10 &THEN

&GOTO PRINTMENU

Only one command may follow an &IF &THEN command, as CPL does not allow more than one command on a line. To group a number of commands together in order to get round this problem, use the &DO command like this:

&IF %A% = 10 &then &do

type A is equal to 10

type This is another line

&end

You can use the &ELSE command too, like this:

&IF %a% = 10 &then &goto part1

&else &goto part2

To test for multiple conditions, you need the AND, OR and NOT characters. You cannot use the actual words — you have to use the characters. These are '&', '!' and '^' respectively.

For example:

&if %a% = 10 & %b% = 20 &then &goto part1

&if %x% ^= %y% &then type X is not the same as Y

&if %a% = 10 ! %a% = 20 &then &goto part3

&if ^ [exists DATAFILE] &then type DATAFILE does not exist

TRACE LISTINGS CPL has commands to help you debug programs. If you put &DEBUG &WATCH at the top of your program, then whenever a variable's value changes, a message will be displayed telling you which variable is altered, and what its value has changed to. If you use this, there will be numerous references to a variable called SEVERITY\$. This is CPL's own error-checking variable, which you can ignore.

If you put the command &DEBUG &ECHO in a program, each statement in the program will be displayed as it is executed.

VARIABLES The &SET_VAR command is used to assign a value to a variable. The command can be abbreviated to &S like this:

&s a := 10

&s b := HELLO

&s c := [response]

&s d := [date -full]

File handling

Like any other programming language, CPL allows you to read and write files. One of the most useful things that Gold allows you to do is to send the output of a command (for example, MAIL READ) to a file instead of to the terminal. You can then read back that file and interpret it. (See the INVITE.CPL program in Program 2 for an example of this.)

The commands that you need are:

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- **COMO filename** — echoes all terminal I/O to the specified file.
- **COMO -e** — ends echoing to a file and closes the file.
- **COMO -NTTY** — turns off output to the terminal. If a COMO to a file is in force, output will still go to the file but not to the user's terminal screen.
- **COMO -TTY** — turns back on echoing to the terminal.
- **OPEN_FILE** — opens a file for reading or writing.
- **READ_FILE** — reads a line from the file.
- **WRITE_FILE** — writes a line to the file.
- **CLOSE**
- **FILVER** — compares two files and reports any differences.
- **CMPF** — is similar to FILVER.
- **UPCASE** — converts any lower-case characters in a file to upper-case.

Now the details.

- **COMO filename** opens a file under the specified name. If the file already exists, it is deleted and a new one is started. All output that would normally go to the user's terminal (characters that the user types as well as those produced by Gold) will be echoed to the file as well.
- **COMO -E** closes the file specified in the COMO filename command.
- **COMO -NTTY** turns off output to the user's terminal. If a COMO filename command is in operation, output will still go to the specified file but will not appear on the user's terminal.
- **COMO -TTY** turns terminal display back on, after it has been turned off with a COMO -NTTY command.

The CPL commands to deal with files are:

OPEN_FILE

Syntax: &S N := [OPEN_FILE filename st -MODE m]

Effect: opens a file called filename. st is the name of a status variable, which will be set to 0 if the file is successfully opened, or to a non-zero value if it is not. m is the mode in which the file is opened. This can be r,w or rw (where r is read and w is write).

N becomes the channel number of the file. This is used to identify the file to be accessed by a READ_FILE or WRITE_FILE command, and NOT the name of the file itself.

READ_FILE

Syntax: &S A := [READ_FILE %N% ST]

Effect: reads one line of the file which was opened under channel N. Variable A is set to the string read from the file. If all is well, ST will be zero, otherwise it will be non-zero.

WRITE_FILE

Syntax: &S A := [WRITE_FILE %N% text]

Effect: writes the specified text to the file which was opened with channel number N.

CLOSE

Syntax: CLOSE filename

Effect: closes the specified file. You must close a file after you have finished with it. Note that the name of the file must be used here, not its channel number.

FILVER

Syntax: FILVER

Effect: you will be prompted for the names of two files. The files will be compared and, if there are any differences, you will be told what the differences are.

CMPF

Syntax: CMPF file1 file2

Effect: similar to FILVER. Compares the two specified files.

UPCASE

Syntax: UPCASE file1 file2

Effect: converts any lower-case characters in file1 to upper case, and puts the new file in file2. File1 is unchanged.

CPL functions

Functions are commands which, instead of just performing an action, return a value. When specifying a function, the name of the function comes first, followed by its arguments, if there are any. The whole thing is enclosed in square brackets. For example:

```
type [date] — prints the date
type [date -dow] — prints the day of the week
&if [date -dow] = Tuesday &then
&goto tues — test for today's day
&s a := [calc 12 * %b%]
type [before WATERFALL TE] — prints WA
```

Functions can be nested, but a space must be left between multiple sets of brackets. Functions can be used in Primos (from the '>' prompt) as well as in CPL programs. However, CPL commands (those that start with a '&') and variables cannot. So, you could use the command:

```
>type [calc 12 * 20]
but you could not use:
>type [calc 12 * %a%]
```

An alphabetical summary of the functions available in CPL is given below. String functions normally return a null string of zero length if the function cannot be evaluated — for example: TYPE [AFTER ABCDE H], while numeric functions return 0. Where (q) appears under the Effect section, this means that the function puts single quotes round its result. To remove these, use the UNQUOTE function.

In the descriptions below, the functions (and arguments) are in capital letters. The values which you supply are underlined — for example: the

Program 3 reads and writes to a file called NUMBERS.

```
/* FILES example program in CPL
&if [exists NUMBERS] &then delete
numbers
&s a := [open_file numbers st -
mode w]
&do x := 1 to 10
    &s dummy := [write_file %a%
number %x%]
&end
close numbers
/* File written, now read it back
&s a := [open_file numbers st -
mode r]
&do x := 1 &to 10
    &s r := [read_file %a% st]
type %r%
&end
close numbers
```

Program 3

word filename would be replaced by the file name of your choice.

AFTER

Syntax: [AFTER bigstring smallstring]

Effect: returns the characters in bigstring that occur after smallstring. (q)

Example: TYPE [AFTER MICROSCOPE MICRO] returns SCOPE

ATTRIB

Syntax: [ATTRIB filename -DTM]

Effect: returns the date and time that the file specified was created or last edited. DTM stands for Date and Time Modified.

BEFORE

Syntax: the reverse of AFTER.

CALC

Syntax: [CALC expression]

Effect: evaluates the specified integer expression. CPL can't handle floating point. Up to five levels of nested brackets are allowed. Boolean expressions may be used, in which case the string TRUE or FALSE is returned. All operators and values must be separated by a space.

DATE

Syntax: [DATE -arg]

Effect: returns the time or date in a variety of formats, depending on the value of arg. Although there is no CPL function to provide random numbers, you could take a few characters from the time and move them around with BEFORE and AFTER functions to produce fairly random numbers. (q)

For an example date of Monday, 9th June 1986, and a time of 7.30 pm, the results returned are:

```
arg string returned
AMPM 7.30 PM
CAL June 9th, 1986
DAY 9
DOW Monday
FTAG 860609.193000
FULL 86-06-09.19:30:00.Mon
```


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TURBO PASCAL

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PROGRAMMING

MONTH June
TAG 860609
TIME 19.30.00
UFULL 06/09/86.19:30:00.Mon
USA 06/09/86
YEAR 1986

EXISTS

Syntax: [EXISTS filename]

Effect: returns a value of TRUE or FALSE depending on whether the specified file exists.

Example: &IF [EXISTS *MAILSAVE*]
&then delete *MAILSAVE*

GET VAR

Syntax: [GET_VAR variable]

Effect: returns the value of the specified variable. This is equivalent to just specifying the variable name enclosed in per cent signs. For example:

TYPE [GET_VAR A]

is the same as

TYPE %A%

CPL does not allow nested per cent signs, but you could use GET_VAR to simulate arrays. To set up an array A and set its first 10 elements to 0, and then print out the values, use the commands:

&do x := 1 &to 10

&s a%x% := 0

&end

&do x := 1 &to 10

type[GET_VAR a%x%]

&end

HEX

Syntax: [HEX string]

Effect: converts string, which should be a hexadecimal number, to decimal.

Example: TYPE [HEX A] returns 10

INDEX

Syntax: [INDEX bigstring smallstring]

Effect: returns the position in bigstring at which smallstring starts.

Example: TYPE [INDEX WATERFALL FALL] returns 6, because the word FALL starts at position 6 in WATERFALL.

LENGTH

Syntax: [LENGTH string]

Effect: returns the length, in characters, of the specified string.

MOD

Syntax: [MOD num1 num2]

Effect: returns the remainder that would be obtained if num1 was divided by num2.

Example: TYPE [MOD 30 7] returns 2.

NULL

Syntax: [NULL string]

Effect: returns TRUE or FALSE, according to whether or not the specified string is null.

Example: &IF [NULL %A%] &THEN
TYPE 'A is a null string'

OCTAL

Syntax: [OCTAL string]

Effect: converts an octal string to decimal. See 'HEX' above for details.

OPEN_FILE

See separate section on 'File Handling'.

QUERY

Syntax: [QUERY text]

Effect: similar to Basic's INPUT statement, QUERY will stop execution of the program and ask the user for a response. However, the response must be Y (or YES), or N (or NO). If any other response is entered, the user will be asked to re-enter. If text is specified, the text is printed before the program asks for the input. To request any input from the user, and not just yes or no, use the RESPONSE function.

Example: &s a := [QUERY 'Do you want to quit?']

QUOTE

Syntax: [QUOTE string]

Effect: puts quotes round the specified string. Used to suppress characters which, if not in quotes, would be interpreted as special commands.

Example: TYPE [QUOTE %A%]

READ_FILE

See the separate section on 'File handling'.

RESCAN

Syntax: [RESCAN string]

Effect: removes the quotes from the string (or removes one set of quotes if there are more than one) and then evaluates the string.

Example: TYPE ['CALC 2 + 2'] would normally return [CALC 2 + 2] and not the result of 4, because the string is in quotes. TYPE [RESCAN ['CALC 2 + 2']] would return 4, as the RESCAN function removes the quotes.

RESPONSE

Syntax: [RESPONSE text]

Effect: equivalent to Basic's INPUT function. If text is specified, the text is printed before the program stops to ask for input. The user must press RETURN after entering his input — there is no CPL equivalent to Basic's INKEY statement.

Example: &s A := [RESPONSE 'What is your name?']

SEARCH

Syntax: [SEARCH string1 string2]

Effect: tells you which is the first character in string1 that also appears in string2.

Example: [SEARCH waterfall top] returns 3, because the third character in 'waterfall' is the first character of that string that also appears in 'top'.

SUBST

Syntax: [SUBST string1 string2 string3]

Effect: In string1, substitutes all occurrences of string2 with string3 (q)

Example: TYPE [SUBST ANDREW WX] returns ANDREX

SUBSTR

Syntax: [SUBSTR string num1 num2]

Effect: returns a substring of string, starting at character num1 and going on for num2 characters. This is identical to MID\$ in Basic. (q)

Example: TYPE [SUBSTR WATERFALL 4 3] returns ERF.

TO HEX

Syntax: [TO_HEX decnum]

Effect: converts the specified decimal number to hex.

TO OCTAL

Syntax: [TO_OCTAL decnum]

Effect: converts the decimal number to octal (base 8).

TRANSLATE

Syntax: [TRANSLATE string]

Effect: converts all lower-case letters in the string to upper-case ones (q).

TRIM

Syntax: [TRIM string side trimchar]

Effect: removes leading and trailing occurrences of trimchar from the specified string. If side is -left, only leading characters are removed. If side is -right, the only trailing ones are removed. If trimchar is not specified, TRIM removes blank spaces.(q)

UNQUOTE

Syntax: [UNQUOTE string]

Effect: removes the quotes (or removes one set of quotes if there are more than one) from string.

VERIFY

Syntax: [VERIFY string1 string2]

Effect: the reverse of the SEARCH function. Tells you which is the first character in string1 that does not appear in string2.

Example: &s a := [response 'How many would you like?']

&if [verify %a% 1234567890] ^ = 0
&then type 'That is not a number!'

WILD

Syntax: [WILD]

Effect: returns a string consisting of the names of the files in your mailbox's file area. Each name is separated by a space. Use the BEFORE and AFTER functions to search for the spaces and isolate each filename.

Example: TYPE [WILD] may return 'C ID TEST.CPL MAIL.REF'.

WRITE_FILE

See separate section on file handling.

Note: By the time you have read this article, those awfully nice chaps at Telecom Gold may have decided that they'd rather you didn't use CPL after all. If you use the CPL command but keep getting "Illegal Command" messages, try typing the command in single quotes and in upper-case, like this:

'CPL' filename.CPL

This should enable you to override any protection that Gold may have put on use of the CPL command.

If you have any comments on this article, or want assistance or further information, drop the author a line on mailbox 72:MAG90141. Don't call Telecom Gold, as its helpline staff don't use CPL and have little knowledge of it. Or you could always go direct to Prime for a CPL manual. **END**

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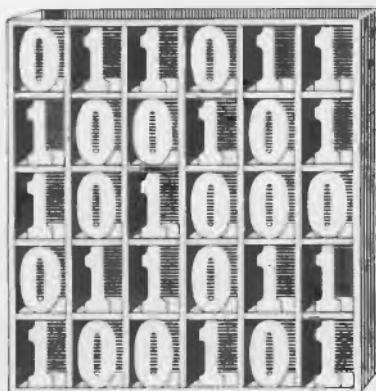
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8086 INTELLIGENT BLOCK TRANSFER

The first datasheet this month illustrates the pitfalls of attempting to convert a tried and tested routine from one language to another without taking into account the major conceptual differences between the languages.

IBT8086 from Steve Hunt of Great Barr, Birmingham, is a straight translation of the Z80 block transfer IBT28 (PCW, August 1984). The program structure of datasheet 1 is identical to that given for IBT28 and Steve has encoded this metalanguage in the nearest 8086 equivalent to the original Z80 code. If identical conditions obtain, then IBT8086 will work exactly as IBT28.

Since the Z80 is essentially an 8080 with 16-bit frills and the 8086 is an 8080 redesigned to cope with larger memory and 16-bit operations, line by line conversion between the two languages would seem not

only possible but the normal method of implementing existing software on the more advanced machine. Indeed, such straightforward conversion will often work correctly where the 8086 system is designed specifically to emulate the Z80 or 8080 and is limited to 64k memory. However, the 8086's unusual method of addressing larger memory in 64k segments is a complicating factor which makes simple conversion difficult in more fully utilised 8086 systems.

Fig 1 applies generally to all processors and languages and shows why the transfer of a block of data within memory cannot be done simply by starting at the lowest address and working through to the highest where source and destination areas may overlap. In case (a) no problems occur, but in case (b), where the source is lower in memory than the destination, the source data in the overlap area will have been overwritten by copied data before it is moved. The problem is eliminated in this case by reversing the process and beginning the

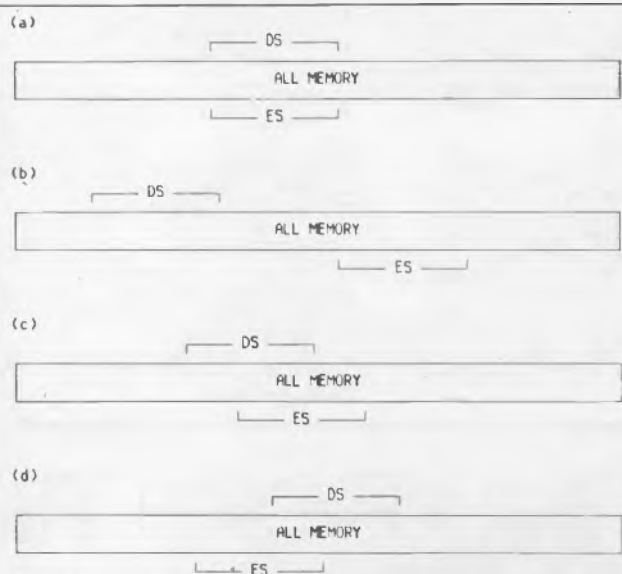


Fig 2

transfer at the higher address.

Case (c) of Fig 1, where source and destination pointers are equal, would seem to not require any transfer at all. It is possible, however, that the system utilises bank switching where read and write instructions each access different memory banks residing at the same addresses. If this is so, then the transfer routine must perform the move since the equality of source and destination is only apparent and not actual.

Fig 2 applies only to the segmented addressing of the 8086. In case (a) the DS and ES registers, used as source and destination segment registers respectively, each address the same 64k block of memory residing at a 16-byte boundary. In this case only, 8086 addressing corresponds to that of other processors and the direction of transfer can be calculated by comparison of the source and destination pointers, SI and DI. However, cases (b), (c) and (d) of Fig 2 each present problems.

In case (b) of Fig 2, the

source and destination segments are entirely distinct and have no overlapping area. This has two important consequences. The first is that if the source and destination pointers, SI and DI, are equal, then two completely separate areas of absolute memory are referred to and the transfer should take place. IBT8086 fails to take this into account.

The second consequence, shown in Fig 3, is that memory wraparound occurring within each segment will split the source and destination blocks, locating them at high and low order ends of the respective segments. This results in the transfer of two smaller blocks of memory (Fig 3(b)) rather than an intended single large block extending past the segment boundary (Fig 3(a)).

In cases (c) and (d) of Fig 2, the source and destination segments overlap. In both cases comparison of only the source and destination pointers without adjustment for the segment locations gives no indication of the relative positions of the two

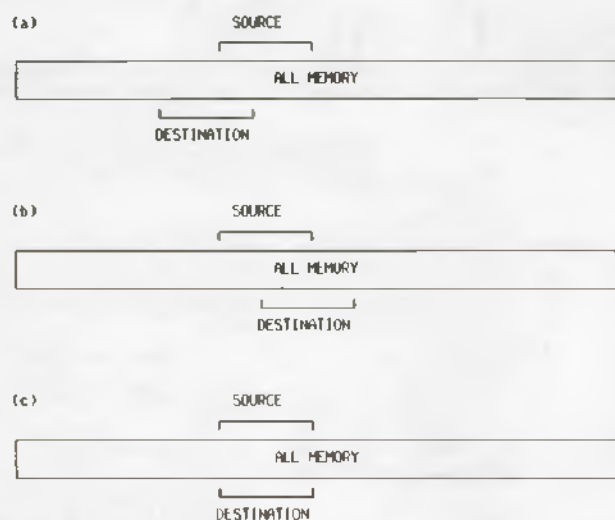
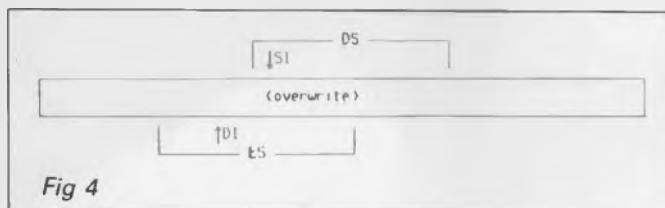
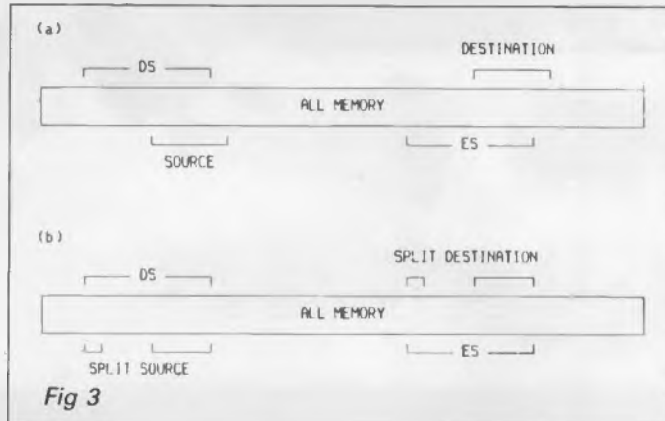


Fig 1



areas in absolute memory terms.

Fig 4 shows one possible case where segment overlap would cause IBT8086 to take the wrong action. The source pointer SI has a lower value than the destination pointer DI.

IBT8086 understands this to mean that the source data resides in lower memory than the destination area and

consequently performs the transfer beginning at the highest source location. Yet, because the destination segment ES is lower than the source segment DS, the source is actually in higher memory. The result is an overwrite of that part of the source data between SI and the end of the destination segment before it has been transferred.

DATASHEET 1

CALL: IBT8086	Non-overwrite data block move within memory.
CONCEPT	(System & language independent description)
Prog. Structure	<pre> IF source = destination { IF source below destination { Set pointers to last bytes. FOR last byte to 1st byte { (destination) = (source); decrement pointers. } } Set pointers to 1st bytes. FOR 1st byte to last byte { (destination) = (source); increment pointers. } } </pre>
SYSTEM	(System implementation requirements)
Processor	8086/8088
Hardware need	RAM for transfer source & destination.
Software need	None.
PROGRAM	(Specific coding and operation details)
Input state	DS:SI addresses source block first byte. ES:DI addresses destination block first byte. CX = number of bytes to transfer.
Output state	If input SI-DI then no move. Flags changed. No other changes. Block at DS:SI copied to ES:DI. CX = 0.
Misuse Errors	If input SI-DI then D flag = 0, SI & DI at last bytes + 1. If input SI-DI then D flag = 1, SI & DI at first bytes + 1.
Register need	Segment (64K) wraparound and the comparative positions of the DS & ES segment registers could cause overwrite before transfer.
Location need	DS ES SI DI CX F
Program Bytes	Correct working can be guaranteed only if DS=ES. Routine is not location dependent but must be called from within the same Code Segment.
Stack Bytes	21
Clock Cycles	(8086) SI-DI: 72+17*CX, SI-DI: 23, SI-DI: 32+17*CX.

SUBSET CLASS	(Environmental hazard guide)			
***** 2	Discreet: NO	Interruptible: YES	Promable: YES	Robust: NO
	Reentrant: YES	Relocatable: YES		
IBT8086	OMP	SI,DI	:If source is not equal	3BF7
	JME	FORWARD	:to dest then continue.	75 01
	RET		:Else exit, no move.	C3
FORWARD	JB	BACKWARD	:If source above dest then	72 04
	CLD		:set auto-inc and	FC
	REP		:for count CX transfer	F3
	MOVB		:DS:SI to ES:DI.	A4
	RET		:Exit, move made.	C3
BACKWARD	ADD	SI,CX	:Source below dest so set	03F1
	DEC	SI	:source & dest pointers	4E
	ADD	DI,CX	:to last bytes for reverse	03F9
	DEC	DI	:transfer.	4F
	STD		:set auto-dec and	F0
	REP		:for count CX transfer	F3
	MOVB		:DS:SI to ES:DI.	A4
	RET		:Exit, move made.	C3

6502 ROTATIONS TOOLKIT

Datasheet 2 from Andrew Johnson, at Trinity Hall, Cambridge, contains a set of three toolkit routines to emulate the Z80's arithmetic right shift and 8-bit rotation with copy to Carry. These useful operations are lacking from the 6502's meagre repertoire.

Andrew points out that at only four bytes each (excluding the RTS), the

routines would probably be more effective as in-line code sequences (macro instructions) unless called often.

68000 Interruptibility

Roger Thomas, writer of last month's character rotation routine, points out that 68000 systems may interrupt user mode programs without reference to the user stack. Hence programs which move the user stack pointer above stacked data may be interruptible.

END

DATASHEET 2

CALL: TLKTASR	Toolkit Arithmetic Shift Right byte.
CALL: TLKTRLC	Toolkit Rotate Left Circular byte.
CALL: TLKTRRC	Toolkit Rotate Right Circular byte.
CONCEPT	(System & language independent description)
Structure	save input value. copy shift/rotate in bit to Carry flag. restore input value. rotate through Carry.
SYSTEM	(System implementation requirements)
Processor	6502
Hardware need	None.
Software need	None.
PROGRAM	(Specific coding and operation details)
Input state	A contains the value to be shifted/rotated.
Output state	V unchanged. H, Z reflect output A status. C = input A msb (RLC) or lsb (RRC & ASR). A = correct result ASR A, RLC A or RRC A. No other changes.
Misuse Errors	None.
Register need	A P
Location need	Not specific.
Program Bytes	15 (5 each)
Stack Bytes	1
Clock Cycles	17 for any one operation.
SUBSET CLASS	(Environmental hazard guide)
***** 1	Discreet: YES Interruptible: YES Promable: YES Reentrant: YES Relocatable: YES Robust: YES
TLKTASR	PHA :Save original value A while 48 ASL A :getting bit 7,A into Carry. 0A PLA :Restore original value and 68 ROR A :Shift right copying sign bit. 6A RTS :Exit, ASR done. 6B
TLKTRLC	PHA :Save original value A while 48 ASL A :getting bit 7,A into Carry. 0A PLA :Restore original value and 68 ROL A :rotate through C effecting an 2A RTS :8-bit rotate with bit 7 to C. 6B
TLKTRRC	PHA :Save original value A while 48 LSR A :getting bit 0,A into Carry. 4A PLA :Restore original value and 68 ROR A :rotate through C effecting an 6A RTS :8-bit rotate with bit 0 to C. 6B



BIBLIOFILE

If you fancy programming your Mac in Logo, a suitable guide exists. Or how about efficient micro management? David Taylor reviews this month's reading matter.



Mac turtle soup

Title: Macintosh Logo
Authors: Roger W Haigh & Loren E Radford
Publisher: Wiley Press
Price: £15.65 (paperback)

Nobody knows why, but the left side of your brain is pretty smart at reasoning and handy with words, but the right side of your brain is the arty part — recognises patterns and shapes,

knows a good tune when it hears one via your ears.

It's almost as if you had an IBM PC on the nearside and an Apple Mac on the offside of your head. Both halves, or both machines, are good at what they do; it's just that they set about their tasks in different ways.

Messrs Haigh and Radford are dedicated MacMen. Nothing at the price to touch Macs for zappy patterns or visualising things, they insist. So why stop at using the boxes full of ready-made applications when the Mac is

itching to be programmed, if only there were a language which could take advantage of its arty-graphical bent?

Like turtle-mad Logo.

Well, the short answer is that it's a time-consuming bore to tell Macs what to do in Logo, when you could just point the mouse and go in any one of dozens of off-the-shelf programs. The plain fact is that the Mac is so user-friendly and all-kinds of purposes are so well-served by excellent packages like Jazz or, for that matter, plain old MacWrite and MacPaint, that it seems

perverse to write programs to tell a turtle to draw shapes which could fall to hand much more easily.

Now, of course, there's something to be said for the skill of programming *per se*, just as there's something to be said for knowing how a car works as well as just knowing how to drive it. But the Mac is the kind of machine which encourages users to get on with it, do something useful and *quickly*, without the need to play around with gobbledygook programming languages.

Well. Decide for yourself whether you're a MacUser who's predisposed to program. If so, then you could do a lot worse than start with Logo, which is by no means the kids' stuff it's often made out to be. Microsoft does a first-rate Logo package for the Mac — and the company also provides a fat manual of reference and a *Guide to Programming* besides. So do you need this book as well?

I rather doubt it myself, unless you're hell-bent on doing things the hard way because it's good for the soul or for your knowledge of what goes on under the computer's bonnet. Of its kind, *Macintosh Logo* is an efficient textbook but the rewards of mastering Logo aren't necessarily up to much — after 200 pages you're still finding out how to analyse your electricity bill or draw some polygons.

Terrific, provided you think that sounds fun. Myself, I'd rather fiddle about with *Music Works* any day and Messrs Mac, of course, would rather you cashed in your savings for a laser printer and set up shop as a desktop publisher.

It takes all sorts.

Ask me another

Title: Concise Encyclopaedia of Information Technology
Author: Adrian V Stokes
Publisher: Wildwood House
Price: £7.95 (paperback)

If you don't know your Floating Gate Avalanche Injection MOS from your Fixed Priority Oriented Demand Assignment, Doctor Stokes (who runs the computers at St Thomas's Hospital) is on call with this updated paperback version of an earlier guide to trendy Computerspeak.

It's a worthy compilation of the computer buff's jargon mountain and stiff competition for the popular *Penguin Dictionary* of what's what in acronyms and bewildering phrases.

Like all such compilations, it's occasionally a godsend, but full of stuff besides which you'd imagine everyone must know by now (VDU — an acronym for visual, or video, display unit) and padded out with entries which you cannot imagine ever being of the slightest use to man or beast (AFNOR — an acronym for Association Francaise de Normalisation).

Now and again it's downright daft. I

cannot for the life of me see much point in entries such as *DISC: an alternative spelling of Disk*; or *WAIT: to halt temporarily until the occurrence of a specified event*.

I'd have thought that PCW's glossary of computer jargon would serve most people's memory-jogging needs and where a fuller explanation is wanted, then encyclopaedias like this, which are by definition concise, can easily leave you not much better off.

If, for example, you came across QAM in your travels and hadn't the foggiest, I wonder whether finding out that QAM stands for Quadrature Amplitude Modulation would prove to be very much help.

HELP, incidentally, the first word to know whenever you're sat at an unfamiliar machine, isn't listed.

Bitter fruit

Title: Business Computing with the Apricot Computer
Author: Peter Rodwell
Publisher: Heinemann
Price: £14.95

It's the sad fate of the office Apricot to be something of an also-ran to the IBM PC and, increasingly, the Apple Mac. In many ways that's a shame, for it's a fine machine. But it's a harsh commercial fact just the same, and the Apricot just isn't as famous as IBM or as easy to use as a Mac.

Peter Rodwell (who used to edit PCW, so it stands to reason must be very sound) is nevertheless an Apricot's best friend and this book takes up where his previous, more general introduction to the machine left off.

He whizzes through a refresher course on MS-DOS and then holds hands through word processing, using spreadsheets and a database, or lumping them together in an integrated package.

It's lucid in the extreme, presumably intended to free those bogged down with the Apricot's own documentation or that provided with applications.

Useful to bemused Apricoters who do not know their DOS from their elbow, but a reminder besides of how much easier the Mac is to grasp.

Look and type

Title: Design and Reproduction for Word Processing
Author: David Hawgood
Publisher: Pitman Office Guides
Price: £3.50 (paperback)

Mr Hawgood is absolutely right when he says that computers, electrostatic copying and offset litho printing have transformed the communications of small and large organisations.

So has the telephone, for that matter,

but let's not quibble: a fact is a fact, however blindingly obvious.

He's right, too, when he adds that responsibility for the presentation and production of finished work is these days more widespread. Bosses want reports smartly turned out to professional standards and expect secretaries who have been given fancy desktop publishing systems to do it almost as well as it might have been done by a jobbing printer.

So the gist of this book is that there's a need for lots of people who once didn't give two hoots to understand the basic principles of typography and arranging text on a page.

So far, so laudable, but this book's a bit thin (even for only £3.50) and seems to consist for the most part of bland little descriptions of esoteric things like 'SLIDE BINDERS — lengths of plastic channel are available in a variety of colours, lengths and thicknesses...' or handy tips like 'RIBBONS — If preparing work for reproduction, use a black ribbon.'

You'd need to be pretty thick to get many surprises out of this 'office guide', but there is at least some useful advice on design, layout and paste-up of pages you intend to have printed.

If you have very gormless office staff, it might be worth asking them to flick through this, but be warned that a good secretary or anyone who is reasonably *au fait* with word processing is likely to feel patronised by this level of instruction.

Short, sharp shock

Title: Managing the Micro
A Guide to Control & Security
Author: John High
Publisher: Deloitte Haskins & Sells
Price: £10 (paperback)

Now hear this. Deloitte Haskins & Sells are top-notch accountants. Busy men. With computers. To process piles of information. And no time to lose.

So they put out this book for busy managers. With no time to lose. And it's all short, sharp, slick, checklisted stuff. Like this. And that.

It addresses two major themes.

One. Efficiency. Quote...

'Senior management needs to pay particular attention to long-term planning of computer systems and equipment, feasibility studies, specification of systems requirements, selection of equipment and software and project control.'

Check.

Two. Computer security. Quote...

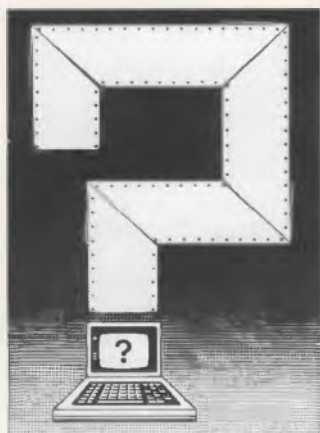
'Keeping the machine and files under lock and key is the safest and cheapest form of security.'

Check.

This book is very badly written. It tries hard to look very snappy and smart-thinking. But it isn't. **END**

COMPUTER ANSWERS

Simon Goodwin takes his toolkit to your problems. The address to write to is Computer Answers, PCW, 32-34 Broadwick Street, London W1A 2HG.



Computer Answers is PCW's help column. We offer advice about all kinds of specific hardware and software problems through the pages of the magazine. We also welcome further information in response to published queries.

Stencils and word processors

The church I belong to produces a monthly newsletter, weekly newsheets and many other printed items. We have excellent duplicating facilities, but wonder whether a word processor might enable us to produce the items more efficiently.

Some of the short runs could be transferred to a word processor without problems, but the longer runs would still need to be duplicated. Can we use standard duplicating stencils in the printer without it quickly becoming 'gummed up' or worse?

Stephen W Hawley, Shrewsbury

I've produced about 1500 copies of a software manual in the manner you describe, cutting typewriter stencils on a Juki 6100 daisywheel printer and printing the result with an aged Gestetner. It's worth trying several makes of stencil, as some are better suited to this method of production than others. The brand of your printing machinery is also a factor.

You must clean the

daisywheel regularly — preferably after cutting each stencil — as material tends to get stuck in the 'holes' in the letters and around the serifs. Cleaning only takes a few moments. Remove the wheel and rest it on a flat surface, with the embossed lettering pointing upwards towards you. Take a piece of clean 'BluTak', or a similar plastic adhesive, and dab it gently against each character face until you have removed all the material from the stencil.

Remove the ribbon from the printer while you cut stencils. Many printers have an adjustment to set the force with which characters are printed, and you may have to alter this from the normal setting to obtain best results. If you use several typesets, experiment to find the best force setting for each.

Daisywheel printers share a common mechanism with many modern typewriters, so you should have no trouble making stencils with them. Replacement or alternative daisywheels only cost a few pounds. The snag is that cheap daisywheel printers are rather slow for general, non-duplicating purposes — you may find it saves time to make a stencil or use a photocopier for short runs.

Dot-matrix printers are cheaper and faster but they are not as reliable when making stencils: they run very close to the stencil, can tear it, and they clog easily. If you're unlucky you can end up having to replace the machine's print-head; this is the most expensive part of most dot-matrix printers and may cost £50-£100.

Special stencils designed to cope with dot-matrix printers are available from office stationery suppliers, but they're expensive and may not cure problems with some printers. Some people claim to be able to get fine results using normal stencils in a dot-matrix machine.

The cheapest printers — those which use special paper — work on a thermal or electrostatic basis. Don't put a stencil in one of these printers unless you're determined to start a fire or damage the printer.

As always, you should take advice from a competent dealer, and get written confirmation that the printer will do what you want before you part with any cash. This may restrict the number of dealers who'll be willing to talk to you, but will eliminate almost all the 'cowboys' at a stroke.

Electron plus 1

I have an Acorn Electron and have just purchased a Plus 1 interface. The ROM cartridge side of it works fine, but I can't get my joystick to work. Is it possible to run a small program to check that the interface works?

Also, I have an Epson RX80 Centronics printer. Can I run this with the Plus 1? Where can I get a made-up lead?

DA Campbell, Westvale, Kirkby

The Plus 1 is compatible with BBC Micro analogue joysticks; on that machine, you can read values from the joystick with the ADVAL function. This returns a value between 0 and 65520, in steps of 16, depending upon the position of the stick. There are four different inputs, and you select between them by putting a number between 0 and 3 in brackets after the ADVAL function.

Cheap joysticks, such as those for the Spectrum, Commodore and Atari computers, only produce an On or Off signal for each of four directions. These won't work properly with the Plus 1, which expects a graduated range of values.

The Plus 1 uses the same printer connector as the BBC Micro. Leads to connect that machine to the RX-80 are widely available, as the printer has a standard parallel socket.

Appropriate joysticks and leads are available from any Acorn dealer; if you can't find a local supplier contact one of the big dealers such as Akhter on (0279) 443521.

Worth waiting for

Last year you referred to CAD on the QL computer in

your answer to a query headed 'Computers in architecture'. Could you please tell me who is preparing such software? I would like to write to the company and provide encouragement, since I have been waiting patiently for such machine code software to appear.

GT Morris, Sutton Coldfield, West Midlands

I've had to sit on this question for a while because it has taken a long time for good QL CAD packages to reach the market. The first few programs were really just drawing packages, and restricted you to the 512 by 256 point area of the QL screen — an unacceptable limitation for real CAD work.

This year has seen the arrival of proper CAD packages, allowing 'windowing' over a design larger than the display area, sub-drawings and scaling. Talent Computer Systems on (041) 552 2128 produces TechniQL, the best QL draughting system I've seen — not to be confused with GraphicQL, Talent's pixel-painting utility. You may also be interested in Design Board 2 from Micra-soft on (0202) 29643 and QCAD from Strong Computers on (0267) 231246.

The Independent QL User Group, Quanta, has an interesting 3-D package, Scriptula, available at nominal cost to members of its library. The group also has packages called Perspective and Autodraw, which I have not seen. For details, call the Quanta secretary, Brian Pain, on (0908) 564271.

Free software!

I have recently purchased an Amstrad CPC6128, and I am very pleased with it. Looking around for utilities, especially a good Z80 assembler, I have been told that there is a large amount of public domain software on CP/M. Where can I obtain it, and what assemblers (if any) are there available in the public domain? Is it possible to obtain this software on a 3in diskette?

AC Leaver, Hitchin, Herts

From whom may I obtain a print spooling program? How easily may I add one to those which I already have, especially to my Sage accounts program?
Russell Clapshaw, Eashing, Godalming

In the July issue of *PCW*, in the article headed 'DIY/XT' by Alan Solomon, mention is given to public domain software. I would be grateful if you could tell me how one might go about acquiring such software.
AE Burdis, Great Baddow, Chelmsford

'Public domain' software is software that you are allowed to copy and distribute (but not sell) without charge.

There is a vast range of CP/M and MS-DOS software in the public domain. Material for other machines is also available through specialist user groups, details of which can be obtained from the Amateur Computer Club which has its own column in *PCW* (see 'End Zone'). I can recommend material from QUANTA (for the Sinclair QL), BEEBUG (BBC Micro and Electron) and the National TRS-80 User Group (Tandy and Video Genie); in fact, most computers are supported by independent groups.

Programmers are not generally paid for public domain software, so the quality is unpredictable, and support and documentation may be limited. With the exception of the first point, the same is, of course, true of commercial software, so it's usually well worth sifting through public domain material.

The largest public software library in the UK is called PDSIG, which stands for Public Domain Software Interest Group. The group has a library of about 20,000 items on 1200 disks. All the material is available for free, but you must pay an annual subscription of £18 (£21 in Europe, £25 elsewhere) to join the group.

Besides the software, members receive a well-printed and informative bi-monthly journal: one issue I have looked at contains introductory material about bulletin boards and buying a computer, a dBase quick-reference, notes on WordStar mail-merge, a tutorial on the C programming language, another on MS-DOS, plus letters, hints, small ads

and a listing of library disks by title!

A full library catalogue is only available on disk — there are four disks of MS-DOS information, three for 'normal' CP/M and one for Apple CP/M (which uses a weird format).

The group copies material from the library onto formatted disks which you send. There's a copying charge — usually this is £2 per disk, plus postage — but discounts for block bookings are available. Some non-standard disk formats cost extra. Alternatively, if you have a modem, you can load software by telephone via three bulletin boards — FIDO, CBBS and TBBS.

I've listed some of the popular machines that the PDSIG supports in Fig 1 — send an *sae* to the group, at 138 Holtys Road, East Grinstead, Sussex RH19 3EA, for the full list. Just about every CP/M or MS-DOS machine is supported.

In the same panel I've summarised the range of programs available — I couldn't list the lot, even if 'Computer Answers' took over all the editorial pages of *PCW*! Utilities, games and business applications predominate.

Dealing with your specific questions, there are several good Z80 assemblers and debuggers in the library, and 'at least half a dozen print spoolers', according to organiser Rod Smith. These work by re-directing output to the printer via a buffer in memory; the process is entirely transparent to the program, as long as there's still enough memory for it to run, so installation should be simple — just run the spooler before loading your software.

Good books on CP/M are few and far between, although almost anything is better than Digital Research's own documentation. The classic title is *The CP/M Handbook* by Rodney Zaks, published by Sybex, but it's getting a bit long in the tooth now: there's no mention of the refinements of CP/M Plus, for instance.

GEM and Olivetti compatibility

I have recently been given the GEM software package (version 1.11C). I have an Olivetti M24 with 256k, and I have been unable to run the package on my system — I get the message: 'This version of GEM cannot run

CP/M MS-DOS computers supported by the PDSIG

Acorn, CP/M, Apple CP/M, Amstrad (3in & 5in), Apricot, Bondwell, Cromenco, Cortex, DEC, Epson, Exidy Sorcerer, Gemini, HP (125 & 150), IBM, ICL, ITT, Logica, Kaypro, Morrow, Memotech, Nascom, NCR, NEC, NewBrain, Olivetti, Osborne, Philips, Plessey, Piper, Rair Black Box, RML, Sage, Superbrain, Sord, Sanyo, Sharp, Spectravideo, Tatung, Tandy, Torch, Wang, Wren, Xerox, Zenith

Some programs in the PDSIG library

BUSINESS: general ledger, CAD, databases, inventory control, spreadsheets, typing tutors, word processors, stockmarket analysis, vehicle maintenance ...

UTILITIES: communication packages, CP/M multi-tasking, lots of text editors and formatters, file encrypters, stats packages, print spoolers, disk editors, file managers ...

PROGRAMMING: various machine code monitors, compilers and interpreters for Basic, Pascal, Fort, C, XLisp, Logo, Cobol, Algol M, assemblers and cross-assemblers for almost everything from the RCA 1802 to the IBM 370 ...

PLUS: games, adventures, educational programs, magazine indices (including *PCW*), music utilities. There's lots of support for commercial packages such as Turbo Pascal, WordStar, dBase, BDS C, VisiCalc, Lotus 1-2-3, plus commercial software demo disks

Fig 1 Details of PDSIG programs

on this computer. GEMVDI not installed'.

I seem to recall that *PCW* succeeded in running GEM on its M24 after making a minor machine code correction. Is there any way in which you could help me out?

Nishy Wijewardane, Falmer, Brighton

Digital Research has inserted code to stop you running GEM on 'compatible' computers other than the one for which GEM was purchased. Paul Bailey at DR told me that this was 'probably something that we will relax,' but wouldn't give a date. There's also a possibility of offering an exchange service at a concessionary rate, if there's sufficient demand.

He explained that the version of GEM specially for the Olivetti has been enhanced to take advantage of the extra graphics resolution of the machine (640 x 400 points) and the Olivetti mouse — you wouldn't get those features using the standard IBM PC program. Presumably, it wouldn't be economical for DR to produce that special version if people could re-use the standard one for free.

If you have a machine code monitor, and know how to use it, it isn't too difficult to remove the check from your copy of GEM. I can't tell you exactly what to do, for legal reasons!

Feedback — can you help?

I Cartright has bought a second-hand Andromeda Zita computer and now finds that he has no program to format disks! I have not been able to track down the required program — can any *PCW* reader help?

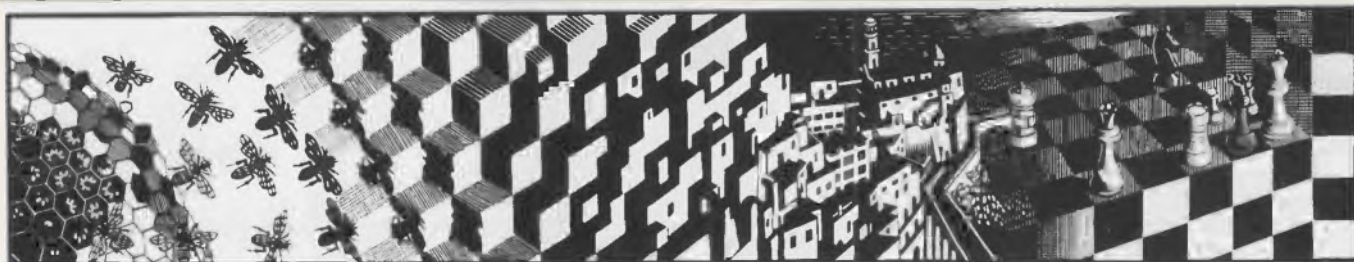
Saleem Yousaf has written asking for information about a Source 7600 computer, made by the American MIS Data Corporation, which he has found abandoned in his new office. Should it be abandoned? Are manuals and software available for the machine?

Anthony Tagg wants to use Commodore peripherals, such as the MPS-801, the 1541 disk drive and the 1520 printer-plotter with a BBC Micro. A few months ago, I mentioned a reader trying to link a Commodore DPS-1101 printer to a QL. Commodore uses its own esoteric serial interface to link peripherals, rather than RS232 or Centronics. Does any reader know how to persuade a standard interface to 'speak Commodore'?

If you can help, please write to 'Computer Answers'.

*Simon Goodwin can only reply to queries through the pages of PCW. Please don't send him an *sae*, expecting an individual reply.* **END**

SCREENPLAY



True arcade quality is found in marbles, and, not content with a lunchtime tippie, Stephen Applebaum joins the Bard's motley band of revellers and adventurers. Here, in a stupor, he presents this month's games.



Marble quality

Title: Marble Madness
Computer: Amiga
Supplier: Ariolasoft
Format: Disk
Price: £29.95

When we talk about graphics being arcade quality, we mean that they're in some way comparable to those found on machines down at your local arcade; the term isn't meant to suggest they are perfect reproductions. The screenshots above, taken from Ariolasoft's incredible new acquisition for the Amiga, Marble Madness, expunge any ambiguity, however, and show the skill that has been employed in bringing an arcade classic into the home, with total fidelity.

Electronic Arts, the source of the computerised version of Marble Madness, can now consider itself the Keating of the micro world; were the forgery of computer games a profitable pastime, Electronic Arts could earn itself a large perquisite by fooling even the most ardent connoisseurs with its excellent pastiches.

Although not featured in 'Screenplay', there have been several earlier attempts by companies to write games for the Spectrum, Amstrad, Commodore 64, et al, that imitate some of Marble Madness' features. Apart from Spin Dizzy, they are all fairly dismal and often unplayable affairs. Now we have an accurate reproduction of the archetype of the genre that not only mirrors the ori-



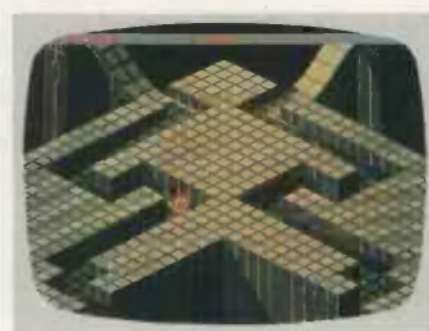
ginal, but if anything, makes it even more playable.

Marble Madness, for those who haven't yet seen it, is a hazardous race against time, where you must guide a marble around a series of obstacle-strewn mazes inside a pre-set time limit. The coin operated Marble Madness machine employs a large tracker ball as the means of manipulating the sphere. Electronic Art's version can use a tracker ball as long as it has an Atari-standard plug, but most players will probably find the Amiga's mouse perfectly adequate.

The initial phase of Marble Madness is a simple training run along a meandering groove, ending between two fluttering flags representing goal-posts. Hardly representative of what's to come, this first stage is merely a friendly way of familiarising the player with the feel of the controls.

Marble Madness proper begins with you and the marble having to battle your way past a rogue ball, which tries its hardest to force you off the edge of the screen. If you're lucky, the ball only gets as far as pushing you onto another level, but this leaves you dazed and, at worst, prey to a bunch of even more malevolent characters.

Evading the black ball takes you down a precipitous drop which lands you on a plateau inhabited by green, voracious, hydra-like creatures. These gluttonous monsters leap into the air, land on your marble, swallow it, then pause momentarily to lick their lips in appreciation of the im-



promptu meal.

To avoid being consumed, you must steer your marble across a bridge that opens and closes on superbly drawn, fully-animated hydraulic jacks. This leads to a conduit running down onto a ledge that twists and turns, threatening to send you to your death at the slightest hint of a mistake. Navigate this section successfully and you'll come to another pipe which leads to the relative safety of an ice field, the last 'hazard' before your goal.

As the game proceeds, the number of hazards increases in both number and severity. At one point, giant vacuum cleaner-type machines appear and try to suck you up into oblivion, while tiny rubber mallets emerge from underground, crushing your marble to a pulp. There are even giant rods which toss your marble into the air, sending it plummeting to its death.

Points are scored by completing a phase within the time set at the start, as well as reaching specific points on a course and eluding the various things lurking there. Bonuses can be picked up by having time left at the end.

Much like Arcticfox, also reviewed here, Marble Madness includes some superb sound effects. The music, a farrago of delightful little ditties, is an exact simulation of that found on the arcade original. Even the vicious vacuums make a disturbing roar as they appear, seemingly from nowhere.

One of the most amusing features of Electronic Art's Marble Madness is

the inclusion of all the original 'bugs', or rather, idiosyncracies. The most obvious of these is the game's collision detection. For instance, if a ball falls off a surface and touches a wall as it drops, a brush appears in mid-air to sweep up the pieces. Apart from this rather nice effect, there aren't any other quirks poignant enough to warrant a mention.

Marble Madness is a game with balls. If ever there were a game that could be accurately dubbed arcade quality, this is it. The fact that Ariolasoft has gotten hold of it will confirm the company's position as the top games software publisher in the UK. While other software houses chase each other down a creative blind alley, Ariolasoft is busy sniffing out

the best from high-powered companies like Electronic Arts and Batteries Included.

With Arcticfox, The Bard's Tale and Marble Madness in its catalogue, Ariolasoft has reached its peak. Hopefully the company will remain there for a long time, because it will certainly give us a lot to look forward to in the future.



Wine, magic and song

Title: The Bard's Tale
Computer: Apple II, Commodore 64
Supplier: Ariolasoft
Format: Disk
Price: £14.95

Listen, dear reader / I hath a tale to tell / fiddle de, diddy, I doe / It tells of drink and aborted conquests / tiddly, piddly, ho — anusha jink, pleesh, inn-keeper ... Come, dear reader, quoff an ale with me, and listen to The Bard's Tale:

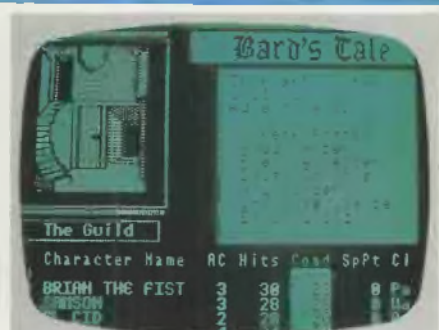
Once upon a time, the sun shone on Skara Brae and providence smiled kindly upon its inhabitants. Then, quite suddenly, out of the tenebrous depths of Hell, came Mangar, a black-hearted Mage possessed of dark powers. With incantation and necromancy, Mangar evoked an army of the dead to enthrall the people of Skara Brae; and to ensure that none of them could escape his clutches, the evil sorcerer erected vast catacombs and labyrinths that led nowhere but to Earth's icy bosom.

Now reader / listen on / for with music and song / you could release Skara Brae / and turn night into day.

The Bard's Tale, from Ariolasoft, is a fantasy role-playing game in the mould of Dungeons and Dragons and Wizardry. Much like its forebears, Bard has you taking on the multiple personalities of a mixed band of adventurers. As usual, you're confronted with a perilous task — in this case, the apprehension of Mangar.

Minor enterprises include mapping Skara Brae and the subterranean dungeons that run under its streets, and developing the skills of the characters in your merry band.

The Bard's Tale comes on two disks containing the program and dungeons respectively. On one of



these is a pre-built party, appropriately called the A Team. Although excellent for practising with, the A Team doesn't really let you test your skill for selecting a worthy group of fighters; better is to make your own character disk of unseasoned adventurers. Players who have characters left over from either Wizardry or Ultima III can load these into The Bard's Tale, as Electronic Arts has equipped its program to be compatible with them.

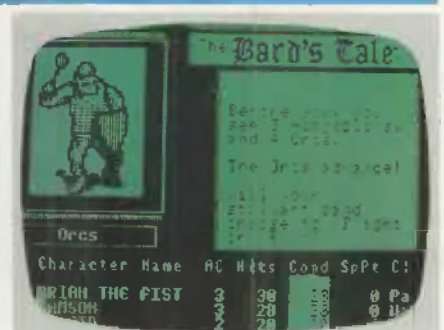
A party consists of a maximum six characters, each belonging to one of seven different races. In a party you can have: a human; an elf, Tolkien style; a dwarf; a hobbit; a half-elf; a half-orc; or a gnome.

When you select your various characters, you must give them each a profession. The Bard's Tale contains 10 professions, but only eight can be selected at the outset, as some require skills not mastered until well into play. The 10 classes include: warrior; paladin; rogue; bard; hunter; monk; conjurer; magician; sorcerer; and wizard. Of all these, the mystical Bard is one of the most useful to have in your party, because his repertoire of magical tunes has the power to soothe the savage breast.

However, to be successful in song, the Bard must be well-sodden (a man after my own heart). The packaging is at pains to point out that: 'When the going gets tough, the Bard goes drinking.'

Characters have five basic attributes, their values ranging between one and 18. When a party member is created, the values are randomly assigned, but can be increased or decreased at your discretion. Obviously the higher the number, the more finely honed the particular facet.

For the most part, the five attributes mentioned above relate to physical and mental capabilities. Other statistics include a character's armour class, his hit points, condi-



tion, experience, spell points, the amount of gold in his possession, and the level that he has attained.

When you're satisfied with your fey band, you can save them to disk, then go to the Adventurer's Guild from where you start the search for Mangar.

Your first stop should be Garth's Equipment Shoppe, where you can accoutre your men reasonably well, though you'll definitely have to return as the game progresses and the going gets harder.

The Bard's Tale's playing screen is divided into two boxes and a list containing the details on your party's characters. At the top-left of the display is a window graphically depicting your passage along Skara Brae's narrow streets, in wonderful 3D. Most of the buildings bordering the various walkways can be entered by kicking-in their doors.

If you're lucky, a herd of monsters might sally forth, giving you the opportunity to indulge in some mindless violence and thus gain valuable experience points.

Skirmishes are fought by issuing commands to individual party members. The various options available allow you to tell a character to attack or defend, use an item from his inventory, cast a spell, hide in the shadows or, if he's a Bard, sing a song. In times of great danger, you tell the whole party to attack.

After a while, you'll want to try and move some of the members of your party up a level, increasing their various attributes. This is done by taking them to the Review Board, if you can find it.

The Review Board is composed of representatives from the 10 different classes. If, in their estimation, a character has gained enough points to warrant promotion to a higher level, they will promote him. For a small fee, the Board will even teach Magic Users new spells.

SCREENPLAY

Several locations in Skara Brae have entrances to the aforementioned underground mazes. These places are pitch black, so you require a torch to explore them. When the torch has been lit, a small,

animated flame appears in the middle of the screen.

The Bard's Tale owes a lot to Wizardry and the like, but that said, still looks set to become a minor classic in its own right. There are

enough flashes of originality to keep the player interested, and the program's ability to accept both Wizardry and Ultima III characters should ensure it a following among the fantasy role-playing games fraternity.



Fire and ice

Title: Arcticfox
Computer: Commodore Amiga
Supplier: Ariolasoft
Format: Disk
Price: £29.95

Beware — the enemy is among us! Somewhere in the icy wastes of Antarctica, an alien cadre is busily preparing the way for an Armada from its home planet, STV-7X, by building towering edifices to convert the composition of the Earth's atmosphere into a form more suited to its physiological make-up.

With each passing day, the alien's grip on the Earth tightens, pulling Mankind ever nearer to the abyss. Oblivion is not far off, unless something can be done to breach the extensive forcefield protecting the creatures and destroy the heart of their operation — the Main Fort.

And so to Arcticfox, a supertank, built courtesy of General Polemics. In your capable hands this formidable piece of hardware could prove to be the alien's nemesis. If it doesn't, the rout of civilisation will be quick to follow.

When positioned in the driver's seat inside the Arcticfox, you can look out through a large window onto the almost extraterrestrial Antarctic landscape; below, a small radar-cum-aft-view offers another perspective. Located along the bottom of the display is a control panel.

To the right, a hand grips a joystick, simulating the movement of your hand as you steer the Arcticfox to its quarry; on the left are six buttons, over which is poised the computerised driver's other hand.

The six buttons relate to six keys laid out in a similar form on the Amiga's keyboard. These correspond to: cannon inclination; aft view selector;



mine release; relative reverse; guided missiles; and dig-in. Most of these devices are self-explanatory, but it's worth looking at some *in extenso* by dint of the work that has gone into the detail of their operation and effect.

When a guided missile is launched, it can be steered toward its target from the safety of the Arcticfox. If you're feeling particularly sadistic, however, you can become the missile itself, putting yourself in the position of a pseudo-Kamikazi pilot. In becoming the missile, you temporarily gain the ability to fly, and can engage enemy aircraft in a deadly game of cat and mouse.

Pressing the 'dig-in' function when in snow literally buries the Arcticfox, protecting it from almost any enemy onslaught. Going to ground also provides protection during one of the many electric storms that become increasingly more frequent as you near the Main Fort, caused by the oxygen in the atmosphere being replaced by a volatile mixture of deadly gases.

Accompanying the master controls are various dials and digital counters which provide vital data such as the number of guided missiles you have left, the number of mines onboard, the tank's speed, your direction, and a constantly updated damage report.

Before setting out on a mission, the game's one and only menu lets you identify the various kinds of enemy craft — an idea dreamed up by an Electronic Arts games tester who didn't survive long enough to see his executioner, no doubt. Beginners can, and should, start on the easy level, as this has a smaller number of alien craft around the Main Fort. If you're a glutton for punishment you can move straight on to the advanced level where, unless you employ a good stratagem, you'll be wiped out before getting anywhere



near the alien HQ.

Dotted about the landscape are Communications Forts that the aliens have deployed to keep them posted as to your whereabouts. These, and things called Recon Sleds and Recon Flyers, can reveal your position to other craft in the vicinity, so should be destroyed when first spotted.

At the end of a game (which is to say, when you've been destroyed) you're presented with a tactical rating and the manner in which you met your death. Apart from being ripped apart by enemy gunfire, which is an obvious way to go, you can meet the man with the scythe by driving the Arcticfox into a crevasse!

If you're one of the few people who currently own an Amiga, you'll no doubt be aware of its amazing stereo sound. Should you not have bought any games for it, however, you probably won't realise just how good it is. Play Arcticfox and you'll be enthralled by the realistic trundling of the tank's caterpillar tracks, and the pleasing crunching sound made when passing over the wreckage of an alien vehicle. Missiles, too, make an impressive whooshing noise, while forked lightning strikes the ground with a veritable crack.

Arcticfox is also impressive graphically, using filled Battle Zone/Elite-type figures. Unfortunately the speed of movement is slow, but because everything moves at around the same pace, missiles included, the game is just as difficult as if everything were moving at full tilt.

It has taken a long time for the PCW office to be graced with an Amiga, but if all the software is of the same high standard as Arcticfox, it has been well worth the wait. Although a little pricey, Arcticfox justifies every last penny, and the enjoyment it gives will make you forget about the hole it has left in your pocket.

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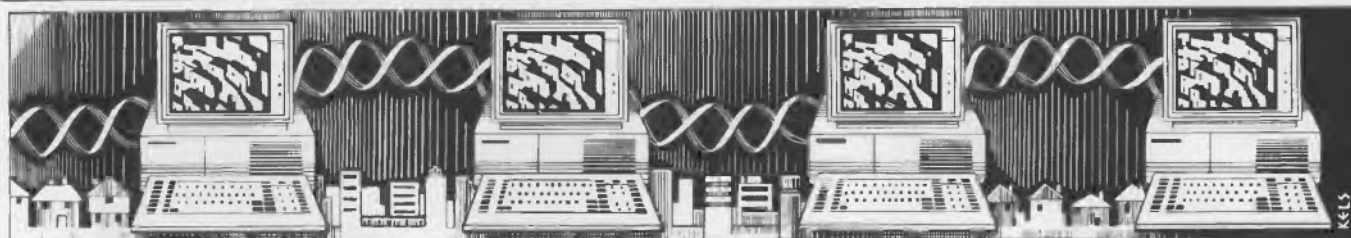
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Over and out!

Peter Tootill gives details of the newly-formed Bulletin Board Operators' Association, and puts you in touch with a new commercial online system, Microlink.

Some time ago I mentioned that a Bulletin Board Operators' Association was to be formed, taking over where the old Association of Free Public Access Systems (AFPAS) left off. The BBOA is now well under way. A meeting in London back in June adopted a formal constitution and elected a management committee under the chairmanship of John Newgas, one of the longest-serving sysops in the UK. The meeting was well-attended with around 50 sysops there. These were not just those people who run traditional bulletin boards, but also included contributors to Micronet and other commercial systems.

The aims of the Association are set out as:

- 1) the encouragement of public electronic communication of data;
- 2) the promotion and coordination of individual bulletin boards; and
- 3) the establishment and maintenance of standards and practices by means of a code of conduct.

Membership is likely to be fairly wide-ranging, with the majority expected to be individuals running bulletin boards on micros as a hobby. However, a certain amount of commercialisation is accepted as being inevitable, and it's likely that semi-commercial systems will become members, as will 'sysops' of special services on other systems such as Micronet.

Full membership will be open to active sysops: anyone else interested in the telecomputing scene will be welcome as an associate member. Subscriptions have been set at £15 per year.

Benefits are expected to include access to the BBOA's own bulletin board (which is already running), insurance cover, and bulk purchase of equipment such as modems.

One of the main reasons for forming the Association is to provide a forum for sysops to speak with a unified voice to authorities such as British Telecom and Mercury. Hopefully, this will lead to the negotiation of better treatment of people who make quite a bit of money for these companies by providing (at their own expense) systems which micro users want to call. I once calculated the revenue that BT gets from people calling my BBS, Liverpool Mailbox, as running into hundreds of pounds a week — wish I had a share!

The code of conduct, which was adopted at the meeting, is intended to ensure that BBSs stay respectable, and clearly excludes activities such as 'hacking' into systems that callers have no right to use. This is intended to prevent any moves by the author-

ities against members. (Not that any are expected, but there's felt to be a danger that too much hacking could lead to a clamp-down that would affect legitimate systems as well as those which encourage it.)

Anyone interested in further details of the Association can write (enclosing an sae) to the BBOA, c/o Tony Game, 15 Lansdowne Road, Felixstowe, Suffolk IP11 9HG.

Microlink

One of the newer commercial online systems aimed at home users is Microlink. This is run by Database Publications (publisher of a number of micro magazines) and operates on a Telecom Gold computer, giving access to all of Gold's features as well as the extra ones provided by Microlink itself.

Electronic mail (or 'e-mail') systems are a very useful way of contacting people, but only if they use the same system as you do. However, BT is working on a way of linking the various e-mail systems together, so that a Telecom Gold subscriber could send a message to someone using One to One or Easy Link, for example. This isn't possible at present (although I suppose it could be done by using the telex facilities which most e-mail systems provide).

Telecom Gold provides a number of other features to encourage subscribers to spend time on the system. These include games and useful utilities (ranging from business accounts to assemblers) that can be used while online. The ones I have tried seem to be American in origin and are by no means free of bugs.

Microlink (now just over a year old) has set out to make the system more available and more interesting to non-business users. It has done this by providing a range of features on top of the standard ones. The Microlink main menu is shown in Fig

BB:	Bulletin board
EE:	Electronic mail
FL:	Floralink
GG:	Telecom Gold
MM:	Microlink menu
NB:	NewsBytes
NN:	MicroNews
PP:	MemoPad
SS:	MicroSearch
TM:	Telemessages
UU:	User Guide
WW:	Who's Who in Microcomputing
BR:	British Rail
EG:	Exhibition Guide
FP:	Free Pen Offer
LL:	List of Bulletin Boards
MP:	Mail Plus — Easier to use
NL:	MicroLink Newsletter
OL:	Order Link
RR:	Press Reviews
TL:	TheatreLink
TT:	Telex
WL:	WeatherLink
XX:	TeleSoftware

Enter the letters of your choice — these can be used at any > prompt

Fig 1 The Microlink main menu

1, and the newest and most interesting option on it is the bulletin board. At the time of writing this is still being tested, but it seems to offer most of the facilities of the messaging parts of the average micro-based BBS. These include the ability to retrieve messages selectively (for example, by category, by keyword in the subject, or those sent since your last call). Messages can be replied to publicly or privately, but there's no automatic way for you to be notified of a reply to a public message that you have posted on the system. The fact that Microlink is always available, unlike popular micro-based BBSs which are always engaged when you call them, is a big point in its favour.

Most of Microlink's features are self-explanatory, but I'll give you a little more background information where I think it's appropriate.

NewsBytes is an interesting (but fairly short) weekly news column written by Steve Gold. MicroNews is another news column, but hadn't been updated for months the last time I looked at it.

The British Rail section provides details of trains from 23 regional cities to London, together with information about excursions and special breaks.

Product Search allows you to locate information provided by retail establishments about their products.

Mail Plus is a 'shell' designed to make Telecom Gold easier to use. It's a fairly recent feature, and is expected to be expanded eventually to include most of the features of Microlink.

Weather Link allows you to download satellite weather maps which originate from Swadlands School. You need a special program to decode them.

There's a small amount of telesoftware for BBC, Atari, Apple and Amstrad micros.

Theatre Link allows you to book theatre seats at a number of London theatres.

The main problem with Microlink is the cost. This is a monthly subscription of £3 plus normal Telecom Gold connect charges. These are 3.5p a minute (11p/min daytime) plus nor-

mal telephone charges (usually a local call). On top of this, callers from outside London have to pay an extra charge for the use of Gold's PSS account to connect to it; this is 2.5p for 300 baud callers, and 3p for 1200/75 and 1200/1200 callers. The total cost is nearly £5 an hour including VAT for callers from outside London using 1200 baud modems. On top of this, you have to pay storage charges of 20p/block per month. There are probably four or five files you need to have to work the system properly, so that's another £1 to include. I checked with a friend who is pretty careful about usage — downloading mail, preparing messages offline, and so on. His average monthly bill is around £10, but he certainly thinks it's worth it.

For more details, contact: Microlink, Database Publications, Europa House, 68 Chester Road, Hazel Grove, Stockport SK7 5NY.

You can contact Peter Tootill on Microlink 72: MAG011, Prestel 219991119 or CompuServe 72746,3202.

UK public online systems

Number	Name	Location	M-F hours	W/E hours	Baud rates	Notes
(0001)385 634	DUBBS-Dublin	Dublin	8pm-8am	24	3-24	
(0001)903 341	IACCBBS	Eire	24	24	3	Irish ACC. Runs on Comodore 64
(01)200 3437	Airtel - TBBS	London	24	24	3/1275	Pilot's area
(01)200 7577	TBBS London NW	London	24	24	3/1275	TBBS, handy SIG
(01)240 5747	Prestel 24 hrs	London	24	24	3	No graphics on this number
(01)346 7150	Harcel	London	24	24	3/1275	FBBS system.
(01)348 9400	TBBS London	London	24	24	3-12	
(01)395 2136	MG-Net	London	-	Sun 5pm-10pm	3	
(01)429 3047	OSI Lives!	London	24 Ring back	24 Ring back	3	
(01)450 9764	Techno Line	London	24	24	1275v	Commercial + 452 1500 eve +w/e
(01)452 1500	Techno-Line 2	London	evenings	24	1275v	Commercial
(01)455 6607	NNBBS London	London	24	24	3/1275	
(01)542 3772	WBBS Wimbledon	London	-	Sat 7pm-mon 8am	3/1275	
(01)542 4977	TBBS Royston	London	24	24	3-24	
(01)638 2034	CyberZone	London	24	24	3	
(01)640 0018	MBBS Mitcham	London	24	24	3/1275	
(01)650 6942	Tynet	London	24	24	3	
(01)679 1888	Bistel	London	24	24	3	Display electronics - Commercial
(01)679 5183	Distel	London	24	24	3/1275	Display Electronics - Commercial
(01)735 6153	Brixton iTeC	London	24	24	1275	
(01)853 3965	Assyrium	London	24	24	3	Writers and comms areas
(01)863 0198	London Underground	London	24	24	3/1275	Fido -Amiga,Atari, ST sigs
(01)883 5290	NBBS London	London	24?	24	3/1275	
(01)888 6594	Gnome at home	London	24	24	1275v	
(01)927 5820	OwlTel	London	24	24	1275v	
(01)941 4285	Metrotel	London	24	24	1275v	
(01)954 9347	Bark Crystal	London	24	24	3/1275	
(01)960 4742	ITCU Exchange & Mart	London	24	24	1275v	iTeC's central system?
(01)960 7402	Communitel	London	24	24	1275v	
(01)985 3322	Hackney BBS	Hackney	24	24	1275v	
(01)986 4360	Health data	London	24	24	1275v	
(0204) 43082	Bolton BBS	Bolton	8pm-8am	24	3-24	8am-8pm on ring back
(0206)362 354	Pete's Place	Colchester	24	24	3	
(021)430 3761	CBABBS	Birmingham	24 (not Thurs)	24	300	
(021)444 1494	TUG II	Birmingham	8am-10pm R/B + 10pm-9am		3	
(0222)461 824	Capital Data Line	Cardiff	24	24	3	Computer repair company

NETWORKS

(0222)464 725	Cardiff lTeC	Cardiff	24	24	1275v	
(0223)243 642	Acorn BBS		24	24	1275v	
(0224)641 585	ABERDEEN lTeC	Aberdeen	24	24	1275v	
(0224)781 919	Aberdeen Commodore	Aberdeen	24	24	300	Commodore 64 based
(0247)455 162	SBBS II (Irish Man)	Ireland	9pm-11pm r/b + 11pm-9am		3/1275	rates are daily
(0258)54 494	TBBS Blandford	Dorset	24	24	300	Blandford Computers
(0268)22 177	BITEC	Basildon	24	24	1275v	
(0268)25 122	BITEC	Basildon	24	24	300	
(0268)710 637	RICBBS	Basildon	5pm-10pm	24	?	
(0272)421 196	Octopus	Bristol	6pm-6.30am	24	3/1275	
(0295)720 812	Bloxam	Bloxham	10pm-1am	10pm-1am	300	
(0342)315 636	Fido PD Software	E.Grinstead	24	24	300	PD software database
(0376)518 818	REACT	?	24	24	300	
(0384)635 336	West Midlands	Stourport	6pm-8am	6pm-8am	300	TBBS
(0392)53 116	CBBS South West	Exeter	24	24	3/1275	
(0394)276 306	BABBS-1 Felixstow	Felixstow	24	24	300	
(0395)272 611	OFC	?	24	24	300	John Burden
(0401)50 745	MBBS Leconfield	Leconfield	24	24	300	Martin Taylor
(0429)34 346	On-Line Systems	Cleveland	24	24	3/1275	Commercial
(0443)733 343	MGBBS Mid Glamorgan	Ferndale	6pm-1am	6pm-1am	300	was on 755298
(0463)321 339	Betelgeuse 5		24	24	3/1275	
(0482)465 150	Hannet	Hull	6pm-8am	24	300	Radio Hams
(0482)859 169	Forum-80	Hull	7pm-11pm	10m-11pm	300	Midnight-8am Bell 103
(0483)573 337	Fido Compulink 1	Guildford	24	24	3/1275	Multi-user (see C/link 2)
(0483)573 338	Fido Compulink 2		24	24	3-24Bel	Multiuser system
(0486)2125 174	PBBS-'Adult' BBS	Mitcham	24	24	3/1275	
(0492)49 194	CymruTel	Colwyn Bay	24	24	1275	
(0506)28 526	Livingstone BBS	Livingstone	24	24	300	
(051)428 8924	Liverpool Mailbox	Liverpool	24	24	3-24	Britain's first 24 hr system
(0524)60 399	CNOL	Lancaster	24	24	300	Clinical BBS for medics
(0534)39 389	Jersey Fido	Jersey	24	24	3	
(0592)860 313	JMBBS Amstrad BBS	Fife	9.30pm-8am	9.30pm-8am	300	Sponsored by John Menzies
(0602)817 696	MACTEL	Nottingham	24	24	3-12	Macintosh Users
(0604)20 441	Novview	Northants	24	24	1275v	
(061)427 1596	OBBS Manchester	Manchester	24	24	3/1275	
(061)494 6938	Fido TeePee link	Manchester	24	24	3-24	
(0625)33 703	Telemac 15	?	24	24	3/1275	
(0642)481 643	System 2000 Com.Club	?	7pm-7am	?	300	
(0678)884 804	SABBS	?	24	24	300	Atari based system
(0702)54 6373	C.View Rochford	Kent	24	24	1275v	
(0702)552 941	Maple	?	24	24	300	Commercial system
(0705)524 805	Gosport Apricot BBS	Gosport	24	24	300	300
(0705)736 025	BBBS Wed & Sat 7pm-	?	7pm-10pm Wed	10am-10pm Sun		7 bits even parity
(0707)52 242	ASGB	London	24	24	1275v	
(0742)667 993	PIP	Sheffield	24	24	300	
(0752)364 059	Hawking Thunder	?	2am-6am???	???	3/1275	Fido
(0762)333 872	PBBS-1 Portadown	N.Ireland	10pm-1am R/B	10pm-1am R/B	300	
(0767)50511	CBBS Gamlingay	Nr Sandy	24	24	3	
(0782)265 078	Stoke lTeC	Stoke	24	24	1275v	
(0792)203 953	FBBS Swansea	Swansea	24	24	3	
(0874)711 147	Communitree	?	24	24	300	
(0883)844 164	LABBS	?	24	24	3/1275	The Prisoner - 2 lines
(0895)420 164	CBBS(London NW)	?	24	24	300	
(0895)52 685	London West Tech	?	24	24	3/1275	TBBS
(0903)212 552	Lasermail Fido		24	24	3/12	Subscribers (12/24 coming?)
(0903)668 398	Key Board	M.Keynes	6pm-8am ex.Tue and Thurs		12h	Spectrum Micron BBS
(0923)676 644	SBBS - Watford	Watford	9pm-11pm plus +11pm-6am		3/1275	Times are daily
(0936)77 025	NBBS Cheshire	?	24	24	3/1275	

CORRECTION: the number for Betelgeuse 5 should be (0463) 231339

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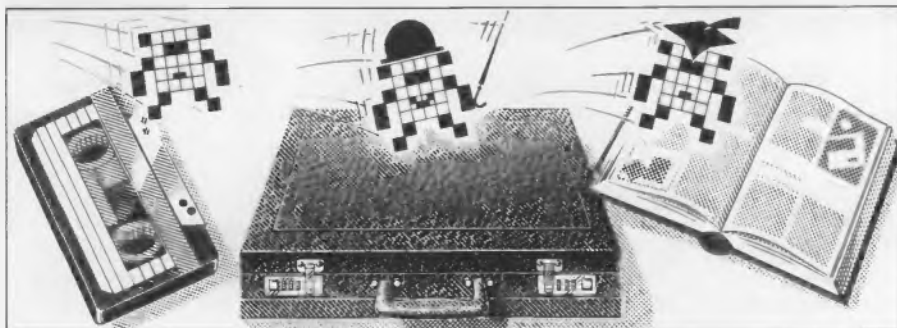
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PROGRAM FILE



Games



Scientific/mathematic



Business



Toolkit/utilities



Educational/Computer
Aided Learning

*Owen Linderholm selects the best of readers' programs.
For details on submitting your own, see the end of
this section.*

There are no QL or Amstrad PCW8256 programs in 'Program File' again this month. There are still signs that we may be able to get hold of one of these machines in order to review software, but despite some signs of action, Amstrad, like all large companies, is taking its time over helping us. I don't want to put anyone off, but until we get the machines to evaluate programs, I won't be able to publish any QL or PCW8256 programs.

Please don't let this prevent you sending in programs, since by the time you read this, we may well have got hold of the machines. Nevertheless, if you want to submit a program for the QL or the PCW8256, then it would be a good idea to telephone first to check the situation.

Response to changes

There has been a generally positive response to the changes to 'Program File'. These changes were to introduce more documentation and commenting to make programs easier to understand. In addition, I have tried to have the Program of the Month accompanied by a decent introduction which explains how the program was written and how it works. I'm hoping to extend this policy to cover more of 'Program File', in order that all the long programs are accompanied by documentation which reveals how the programs are written and why the program was written in the way it was.

The hints and tips section of 'Program File' will not be affected, and I hope to continue to receive any snippets of hardware or software knowledge that you have discovered about your machines.

Due to the aforementioned change, readers should send in much more thorough documentation with their programs. It should include information on how to run the program, any idiosyncrasies or alternative versions, reference to machine-specific parts of

the code, why the program was written, how it was written, and some indication of why particular algorithms or data structures have been used.

These changes, which will take a few months to implement, should result in 'Program File' being easier to understand and more interesting. So, if you're thinking of submitting anything to 'Program File', please bear these things in mind.

This month's programs

The Program of the Month is an unusual and extremely useful utility written by Jim McCartney. It's called Snoopy, and its purpose is to examine and modify records from all sorts of programs, especially databases. The format in which records are stored can be decoded so that they can be used by other programs or accessed by user-written ones. It can also be used to edit the records and then save them.

The program works slowly and is best compiled by something like Microsoft's QuickBasic. One limitation of the program is that it is designed to be used with fixed-length records. It's still possible to access variable records, but it's difficult to do in a completely organised way.

The program could be used to analyse records, and also as a stepping stone to writing other programs which use records that this program has analysed. File records could then be manipulated in all sorts of additional ways than are provided by the original program.

The program Cribbage is for the Enterprise 128. This program is rather long and a little slow on the Enterprise, as are all programs in Basic for that machine, but it is well-written and plays a very good game.

There's also a utility to provide simple disk management functions on a wide range of Commodore computers and disk drives. The program works with the C1541 disk drive, the 1570 disk drive in C64 mode, the Pet disk drives, and with all Commodore computers that drive these disk drives.

For the BBC, there's a program to assist with installing ROMs in the machine, or programs in sideways RAM that are to act as if they are ROMs. The program creates and writes to disk a machine code file that provides the necessary header to install these programs.

There's a large selection of tips this month, including Commodore 64 IRQ program installation.



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Program of the Month

MBasic Snoopy

by Jim McCartney

In business, one of the regular requests to Micro Support is for special reports from data generated by package programs. Quite a lot of packages will supply you with a report generator for this purpose (at a good price, mind you) and some software houses will tell you the data fieldings, if you ask nicely.

There remains a substantial number of packages with which you can't get at the data easily because you don't know how it's fielded. Admittedly, a session with Norton Utilities may throw some light on it, but the time which needs to be spent in working out double-precision numbers from the hexadecimal usually defeats all but those who have nothing better to do.

The following program is designed as a versatile tool to deal briskly with this problem, on IBM and compatibles — and primarily for Basic-style random access records — although it can read any DOS files. Besides decoding records, it can also be used to edit text bytes or hex nybbles, and save the resulting record back where it came from.

Records may be printed out in a

variety of ways.

The program does not include any disassembler facility — it is designed for data.

To get the best out of it, the program should be compiled, because interpreted Basic won't let you handle a string longer than 255 characters and records are handled as strings. Besides, the amount of work it has to do makes it fairly sluggish on a PC or XT unless it's compiled, though leaving out the REMs will help. The code uses Basic-A version 3.0, which includes the useful SHELL; but if you don't have this version, you can do without the fancy bits from lines 690–830, and make line 820 as follows:
820 M\$=" ENTER DRIVE:/PATH/
FILENAME TO INSPECT ": GOSUB
390: CLS: FIL\$=Q\$: A\$="": IF Q\$=""
THEN END

delete the KILL in 1460, and change "770" to "820" in lines 1470 and 2880.

Records under Basic-A

Using Basic-A, you can open any file you like as a random access file with

an arbitrary record length — it doesn't matter if it's a text file, a binary file or a genuine data file. All characters (including the text end-of-file marker, Hex 1A) are treated as part of the data. If it was originally a random access file with a specific record length, you can open it with the original or any other record length you please. Of course, this leads to the problem of finding out what the original record length really was, since there's nothing in the record or in the DOS to tell you. The program (which I have dubbed Snoopy) checks the file length (LOF) and asks you for the number of records (you will usually know this), and works out the record length. However, it doesn't insist on it, and if you want to chop, say, a 512-byte record into convenient 64-byte pieces for easier handling, you are welcome to do so.

The DUMP facility

There's a facility to dump one or more records to the printer in hex format, text format, or both. The program asks you for your printer width to set the WIDTH parameter to an appropriate figure, and assumes that CHR\$(15) will produce condensed print. Fig 1 shows a hex and text dump on a payroll record, originally 384 bytes long but broken down into 12 32-byte lines for convenience. This is also a useful tool for developing your own applications (what happened to that field?) and for investigation of data corruption problems. Inspection of this type of dump will help you with the analysis, by letting you see the whole record, or several records, at once.

The analysis

You first select a file and a record length, and a record (default no 1) for analysis. This is displayed on-screen as shown in Fig 2, initially starting at Byte 1. Reading the columns from left to right, we have:

- 1) The byte number.
 - 2) The byte value in hex.
 - 3) The ASCII text, if appropriate (otherwise a dot).
 - 4) The interpreter string.
 - 5) The interpretation
- and at the bottom, a function key menu.

The interpreter string is the key to the operation of the program. It's a string the same length as the record,



'No wonder the magazine gave it a great write-up — it keeps taking out subscriptions and it won't stop!'

and its initial state is such that any bytes in the record to be analysed whose values lie in the range 32 to 126 are interpreted tentatively as text characters — the same as in the DUMP. It accomplishes this by setting the corresponding byte in the interpreter string to 't'. If you have some undoubted text, you can confirm this by pressing 'T' on the keyboard for each corresponding byte. This will change the letter in the interpreter string to upper case, which prevents it being overwritten by further tentative interpretations. Should you be working with a text file, the more common text control characters such as CR and LF are displayed (listed in 160-190), or failing this, as in the IBM character set.

The up and down arrows, Home, End, Page Up and Page Down do what you would expect them to do, although the up arrow is a bit tedious at the top of the screen since I have made no special provision for back-scrolling. Entering a letter corresponding to one of the data types below moves the cursor down the corresponding number of bytes.

The program recognises the following data types:

- 1) Text, as explained.
- 2) Bytes: that is, numbers in the range 0 to 255.
- 3) Integers: any two consecutive bytes may be interpreted as an integer.
- 4) Single-precision floating point numbers. Any four consecutive bytes may be so interpreted. However, in order to eradicate improbable numbers, press function key 8; this will interpret only those numbers in the range ABS(.0001 to 999999.999 —

that is, those numbers which you are most likely to come across in accounting; things like 3.479167E-16 are ignored. F8 will toggle between the maths and accounting formats. In the accounting format, numbers outside the range are marked as a star. Zeros are not interpreted because there are a lot of them about, usually.

5) Double-precision floating point numbers, interpreting eight bytes in the same way.

6) Integer dates (type X) as the number of days from 1.1.1970 to 2000.

7) Ditto (type Y) from 11.1980 to 2000.

8) Single-precision dates (type Z) which interpret a mathematical integer in single-precision format as a date in the range 1.1.1900 to 2000.

These are the date formats which I have found in most common use, but there may be others.

Having removed obvious text, you can interpret the rest of the record tentatively as any of the above types, by pressing ALT with the corresponding letter. At this point, it's a great help to have the data from the original program printed or written in whatever form it may be available. Press F8 then ALT-S; and you can see at once if there's any accounting data held in single-precision form. ALT-Z is a complete giveaway for that kind of date, because the probability of any four random bytes coming across as a single-precision number which is both integer and in the range 1 to 36525 is minute. If you compare the interpretations with your original data, you can 'fix' any data by pressing the corresponding key on the first byte, without the

ALT. This converts the interpreter string to upper case, which is proof against over-writing with further tentative interpretations. A dash, '-', disables the interpretation of a byte.

When all or most of your record has been interpreted, you can select another record with F6 and see how it looks with the same interpreter string. This helps to clear up any ambiguities. If, instead, you get in a mess, use F7 to restore the original default interpretation.

You can dump a screen in the usual way with PrtSc (Fig 2), but F10 will print the entire record as you see it onscreen.

If you come across data which doesn't seem to correspond to any of the data you put into the record, suspect status flags (usually bytes) or pointers or links to other records (usually integers) which may be in other files.

Editing

You can change the data in the record by shifting the cursor to the second or third columns (left and right arrows) and pressing any valid text or hex value key. You can also save changes made by using F9 — with extreme caution on live data! It isn't possible, however, to edit numeric data directly in the same way as text, but you can change numeric data by editing the hex, since you can see the effect on the number displayed immediately. In this respect, the significance of the nybbles increases as you move left and downwards — it isn't hard to get the number you want by successive approximation, and you'll gain much insight into the storage of floating point numbers!

PCW is interested in programs written in any of the major programming languages for all home and small business micros. When submitting programs please include a cassette or disk version of your program, brief but comprehensive documentation, and a listing on plain white paper — typed if you have no printer.

Please ensure that the software itself, the documentation and the listing are all marked with your name, address, program title, machine (along with any minimum requirements) and — if possible — a daytime phone number.

Check through the previous Program Files to see the kind of programs we prefer. As a rough guide, original ideas are always welcome, as are good implementations of utilities and applications.

Obviously the programs should be well-written, easy to understand, and preferably not too long (remember that other readers have to type them in).

All programs should be fully debugged and your own original, unpublished work.

We prefer to receive programs with a maximum 80-column width printed in emphasised typeface.

We will try to return submissions if they are accompanied by a stamped, addressed envelope of the appropriate size, but please keep a copy of everything.

Programs are paid for at the rate of £50 per page of published listing, plus a £50 bonus for the Program of the Month. Send your contributions to Owen Linderholm, Program File, PCW, 32-34 Broadwick Street, London W1A 2HG.

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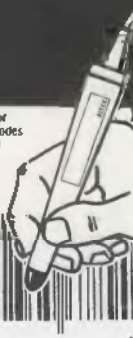
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190 1111*****RECORD CONTENTS ANALYSIS PROGRAM "SMOOPY.BAS"*****
191 ***** J. McCartney May 1986 *****
192
193 ON ERROR GOTO 2000
194 KEY DEF: FOR J1=1 TO 10: KEY J1,"": NEXT
195 DATA "NULL"," ",""," ",""," ",""," ","","BEEP"
196 DATA "BACKSPACE","TAB","LF","HOME","FF","CR","",""
197 DATA " "," "," "," "," "," "," "," "," "
198 DATA " "," ","KOF","ESC","CURS RIGHT","CURS LEFT","CURS UP","CURS DOWN
200 DIM Q$(31): FOR Q1=0 TO 31: READ Q$(Q1): NEXT
210 N$="": T$="T": B$="B": I$="I": X$="X": Y$="Y": Z$="Z": S$="S":
D$="D": U$="U": L$="L": A1=999999.99999: A2=.0001:
M$="EEEE.EEEE": BLS=""
220 DIM C1(6): DATA 31.35,36.40,44.40: FOR J1=1 TO 6: READ C1(J1): NEXT
'column positions
230 DIM A1(8),R1(8)
240 M0$="31203130313031313031"
250 PR1$="1 HELP:2 END:3 PATH:4 FILE:5 DUMP:6 RUC:7 CLEAR:8 ACCT:9 SAVE:10
PRINT:"
260 GOTO 670
270 ***** UTILITY SUBROUTINES *****
280 BEEP
290 Q$=SPACES(39-LEN(M$)/2): LOCATE 25,1: COLOR 0,7:
PRINT Q$;Q$: COLOR 7,0: RETURN 'print a message M$
300 GOSUB 280: FOR J1=1 TO 10000: NEXT
LOCATE 25,1: PRINT SPACES(70): RETURN 'message, pause, delete
320 GOSUB 280: Q$="": LOCATE 1,1: Q1=ASC(INPUT$(1)) AND 95:
IF Q1=13 THEN Q$=D$
IF Q1=65 THEN Q$="A"
IF Q1=70 THEN Q$="N"
IF Q1=68 THEN Q$="D"
IF Q1=89 THEN Q$="Y"
IF Q1=32 THEN Q$=""
GOSUB 310: RETURN 'message, Y/N/A/D answer
390 Q$=SPACES(70-LEN(M$)): LOCATE 25,1: COLOR 0,7: PRINT M$;Q$: COLOR 7,0:
LOCATE 25,LEN(M$)+1: LINE INPUT Q$: RETURN 'prompt M$: input Q$
400 GOSUB 390: Q1=VAL(Q$): IF Q1<1 OR Q1>10 THEN CLS: BEEP: Q1=-1
RETURN 'prompt M$: input Q1
420 Q1=ASC(R1$): IF Q1<32 OR Q1>126 THEN Q1=46 ELSE Q1=Q1
RETURN 'text of "." if not
440 IF AFLAG1=0 THEN PRINT A1: RETURN
450 IF ABS(A1)>A1 OR ABS(A1)<A2
THEN PRINT "0" & BLS: ELSE PRINT USING P$;A1: RETURN
'accounts or maths
460 CL1=CSHLIN: CC1=POS(0): CA1=(SCREEN (CL1,CC1,1)) MOD 16:
IF CA1 THEN COLOR 0,7 ELSE COLOR 7,0
470 PRINT CHR$(SCREEN (CL1,CC1,0)):
IF CA1 THEN COLOR 7,0 ELSE COLOR 0,7
480 LOCATE CL1,CC1: RETURN 'reverse chr at cursor
***** INTERPRET A BYTE *****
490 A1$=MID$(A1,K1,8): R1$=MID$(R1,K1,8):
FOR A1=1 TO 6
A11=ASC(MID$(A1$,A1)):
IF A11=95 THEN MID$(A1$,A1)=CHR$(A11-LC1)
NEXT
LOCATE L1,C1(1): PRINT MID$(STR$(K1),2);
LOCATE L1,C1(2): PRINT RIGHT$("0"+HEX$(ASC(R1$)),2); 'hex code
LOCATE L1,C1(4): GOSUB 420: PRINT CHR$(Q11):
LOCATE L1,C1(5): PRINT MID$(A1$,K1,1):
LOCATE L1,C1(6):
IF LEFT$(A1$,1)=N$ THEN 650
'null
IF LEFT$(A1$,1)=T$ THEN IF Q1<32 THEN IF Q$(Q1)="" THEN
PRINT CHR$(Q1):GOTO 650 ELSE PRINT Q$(Q1):GOTO 650
ELSE PRINT CHR$(Q1):GOTO 650
'byte
IF LEFT$(A1$,1)=B$ THEN PRINT Q1: GOTO 650
'integer
IF LEFT$(A1$,1)=X$ THEN GOSUB 210: PRINT DT$: GOTO 650
'base 1970
IF LEFT$(A1$,1)=Y$ THEN GOSUB 210: PRINT DT$: GOTO 650
'base 1900
IF LEFT$(A1$,1)=S$ THEN A=CVS(R1$): GOSUB 440: GOTO 650
'ap real
IF LEFT$(A1$,1)=Z$ THEN GOSUB 210: PRINT DT$: GOTO 650
'base 1900
IF LEFT$(A1$,1)=D$ THEN A=CVD(R1$): GOSUB 440: GOTO 650
'dp real
PRINT BLS: RETURN
660 ***** INITIAL PROCEDURES *****
670 ***** SELECT DIRECTORY *****
680 CLS: LOCATE 1,20: COLOR 0,7: PRINT "Records Analysis Program":COLOR 7,0
690 CLS:D$="Y": M$="HAVE YOU A WIDE (14 inch) PRINTER? <Y> ": GOSUB 320:
P1=224: P2=132: IF Q$="Y" THEN P1=136: P2=80
700 M$=SPACES(20)+"PLEASE ENTER DRIVE (A to Z) <C> ": GOSUB 390
710 IF Q$="" THEN Q$="C"
720 Q1=ASC(Q$) AND 95: IF Q1<65 OR Q1>90 OR LEN(Q$)>1 THEN BEEP:
GOTO 682 ELSE D$=CHR$(Q1)+"":
730 OPEN D$+"ZZZZZZZ" FOR OUTPUT AS #1: CLOSE: KILL D$+"ZZZZZZZ"
LOCATE 3,1
740 Q$="TREE "+D$+">D1.TMP":SHELL Q$: Q1$=""
750 OPEN "D1.TMP" FOR INPUT AS #1
760 OPEN "D2.TMP" FOR OUTPUT AS #2
770 PRINT #2,D$
780 WHILE NOT EOF(1)
LINE INPUT #1,Q$: IF INSTR(Q$,Q1$)=0 THEN 760
Q$=MID$(Q$,INSTR(Q$,Q1$)): PRINT #2,D$;Q$
WEND: CLOSE
790 D1$=0: OPEN "D2.TMP" FOR INPUT AS #1: LOCATE 3,1
CLS: LOCATE 1,20:COLOR 0,7: PRINT "DIRECTORIES ARE: ":COLOR 7,0: PRINT
800 WHILE NOT EOF(1): D1=D1+1: INPUT #1,Q$:
PRINT TAB(27);Q1;TAB(35);Q$: WEND: CLOSE 'directories menu
810 M$=""
SELECT DIRECTORY (1 to+STR$(D1)+") ":
L1=1: U1=D1: GOSUB 400: IF Q1=-1 THEN 770
OPEN "D2.TMP" FOR INPUT AS #1: FOR J1=1 TO Q1: INPUT #1,Q$: NEXT: CLOSE
DIR$=Q$: D1$="dir "+Q$+"\n."/M: MORE"
***** SELECT FILE *****
820 CLS: SHELL D1$

```


PROGRAM FILE

```

830 MS=" ENTER FILE NAME TO INSPECT ": GOSUB 390: CLS:
FILE=DIR$+Q1$+Q2$: AS="": IF Q3="" THEN END 'select a file
840 OPEN "R",#1,FILE: FL=LOF(1): CLOSE 'is it there?
850 IF FL=0 THEN MS="No such file!": GOSUB 300: KILL FILE: GOTO 820
'kill a file of length 0
860 CLS: LOCATE 1,20: COLOR 0,7: PRINT "ANALYSIS ON "FILE: LENGTH "FL:
COLOR 7,0: PRINT
'***** RECORDS / SIZE
870 MS=SPACES(30)+NUMBER OF RECORDS ? ": LI=0: UI=32767: GOSUB 400
880 IF Q1=-1 THEN END
890 IF Q1=0 THEN DES="Y":
900 MS="NUMBER OF RECORDS NOT KNOWN - OK ? (Y)": GOSUB 320:
IF Q2="Y" THEN 930 ELSE 880
910 NR1=Q1: RL=FL/NR1: IF RL<INT(RL) THEN DES="Y":
MS="NUMBER OF RECS. IS NOT A FACTOR OF FILE SIZE - OK ? (Y)": GOSUB 320:
IF Q2="Y" THEN 930 ELSE 880
920 DES="Y": MS="RECORD LENGTH IS "+STR$(RL)+" OK ? (Y)": GOSUB 320:
IF Q2="Y" THEN 950
930 MS=SPACES(30)+RECORD LENGTH ? ": LI=1: UI=32767: GOSUB 400: RL=Q1:
NR=INT(FL/RL)+1: IF NR>32767 OR NR<1 THEN 880 ELSE NR=NR: GOTO 920
'***** WHAT TO DO
940 MS="DO YOU WANT ANALYSIS (A) OR DATA DUMP (D) ? (A)": DES="A":
950 GOSUB 320: IF Q3="D" THEN GOTO 2610
960 MS=SPACES(30)+RECORD TO ANALYSE ? (1)": LI=0: UI=NR1:
IF UI=0 THEN UI=32767
970 GOSUB 400: NR1=Q1: IF NR1=0 THEN NR1=1 'select suitable record
'***** INITIAL DISPLAY *****
980 OPEN "R",#1,FILE,RL: FIELD #1, RL AS RS: GET #1,RS1
990 IF AS<>" " THEN 1030
1000 AS=STRINGS(RL,45):
1010 FOR J1=1 TO RL:
Q1=ASC(MID$(RS,J1)): IF Q1>31 AND Q1<127 THEN MID$(AS,J1)=" "
'find possible text
1020 NEXT
1030 K1=1: M1=5: GOTO 1010 'first page
'***** INTERACTIVE ANALYSIS *****
IF MS<>PR$ THEN MS=PR$: GOSUB 290: LOCATE LI,C1(M1): COLOR 0,7:
PRINT CHR$(SCREEN(LI,C1(M1))): COLOR 7,0: LOCATE LI,C1(M1)
1060 Q3=INKEY$: IF Q3="" THEN 1060
1070 IF LEN(Q3)=2 THEN Q1=ASC(MID$(Q3,2))+200 ELSE Q1=ASC(Q3)
'extended codes add 200
1080 IF Q1=275 THEN IF M1>2 THEN M1=M1-1: GOTO 1050 'cursor left
1090 IF Q1=277 THEN IF M1<5 THEN M1=M1+1: GOTO 1050 'cursor right
1100 IF Q1<>200 THEN 1140 'down a line
1110 IF K1=RL THEN 1070 'skip if end of record
1120 IF LI<24 THEN LI=LI+1: K1=K1+1: GOTO 1050 'move down one line
1130 K1=K1+1: GOSUB 460: COLOR 7,0: LOCATE 24,79: PRINT:
GOSUB 490: GOTO 1060 'scroll up at bottom
1140 IF Q1<>272 THEN 1180 'up a line
1150 IF K1=1 THEN 1070 'skip if first
1160 IF LI>1 THEN LI=LI-1: K1=K1-1: GOTO 1050 'move up one line
1170 K1=K1-1: GOTO 1010
1180 IF Q1<>201 THEN 1210 'down a page
1190 IF LI-L1+RL-26 THEN X1=INT((RL/24)*24+1: GOTO 1010 'on last page
1200 X1=K1-L1+25: GOTO 1010 'next page
1210 IF Q1<>273 THEN 1240 'up a page
1220 IF K1-L1<24 THEN X1=1: GOTO 1010 'on first page already
1230 X1=K1-L1-23: GOTO 1010 'previous page
1240 IF Q1=271 THEN X1=1: GOTO 1010 'first page
1250 IF Q1=279 THEN X1=INT((RL/24)*24+1: GOTO 1010 'last page
1260 IF M1<5 THEN 1450 'skip interpret
1270 IF Q1=45 THEN MID$(AS,K1)=MS: B11=1: GOTO 1720 'null
1280 IF Q1=84 THEN MID$(AS,K1)=T$: B11=1: GOTO 1720 'text
1290 IF Q1=66 THEN MID$(AS,K1)=B$: B11=1: GOTO 1720 'byte
1300 IF Q1=73 THEN MID$(AS,K1)=I$: B11=2: GOTO 1720 'integer
1310 IF Q1=88 THEN MID$(AS,K1)=X$: B11=2: GOTO 1720 'date 1970
1320 IF Q1=89 THEN MID$(AS,K1)=Y$: B11=2: GOTO 1720 'date 1980
1330 IF Q1=83 THEN MID$(AS,K1)=S$: B11=4: GOTO 1720 'sp real
1340 IF Q1=90 THEN MID$(AS,K1)=Z$: B11=4: GOTO 1720 'dp real
1350 IF Q1=68 THEN MID$(AS,K1)=D$: B11=8: GOTO 1720 'dp real
1360 IF Q1=330 THEN US=" ": GOTO 1660 'all null
1370 IF Q1=220 THEN US="t": GOTO 1660 'all text
1380 IF Q1=240 THEN US="b": GOTO 1660 'all byte
1390 IF Q1=223 THEN US="i": GOTO 1660 'all integer
1400 IF Q1=245 THEN US="x": GOTO 1660 'all date 1970
1410 IF Q1=221 THEN US="y": GOTO 1660 'all date 1980
1420 IF Q1=231 THEN US="s": GOTO 1660 'all sp reals
1430 IF Q1=244 THEN US="z": GOTO 1660 'all dp reals
1440 IF Q1=232 THEN US="d": GOTO 1660 'all "ALT" KEYS-
'F1 = HELP
'F2 = END ****
'F3 = DIR
'F4 = FILE
'F5 = A or D
'F6 = RECORD
'F7 = Restart
'F8 = Toggle Adcts/Mat
1450 IF Q1=259 THEN 2220
1460 IF Q1=260 THEN CLS: CLOSE: KILL "D7.TMP": END
1470 IF Q1=261 THEN CLOSE: CLS: GOTO 770
1480 IF Q1=262 THEN CLOSE: GOTO 820
1490 IF Q1=263 THEN 950
1500 IF Q1=264 THEN 960
1510 IF Q1=265 THEN AS=" ": GOTO 1010
1520 IF Q1=266 THEN AFLAG1=1-AFLAG1: GOTO 1660
1530 IF Q1=267 THEN MS="REPLACE RECORD ? (Y)": DES="Y": GOSUB 320:
IF Q2="Y" THEN PUT #1, NR1: GOTO 1050 'F9 = Save rec.
1540 IF Q1=268 THEN GOSUB 1090: GOTO 1050 'F10 = PRINT
1550 IF M1=5 THEN 1070
1560 IF M1=4 THEN 1070
'***** HEX$ EDIT
1570 IF Q1=40 OR (Q1=57 AND Q1<65) OR Q1=70 THEN 1070 'invalid hex$
1580 Q1=Q1-40: IF Q1>9 THEN Q1=Q1-7
1590 IF M1=2 THEN Q2=1 ELSE Q2=-1
1600 Q11=SCREEN(CLI,C1+Q21,0)-40: IF Q11>9 THEN Q11=Q11-7 'other nybble
1610 IF
M1=2
THEN
MID$(RS,K1)=CHR$(Q11*16 + Q1)
ELSE
MID$(RS,K1)=CHR$(Q11*16 + Q1)

```

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```

-70 to 2000
2420 PRINT "Y Interpret: two bytes as an integer date; days from 01-01
-00 to 2000
2430 PRINT "S Interpret: four bytes as an sp real in maths or acctg. r
anges (F8)
2440 PRINT "Z Interpret: four bytes as an sp real date; days from 01-0
1-00 to 2000
2450 PRINT "D Interpret: eight bytes as a dp real in maths or acctg. r
anges (F8)
2460 PRINT
2470 PRINT "ALT- with any of the above interprets all bytes in the record
as described)
2480 PRINT "F restores to the default interpretation
2490 LOCATE 25,33:PRINT "**** PRESS A KEY ****"; Q$=INPUT$(1); CLS
2500 PRINT TAB(33);"OTHER FUNCTIONS
2510 PRINT
2520 PRINT "The cursor control keys, also Home, End, Pg Up, Pg Down, act as e
xpected.
2530 PRINT "The cursor can move left and right between the HEX column, the TE
XT column
2540 PRINT "and the interpreter column.
2550 PRINT
2560 PRINT "You can edit the record by changing the characters in the HEX and
TEXT columns
2570 PRINT "and save your changes with F10.
2580 LOCATE 25,33:PRINT "**** PRESS A KEY ****"; Q$=INPUT$(1); CLS
2590 M$="": GOTO 1600

2600 '***** DATA DUMP *****
2610 CLS: COLOR 0,7: PRINT "DATA DUMP ON: ";F1$; COLOR 7,0: PRINT
2620 LOCATE 5,1: INPUT "Start at record: ".Q$; IF Q$="" OR VAL(Q$)<1
OR VAL(Q$)>NR$ THEN M$="Invalid Record Number": GOSUB 300: GOTO 2620
2630 START$=VAL(Q$)
2640 LOCATE 7,1: INPUT "End at record: ".Q$; IF Q$="" OR VAL(Q$)<1
OR VAL(Q$)>NR$ THEN M$="Invalid Record Number": GOSUB 300: GOTO 2640
2650 F1$=VAL(Q$)
2660 LOCATE 9,1:INPUT "Do you want Text, or Hex, or Both? (T/H/B) ":Q$;
IF Q$="" THEN 2660
2670 Q$=CHR$(ASC(Q$)+95): IF Q$="T" AND Q$="H" AND Q$="B" THEN 2660
2680 LOCATE 11,1: PRINT "Press any key to stop....
2690 OPEN "R",#1,F1$,RL: FIELD #1, RL AS B$
2700 LPRINT CHR$(15); WIDTH "LPT1: ".PW1 'condensed print on
2710 LPRINT "Dump on file: ";F1$
2720 LPRINT "Record length = ";RL
2730 LPRINT "Start at byte ":(START$-1)*RL+1
2740 LPRINT
2750 FOR J$= START$ TO F1$: J$=INKEY$: IF J$<>" " THEN J$=F1$: GOTO 2850
2760 GET #1,J$: IF Q$="T" THEN 2800
2770 LPRINT LEFT$(STR$(J$)+BL$,7);
FOR K$= 1 TO RL:
B$=ASC(MID$(R$,K$))
H$=RIGHT$("0" +HEX$(B$),2)+" ";
LPRINT H$;;
NEXT: LPRINT
IF Q$="H" THEN 2830
2790 LPRINT LEFT$(STR$(J$)+BL$,7);
FOR K$= 1 TO RL:
B$=ASC(MID$(R$,K$))
IF B$<32 OR B$>126 THEN R$=+6
LPRINT CHR$(B$); " ";
NEXT: LPRINT
2810 IF (J$-START$+1) MOD 24 = 0 AND Q$="B" THEN LPRINT CHR$(12): GOTO 910
2820 IF (J$-START$+1) MOD 48 = 0 THEN LPRINT CHR$(12) 'fore feed here
2830 NEXT J$
2840 LPRINT CHR$(12): LPRINT CHR$(18); WIDTH "LPT1: ".PW2: CLOSE: GOTO 950
2850 'END OF DUMP

2870 '***** ERROR TRAP *****
2880 IF ERR=75 OR ERR=76 AND ERL=840 THEN CLS: D1=0: RESUME 740
2885 IF ERR=76 AND ERL=606 THEN BEEP: RESUME 682
2890 IF ERR=53 AND ERL=840 THEN M$="No such file!": GOSUB 300: RESUME 820
2900 IF ERR=55 AND (ERL=790 OR ERL=2670) THEN CLOSE: RESUME
2910 IF ERR=5 AND ERL=500 THEN RESUME 510
2920 IF ERR=5 AND ERL=1930 THEN RESUME 1940
2930 ON ERROR GOTO 0

```

[illegible]

Fig 1

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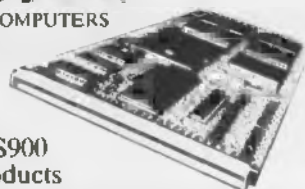
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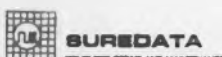
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PROGRAM FILE

Fig 2

```

43 20      I
44 20      T
45 00      Z 15-02-42
46 00      H Z *
47 70      D Z *
48 00      Z *
49 00      Z 10-09-84
50 00      Z
51 71      q Z
52 01      Z
53 40      H I
54 40      M I M
55 37      7 T 7
56 37      7 T 7
57 34      4 T 4
58 36      6 T 6
59 33      3 T 3
60 30      0 T 0
61 44      0 T 0
62 41      A T A
63 59      Y I Y
64 01      B T
65 40      H T H
66 20      T
    
```

{1 HELP}2 END {3 PATH}4 FILE{5 DUMP}6 REC {7 CLEAR}8 ACC{9 SAVE}10 PRINT{



Commodore 1541 Disk Utilities

by C Whitfield

This program should work with any would usually be typed-in to perform Commodore computer and a 1541 a function. The exceptions are disk disk drive. Its purpose is to simplify rename and the directory. The disk disk housekeeping to make free rename works by doing the equivalent blocks usable and speed up the lent of a POKE directly to the disk via directory listing. The program has one of the RAM buffers inside it. It been tested on the C64 and Plus/4, isn't possible to change the disk ID and should work on all other Commodore machines with 2031, 4040 or routine works by PEEKing at the conven 1571 (C64 format only) disk tents of the directory via a RAM drives. buffer.

The program is fully menu-driven All the REMs can be omitted when and self-explanatory. Most sections typing-in the program. To stop the simply emulate the commands that program, press RUN/STOP.

```

10 REM *****
20 REM "DISK UTILITIES"
30 REM "BY C.WHITFIELD"
40 REM *****
50 REM *** ALL REM LINES CAN BE MISSED
60 REM *** DON'T PUT A SPACE BETWEEN 'DRIVE' AND 'NUMBERS' ON LINE 1020
70 V=0:D=0:DS=""
1000 REM *** MAIN SECTION
1010 PRINT""-PRESS APPROPRIATE KEY TO SELECT OPTION"
1020 PRINT""PRESS NUMBER KEYS TO CHANGE DEVICE/DRIVENUMBERS"
1030 PRINT""C - COMPACT DIRECTORY"
1040 PRINT""D - DIRECTORY"
1050 PRINT""F - FORMAT"
1060 PRINT""R - RENAME A FILE"
1070 PRINT""S - SCRATCH A FILE"
1080 PRINT""T - RENAME DISK"
1090 PRINT""-PRESS APPROPRIATE KEY TO CHANGE DEVICE NUMBER =":V
1100 PRINT""-PRESS APPROPRIATE KEY TO CHANGE DISK NUMBER =":D
1110 GETA$:IF A$=""THEN1100
1120 IF A$="C"THEN2010
1130 IF A$="D"THEN3010
1140 IF A$="F"THEN4010
1150 IF A$="R"THEN5010
1160 IF A$="S"THEN6010
1170 IF A$="T"THEN7010
1180 IF A$="0"THENV=0:GOTO1090
1190 IF A$="9"THENV=9:GOTO1090
1200 IF A$="0"THENDS=""D=0:GOTO1090
1210 IF A$="1"THENDS="1":D=1:GOTO1090
1220 GOTO 1100
2000 REM *** COMPACT (VALIDATE)
2010 PRINT""COMPACTING NOW."-OPEN:V,15,"V"+D$:CLOSE15:GOTO1010
3000 REM *** DIRECTORY
3010 PRINT""
3020 OPEN:V,0,"$"+D$
3030 FORA=1TO29
3040 GETE1:A$
3050 IF A$=""THEN3040
3060 IF ASC(A$)<32ORASC(A$)>128THEN3060
3070 PRINTA$:
3080 NEXT:PRINT
3090 FORB=1TO21
3100 GETE1:A$
3110 IF A$=""THEN3100
3120 IF ST<0THENCLOSE1:GOTO3240
3130 IF ASC(A$)<32ORASC(A$)>128THEN3160
3140 PRINTA$:
3150 NEXT
3160 GETE1:A$:IF A$=""THEN3160
    
```


PROGRAM FILE

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```

3170 IFST<>0THENCLOSE1:GOTO3240
3180 IFASC(A$)<>34 THEN 3160
3190 GETC1,A$:IFA$=""THEN3100
3200 IFST<>0THENCLOSE1:GOTO3240
3210 IFA$="" THEN3160
3220 PRINT:PRINTCHR$(34):A$;
3230 GOTO3090
3240 PRINT:PRINT"PRESS ANY KEY."
3250 GETB$:IFB$=""THEN3250
3260 GOTO1010
4000 REM *** FORMAT
4010 GOSUB8010
4020 INPUT"NEW ID";I$
4030 IFLEN(I$)>2THENPRINT"ID TOO LONG":GOTO4020
4040 PRINT"ARE YOU SURE ? (Y/N)"
4050 GETA$:IFA$="Y"THEN4070
4060 IFA$="N"THEN1010:GOTOGOTO4050
4070 PRINT"FORMATTING NOW"
4080 OPEN15,V,15,"N"+D$+"":N$+"":+I$
4090 CLOSE15
4100 GOTO 1010
5000 REM *** FILE RENAME
5010 INPUT"OLD NAME";O$
5020 IFLEN(O$)>16THENPRINT"NAME TOO LONG":INPUT"OLD NAME";O$:GOTO5020
5030 GOSUB8020
5040 PRINT"RENAMING NOW"
5050 OPEN15,V,15,"R"+D$+"":N$+"":+O$
5060 CLOSE15
5070 GOTO 1010
6000 REM *** SCRATCH
6010 INPUT"FILE TO BE SCRATCHED";S$
6020 IFLEN(S$)>16THENPRINT"TOO LONG":INPUT"FILE TO BE SCRATCHED";S$:
GOTO6020
6030 PRINT"ARE YOU SURE (Y/N)?"
6040 GETA$:IFA$="Y"THEN6070
6050 IFA$="N"THEN1010
6060 GOTO6040
6070 PRINT"SCRATCHING NOW."
6080 OPEN15,V,15,"S"+D$+"":+S$
6090 CLOSE15:GOTO1010
7000 REM *** DISK RENAME
7010 GOSUB8010
7020 PRINT"RENAMING NOW."
7030 B$="":FORL=1TO10:B$=B$+CHR$(160):NEXTL
7040 C$=LEFT$(LEFT$(N$.16)+B$.10)
7050 OPEN15,V,15
7060 OPEN5,V,5,"E"
7070 PRINT15,"U1":5;D;10;0
7080 PRINT15,"B-P":5;144
7090 PRINT15,C$;
7100 PRINT15,"U2":5;D;10;0
7110 PRINT15,"I"+D$
7120 CLOSE5:CLOSE15
7130 GOTO 1010
8000 REM *** NAME INPUT ROUTINE
8010 PRINT"?"
8020 INPUT"NEW NAME";N$
8030 IF LEN(N$)>16 THEN PRINT"NAME TOO LONG":GOTO 8020
8040 RETURN
    
```



Enterprise 128 Cribbage by DM Race

This program is fully structured but entered as value (A,2,3, ...) followed doesn't include any instructions as by suit (S.H.D.C). If you don't know, it's already fairly long. If you know then any book giving rules for card how to play cribbage, then all you games should be enough to get you need to know is that cards should be started.

```

100 PROGRAM "CRIBBAGE.BAS"
110 RANDOMIZE
120 WHEN EXCEPTION USE DEFAULT
130 LET I0$=HEX$(10,49,0)
140 LET I1$=HEX$(10,49,1)
150 LET B0$=HEX$(10,52,0,FF,0,0)
160 LET D0$=HEX$(10,52,0,0,FF,0)
170 LET D1$=HEX$(10,52,0,0,FF,0)
180 LET D2$=HEX$(10,52,0,0,FF,0)
190 LET D3$=HEX$(10,52,0,0,FF,0)
200 LET D4$=HEX$(10,52,0,0,FF,0)
210 NUMERIC MH(1 TO 5),MS(1 TO 5),WH(1 TO 13),CC(1 TO 52),CP(1 TO 21),CT(8),
CO(8),MH(1 TO 3),TH(1 TO 2),SC(1 TO 2),ST(1 TO 9)
220 NUMERIC AA,BB,AN,SS,X,Y,DI,HT,EP,K,Z,P,ZR,ZQ,ZF,ZJ,OVER,CLR
230 STRING N$(1 TO 13),W$(1 TO 2),S$(1 TO 4),R$(1 TO 4),ZHS$(1 TO 8)
*11.SPACES*40.NI$*2.PC$(1 TO 6)*2
240 CALL TITLE
250 CALL CUT
260 DO
270 LET SC(1),SC(2),B1,B2,F1,F2=0
280 CALL FRAME
290 LET WIN=0
300 DO
310 LET DL=2+(DL=2):LET PL=2+(DL=2)
320 LET C1=6:LET C2=4:LET C0,GF,PT=0
330 IF DL=2 THEN
340 LET D1=" I"
350 ELSE
360 LET D$="YOU"
370 END IF
380 PRINT L01,AT 1,30:DEL35:D$
390 CALL DEAL
    
```


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PROGRAM FILE

```

400 LET SK=1:LET J5=6
410 CALL SORT
420 CALL DISPLAY
430 CALL CDISC
440 CALL PDISC
450 CALL TURNSC
460 DO
470 CALL TOT
480 IF PL=1 THEN
490 CALL PTABLE
500 ELSE
510 CALL CTABLE
520 END IF
530 LET ZH=0
540 IF HT<>0 THEN
550 IF ZH<0 THEN
560 LET ZH=4:LET HT=ZH
570 CALL REPORT
580 END IF
590 SELECT CASE ZP
600 CASE 0
610 CASE 2
620 LET ZH=3:LET HT=ZP:CALL REPORT
630 CASE 6
640 LET ZH=5:LET HT=ZP:CALL REPORT
650 CASE 12
660 LET ZH=8:LET HT=ZP:CALL REPORT
670 CASE ELSE
680 LET HT=ZP:CALL REPORT
690 END SELECT
700 END IF
710 LET HT,ZP,ZH=0
720 CALL CHKWIN
730 IF CLR=1 THEN CALL CLRTABLE
740 LOOP WHILE OVER=0
750 LET PF=0
760 IF DL=1 THEN
770 LET HP=2
780 ELSE
790 LET HP=1
800 END IF
810 DO UNTIL PF>2 OR WIN=1
820 LET J5=4:LET SK=MP
830 CALL SORT
840 FOR J=1 TO 4
850 LET HN(J)=HH(MP,J):LET HS(J)=HH(MP,J+6)
860 NEXT
870 SET INK 0
880 FOR X=15 TO 24
890 PRINT £101,AT X,1:SPACES$
900 NEXT
910 SET INK 1
920 LET PF=PF+1:LET HN(5)=TU(1):LET HS(5)=TU(2)
930 SELECT CASE HP
940 CASE 1
950 LET D$="YOUR"
960 CASE 2
970 LET D$="MY "
980 CASE 3
990 LET D$="CRIB"
1000 CASE ELSE
1010 END SELECT
1020 PRINT £101,AT 11,2:DEL4$
1030 PRINT £101,AT 11,2:D$
1040 FOR IJ=1 TO 4
1050 CALL CFRAME(IJ+15):CALL PRINT(HN(MP,IJ+6),HN(MP,IJ))
1060 NEXT
1070 CALL JACK
1080 PRINT £101,AT 16,8:"This hand scores:"
1090 IF ZQ>0 THEN PRINT £101:TAB(10);"Firstmans ";ZQ
1100 IF ZR>0 THEN PRINT £101:TAB(10);"Runs ";ZR
1110 IF ZP>0 THEN PRINT £101:TAB(10);"Pairs ";ZP
1120 IF ZF>0 THEN PRINT £101:TAB(10);"Flush ";ZF
1130 IF ZJ>0 THEN PRINT £101:TAB(10);"And one for his nob."
1140 IF HT=0 THEN
1150 PRINT £101:TAB(10);"Nothing."
1160 ELSE
1170 PRINT £101:TAB(10);"Total ";HT
1180 END IF
1190 IF PF<3 THEN LET SCO=HT:LET SP=HP
1200 IF HP=3 THEN LET SCO=HT:LET SP=DL
1210 IF HT=0 THEN CALL BOARD1
1220 IF WIN<1 THEN
1230 PRINT "Press any key to continue."
1240 DO WHILE INKEY=""
1250 LOOP
1260 CLEAR E0
1270 END IF
1280 FOR IJ=1 TO 4
1290 CALL CERASE(IJ+15)
1300 NEXT
1310 LET MP=2+(HP=2)
1320 IF PF=2 THEN LET HP=3
1330 LOOP
1340 SET INK 0
1350 FOR X=15 TO 24
1360 PRINT £101,AT X,1:SPACES$
1370 NEXT
1380 SET INK 1
1390 CALL CERASE(15)
1400 PRINT £101,AT 11,2:DEL4$
1410 IF WIN<1 THEN
1420 CALL LFRAME
1430 END IF
1440 LOOP UNTIL WIN=1
1450 PRINT £101,AT 12,2:DEL4$
1460 IF SP=1 THEN
1470 LET MS$="YOU WIN"
1480 ELSE
1490 LET MS$="I WIN"
1500 END IF
1510 FOR N=1 TO LEN(MS$)
1520 CALL CFRAME(N):CALL CHACK(N)
1530 NEXT
1540 FOR N=1 TO LEN(MS$)
1550 CALL CERASE(N):CALL CFRAME(N)
1560 SET INK 2
1570 PRINT £101,AT Y+1,X+1:MS$(N)
1580 SET INK 3
1590 PRINT £101,AT Y+3,X+2:MS$(LEN(MS$)-N+1)
1600 NEXT

```


PROGRAM FILE

```

1610 INPUT PROMPT "Do you want another game ? ":AS
1620 CLEAR %0
1630 LOOP WHILE UCASES(AS(1))="Y"
1640 END
1650 DEF TITLE
1660 CLEAR FONT
1670 SET VIDEO X 40
1680 SET VIDEO Y 25
1690 SET VIDEO MODE 1
1700 SET VIDEO COLOUR 1
1710 OPEN #101:"video:"
1720 SET VIDEO Y 3
1730 SET VIDEO MODE 0
1740 SET VIDEO COLOR 0
1750 OPEN #10:"VIDEO:"
1760 SET #10:SCROLL OFF
1770 SET #10:CUSOR CHARACTER 32
1780 CLOSE #0
1790 SET EDITOR VIDEO 10
1800 OPEN #0:"editor:"
1810 SET PALETTE RGB(.7,.7,.6):RGB(.3,.2,0):RGB(.7,.3,.3):BLACK
1820 SET #10:PALETTE RGB(.7,.7,.6):RGB(.3,.2,0):RGB(.7,.7,.6):BLACK
1830 CALL INIT
1840 CLOSE #20
1850 DISPLAY #101:AT 1 FROM 1 TO 25
1860 DISPLAY #10:FROM 1 TO 2 AT 26
1870 SET BORDER RGB(.7,.7,.6)
1880 END DEF
1890 DEF DELAY(M)
1900 FOR X=1 TO 20*M
1910 NEXT X
1920 END DEF
1930 DEF INIT
1940 RESTORE 2010
1950 FOR I=146 TO 150
1960 FOR J=0 TO 8
1970 READ CO(J)
1980 NEXT
1990 SET CHARACTER I,CO(0),CO(1),CO(2),CO(3),CO(4),CO(5),CO(6),CO(7),CO(8)
2000 NEXT
2010 DATA 0,0,0,24,24,0,0,0,0
2020 DATA 0,0,0,36,36,0,0,0,0
2030 DATA 0,0,0,1,6,8,8,8
2040 DATA 8,8,8,6,1,0,0,0,0
2050 DATA 0,0,0,192,40,8,8,8
2060 DATA 8,8,8,40,192,0,0,0,0
2070 DATA 0,0,0,255,0,0,0,0,0
2080 DATA 8,8,8,8,8,8,8,8,8
2090 DATA 129,66,36,24,36,24,36,66,129
2100 DATA 0,0,102,255,255,126,60,24,0
2110 DATA 16,56,124,254,254,124,16,56,0
2120 DATA 60,60,24,219,255,219,24,24,60
2130 DATA 0,24,60,126,255,126,60,24,0
2140 CALL SCREEN
2150 RESTORE 2190
2160 FOR J=1 TO 13
2170 READ NS(J),VN(J)
2180 NEXT
2190 DATA A,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,T,10,J,10,Q,10,K,10
2200 FOR J=1 TO 4
2210 READ %S(J),M
2220 LET %S(J)=CHR$(H)
2230 NEXT
2240 DATA S,156,C,157,D,158,H,155
2250 FOR J=1 TO 21
2260 READ CP(J)
2270 NEXT
2280 DATA 600,612,616,620,624,628,632,636,640,644,648,652,656,660,664,668,672,676,680,684,688,692,696,700,704,708,712,716,720,724,728,732,736,740,744,748,752,756,760,764,768,772,776,780,784,788,792,796,800,804,808,812,816,820,824,828,832,836,840,844,848,852,856,860,864,868,872,876,880,884,888,892,896,900,904,908,912,916,920,924,928,932,936,940,944,948,952,956,960,964,968,972,976,980,984,988,992,996,1000
2290 FOR J=1 TO 4
2300 READ ZHS(J)
2310 NEXT
2320 DATA 15,31,A PAIR,A RUN,3 OF A KIND,A GO,LAST CARD,4 OF A KIND
2330 LET %S(1)="YOU":LET %S(2)="I"
2340 LET SPACES=""
2350 LET NL3=CHR$(10)&CHR$(13)
2360 END DEF
2370 DEF CUT
2380 PRINT #101,AT 3,6:"CUTTING FOR DEAL"
2390 LET DD=53
2400 FOR A=1 TO 52
2410 LET CC(A)=A
2420 NEXT A
2430 DO
2440 FOR J=1 TO 2
2450 CALL DRAW
2460 LET HN(J)=NN:LET HS(J)=SS
2470 NEXT
2480 CALL CFRAME(10):CALL CBACK(10):PRINT #101,AT 9,10:"MY CARD"
2490 CALL CFRAME(11):CALL CBACK(11):PRINT #101,AT 19,10:"YOUR CARD"
2500 CALL DELAY(20)
2510 CALL CERASE(10):CALL CFRAME(18)
2520 CALL PRINTHS(1),HN(1)
2530 CALL DELAY(20)
2540 CALL CERASE(11):CALL CFRAME(1)
2550 CALL PRINTHS(2),HN(2)
2560 CALL DELAY(40)
2570 IF HN(1)>HN(2) THEN EXIT DO
2580 PRINT #101,AT 5,12:"We'll cut again."
2590 CALL DELAY(60)
2600 SET INK 0
2610 PRINT #101,AT 5,12:SPACES(1:16)
2620 SET INK 1
2630 CALL CERASE(10):CALL CERASE(11)
2640 LOOP
2650 IF HN(1)>HN(2) THEN
2660 LET AS="YOU":LET DI
2670 ELSE
2680 LET AS="I":LET DL=1
2690 END IF
2700 PRINT #101,AT 5,9:AS:"WIN AND DRAW FIRST."
2710 CALL DELAY(80):CALL CERASE(11):CALL CERASE(18)
2720 END DEF
2730 DEF DRAW
2740 LET DD=DD-1:LET F=RDND(DD)+1
2750 LET C=CC(F):LET CC(F)=CC(DD)
2760 LET SS=INT((C-1)/13)+1
2770 LET NN=MOD(C-1,13)+1
2780 END DEF
2790 DEF CFRAME(N)

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PROGRAM FILE

```

4010 LET ZF=RT=0
4020 FOR A=1 TO 4
4030 LET RT=RT+(HS(A)=HS(1))
4040 NEXT
4050 IF RT=-4 THEN LET ZF=-1:HS(5)=HS(1)
4060 FOR A=1 TO 4
4070 FOR B=A+1 TO 5
4080 IF HN(A)>HN(B) THEN LET F=HN(A):LET HN(A)=HN(B):LET HN(B)=F
4090 NEXT
4100 NEXT
4110 LET ZP,ZQ,ZR=0
4120 IF (HN(2)-HN(1)=1) AND (HN(3)-HN(2)=1) AND (HN(4)-HN(3)=1) AND (HN(5)-HN(4)=1) THEN LET ZR=5
4130 IF VN(HN(1))+VN(HN(2))+VN(HN(3))+VN(HN(4))+VN(HN(5))=15 THEN LET ZQ=2
4140 LET ZZ=0
4150 FOR A=1 TO 2
4160 FOR B=A+1 TO 3
4170 FOR C=B+1 TO 4
4180 FOR D=C+1 TO 5
4190 IF (HN(B)-HN(A)=1) AND (HN(C)-HN(B)=1) AND (HN(D)-HN(C)=1) AND 2
R=0 THEN LET ZZ=ZZ+4
4200 IF VN(HN(A))+VN(HN(B))+VN(HN(C))+VN(HN(D))=15 THEN LET ZQ=ZQ+2
4210 NEXT
4220 NEXT
4230 NEXT
4240 NEXT
4250 LET ZR=ZR+ZZ:LET ZZ=0
4260 FOR A=1 TO 3
4270 FOR B=A+1 TO 4
4280 FOR C=B+1 TO 5
4290 IF (HN(B)-HN(A)=1) AND (HN(C)-HN(B)=1) AND ZK=0 THEN LET ZZ=ZZ+3
4300 IF VN(HN(A))+VN(HN(B))+VN(HN(C))=15 THEN LET ZQ=ZQ+2
4310 NEXT
4320 NEXT
4330 NEXT
4340 LET ZK=ZK+ZZ
4350 FOR A=1 TO 4
4360 FOR B=A+1 TO 5
4370 IF VN(HN(A))+VN(HN(B))=15 THEN LET ZQ=ZQ+2
4380 IF HN(A)=HN(B) THEN LET ZP=ZP+2
4390 NEXT
4400 NEXT
4410 LET HT=ZP+ZQ+ZR+ZF+ZJ
4420 END DEF
4430 DEF CRIB
4440 LET HM(3,F)=HM(2,SK)
4450 LET HM(3,F+6)=HM(2,SK+6)
4460 LET HM(2,SK)=HM(2,7-F)
4470 LET HM(2,SK+6)=HM(2,13-F)
4480 END DEF
4490 DEF POISC
4500 FOR J=1 TO 6
4510 LET PCS(J)=NS(HM(1,J))+88*(HM(1,J)+6)
4520 NEXT
4530 FOR QP=3 TO 4
4540 IF QP=3 THEN
4550 LET QS="first"
4560 ELSE
4570 LET QS="second"
4580 END IF
4590 DO
4600 INPUT AT 1,1,PROMPT "What is the 'QS' card you wish to put in th
o crib? ":AS
4610 CLEAR EO
4620 LET AS=UCASE$(AS)
4630 CALL VALID
4640 IF EF=0 THEN EXIT DO
4650 PRINT "You do not hold that card!"
4660 CALL DELAY(50)
4670 CLEAR EO
4680 LOOP
4690 LET HM(3,QP)=HM(1,K)
4700 LET HM(3,QP+6)=HM(1,K+6)
4710 CALL UPDATE
4720 NEXT
4730 END DEF
4740 DEF VALID
4750 LET EF=1
4760 FOR J2=1 TO C3
4770 IF AS=PCS(J2) THEN LET K=J2:LET EF=0
4780 NEXT
4790 END DEF
4800 DEF UPDATE
4810 LET AA=HM(1,K):LET BB=HM(1,K+6)
4820 CALL CERASE(C1+8)
4830 IF K=C1 THEN
4840 FOR C=K TO C1-1
4850 LET HM(1,C)=HM(1,C+1):LET HM(1,C+6)=HM(1,C+7)
4860 CALL CERASE(C+8):CALL CFRAME(C+8)
4870 CALL PRINT(HM(1,C+6),HM(1,C))
4880 LET PCS(C)=PCS(C+1)
4890 NEXT
4900 LET HM(1,C1)=AA:LET HM(1,C1+6)=BB:LET PCS(C1)="
4910 END IF
4920 LET C1=C1-1
4930 END DEF
4940 DEF TURN
4950 CALL TURN
4960 IF TU(1)<>11 THEN EXIT DEF
4970 FOR IJ=1 TO 4
4980 CALL TURN:CALL DELAY(20)
4990 NEXT
5000 LET SP=DL:LET SCO=2
5010 PRINT "Jack turned up.":NS(DL):" score 3 as dealer "
5020 CALL DELAY(50)
5030 CLEAR EO
5040 CALL BOARD:CALL DELAY(50)
5050 END DEF
5060 DEF TURN
5070 CALL CERASE(15)
5080 CALL CFRAME(15)
5090 CALL PRINT(TU(2),TU(1))
5100 END DEF
5110 DEF BOARD
5120 LET SC(SP)=SC(SP)+SCO
5130 IF SP=1 THEN
5140 LET PP=9
5150 ELSE
5160 LET PP=1
5170 END IF
5180 PRINT EO:AT PP,15:DEL3:STR$(SC(SP))

```

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PROGRAM FILE

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5190 IF SC(SPI)>120 THEN
5200 LET WIN=1:LET SCO=61
5210 ELSE
5220 LET SCO=SC(SPI)
5230 IF SCO>60 THEN LET SCO=SCO-60
5240 END IF
5250 IF SP=1 THEN
5260 CALL BOARD2
5270 ELSE
5280 CALL BOARD3
5290 END IF
5300 END DEF
5310 DEF BOARD2
5320 LET F3=B2
5330 IF F3>0 THEN
5340 LET M1$=CHR$(146):LET M2$=CHR$(147)
5350 LET M2$=CHR$(147)
5360 CALL BOARD6:CALL BOARDS
5370 END IF
5380 LET B2=F2:LET F2=SCO:LET F3=BCO:LET M1$=CHR$(147):LET M2$=CHR$(146)
5390 CALL BOARD6:CALL BOARDS
5400 END DEF
5410 DEF BOARD3
5420 LET F3=B1
5430 IF F3>0 THEN
5440 LET M1$=CHR$(146):LET M2$=CHR$(147)
5450 LET M2$=CHR$(147)
5460 CALL BOARD4:CALL BOARDS
5470 END IF
5480 LET B1=F1:LET F1=SCO:LET F3=SCO:LET M1$=CHR$(147):LET M2$=CHR$(146)
5490 CALL BOARD4:CALL BOARDS
5500 END DEF
5510 DEF BOARD4
5520 IF F3<31 THEN
5530 LET PP=INT(122+F3+(F3-1)/5)
5540 ELSE
5550 LET PP=CEIL(228-F3-(F3-31)/5)
5560 END IF
5570 END DEF
5580 DEF BOARDS
5590 FOR K=1 TO 3
5600 PRINT #101,AT PP/40,MOD(PP,40):DEL$;M2$
5610 CALL DELAY(5)
5620 PRINT #101,AT PP/40,MOD(PP,40):DEL$;M1$
5630 CALL DELAY(5)
5640 NEXT
5650 END DEF
5660 DEF BOARD6
5670 IF F3<31 THEN
5680 LET PP=INT(282+F3+(F3-1)/5)
5690 ELSE
5700 LET PP=CEIL(306-F3-(F3-31)/5)
5710 END IF
5720 END DEF
5730 DEF TOT
5740 LET DS=STR$(PT)
5750 IF PT=0 THEN LET DS=" "
5760 PRINT #101,AT 10,2:DEL$;DS
5770 END DEF
5780 DEF PTABLE
5790 LET AS="GO"
5800 IF C1<=0 THEN
5810 DO
5820 INPUT PROMPT "Your turn. Type 'GO' if you can't play ":AS
5830 CLEAR #0
5840 LET AS=UCASE$(AS)
5850 IF AS="GO" THEN
5860 IF PT+VN(HH(1,1))>31 THEN EXIT DO
5870 ELSE
5880 CALL VALID
5890 IF B1=1 THEN
5900 PRINT "You don't hold the card ":AS
5910 CALL DELAY(50)
5920 CLEAR #0
5930 ELSE
5940 IF PT+VN(HH(1,K))>31 THEN
5950 PRINT "Too large."
5960 CALL DELAY(50)
5970 CLEAR #0
5980 ELSE
5990 EXIT DO
6000 END IF
6010 END IF
6020 END IF
6030 LOOP
6040 END IF
6050 IF AS<>"GO" THEN
6060 LET PT=PT+VN(HH(1,K))
6070 CALL UPDATE:CALL CTOTABLE:CALL TOT:CALL TSCPAIRS
6080 ELSE
6090 LET GF=GF+2
6100 END IF
6110 END DEF
6120 DEF CTOTABLE
6130 LET C0=C0+1:LET CT(C0)=AA
6140 CALL CFRAME(C0)
6150 CALL PRINT(B0,AA)
6160 END DEF
6170 DEF CTABLE
6180 IF OP=1 OR GF=3 THEN LET GF=3:EXIT DEF
6190 IF C2<=0 AND GF=0 THEN
6200 PRINT "I'm out of cards."
6210 CALL DELAY(50)
6220 CLEAR #0
6230 IF GF=1 THEN
6240 LET GF=3
6250 ELSE
6260 LET GF=1
6270 END IF
6280 EXIT DEF
6290 END IF
6300 IF C2<=1 THEN
6310 IF PT+VN(HH(2,1))>32 THEN
6320 LET K=1
6330 CALL PLAY
6340 ELSE
6350 IF GF=2 THEN
6360 LET GF=4
6370 ELSE
6380 IF C1>0 THEN

```


PROGRAM FILE

```

6390      CALL CANTPLAY
6400      ELSE
6410      IF GF=1 THEN
6420      LET GF=3
6430      ELSE
6440      LET GF=1
6450      END IF
6460      END IF
6470      EXIT DEF
6480      END IF
6490      END IF
6500      EXIT DEF
6510      END IF
6520      IF C0=0 THEN
6530      LET K=0
6540      FOR J2=4 TO 1 STEP-1
6550      FOR J1=1 TO C2
6560      IF VN(HH(2,J1))=J2 THEN LET K=J1:LET J1=C2:LET J2=1
6570      NEXT
6580      NEXT
6590      IF K=0 THEN
6600      FOR J2=6 TO 10
6610      FOR J1=1 TO C2
6620      IF VN(HH(2,J1))=J2 THEN LET K=J1:LET J1=C2:LET J2=10
6630      NEXT
6640      NEXT
6650      IF K=0 THEN LET K=C2
6660      END IF
6670      ELSE
6680      LET K=0
6690      FOR J1=1 TO C2
6700      LET J2=PT+VN(HH(2,J1))
6710      IF J2=15 OR J2=31 THEN LET K=J1:LET J1=C2
6720      NEXT
6730      IF K=0 THEN
6740      FOR J1=1 TO C2
6750      IF HH(2,J1)=CT(C0) THEN
6760      LET J2=PT+VN(HH(2,J1))
6770      IF J2=32 AND 31-J2<>VN(CT(C0)) THEN LET K=J1:LET J1=C2
6780      END IF
6790      NEXT
6800      IF K=0 THEN
6810      IF C0=2 THEN
6820      LET C0=C0+1
6830      FOR J1=1 TO C2
6840      LET ZR=0:LET CT(C0)=HH(2,J1)
6850      CALL TSCRUNS
6860      IF ZR=0 THEN LET K=J1:LET J1=C2
6870      LET MT=0
6880      IF K=0 THEN
6890      IF PT+VN(HH(2,K))>31 THEN LET K=0
6900      END IF
6910      NEXT
6920      LET C0=C0-1
6930      END IF
6940      IF K=0 THEN
6950      LET J9=10
6960      IF (31-PT)<10 THEN LET J9=31-PT
6970      FOR J1=1 TO C2
6980      FOR J2=J9 TO 1 STEP-1
6990      IF VN(HH(2,J1))=J2 AND ABS(HH(2,J1)-CT(C0))>1 THEN
7000      LET J3=PT+VN(HH(2,J1))
7010      IF J3<5 AND J3>21 AND J3>10 AND J3<32 THEN LET K=J1:LET J1=C2:LET J2=1
7020      END IF
7030      NEXT
7040      NEXT
7050      IF K=0 THEN
7060      FOR J1=1 TO C2
7070      FOR J2=J9 TO 1 STEP-1
7080      IF VN(HH(2,J1))=J2 THEN LET K=J1:LET J1=C2:LET J2=1
7090      NEXT
7100      NEXT
7110      END IF
7120      END IF
7130      END IF
7140      END IF
7150      END IF
7160      IF K=0 THEN
7170      CALL PLAY
7180      ELSE
7190      CALL CANTPLAY
7200      END IF
7210      END DEF
7220      DEF PLAY
7230      PRINT "I play ";N3(HH(2,K)):S3(HH(2,K+6))
7240      LET PT=PT+VN(HH(2,K))
7250      CALL CSTOTABLE:CALL CTOTABLE:CALL TOT:CALL TSCRPAIRS
7260      CALL DELAY(50)
7270      CLEAR *0
7280      END DEF
7290      DEF CANTPLAY
7300      IF GF=2 THEN
7310      LET GF=4
7320      ELSE
7330      IF C1=0 THEN
7340      PRINT "I can't play. Your go."
7350      CALL DELAY(50)
7360      CLEAR 0
7370      END IF
7380      IF GF=1 THEN
7390      LET GF=3
7400      ELSE
7410      LET GF=1
7420      END IF
7430      END IF
7440      END DEF
7450      DEF CSTOTABLE
7460      LET AA=HH(2,K):LET BB=HH(2,K+6)
7470      LET HH(2,K)=HH(2,C2):LET HH(2,K+6)=HH(2,C2+6)
7480      LET HH(2,C2)=AA:LET HH(2,C2+6)=BB
7490      LET C2=C2-1
7500      CALL CERASE(16+C2)
7510      END DEF
7520      DEF JACK
7530      LET ZJ=0
7540      FOR A=1 TO 4
7550      IF HH(A)=J1 AND HS(A)=HS(5) THEN LET ZJ=1
7560      NEXT

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PROGRAM FILE

```

7570 CALL SCORE
7580 END DEF
7590 DEF TSCRPAIRS
7600 LET HT=0:LET ZP=0:LET ZR=0
7610 IF C8=1 THEN EXIT DEF
7620 LET J7=0
7630 FOR J9=C8-1 TO 1 STEP-1
7640 LET J7=J7+2
7650 IF CT(J9)<>CT(C8) THEN
7660 LET J9=1
7670 ELSE
7680 LET ZP=ZP+J7
7690 END IF
7700 NEXT
7710 IF ZP>0 OR C8<3 THEN
7720 LET HT=ZP+ZR
7730 EXIT DEF
7740 END IF
7750 CALL TSCRUNS
7760 END DEF
7770 DEF TSCRUNS
7780 FOR J9=C8 TO 3 STEP-1
7790 FOR J8=1 TO J9
7800 LET ST(J8)=CT(C8-J8+1)
7810 NEXT
7820 IF PT=0 THEN
7830 FOR J8=1 TO J9-1
7840 FOR J7=J8+1 TO J9
7850 IF ST(J7)<ST(J8) THEN LET S1=ST(J7):LET ST(J7)=ST(J8):LET ST(J
81=S1
7860 NEXT
7870 NEXT
7880 END IF
7890 LET ZX=0
7900 FOR J8=1 TO J9-1
7910 IF ABS(ST(J9)-ST(J8))<>J9-J8 THEN LET ZX=1
7920 NEXT
7930 IF ZX=0 THEN LET ZR=J9:LET J9=3
7940 NEXT
7950 LET HT=ZP+ZR
7960 END DEF
7970 DEF REPORT
7980 PRINT WS(PL):" score ":"HT:" for ":"ZH$(ZH)
7990 LET SP=PL:LET SCO=HT
8000 CALL BOARD1
8010 IF PT<>15 THEN LET HT=0
8020 CLEAR L0
8030 END DEF
8040 DEF CLRTABLE
8050 FOR J7=1 TO C8
8060 CALL CERASE(J7)
8070 NEXT
8080 LET C8=0:LET PT=0:LET GF=0
8090 CALL TOT
8100 END DEF
8110 DEF CHKWIN
8120 LET OVER=1:LET CLR=0
8130 IF PT=31 THEN
8140 LET HT=2:LET ZH=2
8150 CALL REPORT
8160 LET CLR=1
8170 END IF
8180 IF PT=15 AND ZH<>1 THEN
8190 LET HT=2:LET ZH=1
8200 CALL REPORT
8210 END IF
8220 IF GF<>0 THEN
8230 IF GF=2 THEN
8240 LET PL=GF-2
8250 ELSE
8260 LET PL=GF
8270 IF PT=31 THEN
8280 IF NOT((PL=2 AND C2=0) OR(PL=1 AND C1=0)) THEN
8290 IF WIN=0 THEN LET OVER=0
8300 EXIT DEF
8310 END IF
8320 END IF
8330 END IF
8340 IF C1+C2<>0 THEN
8350 LET HT=1:LET ZH=0
8360 CALL REPORT
8370 LET CLR=1
8380 LET PL=2+(PL=2)
8390 IF WIN=0 THEN LET OVER=0
8400 EXIT DEF
8410 ELSE
8420 IF C8=0 THEN
8430 LET HT=1:LET ZH=7
8440 CALL REPORT
8450 LET CLR=1
8460 EXIT DEF
8470 END IF
8480 END IF
8490 END IF
8500 IF C1+C2<>0 THEN
8510 LET PL=2+(PL=2)
8520 IF WIN=0 THEN LET OVER=0
8530 ELSE
8540 IF C8=0 THEN
8550 LET HT=1:LET ZH=7
8560 CALL REPORT
8570 LET CLR=1
8580 END IF
8590 END IF
8600 END DEF
8610 END WHEN
8620 DEF SCREEN
8630 SET STATUS OFF
8640 RESTORE #020
8650 SET VIDEO MODE 1
8660 SET VIDEO COLOUR 2
8670 SET VIDEO X 40
8680 SET VIDEO Y 24
8690 OPEN #20:"VIDEO:"
8700 DISPLAY #20:AT 1 FROM 1 TO 24
8710 SET #20:BIAS 255
8720 SET #20:INK 6
8730 LET X=9:LET Y=2

```


PROGRAM FILE

```

8740 PRINT £20,AT V,X:CHR$(146) CHR$(152) CHR$(150)
8750 FOR J=1 TO 2
8760 PRINT £20,AT V+J,X:CHR$(153) CHR$(153)
8770 NEXT
8780 PRINT £20,AT Y+3,X:CHR$(149) CHR$(152) CHR$(151)
8790 FOR L=1 TO 0
8800 SET £20:INK 1
8810 READ MS$
8820 FOR J=1 TO 2
8830 PRINT £20,AT J+Y,X+1:CHR$(154)
8840 NEXT
8850 WAIT 1
8860 FOR J=1 TO 2
8870 PRINT £20,AT J+Y,X+1:DEL$
8880 NEXT
8890 PRINT £20,AT 1+Y,X+1:DS$:MS$
8900 WAIT 1
8910 PRINT £20,AT 1+Y,X+1:DS$:DEL$
8920 FOR J=1 TO 2
8930 PRINT £20,AT J+Y,X+1:CHR$(154)
8940 NEXT
8950 SET £20:INK 1
8960 PRINT £20,AT 10,1+2*L:MS$
8970 NEXT
8980 FOR L=1 TO 20
8990 SET £20:BIAS RND(247)+6
9000 CALL DELAY(5)
9010 NEXT
9020 DATA C,R,I,B,B,A,G,E
9030 END DEF
9040 HANDLER DEFAULT
9050 SET BORDER 0
9060 SET STATUS ON
9070 TEXT
9080 EXIT HANDLER
9090 END HANDLER

```

BBC ROM Header by David McKay

One of the more powerful features of the BBC machines is their ability to support paged ROM software. This is 6502 machine code held in ROM, EPROM or sideways RAM, which has been assembled to run in the area &8000 to &BFFF. The operating system can handle up to 16 of these ROMs, although the motherboard as it stands can only take four. Only one ROM is paged-in at a time. The most common of these is Basic, followed by, probably, the disk filing system (DFS).

These ROMs can either provide a new environment (programming language, word processor, machine code monitor, and so on), an additional set of operating system commands (disk filing system, debugging aids), or both.

Paged software presents the user with the ability to write his own set of routines and store them on disk to be loaded into sideways RAM or to blow as his own EPROMs. This means that the commands added are always available and do not encroach on any of the precious 32k BBC owners get by on. But for the ROM to be recognised and treated as such, it must conform to certain protocols and function under certain criteria laid down by Acorn.

To illustrate this, presented here is a program which will generate the header for any service ROM. This is a ROM which provides, DFS-like, a new set of * commands. By inserting your own ROM name, copyright messages, and so on, the program is easily customised. Also included are

routines to demonstrate how the ROM can cater for *HELP and *'command' requests. These are handled intelligently, the routines accepting either form of request in upper, lower or a combination of cases, with or without an abbreviation.

Two trivial commands are included to show you how they are implemented. These are: *POP, which gives a little bleep; and *HOME, which sends the cursor to the top-left corner of the screen without clearing the display. (These commands are the same as Basic's VDU 7 and VDU 30 respectively; they are for purposes of illustration rather than power, but one advantage is that they can be issued from non-Basic environments.)

All ROM headers are identical in format but differ in content, as you'll see. The format is as follows. The first six bytes take the form of two JMP statements: one to the language entry point of the ROM, which we don't deal with here; and the second to the service entry point.

The next byte specifies the ROM type, depending upon which bits are set; for our purposes, this will contain &82. This is because bit one must be set, which gives &02, and bit seven is set to signify that the ROM has a service entry. This gives &80, and added they give &82. If bit six were set, the ROM would have a language entry too (this byte would contain &C2).

Byte seven holds an offset that points from &8000 to the byte containing zero which precedes the

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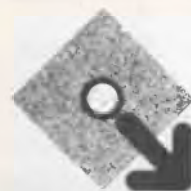
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PROGRAM FILE

copyright message. Byte eight contains a version number, which doesn't do anything apart from inform people which version of the ROM they are examining.

The title of the ROM is held from byte nine onwards, in ASCII, terminated by a zero byte. Right behind this comes (if there is one at all) a version string, a literary equivalent of the version number. This is followed by a zero byte and the copyright string. Due to the various lengths of the preceding strings, the location of this is going to differ from ROM to ROM; hence the need for an offset held in a known address that the operating system can look-up, then use to find the copyright string.

This is important because there must be a copyright string, even if it's the minimum (C). If these characters are omitted, the ROM is not recognised as a valid ROM. The copyright string usually has something like '(C) Dr Dupree 1986'; the message is terminated by a zero byte. If there's going to be a second processor relocate address, it would follow on here, but we won't need one. They are for languages which need to be copied across to a specific address in the second processor.

Unrecognised operating system commands are offered to the paged ROMs in order of priority (&0F down to &00) and if the command is still unclaimed, then the disk is searched for a file of that name. The command is stored at a location pointed to by &F2 and &F3, plus an offset held in the Y register. The ROM is given a service call with &04 in the accumulator. It then scans the command and compares it with the commands it responds to. It either performs the function and exits, telling the other ROMs that the command has been dealt with (by storing &00 in A), or exits and passes the chance of execution to the next ROM down the line.

*HELP causes a similar service call, with &09 in the accumulator. The ROM must print out its name and, by convention, another word (or pair of words for some ROMs) slightly indented from the left margin that the ROM can give further help on. The service call is then passed on down to the next ROM. Some ROMs of course, don't offer any further help, and just print their name.

If it's a specific *HELP request, asking for help from one, and only one, ROM — for example, *HELP DFS, then the ROM can do one of three things. If the request is for

another ROM, it can pass the request on; if it's for itself, it must give the extra help then stop the service call going to other ROMs; or it can print out its name as before and pass on the call. The program as set up does the latter.

The code is assembled at &4000 as if it were being assembled at &8000. The service call causes control to JMP to CHECK, where the accumulator is examined. If it contains &04, the commands are examined; if it contains &09, the help check routine is used. If it's neither, control is passed back to the operating system with the accumulator intact, ready for the next ROM.

The help-checking routine is entered at HLPCH, saves the registers and checks to see if the request was for this ROM, printing either a small help or large help output. The registers are restored and the ROM exited, with either the accumulator intact or zeroed, depending on the action performed by the ROM.

The command check functions similarly, deciding whether the request is to be performed by this ROM, getting the address of the command location if it is, and JMPing to it. The ROM is then exited with the accumulator set to zero. Otherwise, the service call is passed on.

The commands are stored in a table, with the ASCII command followed by the high byte and low byte of the address at which the code that executes the command is located. This is set up automatically by the program. The bottom of the table is marked by &FF, a pseudo-negative byte. New commands are easily added in the format shown, inserting the name and address bytes, referenced by the label that you used for the location at which the command code resides. If this sounds fierce, just look at the program; it really is easy.

The program is liberally commented and spaced out, but you can leave out the comments when you type it in. Put in the title you want, and alter the HELP tables to give the details you need.

When RUN, the program generates the necessary 6502 code header and then *SAVES it under a filename you've been previously prompted for. You are told the length of the code, and reminded that *LOAD filename 8000 will insert it into the sideways RAM. The code, if it performs correctly without debugging, is ready to be blown into an EPROM.

```
10 REM ROM HEADER CODE
20 MODE 7
30 PRINT:INPUT "Filename for ROM CODE "FL$
40 FOR PASS=4 TO 6 STEP 2
```


PROGRAM FILE

```

50      OI=&4000:PI=&8000
60      IOPT PASS
70      .LANG      EQUH &0000
80      EQUH &00      ;NO LANGUAGE ENTRY
90      .SERV      JMP CHECK      ;SERVICE ENTRY
100     .TYPE      EQUH &02      ;COMMANDS ONLY
110     .OFST      EQUH HERE-LANG
120     .VERNO      EQUH &01
130     .TITLE      EQUH "DEMOROM"
140     EQUH &00
150     .VERSTR      EQUH "DEMO ROM VERSION 1.0"
160     .HERE      EQUH &00
170     .COPYRT      EQUH "(C) copyright message"
180     EQUH " MUST have the bracketed"
190     EQUH " capital C at least."
200     EQUH &00
210     .CHECK      CMP &04      ;IS IT A COMMAND
220     BNE HPCCH      ;NO, IS IT A HELP
230     JMP COMCH      ;YES, CHECK COMMAND LIST
240     .HPCCH      CMP &09      ;IS IT A HELP REQUEST
250     BNE OUT      ;NO, SO LEAVE ROM
260     JMP HLPCH      ;YES, CHECK IF FOR THIS ROM
270     .OUT      RTS      ;ROM EXIT
280     .HLPCH      PHF
290     PHA
300     TXA      ;SAVE REGISTERS
310     PHA
320     TYA
330     PHA
340     LDX &00
350     .BLOOP      LDA (&F2),Y
360     CMP TITLE,X      ;CHECK REQUEST AGAINST
370     BEQ NKLET      ;TITLE, CATER FOR LOWER
380     SEC      ;CASE LETTERS
390     SBC &20
400     CMP TITLE,X
410     BNE SMALL      ;NOT THIS ROM, PRINT
420     .NKLET      INX      ;NAME ONLY
430     INY
440     LDA (&F2),Y
450     CMP &2E      ;CATER FOR ABBREVIATIONS
460     BEQ LARGE
470     CPX &05
480     BCC BLOOP
490     .LARGE      LDX &00
500     .LLOOP      LDA BTEXT,X      ;PRINT FULL HELP
510     CMP &00
520     BEQ BOUT
530     JSR &FFE3
540     INX
550     JMP LLOOP
560     .SMALL      LDX &00
570     .SLOOP      LDA LTEXT,X      ;PRINT SMALL HELP
580     CMP &00
590     BEQ LOUT
600     JSR &FFE3
610     INX
620     JMP SLOOP
630     .HOUT      PLA
640     TAY
650     PLA      ;RESTORE REGISTERS
660     TAX      ;FORBID OTHER ROMS
670     PLA      ;FROM RESPONDING
680     PLP
690     LDA &00      ;BY SETTING A TO ZERO
700     RTS
710     .LOUT      PLA
720     TAY
730     PLA      ;RESTORE REGISTERS
740     TAX      ;OFFER HELP REQUEST
750     PLA      ;TO THE OTHER ROMS
760     PLP      ;BY NOT ALTERING A
770     RTS
780     .BTEXT      EQUH &01
790     EQUH "DEMOROM - new * commands"
800     EQUH &0D
810     EQUH " HOME"
820     EQUH &0D
830     EQUH " POP"
840     EQUH &0D
850     EQUH &0D
860     .LTEXT      EQUH &0D
870     EQUH "DEMOROM 1.0"
880     EQUH &0D
890     EQUH " DEMOROM"
900     EQUH &0D
910     EQUH &0D
920     .LOCHK      LDA COMLIST,X      ;ROUTINE TO CATER FOR
930     CLC      ;LOWER CASE LETTERS
940     ADC &20
950     CMP (&F2),Y
960     BEQ CLOOP
970     JMP BACKUP
980     .COMCH      PHA      ;COMMAND CHECK
990     TXA
1000    PHA
1010    TYA
1020    PHA
1030    STY &0A02      ;SAVE Y OFFSET
1040    LDX &FF
1050    .GRABY      LDY &0A02
1060    DEY
1070    .CLOOP      INY
1080    INX

```

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PROGRAM FILE

```

95 p=FNR(8):a=p
100 IF p=4 THEN (p$="woman's":q$="men's"):GOTO 110
105 (p$="man's":q$="woman's")
110 p=FNR(7):a=p
115 p=FNR(4):IF a<5 THEN a=p+4 ELSE a=p
120 FOR x=1 TO 3
125 p=FNR(8):IF d1(p)=1 THEN 125
130 d1(p)=1
135 NEXT
140 p=FNR(14):IF p=6 OR p=11 OR p=1 THEN 140
145 b1=p
150 x=1:FOR y=1 TO 14:check(x)=0:NEXT
155 WHILE x<4:p=FNR(14):IF p=6 OR p=11 THEN 155
160 IF check(p)<>0 THEN 155
165 v1(x)=p:check(p)=1: x=x+1
170 WEND
175 x=1: WHILE x<8
180 p=FNR(14):IF p=6 OR p=11 OR p=1 THEN 180
185 IF x=a% THEN 195
190 v1(x)=p
195 x=x+1
200 WEND
205 x=1: WHILE x<9
210 p=FNR(14):IF p=6 OR p=11 OR p=1 THEN 225
215 v1(x)=p
220 x=x+1
225 WEND
230 x=1: WHILE x<7
235 p=FNR(12):IF k1(p)=6 THEN 245
240 k1(p)=6: x=x+1
245 WEND
250 FOR x=1 TO 12
255 IF k1(x)=0 THEN k1(x)=11
260 NEXT
265 p=FNR(14):IF p=6 OR p=11 OR p=1 THEN 265
270 k1(13)=p
275 FOR x=1 TO np: p1(x)=1: NEXT
280 FOR x=1 TO np: p2(x)=0: p1(x)=0: NEXT
285 a1=FNR(3)
290 IF a1=1 THEN a0$="SHOT"
295 IF a1=2 THEN a0$="CLUBBED TO DEATH"
300 IF a1=3 THEN a0$="STABBED"
305 x=1: (p1(a1)=1: p2(a1)=1)
310 WHILE x<3
315 p=FNR(3):IF (p1(p)=1 THEN 315
320 IF x=1 THEN p1(p)=p1
325 IF x=2 THEN p1(p)=q1
330 (p1(p)=1)
335 x=x+1: WEND
340 FOR x=1 TO 14: FOR y=1 TO 4: READ dr$(x,y): NEXT: NEXT
345 FOR x=1 TO 14: FOR y=1 TO 4: READ nr$(x,y): NEXT: NEXT
350 FOR x=1 TO 3: READ w1(x): NEXT
355 FOR x=1 TO 7: READ v1(x): NEXT
360 FOR x=1 TO 6: READ s1(x): NEXT
365 FOR x=1 TO 14: READ r1(x): NEXT
370 FOR x=1 TO 14: r1(x)=a: NEXT
375 FOR x=1 TO 14: check(x)=0: NEXT
380 a1a1=b1: sw(a1)=b1: IF a1<5 THEN qq=0 ELSE qq=4
385 x=1: WHILE x<4
390 y=FNR(4): qq: IF sw(y)<>0 THEN 390
395 z=FNR(14): IF z=11 OR z=6 OR z=b1 THEN 395
400 IF check(z)=1 THEN 395
405 check(z)=1: sw(y)=z: x=x+1
410 WEND
415 IF a1<5 THEN pp=4 ELSE pp=0
420 FOR x=1 TO 14: check(x)=0: NEXT
425 x=1: WHILE x<4
430 y=FNR(4): pp: IF sw(y)<>0 THEN 430
435 p=FNR(4): qq: IF sw(p)=b1 THEN 435
440 IF check(sw(p))=1 THEN 435
445 check(sw(p))=1: sw(y)=sw(p): sk(p)=y: sk(y)=p: x=x+1
450 WEND
455 sk(a1)=a1: sk(a1)=x
460 x=1
465 FOR y=1 TO 8: sk1(y)=0: NEXT: WHILE x<3
470 p=FNR(4): q=FNR(4): IF p=q THEN 470
475 IF sk1(p)<>0 OR sk1(q)<>0 THEN 470
480 sk1(p)=q: sk1(q)=p
485 x=x+1: WEND
490 x=1: WHILE x<3
495 p=FNR(4): q=FNR(4): IF p=q THEN 495
500 IF sk1(p)<>0 OR sk1(q)<>0 THEN 495
505 sk1(p)=q: sk1(q)=p
510 x=x+1
515 WEND
520 IF sw(nr1(a1))=sw(sk1(a1)) THEN 460
525 PEN 0: LOCATE 38,23: PRINT "W": CHR$(159): "E": LOCATE 38,2
5: PRINT "S"
530 FOR x=1 TO 3
535 LOCATE 43,1: x: PRINT 43: x: v1(x)
540 NEXT
545 FOR x=1 TO 7
550 LOCATE 44,1: x: PRINT 44: x: v1(x)
555 NEXT
560 FOR x=1 TO 8
565 LOCATE 45,1: x: PRINT 45: x: a1(x)
570 NEXT
575 GOTO 650
580 GOSUB 1765: CLS: INPUT 2, "How many players, please (1 to 6)": np1
585 IF np1<0 OR np1>6 THEN 590
590 PRINT 2, "The computer will decide who goes first"
595 GOSUB 1765: INPUT 2, "How many questions to be allowed on any one turn (max 5)": nqr
600 IF nqr<0 OR nqr>5 THEN 595
605 FOR x=1 TO np1
610 GOSUB 1765: CLS: PRINT 2, "Player number": x: INPUT 2, "Please type your name (a
as 8 letters)": (a1(x))
615 pnt(x)=UPPER$(IN$(x))
620 IF LEN(pnt(x))>8 THEN 610
625 GOSUB 1765: CLS: PRINT 2, pnt(x): INPUT 2, "Without letting the other players
see type a 2 letter code for identification, please.": code1(x)
630 CLS:
635 NEXT
640 RETURN
645 REM: main game loop
650 t=0: pn=FNR(np1)
655 WHILE t=0
660 pn=pn+1: IF pn>np1 THEN pn=1
665 IF pr(pn)=1 THEN 825
670 GOSUB 1765: CLS: PRINT 2, pnt(pn): INPUT 2, "Please type in your code letters"

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PROGRAM FILE

```

:cl3:IF cl3<>code$(pn) THEN 670
675 PRINT2,"Looking for the floor plan"
680 IF p1$(pn)=0 THEN GOSUB 1790 ELSE GOSUB 1805
685 yy=p1$(pn)
690 CLS6:FOR x=1 TO 3:LOCATE6.1,x:PRINT6,place$(pn,x):NEXT
695 FOR x=1 TO 7:LOCATE6.1,x+4:PRINT6,place$(pn,x+3):NEXT
700 FOR x=1 TO 8:LOCATE6.1,x+12:PRINT6,place$(pn,x+10):NEXT
705 pv$(pn)=pv$(pn)+LEFT$(r$(yy),1)
710 CLS7:PRINT7,pv$(pn)
715 IF b1$(pn)=1 THEN LOCATE7.6,3:PRINT7,"BODY IS IN ":LEFT$(r$(b1),1)
720 CLS2:PRINT2,"You are standing in the ":r$(yy):GOSUB 1750:GOSUB 970
725 GOSUB 1750
730 CLS2:fq=0:qa=0:qx=0
735 PRINT2,"1)QUESTION SUSPECT 2)SEARCH 3)ACCUSE"
740 PRINT2,"4)NOTHING 5)PICK UP 6)FILCH"
745 GOSUB 1765:INPUT2,"Which option do You want(1-6)";op2
750 IF op2<1 OR op2>6 THEN PRINT2,"Try again":GOTO 730
755 ON op2 GOSUB 1200,1320,1470,1705,1340,1410
760 IF fq=1 THEN 730
765 IF pr(pn)=1 THEN 825
770 IF f=1 THEN 825
775 CLS2:PRINT2,"Looking for the floor plan":IF p1$(pn)=0 THEN GOSUB 1780:ELSE
GOSUB 1805
780 CLS2:fd=0:PRINT2,"You are standing in the ":r$(yy)
785 PRINT2,"You can move ":
790 FOR x=1 TO 4
795 IF dr$(yy,x)<>"Q" THEN PRINT 2,dr$(yy,x);": "
800 NEXT
805 GOSUB 1765:LOCATE2.1,3: INPUT2,"Move to another room (y/n)";ans$
810 IF ans$<>"y" AND ans$<>"n" THEN 805
815 IF ans$="y" THEN GOSUB 895:IF fd=1 THEN 780 ELSE yy=p1$(pn):CLS2:PRINT2,"Y
ou are moving to the ":r$(yy):GOSUB 1750
820 CLS1:CLS2:CLS6:CLS7:qx=0:qa=0:GOSUB 2295
825 HEND
830 CLS:LOCATE 12,3:PRINT pn$(pn);": YOU HAVE WON 1"
835 GOSUB 2305
840 PRINT :PRINT
845 PRINT "TO HELP THE OTHER CRIME BUSTERS THIS IS"
850 PRINT"THE SOLUTION"
855 PRINT:PRINT"The murderer was the ":x$(m1)
860 PRINT"The accomplice was the ":x$(a1)
865 PRINT"The murder weapon was the ":v$(w1)
870 PRINT"The stolen article was the ":v$(a1)
875 PRINT"The body was in the ":r$(b1)
880 PRINT"The "w$(m1):" was in the ":r$(w1)
885 PRINT:PRINT"Hope you enjoyed playing CRIME BUSTERS !"
890 GOTO 890
895 CLS2
900 GOSUB 1765:INPUT2,"Type initial letter of the direction you wish to move";di
r$
905 IF dir$="n"AND dr$(p1$(pn),1)="N" THEN xx=1:GOTO 950
910 IF dir$="s"AND dr$(p1$(pn),2)="S" THEN xx=2:GOTO 950
915 IF dir$="e"AND dr$(p1$(pn),3)="E" THEN xx=3:GOTO 950
920 IF dir$="w"AND dr$(p1$(pn),4)="W" THEN xx=4:GOTO 950
925 IF dir$="u"AND dr$(p1$(pn),1)="UP" THEN xx=1:pr$(pn)=1:GOTO 950
930 IF dir$="d"AND dr$(p1$(pn),1)="DOWN" THEN xx=1:pr$(pn)=0:GOTO 950
935 CLS2:PRINT2,"You can't move that way":FOR x=1 TO 1500:NEXT
940 PRINT 2,"You are standing in the ":r$(yy)
945 GOTO 900
950 IF nr$(yy,xx)=100 THEN GOSUB 1105:GOTO 960
955 b=nr$(yy,xx)
960 p1$(pn)=b
965 RETURN
970 CLS1:CLS2
975 f1=0
980 IF p1$(pn)=0 THEN PRINT2,"You are carrying nothing":GOTO 995
985 IF p1$(pn)=13 THEN PRINT2,"You are carrying the skeleton key":GOTO 995
990 PRINT2,"You are carrying the ":r$(p1$(pn));": key"
995 PRINT1,"You can see"
1000 f1=0
1005 FOR x=1 TO 7:IF v1$(x)=0 THEN 1015
1010 IF v1$(x)=r1$(yy) THEN PRINT1,CHR$(32);v$(x):f1=1:place$(pn,x+3)=LEFT$(r$(yy
),1)
1015 NEXT
1020 PRINT1
1025 FOR x=1 TO 12
1030 IF k1(x)=r1$(yy) THEN PRINT1,x;r$(x);": key":f1=1
1035 NEXT
1040 IF k1(13)=r1$(yy) THEN PRINT1,"13 SKELETON key":f1=1
1045 PRINT1
1050 fb=0:FOR x=1 TO 8
1055 IF s1(x)=r1$(yy) THEN PRINT1,CHR$(32);s$(x):f1=1:place$(pn,x+10)=LEFT$(r$(y
y),1)
1060 NEXT
1065 FOR x=1 TO np1
1070 IF x=pn THEN 1080
1075 IF p1$(x)=r1$(yy) THEN PRINT1,x;pn$(x):f1=1
1080 NEXT
1085 PRINT 1
1090 IF b1=p1$(yy) THEN PRINT1,CHR$(32);":The cook's body.":PRINT1,"She has been
":b1:f1=1:b1$(pn)=1
1095 IF f1=0 THEN PRINT1,"NOTHING OF INTEREST"
1100 RETURN
1105 b=nr$(yy,xx)-100:a=yy
1110 IF a*b=3 THEN d=1
1115 IF a*b=12 THEN d=2
1120 IF a*b=28 THEN d=3
1125 IF a*b=42 THEN d=4
1130 IF a*b=10 THEN d=5
1135 IF a*b=110 THEN d=6
1140 IF a*b=96 THEN d=7
1145 IF a*b=72 THEN d=8
1150 IF d1(d)=0 THEN 1190
1155 IF d1(d)=1 THEN CLS2:IF p1$(pn)=a AND p1$(pn)=b AND p1$(pn)<13 THEN PRI
NT2,"The door is locked and you haven't a key":fd=1:GOSUB 1750:RETURN
1160 IF p1$(pn)=13 THEN PRINT 2,"The door is locked but the skeleton key will o
pen it":d1(d)=0:GOSUB 1750:GOTO 1195
1165 PRINT2,"the door is locked but you have the ":r$(p1$(pn));": key"
1170 GOSUB 1765:INPUT2,"do you want to lock the door behind you (y/n)";ld$
1175 IF ld$<>"y" AND ld$<>"n" THEN 1170
1180 IF ld$="y" THEN d1(d)=1:GOTO 1195
1185 d1(d)=0:GOTO 1195
1190 IF p1$(pn)=a OR p1$(pn)=b THEN PRINT2,"You have the ":r$(p1$(pn));": key":G
OTO 1170
1195 RETURN
1200 FOR x=1 TO 8:IF s1(x)=p1$(pn) THEN vv=1
1205 NEXT
1210 IF vv=0 THEN PRINT2,"There are no suspects in this room":fq=1:GOSUB 1750:R
ETURN
1215 WHILE qa<nr$:GOSUB 1765:CLS2: INPUT2,"Which suspect do you wish to questi

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PROGRAM FILE

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on (1-8).Type 9 If no further questions:gs:IF qs<1 OR qs>9 THEN 1215
1220 IF qs=9 THEN qs=mr:GOTO 1315
1225 IF s1(qs)<plz(pn) THEN PRINT2,"The ";s1(qs); " is not in this room":GOSUB
1750:GOTO 1215
1230 CLS2:PRINT2,"a) WHERE IS THE... (1-8)"
1235 PRINT2,"b) AT THE TIME OF THE MURDER WHERE WAS"
1240 PRINT2,"THE... (1-8)"
1245 GOSUB 1765:PRINT2,"Which question do you want to put to the ";s1(qs); " (a
or b)":INPUT2,wq$
1250 IF wq$<"a"AND wq$<"b" THEN 1230
1255 GOSUB 1765:IF wq$="a" THEN CLS2: INPUT2,"Whose whereabouts do you wish to
know (1-8)":wh: PRINT2,"The ";s1(wh); " is in the ";r1(s1(wh)):GOTO 1305
1260 CLS2:GOSUB 1765:INPUT2,"Whose whereabouts at the time of the murder do yo
u wish to know (1-8)":wt
1265 IF wt=qs THEN PRINT2,"I'm not telling you !":GOTO 1305
1270 CLS2:IF s1(qs)<wt AND s1(qs)<wt THEN PRINT2,"The ";s1(qs); " doesn't kn
ow"
1275 IF s1(qs)<wt AND qs=1 THEN PRINT2,"The ";s1(wt); " was in the ";r1(s1(wt))
(qs)):GOTO 1305
1280 IF s1(qs)<wt AND qs=2 THEN PRINT2,"The ";s1(wt); " was in the ";r1(b1):GO
TO 1305
1285 IF s1(qs)<wt AND qs=3 THEN PRINT2,"The ";s1(wt); " was in the ";r1(s1(wt))
(qs)):GOTO 1305
1290 IF s1(qs)<wt AND qs=4 THEN PRINT2,"The ";s1(wt); " was in the ";r1(b1):GO
TO 1305
1295 IF s1(qs)<wt THEN PRINT2,"The ";s1(wt); " was in the "; r1(s1(wt))
1300 IF s1(qs)<wt THEN PRINT2,"The ";s1(wt); " was in the ";r1(s1(wt))
1305 q=qs+1 :GOSUB 1750
1310 WEND
1315 RETURN
1320 CLS2:kk=0:FOR x=1 TO 3:IF w1(x)<plz(pn) THEN PRINT2,"You find the ";w1(x)
:kk=1:PRINT2,"On it are a ";p1(x); " fingerprints":plac(s1(pn),x)=LET(r1(s1(v1),1)
+CHR$(32)+LEFT$(p1(x),1)
1325 NEXT
1330 IF kk=0 THEN PRINT2,"You find nothing"
1335 GOSUB 1750:RETURN
1340 CLS2:kk=0:FOR x=1 TO 13:IF k1(x)=r1(yy) THEN kk=1
1345 NEXT
1350 IF kk=0 THEN PRINT2,"There are no keys to pick up":GOSUB 1750:RETURN
1355 GOSUB 1765:INPUT2,"Which key do you want to pick up(1-13)":kp
1360 IF k1(kp)<r1(yy) THEN PRINT2,"The ";r1(kp); " key is not in this room":GOS
UB 1750:RETURN
1365 IF kp=13 THEN PRINT2,"You have picked up the SKELETON key":GOTO 1375
1370 PRINT2,"You have picked up the ";r1(kp); " key"
1375 dk=pc1(ph):IF dk=0 THEN 1395
1380 IF dk=13 THEN PRINT2,"You have dropped the ";r1(dk); " key":GOTO 1390
1385 IF dk=13 THEN PRINT2,"You have dropped the SKELETON key"
1390 k1(dk)=yy
1395 pc1(pn)=kp
1400 k1(kp)=pc1
1405 GOSUB 1750:RETURN
1410 fp=0:CLS2:FOR x=1 TO np1:IF p1(x)=yy AND x<pn THEN fp=1
1415 NEXT
1420 IF fp=0 THEN PRINT2,"There are no players here":GOSUB 1750:RETURN
1425 GOSUB 1765:INPUT2,"From which player do you want to filch?Type number sho
w before their name":pf
1430 IF p1(pf)<r1(yy) THEN PRINT2,"pf"; " is not here":GOSUB 1750:RETURN
1435 IF pc1(pf)=0 THEN PRINT2,"pf"; " is not carrying anything":GOSUB 1750:RE
TURN
1440 IF pc1(pf)<13 THEN PRINT2,"You have filched the ";r1(pc1(pf)); " key":GOTO
1450
1445 IF pc1(pf)=13 THEN PRINT2,"You have filched the SKELETON key":GOTO 1450
1450 IF pc1(pn)=0 THEN 1465
1455 IF pc1(pn)<13 THEN PRINT2,"You have dropped the ";r1(pc1(pn)); " key":k1(p
c1(pn))=yy
1460 IF pc1(pn)=13 THEN PRINT2,"You have dropped the SKELETON KEY":k1(13)=yy
1465 pc1(pn)=pc1(pf):pc1(pf)=0:GOSUB 1750:RETURN
1470 CLS2:PRINT2,"YOU MUST GIVE THE FOLLOWING INFORMATION"
1475 PRINT2,"CORRECTLY: MURDERER,ACCOMPLICE,WEAPON,"
1480 PRINT2,"STOLEN OBJECT,LOCATIONS OF BUDY & WEAPON";
1485 GOSUB 1765:INPUT2,"Are you prepared (y/n)":yp$
1490 IF yp$<"y" AND yp$<"n" THEN 1485
1495 IF yp$="n" THEN fp=1:RETURN
1500 wa=0
1505 GOSUB 1765:CLS2:INPUT2,"Type in the number of the MURDERER (1-8)":ag
1510 IF ag<1 OR ag>8 THEN 1505
1515 GOSUB 1765: PRINT2,"You say the murderer is the ";s1(ag):INPUT2,"(y/n)":a
n$
1520 IF an$<"y"AND an$<"n" THEN 1515
1525 IF an$="n" THEN 1505
1530 IF s1(ag)<plz(pn) THEN PRINT 2,"You must be in the same room as the suspe
ct you accuse":fp=1:GOSUB 1750:RETURN
1535 IF ag<=1 THEN wa=1
1540 GOSUB 1765: CLS2:INPUT2,"Type in the number of the ACCOMPLICE (1-8)":ag
1545 IF ag<1 OR ag>8 THEN 1540
1550 GOSUB 1765: PRINT2,"You say the accomplice is the ";s1(ag):INPUT2,"(y/n)"
:an$
1555 IF an$<"y"AND an$<"n" THEN 1550
1560 IF an$="n" THEN 1540
1565 IF ag>=1 THEN wa=1
1570 GOSUB 1765:CLS2:INPUT2,"Type in the number of the WEAPON (1-13)":wg
1575 IF wg<1 OR wg>13 THEN 1570
1580 GOSUB 1765: PRINT2,"You say the weapon is the ";s1(wg):INPUT2,"(y/n)":an
s$
1585 IF an$<"y"AND an$<"n" THEN 1580
1590 IF an$="n" THEN 1570
1595 IF wg>=1 THEN wa=1
1600 GOSUB 1765:CLS2:INPUT2,"Type in the number of the STOLEN OBJECT (1-7)":og
1605 IF og<1 OR og>7 THEN 1600
1610 GOSUB 1765:PRINT2,"You say the object is the ";v1(og):INPUT2,"(y/n)":an$
1615 IF an$<"y"AND an$<"n" THEN 1610
1620 IF an$="n" THEN 1600
1625 IF og>=1 THEN wa=1
1630 CLS1:FOR k= 1 TO 14:PRINT1,x; " ";r1(x):NEXT
1635 GOSUB 1765:CLS2:INPUT2,"In which room was the body (1-14)":gb
1640 IF gb<1 OR gb>14 THEN 1635
1645 GOSUB 1765:PRINT2,"You say the body was in the ";r1(gb):INPUT2,"(y/n)":an
s$
1650 IF an$<"y"AND an$<"n" THEN 1645
1655 IF an$="n" THEN 1635
1660 IF gb>=1 THEN wa=1
1665 GOSUB 1765:CLS2:INPUT2,"In which room was the weapon (1-14)":gw
1670 IF gw<1 OR gw>14 THEN 1665
1675 GOSUB 1765:PRINT2,"You say the weapon was in the ";r1(gw):INPUT2,"(y/n)":
an$
1680 IF an$<"y"AND an$<"n" THEN 1675
1685 IF an$="n" THEN 1665
1690 IF gw>=1 THEN wa=1
1695 IF wa=0 THEN 1700
1700 IF wa=1 THEN GOSUB 1710

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1705 RETURN
1710 CLSCL:PRINTEL pns(pn); " YOU HAVE AILED"
1715 PRINTEL:PRINTEL,"YOU ARE NO LONGER A"
1720 PRINT EL,"CRIME BUSTER I"
1725 PRINTEL:PRINTEL,"IN FACT YOU'RE OUT OF THE GAME !"
1730 GOSUB 2300
1735 pr(pn)=1:p1z(pn)=0
1740 GOSUB 1750
1745 RETURN
1750 PRINTEL2,"PRESS SPACE BAR TO CONTINUE"
1755 IF INKEY(<7>)<>0 THEN 1755
1760 RETURN
1765 cbs=INKEYS:IF cbs<" " THEN 1765
1770 RETURN
1775 REM:ground floor plan
1780 CLSCl:LOCATECl,1,1:INK 3,20
1785 PRINTEL CHR$(150)+STRINGS(8,154)+CHR$(150)+STRINGS(12,164)+CHR$(156);
1790 PRINTEL CHR$(149);"UTILITY ";CHR$(149);"CONSERVATORY";CHR$(149);
1795 PRINTEL CHR$(149);" ROOM ";CHR$(240)+SPACES(12)+CHR$(149);
1800 PRINTEL CHR$(149)+SPACES(8)+CHR$(151)+CHR$(154)+CHR$(158)+CHR$(154)+CHR$(149);
1805 PRINTEL CHR$(151)+STRINGS(7,154)+CHR$(32)+CHR$(159)+CHR$(154)+CHR$(157)+SPA
Ces(2)+CHR$(149)+SPACES(7)+CHR$(149);
1810 PRINTEL CHR$(149)+SPACES(8)+CHR$(151)+CHR$(154)+CHR$(157)+SPACES(2)+CHR$(14
9)+SPACES(7)+CHR$(149);
1815 PRINTEL CHR$(149)+SPACES(8)+CHR$(151)+CHR$(154)+CHR$(157)+SPACES(2)+CHR$(14
9);"SITTING";CHR$(149);
1820 PRINTEL CHR$(149)+SPACES(8)+CHR$(151)+CHR$(154)+CHR$(157)+SPACES(2)+CHR$(14
9);" ROOM ";CHR$(149);
1825 PRINTEL CHR$(149);"KITCHEN ";CHR$(151)+CHR$(154)+CHR$(153)+SPACES(2)+CHR$(1
49)+SPACES(7)+CHR$(149);
1830 PRINTEL CHR$(149)+SPACES(21)+CHR$(149);
1835 PRINTEL CHR$(151)+STRINGS(3,154)+CHR$(241)+STRINGS(3,154)+CHR$(158)+CHR$(1
53)+SPACES(4)+CHR$(149)+SPACES(7)+CHR$(149);
1840 PRINTEL CHR$(149)+SPACES(7)+CHR$(149);" HALL";CHR$(151)+STRINGS(3,154)+CHR$(
241)+STRINGS(3,154)+CHR$(157);
1845 PRINTEL CHR$(149);"REFLECT-";CHR$(149)+SPACES(5)+CHR$(149)+SPACES(7)+CHR$(14
9);
1850 PRINTEL CHR$(149);"ORY ";CHR$(151)+STRINGS(2,154)+CHR$(32)+STRINGS(2,154)
+CHR$(157);"MORNING";CHR$(149);
1855 PRINTEL CHR$(149)+SPACES(7)+CHR$(149);"FOYER";CHR$(149);" ROOM ";CHR$(149)
;
1860 PRINTEL CHR$(149)+SPACES(13)+CHR$(240)+SPACES(7)+CHR$(149);
1865 PRINTEL CHR$(147)+STRINGS(7,154)+CHR$(155)+STRINGS(5,154)+CHR$(155)+STRINGS
(7,154)+CHR$(153);
1870 INK 3,6
1875 RETURN
1880 REM :1st floor plan
1885 CLSCL:LOCATECl,1,1:INK 3,20
1890 PRINTEL CHR$(150)+STRINGS(8,154)+CHR$(150)+STRINGS(4,154)+CHR$(158)+STRINGS
(7,154)+CHR$(156);
1895 PRINTEL CHR$(149)+SPACES(9);" P ";SPACES(8)+CHR$(149);
1900 PRINTEL CHR$(149)+SPACES(8)+CHR$(149);" A ";CHR$(149);" QUEST ";CHR$(149);
1905 PRINTEL CHR$(149);" BEDROOM";CHR$(151)+CHR$(154)+CHR$(156);"S ";CHR$(149);S
PACES(7)+CHR$(149);
1910 PRINTEL CHR$(149)+SPACES(8)+CHR$(151)+CHR$(154)+CHR$(157);"S ";CHR$(149);"
ROOM ";CHR$(156);
1915 PRINTEL CHR$(149)+SPACES(8)+CHR$(151)+CHR$(154)+CHR$(157);"A ";CHR$(149)+SP
ACES(7)+CHR$(149);
1920 PRINTEL CHR$(149)+SPACES(8)+CHR$(151)+CHR$(154)+CHR$(157);"G ";CHR$(149)+SP
ACES(7)+CHR$(149);
1925 PRINTEL CHR$(149)+SPACES(10)+CHR$(151)+CHR$(154)+CHR$(153);"B ";CHR$(151)+ST
RINGS(3,154)+CHR$(241)+STRINGS(3,154)+CHR$(157);
1930 PRINTEL CHR$(149)+SPACES(8)+CHR$(149)+SPACES(4)+CHR$(149);"LINEN ";CHR$(14
9);
1935 PRINTEL CHR$(149)+SPACES(8)+CHR$(149)+CHR$(32)+CHR$(150)+CHR$(154)+CHR$(32)
+CHR$(157);"ROOM";SPACES(3)+CHR$(149);
1940 PRINTEL CHR$(151)+STRINGS(3,154)+CHR$(241)+STRINGS(4,154)+CHR$(155)+CHR$(15
4)+CHR$(157)+SPACES(10)+CHR$(149);
1945 PRINTEL CHR$(149)+SPACES(10)+CHR$(149)+SPACES(2)+CHR$(147)+STRINGS(7,154)+CH
R$(157);
1950 PRINTEL CHR$(149);" DRESSING ";CHR$(149)+SPACES(10)+CHR$(149);
1955 PRINTEL CHR$(149)+SPACES(3);"ROOM";SPACES(3)+CHR$(240);" NURSERY ";CHR$(14
9);
1960 PRINTEL CHR$(149)+SPACES(10)+CHR$(149)+SPACES(10)+CHR$(149);
1965 PRINTEL CHR$(149)+SPACES(10)+CHR$(149)+SPACES(10)+CHR$(149);
1970 PRINTEL CHR$(147)+STRINGS(10,154)+CHR$(155)+STRINGS(10,154)+CHR$(153);
1975 INK 3,6
1980 RETURN
1985 REM: title screen
1990 BORDER 0:PAPER 0:INK 0,0:PEN 1:INK 1,26:PEN 2:INK 2,6:PEN 3:INK 3,0,26:CLS
1995 id$=CHR$(21)+CHR$(10)+CHR$(8)+CHR$(6);
2000 up$=STRINGS(3,11)
2005 hd$=CHR$(10)+CHR$(8)
2010 lc$=CHR$(204)+CHR$(205)+id$+CHR$(211)+hd$+CHR$(211)+hd$+CHR$(205)+CHR$(204)
+up$
2015 l1$=CHR$(242)+CHR$(205)+CHR$(10)+STRINGS(2,8)+CHR$(243)+CHR$(204)+CHR$(10)+
STRINGS(2,8)+CHR$(211)+CHR$(205)+CHR$(10)+STRINGS(2,8)+CHR$(211)+CHR$(209)+up$
2020 h1$=CHR$(211)+hd$+l1$+h1$+h1$+h1$+CHR$(211)+up$
2025 hm$=CHR$(211)+CHR$(209)+id$+l1$=CHR$(244)+CHR$(245)+id$+hm$+hm$+CHR$(211)+C
HR$(209)+up$
2030 la$=CHR$(242)+CHR$(208)+id$+CHR$(243)+CHR$(210)+id$+CHR$(211)+hd$+CHR$(243)
+CHR$(210)+up$
2035 lb$=CHR$(242)+CHR$(205)+id$+CHR$(243)+CHR$(204)+id$+CHR$(211)+CHR$(205)+id$
+CHR$(243)+CHR$(204)+up$
2040 lu$=hm$+hm$+hm$+CHR$(205)+CHR$(204)+up$
2045 ls$=CHR$(204)+CHR$(205)+id$+CHR$(10)+CHR$(10)+CHR$(205)+id$+CHR$(205)+CHR$(
204)+up$
2050 lcs=CHR$(200)+CHR$(242)+hd$+CHR$(211)+hd$+CHR$(211)+hd$+CHR$(211)+up$
2055 gun$=CHR$(210)+CHR$(246)+STRINGS(4,210)+CHR$(247)+CHR$(248)+CHR$(249)+CHR$(
10)+STRINGS(9,8)
2060 gun$=gun$+CHR$(247)+STRINGS(4,210)+CHR$(249)+SPACES(4)+CHR$(149)+CHR$(10)+S
TRINGS(6,8)
2065 gun$=gun$+CHR$(143)+CHR$(250)+CHR$(154)+CHR$(254)+CHR$(32)+CHR$(253)+CHR$(2
55)+CHR$(10)+STRINGS(16,8)+CHR$(193)+CHR$(154)+CHR$(211)+SPACES(2)+CHR$(205)+CHR$(
10)+STRINGS(4,8)
2070 gun$=gun$+CHR$(205)+CHR$(255)+CHR$(32)+CHR$(209)+CHR$(10)+STRINGS(3,8)+CHR$(
253)+CHR$(210)+CHR$(252)
2075 bu1$=CHR$(231)+CHR$(32)
2080 WINDOW1,31,40,6,12:PAPER Cl,0:CLSCL:PENE1,2:PRINTEL,gun$
2085 WINDOW2,1,18,6,9:PENE2,1
2090 LOCATE 30,7:PRINT CHR$(230):GOSUB 2250:FOR x=1 TO 250:NEXT:FOR y=29 TO 9 ST
EP-1:LOCATE x,7:PRINT bu1$:FOR y=1 TO 5:NEXT:NEXT
2095 PAPER 22,3:CLSCL:FOR x=1 TO 700:NEXT :PAPER2,0 :CLSCL2
2100 PRINTEL2, USING"a":lc$; "lr$"; "ll$"; "ls$"; "lo$":FOR z=1 TO 1500:NEXT
2105 CLSEL:WINDOW1,31,40,14,20:PRINTEL,gun$
2110 LOCATE 30,15:PRINT CHR$(230):GOSUB 2250:FOR x=1 TO 250:NEXT:FOR y=29 TO 12
STEP-1:LOCATE x,15:PRINT bu1$:FOR y=1 TO 5:NEXT:NEXT
2115 WINDOW2,1,24,13,16 :PENE3,1:PAPER 23,3:CLSCL3:FOR x=1 TO 700:NEXT :PAPEREC

```


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PROGRAM FILE

```

2670 PRINT
2675 PEN 2:PRINT"PRESS SPACE BAR TO CONTINUE"
2680 AS=INKEYS:IF AS<>" " THEN 2680
2685 CLS:PEN 1
2690 PRINT"There is also a skeleton key in one of"
2695 PRINT"the rooms.This key will unlock any door"
2700 PRINT"but cannot be used to lock doors. You "
2705 PRINT"can only carry one key at a time. Using"
2710 PRINT"keys avoids detours which are time"
2715 PRINT"consuming. Three of the rooms have all"
2720 PRINT"their exits lockable so that you say not";
2725 PRINT"be able to see what's in the room unless";
2730 PRINT"you have a key. Also you may get locked";
2735 PRINT"in one of these three rooms.
2740 PRINT" At the start of the game you will type";
2745 PRINT"in 2 code letters.On your turn you must";
2750 PRINT"type in this code.No other player should";
2755 PRINT"see the screen during your turn. A list"
2760 PRINT"of possible weapons,values and"
2765 PRINT"suspects is shown on the left of the"
2770 PRINT"screen. As you find them the initial"
2775 PRINT"letter of the room in which they were"
2780 PRINT"found is shown alongside.The type of"
2785 PRINT"fingerprint(/) on the weapons is also"
2790 PRINT"shown.The initial letter of rooms you"
2795 PRINT"have visited is shown at the bottom"
2800 PRINT
2805 PEN 2:PRINT"PRESS SPACE TO CONTINUE"
2810 AS=INKEYS:IF AS<>" " THEN 2810
2815 PEN 1
2820 CLS:PRINT"At your turn you will be shown the room"
2825 PRINT"you are in and a list of its visible"
2830 PRINT"contents. A menu displays the following"
2835 PRINT"options.Only one can be used each turn"
2840 PRINT"NOTHING Carry on.No option used"
2845 PRINT"PICK UP Pick up a key.You will drop any"
2850 PRINT"other key."
2855 PRINT"SEARCH Will reveal any hidden weapon"
2860 PRINT"ACCUSE When you have the answers go to"
2865 PRINT"the room where the murderer is"
2870 PRINT"for debriefing"
2875 PRINT"FILE If you are in the same room as"
2880 PRINT"another player,you can steal"
2885 PRINT"any key they are carrying"
2890 PRINT"QUESTION At the start of the game, an"
2895 PRINT"agreed number of questions(up to 5) is"
2900 PRINT"fixed for any one turn.There are two"
2905 PRINT"possible questions.You must be in the"
2910 PRINT"same room as the suspect you question."
2915 PRINT"The possible questions are"
2920 PRINT"a) In which room is the...(any suspect)"
2925 PRINT"This question will always be answered"
2930 PRINT"positively and truthfully"
2935 PRINT
2940 PEN 2:PRINT"PRESS SPACE BAR TO CONTINUE"
2945 AS=INKEYS:IF AS<>" " THEN 2945
2950 CLS:PEN 1
2955 PRINT"b) At the time of the murder where was"
2960 PRINT"the...(any suspect)
2965 PRINT"The whereabouts of every suspect at the"
2970 PRINT"time of the murder is known by two other";
2975 PRINT"suspects(including the person with them";
2980 PRINT"at the time of the murder).All suspects"
2985 PRINT"with the exception of the murderer and"
2990 PRINT"the accomplice will answer truthfully if";
2995 PRINT"they can.When questioned the murderer"
3000 PRINT"and the accomplice will lie to protect"
3005 PRINT"each other.When questioned,the murderer"
3010 PRINT"will switch the location of the"
3015 PRINT"the accomplice with the location of the"
3020 PRINT"other suspect whose whereabouts he knew."
3025 PRINT"The accomplice will use similar tactics"
3030 PRINT"when questioned about the whereabouts of";
3035 PRINT"the murderer."
3040 PRINT" You will then have the opportunity to"
3045 PRINT"move to another room before your turn"
3050 PRINT"ends.You are advised to have pencil and"
3055 PRINT"paper with you to take notes"
3060 PRINT
3065 PEN 2:INPUT "DO YOU WANT INSTRUCTIONS AGAIN (y/n)";IS
3070 IF IS<>"Y" AND IS<>"N" THEN 3070
3075 IF IS="Y" THEN 2460
3080 RETURN

```

Commodore 64 IRQ Programs and Memory Saving by Justin O'Brien

The first of these tips allows any user with some knowledge of machine code to run simple tasks in a way that doesn't slow down the operation of Basic programs. It makes use of the IRQ service interrupt which occurs every sixtieth of a second to scan the keyboard, and so on. Changing the pointer at locations \$314 and \$315 enables a short machine code routine to be executed before the normal system servicing at location \$EA31.

The program is as follows:

```

10 X=49152
20 READ A
30 IF A=225 THEN 120
40 POKE X,A

```


PROGRAM FILE

```
50 x=x+1
60 GOTO 20
70 DATA 120,162,15,142,20,3
80 DATA 162,192,142,21,3,88
90 DATA 76,174,167
100 REM DATA ***Your Routine***
110 DATA 76,49,234,255
120 SYS 49152
130 REM ***Rest of Basic
Program***
```

In the 'Your Routine' part of the program, insert the machine code instructions to be executed. An example is:

```
100 DATA 238,0,208 (increases x
coord of sprite 0)
110 DATA 206,1,208 (increases y
coord of sprite 0)
120 DATA 238,32,208 (flashes the
border)
```

To stop the computer executing the added routines, press Run/Stop and RESTORE.

The second tip allows all areas of memory to be saved to cassette, not just the Basic text area as normal. This is done as follows:

```
POKE 43, (low byte of start address
```

```
of memory to be saved)
POKE 44, (high byte of start address)
POKE 45, (low byte of end address of
memory to be saved +1)
POKE 46, (high byte of end address
+1)
```

SAVE "filename"

This method cannot be used from within a Basic program because it makes the interpreter think that the program is in a different place than it actually is. The routine in the listing allows the same thing from within a Basic program. The first part is the assembly code used, the second a Basic program to put it in memory. When it is in memory, it can be used as follows:

```
POKE 251, low byte of start address
POKE 252, high byte of start address
POKE 253, low byte of end address
POKE 254, high byte of end address
```

Next, print the required filename in the top-left corner of the screen (memory locations 1024 to 1038) and, finally, type SYS 49152. All this can be done from within a Basic program.

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MBasic Structured ON.ERROR

by MJ Buja

One facility which Microsoft Basic lacks is a case-type structuring of the ON ERROR GOTO statement since it can only branch to one line. This tip provides a short bit of code which gets around the problem.

```
10 ON ERROR GOTO 1000
20 ERROR.CODE$=STR$(<ERR.1>)
+STR$(<ERR.2>)+STR$(<ERR.3>)
1000 ON (INSTR (ERROR.CODE$, STR$
(Err)-1)/+1) GOTO <TRAP.1>,
<TRAP.2>, <TRAP.3>
```

1010 ON ERROR GOTO 0

ERR.1, ERR.2 and ERR.3 are the error codes which are being trapped. They do not have to be strung together with STR\$ but can be numbers within quotes (remember — there will be an extra space in this case). Line 1000 searches the string for the code and returns a value which corresponds to the code position, and causes a branch to the appropriate line.



WordStar Tips

by Mandy Alford

In response to the WordStar tip given by Mike Rhodes in May's 'Program File', here's a simpler way to edit with single-spacing onscreen and print out in double-spacing. Use LH commands at the start of the file.

.LH12 to give one-and-a-half spacing and .LH16 to give double-spacing. This facility can be added and removed at any time from the start of the file.

```
C000 A9 01 LDA #01
C002 A2 01 LDX #01
C004 A0 FF LDY #FF
C006 20 BA FF JSR $FFBA
C009 A9 0F LDA #0F
C00B A2 00 LDX #00
C00D A0 04 LDY #04
C00F 20 B0 FF JSR $FFB0
C012 A9 FE LDA #FE
C014 A5 FD LDX #FD
C016 A4 FE LDY #FE
C018 20 D8 FF JSR $FFD8
C01A 4C AE A7 JMP $A7AE
```

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Vale, Gwent.

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● **PRINTER C. ITOH 8510B. £160.** Sharp MZ80A computer, integral monitor, keyboard and cassette, plus £100 software £145. Both superb condition and boxed. Possible delivery. Tel: Branscombe (029780) 421.

● **HAPPY 1050 ENHANCEMENT.** Latest revision 7 software, full documentation, installation instructions lost, but will fit free or swap enhanced 1050 with ordinary drive. £125 o.n.o. Tel: (0532) 752251 after 6pm.

● **APPLE II CARDS: Grapper parallel printer.** RS232 serial Apple communications, all with cables, £35 ea. Z80 runs CP/M £30. Speech, disk controller language 16k £30 ea. Music (A1) Card £45. IC test £75. Post inc. Tel: (01) 736 7809.

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● **UNUSED IBM SOFTWARE.** WordStar, £175. DBase III, £300. Framework, £300. Bonsai

20MB IBM tape streamer with interface and software. Unused £500. Unused IBM flight simulator £40. Tel: Shepperton 0932 220591.

● **UNUSED IBM SOFTWARE.** Pegasus purchase sales, nominal, payroll, costing, stock, report generator suite, £1000. Cobol level II £300. CIS Cobol £250, Pascal MT+86 £275, SPP86 £35. Tel: Shepperton 0932 220591.

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● **MAGAZINES: Bound PCW April 1981/March 1986.** Practical Computing March 1981/March 1984, Your computer June 1981 (V1.1/ June 1984. Unbound Various PCW/Acorn User. Offers to Winchester 884938 (Eves).

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● **WANTED.** Secondhand disk software for Sharp MZ-80k. Games, utilities, languages, good business programmes, all considered. Please state asking price. Gibbs, Marigold Cottage, Dittons Road, Polegate, Sussex BN26 6HU.

● **EPSON HX-20 FOR SALE.** Complete with case, micro drive, charger, RS232 cable, manuals, cassettes £200 o.n.o. Write N. Schofield, c/o HTS, Elstree Way, Borehamwood, Herts, WD6 1SB. Tel: (01) 953 6161.

● **ITT 3030. 2 Quad density drives,** 7MB hard disk, LQP02 daisy wheel printer, BOS operating system. £499 o.n.o. Tel: (01) 834 9060 Ext 240.

● **ACORN ATOM.** Complete system, disk pack, GP100A printer, B&W TV with monitor conversion, software includes Atomcalc, Wordpack, Forth, Lisp, games, toolbox ROMs, etc. £150. Reading 882354 Eves, Wends.

● **APPLE 2C.** Boxed s new with some business software, monitor and stand. £400. Includes 128k RAM and 143k internal drive. Adrian Wooster, 11 Queens Park Road, Brighton.

● **COMPLETE SHARP MZ80K SYSTEM.** Including printer disks and interface unit, a snap at £150. Good condition with software and manuals, will negotiate on price. Call Alex Doyle, after 5 o'clock on (01) 692 4738.

● **BBC B. Twin 400k disk drives,** Torch Z80 processor, Aztec C (commercial), BCPL, Lisp, Forth, Perfect suite and more. £950 o.n.o. Tel: Graham Jeffery (01) 871 0068 (office hours).

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● **APPLE IIe 1MEGABYTE COMPLETE SYSTEM.** Flippercard, Superserial, 2 drives, monitor, Qume daisywheel, 55 cps plus tractorfill. Nightingale modem, mastercard, TV modulator, extension business communications, games, software, manuals, joystick, disks etc. Nigel (01) 586 7285 £1,750 the lot.

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Mike Mudge goes back to basics . . . how large is a large integer? He also looks at the results, and some of your ideas, to April's Geometry of Numbers problem.

The primary requirement in empirical number theory is to escape from 'the largest integer which can be handled' is $2^{32} - 1$ (= 4294967299) or similar restriction to be found in the user manuals of all personal computers.

Now, what is meant by 'handling' a large integer?

(a) **Identification** Ideally using a single identifier, as with conventional integers (maybe prefixed by L for 'long'), but possibly using an array-type declaration.

(b) **Input and output** It is essential to provide a facility enabling a large integer to be input to memory. Such a facility may require the integer to be accompanied by a parameter defining its length, either in digits or some other convenient unit; and should contain a sum-check to detect the majority of keying errors.

The output of a large integer need not be accompanied by the length-defining parameter: however, attention should be paid to formatting in relation to the output device in use. Spurious line-filling characters should be avoided and the conventional form of right justification is desirable, although not essential.

(c) **Very simple arithmetic** Addition and subtraction of large integers are to be readily available, called through either user-named functions (or procedures) or ideally in the natural manner with + and - linking the appropriate identifiers.

(d) **Simple arithmetic** Multiplication of large integers should be carried out with any possibility of unreported overflow removed; in general, reported overflow (Note: since all computers have a finite capacity, overflow is ultimately unavoidable) must be accompanied by termination of the program.

(e) **Not-so-simple arithmetic** Division: we are unable to subscribe to the philosophy of the eminent number theorist DH Lehmer — 'Not only should division by zero be excluded from arithmetic, but all division should be avoided. . .'. Division should produce a quotient and a remainder, both of which may be very large: a trivial example 1234567898/231 yields 3846005 remainder 293. Decimal places are not relevant and floating-point arithmetic should be avoided in general.

Partial factorisation is a desirable

standard subroutine, assuming the accessibility of a 'table' of prime numbers up to a given maximum. An efficient division routine with a test for non-zero remainder will clearly expedite this procedure.

Determination of integer roots (or rational powers). The determination of square, cube, fourth. . . roots of large integers — only when these are integers — is a desirable facility and can clearly be related to the factorisation algorithm referred to above. For example, $7\sqrt{(105413504)} = 7\sqrt{(2^7 \cdot 7^7)} = 2.7 = 14$.

A Computation of Devi The following 201 — digit integer had its 23rd root extracted mentally by Miss Shakuntala Devi in 50 seconds. A Univac 1108 computer at The National Bureau of Standards, Washington, using 13,000 pre-programmed instructions, repeated the calculation in one minute!
91674867692003915809866092758538
01624831066801443086224071265164
27934657040867096593279205767480
80679002278301635492485238033574
53169351119035965775473400756816
88305620821016129132845546805780
158806771

Specimen problem

Input the large integer 12345678910112131415. . . n, calculate its n^{th} power and output this, together with its factors. What is the maximum n which your computer will handle? For example, $n = 2$, $12^2 = 144 = 2^4 \cdot 3^2$, $n = 3$, $123^3 = 1860867 = 3^3 \cdot 41^3$.

Readers are encouraged to investigate the efficient manipulation of large integers using techniques ranging from array facilities in high-level languages such as Basic, Pascal or Fortran, through general string handling to machine code/assembler coding. The specimen problem together with the computation of Devi should be attempted.

Achievements may be submitted to Mike Mudge, 'Square Acre', Stourbridge Road, Penn, nr Wolverhampton, Staffordshire WV4 5NF, tel: (0902) 892141, to arrive by 1 January 1987. It would be appreciated if such submissions contained a brief summary of results, together with thoughts relating to the associated outstanding problems, in a form suitable for future publication in PCW.

These submissions will be judged using suitably vague criteria, not nec-

cessarily related to the answer to Devi's Computation! A prize will be awarded to the 'best' contribution received by the closing date.

Please note that submissions can only be returned if a suitable stamped, addressed envelope is provided.

Mike Mudge welcomes correspondence on any subject within the areas of number theory and other computationally related mathematics, particularly containing suggestions for future 'Numbers Count' articles, and will endeavour to reply to all letters after a sufficiently long time.

Interested readers can be readily put into contact with others who have submitted attempts at previous problems. However, in the interests of efficiency, readers are encouraged to contact the prize-winner directly.

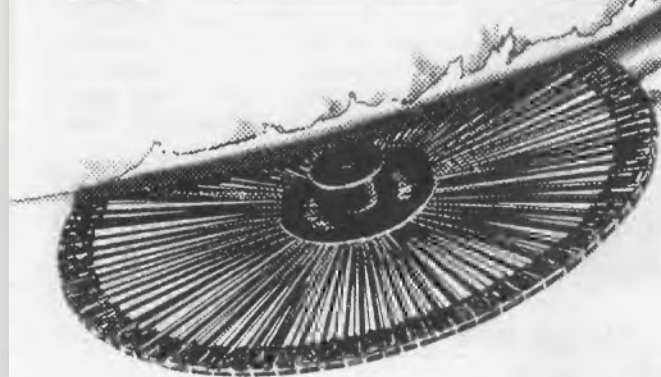
Review — The Geometry of Numbers

Relatively few graphics enthusiasts answered the call of April's problem. The typographical error in question five, line three — the word 'lattice' should be deleted — brought rapid response from several careful readers; however, question five, problem E, proved to be too abstract. Further comments relating to it would still be very welcome.

Any reader interested in the mathematical background of this topic is encouraged to consult Minkowski's classic work, *The Geometry of Numbers*. Those particularly interested in question four, problem C, are referred either to C Hylten-Cavallius, 'On a combinatorial problem', *Colloq Math*, vol six, 1958, pp 59-65, or more readily to Robin Merson, 2 Vine Close, Wrecclesham, Farnham, Surrey GU10 4TE, tel: Frensham 3587, who has extended the results quoted to $k(8) = 43$, $k(9) = 50$, $k(10) = 61$ and $k(15) = 121$, with marginal assistance from his Apple computer.

Richard Tindall of 26 Poplar Close, Great Shelford, Cambridge, a regular correspondent, has dealt effectively with problems A and B, and having confirmed the known results of problem D, has conjectured (without proof) results for $n = 8$ and 9. Problem C was Richard's chief interest and I feel sure that he would share

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NUMBERS COUNT

the details of his approach upon receipt of a stamped, addressed envelope.

The prize-winner this month is John Gale of 16 Wrensfield, Hemel Hempstead, Herts HP1 1RN, tel:

(0442) 53643, who used a Video Genie with an Epson MX80 and programmed in Microsoft Basic. John's approach to graphical display of lattice points was simple but effective, and his attempts to re-

late results in the geometry of numbers to rational approximations (best-possible in some sense) to certain transcendental numbers were enthusiastic, if not greatly productive.

LEISURE LINES

Brain-teasers courtesy of JJ Clessa.

Of 100 people interviewed, 10 said they neither smoked nor drank, 75 said they drank, and 83 said they smoked.

How many people both drink and smoke?

Prize puzzle

When someone shouted 'Bingo', Fred still had nine numbers to get on his card. There was one number in each column, and three on each of the three rows on the card.

Fred noticed that one row contained three square numbers, one

contained two squares and a prime, and the other contained one square and two primes. Moreover, the total of the three numbers in each row was the same.

What were the numbers, and which rows were they on?

(Note: the Bingo card contains 9 x 3 squares, and the first column contains numbers less than 11. The second column has numbers in the range 11-20, the third 21-30, and so on.)

Answers on postcards, please, or

backs of envelopes, to reach us not later than 30 October 1986. Send your entries to Leisure Lines, October Prize Puzzle, PCW, 32-34 Broadwick Street, London W1A 2HG.

July prize puzzle

Not too difficult a problem.

The answer to the puzzle is that there are 191 numbers (excluding unity) which have no common factors with the number 720. The winning entry came from Paisley, and was from Mr John Paton. Congratulations John, your prize is on its way.

ACC NEWS

The ACC will be at the PCW Show — find out what it can offer you, courtesy of Rupert Steele.

The Association of Computer Clubs acts as the national umbrella organisation for computer clubs around the UK. This month, the ACC has been actively involved in preparations for the PCW Show, setting up the club area there. This has been coordinated as usual by Dr David Annal, who has run the hobby club presence at the show for several years; indeed, few can remember a PCW Show without the ACC's presence. We remain grateful to PCW and the show organiser, Montbuild, for their continued sponsorship of this aspect of the ACC's work, and believe that the show will again be enhanced by the reserve of unbiased help and advice that the hobby stands provide.

Outside PCW show time, the ACC provides a number of other services to clubs. An important aspect of this is the insurance scheme, whereby each qualifying computer club is covered against public liability risks as part of its affiliation fee, and through which inexpensive insurance is available for equipment at club meetings. The ACC also runs the ClubSpot 810 database on Prestel, which is constantly one of the most accessed parts of the whole system, and is expanding into new areas on Prestel,

including hobbies more generally. This is all run through the electronic publishing sub-committee of the Association, which reports to the Council of computer club representatives from around the UK.

The ACC also helps computer clubs with their publicity, both through this column and through our national clubs database, through which people can get in touch with their local computer club. To help keep the costs of affiliation down, the ACC sells label sets of the database to those considering direct mail to computer clubs.

Around the clubs

Alan Sharkey has written to me about The Anglia PC User Group. This is a new club, presumably for PC (that is, IBM think-alike) users in East Anglia. The group recently had its first meeting, which was apparently a considerable success. United Business Systems of Norwich provided the premises for the first two events. The first meeting featured Compaq, complete with some highly entertaining John Cleese videos. This was followed up by X-Data Ltd. As well as the meetings, members are offered public domain software, regular newsletters, cheap diskettes, and help with

problems. For details, contact Alan on (0223) 244438 (evenings) or (0493) 730107 (daytimes), or you can write to him at 5 Forest Road, Cherry Hinton, Cambridge CB1 4JA.

Philip Ramage, the secretary of the Croydon Apple User Group, has very kindly been keeping me informed of what is going on in his club by sending me the monthly newsletter. A particularly interesting recent meeting featured the Pagemaker software for the Apple Mac. This has, of course, been hyped-up by the press everywhere — the basic idea is that with the Mac's onscreen icon environment, and using a relatively cheap laser printer, you can produce high-quality magazine-style pages 'in-house' without expensive typesetting equipment. However, Philip regrets that the kit is not quite cheap enough yet: 'One day, perhaps, this newsletter will be a multi-font publication with hi-res pictures of indiscretions from the last meeting, but for the time being you'll have to make do with a worn-out ribbon and the Gestetner, and just imagine the rest.' The club also intends to get an early demonstration of Apple's new machine. The club meets at the Waddon Hotel, 2 Stafford Road, Croydon, every third Thursday at 7.30pm. Or

you can contact Philip at 515 Limpsfield Road, Warlingham, Surrey, or on (08832) 5262.

Talking of worn-out ribbons, I have had a most interesting letter from Nick Godwin. Nick has featured in these columns through a number of user groups that he has run or been involved with, but this one is more of a commercial enterprise. Nick has found a way to re-ink computer ribbon cartridges (the fabric ones), and is offering this service for one third of the price of the ribbon. Assuming this service works, and the idea catches on, this should mark the end of computer users being overcharged for ribbons. Hopefully, we can all limit ourselves to two ribbons, and send the spare off to Nick for re-inking while using the other. Eat your heart out, Epson! Anyway, to try out this idea, send your used ribbon cassette, stating printer model and make, with a remittance equal to one third of the price of a new one (minimum £1) to ALADDINK, Dept ACC, 4 Hurkur Crescent, Eyemouth, Berwickshire TD14 5AP — and let me know how you get on.

Talking of Apple Pagemaker, I have also received my first letter written using the system. It is from David Nicholson-Cole, one of the three Sysops of MacTel, a bulletin board

for Mac users, with its own Pagemaker-produced news sheet to help you keep your subsidy to British Telecom within bounds. There are about 450 users, of which 150 are 'subscribers', who pay either in cash, or news, text or public domain software for greater facilities. David's address is 15 Elm Tree Avenue, West Bridgford, Nottingham NG2 7JU. You can also call MacTel — if you have a modem and terminal software, eight bits no parity — on (0602) 817696, or in Sheffield (0742) 350319. Either way, the system does 300/300, 1200/75 or 1200/1200.

While we're on bulletin boards, John Bone has sent me more information about Log-on-the-Tyne, now run by ComputerTown NE! The system is the FIDO software suite written by Tom Jennings. At the last count, there were 14 FIDO bulletin boards around the UK, all linked by BRITNET networked messages (and linking to the international FIDONET). Log-on-the-Tyne brings all these facilities to those in the North East via a local phone call. Phone (091) 477 3339, 10pm-7pm (21 hrs) daily or via FIDONET, net 503 node 17. This facility is run on equipment made available to the ACC by Sperry UK. More hardcopy information is available by sae to John Bone, 3 Claremont

Place, Gateshead, Tyne & Wear NE8 1TL.

A little further afield, I have had a letter which might be of interest to our oily expatriates. Jaiwad Mohammed Ali has written to me from sunny Kuwait to tell me that he is planning to set up a public domain CP/M Basic user group for Kuwait. This will provide for information exchange on computer and related activities, both within Kuwait and internationally; it will also provide a re-formatting service for computer users in Kuwait, so that they may use material released in other countries using different disk formats. The group is just getting off the ground, and I confidently predict that it will not be serving wine at its meetings! For more info, contact JM Ali, PO Box 9567. Ahmadi 61006, Kuwait.

For a mention in this column, to tell the ACC about your club, or to obtain address labels for mailing to UK computer clubs, contact: Rupert Steele, 12 Philbeach Gardens, London SW5 9DY.

For any other enquiry, including the details of your local computer club, contact: Mike Mudge, 'Square Acre', Stourbridge Road, Penn, Wolverhampton WV4 5NF, or call (0902) 892141.

DIARY DATA

Readers are strongly advised to check details with exhibition organisers before making arrangements, in order to avoid wasted journeys due to cancellations, printers' errors, and so on.

London	Novotel;	Int Spectrum Computer Exhibition	Contact: Swan House Special Events Ltd	(01) 783 0055	23-25 September
London	Olympia;	Computer-aided Sciences Exbn & Conf	Contact: Curtis Steadman & Partners Ltd	(0799) 26699	23-25 September
Manchester	UMIST;	The Electron & BBC Micro Show	Contact: Database Exhibitions	(061) 456 8835	26-28 September
Glasgow	Anderston Centre;	Small Business Computer Show	Contact: Trade Exhibitions Scotland	(0764) 4204	1-2 October
London	Novotel;	The Amstrad Computer Show	Contact: Database Exhibitions	(061) 456 8835	3-5 October
Belfast	Forum Hotel;	Irish Computer Exbn, Computex	Contact: SDL Exhibitions Ltd	(Dublin) 900600	7-9 October
London	Barbican;	DEC User Show & Conf	Contact: EMAP International Exhibitions	(01) 608 1161	14-16 October
London	Wembley Cnf Centre;	Computer Graphics Exbn & Conf	Contact: Online Conferences Ltd	(01) 868 4466	15-17 October
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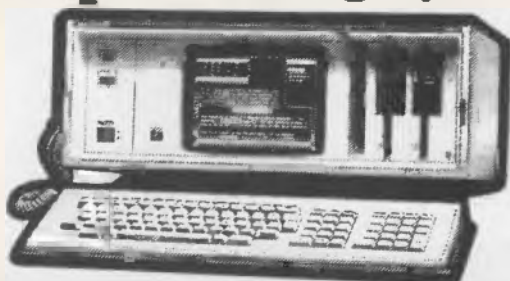
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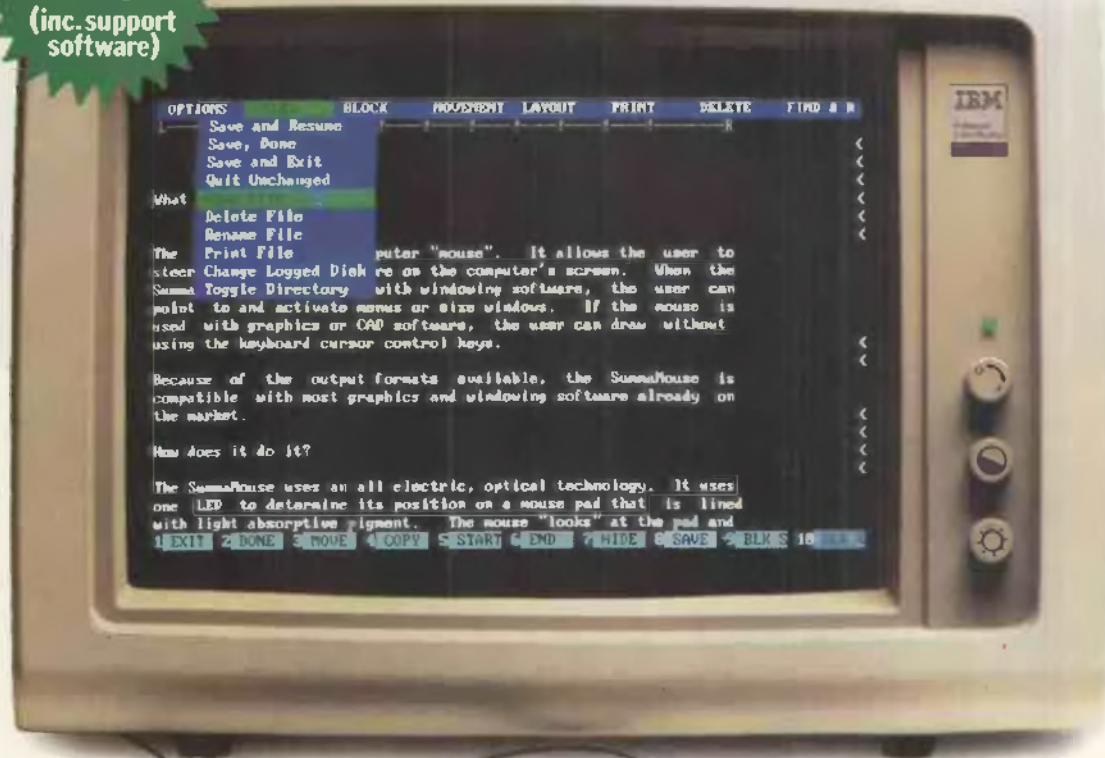
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PC LETTER

Stewart Alsop's famous U.S. Computer News Sheet, which is read by thousands of U.S. computer experts, is offered to you direct for £285 per annum (inclusive of airmail postage).

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Ranked alongside Esther Dyson and Portia Isaacson, Stewart Alsop II (also Western Editor of PC Magazine) has a dramatic, authoritative, and at times humorous style which is compelling, interesting and farsighted...

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MEDIATOR will run under DOS 3.2 & a RUNTIME version is available for tailored applications.

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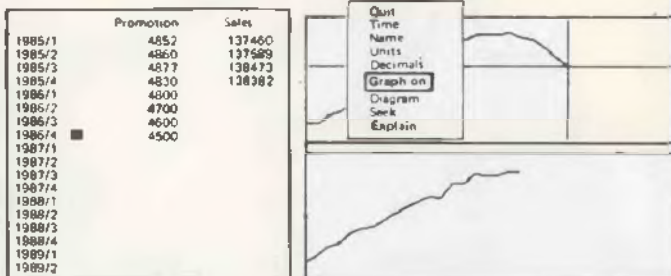
2nd SIGHT

is brilliantly accurate economic forecasting software which uses a powerful new maths to handle multiple time series data. Four software versions are available — 1/4/20/100 Time series.

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2nd SIGHT is amazingly easy to learn and was designed in the U.S. by a British mathematician. Now available for the first time in the U.K. 2nd SIGHT runs under PC/MS DOS and needs 512K RAM (+8087/80287), ideal for AT users.

Entry Forecast Model Graph Disk Print Options Configure Quit



A FULL DEMO version of 2nd SIGHT costs £28.75 (inc. VAT, p & p) which is redeemable against purchase of a complete system. (Prices range from £95 — £870 exclusive of VAT.) MICROWAY maths coprocessors are supplied.

2nd SIGHT has been validated by the London Business School, and is an ideal tool for accountants, Sales, Marketing, Brand or Financial Managers, planners/analysts, Economists, Ad Agencies, Market researchers etc.

TO ORDER any of these exclusive new products or for more information, SIMPLY write to: STRATEGIES, FREEPOST, 24 OAKFIELD PARK, WELLINGTON, SOMERSET TA21 8BR
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So send in the coupon today and maybe you can call off the hunt for that best value compatible.

*Prices correct at time of going to press and do not include VAT.

£1399



Walters AT

Price includes:-

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PCW 10-86



Series Four

V21, V23, V22, V22bis Data Modems

The last word in Micro-communications

Once in a while a truly exceptional product reaches the market place. When the first modem appeared for a micro computer in the seventies, it transformed the role of the micro. Now the Modem has come of age with the introduction of *Series Four* the range of intelligent modems from Pace.

All *Series Four* models include as standard V21/V23 CCITT capability coupled with microprocessor control, automatic dialling and answering, Hayes compatibility and standard ports for RS232C, telephone, and parallel printer connection.

A 32 character LCD display and three 'touch' controls are used to relay messages about call progress to display time, date etc and to simplify programming of the modem via the Hayes commands. In addition status LED's monitor modem operation and provide visual indication of the line condition.

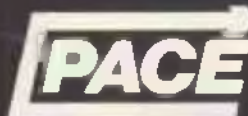
Multiple baud rates are supported by all *Series Four* models with 300/300, 1200/75 and 75/1200 rates

being available for use with standard viewdata and low speed full duplex systems. For more exacting requirements the *Series Four* 1200S will support 1200 baud full duplex (V22), and the *Series Four* 2400S will provide 2400 baud full duplex (V22 bis) operation.

Some of the features of *Series Four* include:

- Multiple baud rates (upgradeable)
- Auto dial/auto answer
- Microprocessor control
- Inbuilt date/time clock
- Automatic speed buffering
- Automatic baud rate detection
- Hayes compatibility
- Auto re-dial
- Dial tone detect
- 64 number/service store
- Call progress monitoring
- Printer port
- Unattended printing of incoming data
- 32 character LCD display
- Tone dialling
- Comprehensive 'help' command pages
- Visual line condition indication

The features offered by the new Pace Series Four modems are too numerous to detail fully here, a comprehensive fact sheet is available free on request.



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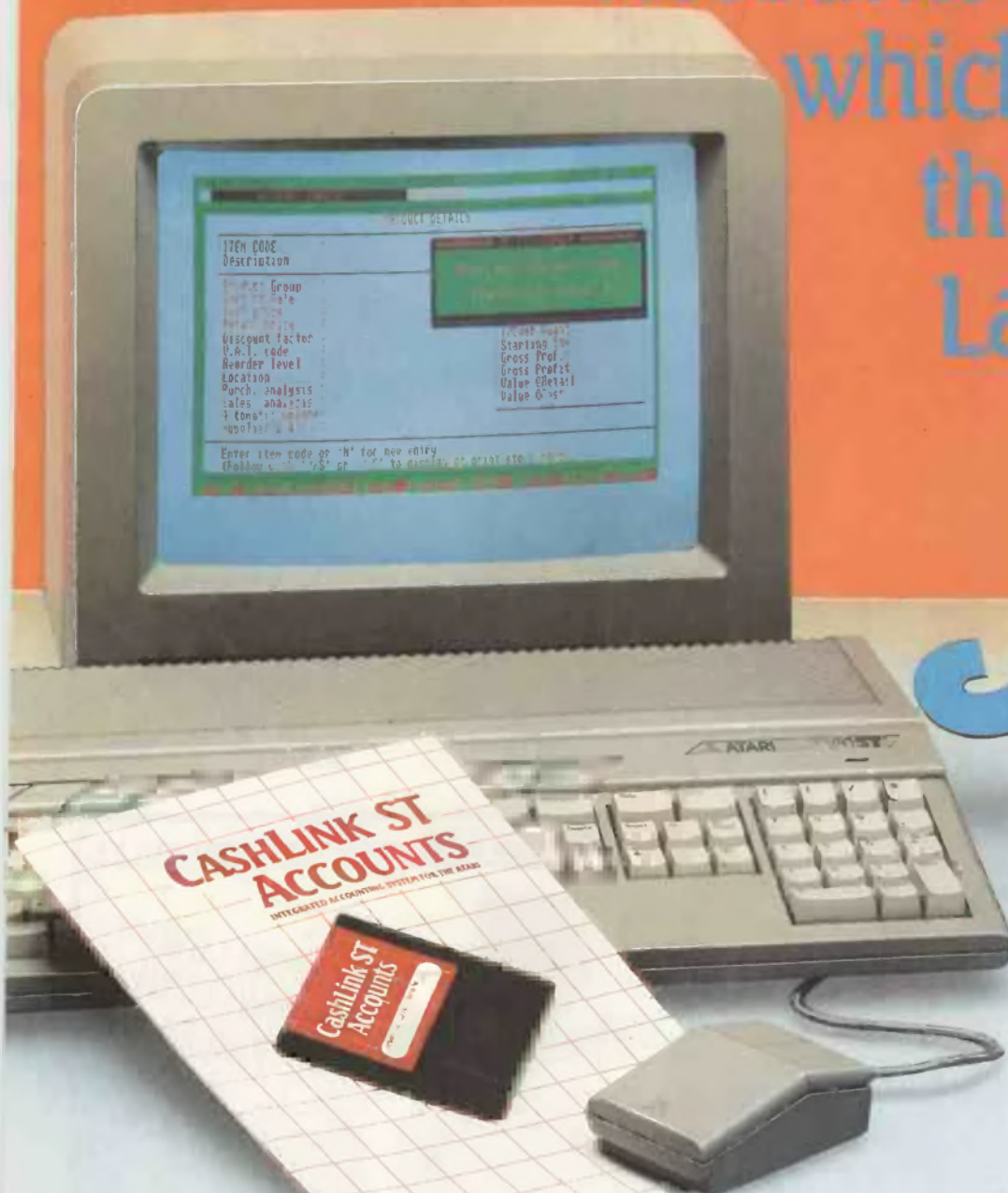


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1st column is Pascal80, second is Turbo. Benchmark 1 is untableable. On average, the code generated by Pascal80 is just over half the size of that produced by Turbo Pascal.

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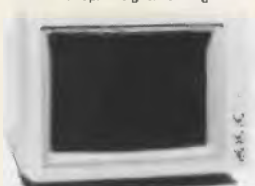
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ATARI ST

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520ST PACKAGES

The 520ST-M keyboard costs only £346.96 (+VAT-£399) and includes an RF modulator and cable, allowing you to connect it to an ordinary domestic TV set. The keyboard is supplied with 512K RAM, a mouse and a free set of 3 1/2" disks containing applications software. For a limited period from August 11th 1986, we have some special packs offering combinations of the 520ST-M keyboard with a 1/2 Mbyte SF354 Atari disk drive and an Atari monitor (either the Mono SM124, or Colour CM36512). These packages offer up to £200 extra discount on a system. If purchased from Silica, they also come with our free 'ST STARTER KIT'. All of the pack prices shown in the chart include VAT.

UPGRADE TO 1024K RAM

We are pleased to be able to offer a 1Mbyte upgrade on the standard 520ST keyboard to increase the memory from 512K to a massive 1024K. It has a full 1 year warranty and is available from Silica at an additional retail price of only £86.96 (+VAT-£100). Any of the five packs can be upgraded to 1Mbyte for only £100. The 1Mbyte ST offers a low price alternative to the 1040, but also gives you the benefit of an RF modulator (not normally fitted on the 1040).

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REDUCED PRICES

Atari's ST personal computers are now firmly established both in the USA and Europe. The main attraction of the ST range is the value for money which these computers represent, giving both private and business users a powerful asset at a very modest price. There are now several ST packages available from Silica at a reduced price, further enhancing the Atari 'Value for Money' reputation. In addition, we are giving away a FREE Silica 'ST STARTER KIT' with every 520 or 1040 ST purchased at Silica Shop. These offers will only be available for a limited period and commence on 11/8/86.

POWER FOR BUSINESS

The list below shows some of the new business products which have been recently launched for the Atari ST range. It gives an indication of the ST's potential to business buyers looking to install a powerful, low-cost system.

CP/M EMULATOR 20Mbyte HARD DISK LOTUS 123™ CLONE dBASE III CLONE

IBM COMPATIBILITY VT100 EMULATOR MICROSOFT WRITE dBASE II

Any ST computer will provide its user with a very powerful asset, utilising a vast range of applications, particularly in the business world. Many software companies have been quick to recognise it for its business potential, and have produced programs for the ST which harness this potential. In addition, there are several peripheral and hardware products becoming available to add to the ST's 'Power For Business'. Software now available includes dBase, a dBase III clone as well as dBase Base, a dBase II clone. In fact, First Software have now launched Ashton Tale's original dBase II program for the ST. In addition, PC Intercomm is a VT100 emulator which enables you to use any ST keyboard as a terminal connected to a mainframe or mini. Other programs include a powerful accounts package by Cashlink and a Lotus 1-2-3™ clone called VIP Professional. Microsoft have announced that their powerful word processor 'Microsoft Write' will soon be available for the ST. Many packages are available for very specific market applications including a powerful CAD (Computer Aided Design) program called Easy Draw from Migraph. In addition, there is an engineering tool called PC Board Designer by Absolut Software which will enable the user to design printed circuit boards. For further details of how the ST can help in your business, return the coupon below. We will be pleased to send you our latest newsletter and price list.

PRICE MATCH PROMISE

We hope you will find that the combination of our low prices, FREE delivery service, FREE Starter Kit and after sales support, will be enough to make you buy your Atari equipment from Silica Shop. If however, there is something you wish to purchase, and you find one of our competitors offering it at a lower price, please contact Owen Pascoe (Office Manager), or one of the telesales staff in our sales department. When you telephone us, please provide us with our competitors name, address and telephone number. Providing our competitor has the goods in stock, we promise to match his offer (on a 'same product - same price' basis) and still provide you with our normal free delivery. You will also be entitled to our full after sales service, including free newsletters and technical helpline support. We don't want you to go anywhere else for your Atari products. So shop at Silica, the U.K.'s undisputed No.1 Atari specialists.

FREE SOFTWARE

When you buy a 520 or 1040 ST computer keyboard from Silica Shop, you will receive a large and varied software package free of charge. This package consists of twelve programs. Wherever you purchase your Atari ST computer, you should receive the first six software titles as standard. However, if you purchase your ST from Silica, you will also receive a further six extra titles, giving you a total of twelve. All ST's now have TOS/GEOS already installed on ROM, so the list of free software you should receive is as follows:

- 1) GEM - DR Desktop environment with WIMP (fitted in ROM)
- 2) TOS - Transient Operating System (fitted in ROM)
- 3) 1st WORD - Word Processor by GST using GEM
- 4) BASIC - Personal Basic by DR (with manual)
- 5) LOGO - Logo language by DR (with manual)
- 6) NEOCHROME - A powerful colour paint and graphics package (only usable with colour systems)

If you purchase your ST from Silica, not only will you receive the standard six pieces of software as listed above, but we will also give you the following six additional programs FREE OF CHARGE:

- 7) MEGARIDS - Asteroids type game by Megamax
- 8) DOODLE - Simple paint/doodle drawing package (works on mono or colour systems)
- 9) CP/M EMULATOR - Allows use of DR's Z80 CP/M software to run on the ST range
- 10) CP/M UTILITIES - Various utilities to use with CP/M
- 11) DEMONSTRATION & PUBLIC DOMAIN SOFTWARE - Various games, demos and accessories
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These additional free software titles are all part of the FREE Silica 'ST STARTER KIT', return the coupon below for further details.

FOUR FREE MANUALS

In addition to the free software which will be given to you when you buy your ST from Silica, you will receive four free manuals:

- 1) ST OWNERS MANUAL (80 pages): Easy access to the information you require to unpack, set-up and become familiar with the ST.
- 2) ST BASIC SOURCE BOOK & TUTORIAL (240 pages): Gives you the information to increase your level of programming expertise.
- 3) ATARI LOGO SOURCE BOOK (77 pages): A source book for Logo, showing how to use the language in the GEM environment.
- 4) 1st WORD MANUAL (16 pages): Instructions for 1st Word.

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1040ST-F

For the businessman and the more serious home user, there is the 1040ST-F with 1024K RAM. This can be used in a business environment as a stand-alone system, or can support a mainframe computer as a terminal. The 1040ST-F keyboard with integral 1Mb disk drive costs only £699 (+VAT-£803.85). As the 1040ST-F was manufactured solely with business use in mind, it does not come with an RF modulator, but a Commodore TV interface. It requires a monitor. There are three Atari monitors available and the prices for the 1040 with these monitors are as follows:

1040 Keyboard Without Monitor	-£699 (+VAT- £803.85)
1040 Keyboard + 12" res mono monitor	-£798 (+VAT- £918.83)
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1040 Keyboard + Med res colour monitor	-£999 (+VAT- £1148.83)

The 1040ST-F includes 1Mbyte of RAM as well as a 1Mbyte double sided disk drive and mains transformer, both built into the keyboard to give a compact and stylish unit, with only one mains lead. The 1040ST-F is supplied with a set of software disks as well as our own FREE Silica 'ST STARTER KIT'. See into your nearest branch of Silica Shop for a demonstration.

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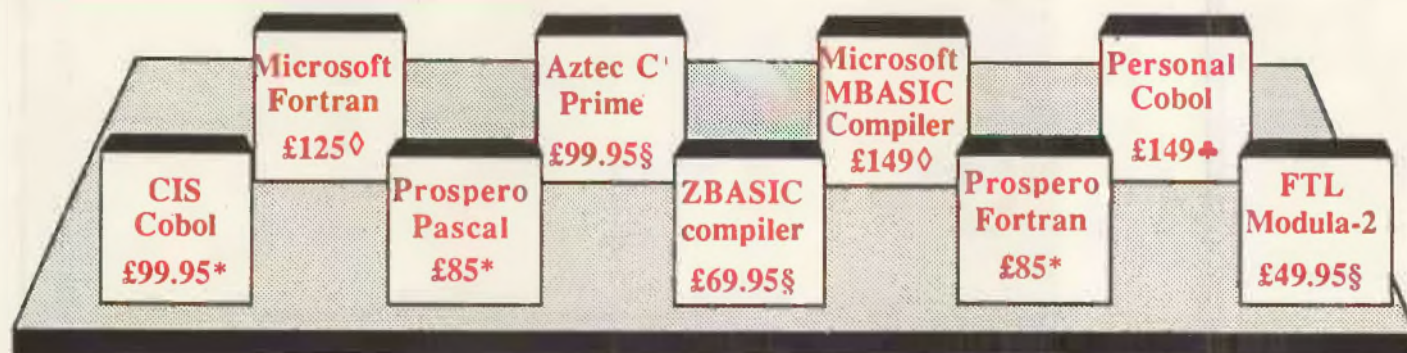
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What's in a name? Quite a lot, on the evidence of recent press releases received at our red brick fortress . . . First in was US corporation Connecticut Software which wishes to inform us that the name DOS Commander (as applied to its DOS shell software) belongs exclusively to the aforesaid corporation. What's more, it would like us to 'alert them immediately' to any use of the word 'Commander' in descriptions of software by other vendors. Anxious to comply, we dashed off telexes to Peter Norton (author of The Norton Commander shell) and to Buckingham Palace, since we fear that the title of 'Knight Commander of the Bath' may constitute a software product; we leave it to the Queen to pass it on to the Armed Forces. Peter Norton replied with alacrity, and is of the opinion that the word 'Commander' is no more subject to ownership than is, say, 'Cola' (as in Pepsi versus Coca) or 'Word' (as in Microsoft versus The Final versus Samna). In a private aside he likened Connecticut's claim to an

organic substance (of equine origin) used to promote the growth of roses . . . Naming software products has always been difficult. One soon runs out of combinations along the lines of PC-Turbo-Write, Turbo-PC-Word and Write-PC-Turbo. However, there is evidence of desperation in the portentous names given to certain new products. We've recently seen an architect's job-costing program called Prophet from The Silk Purse Company (we hope the company didn't make a pig's ear of it) . . . A new Fourth Generation Applications Development System is called Sculptor, presumably because it crafts Stock Control and Accounts Receivable into things of ineffable beauty. The marketing agency tells us that it is primarily (sic) aimed at DP managers, accountants and programmers. The agency is also under the illusion that it is dealing with a product called Sculpture . . . Subscribers to this highbrow and artistic style of computing will almost

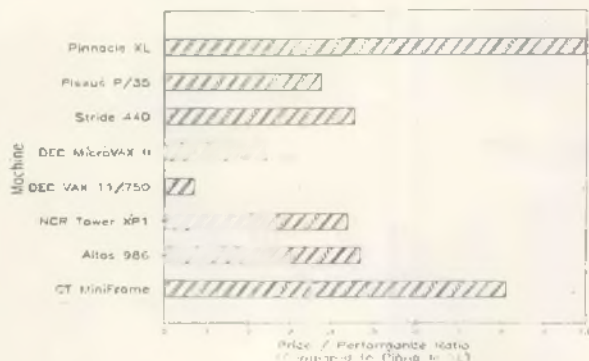


A load of old Kellogg's disks!

certainly wish to use Designer Diskettes from RPS, rather than ugly old black ones. These 'personalised disks with a bespoke design service' are already in use at Kellogg's whose trademark, if memory serves, is a large red cock . . . Meanwhile, the PC User Show catalogue suggests that a well-known Milton Keynes clone importer has opened up an Indian subsidiary called CTRL ALT DELHI . . . Consternation is reported at modern manufacturer Dowty, which supplied several Steebek Quattro 2422 modems to Germanic automobile vendor BMW. BMW became quite upset for some reason at the innocuous word 'Quattro' and refused to take delivery until a new badge bearing the legend 'BMW 2422' was fashioned. Like imperfect postage stamps, these units may in time become collectors' items . . . A

wonderful feature of computers is the way that they allow untrained laypersons to manipulate complex mathematical and statistical formulae and generate impressive graphs, histograms and pie charts. Such graphs, of course, encourage immediate comprehension of vital data relationships, and generally promote the spread of truth. We were deeply impressed, therefore, by the candour of Pinnacle (UK) Ltd, which sent us such a histogram revealing without doubt that its Pinnacle XL has by far the largest price/performance ratio of any computer in its class; it's no less than 10 times less cost effective than a DEC MicroVAX. Or was the ratio perhaps upside down? . . . The PC User Group magazine has been 'fiddling' with DOS shells recently. It reports that 'you simply tag sub-entries and — viola!

Byte Benchmarks
Price / Performance Ratio
(Compared to Pinnacle)



A graph is worth 1/1000 words . . .

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