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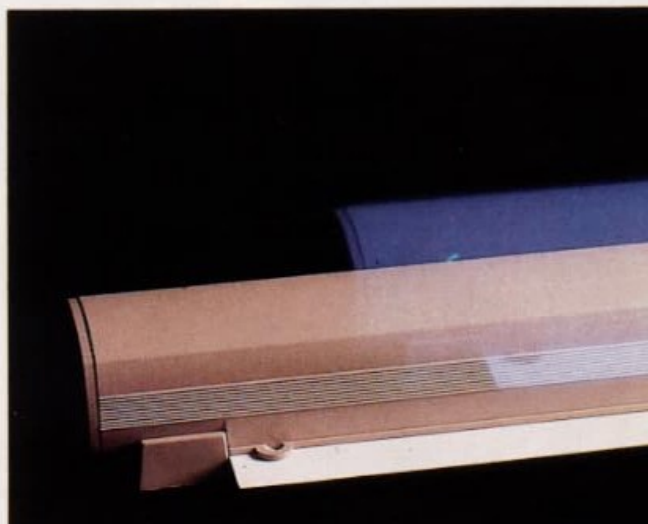
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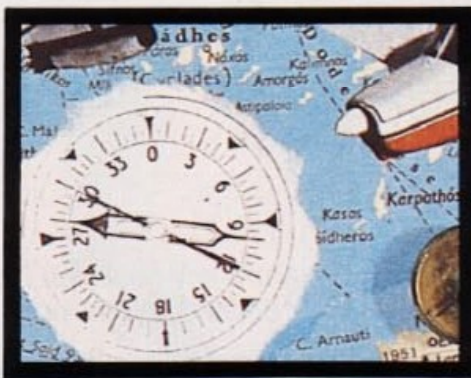
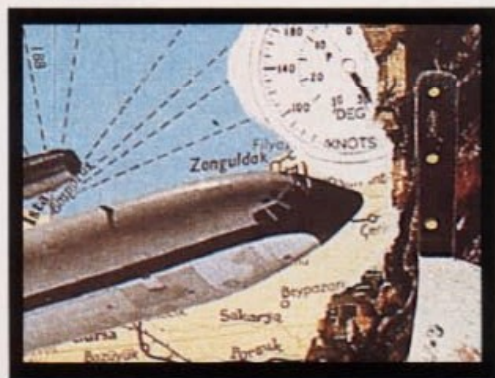
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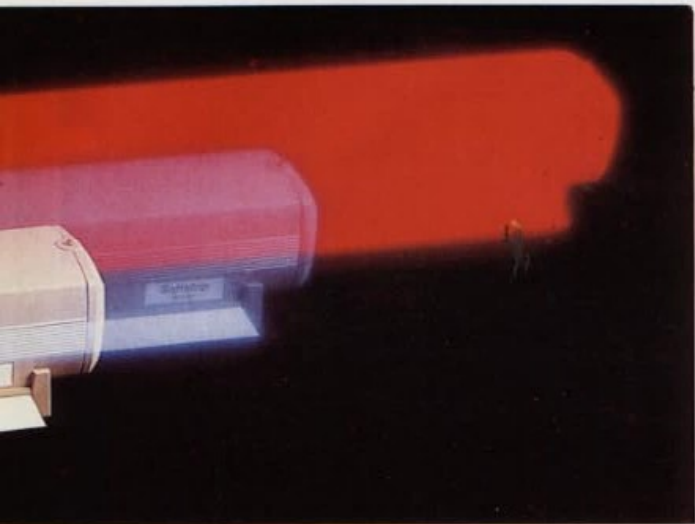


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A smaller price for a smaller Amiga. Phil Cohen takes a look at Commodore's latest attempt to boost Amiga sales.

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The new Macintosh has finally arrived. Announced at the recent Apple World conference in Los Angeles, the Macintosh II is an open-architecture, colour IBM-compatible. Launched at the same time was the Macintosh SE, a Macintosh with more 'get up and go'. Stuart Kennedy previews these machines. Watch for a full Benchtest next month.

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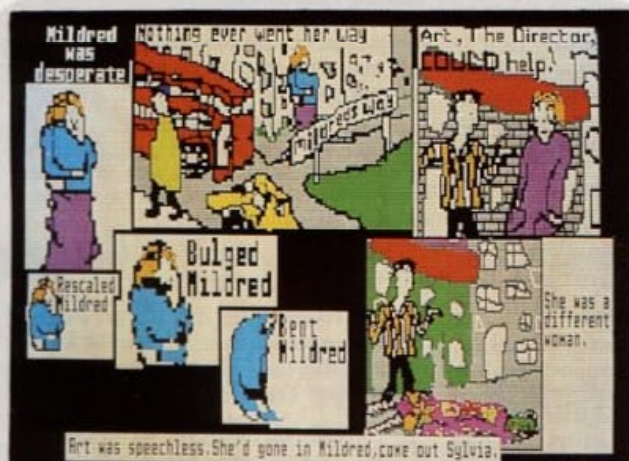
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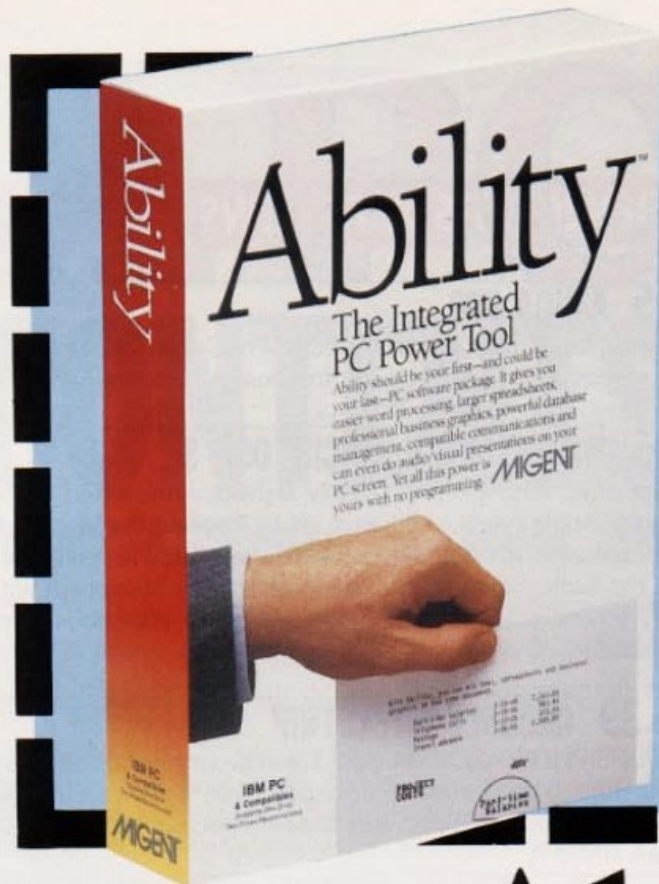
Ian Davies continues his series on MS-DOS programming, with a 'dump screen to disk' utility.



Verbatim sample diskette

The double sided double density diskette accompanying each copy of this issue of APC was supplied courtesy of Verbatim Australia. It is the result of a joint promotion of Verbatim, Computer Publications and Telecom Australia whose Viatel demonstration program (suitable for IBM PCs and compatibles) has been supplied with each disk. To see the demo, insert the disk into drive A, log on to that drive and at the 'A>' type MICRODEM then hit the 'return' or 'enter' key. It's well worth seeing — a sort of mini Viatel database on a disk, including pages from such notable service providers as Microtex and Money Watch.

If the disk supplied with your copy of APC has been damaged in transit, please call Jean at Computer Publications on (02) 264 1266 to arrange a replacement.



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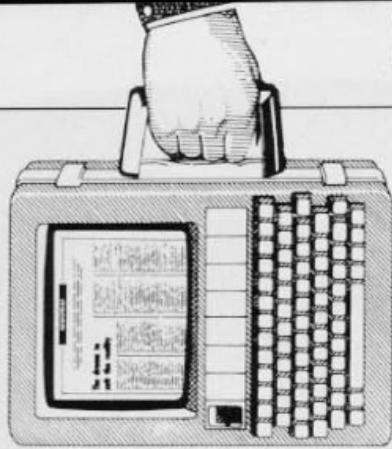
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There are new machines galore on the horizon, with Commodore and Atari losing no ground in the business PC race. Guy Kewney's news this month also includes a special report from CES in Las Vegas.

Made for sharing

Digital Research has announced the first operating system to use the all-powerful 80386-based machines emerging from the likes of Compaq and Kaypro. Tentatively named Concurrent DOS 386, the operating system will address 4 gigabytes of memory (4000Mbytes) and handle 255 tasks simultaneously.

I suppose, if you were greedy, you could keep all these tasks to yourself on the one machine; but most managers will allocate them four to eight per person across a number of terminals in a multi-user system.

DOS 386 provides each user with its own 8086-like environment, with 640k and access to extra memory, using the EMS (extended memory standard).

Don't be fooled by that 8086, 640k specification. Like the old Concurrent DOS, only text-based applications can run on the terminals as their slow serial links can't cope with graphics. So, running Gem Paint, for instance, will be out except for the person lucky enough to use the host 386 machine itself.

Chips with ATs

I now know of two 80386 boards to plug into AT machines, to make them even faster: the Orchid Jet386 card and the Intel InBoard 386.

One gets the impression that the manufacturers aren't quite prepared for the

problems they will cause. They says that both boards will work in any AT or AT lookalike. I think they will find they won't unless they are ATs from which the old 80286 chip can be unplugged.

My Tandon, thank heavens, seems to have a chip with the pins going down, not sideways.

Others have a different mounting, and the cable from these new 80386 products won't attach.

At \$2595 the Orchid product is by far the cheaper, providing a simple three-times speed-up factor for the user.

Intel's board starts at \$3395, without any added memory. With an onboard 1Mbyte of RAM, the cost goes up to \$4345. Then there are expansion 'piggy-back' memory boards, 1Mbyte costing \$1350.

However, Intel promises its board will be special: 'It will work in conjunction with new Microsoft software to create a completely new environment. The idea is that by combining the power of the chip and this environment, not only will it make the system run faster, but it will also do multi-tasking'.

'No information' was available on when the Microsoft environment software would be available. Well, that's honest, at least. Microsoft doesn't either, but this company is pretending it's a secret.

Good publicity

Your reaction on hearing that your \$3m company has been sued by Lotus Development Corporation for



Commodore plans to make the Amiga more popular, and a few select journalists were shown the new A500 and A2000 machines at the Consumer Electronics Show in Las Vegas last month.

The A500 will be a self-contained unit with a case very similar to the current 128. To make no bones about it, the A500 will be a 512k A1000 in a smaller box and with Kickstart in ROM.

A single slot will allow for an add-on 512k RAM board, but otherwise the system will be closed. Australian retail price will be around \$1000.

The A2000 is the up-market model and comes in a standard PC-type box. It will house up to three disk drives and comes with 1Mbyte of RAM as standard. Australian price is estimated to be around \$3000 including a 20Mbyte hard disk. Internal slots will allow for expansion, and even Sidecar on a card will allow for the machine to run PC-compatible software.

Commodore is talking seriously about migrating people from the Commodore 64 range of computers to the A500. But there is no way those people will pay \$500 plus \$1000 for the best Amiga monitor if their previous ambition were a 64.

The people who might be tempted away from their current favourites will be those looking at the Atari STs.

copyright infringement, might be less enthusiastic than that of Adam Osborne.

On hearing that his VP Planner was being attacked in court for its 'trivial differences' from Lotus 1-2-3, Osborne rose in the air and ut-

tered small excited cries of 'Yahoo!'

Adam Osborne is an astonishingly small-time businessman to have the enormous reputation he still has as president of Paperback Software.

He started out as a programmer, set up a publishing business, sold that to start a computer manufacturing business which made the first low-cost business micro, the first briefcase portable, and the first micro with bundled applications software. That went bust, and he now runs a little software publisher in Berkeley, California, which Lotus now proposes to make into a star.

For the life of me, I can't see why Lotus is bothering.

VP Planner has functional compatibility (now that the bugs are out) with Lotus 1-2-3 version 1a. It also has a three-dimensional database, capable of manipulating dBasell and dBasell files in a vastly sophisticated manner — far beyond the wit of most users to exploit, I would say. It is no more a copy of Lotus 1-2-3 than the Empire State Building is a copy of my house, though both are built with bricks.

Not only that, but VP Planner has been on the market for two years.

Lotus has also sued Mosaic, another American publisher of a 1-2-3 lookalike. It published a program called The Twin, which succeeded on so small a scale that Mosaic is now in fairly heavy financial trouble.

Osborne's response, when I asked him: 'I couldn't buy publicity like this, even if I could afford it'. He's an old mate of mine, and I'm probably hopelessly biased, but I can't help thinking he's right. Warranted compatible by Lotus itself, my, my, my. Unsolicited testimonials on this scale...I wonder if I could get Douglas Adams to accuse me of imitating his jokes?

When in doubt, sue

Connecticut Software, of which no-one has ever heard, reckons that Peter

Some people were very impressed by Atari's announcement of a PC clone for \$US500 at the Consumer Electronics Show, in Las Vegas.

The Atari announcement, at face value, is a move into the serious business computing market. Two 'business-level' ST models which use the 68000 chip were previewed, a desktop publishing system based on one of those Mega STs was also previewed, and two IBM PC clones were discussed. One was shown.

The desktop publishing idea is simple; you need a laser printer with 2Mbytes of memory to run Postscript. Postscript handles all the conversions from your computer's codes into circles, shaded areas, curves, characters, fonts, lines and pie charts.

By buying a Canon laser engine and attaching an ST with 4Mbytes of memory, all Atari has to do to make a publishing system to rival Macintosh-plus-LaserWriter is write some software.

Ah, yes, you have put your finger on it, the software still doesn't exist. It may not exist before June in reliable form, say Atari sources. Interpretation: you still have time to save up to buy it.

The Mega STs will include the fabulous blitter chip which so excited my APC colleagues. Well, it goes faster than the machine did without it, but I'd still call it more of a blitter than a blitter. (If it has bugs, it could be a bug-blitter Beast and be sent to Trall).

Now, the PCs.

There will be two. The simple clone-basher starts at \$US499, without screen. For \$US699 you get a machine with a monochrome (16 levels of grey) high scan rate display, capable of running EGA graphics. The machine includes EGA output as standard. You also get 512k of memory, a single disk drive (5in) and a serial and parallel port.

Could we get information from Atari's Australian distributor about pricing? No



The Mega STs include a blitter as standard

way. But we'll guess \$999 without monitor, unless it's a long time coming, in which case market pressure will probably see the monitor thrown in too. Atari used the term 'second quarter' to define when it would be available. That is a technical term used in the computer industry to mean 1 July.

People who saw it expressed some scepticism about how nearly ready it was. 'The chips inside that do the EGA are either standard CHIPS and Technologies things, and are ready to ship, or else they are what Atari says — custom designs — and they are nowhere near ready', said one scornful technologist.

Atari's retort: 'They are Atari chips and they are ready. The machine was on the shelf, on ice, and we just had to dust it down'.

The same applies, say Atari people, about the secret machine, the AT clone. The plan is to launch that very soon after the PC clone at under \$US2000 for a 20Mbyte hard disk and a colour display (including the same EGA standard).

The basic Atari ST models, the current 520 and 1040, will become 'home computers' and the price will fall, as APC has already stated, down to the level where they become worth buying. But there will still be more software for a Commodore 64, for a long time to come.

Norton of Peter Norton Computing, most famous of all utility writers, has 'knowingly and wilfully infringed the trademark DOS Commander owned by Connecticut'.

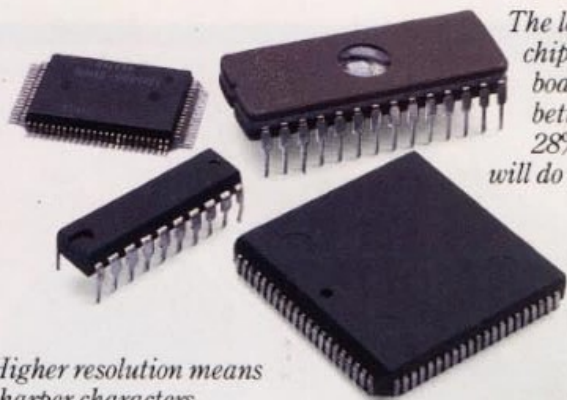
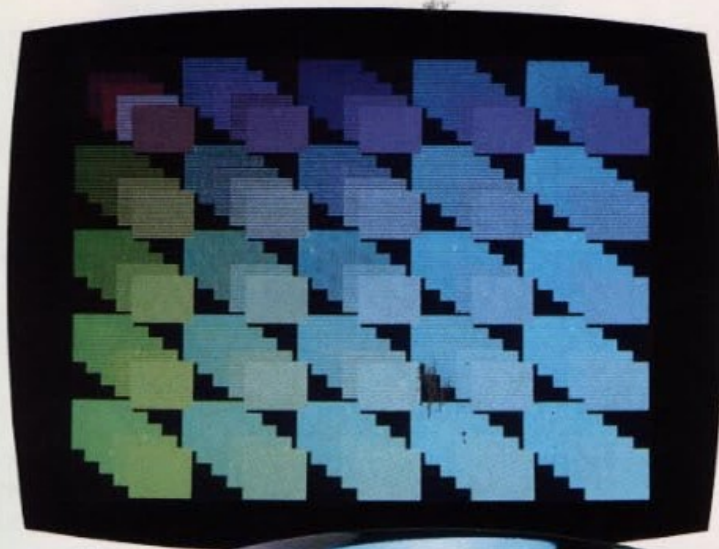
Connecticut's program, DOS Commander, was

launched in 1984, says Raymond Speer, president of Connecticut Software.

Adding outrage to injury, when Connecticut Software told Peter Norton about this and asked him to stop, Peter Norton responded by

sueing for a half a million dollars, claiming libel.

Obviously, Norton had never heard of Connecticut Software's product — and neither had I. But I seriously doubt that I would ask the world to give me half a mil-



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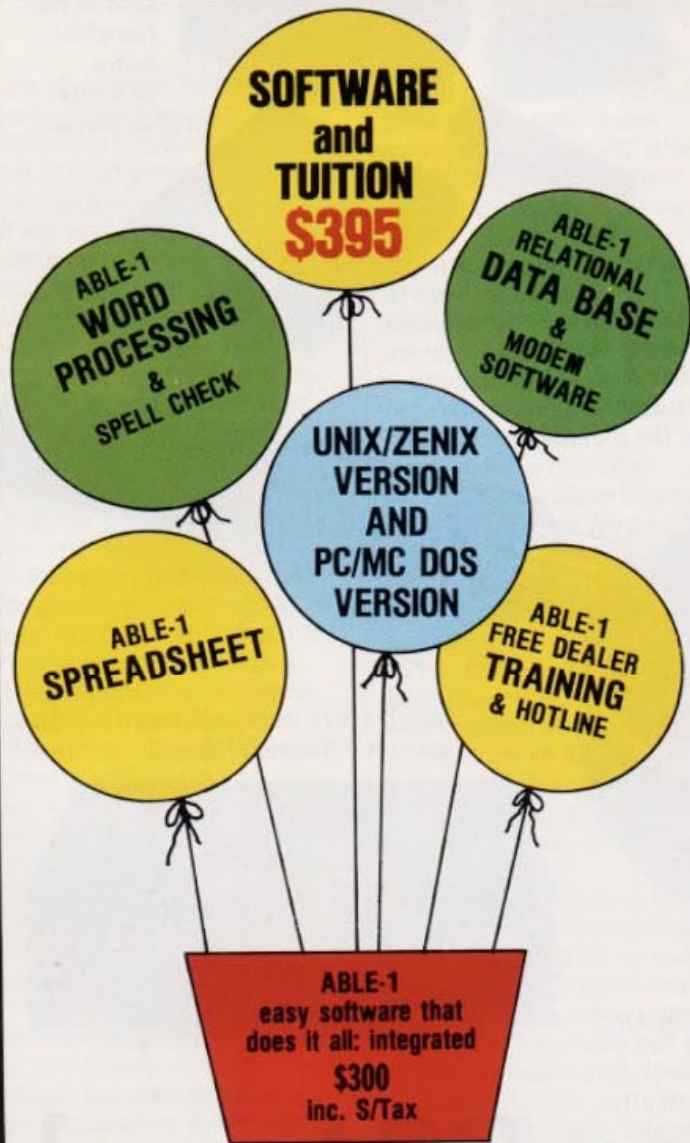
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lion bucks for every program I'd never heard of. And unless Connecticut's Speer is telling the most amazing pork pies, I can't help thinking that Norton has lost some of his marbles

Approach with caution

It is true that some people have been breaking copyright of PC-SIG's public domain library. But I'm not entirely happy making a misleading statement like that — and misleading it certainly is — the way PC-SIG, seems to be happy.

A Special Interest Group is normally a collection of people who share a machine. There are lots of clubs calling themselves that. PC-SIG, however, is not one of those: it's a commercial organisation, publishing software.

The software concerned needs publishing. Most of it is shareware, or user supported; a lot of it is simple freeware, or public domain.

A very great deal of it is very good stuff.

What PC-SIG has done, which makes it worth supporting, is to catalogue the software. What it has also done, however, is to write letters which really don't make clear that it is *only the catalogue* which it has copyright to. The substance is: 'We were not aware that you were distributing our Library. The Library is the proprietary and copyright work of PC-SIG, as such it is protected by international copyright law'.

PC-SIG has written in a similar vein to many journalists.

The situation is this: the programs are available freely. Only PC-SIG's own method of cataloguing them, and numbering disks on which they are distributed, are copyright.

In this country, PC-SIG has only one authorised dealer that I know of. Manac-

com is based in Sydney, tel: (02) 875 3538.

Frankly, a good job though these people have done in publicising freeware and distributing it in an organised way, you should deal with them with your eyes open. Mixed in among the share and freeware are plain, honest 'buy-now-regret-it-later' programs from standard authors which you are *not* free to test and return if you don't like them. And the catalogues don't always make the distinction clear. (So far, most of my browsing among the treasures of PC-SIG have been through the Source's electronic user group). What kind of programs can you find there?

Top of the list is Procomm, a communications program, and ARC51, an archival and data compression program. Procomm is optimised for fast software downloading, and ARC reduces almost any program or text file to a third of its normal size. Between the two of them, you can get software off a bulletin board at a fraction of the connect time normally taken. Worst surprise so far: FreeWord. This is advertised as a word processor and is almost worth downloading, just so that you can tell your friends how awful it is. It barely accepts text, goes into stasis if asked to back-up a page, runs out of 512k of memory when asked to load a 64k file, takes half a minute to clear its memory (what on earth does it do this for?) at the end of an edit session, and performs almost none of its functions.



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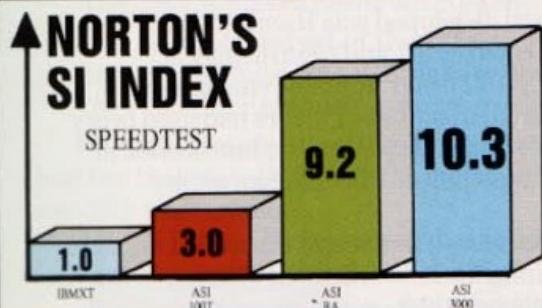
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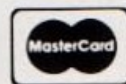
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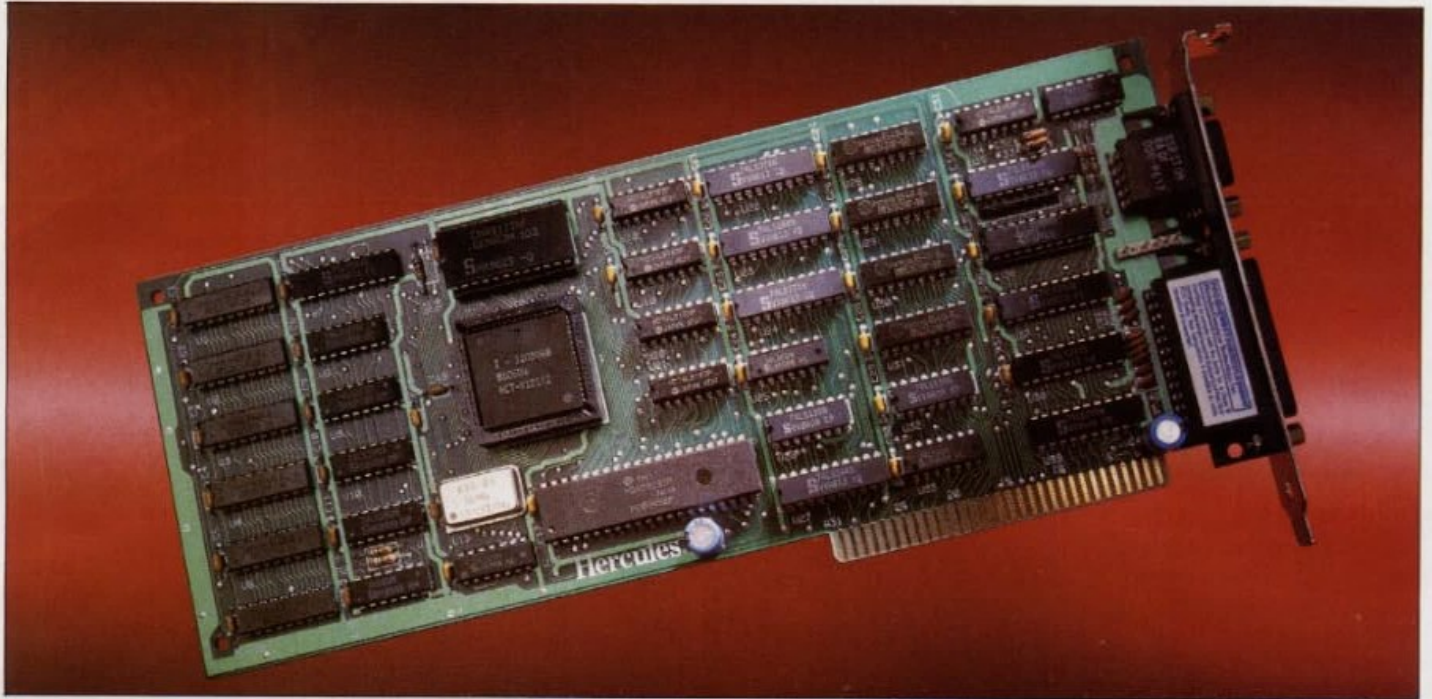
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The idea for RamFont first occurred to Hercules co-founder and chief engineer Van Suwannukul, two years ago.

At the time he was working with Microsoft engineers on their new word processor, later known as Microsoft Word.

Microsoft's engineers knew that soon there would be very high resolution laser printers offering multiple typefaces.

They reasoned that if you could print italics and boldface, you should be able to see italics and boldface on the display.

Unfortunately, the Microsoft engineers were ahead of their time.

It was not possible, with the graphics cards that existed at the time, to get both the flexibility to display multiple typefaces, and the speed that is

essential to a word processor.

Van knew that to solve Microsoft's problem, new hardware would be needed.

So he invented RamFont.

Word 3 - Three times faster.

Two years later, the Hercules Graphics Card Plus was ready.

What Van had developed was RamFont, a new mode that could store, and then display at lightning speed, 3072 programmable characters.

By this time, Microsoft's engineers had used every trick in the book to speed up Word, and succeeded in making Word 3 considerably faster than earlier versions.

However, for many users it still wasn't fast enough.

So you can imagine how delighted Microsoft's engineers were when they saw Word 3 running over three times faster on the Hercules Graphics Card Plus.

At last their word processor could really process.

1-2-3 Release 2 fulfills its promise

At Hercules, we knew that this was just the tip of the iceberg. RamFont was a revolution waiting to happen.

The more we used it, the more possibilities opened up.

Take 1-2-3 Release 2 for example.

Release 2 has an optional character set that nearly doubles the size of the viewable spreadsheet.

It's a great idea... until you try scrolling up and down or right and left. It takes forever.

As RamFont has the ability to display characters ranging in size from 8 by 4 to 9 by 16, it was easy to adapt Release 2's smaller characters.



VAN SUWANUKUL AND
KEVIN JENKINS, CO-FOUNDERS
HERCULES

The result is that now you can scroll a far larger spreadsheet as fast as version 1A could scroll a smaller one.

Then another idea occurred to us.

If RamFont could be programmed to display characters, why couldn't it be programmed to display graphics?

Well, it turned out it could.

So we did a bit more work and now you can draw 1-2-3 graphs in a window on top of your spreadsheet, and view your data in the background.

(Or, you can still view a graph on a full screen if you prefer.)

We liked what RamFont did for Word and 1-2-3 so much we did the same thing for Symphony and Framework.

Can a graphics card be a work of art?

Van will tell you that the Hercules Graphics Card Plus is the best monochrome graphics card he's ever designed.

Which is significant because 1) Van is not given to exaggeration, and 2) his three previous designs have met with a certain degree of success.

What makes the Graphics Card Plus so good is a chip Van designed called the V112.

The V112 does three things.

First, it runs every single one of the thousands of programs written for the IBM Monochrome Display/Printer Adapter.

Second, it runs every single program written for the famous Hercules 720 x 348 graphics standard.

And third, it makes RamFont possible.

Survival of the fittest

Actually, chips like the V112 do something else. They make our products even more reliable.

One chip manufacturer was astonished when we told him that we test 100% of the nodes on a chip. He said 93% was common.

By testing each chip individually to such high specifications, we are able to weed out weak V112s before they go to assembly.

Then we subject the survivors to more testing at temperatures above 70°C, weeding out whatever weaklings are left.

After the V112 has been

thoroughly tested, we insert it into a fully assembled Graphics Card Plus. (Incidentally, all our PC boards are 100% tested, which is another rarity.)

Then batches of the finished product are heated in ovens to greater temperatures than you are ever likely to encounter.



LOTUS
1-2-3 RELEASE 2

While still hot, the Graphics Card Plus is placed in a PC just like the one you use, and we run special software that exhaustively tests all functions.

Then, as a final precaution, each tested unit is carefully placed in an anti-static bag to protect it during shipment.

Free software, and parallel ports.

Hercules has become famous for the software we include with each monochrome graphics card.

And the Graphics Card Plus has the best software yet.

You get a program to extend the life of your monitor.

And to print graphics.

Then Fontman, a program that makes it easy to create your own RamFont characters.

Plus 25 fonts to get you started.

Plus

everything you need to run 1-2-3

Release 2,

Microsoft Word 3,

Symphony 1.1,

and

Framework II.

And the

Graphics Card Plus comes with

a parallel printer port that you can

disable. (Some PC compatibles require this.)

What price perfection?

With the RamFont breakthrough, 100% compatibility with our original card, free software, a parallel printer port, and the Hercules Graphics Card Plus should cost at least \$1200.

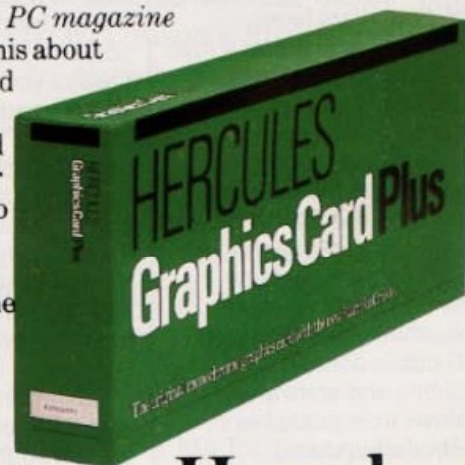
Surprise. Its suggested list price is only \$595 ex. tax.

If you think that the Graphics Card Plus must be the ultimate monochrome card, you're not alone.

John Dvorak, *PC magazine* columnist, said this about the Graphics Card Plus:

"If you intend to buy an IBM or clone and want to run a monochrome system, this is the card to get. I wouldn't even think about anything else."

Neither would we.



Hercules.

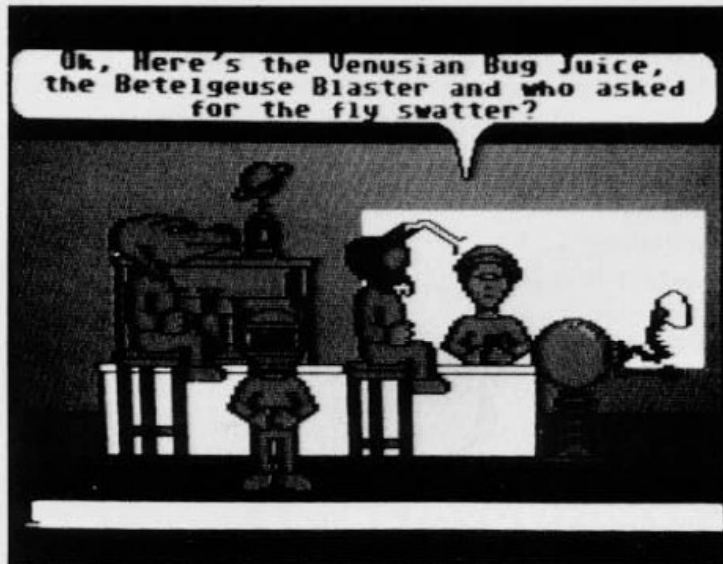
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Trademarks/Owners: IBM/IBM, Lotus, 1-2-3, Symphony/Lotus, Microsoft, Framework II/Ashton-Tate, Hercules, RamFont, Font Man/Hercules.

Derek Cohen previews some of the highlights from the Consumer Electronics Show In Las Vegas



No chance of getting bored with Habitat for the Commodore — all tastes are catered for with this system

Commodore's habitat

Imagine a cross between Little Computer People and a bulletin board/chatline. Now imagine that system designed by George Lucas — of *Star Wars* fame.

The result is Habitat, a real-time, multi-user online series of cities displayed in animated colour graphics on your own Commodore 64.

The system will soon be available in the US on Quantum Link, a sort of variation on Viatel which contains numerous information services, chatlines, a library of 5000 public domain programs and software previews from publishers like Broderbund and Electronic Arts.

In Habitat you wander around the town, meeting people, holding private chats in various rooms, and even gaining Habitat money to spend by selling services.

To enter Habitat you have to purchase a \$US30 disk. On logging on for the first

time you are given the opportunity to design your own body appearance — clothing and hairstyle. This image is also how other people on the system see you on their screens. And should you get tired of your latest rig, a trip to the head shop or the purchase of a body sprayer from a Habit vending machine can make you into a new person — instantly. To help pay for things, money keeps appearing in your pocket from a trust fund that each Habitat member has.

Habitat residents converse with each other by typing at the keyboard. The words appear as speech bubbles above their heads. In addition there are conferences.

The trick which makes Habitat and the rest of Quantum Link's graphics possible is that the system treats the 64 as an intelligent rather than as a dumb terminal. So, for example, when you

enter a new room or region in Habitat there is a small delay during which the total description of the place and its objects is loaded down the phone line. Then, when you walk around, updating the screen can happen locally, and at speed.

Access to Quantum Link costs about 10c per minute including the cost of the phone call, but a number of the services costs extra.

New applications for GEOS

Since its launch last year, the GEOS operating environment from Berkeley Softworks has caused quite a stir in the Commodore 64 world. It takes the slow 1541 disk drive and unfriendly operating system, and turns it into a fast windows and icon-based system.

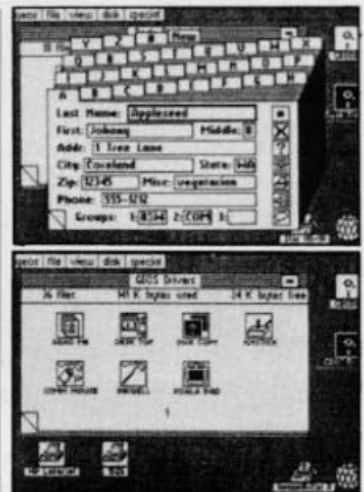
While third parties are already gearing up to launch programs to run under GEOS, Berkeley Softworks has itself produced a new desktop and applications.

Writer's Workshop includes an upgraded GeoWrite, Text Grabber, to port text from other applications, a laser printer driver, mail merge plus additional printer drivers.

GeoWrite can be enhanced with Fontpack 1 which contains 20 extra fonts for use in any GEOS applications. Each is available in one to four sizes.

GeoDex is a card-indexed program for names and addresses with the possibility of grouping people and searching on a number of criteria.

As if these weren't mouth-watering enough, an 80-column version of GEOS is promised for April as well as



one which fully uses the capabilities of the C128.

For fitness freaks only

At last an alternative to the joystick for those who need to exercise more than their fingers. Bandai's Family Fun Fitness system is a pressure-sensitive floor mat that plugs into a Nintendo games console.

The player clears hurdles and obstacles by jumping on the relevant spots on the mat and the figure on the screen mimics the actions.

Fortunately, when you miss and fall in the river, the Nintendo machine doesn't throw a bucket of water at you.



END

NewsMaster

Specialty Desktop Publishing program

NewsMaster is an affordable desktop publishing program that combines high quality graphics and versatile text processing capabilities in an easy-to-use format. It has been specially designed for dot-matrix printer owners who want to create professional quality newsletters, bulletins, schedules, ads, charts, menus, and a variety of other materials. In addition, NewsMaster also works with laser printers.

Easy to Learn and Simple to Use

You can use NewsMaster to create text files as easily as you would on any word processor.

Features include:

- Mixing of lines, text, boxes and clip art
- Choose from four different page views - expanded, normal, full-width and full page - with 8 levels of zoom. And you maintain complete editing capabilities regardless of the view.

Extremely Versatile

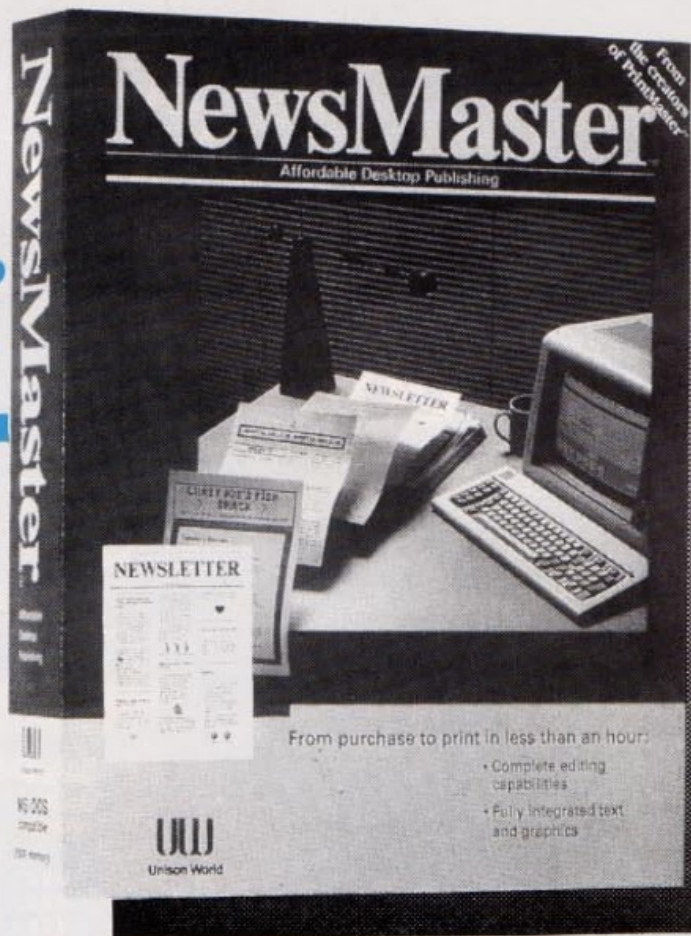
Layout options include a choice of 1-10 columns per page, with multiple pages in a single document.

Automatic Text Flow

With NewsMaster your body copy automatically flows from column to column and page to page.

Full editing Capabilities

You can cut, paste and copy both artwork and text. And you can change type-fonts even after you have entered the text. You can also incorporate ASCII files created by most word processing programs. NewsMaster's fast text and screen updating places no limit on your typing speed.



Over 30 Different Type Fonts

Choose from serif and sans serif faces, bold, medium, italic, and condensed versions, in various sizes ranging from 8 to 60 points.

Over 250 pieces of Clip Art

Pick the pictures and placement on the page. Even use graphics from Unison's PrintMaster. All graphics can be stretched, cropped and flipped.

Graphics Tools

Vertical, horizontal and box lines of any width can be drawn anywhere on the page. Boxes can be filled with your choice of 30 different patterns.

Technical Information

NewsMaster is available for MS-DOS compatible computers. It requires CGA, EGA or Hercules graphics capabilities. Minimum memory: 256K.

Recommended Retail Price: \$159.85 inc tax

NewsMaster is available from computer software suppliers around Australia. For the address of a supplier near you, contact the Australian distributor:

dataflow Computer Services Pty. Ltd.
134 Barcom Ave, RUSHCUTTERS BAY 2011 Ph: (02) 331 6153

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NEC APCIV



Commodore Amiga A500

Commodore's new Amiga A500 has all the fundamental tell-tale signs of an Amiga 1000, but has lost a lot of its bulk and price. Phil Cohen sneaks a preview of what it's got to offer.

The Commodore Amiga A500 is a re-engineered but otherwise functionally identical version of the A1000 'original' Amiga, and as such is not a very exciting advance. However, the A1000 was itself, and still is, an exciting machine in its own right.

Basically the Amiga is a superb graphics and sound engine, with the same processor (the 68000) as the Apple Macintosh and a very rich implementation of the Xerox/Mac windows environment. It could even be argued that what Apple started with the Macintosh environment, Commodore has perfected for the micro.

Hardware

The biggest difference between the A1000 and the A500 is the case. The original Amiga had a case about the same size as an IBM PC, and was designed so that the monitor (which, in this country, is bundled with the computer) sat on top of the main unit. There was

a separate keyboard (which cleverly slid underneath the front of the main unit to allow room for the mouse to play) and essentially the bundle, which included a mouse, was all the hardware you had to buy.

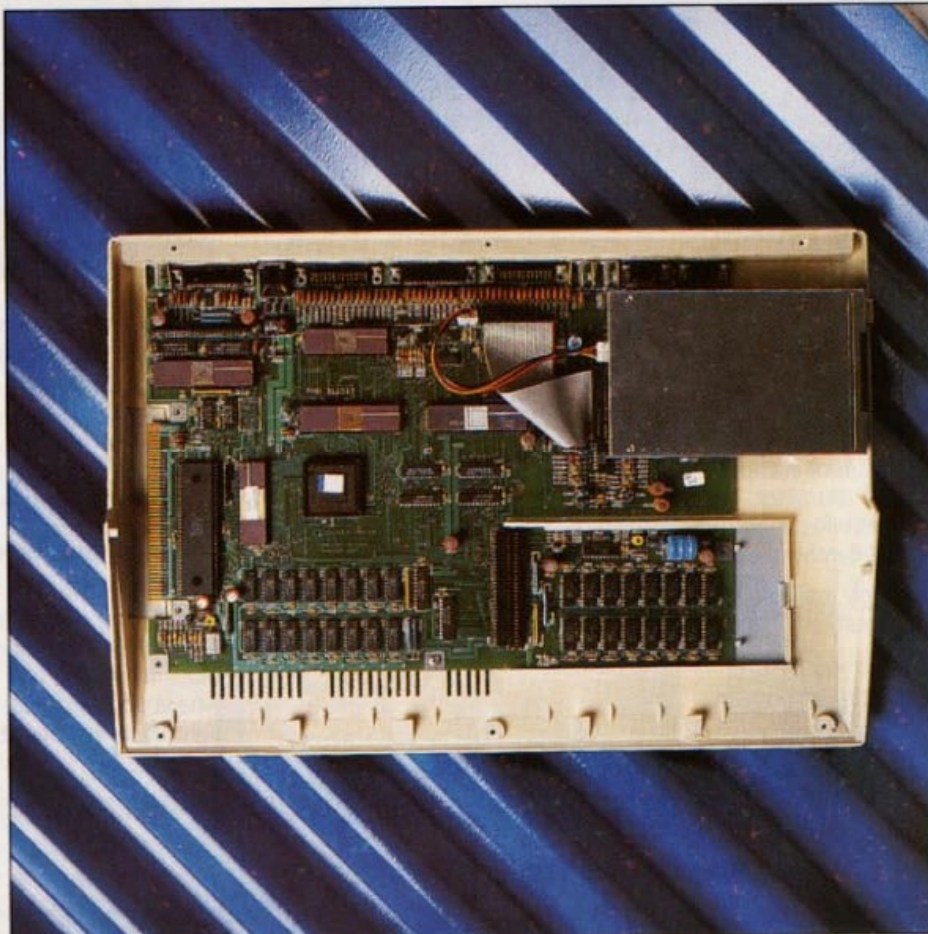
But the A500 is a totally different ket-

tle of fish. It's modelled more on the infamous Commodore 64 and 128 with the keyboard and CPU all in one slope-fronted unit and the power supply in a separate 'brick' rather than within the main unit itself.

The resemblance to the C-64 is taken

even further by the addition (although not with this pre-production model) of a UHF RF modulator which invites users to plug the A500 into their colour TV set rather than into a colour monitor.

The pre-production model I was given for review was also supplied with a rather smart soft carrying case, which included little pockets for holding 3.5in disks, manuals, and so on. So who is this new Amiga aimed at? Certainly it is possible to use it in just the same way as the old A1000, by attaching an RGB monitor, but that is not Commodore's aim at all. Commodore say that the A500 is tar-



C&PA

Whether you produce a few letters a day or thousands, Qume's range of letter quality printers can handle it. From the low cost LetterPro range to the power of the LaserTEN we have the printer for you. All with Qume's legendary reliability. All sold and supported nationally by C&PA.

The LaserTEN

If you're producing up to 5,000 pages a month and the highest quality is essential, the LaserTEN is the solution. This is the first laser printer designed specifically as a high production business machine for either individual or multi-user computer systems. It will fit effortlessly into your business and start working for you right away. Simple plug-in interface modules make it compatible with all major business computers and word processors. Emulations of popular laser, daisywheel and dot matrix printers eliminate software modifications. It will feed three sizes of paper, film and envelopes.



LetterPro personal printers

Top quality daisywheel printing is now affordable by even the smallest business. The LetterPro 20 is Qume's lowest priced daisywheel printer. Yet it still delivers crisp, clear printing at a full 22 characters per second.

And if you need higher output without the high price tag, the LetterPro PLUS is the answer. It prints at a fast 45 characters per second and has an 8K buffer memory that can handle up to four pages of text. And thanks to built-in Centronics and RS-232 interfaces, one LetterPro PLUS can be used with a variety of systems.

Both LetterPros use widely available Qume ribbons and daisywheels (with a choice of over 100 different typesyles).

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You can't buy a faster daisywheel printer. At 90 characters per second, the SPRINT II/90 PLUS is nearly as fast as a dot-matrix printer, but with the high quality of a daisywheel. And this incredible speed doesn't sacrifice anything in quality or reliability. Its reliability rating is almost a year longer than any other letter quality printer, regardless of speed.



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THE FARWAGI COMPANY 7158A

getted at the home and education market, squarely at the market where machines like the Macintosh and the ill-fated IBM PCjr were aimed. Of course, the A500 is cheaper and has colour, and is a more powerful machine . . . but it's also late in the market and is not compatible with much software.

Commodore is projecting sales of 20,000 units in the coming year, three times its claimed sales figure for the A1000. Apart from the 'cosmetic' differences, there are a few hardware additions which are intended to make the A500 more attractive. It will be sold in this country with 1Mbyte of RAM as standard (the A1000 has 512k), and with a battery-backed clock chip. Also, Commodore has dropped the ludicrous modifications to the serial and parallel ports to make the machine truly compatible with serial and parallel peripherals.

Both the RAM expansion and the clock/calendar fit into a little trapdoor on the bottom of the case, and that seems to be it for internal expansion.

But the same 86-pin bus connector appears on the side of the A500 although (and here I have to rely on my 64k memory!), I believe it's on the other side of the box to the expansion slot of the A1000. In any event, it's a good deal closer to the ground because the machine has a much lower profile. One or both of these details is going to cause a lot of grievance for engineers who are designing things to plug into the the Amiga. In the meantime, even if the slot is on the correct side it's going to involve putting a book or two under the A500 to get it to the right height. According to Commodore, the Hong Kong telephone directory is just the right height for the job (but do two Wongs make a height?).

There have been some changes to the keyboard, too. None of the old keys are missing, of course, but a few



Part of the reason for the A500's price cut is a cut-down component count

have been moved around. Commodore has adopted what is now I believe a world standard for cursor key placement, and put them in an upside-down T shape. The 'Del' and 'Help' keys have also been brought out into the open.

The numeric keypad has also mysteriously grown a new set of functions, which just happen to mirror the ones on the much-maligned IBM PC keypad. There are notations for 'Pg



The new integrated CPU and keyboard — very 128ish

Up', 'Pg Dn', and even 'Prt Sc'. I hope this is not the start of yet another *de facto* standard in keyboards based on what is already regarded (even by IBM) as being a clumsy way of doing things. On the right hand side of the A500 box is a 3.5in drive which is fully compatible with the one on the A1000.

Software

There is little to say about the software that runs on the A500 except that the Kickstart Bios which on the A1000 had to be loaded from disk, is included in ROM on the A500. Apart from that, the machine is claimed to be functionally identical to its older counterpart.

Released with the A500 is a new version of Workbench

(version 1.2) and a new version of Extras (also version 1.2). Workbench now has a number of new utilities, including an icon editor, a text to speech utility (presumably the same one used in Basic), a 'setmap' utility which allows you to set up the machine for different keyboard standards (German, French, etc), a graphic printing utility, and a pop-up calculator. There is also a new tool called KeyToy which shows you what the current keyboard map looks like.

The Enhanced Extras package has a whole lot of new stuff, including utilities for copying to and from IBM PC disk format, given that you have a 5 $\frac{1}{4}$ in disk drive connected somewhere in the system. Extras includes a text editor, font editor, print spooler, and other utilities.

It also contains a utility called 'performance monitor' which, for those of you who like me own an 'ordinary' PC is something of an eye-opener. Performance monitor keeps track on a second-by-second basis of the level of utilisation of the CPU and other devices in the machine, and shows them on a graph in real time while you are running other tasks.

Before Xerox Ventura

Which would you rather read?

If you chose the ad on the right hand page and you own an IBM or compatible PC, you'll be pleased to hear that Xerox Ventura Publisher has arrived!

Professional Layouts

Now even the most inexperienced user can create professional looking documents. Xerox Ventura Publisher accepts and combines graphics with text from a number of graphics, spreadsheet and wordprocessing packages. It even takes images from GEM, PC Paintbrush or scanners.

Simply choose a pre-set style sheet, or create your own style sheet, enter your text and Ventura will generate a completely formatted document and display it on your screen - exactly as it will appear when you print it.

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This combination of graphics with text produces documents previously unachievable in the IBM workplace.

For the IBM and compatible PC user, that means you no longer need expensive typesetting and graphic artistry to produce great looking documents.

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One of the great advantages of publishing your own documents is speed. If you want to publish today and not tomorrow, it is important to be free of external suppliers and their timings, particularly with presentation documents and newsletters.

The speed with which Xerox Ventura Publisher runs on the IBM AT has been described in a published review as "staggering" - load a 10 page document in less than 20 seconds! Even on the IBM XT, you'll find that Xerox Ventura Publisher runs faster than most programs on an IBM AT.

Easier Editing

Editing is also faster, because Xerox Ventura Publisher is document- rather than page-oriented. The pre-formatted style sheets allow you to re-format your entire document instantly. Time-saving devices such as automatic page numbering, footnotes, and section numbering, makes finding the right information quicker and easier for the user. Xerox Ventura Publisher will also create an automatic Table of Contents as well as automatic headers and footers.

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To achieve a document with the same standard of finish as the right hand page all, you need is Xerox Ventura Publisher linked to a laser printer. Or if you really want you can still print on a dot matrix printer demonstrated on the left-hand page.

What is Desktop publishing?

If you're in business, you're also in the business of publishing documents, whether for internal or external use. And because it is a reflection of you and your business, desktop publishing (DTP), simply means using a personal computer to produce a document, printed with a laser printer.

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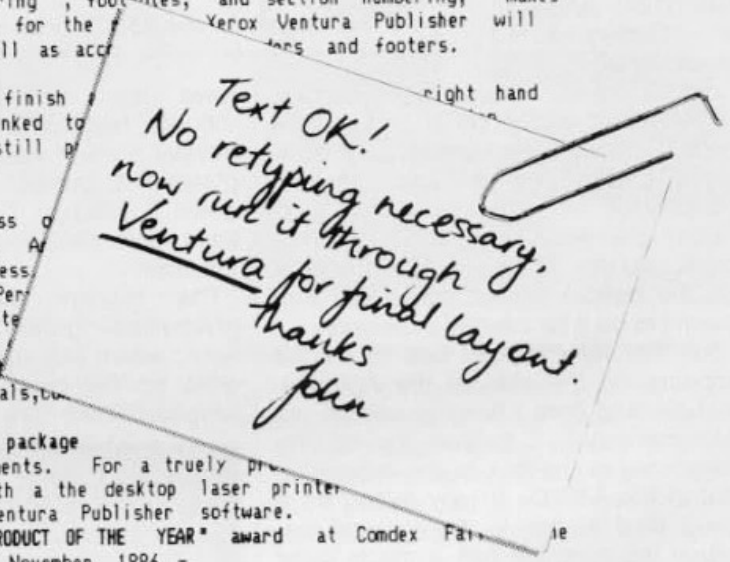
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Save time and money by publishing your own documents. For a truly professional look you'll need is an IBM compatible PC teamed with a the desktop laser printer (Xerox 4045 laser printer) and of course Xerox Ventura Publisher software. Xerox Ventura Publisher won "PC SOFTWARE PRODUCT OF THE YEAR" award at Comdex Fall 1986 - the worlds largest computer software exhibition - in November 1986 -

Want to know more?

If you would like to know more about how Xerox Ventura Publisher can improve the look of your documents, cut out the coupon opposite and mail it today. Xerox Ventura Publisher is available from Megavision Authorized Software Dealers and Xerox Authorised Laser Printer Dealers.

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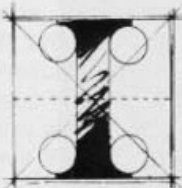


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- Memos
- Newsletters
- Technical manuals
- Sales Proposals
- Contracts
- Forms
- Marketing documents
- Reports
- Presentations



Put together your own desktop publishing package

(PC with laser printer and Xerox Ventura Publisher on desk). Save time and money by publishing your own documents. For a truly professional finish all you'll need is an IBM compatible PC teamed with a desktop laser printer (such as the Xerox 4045 laser printer) and of course Xerox Ventura Publisher software.

hyphenation and justification changes are made to fit the text and graphics neatly together.

This combination of graphics with text produces documents previously unachievable in the IBM workplace.

For the IBM or compatible PC user, that means you no longer need expensive typesetting and graphic artistry to produce great looking documents.

Faster Publishing

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demonstrated on the left-hand page.

Want to know more?

If you would like to know more about how Xerox Ventura Publisher can improve the look of your documents, cut out the coupon opposite and mail it today. Xerox Ventura Publisher is available from Megavision Authorised Software Dealers and Xerox Authorised Laser Printer Dealers. Rank Xerox Free Post 2, PYMBLE NSW 2073

WOULD YOU BELIEVE?

Believe it or not, this entire advertisement (typesetting, graphics and layout) was created in less than 5 minutes using an IBM compatible PC teamed with a desktop laser printer, a scanner and Xerox Ventura Publisher software. It was also designed by a person with little formal training in computer operation or professional print production. (All this text was already on a disk for the left hand page advertisement ... so no time was wasted retyping. The text was simply converted with the Xerox Ventura Publisher.)

RANK XEROX FREE POST (2)
PYMBLE NSW 2073

YES

I would like to know more about new Xerox Ventura Publisher. Please rush me further information on its amazing desktop publishing capabilities.

NAME _____

COMPANY _____

ADDRESS _____

POSTCODE _____

PHONE _____

XEROX

The First. Others can only copy.

Despite all of the above mentioned fantastic utilities and development tools, applications software for the Amiga continues to roll in fairly slowly, and consists mainly of paint, animation and sound packages.

There doesn't seem to be much in the way of business software (Commodore will no doubt disagree with me), and when people develop business software for the Amiga it's usually because of its animation or sound — take for example a system under development in Australia which uses the fantastic graphics capabilities of the Amiga to help dentists keep their patient records by producing drawings of the inside of each mouth.

If you had a great idea for a new business package, which machine would you develop it for: the Amiga or the IBM PC? The answer for most people is that they would only choose the Amiga when they *needed* to, which is exactly what is happening. So there is a lot of pretty software available — but how does this affect what Commodore is now trying to do with the new version of the machine? Are there enough games around to sell the machines into homes? Not really. Are there enough educational packages to sell the machine into schools? Not really.

The Amiga is a superb *son et lumier* machine, great for paint packages and MIDI interface tune editors. It would undoubtedly be a marvellous machine for either the home or school, but the question is whether it can get over the software hurdle. Up to now, everyone has been expecting the Amiga to go up rather than down — it's a graphics and sound machine, isn't it, rather than just a games machine?

It will undoubtedly take a while for games developers to really start marketing software for the Amiga that will take it into the 1987 Christmas stocking, and educational software developers will probably take even longer to get to grips with the machine.

Price

It's not even as if the price of the machine were incredibly low. Commodore will sell the A500 for around \$1300. Now at first glance, this looks like a major drop from the \$2500 that Commodore is asking for the A1000, but it's not.

For a start, the street price of the A1000 is around \$2000.

Secondly, the price of the A1000 includes a quality RGB monitor which would easily be worth \$700. That



takes us down to . . . \$1300. So the A500 is not really cheaper than the A1000, except when you consider the additional memory, clock, Kickstart ROM and so on. That's against the fact that the A1000 has a separate keyboard.

Certainly, the entry price of the A500 is lower, but with a C-64 costing a couple of hundred dollars, it's still not *that* low.

Conclusion

There is no doubt in my mind that the Amiga is a technically superb computer. The dedicated graphics and sound chips set it apart from almost any other machine on the market. For animation, sound and graphics it is amazing.

But is it really cut out to be a games machine? And can it meet the prime requirements for an educational machine — good software availability and low price in quantity?

I'll be interested to see at what price Commodore will be offering the A500 to the education departments. The component count of the machine is about one third that of the A1000, and the retail price (as I've already discussed) is about the same level. For real quantity, the A500 may yet have a few price tricks up its sleeve. Maybe we'll even see the same price breaks in the retail market when sales start to move later this year — heavy discounting could become the order of the day, especially if that's the game the competition is playing as well. I for one would love to see an Amiga in every school. The internals of the machine, and its operating system, are not just state of the art, they are actually new ground.

END

Technical specifications

Processor:	Motorola MC68000
RAM:	1Mbyte, externally expandable to 8Mbytes
Mass storage:	One built-in 3.5in double-sided disk with an 880k formatted capacity
Keyboard:	94 keys
I/O:	RS232 serial, Centronics parallel, external disk drive, two mouse ports, stereo sound outputs, RGB monitor, UHF TV
Operating system:	AmigaDos

Commodore PC5

Commodore has done a similar thing to its PC line as to the Amiga: released a cut-down version. The cut-down PC is called the PC5.

The difference is that, while the Amiga A500 is a re-tooled version of an otherwise identical and very powerful machine, the PC5 is very much a pale shadow of other machines on the market. The PC10 and PC20 have been around for some time — the PC10 is a dual floppy version and the PC20 a 20Mbytes hard disk machine — and the only way Commodore could go down from the PC10 was to take one of the disk drives out. That's just what it did. The PC5 has one floppy drive, which as it stands makes it just about useless for most business applications.

It does, however have a respectable amount of RAM (512k), four free slots, and comes bundled with a little desktop application (word processor, database, etc) called Able One. But the price (\$1495 including monitor, keyboard, 512k and one floppy) is the most significant thing about it, putting it firmly in the ranks of the Taiwanese clones in terms of cost per box.



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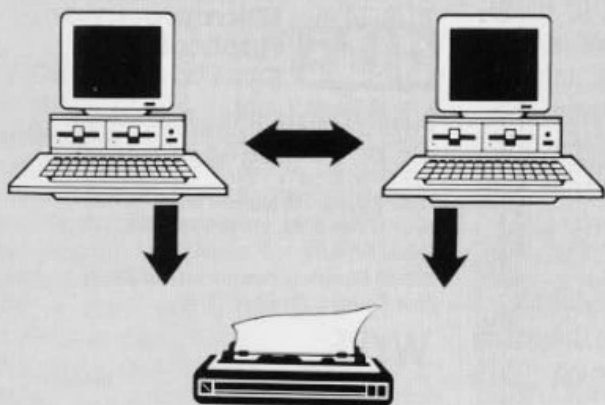
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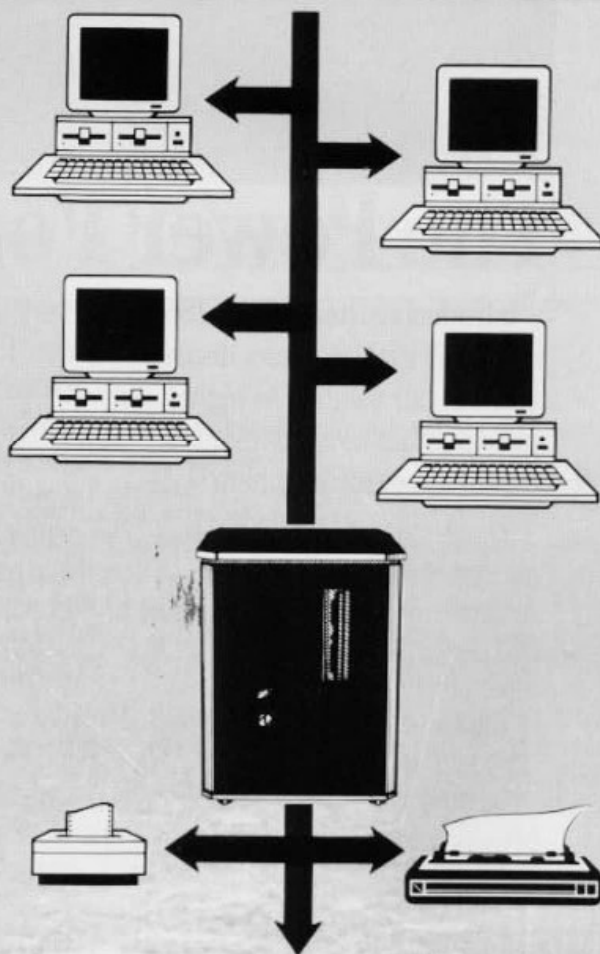
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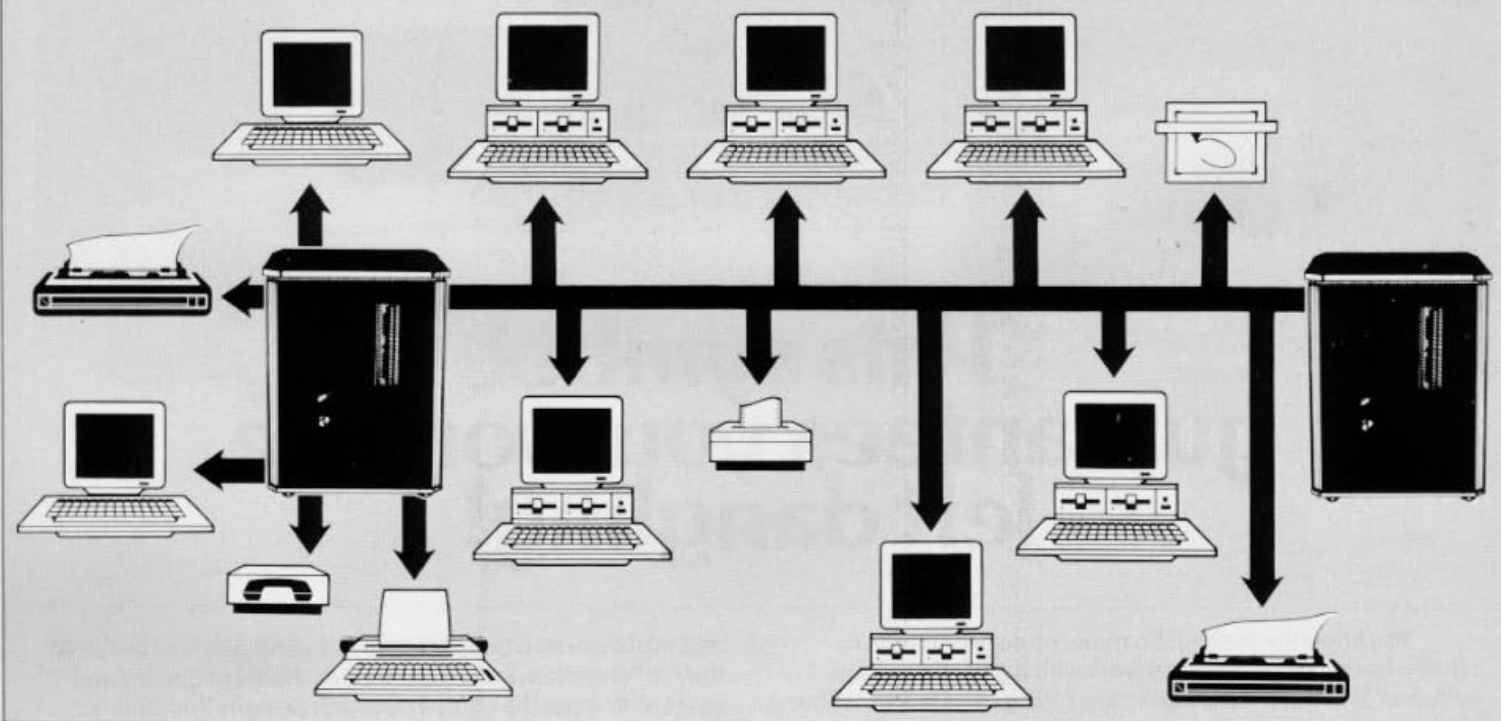
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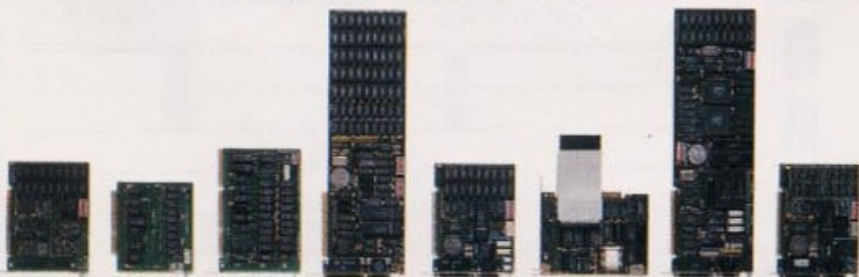
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*Hypertec featured in the first four places in no less than three hardware categories in the 1986 PC World Class Awards.

Mac II/Mac SE

We all knew it would come — but didn't know when. Apple has finally released its open-architecture, IBM-compatible PC with colour screen — the Macintosh II — as well as a high performance Macintosh — the Macintosh SE. Stuart Kennedy presents a sneak preview.



Apple's future direction: the Mac 11 (on the left) and the Mac SE

Apple has released two new Macintoshes as well as a bevy of peripherals — the most new hardware to come from the company in one hit during its nine years of commercial life.

The Macintosh line up now consists of the familiar Macintosh Plus at entry level, a jumped up Macintosh Plus called the SE for those who want a tad more performance and improved on-board mass storage and the top dog Macintosh II for so called power users who dream of Cray II supercomputers in their sleep.

Hardware

The subject of this preview is the Macintosh SE, which, of the two machines released, is the only one cur-

rently in Australia. Next month APC will have a full Benchtest of the Macintosh II but in the meantime this is what you can expect: the Macintosh II looks like an up-market IBM PC clone with its conventional case, detached keyboard and monitor stacked on top. However, inside the case lies a hot rod which is anything but one of Big Blue's 'staid old micros'.

At the heart of the Macintosh II sits a Motorola 68020, a true 32-bit CPU cracking along at 15.7MHz — double the clock speed of previous Macintoshes. Snuggled in next to the 68020 is its mathematical cousin, the 6881 floating point co-processor which Apple says can speed up some calculations by as much as 300 per cent. Just the ticket for calculating complex 3D

graphics manipulations or zipping through an equation packed spreadsheet.

Apple claims a healthy two mips for the Macintosh II which means it processes information around four times faster than the Macintosh Plus. This same chip set forms the base of super-micros from companies such as Sun and Apollo.

These true supermicros, known as technical workstations, are beloved of scientists, engineers and other computer-aided design boffins who need all the mips that can be had from a desktop machine.

Standard memory for the Macintosh II has been pegged at 1Mbyte, although this can be expanded to 8Mbytes on-board using 1Mbyte Single Inline

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Finished documents can be printed on standard dot-matrix, laser or colour ink-jet printers, or they can be output to phototypesetters.

While AT-class computers will give super performance, Ventura Publisher will run quite acceptably on a standard PC provided it has at least 512K memory, Winchester disk and graphics card. A mouse is also required. Printers and image scanners are optional, depending on your needs.

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IBM-compatible function keys now adorn a Mac



The Mac SE sports IIGS-like keyboard

Memory Modules (SIMMs) or an elephantine 1.5 gigabytes with the optional 68851 Paged Memory Management Unit (PMMU) and add-on cards.

There are two basic configurations available. The first has a single 800k 3.5in floppy disk with the option of another 800k drive or 40Mbytes hard disk, while the other has an 800k floppy and a 40Mbytes internal hard disk.

Inside the Macintosh II's case are six slots which well and truly change Apple's previous 'locked box' philosophy. Everyman, his dog and legions of hungry third party add-on board manufacturers can get at the Macintosh II's bus. A whole new Apple add-on industry will probably emerge overnight with fortunes being made by engineers with the right products at the right price.

The NuBus which handles the expansion slots is an industry standard bus able to shift data at 10Mbytes per second and is also capable of 'fair arbitration and geographical addressing'. Far from being a plug for Australia's method of trade union negotiations this gobbledygook means that any add-on card can fully identify itself at power up without the user having to go through a tedious configuration procedure. It also means that any card can sit in any slot.

One slot is already occupied by an Apple video card which puts an end to the Mac's often criticised colour blindness when hooked up to the optional 12in Apple Analogue Colour Monitor. There is a cheaper 13in Apple Analogue Monochrome Monitor for those who prefer to see things in black on white. Both monitors have a non-interlaced scan rate of 66.7Hz which should mean flicker free viewing and the monochrome version is capable of true grey shades.

Screen resolution is 640 x 480 pixels at a density of 76 dots per inch in monochrome and 69 dots per inch in colour. The new display card has 256k of video memory standard, with an upgrade option of 512k. This gives four attribute bits per pixel to display up to

16 colours or grey scales standard and eight bits per pixel for up to 256 colours or grey scales on the upgraded card. The colour palette supplies a mind boggling 16 million colours allowing fussy Macpainters to choose between black, white, grey, red, green, blue, chartreuse. . .

The Macintosh II's ROM has grown to 256k to accommodate new routines such as Colour Quickdraw, but Apple Australia is hazy over what else is in there. One source said that the bulk of the extra 128k was empty space for future enhancements.

There are two keyboards available — the standard one has 81 keys and is similar, if somewhat larger to the keyboard used on the Apple IIGS. Both hook through the Apple Desktop Bus first introduced on the IIGS. This device allows input devices like mice and graphics tablets to be daisy chained, giving the user as many peripherals as desired. The optional keyboard has an extra 25 ivories including a 'T' shaped cursor pad and functions keys for those who like to run MS-DOS applications.

MS-DOS applications? Yes, Apple has decided to knuckle under to the IBM-compatible world after pretending it did not exist for years and accommodate all those people whose first move after buying a slotted Macintosh will be to add an IBM-compatible card. If this sounds like heresy call it *realpolitik*.

AST Research in the US has already announced an IBM-compatible board for the Macintosh II and SE, jointly developed with Phoenix and Apple, which allows the user to run MS-DOS applications in a window much like the Amiga's Sidecar.

Music, speech and bleeps come via a new proprietary four voice sound chip which has a sampling rate of 44KHz — twice the rate of the chip used in the Macintosh Plus.

Communication ports on both the Macintosh II and the SE consist of two RS422 connections, an external drive

socket, a SCSI port, a phono socket and a Desktop Bus socket for the mouse.

The SE is a refinement of the Macintosh Plus rather than a brand new machine like the Macintosh II.

The Macintosh SE looks very much like a Macintosh Plus on the outside, but the colour has been changed to a high tech platinum. I prefer the previous cosy beige but there is no accounting for taste (or marketing departments looking for product differentiation).

Inside, the motherboard has been completely redesigned. Apple has whittled the chip count down from 42 on the Macintosh Plus to 26 on the Macintosh SE. The SE uses the same CPU as the Macintosh Plus — a Motorola 68000 running at 7.8MHz.

However, Apple claims an average speed increase for the SE of 15 per cent due to firmware changes — the SE carries the same 256k ROM as the Macintosh II — and a new graphics chip which takes a lot of the graphics workload off the CPU. The screen now updates four times faster than the Macintosh Plus and this is especially evident when scrolling a window. Lines of text flow up and down very smoothly and scrolling a picture no longer stalls the screen for seconds at a time.

Screen resolution remains the same as the Macintosh Plus at 512 x 350 pixels, however the expansion slot could be used to give it colour capabilities, although Apple has not announced a colour card for the machine.

Other improvements on the Macintosh SE are a range of internal mass storage options and a single 96 pin Euro din expansion slot.

The expansion slot is inside the case, not poking out the back as one might expect. There are two holes in the back covered by plastic plates with one hole for ribbon cables to run out of and the other giving dexterous fingers access to the internal slot.

The din slot is not compatible with the Macintosh II's NuBus slots so cards

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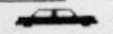
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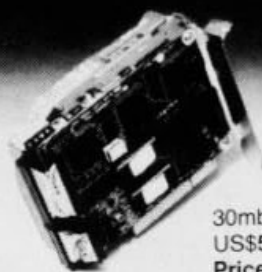
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PREVIEW

will not be interchangeable between the two models. Apple is saying that all add-on cards must be dealer installed to keep warranty but I expect anarchy will prevail.

In Australia, the Macintosh SE will be offered in two configurations. The base machine has two 800k 3.5in drives while the upmarket model features one 800k drive and a 20Mbytes hard disk. The power supply has been upgraded to 75 watts and a fan installed to cope with the extra heat. Now we have a Macintosh which whirrs — another stab at Steve Jobs' once holy design dictums. At least it's reasonably quiet.

Keyboard options are the same as the Macintosh II — either the standard 81 key unit or the optional 105 key model.

Bad news for Macintosh Plus owners is that Apple's new policy on upgrades is: 'definitely *no* upgrades.' If you own a Macintosh Plus and want an SE then you will have to purchase a whole new machine.

Software

The big software news is that the

Macintosh II is capable of running a full blown version of AT&T's Unix System V, once equipped with the optional 68851 PMMU. It is not known, however, whether Apple will be going into Unix itself or leaving that to interested third parties.

Meanwhile, the Macintosh disk operating system, called the Finder, has gone through another incarnation to version 5.4.

The new version has a number of aesthetic changes to dialog boxes and 'Get Info' windows and seems to manage windows more quick — even on the Macintosh Plus. There is a new, better laid out Control Panel and a very handy desk accessory called 'Find File' which can search for file name strings through deep layers of folders.

Compatibility could become even more of an issue than that of the Macintosh Plus and its Hierarchical File System. Apple says the Macintosh II can run 'the majority' of existing software but whether this means 51 per cent or 99 per cent is still unclear. Judging from the Macintosh II's radical specifications I would suspect a figure closer to the former. Macintosh SE

compatibility is currently pegged at 90 per cent.

Surprisingly Apple has not deigned to develop a multi-tasking operating system for the new machines — the Macintosh II especially could simultaneously run a number of present day Macintosh applications on its ear. Perhaps Apple is leaving that issue to Unix fanciers.

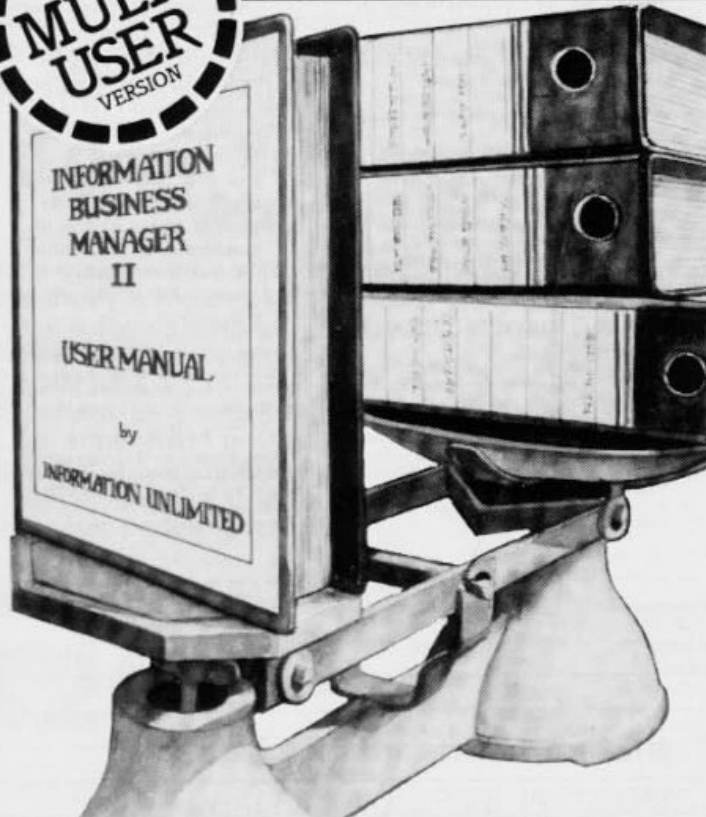
Good news for people who work on both Macintoshes and IBM PCs is the announcement of a 5.14in disk drive which can read MS-DOS files. The disk drive comes with a piece of software called Interchange which can change Macintosh files into IBM formats and vice versa. This means you can take an MS-DOS disk with say, Lotus 1-2-3 spreadsheets on it, put it into the 5.14in drive and convert the files into Excel readable format.

Prices

Apple Australia would not divulge any details of prices at press time, however all will no doubt be revealed during the first public showing at The Eighth Australian Personal Computer Show.

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So, in lieu of any information from Apple, I will have to make some 'guesstimations' which should be taken in the spirit they are given: the price of a Macintosh Plus will drop between \$500 and \$1000; the Macintosh SE will cost around \$5000 without a hard disk and an extra \$1500 with one; and the Macintosh II will cost \$8000 for a base unit with monochrome screen and \$11,000 for a colour unit with a hard disk.

Conclusion

Apple could not have chosen a better time than now to strike the market with a machine like the Macintosh II. The only mass market micros with a chance of competing are the new wave of Intel 80836 machines but this breed suffers from confusion over architecture and lack of an operating system able to take advantage of the vastly increased memory addressing and processing speed. It should be a formidable machine for the technical and scientific market, heavy duty desktop publishing and the so called 'power' business users.

The Macintosh SE is a logical mid-range model with improved perfor-

mance over the Macintosh Plus, an optional internal hard disk and a modest degree of expandability.

Stay tuned for a full Benchtest next month.

END

Technical specifications

Macintosh II:

Processor:	68020 at 15.7MHz and 6881 maths coprocessor
RAM:	1Mbyte expandable to 8Mbyte onboard
ROM:	256k
Keyboard:	Detachable 81 key full stroke keyboard and mouse or optional 105 key extended keyboard
Mass storage:	One 800k 3.5in drive drive, 40Mbytes hard disk, or second floppy optional
I/O:	Six NuBus expansion slots, two nine way RS422 ports, SCSI port and mouse port
DOS:	Macintosh Finder 5.4 or Unix System V

Macintosh SE:

Processor:	6800 at 7.8MHz
RAM:	1Mbyte expandable to 4Mbyte onboard
ROM:	256k
Keyboard:	Detachable 81 key full stroke keyboard and mouse or optional 105 key extended keyboard
Mass storage:	Two 800k 3.5 disk drives, optional 20Mbytes hard disk drive
I/O:	One 96 pin din slot, two nine way RS422 ports, SCSI port and mouse port
DOS:	Macintosh Finder 5.4

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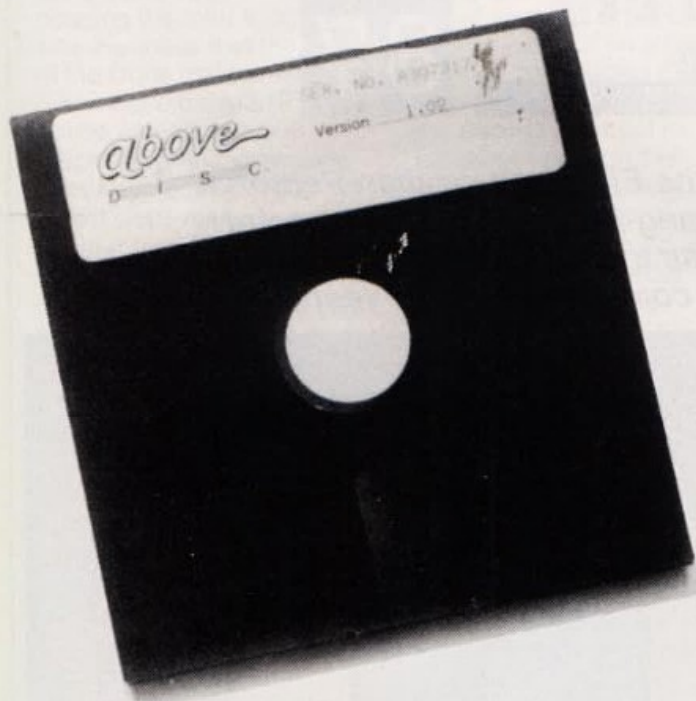
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CENTREPOINT SYDNEY 17-20 MARCH 1987



It's show time again in Sydney, and the Eighth Australian Personal Computer Show is starting with a bang in Sydney's Centrepont Tower on March 17. Garry Ross has a sneak preview of what promises to be the most exciting computer show in years.

If you think that computer shows are boring, stuffy events where the same tired people try to look enthusiastic about the same tired grey boxes, then you'd better not go to the PC87 Show at Sydney's Centrepont Tower, because you'll have your illusions rudely shattered.

This year's show crackles with new products including — not one — but two new Macintosh computers never before seen in this country; two new Amiga models, also not seen in this country; at least two and possibly more of the new Intel 80386-powered computers; new 19in monitors on which to use the several new page-making systems on show. . . the list goes on and on.

After several years in the doldrums, the computer industry has suddenly exploded into action again. And this year's show, which runs from March 17-20, looks like being the most exciting show in years.

Radical things have been happening at both Apple and Commodore. Both have two brand new models which will be unveiled to the Australian public at the show, and both have top-of-the-line models that break new ground.

The Macintosh II and the Amiga 2000 introduce expansion slots and varying degrees of IBM compatibility for the first time. True, Amiga had the Sidecar which allows the user to run



The star of the show: Apple's Macintosh II . . . can now run IBM-compatible software

PC software on a second processor (though it was a while before you could get files from one side of the fence to the other). But four of the Amiga 2000's expansion slots are IBM compatible and an optional co-processor board will now allow IBM and Amiga software to run concurrently.

The bright boys at Apple have not been resting on their laurels either. The Macintosh II is Apple's open architecture machine with eight expansion slots and the ability to plug in alternate processors. Anyone for Unix?

Actually, Apple's moves to accommodate the IBM world

go further than that. There is now an optional 5 $\frac{1}{4}$ in disk drive available, and the new extended keyboard has IBM-style function keys that should make it possible to run PC-style software as well.

The IBM camp has also been busy, though most of the activity has been taking

PREVIEW

place outside the inner sancta of International Business Machines itself. The clones are getting cheaper and more powerful.

Although Compaq was first out the door with a PC incorporating the Intel 80386, it was inevitable that the rest of the clone makers would follow close behind. There will be at least two 386 machines at the show, one from Kaypro, one of the oldest clone makers, and another from a new start-up called Vision. Others may turn up and it needs no crystal ball to forecast that most major clone manufacturers will have 386 machines available by the end of this year.

Activity in the clone world has not been restricted to the top of the line machines either.

In the low priced clone department, AWA-Mitsubishi will be displaying the Amstrad PC1512, it's a \$1499 IBM compatible. The Amstrad is one of four low priced IBM clones expected to make their show debuts; the others will come from Atari (whose distributor did not know at press time if it would have an example in time for the show), Commodore's PC 5 and Tandy's 1000EX, both of which have the keyboard and processor integrated into one unit.

The Commodore and Atari machines are expected to have price tags of less than \$1000 excluding the screen and an all-up price of around \$1400-\$1500.

All four machines owe their low prices to extensive use of modern manufacturing technology and custom-built chips to reduce the number of components.

The introduction of low-priced versions of popular machines is not restricted to the IBM-compatibles either.

Commodore also has a low priced version of the Amiga computer in the works. Called the Amiga 500, it has the processor built into the keyboard and uses an external power supply. It comes with 1Mbyte of RAM, a 3.5in disk drive and has an RF modulator built-in so that it can be hooked up to a TV. It is expected to retail for \$1295.

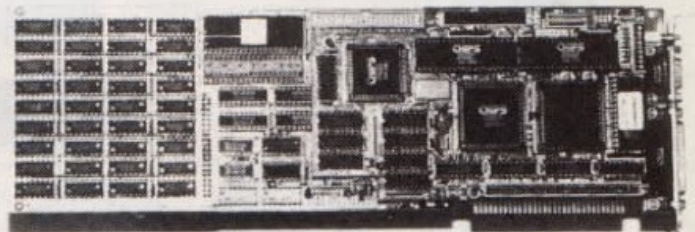
Not to be left behind, Atari will be showing off its bottom-of-the-line member of the ST range, the 520ST, which is now available with an RF modulator so you can use your TV set as a screen, or use Atari's own monochrome or colour monitors. Also on display will be the 1040ST, a 1Mbyte system with colour and mono screens, as well as a range of ST peripherals including printers and hard disks.

Atari will be making a new pitch at the low end of the games market with a range of 8-bit products for its new 128k 130XE computer. On sale at the show will be a family pack including data cassette, and games software for \$399. A disk



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PREVIEW



A show not to miss. Come early, stay late

drive is an optional extra.

Returning to its original roots, Atari will also be displaying a new TV games product, the Atari 2600, and a wide range of software. This machine can be upgraded to a computer by the later addition of a keyboard.

Desktop publishing is making an impact on the IBM world, and a number of new products will be on display for the first time. Imagineering will be showing off AST's publishing system, Premium Publisher;

Software Source will have its Spellbinder Desktop Publisher; while Megavision will be demonstrating the Ventura system from Xerox, probably on its new 19in, high resolution Viking monitors.

In a similar vein, Minicomp will be showing off its Artwork software package, a series of modules that can be used for everything from desktop publishing to video production.

On the Macintosh front, Imagineering will be demonstrating the latest version of the desktop publishing package Ready Set Go, a local area network called Tops which can work with both the Apple Macintosh and IBM-style PCs, and the latest offering from Living Videotext — a new outline processor called More.

Imagineering will also dis-

play two new Lotus products for IBM systems: HAL, which adds artificial intelligence and the ability to work using plain English to the best-selling Lotus 1-2-3 spreadsheet, and Manuscript, the company's newly released word processor for technical writers.

Desktop publishing is not much use if you can't combine text and graphics, so there should be considerable interest in Remington's PC-Scan-Plus optical character reader which can handle both text and graphics, and loads a page into a PC in nine seconds.

Sourceware will show off Magician, claimed to be the first, locally developed, fully integrated computer graphics systems for the IBM PC. Unlike most graphics packages which can only do one job, Magician includes business graphics and computer-aided design. The program's features include macro graphics programming, electronic slide show capabilities and interactive graphics design.

And finally, for those with a weakness for a flutter, Dick Smith Electronics will be displaying Superform, a local product claimed to be the ultimate in computerised racing analysis.

END

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- Speaker with volume control.
- 8 status indicators.
- 6 self test modes.
- Call progress detection (dial tone, busy).



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- Call progress detection (dial tone, busy).

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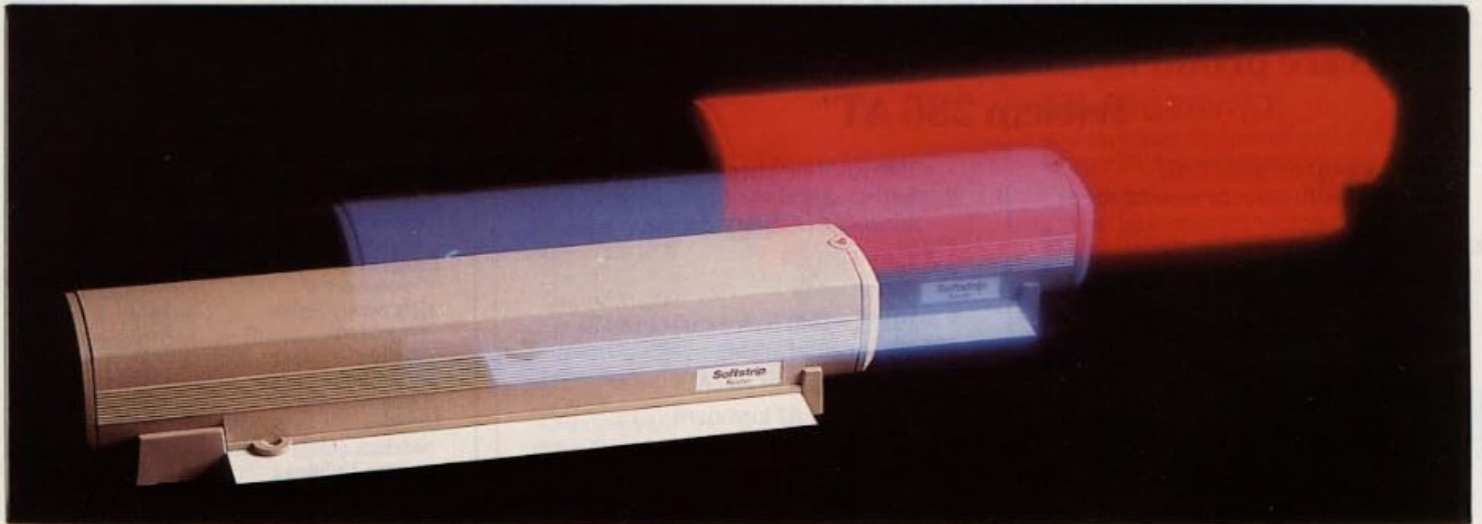
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Cauzin's Softstrip

Aimed at serious business users but without any clearly defined niche, Cauzin's Softstrip is a practical, if expensive, high-precision device for reading small amounts of data and programs. David Tebbutt finds it a temporary home.



'All dressed up and nowhere to go'. That phrase keeps coming into my mind when I look at Cauzin's Softstrip system. In the past I had often thought how computer magazines such as *APC* could publish program listings in a form which would enable cheap direct input into computers. The nearest I got was an idea involving very narrow bar-code strips and a design for a DIY reader. Like lots of my wilder ideas, this one was quietly shelved.

Softstrip is a more practical development for reading small amounts of data and programs. The information is printed much more densely than bar code and must be read by a high-precision scanning device. The system works beautifully but, at a price of around \$699, I'm having a devil of a job deciding who could justify the price. To date no-one has come up with the winning formula. If, after reading about Softstrip you reckon you have the

answer, you could be well on your way to fame and fortune.

The Softstrip system

Cauzin provides you with a strip reader — a combination of optics and electronics sealed into an oblong box, a disk containing the driver software



A low-density Softstrip data strip blown up to twice its normal size

and a manual containing the instructions and programs printed (surprise, surprise) on Softstrip data strips. One of these programs allows you to produce your own data strips, provided you have a printer with the appropriate graphics capability. I was lucky and everything hung together beautifully on my combination of an AT clone, serial port two, with a Star NL-10 printer on the parallel port.

The figure opposite shows the top of a low-density data strip at twice its normal size. The header information tells the reader how many bytes will be contained in each horizontal line of data and how high each line will be. The header is also used to align the optical mechanism and to gauge the contrast between the black ink and the background colour (referred to as 'white' hereafter).

This is followed by the length of the strip, its checksum, its identification number and its sequence number.

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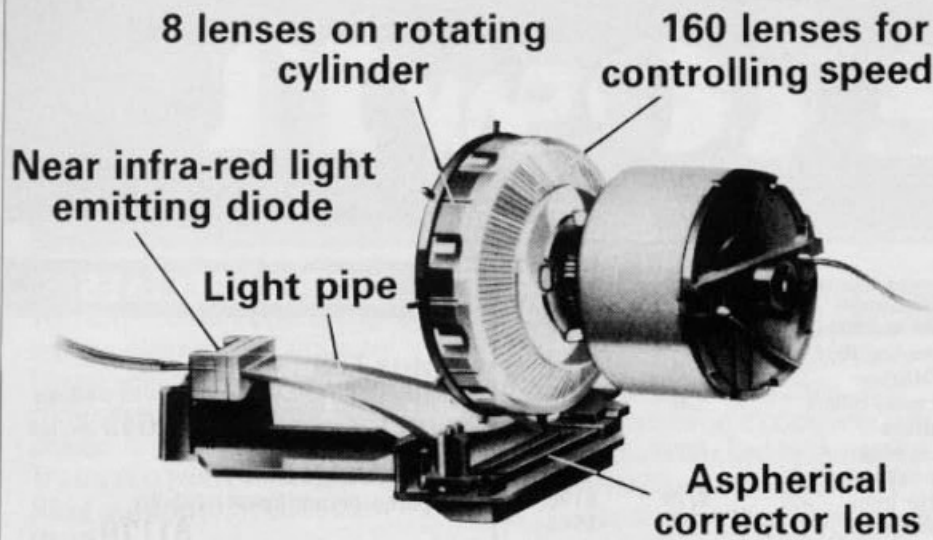
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The internal circuitry of the Softstrip reader shows how the opto-electronic system works. A 'near infra-red' light is shone onto the paper (the strip). This is picked up by an aspherical lens which in turn focuses the reflected light into a curved plane from where it is picked up by one of the rotating lenses as it moves around

Then comes a directory of file names, types and lengths for up to 10 files.

Black boundary lines run down each side of the strip with marks to their right to synchronise the activity of the reader. A 'chequerboard' pattern is used on the left and a 'rack' on the right.

The rest of the strip contains the data described in the header information. The data is straight binary, so you can encode program sources or object files, spreadsheet cells contents, textual information — anything, in fact, which can be encoded as a bit stream. Strips can contain between 900 and 5500 bytes, depending on the printing method used.

Each bit is represented by a pair of rectangles — one black, the other white. Zero is black followed by white, and one is precisely the opposite. These pairs of rectangles have been christened 'DiBits' by Softstrip. The most readable data strips are those whose DiBit rectangles are the most precise and whose contrast is maximised between black and white.

The data is encoded on a line in two interlaced groups: odd bits (1, 3, 5 and so on) and even bits. Each group has a parity bit associated with it. If only one bit in a group is unreadable, then the parity bit is used to recreate it. The checksum is the sum of all the information in the strip. When reading is successful, this will match the checksum printed at the start of the strip.

The reader

The system comprises the reader, a

base unit to protect its underside when not in use, three Velcro feet to secure the base to a convenient horizontal surface, a power supply and a serial cable. The whole thing is very easy to set up — a minute or two at most. I did notice, however, that if the power supply was located too close to my monitor, the screen got the jitters. It is now about 40cm away where it causes no problems.

The plastic reader has a slot in its base just over 2.5cm wide and almost 28cm long, through which it scans the data strip, which can be up to 20cm long. One side of the case comprises a straight edge, at the end of which is a small projection with a hole in the middle. Each data strip is printed with a blob at one end and a small vertical line at the other. The reader is aligned by placing the straight edge against this line and the projection hole over the blob. Alignment doesn't have to be too precise, as the reading mechanism can handle a fair amount (6mm or so) of skew.

The reading is performed by an opto-electronic system mounted on a truck which trundles up and down inside the plastic case. A 'near infra-red' light is shone onto the paper and the reflection picked up by an aspherical lens. The colour is supposed to 'see through' many stains and colours, so I scribbled on top of data strips with a blue marker pen, a red felt-tip pen and an ordinary black ball Pentel (fine point). I also marked a solid block using a very dark blue marker. The reader happily read through everything,

The aspherical lens focuses the reflected light into a curved plane where it is picked up by one of the rotating lenses as it moves around this plane. Eight protrusions on the outer edge of the lens assembly help synchronise the electronics with the optics.

Each reading lens is accompanied by 20 further lenses through which light is shone and sensed to give control of the motor speed. As well as rotating the lens assembly, the motor drives the truck forward in a smooth continuous motion at .00635cm per scan. Depending on the resolution of the strip, each data line is scanned between four and 16 times.

The device worked flawlessly on all strip densities, including those produced with a grey ribbon on my own printer.

Software

The reading software, CAUZCOMM, may be loaded as a transient or a resident program, where it takes up 19k. In its present incarnation, there is little need for the program to be present all the time and it does tend to get in the way of other resident programs. I found that my version of Basic crashed when CAUZCOMM was loaded on top of Smartkey, SideKick, Dosedit, Graphics and Lightning (what do you mean, 'Serves me right?'), although it was fine if I loaded CAUZCOMM first.

The program allows you to read strips, to execute them when loaded, to set and save configuration details

'some of the future variants of the product — miniprinters, credit card-style readers — could open up specialist markets'

and to unload the program. Program control is through a three-part pop-up window. One part displays the options available, another the files read and the third the messages. The messages are so explicit, you just can't go wrong.

The other main program, Stripper, comes in Softstrip format and allows you to make strips on your own printer. Like CAUZCOMM, it hogs your machine while it's in use, which is a pain when printing large files. A 21k .COM file took over 50 minutes to

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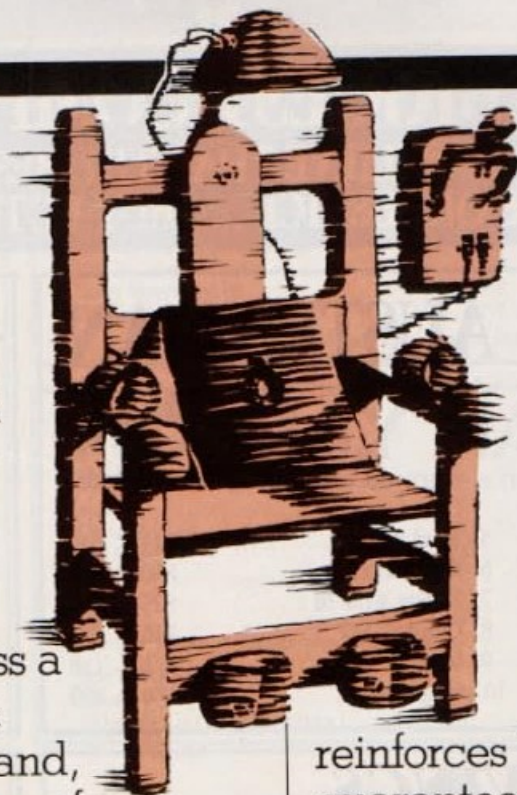
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print, took up 26 strips in low density and took 20 minutes to read back in.

Applications

The Softstrip machine was launched in the States as a hacker's device but, in Australia, the pitch is at the more serious user. The manual has been rewritten and put in a large binder so that the overall impression is that of a fairly substantial product. The sample data strips which come with Softstrip reflect this more upmarket image with things like Lotus 1-2-3 models, critical path analysis and cost-of-sales calculations.

Softstrip offers a cheap way of disseminating information in machine-readable form, either by photocopying or by printing it. Illegal duplication of Softstrips can be overcome by overlaying the strip with a coloured band which would prevent readable photocopies being made.

Among the applications suggested by Cauzin for the Softstrip are:

fonts, icons and other graphic devices for desktop publishers;

- free software in educational establishments;
- strips included in school-books to bring examples to life;
- updates to price lists, stop lists and parts lists; and
- strips added to invoices, orders, and so on, to make them legible to both machines and humans.

Conclusion

Here is a very clever piece of technology looking for an application. At \$759 (the manual and programs cost an extra \$60), it is out of the reach of most Australian enthusiasts, so Softstrip has to look towards the business user. Unfortunately, no single business application has yet leapt out which says: 'At last, the answer to our problem'. Some of the future variants of the product — miniprinters, credit card-style readers — could open up specialist markets, but in its present form I still maintain that the Softstrip product is 'all dressed up, with nowhere to go'.

END

Softstrip (available for IBM PCs, compatibles and Apple) is distributed in Australia by Verbatim Australia on (02) 437 6477.

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Beat the clock

As humans strive to adapt to the furious pace of technological development, the intense pressure takes its toll. Martin Banks tries to keep up.

Every so often, I find myself wondering about all these computer thingies. I'm not so concerned about the technology as such — which manufacturer is making the best use of the latest gizmo, for example — rather, what the things are actually being used for.

The reason for this mental exercise is founded, in the end, on the fact that I rather like people. I like them, with certain exceptions, a good deal more than most things material, such as computers. The trouble is, I get the distinct impression from reading history books and current newspapers that not many individuals feel the same way that I do. They can't do, otherwise they wouldn't do unto others what they seem to enjoy doing so much.

I am finding it just a touch sad that the computer is becoming the latest weapon in a long line of tools that individuals use against one another, either directly or, more commonly, in some subtle and indirect way. Let me give you an example. I recently saw an item in an American magazine for a clever box for your average PC. At least, I thought it was clever — until I started to think about it. This box is called PC Type Right and it comes from that house of many clever things, Xerox.

PC Type Right sits between the keyboard of a PC and the keyboard port. It is a little box that has a dictionary built into it so that, as you type a word at the keyboard, you can verify the accuracy of your spelling. Get a word wrong and the machine will beep to draw your attention (and other people's in the same office) to your abject failure. At first this struck me as a rather clever idea: after all, having the spelling-checker online is more efficient than having to close a file, run the spell-check program, re-open the file and see what comes out. However, then one or two 'but what ifs' occurred to me.

But *what about* the spelling checker, for example? We have all heard about

those that come up with some very improper alternatives if you miss the middle 'r' out of further. Strangely, the one alternative not normally suggested is the correct spelling. This may not matter when the check is an option made after writing something, *but what if* it's online? — you're stuck with it. *What if* you mean to spell something wrong, just for effect or to add a bit of humour to a business communication? The thing just won't let you.

There would seem to be great scope here to introduce a whole new level of computer-controlled conformity into life. Language is one of the things that shows we're alive and kicking. It is always changing and developing, with ever-revised dictionaries acting as its history books. If the computer won't even let you past the keyboard unless you conform...

Another example that popped onto my desk the other day was a press release from Selby MillSmith, a management psychology consultancy (whatever that is). It has always struck me that an individual is either naturally good at management, or not. If the latter is the case, no amount of psychology will make them better at it. And if you try and make individuals compete in that way, many of them simply burn out.

This is, of course, what we find in much of industry these days, especially the computer industry where, if you're over 40 you're a freak, or you've got something on the MD (or, of course, you *are* the MD). Most others have burned themselves out long before that time, which is why Selby MillSmith has introduced a 'lifestyle management system' for computer-industry executives.

It seems that, these days, having a 'lifestyle' and then being 'burned out' by it are particularly important icons in the 'career path' of the average 'computer-industry executive', so I suppose it's sensible for them to have a computer program geared to monitoring their progress.

Actually, it's supposed to help people cope with the stresses of a job, but I can't help feeling that it would be a lot more sensible to change the system that causes the stresses in the first place. Why is it that humans insist on producing inadequate life systems, and then demand that we adapt to fit them?

Perhaps the best example of this, and how the computer is used as a major weapon in the process, can now be seen in many big cities. Callow youths with degrees are being turned into the modern equivalent of the battery hen, all for the sake of Mammon. Poor things!

Not, of course, that they are *poor* as we might understand it. These young executives, with brains like IBM mainframes, can earn up to \$200,000 a year and drive company Porsches. They are also probably in desperate need of Selby MillSmith's lifestyle management package because if Mammon and its computers get their way, they aren't going to have much of one, anyway.

Imagine having a job where you slept at your place of work, and you worked whenever there was a dealing floor anywhere in the world open for business — which essentially meant all the time. You were paid lots and lots of money but never got a chance to spend any of it, so it actually stayed in the bank — that is, Mammon's back pocket. You had a Porsche but never got the chance to drive it. In fact it was fourth-hand at least, but only had 70km on the clock and was now being re-valued upwards as an antique. Soon enough you died at your desk, and Mammon promptly passed the Porsche on to the next bright young thing and forgot you ever existed.

I can't help wondering if this is the kind of automaton that computer technology is turning us into, and wondering whether we will soon be seeing the computer-equivalent of the free-range egg!

END



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Run around the clock

Peter Malcolm examines the current network technology and explains the principles of operation of the various standards, using local area networks for use in a PC environment as his example.

Networks generally have had a rough ride in the computer press recently. Much of the criticism arises from confusion rather than practical facts, which is a pity because there are network installations that can — and do — work very well. It's also true that networks currently have shortcomings in software standards which can cause problems for certain groups of users.

Types of LAN

Let's define a network as a system of communication between devices, be they PCs, printers or whatever, and ignore the network transmission method and medium for the time being. (Incidentally, all comparison timings are based on actual readings, not theoretical transfer rates, and when I use the term 'PC' I do so independently of machine type.)

Basic disk-sharing systems have been around for some time, and involve connecting a number of PCs to the same external hard disk and time-slicing each PC's use of it. Under our definition, this is not a network at all because each PC can only communicate with the hard disk. Transfer of information is achieved by writing to disk during your time-slice, and the information can then be read by others on their time-slices. Generally the disk is divided into virtual volumes and each user can mount one or more of these at a time, assigning a different drive designation to each. These systems tend to offer little in the way of management functions, but they are relatively inexpensive. As they don't use real net-

work technology (they usually connect up with big ribbon cables), I won't consider them here.

At the bottom end of the true network are RS232-based devices which communicate through a standard serial port to a network access box, which sends data over the network to other access boxes which are in turn connected to other serial devices. These systems enable several PCs to share a printer, for example, or to send a file from one PC to another (the number of devices is usually limited to approximately one hundred).

'you will probably be held up until the device is clear, and it's almost certain that when you want to print, someone else will also want to'

However, RS232-based devices have three major drawbacks. Firstly, they are very slow: most serial ports can only manage 9600 baud at best (around 960 characters per second). Assuming there is no network congestion, transferring anything but the smallest files is a slow process — about five times slower than to a floppy disk. When the data is pumped into the network by the access box, it travels much faster (typically 50k or so per

second), so even if there is heavy network traffic, the transmit time remains constant.

Secondly, is the receiving device able to accept the data? An unbuffered printer may already be busy printing. The printer, the access box or your PC may have buffers but they are unlikely to be very large, so you may have to wait some time before you can continue processing.

The third major snag occurs if two users want to access the same device at the same time. RS232-based systems will work out that the device is busy and give you a message, but you will probably be held up until the device is clear, and it's almost certain that when you want to print, someone else will also want to.

The next category is what I call mid-range networks, and this is where the bulk of products fit in. All devices on the network have a network interface (usually a plug-in card) which connects them directly to the transmission medium. A device on the network is able to send information to any other device.

Other than PCs, many types of device can be connected and are usually known as 'servers'. There is usually one or more file servers, a dedicated unit with a processor and hard disk storage. Typically, 95 per cent of network transmissions are to or from a file server. Other servers may include print servers which manage one or more printers; gateways to other systems (mainframes, minis or other networks); and communications servers, which link to other systems via

Telecom links for viewdata, telex, file transfer, and so on.

Servers may be PCs dedicated to the task, or purpose-built boxes capable of performing only the appropriate task. Software will automatically spool information to the file server if the required server is busy, and will ensure that jobs are dealt with in rotation. On this type of network you can connect up to a hundred devices, and in practice you can load a file at approximately the same speed as from a local hard disk, depending on device usage.

Mid-range systems have network management software in varying degrees of sophistication, and manufacturers have developed differing levels of operating system support. On some systems, different types of PC hardware can co-exist as well as multiple operating systems for the same PC standard.

The top-of-the-range group doesn't differ much technically from the mid range; the systems are simply more sophisticated, have greater all-round capacity and take a great leap upward in price. They are also fast becoming alternatives to minicomputers. The practical differences are as follows.

Firstly, top-range systems cater for at

least 250 devices. They use purpose-built file servers with capacities ranging from 100Mbytes of storage to well over one gigabyte (1000Mbytes), with faster access time, and built-in high capacity tape streamers, and cost from around \$40,000. These networks offer support for multiple operating systems, PC/MS-DOS, p-System, Unix and other manufacturers' standards such as Apple DOS, all running simultaneously and transparently. Some also offer facilities such as fault tolerance and complex mainframe links. The network management software, and operating tools and utilities, are more sophisticated in these systems.

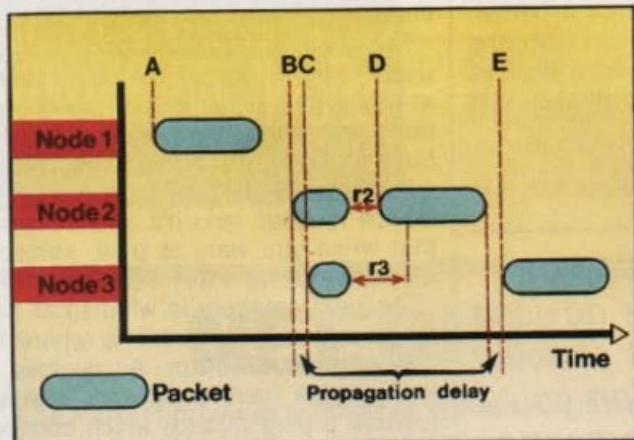
Methods

Common to all networks is the concept of 'packets' of information. A packet, sometimes a fixed number of bytes and sometimes of variable length, is sent from one device for the attention of another device. Each device has a unique identity number (usually called the station address and set by DIP switches on the interface board) and all packets must contain the destination station number. When the destination address sees the packet and iden-

tifies its own destination address, it accepts it as data.

To show how this works in practice, assume you're using an IBM PC on the network, loading a Basic program from a PC-DOS volume stored on the file server. Basic calls DOS software interrupts to find and load the file. DOS calls the network device driver (each manufacturer provides one) to translate the DOS sector addresses into the appropriate file server sector addresses. The network device driver then sends a packet over the network, headed by the file server's destination address and containing the 'read' sector's command plus the return address. The file server sees its own address on the packet, picks it up and acknowledges receipt. It then interprets the command, reads the requested sectors from its hard disk, and transmits the sectors back in packets headed by the address of your PC, which in turn picks them up, acknowledges receipt and returns them to Basic through DOS.

Although this example is specific to the IBM PC and compatibles, the same principles apply to all machines and operating systems. Note that some manufacturers modify DOS itself as well as, or instead of, using a device



Node 1 sees that the network is clear and transmits a packet at A. Data is passed successfully

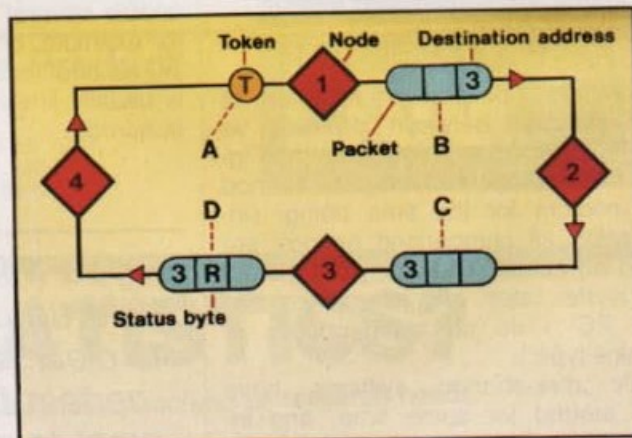
Node 2 sees that the network is clear and begins transmitting at B

Node 3 thinks that the network is clear because of propagation delays, and starts transmitting at C. A collision occurs. All nodes detect this and stop transmitting

Node 2 waits random time r_2 , then sees that the network is clear and begins again at D

Node 3 waits random time r_3 , sees that the network is busy, and waits until it is clear at E before transmitting.

Fig 1 CSMA/CD



The token is passed from node to node around the ring until a node wishes to transmit

Node 1 takes the token (A) and passes on data packet instead (B). The packet is passed on by node 2

Node 3 recognises its own address as the packet's destination and takes the packet (C)

Node 3 modifies the packet to show it has been received, and passes it on (D)

The packet is passed on by node 4

Node 1 takes the packet because it still holds the token, and then releases the token ready for the next transmission

Fig 2 Token. All token systems use a logical ring even though physical topology may be a bus

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driver, particularly if they allow booting from the network.

There are currently four basic methods of transmitting packets over the network; by collision detection; by token; by frequency division; or by empty slot. The first method is known as CSMA/CD (Carrier Sense Multiple Access with Collision Detection). In this system, each device (or node) listens to the network and transmits only if there are no other transmissions in progress. If two (or more) stations begin transmitting at the same moment, the signals will be garbled and the nodes will detect this. The stations will stop transmitting, and each one will restart the procedure after a random time period (this is shown graphically in Fig 1). Ethernet, IBM PC Network, Apple Talk and Omnet are all CSMA/CD systems.

The token method has two variations, depending on connection topology, but logically they work in the same way. A

unique packet of data — the token — is passed continuously from one node to the next in sequence (and then from the last back to the first, and so on). When a node wishes to transmit, it waits until it is in possession of the token, and then instead of passing the token on, it passes its packet of data. The data packet is passed from node to node until it reaches its destination. Normally, the receiving node modifies the packet to indicate if it were received intact or garbled, and then passes the packet on.

When the packet arrives back at the original sending node, the sender can detect if it reached its destination (it will have been modified if it got there, but not if the destination node were inactive or disconnected); and if it were not received intact, the packet can be sent again. When the packet has been received and acknowledged or if the sender gives up, it passes the token again instead of a data packet, ready for the next node which wishes to transmit (see Fig 2). ARCnet (used by many manufacturers) and IBM Token Ring are the best-known token systems.

The frequency division multiplexing method (FDM) involves each node having the ability to transmit at different frequencies, and hence several conversations can occur at the same time (just like having several stations coming down your TV aerial wire, each on a different frequency). Generally some form of controller is required to allocate frequencies, and separate frequencies are needed for transmit and receive in each conversation. There are only a handful of manufacturers using this system.

Empty-slot systems (also known as Cambridge ring and slotted ring) employ multiple packets (or slots) travelling round a physical network ring. Each packet contains a status flag which identifies the packet as being in use or not, and a node which wants to transmit places its data into a free packet. This arrives, and is returned exactly as in the token method to establish whether the data arrived intact. When receipt of data has been confirmed, the sender marks the packet as free and passes it on.

The empty slot method is not so different from the token system, except that the topology must be a ring and not a bus, and that packets are flagged instead of using tokens. A variation on the slotted ring is buffer insertion where a node inserts its packet into a free space in the ring data stream, but this can lead to timing problems and isn't often used.

Topology

There are two distinct types of network topology: either in a ring, where each node is only physically connected to the nodes before and after it; or using a bus, where all nodes are connected together and theoretically all receive the same signals at the same time. CSMA/CD nearly always uses a bus type topology, as does FDM. Empty-slot systems must, by definition, use a ring topology. Token systems can use either bus or ring. When it's a bus environment the system is known as token-passing (because the token is passed logically between stations across the bus), and in the ring environment it is known as token ring.

A third type of topology, known as 'star', is where all nodes are brought back individually to one central device. This is only necessary where a central controller is used, such as in some FDM systems. Note that a bus system could be star-shaped where only one central connecting point is used, but that does not make it a star topology in this sense (see Fig 3).

Electrical signals

Electrical signals can be transmitted either broadband or baseband. The majority of manufacturers use baseband, an expensive method in which the data is introduced directly into the transmission medium. In a broadband system, data modulates a carrier (as in a modem) and this enables several conversations to take place at once. Therefore, by definition, FDM systems must be broadband.

Baseband systems can only have one node transmitting at a time or the signal becomes garbled (CSMA/CD collisions), and the network speed has to be greater to cope with the demands of all nodes on a single channel. Broadband systems are generally more expensive, but do allow integration with other signals such as TV signals in the same medium.

Drawbacks

Each of these variations has its strengths and drawbacks, and the CSMA/CD system has three major drawbacks. Firstly, as more nodes are added, collisions are more likely to occur and delays will be introduced by the random time interval. This practically limits the number of nodes.

Secondly, the packets must be of a minimum size depending on the length of the network, due to propagation time down the transmission medium. When a collision occurs, it must occur for

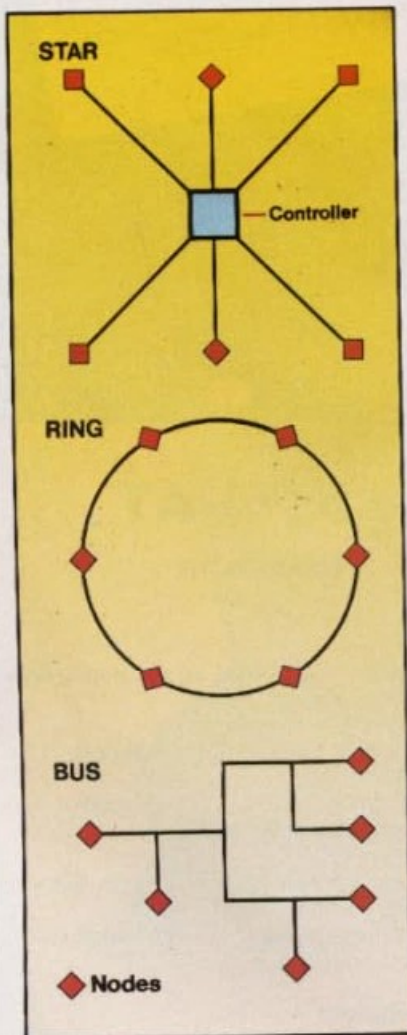


Fig 3 Basic topologies. All other topologies are based on one of these three types



For once, being smaller than IBM is a definite advantage.

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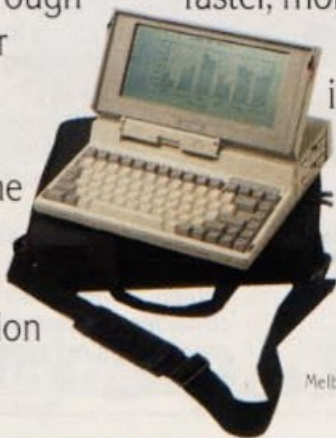
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NETWORKS

long enough for all nodes to see it, and the further away the node is, the longer it will take. The longer the network, the larger the packet size must be, and this can result in packets of unnecessary length, time-wasting or limits on the physical length of the network.

Thirdly, when data is corrupted (excluding collisions), the transmitter is unable to detect this as the packet is not automatically returned as in token and empty-slot systems; the sending node

must rely on time-out delays and receives no clue as to the problem which occurred. CSMA/CD has, however, been adopted by many manufacturers, is simple to connect and is a cost-effective solution for smaller installations.

Token systems really have only one drawback, and that is if a node becomes disconnected from the passing chain. This is more serious with ring rather than bus networks because if

the physical ring breaks, everything grinds to a halt, and therefore devices are needed to ensure that the ring remains linked if a node is disconnected. Both ring and passing systems need some software mechanism to detect when nodes enter or leave the network, to ensure that packets continue to be passed. In practice all token systems cater for this, and the procedure which is undertaken when a node enters or leaves the network — reconfiguring — takes only a fraction of a second.

Token-passing bus systems are simple and cheap to connect, and additions are easily made by tapping into the nearest cable. Token ring is rather more tricky to cable and is expensive. Bus systems also allow weighting of certain stations so that heavy-usage nodes can receive the token more than once in a cycle; in the same way, read-only nodes need not be passed to the token at all.

FDM systems have the advantages of broadband but that does not imply that the manufacturer has designed them to be used over existing cables or with other transmissions, though certainly some have — for example, over existing PABX lines. Here, the data frequency will be way above the limits of human speech, so they don't interfere with the phone. FDM systems are, however, very complex and often expensive.

Empty slot has similar drawbacks to Token Ring, and in addition requires more complex control. It is available from a small number of manufacturers, mainly for educational and scientific purposes.

Media

The most common form of network media is co-axial cable which is used in varying grades, as is the next widely used, twisted-pair cable. Higher-quality cable with better screening improves the maximum run length, because less interference is likely. Manufacturers will recommend different types of cable which vary in price from a few cents per metre to well over \$2. It's important to stick to the recommended grade of cable, but that doesn't mean buying it at your supplier's inflated price.

Fibre-optic cable is slowly catching on and has several advantages. It is totally immune to electrical interference, and can be used in much longer runs before amplifiers are required. It can't be easily tapped and is thus suitable for security-conscious installations. The major disadvantage is that the electri-

Glossary

Access method	Method of managing network communication		
Baseband	Transmission method where data is introduced directly onto the transmission medium		
Broadband	Transmission method where data modulates a carrier and the medium can therefore hold several transmissions, each with a different carrier frequency	NetBios	Network cabled locally usually within one building or site (Network Basic Input/Output System) A set of machine language calls to provide basic network functions
Bus	A topology where all devices are connected in parallel and hence can all listen to network activity	NetWare	Trade name of Novell's Network Operating System
CSMA/CD	(Carrier Sense Multiple Access with Collision Detection). A network access method where all stations listen to the network and transmit only when it is not in use, with techniques to manage two or more stations transmitting together (collisions)	Node	See station
Empty slot	An access method where a node may insert data into a packet labelled as empty	PC Network	Trade name of IBM's implementation of Microsoft's MS-NET Operating System
Ethernet	A widely used CSMA/CD standard developed mainly by Xerox	Ring	A topology in which each node is connected to the one immediately before and after it to form a ring
FDM	(Frequency Division Multiplexing) Using a number of frequencies to hold simultaneous transmissions in the same medium	Server	A network device offering shared facilities to other network devices
File server	Network device which offers disk storage facilities to the network	Star	A topology in which all nodes are wired to one central point
Gateway	Network device enabling connection to other systems such as mainframes, minis or communications devices	Station	A device or node on the network. Each station is usually assigned a unique number or address
LAN	(Local Area Network)	Token Access	Network access method where a unique packet of data called the token is passed from node to node. A node must be in possession of the token before transmitting
		Token Access	Network using token access method in a logical ring generally using a bus topology
		Token Ring	Network using access method in physical ring topology. Used as trade name by IBM
		Topology	Network layout or shape
		WAN	Wide Area Network usually covering some considerable distance probably using telecommunication links

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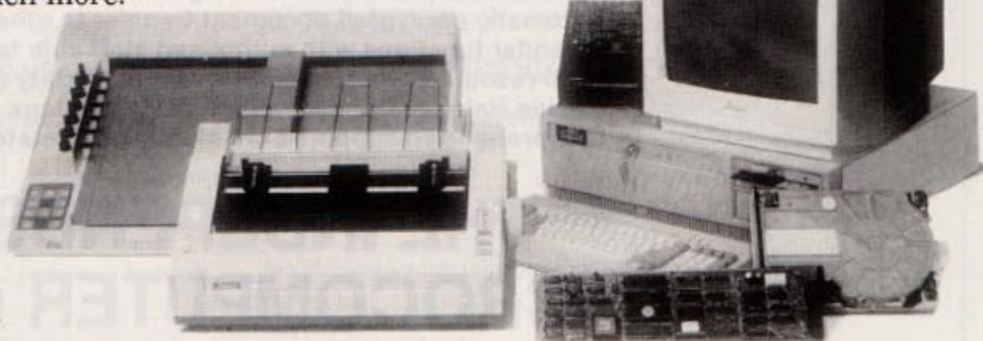
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cal data signals need converting into light and back again, which makes it an expensive and more complex solution.

There are other transmission media, such as modulated laser links, but these are rare.

Speed & stamina

Transmission speeds vary enormously — anything from 20k bits per second to 10Mbits per second, which give transmission rates of about 2 to 900 complete A4 pages per second. Many manufacturers rave about being faster than their competitors, but in practice this speed is largely irrelevant. The limiting factor on all networks is the speed at which devices respond. As 95 per cent of all conversations are to or from a file server, it's the speed of this device that limits the performance of most networks — it's nothing to do with the network speed.

The maximum distance allowed between nodes or repeaters also varies, based on the cable quality and the network speed. With the exception of CSMA/CD systems where total length may be limited, you are unlikely to encounter problems unless your network

stretches over half a mile or so.

Signals can be boosted with repeaters or, in the case of bus systems, signal-splitting devices can be used. Splitters fall into two categories, active and passive. Active splitters boost each output to standard levels, while passive ones merely split the available signal three or four ways. Obviously you can't split passive signals too much or the results will not be strong enough. Ring systems only use repeaters because the signal is never split.

Operating systems

A network operating system is the interface between applications programs and the network environment, and it's in this area that the battles are taking place to establish a standard. There are two main contenders:

- Microsoft's MS-Net provides low-level routines to applications software, and is used with minor variations by IBM on PC Network and Token Ring, Ungermann Bass on Net/One, and 3Com on 3Com+.
- Novell's NetWare offers more facilities at a higher level, but it is more complicated for software

developers to employ.

The goal with establishing a standard is, of course, to create independence from network hardware which can then be chosen for speed, expandability and features.

Management functions

Management functions are generally network operating systems independent and transparent to applications programs, but they can make all the difference between pain and joy for the system manager.

The back-up of file server data is obviously crucial, and is a prime consideration in any system. The major problem is that integrity must be assured across whole volumes as well as within files, so the file server must be read only during the back-up period. Suppose an index file has been backed up but the transaction file has not been reached when a new record is added. The back-up will contain a mix of old and new, and will be useless. In practice, most manufacturers take the server off-line during back-up; this can be overcome by using two servers in fault-tolerance mode and backing them up separately.

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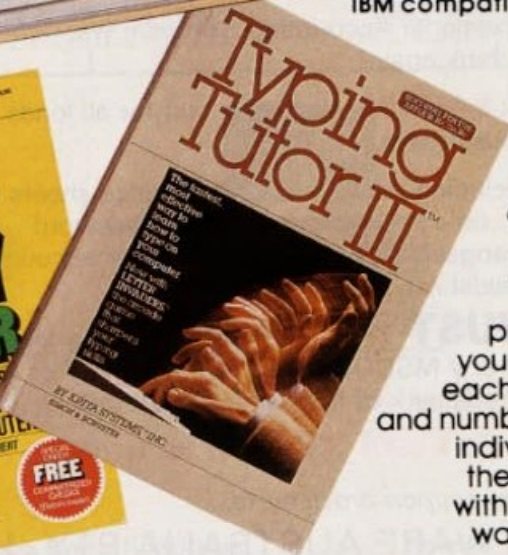
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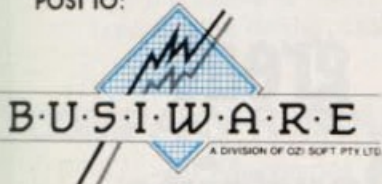
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Alternatively, automatic back-up routines are now available from at least one manufacturer, which enable you to time a back-up to occur automatically. Facilities for selective back-up of only modified volumes is desirable because few tape drives can cope with more than 60Mbytes, and waiting around to change tapes is tedious and time-consuming.

Password security is offered by many manufacturers in varying degrees of sophistication. Usually each volume can have different read and write access passwords, although they are simple to bypass in some cases. For absolute security, there are a number of utilities available for file encryption.

Utilities for sending messages between stations can be useful, particularly those which appear on pop-up windows. Unfortunately, these background utilities are sometimes unable to run beside others like SideKick, or when graphics modes are in use. Pop-up windows for network management functions are also useful, but tend to suffer from the same problems as message windows.

It's extremely useful to have a network clock in order that all stations keep the same time and date. Most manufacturers provide a driver to set your PC clock to the network clock on booting.

Finally, a system log of who mounted what and when is useful, but tends to slow response time on some hardware.

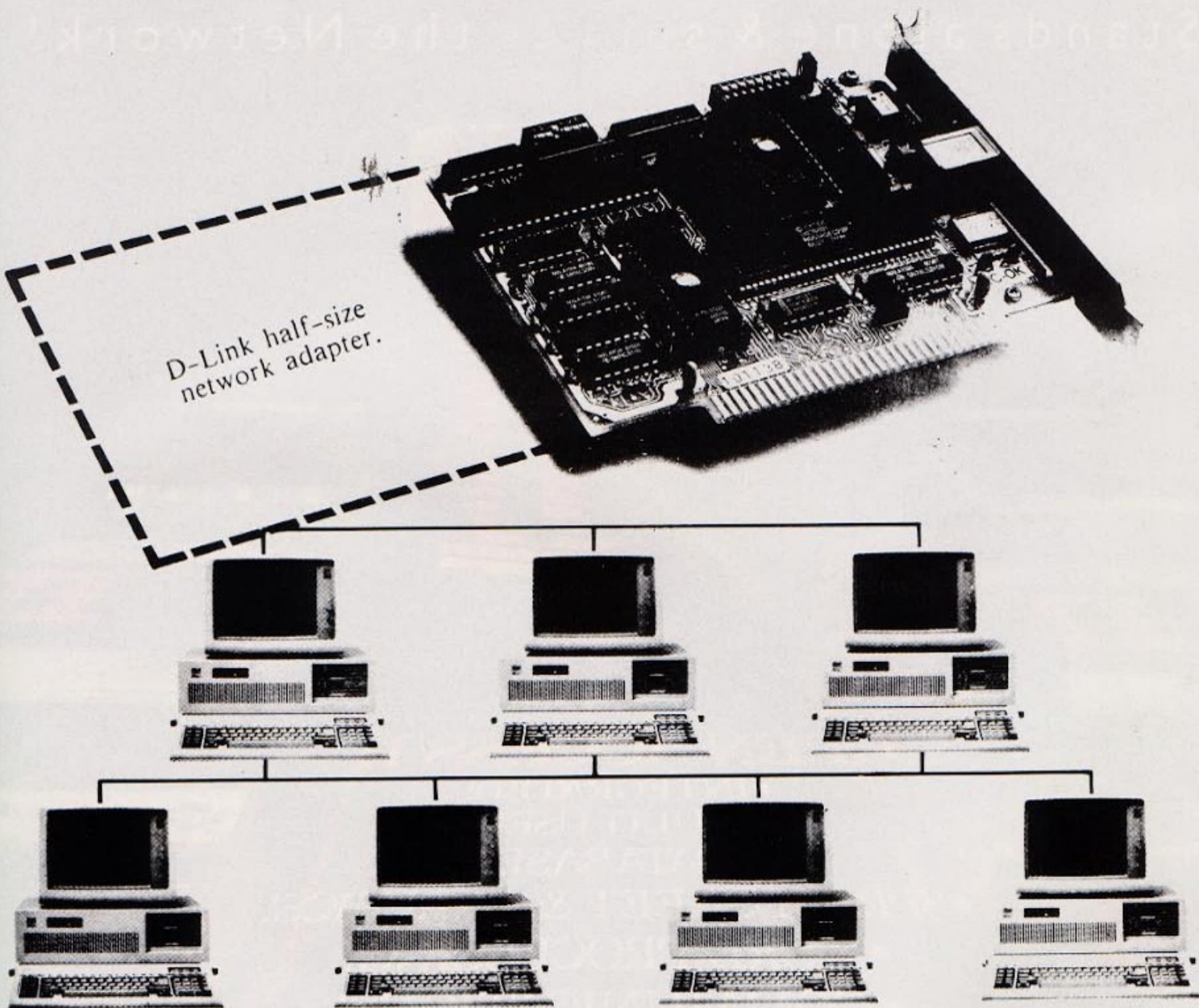
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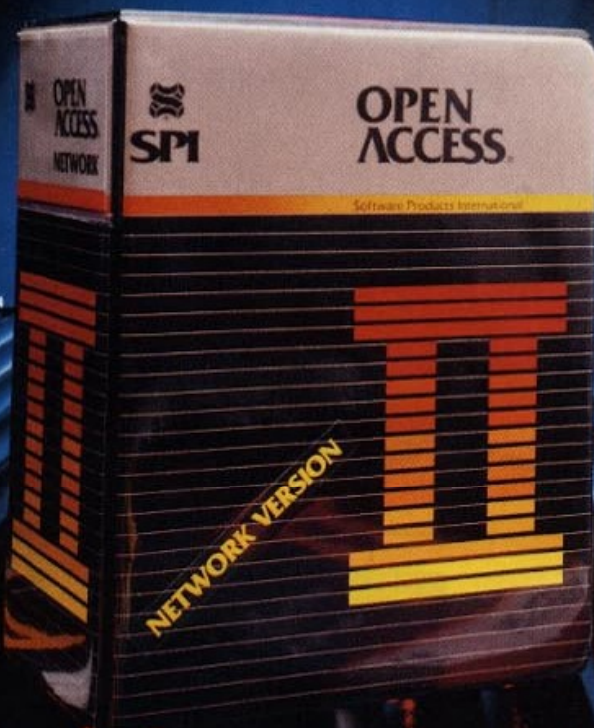
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SCREENTEST

Degas Elite and Art Director

One of the major criticisms of computer art packages is that they ignore the artist's viewpoint and are designed for experienced micro users. Angie Brew takes a look at Degas Elite and Art Director for the Atari ST with the artist in mind.

How well do computer art packages serve the needs of the artist? Micro-based art packages can give computer users with little artistic ability the tools to create diagrams and freehand drawings, but computers can't give the user the 'creativity' which turns brush and paint or pencil and paper into a work of art. Similarly, the tools provided by computer art packages can either enhance or restrict the scope of an experienced artist. It's from the latter perspective — that of an artist rather than a computer user — that I will be looking at two art packages for the Atari ST.

Degas Elite, published by Batteries Included and distributed in Australia by ECP, is an enhanced version of Degas. Art Director, from Mirrorsoft, will be coupled with a program called Film Director so that simultaneously they form an effective tool for computer animation.

At the heart of both packages is a set of tools which enable the user to 'paint' the screen with a range of lines, shapes, textures and colours. Both packages are 'bit image' rather than 'object' based: apart from undoing the last instruction, anything painted onto

the screen can't be separated from the existing image. In an object-orientated package, lines, shapes and textures are objects that can be manipulated onscreen independently from other objects. It doesn't matter if something has been placed on top of them, or added to them; each individual object can be retrieved, altered, moved or even replaced.

During the review I wanted to assess whether there were any advantages in using a computer in art rather than traditional methods, and I set out excited by the possibilities a computer might offer. Among my expectations were the potential to work more quickly, and the production of intense colours and interesting effects. I set myself two tasks: to produce a cartoon strip; and to do some interior and textile design. The cartoon strip would need the ability to create frames, and to 'paste' or copy bits of the picture between frames before modifying it, as well as trying out different formats. The interior design task required the ability to look at various texture and colour combinations, and to compare several variations of an interior on different screens.

Degas Elite

I chose Degas Elite to create the interior design mainly because it provides access to eight working screens at once; the numeric key pad takes you from one screen to another. It's possible to use the Atari ST in any of the following graphic resolutions: low resolution — 320x200 pixels with 16 colours from a palette of 512; medium resolution — 640x200 pixels in four colours; and high resolution — 640x400 pixels monochrome. Degas Elite will run in all of these modes.

Degas Elite provides a number of functions which are useful in interior design, including freehand drawing, and block manipulations to cut and paste between different areas of the picture. It's also possible to stretch and rotate a defined block. Most important, however, is the ability to construct complex colour patterns that could be used to 'paint' walls, fabrics, and so on.

Using the line-drawing commands, I produced the basic plan of the room very quickly. In addition to the 'regular lines' function which draws a straight line between two points, the 'ray' function gives a focal point from which to

SCREENTEST

generate lines. Using the ray function it's possible to position walls and objects in perspective, although there's a lot of rubbing out of unwanted lines when the room has been constructed.

Removing parts of the picture can be accomplished using either the 'Undo' function or the customisable eraser. Undo will erase the last line drawn: in fact, it cancels the effect of the last command, whatever it was. It was frustrating that only one level of Undo was available, because you are inevitably going to make mistakes while drawing, and also may want to experiment with a number of things simultaneously. The eraser acts like a brush except in reverse, and can be created out of a block defined on the screen. The eraser can be as small as one pixel or as large as the whole screen, and so to save time there is an 'Erase Screen' function. Annoyingly, the eraser is extremely difficult to see when you're working on a picture with a white background.

Geometric shapes such as frames, boxes, circles and polygons are easy to generate. You choose the correct option from the command screen, then switch to the drawing screen where you use the mouse to position and draw the required shapes. The shapes drawn this way can be filled with any colour or texture.

Patterns are user-definable and a wide selection is available at any time, and they are made up from any of the 16 colours which are available in the colour palette at any time. The 16-



A finished interior design which features several pattern fills and a wide range of colours. Details to enhance the image (the technical term is 'finishing'), and other changes, were made using the ordinary drawing facilities which are contained within Degas Elite

colour palette is made up from the ST's 512 colours. Colours can be chosen from a display showing all 512 colours, or can be individually changed by altering the red, green or blue levels that make up the colour.

The range of possible fill patterns is exciting, and your customised fill patterns can be stored in special 'Fill' files on disk. Additionally, a 'Change' function will change any colour in the picture to another from the palette without having to use the Fill function. This proved to be useful when I was experimenting with different colour combinations.

I produced the interior design in Degas Elite's low-resolution mode in order to be able to use as many colours as possible, but unfortunately there's the inevitable trade-off in terms

of pixel size. While the line commands are a quick method of producing a basic perspective drawing, unless they are exactly horizontal or vertical, the lines are very jagged.

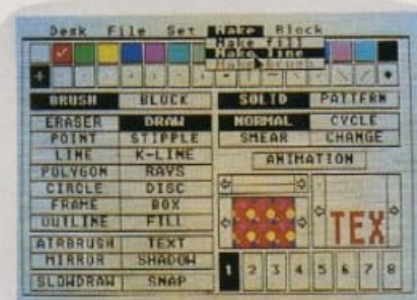
Degas Elite features a slow-draw mode which increases accuracy. It makes the cursor move more slowly and smoothly relative to your mouse movements, so you have more control over the lines you draw.

The availability of eight screens within Degas Elite proved to be a useful facility. I could create the different elements of the picture in separate frames and then use the block functions to 'grab' the specific areas I wanted to move; these could then be transferred to another place on the same page or

onto another screen, and positioned correctly. You can also copy images, leaving the original in place, and reposition the copies. There are commands that can alter the size and shape of blocks in different ways, such as 'stretch', 'rotate', 'distort' and 'skew'.

When using the Fill function, it's extremely important to ensure that the area being worked on is enclosed, otherwise the colour/pattern leaks over the whole screen. In this situation the Undo function is essential, enabling you to test whether an area is enclosed or not.

As I progressed with Degas Elite, the potential for a computer-based design system revealed itself. By using either the whole or a reduced palette I could 'animate' the interiors, enabling me to place a number of colours into a se-



The editor screen in Degas Elite showing the tools available. Other tools can be selected from the menu bar at the top of the screen



A basic room plan which has been drawn with rayed lines: note that the lines are jagged, which makes it easy to see the screen pixels



An interior which has been drawn using a different set of colours and fill patterns. It has not been 'cleaned up' with the zoom facility

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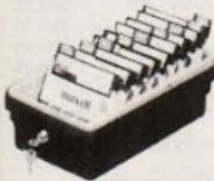
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• 1.2 M/Byte to 720K formatted
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NEC drive with DTC controller card.
Cat. X20010 **WAS \$1,250**
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Japanese Chiron mechanism.
compatible with Apple 2+
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 47Hz - 63Hz
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• Female to Female.
• Saves modifying or replacing non-mating Centronics cables.
• All 36 pins wired straight through.
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RS232C GENDER CHANGERS
• Saves modifying or replacing non-mating RS232C cables.
• All 25 pins wired straight through.
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Cat. X15651 **Male to Female**
Cat. X15652 **Female to Female**
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• All 25 pins connected
Cat. X15657 **Male to Male**
Cat. X15658 **Male to Female**
Cat. X15659 **Female to Female**
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• Interface RS232C devices
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• 25 leads with tinned end supplied
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Cat. X15654 **Female to Male**
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• Male to female connections
• All pin wired straight through
• Dual colour LED indicates activity and direction on 7 lines
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D.S.R. Data Set Ready
R.D. Receive Data
C.D. Carrier Detect
R.T.S. Request to Send
D.T.R. Data Terminal Ready
C.T.S. Clear to Send
Cat. X15656 **Normally \$39.95**
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These new keyboards are both XT and AT compatible!
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SPECIAL, ONLY \$199



SAVE
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• Curt lead plugs straight into PC/XT
• 3 Status displays
• Just like the "Real McCoy" only at a fraction of the price!
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These joysticks have adaptor connectors to suit the Apple II, IIc, IIe and II+ computers. Features include selectable "spring centering" or "free floating". Electrical trim adjustments on both axis, 360° cursor control and dual fire buttons.
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JOYSTICK FOR IBM
Features Selectable "Spring centering" or "free floating". Electrical trim adjustments on both axis. 360 degree cursor control
Cat. C14205 **\$49.95**



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• Male to female
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• 2 mini jumpers
• Ideal for experimenting or temporary connections
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Erase your EPROMs quickly and safely. This unit is the cost effective solution to your problems. It will erase up to 9 x 24 pin devices in complete safety, in about 40 minutes (less for less chips).
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WITHOUT TIMER
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TELEPHONE ADAPTOR
• Australian plug to U.S. socket
• Length 10cm
Cat. Y16026 **\$5.95**



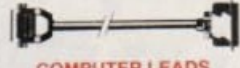
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PRINTER CABLE FOR IBM's
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CL3
• 9 pin 'D' plug to 9 pin 'D' plug
• All pins wired straight through (removable terminals)
• Length 3 metres
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• Length 3 metres
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• All pins wired straight through (removable terminals)
• Length 3 metres
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• Length 1.5 metres
Cat. P19011 **\$26.95**

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• 25 pin 'D' plug to 25 pin 'D' plug
• Pins 1 through to 8 and 20 wired straight through (removable terminals)
• Length 3 metres
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• Pins 1 through to 8 and 20 wired straight through (removable terminals)
• Length 7.5 metres
Cat. P19037 **\$34.95**

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• 25 pin 'D' plug to 25 pin 'D' socket
• Pins 1 through to 8 and 20 wired straight through (removable terminals)
• Length 3 metres
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• All pins wired straight through (removable terminals)
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• 25 pin 'D' plug to 25 pin 'D' plug
• All pins wired straight through (removable terminals)
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• All pins wired straight through (removable terminals)
• Length 3 metres
Cat. P19012 **\$49.95**

CL25
• 36 pin Centronics plug to 36 pin Centronics plug
• All pins wired straight through
• Length 2.13 metres
Cat. P19014 **\$59.95**

CL27
• Apple II, IIc, II+ with parallel interface card
• Dual 10 pin (20 contacts) connector to Centronics 36 pin plug
• Length 2.4 metres
Cat. P19025 **\$29.95**

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• Apple III with universal parallel interface card
• Dual 10 pin (20 contacts) on Apple end to Centronics 36 pin plug
• Length 2.4 metres
Cat. P19026 **\$29.95**

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IBM* COMPATIBLE DISK DRIVES
Tired of paying out more for Japanese Disk Drives? These "direct import" Hong Kong disk drives are the solution! They feature Japanese mechanical components, yet cost only a fraction of the price!

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C11801	500K	Normally \$199
SPECIAL, ONLY \$179		
C11803	1 M/Byte	\$239
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PRINTER LEAD FOR IBM*
• Suits IBM* PC XT and compatibles
• 25 pin "D" plug (computer end)
• To Centronics 36 pin plug
• Length: 2 metres
Cat. P19029

1-9	10+	100+
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(R.R.P. \$44.95)		



2 & 4 WAY RS232 DATA TRANSFER SWITCHES

If you have two or four compatible devices that need to share a third or fifth, then these inexpensive data transfer switches will save you the time and hassle of constantly changing cables and leads around.

- No power required
- Speed and code transparent
- Two/Four position rotary switch on front panel
- Three/Five interface connections on rear panel
- Switch comes standard with female connector

2 WAY Cat. X19120	\$125 \$95
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2 & 4 WAY CENTRONICS DATA TRANSFER SWITCHES

Save time and hassles of constantly changing cables and leads around with these inexpensive data transfer switches. These data switches support the 36 pin centronics interface used by Centronics, Printronics, Data Products, Epson, Micronics, Star, and many other printer manufacturers.

- No power required
- Speed and code transparent
- Two/Four position rotary switch on front panel
- Three/Five interface connections on rear panel
- Switch comes standard with female connector
- Bale locks are standard

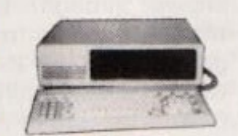
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- 20 M/Byte Hard Disk
- Colour Graphics Display Card
- Floppy and Hard Disk Controller Card
- Printer Card and RS232
- 200W Power Supply
- Keyboard
- Manual
- 3 Months Warranty

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640K RAM: 2 Disk Drives, Multifunction Card, Colour Graphics, Disk Controller, 2 Serial, 1 Parallel Port. **only \$1,195**



RS232 DATA SWITCH WITH TESTER

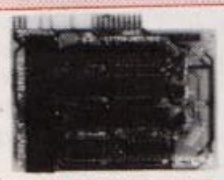
- No power required
- Ideal for 1 computer to 2 peripherals or 2 computers to one peripheral
- 25 pin RS232 "D" connectors
- Six dual coloured LED indicators showing certain flow status:

T.D. Transmit Data
R.D. Receive Data
R.T.S. Request To Send
C.T.S. Clear To Send
D.S.R. Data Set Ready
D.T.R. Data Terminal Ready

• Size: 200(W) x 68(H) x 150(D)mm
Cat. X19110 **R.R.P. \$169**
Our Price \$149



TELEPHONE EXTENSION CABLE UNIT
Allows 15 metres of telephone extension cable to be neatly wound into a portable storage container. The reel sits on a flat base and has a handle to wind cable back on to it after use. No tangles - no mess! Ideal for the workshop, around the house, office, pool etc.
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APPLE COMPATIBLE CARDS!
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Get some colour into your games. Use your Apple or compatible on the second television. Has both UHF and composite video outputs. Fully adjustable so you can fine tune it for a crisp clean image.
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Cat. X18020 **\$225**

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Cat. X18024 **\$59.50**

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Cat. X18026 **\$79.50**

RS232 & Clock Card
Cat. X18028 **\$99**

XT Turbo Motherboard (without memory)
Cat. X18030 **\$275**

Multi I/O & Disk Controller Card
Cat. X18040 **\$199**

I/O Plus Card
Cat. X18045 **\$139**

768K Multifunction I/O Card (includes cable but not 41256 RAM)
Cat. X18050 **\$199**

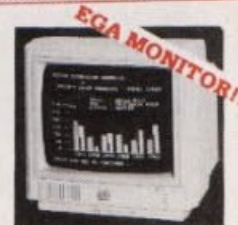
Hard Disk Controller Card
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Enhanced Graphics Adaptor Card
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(AT COMPATIBLE)

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Cat. X **\$495**

D LINK NETWORK CARDS
Runs PC-NET, 1Mbit per second data transfer rate via 2 wire link. Dedicated server not necessary. Up to 255 stations.
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INTRA 14" RGB HIGH RESOLUTION COLOUR MONITOR
Compatible with IBM* and compatibles, and EGA Cards.
Why pay more?
Resolution: 640 x 350 dots
Dot pitch: 31mm
Display Format: 80 x 25 characters
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Our price \$995

INTRA 14" RGB COLOUR MONITOR
Resolution: 640 x 200 dots
Display Format: 80 x 25 characters
Display Colours: 16
Dot pitch: 39mm
Sync Horiz. Scan Freq: 15.75 KHz
Sync Vert. Scan Freq: 50Hz
Band Width: 18MHz
Cat. X14520 **\$695**



TOSHIBA 13" RGB COLOUR MONITOR
High quality IBM* compatible monitors, great with VCR's too!
SPECIFICATIONS:
CRT: 13" 90° deflection colour
Input Signal:
Video Signal: Separate video signal
Video: Positive
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Input Level: TTL Level
Scanning Frequency:
Horizontal: 15.7KHz
Vertical: 60Hz
Display Size: 245(H) x 182(V)mm
Resolution:
Horizontal: 640 dots
Vertical: 200 lines
Size: 343(H) x 362(W) x 421(D)mm
Weight: 11.6kg
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SAMSUNG TTL MONITOR
A quality 12" TTL monitor, with a high contrast, non-glare screen at a very reasonable price!
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Active Display Area: 216(H) x 160(V)mm
Display Characters: 2,000 (80 characters x 25 lines)
Scanning Frequency:
Horizontal: 18.432 ± 0.1KHz
Vertical: 50 Hz ± 0.5%
Description Cat.No. 1-9 10+
Green X14517 **\$189 \$179**
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• Serial Impact Dot Matrix
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Stylish 20MHz RITRON II monitors with 12" non-glare screens. Available in green or amber displays with swivel base!
Green (X14506) **Normally \$235, NOW \$169**
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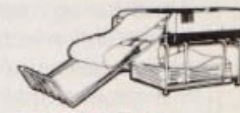
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• Logic Seeking
• 1K Printer Buffer
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• Allows easy examination of print out
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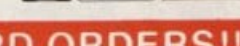
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\$25 - \$49.99	\$4.00
\$50 - \$99.99	\$5.00
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quence. When activated, all the chosen colours in the picture run through the colour cycle. In this way, I could easily view a variety of colour combinations for the room. The animation speed can be adjusted, but unfortunately there is no way to freeze the cycle at a particular point.

Degas Elite is useful for experimentation with colours, patterns, and variations, especially with its colour animation capability, but it can't produce sufficiently precise graphics or a finished drawing.

Problems & reservations

The low-resolution screen is the most limiting 'feature' of the Atari ST, followed closely by the difficulty of clearing a filled area if the fill isn't the immediately previous operation. Using another fill, or a brush with a colour or pattern, will eventually cover the area, but this is not entirely satisfactory.

In drawings with perspective, I had to be careful which fill patterns I used in certain areas. As the pattern fills are two-dimensional and flat, they can't be used satisfactorily when a three-dimensional representation is required as they can't be tilted or made smaller. To do this you have to pre-draw the area, and then tilt and stretch it to match — which negates the advantage of being able to fill areas and paint with patterns. The textures of a fill pattern are constant, and I would have appreciated some method of stretching them while still keeping them as fill patterns.

Art Director

I hoped that Art Director would enable me to create cartoon characters and copy them from one frame to the next. Art Director only works in low resolution, which is an important factor to consider if you are interested in buying the package.

Many of the facilities of Art Director are identical to those of Degas Elite, but most notable among the differences is the enormous range of facilities for modifying brushes that have been defined (similar to the blocks in Degas Elite). Art Director also has size and speed meters to control the size of brushes and the speed of drawing — these are much more flexible than the slow-draw mode in

Degas Elite. A window can be defined onscreen so that only a certain area will be affected by any actions performed.

Art Director allows up to eight colour palettes at once, but only two pictures (in comparison with Degas Elite's eight pictures and one palette). The screen can be scrolled in all directions, with edges of the screen wrapping around to the other side.

The extra brush commands available on Art Director are: 'rescale' — this changes the size of a brush but keeps the sides in proportion; 'bulge' — this bulges a circular brush in a convex or concave way; 'perspect' — this puts a rectangular brush into perspective; 'oval' — this cuts an oval-shaped brush rather than a rectangular one; and 'assimilate' — this tries to match colours on a brush which uses one palette, to colours in another palette. Other commands are 'smear', which smears pixels around in an area; 'scrape', which scrapes pixels away; 'melt', which randomly mixes colours on a canvas; 'shade', which changes colours on a small area of the screen; and 'patch', which fills in small gaps, and several other less important features.

The Toolbox sits in a narrow window across the main screen, and while it can be moved around and removed completely, I often found that I could

restarted before you can return to your original place — a great inconvenience. If the Toolbox is left on the screen however, it gets in the way and functions can easily be activated by mistake.

To create a brush you define an area of the screen, and whatever area is selected — colours and all — becomes the brush. This can be used to create quite stunning effects, and is a really useful technique in computer-based art which is unparalleled in manual forms of drawing.

A brush can be used to pick up and modify parts of a frame for the final cartoon strip; these parts can be saved to disk as a 'library' of pieces to use in other cartoon strips. The same applies to backgrounds, and so on. Brushes can operate in different modes — 'transparent', 'solid' or 'silhouette'.

In transparent mode, the background part of the brush acts as if it were transparent, so the underlying area where the brush is used to draw, shows through. In solid mode, the whole brush is used and the background part of the brush covers up what is underneath it. Silhouette mode makes the brush into a solid block of one colour.

Text can be produced in a number of fonts and sizes, although changing fonts and adding new ones is difficult. When the text has been typed in, it appears

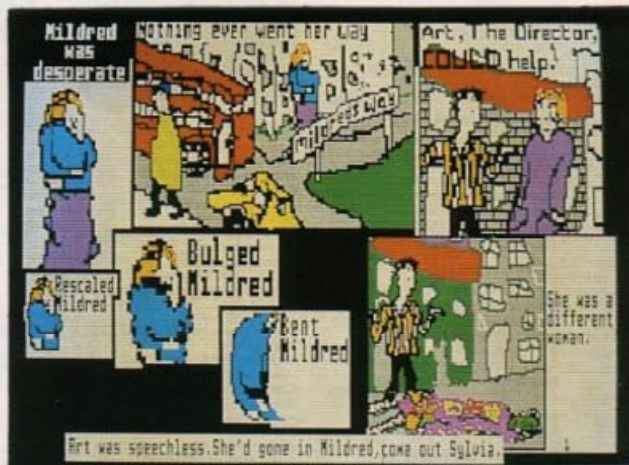
as a defined block that can be positioned anywhere in a picture, and can be used as a brush for special effects.

Art Director's cut functions are excellent, easy to use and an amazing time saver. Special features like 'bulge' offer extra opportunities for modifying parts of a frame before pasting it into a strip. Similarly, 'smear', 'melt', 'shade' and 'patch' seem to offer extra possibilities, but in practice turn out to be rather gimmicky.

'Rescale' is a very useful brush facility. Using this tool it's possible to change the shape and size of a rectangle; I was able to use it to great effect to size the different frames of the cartoon to fit onto one picture. Commands are also provided to automatically modify a block in specific proportions — namely, to halve or double vertically or

horizontally.

Additionally, Art Director offers a 'fat bits'-type magnification tool which enables individual pixels to be edited;



This cartoon illustrates the brush modification facilities of Art Director. Each frame has been drawn separately, copied into the picture and resized to fit the space. Very little 'touching up', to improve the image's appearance, was needed

not retrieve it, even using the methods described in the manual. This is a fairly serious bug, since it means that the picture has to be saved and the program

SCREENTEST

this is good for tidying up stray parts of a picture. The outline function can be used to help finish a drawing, clarifying and defining certain areas, although you often have to put outlines around things as you go, rather than at the end.

Limitations

One of Art Director's main limitations compared with Degas Elite is that it provides only two editing screens, but its range of basic drawing tools is much broader. There are two types of pencil lead — rough and smooth — and a brush with a definable shape. The drawing pen has eight nib sizes. You have to get used to the various functions that work with *some* of these tools, but once the package has been mastered, Art Director gives you a great deal of flexibility in the drawing mode.

While these tools enabled me to produce drawings very much like my own — combining heavy lines with fine lines and shading — the result was nowhere near as good as I could produce using a real pen or brush and a sheet of paper. As with Degas Elite,



The Art Director Toolbox from which most of the basic functions are selected. The advanced brush modification menu is also shown

the lines are jagged and unsatisfactory, and undermine the versatility and scope of Art Director.

Similarities

Both Degas Elite and Art Director comprise roughly the same tools, albeit in a different form. However, Art Director is more complex and has a few functions which Degas Elite lacks. That

said, both packages are basically capable of very similar things and, indeed, there are at least three other art packages available for the ST with comparable functions. Consequently, the *operation* of the tools and functions becomes more important than the tools themselves.

One important thing to note is that it's possible to some extent to convert pictures so that they can be transferred between Degas Elite and Art Director.

'Often, major changes can't be effected, and the artist has to destroy much of the work and start again.'

and other art packages. If you owned all the programs, you could have the best of all worlds and take selective advantage of all the facilities available, although this would be rather expensive. (I should point out that the criticisms of Degas Elite and Art Director unfortunately apply to all similar packages,

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and, in fact, only a couple of other programs are as good as these).

Documentation

The Art Director manual was unfinished and its approach was unhelpful, but hopefully this will have changed in the final version. The Degas Elite documentation however, was comprehensive and friendly.

Conclusion

I found using a computer to create art to be a fast way of working because it enabled me to play with and edit my drawings easily and quickly. In addition, there was none of the mess or deterioration in quality usually associated with hand-drawn work where it's difficult to hide evidence of changes. Often, major changes can't be effected, and the artist has to destroy much of the work and start again. Using the computer with care can avoid some of this hassle.

Despite these significant advantages, the stepped nature of the shapes is a major disadvantage. The low resolution results in jagged lines and poor quality, and gives you unsatisfactory artwork. Art Director's manuals promise a 'round-off' function to smooth the edges, but the drawback is that this rubs out most of the drawings and is smudgy.

The one area where Degas Elite and Art Director score heavily over manual methods is in the field of animation. Using a Super-8 camera, it would be possible to take still images of the screen as characters and colours were changed. This would provide a fast, cheap and easy way to make an animated film by drastically reducing the time needed to draw each new frame.

Another possibility would be to use a digitiser to import images from photographs, and then modify them. But digitisers of this capability cost at least \$1000, and the tools available may not provide the level of sophistication many users would expect.

Reviewers of art packages are consistently impressed by the new functions and possibilities of computer art packages, but the main limitation is the computer's resolution. I have heard many accounts of artists — graphic designers included — initially thinking that computer graphics had great potential, but soon rejecting them and going back to their old methods.

A final caution concerns the use of colour. Most computer users have a

monochrome printer and would have to produce their output in shades of grey. The only alternatives are to take photographs of the screen, or to buy an additional, expensive colour printer.

If I had an Atari ST, I would buy one of these packages. Of the two, Degas Elite comes out on top because it has eight editing screens, it has a less irritating method of handling the Toolbox, and it comes in three resolutions. Art Director would be better for advanced manipulations of simple images and for parts of the drawing process.

Certainly for a home user, art packages like this provide a way in for people new to graphics who want to explore their creative abilities. When someone has become accustomed to what the computer can and can't do, then they will be able to make better use of the machine's versatility and range of possibilities. But anyone who thinks that using a computer will turn them into a great artist will be badly disappointed.

When a user has gained some skill, he or she may well find themselves irritated with the mouse as an input device. I found it coarse and less sensitive than my own hand. Cheaper touch tables are available for Atari STs which will enable novices to trace over existing photographs and diagrams, and so copy them onto the screen. For myself, I would use one of these packages to produce working drawings rather than finished artwork.

The potential of art packages like Art Director and Degas Elite is uncertain. If the resolution were better, then perhaps greater things might be achieved. I wasn't impressed with many of the special functions on either package — I found them too gimmicky. I had to adapt my style too much to the computer, partly because I wasn't experienced at using it. The most important thing to remember is that the extra functions are not as important as the basic drawing ability: if you can't control the tools accurately, it's irrelevant how versatile or impressive a package is in other ways. If you're thinking of buying a computer art package, try it out first to see if you're comfortable with it.

END

Degas Elite costs \$89.95 from ECP (075) 96 3488 and Art Director is currently not available in Australia.

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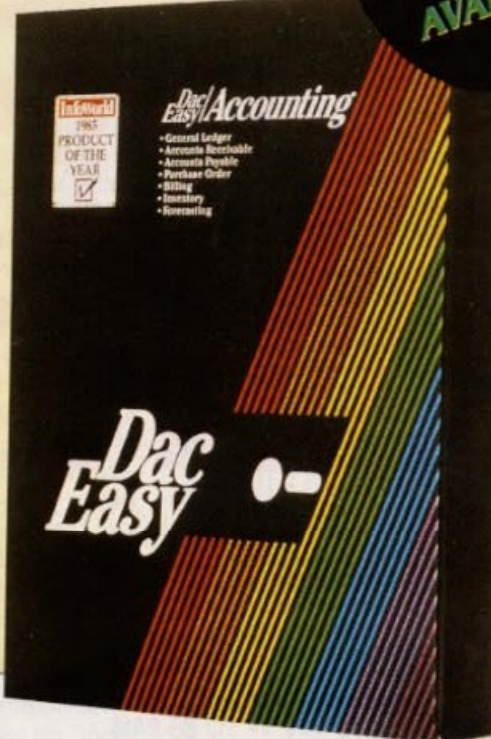
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Everything is turning out very rosy for Apple as the company looks to the future, while the PC is getting a face-lift — and not before time too. Our West Coast correspondent, Tim Bajarin, reports.

Apple's gamble pays off with success of Macintosh

In January of 1984 Apple Computer shipped the first Macintosh. In January 1987, three years later, Apple shipped the one millionth Mac. This is very impressive for a computer that had much working against it and was one of the biggest gambles in the world of computing devices.

At the annual Apple stockholder's meeting in late January, John Sculley, president of Apple Computer, was presented with a gold-plated Mac to commemorate this formidable achievement. Although in its first two years Apple produced approximately 260,000 Macs per year, 1986 saw Apple ship over 480,000 Macs worldwide.

This success is attributed to three factors:

- software products for the Mac came of age in 1986. There are now over 500 programs for the Mac, some being the most creative products available in the world of personal computing;
 - the introduction of the Mac Plus, a machine that broke the 640k barrier for internal memory as a standard feature; and
 - the intelligent marketing programs that Apple developed for desktop publishing, with the Mac and LaserWriter at the heart of the system. This one concept alone gave the company credibility in the corporate world.
- The Mac has now entered

its fourth full year of production. Nineteen-eighty-seven will prove to be Apple's make or break year for this machine, if it is going to be accepted as a true standard and gain the kind of momentum needed to be the real alternative to the world of IBM business computing.

Don't get me wrong; the Mac is here to stay. But its true success is in its ability to create, and be considered a second business standard, not just a 'techie' or 'education' computer for the general market-place.

Apple is working on two new features for the Mac which many believe will change its market presence and allow it to finally be considered a true personal computer in every sense.

The first and most impor-

tant thing that Apple is expected to do is to give the Mac an open architecture, in the same way IBM gave us its open-boxed PC, and allow for the use of third-party slot support. This, along with bigger screens, colour, and powerful memory upgradability, as well as a new Motorola 68020 processor, will make the Mac one of the most powerful personal computers available today.

With this new machine, Apple will launch the start of the personal graphics workstations that will someday be a standard in every desktop PC, be it Apple, IBM or even Atari or Commodore.

This machine, along with the 80386-based products in the IBM world of computers,

also marks the beginning of the era of supermicros in everyday business computing. And, when you link these products to the new generation of graphics chips from Intel and Texas Instruments, it is not hard to see how graphic workstations could be on every desk in the very near future.

The second product that will really impact the Mac's marketability in the computing world that IBM dominates today will be the Mac's ability to run IBM software.

Although a third-party company has developed the slot card that allows for this IBM PC compatibility, sources close to Apple confirmed that Apple funded the project and considers it an important marketing issue that will speed the Mac's acceptance in the business environment.

The new Mac, a new version of the Mac+ and this PC-compatible slot card are due to be announced in early March. The addition of colour in the Mac line will probably come out sometime in spring this year.

Regardless of your personal position on the Mac, I believe that Apple deserves credit for producing an exciting machine that is becoming a very successful computer. And, if Apple continues to enjoy this continued success, perhaps sometime in the future, IBM may be forced to make its own PCs Mac-compatible as well.



PC software card gives new lease of life to Apple II

While on the subject of PC compatibility, the Apple II line of computers will soon have the ability to run IBM PC software. Applied Engineering of Dallas, Texas, one of the largest distributors of add-on products for the Apple II, will soon begin to distribute a card that allows the Apple II to run PC software.

Developed by the Engineering Department of Campbell,

California, made up of ex-Apple engineers, this device allows the existing Apple II computers, for about \$US600, to run all PC-DOS software that is on the market today; that is providing the Apple II has the memory to handle the specific PC programs you wish to run.

This new option for the Apple II could really extend its life. It could provide a

great deal of new product applications for those who have a real investment in their Apple II machines, and are wary of changing over to many of the other operating systems available today. Although it may not run the software as fast as it would on a true PC-DOS machine, this card will still be of great interest to the two and a half million Apple II owners worldwide.

PC puts on friendly face at last

One of the things that has hindered the acceptance of the IBM PC in the computer buyer's mind, has been the difficulty of using and learning DOS.

Companies like Microsoft with its Windows product and DRI with its GEM software are attempting to make the IBM PC range Mac-like in nature and give it an intuitive user interface using icons and pull-down menus. Although both of these products are quite good, they are very code-intensive: Windows needs at least 640k of memory to run efficiently while GEM demands 512k.

Since I really believe that the new era of PC users will demand a DOS shell or DOS interpreter before they will even touch an IBM PC or compatible, I have been on a search for the product that could help these machines gain acceptance

in this potentially large new market. A new product from Matrix Software in Boston, Massachusetts, looks like it could fit the bill.

Called Synergy Desktop, it has an elegant Mac-like interface and can run on a stock 256k machine. Running under the Synergy Operating Environment, (which uses only 12k of code), it is a graphics-oriented program that is both Windows and Topview compatible.

The desktop product is a highly graphic DOS interface that acts as an intermediary between DOS and various applications, as well as managing the system memory and peripherals. It also offers a number of pop-up desktop accessories, calculator, clipboard, clock, calendar and utility functions.

Using the cursor keys, the user simply points to the files icon on the screen,



presses Return and the file opens up. Creating the file with this program is very easy. Dialog boxes also take each user through each DOS operation. If you choose 'delete', a box explains that the file is about to be permanently deleted and prompts the user to approve by selecting a 'yes' or 'no'.

I have been using Synergy for some time now, and being a Mac freak who consistently shies away from my PC in favour of the Mac, this program is wooing me back. It is a *must* for the first-time PC user, and at \$69.95 it is also a bargain.

Trekking into another world

I have never been a fan of the *Star Trek* series but a recent *Star Trek* game by Simon and Shuster Software has caused me to start my own trek into another time dimension and galaxy, and it is causing me problems in getting my work done.

Star Trek: The Promethean Prophecy is a follow-up game to the company's best selling program, Star Trek: The Kobayashi Alternative.

Both games are text games that challenge the players to unravel the mystery of a complex culture and discover new worlds. The Promethean Prophecy presents you with the dilemma and challenge of finding an adequate food source before the Star Ship Enterprise crew starves!

Although shoot-em-up action games are fun, the interactive text games come close to drawing you into the action like a well-written novel. Filled with heroes, villains and weird spacey characters, it is great fun.

Released in the US back in December, it should be available in Australia in early 1987.

Available for the IBM PC and Apple II line of PCs, and at \$US39.95, it will be one you'll want for your software library.

dBase delay for Macintosh

Last spring, Apple's president John Sculley and Ashton-Tate's president Ed Esber joined forces to announce the launch of dBase for the Mac.

For all who attended this conference, the new product looked by far to be one of the more important and impressive products to come out for the Mac. It was Ash-

ton-Tate's first Mac product, and Apple was counting on it to help steer the Mac into corporate accounts already familiar with dBase for the PC. The most significant part of the announcement was that the Mac product represented the way the dBase PC product would look in the future.

Originally due to ship in

December 1986, Ashton-Tate has held off shipping the product until April or May. This is due to some technical problems and the feeling that more time is needed to perfect the product. Although this is good news for dBase competitors in the Mac world, I do not feel the delay will change the impact that

dBase Mac will eventually have.

It will still be a product that will be endorsed by Apple, marketed through Ashton-Tate and give the Mac 'respectability' in the corporate market.

No matter when it comes out, it will be worth waiting for.



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The word processor that leads all the best-seller charts in the US market is Word Perfect. This PC product even outsells Microsoft's Word and IBM's DisplayWrite. To date it has only been available for the IBM PC world, but according to Allen Ashton, president of Word Perfect Corporation of Orem, Utah, a version for the Commodore Amiga, Apple Mac and Atari ST will soon be available.

The IBM PC product is good, but the software for these three 68000-based PCs will be even better.

Word Perfect utilises the power of these computers and their intuitive user interfaces to provide an elegant way to manipulate words.

This type of word processor is destined to become the way all word processors will function.

Coming soon . . . new products at a dealer near you

Sometime during 1987, a US company (who will remain nameless) will begin delivering a scanner that measures 2ins x 2ins x 11ins and is by far the best small scanning device I have seen to date. It scans at a full 300dpi resolution and is small enough to fit into a portion of a briefcase. When it has a portable FAX modem added, it will double up as a FAX machine. Although this scanner is still in prototype stages, it points out the major strides our industry is making in the way of image-processing technology.

In the US market today, we already have a thermal-scanning device that is known as a hand-held copier. It copies a column width of text and, although it is a handy device, it is very limited in its abilities to do serious scanning. This new

portable scanner uses plain paper and could sell for around \$US1000. It does not yet have true optical character recognition, but this feature should be available in the very near future.

Another interesting computer that we expect to see in 1987 will be the entry of a complete one-piece IBM PC clone. Like the Macintosh, this product will be housed in a moulded box and include the screen, disk drives, four slots and parallel and serial ports.

There will be a portion on the back of the machine that lifts off and allows for easy installation of add-on cards. At least two companies are already making products of this nature which are being designed for the low end PC and educational market.

Observers close to these companies think that a single disk system could sell



A thermal scanning copier

for as little as \$US595, but some think that the inability to choose your own monitor will hurt these machines' chances for success, although others believe that the one-piece design makes it a simple, portable-type device that makes it ideal for home or educational use. Such machines could find a real niche in the computing market-place...

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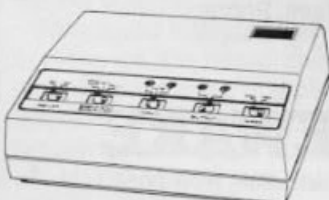
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FileMaker Plus

FileMaker Plus is a flexible and powerful file manager for the Macintosh which supplements your existing database software and allows you to create professional-looking presentations in the format of your choice. Mick O'Neil tests it out.

The major weakness in most database programs or file management software is flexibility in report design. dBasell, the leading database software through several generations of CP/M and MS-DOS machines, was easy enough to use for producing the standard 132-column, line by line, MIS department printouts, but any kind of specialised reports required the use of its obscure programming language or special formatting add-on software.

Though dBasell Plus significantly improves on its predecessor with its Macintosh-like user interface ('Assistant'), special purpose reporting is still tedious, at best. Noting this major

weakness in almost all database software, ForeThought Inc from Sunnyvale, California, recently released FileMaker Plus, a much improved version of FileMaker for the Macintosh that enhances the database reporting function to the degree that it appropriately refers to it as 'database publishing'.

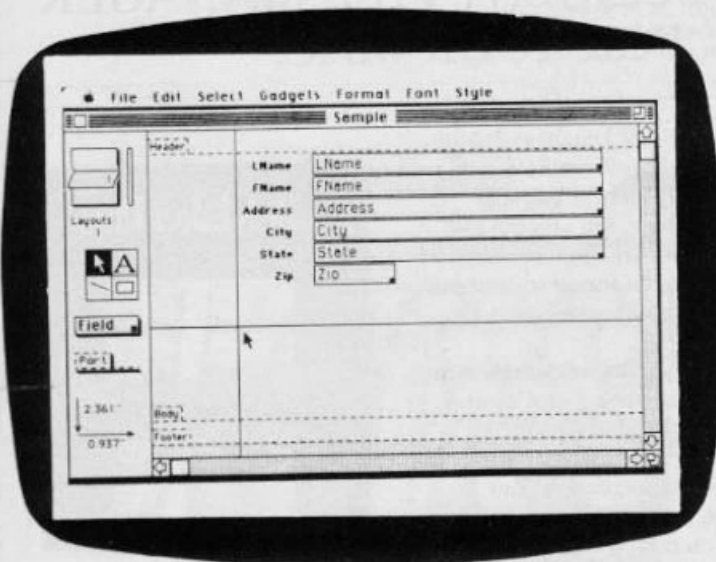
With FileMaker Plus you can create and access a database to produce professional-looking presentations in any format required, from data entry screens, business forms, and form letters, to columnar reports, free-form reports, and mailing labels.

A flexible and powerful file manager

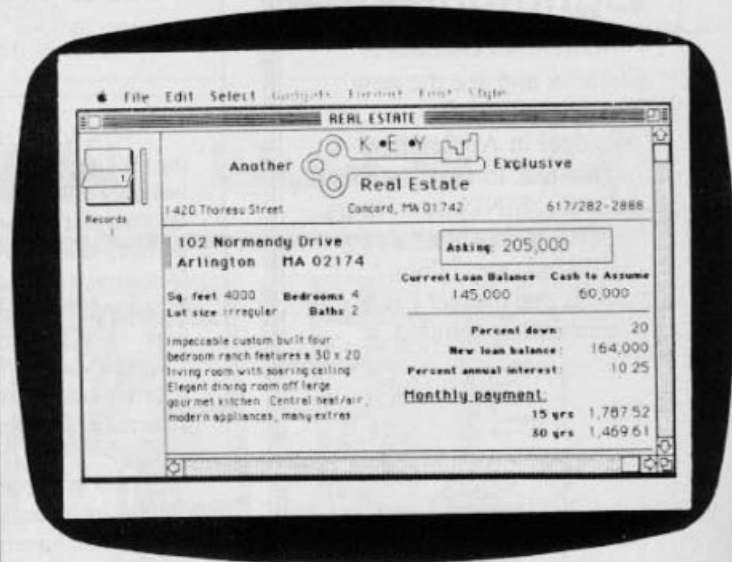
in itself, Filemaker Plus includes the capability to import and export data from full relational database programs, and so offers the power of data publishing to companies that have already invested data management resources in other Macintosh software. In combination with a file transfer and translation system like MacLink from DataViz Inc, this program could well justify the procurement of Macintosh equipment by businesses already committed to PC or PC-compatible equipment.

Capabilities

Before going any further, it is worth



FileMaker's 'layout' option allows the user to design any number of forms, all accessing the same database. Fields can be dragged to any location on the page and highlighted with the box and underline tools. The 'grow' handle allows for the sizing of fields



Sophisticated business forms can be produced with FileMaker which combine the power of graphics, numeric, text and calculation fields. The form shown here includes both fixed text and graphics and variable information from the database

SCREENTEST

pointing out that FileMaker Plus is not a full relational database system in the tradition of Omnis 3 on the Mac or dBase on the PC. Yet, with the capability of opening eight files and an extensive look-up and update option, it certainly fills in the gap between relational databases and simple file managers.

The number of fields and records is limited only by disk space and because every word, date, number, and calculation is automatically indexed, searching is extremely fast. The search function is comprehensive and allows searches based on multiple fields and multiple criteria with Boolean operators, ranges, exact matches, prefix matching, and empty or invalid field values.

FileMaker Plus also allows sorting records (ascending or descending) on any combination of fields including calculated fields. Because the program does not store data files completely in



A typical database may include several types of fields



The online 'help' feature is formatted as a FileMaker database

RAM, FileMaker Plus' sorting process is slower than some database software; but I suspect that unless you are dealing with very large data files, the speed difference will be relatively insignificant.

Data handling

With FileMaker Plus you can define fields as text, number, date, picture, calculation, and summary data. Text fields can hold up to 32,767 characters and feature automatic wordwrap. Thus, you could create a file of all your cor-

respondence or a personnel file with resumés, evaluations, or letters or recommendations. Numbers and dates include flexible formatting options, and pictures can be scaled or cropped.

Calculation fields let you tell FileMaker to compute a formula using values in number, date, or other calculation fields and enter the

result, which can in turn be either a number or a date. Calculation fields can be defined using conditional logic, date arithmetic, and over 25 mathematical, financial, date, logical, and statistical functions and operations. Summary data consists of calculations over several records.

FileMaker includes the option to perform accuracy checks on particular fields during data entry. A field can be modified to accept unique values only. This could be useful for transaction numbers in an accounts file or social security numbers in a personnel file.



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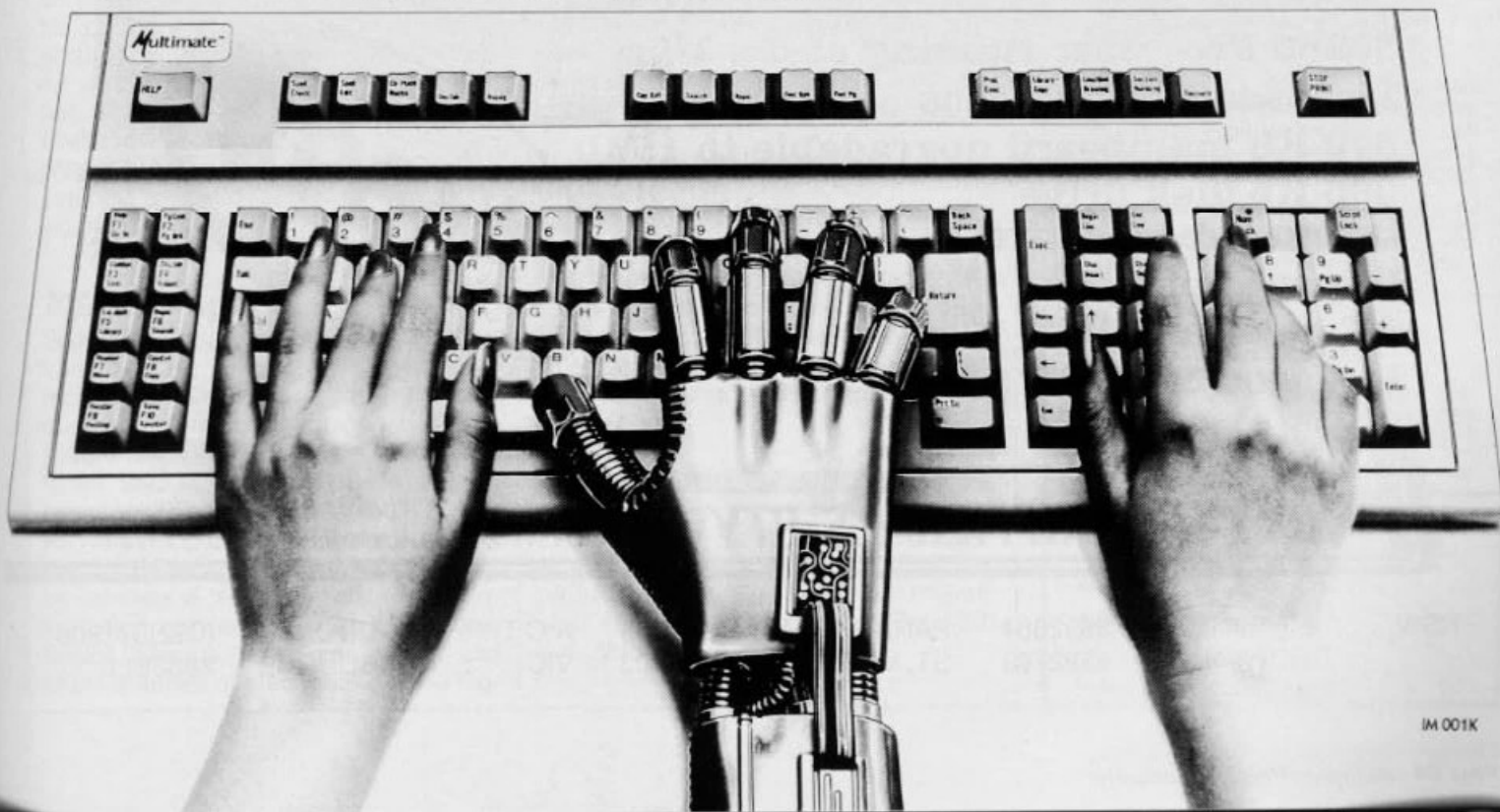


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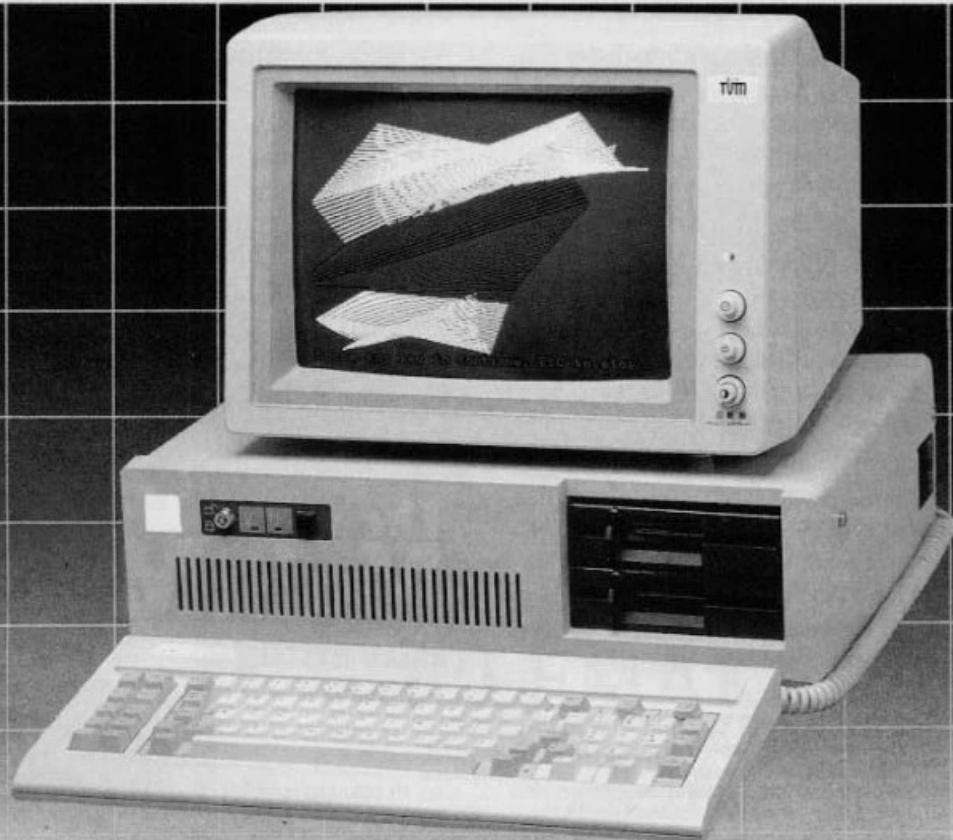


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The program alerts the operator that an entry is not unique but offers the user the choice to make an exception. FileMaker also can be instructed to check designated fields for existing values only: that is, the program alert is triggered by any unique data. In this case, the program asks you if you want to add the value to the list of acceptable values.

Flexibility

By now, you can see that this program can compete well head to head against any file manager or non-relational database program for the Macintosh. The feature that may make it the overwhelming choice for Macintosh users is its ability to generate forms. With its graphics tools and its 'gadgets', it is possible to design your own forms like receipts, form letters, labels, columnar reports, class notes, and so forth, or to design a template that fits information perfectly on a predesigned form like a company report, job application, or the like. ForeThought also includes a disk full of working templates including Expense Reports, Fixed Assets, Mail List, Phone Messages, Rolodex, Sales Order, and so on, which you can modify to fit your needs.

FileMaker refers to these forms as 'layouts', and the number of layouts for a file is limited only by disk space. Graphics can be added to the layouts by simply cutting and pasting from any Mac graphics software and, of course, other graphics can be included as individually defined graphics fields. Text can be formatted with any fonts, styles, or sizes. Fields, text, and graphics can be positioned anywhere on a layout and a grid, and a T-Square is provided for accurate placement. ForeThought has significantly increased the utility of FileMaker by adding a 'Preview Option (WYSIWYG)' which allows the user to examine a form onscreen prior to printing, so easing the design task.

Instant replays

Suppose you use the same file to store transactions, prepare receipts, find records for clients who have a balance due, and print form letters requesting payment. This could involve several different layouts, page setups and print directions and the task could seem very daunting indeed. FileMaker allows you to automate the whole procedure by creating a 'script' which records information concerning open files, page setups, layouts, sorts, and so on, and offers a series of steps that can be tog-

gled for inclusion in the script. The procedure is then stored and can be easily recalled and executed from the 'File Menu'. Scripts in FileMaker are similar to 'macros' in Microsoft Excel, only they are a bit more instinctive to create.

Compatibility

One of FileMaker's most important features is its compatibility with other data formats. It can read and write text files (with tabs), Basic files (with commas), and Syk files (Excel) and can write merge files for use with Microsoft Word's merge capability. This capability insures FileMaker utility in those offices that have already committed themselves to other database software but need a forms generator for existing data.

Price

FileMaker Plus costs \$495, but for those who are hesitant about spending this amount of money without seeing the product, ForeThought offers a 30-day money back guarantee.

Documentation

FileMaker comes with a superb 317-page manual that includes an introduction to the program, a quick tour, a user's guide, a series of very useful examples, and a quick reference section. The software itself is provided on three unprotected diskettes including a program disk, a start-up (systems) disk, and a disk containing sample templates.

If the superior documentation and sample templates still leave you confused, an extensive online help option is available and is appropriately formatted as a FileMaker database.

Conclusion

FileMaker Plus is easy to use and powerful, and meets a distinct need in the information processing market. As a standalone, non-relational database program, it competes well against any other software on the market, and as a sophisticated forms generator it's the industry leader.

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ForeThought Inc is at 250 Sobrante Way, Sunnyvale, California 94086. Tel: (408) 737 7070. FileMaker Plus is available in Australia from SCA. Tel: (03) 699 7255.

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Leave it to the experts

The use of expert systems on mainframes and in Artificial Intelligence has led to speculation that they may also find a niche in micro programming and, more practically, in the fields of research, development and diagnosis. Owen Linderholm examines these pseudo 'experts' in detail and suggests possible areas for their implementation.

An expert system is a computer program/system that models and replaces a human expert's knowledge in their area of expertise. The program can answer questions within this area of knowledge, and can back up its judgement or opinion by correctly showing and explaining its reasoning to the user. In order to do this, the program usually has to obtain data from the user, who may *not* be an expert, and it has to be able to question the user carefully to obtain the data it needs. The program must then be able to provide the same answer that a human expert would have provided, and must be able to arrive at a conclusion by using knowledge and experience that a human expert has given it in the past, or that it has derived from experience in similar problems. It must also be able to justify its answer to the user, and prove that it is right.

Expert systems have been at the forefront of Artificial Intelligence's move into the commercial and microcomputer sections of industry. For several years, people have been predicting the impact that they will have and how they will usher in a new age of cheap computer power, and many expert system shells are now available for micros — especially IBM clones.

An expert system shell is a program that claims to be able to create an expert system on any subject for which you can provide an expert. Expert system shells also provide the environment for complete development of an

expert system. The expert system can be debugged and modified under the shell very easily. When one has been finished, you will usually be given the option to produce a final 'compiled' or run-time version: you design a structure, set up the rules carefully, and un-

'An expert system shell is a program that claims to be able to create an expert system on any subject for which you can provide an expert'

leash your silicon expert on a world demanding answers.

Unfortunately, this dream of instant electronic information and advice for all has yet to materialise. Somewhere between the program, the press release, the publicity and the public, it ran into reality and came off worse.

Despite the claims, most of the so-called 'expert system' programs that have appeared for micros are not what they set out to be. They could be described in several ways — as thought organisers, or structured databases with rules, or whatever — but not as expert systems, and it is misleading to think of them as such, although most of the programs are useful in their own right.

Real expert systems have appeared, but only on computer systems that are much larger and more powerful than the office micro. These programs have proved their worth many times, but they have also been extremely expensive to create; not necessarily in strict financial terms but in terms of manpower, since they have generally been the product of academic research. All this may sound rather complex; after all, it's usually quite easy to find a human expert who'll give you advice quickly and easily, so why bother with a computer? (This question crops up a lot in all fields, not just with expert systems, and very often the answer is that you *shouldn't* bother with a computer!) Unfortunately, in some fields, there are only a couple of experts in the world; or the experts charge huge sums of money for their time; or the field of knowledge to be covered is so large that one human expert cannot possibly know everything within the area.

In these situations expert systems have a lot to offer, but the way they are used and set up is of extreme importance. A badly designed expert system could cause a great deal of damage if its advice were taken seriously. It is also important that users realise the limitations of the particular expert system they are using before they get involved with it — bad advice can be worse than ignorance.

Expert systems apply knowledge and reasoning to data they have been supplied with; explain and justify the con-

channels to add the animal if it's new, and will not be too far off itself when it takes a guess. On the other hand, if the questions are entered in a random order, the program will be hard to use and build up. For example, if the first question is: 'Is the animal green?', then one answer 'yes' will lead to few possibilities (frogs, perhaps) whereas the answer 'no' will lead nowhere.

Example application

An example expert system can be used to illustrate a lot of the considerations outlined above. The one I have chosen fails on some points but adequately illustrates the advantages and failings of expert systems in general. It is an expert system to advise potential purchasers on which microcomputer, software and additional hardware to buy to meet their requirements.

One immediate problem is how to deal with people who say, for example: 'I have been using package xyz at work, and whatever I buy must be able to run xyz'. The problem is that package xyz may be obscure or even purpose-written. The program won't know, because a human expert wouldn't, which computer is suitable for running the software, and it will need to know how to extract this information from the user. Skilful 'programming' of the expert system can overcome this problem by asking detailed questions about the type of computer being used at work, and so on, but nevertheless it is unlikely to come up with an entirely satisfactory answer.

To illustrate this point, suppose that the computer at work is a powerful mainframe. No microcomputer purchaser is going to be able to — or would want to — buy a mainframe. The expert system comes to the conclusion that the person is going to have to do without their pet program at home.

A more flexible human expert might, however, be able to discover whether the high-level source code for the program is still in existence, and whether or not this could be easily converted and recompiled on a micro. After exploring this detour as it leads into other areas, the expert could then recommend a computer, the software, and a source of help for porting program xyz to the micro. It's this kind of unusual circumstance where a human expert can do things that an expert system cannot.

The box on this page shows a very simplified version of the structure of the expert system. (Please note that

Example expert system structure

Question 1: Do you really need one?

Question 2: What do you want to use it for?

Games

Programming

Home word processing, accounts, and so on

Serious programming

Serious word processing

Accounting

Small-business general use

Heavy business use

Question 3: What extra hardware will you need?

Printer

Disk drives

Monitor

Modem

Hard disk

Laser Printer

Question 4: What extra software will you need?

Word processing

Database

Spreadsheet

Accounts

Programming language

Utilities

Graphics

Specialised/custom software

Question 5: How often will you use it?

Question 6: How much money can you spend?

Question 7: Do you want a warranty?

Question 8: Do you want to take out a service contract?

Question 9: Are you reasonably computer-literate?

Question 10: Will you need training?

Question 11: Will you have to use 'user-friendly' packages or be able to dive straight into particular products?

Question 12: Does the computer have to be compatible in any way with ones at work or ones that other people own?

this is only an idea, and has not been seriously considered for long enough to make it a complete structure specification.)


The list of questions and answers in the box is the minimum needed to make a basic recommendation about the type of computer system someone should buy. It isn't good enough to enable the system to pick out a particular computer or piece of hardware (especially in the dot-matrix printer market, where there are innumerable

printers all priced the same and all doing the same things), but it's enough to suggest a range of possibilities. What is needed beyond this list of questions and selected answers is a structure, and a decision-making set of rules which lead to different pieces of advice.

There are several things to be taken into account here. The order in which questions are asked is important, and the information gained from the answers should affect the other questions asked, as well as the answers. Different kinds of answers can be expected, ranging from simple 'yes/no' through numerical values and items selected from a list, to open-ended questions. (The last category should be avoided because the computer can't categorise the answer properly.)

The underlying structure of the expert system can be constructed in several ways, but almost all micro-based expert systems use a tree of IF...THEN...ELSE rules to determine the expert system's path. Questions are part of this structure and provide answers for the IF...THEN structure to work with. The simplest expert systems consist of a series of IF...THEN statements, either nested or listed one after another, or both. Many commercial products really consist of no more than this with a pretty interface, and some of the more advanced ones work with sets of rules and IF...THEN structures which are more cleverly combined. The very best ones make use of other control structures and allow more flexibility, even as far as modifying themselves or pushing for a better answer in response to specific questions. The example given above could be given as a sequential set of IF...THEN statements (see the diagram). Each answer to a question should then modify a list of possible answers, which initially would be a list of all the popular home and small-business micros. At each stage, this would be adjusted according to the answers until all the questions had been answered. It's quite possible at this point that the list of possible machines would contain a selection of several computers or none at all. This reflects the kind of choices people really have to make and the answers they would get from an expert.

Most of the available expert-system programs could be used on this problem; such as Xi Plus, or even the expert system program published in the March '86 issue of 'Program File'. None of these, however, are any more than programs to help design a



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decision tree and present it nicely. More advanced programs, such as Expert-Ease, are unnecessarily powerful.

When the expert system is being constructed, the list of machines as possible choices will have to be indexed by the answers to each question; then, as the questions are answered, those that don't match can be removed. Some questions cover similar ground, and these can be used as a cross-check on how consistent the expert system's user is and so as a check on whether he really knows what he wants. For example, if a user says that he wants to use the computer for word processing and then doesn't want a printer or specialised word-processing software, he will either be so unknowledgeable that he needs more help than the program can give, or he is simply forgetful and needs prompt-

check answers against the table and cross any off the list that didn't match; at the same time, it would be building up a list of desired features that didn't match any of the computers available.

There are still a lot of questions to be answered — the examples described here barely begin to explore structuring the expert system, but they are already leading to ideas. Personally, I would tabulate the machines and indexing data, but cross-index with the answers to help find inconsistencies. There should also be two lists: one of machines that still match all the criteria; and another of criteria that none of the machines match. This second group would then allow the program to advise on closest matches, even if no machines matched everything.

The questions could be embedded in a control structure that asked them in order, and then used the answers to monitor what actions the control structure performed on the two lists and the table, as well as what it did in the way of modifying exactly which questions were asked.

Micro-based expert systems are still generally based on IF... THEN type structures and simple rules entered into the system by a person, although some have started to use the more flexible methods involving probabilities and other control structures. Mainframe-based expert systems explore a problem by using previous knowledge stored elsewhere and then deducing new information by analogy, reasoning and example. They also handle knowledge or information that isn't clear-cut but is expressed in terms of probabilities. When a certain level of probability/possibility is reached, the

one of the possibilities hardens into certainty.

For many purposes, programs other than expert system shells should be used to create expert systems. In many cases, a database programming language like dBaseIII (with which many people will be familiar) would be a better choice for making an 'expert system' than an expert systems shell. dBaseIII is, essentially, a programming language, and as such has more flexibility than an expert system shell.

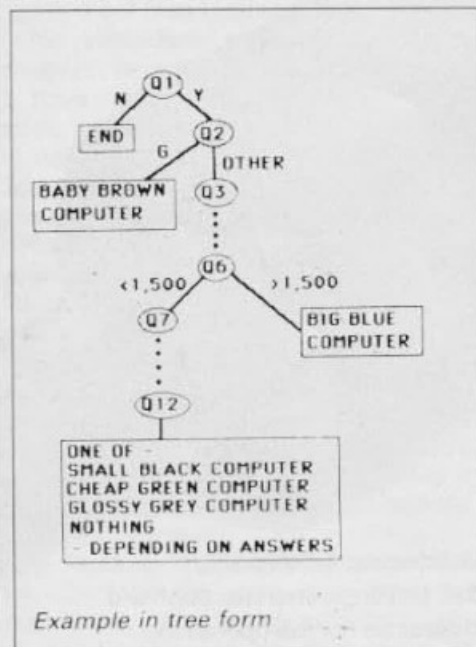
As an expert system is a program in which you are going to invest a lot of time and effort, you might be better off programming it directly. Although this involves much more work, it is likely to result in a more powerful and flexible expert system. The problem with this method is the extra time and costs involved in the programming, development and debugging, which must be weighed against expert system shells that are quicker and easier to use. In particular, expert system shells already have a built-in mechanism for querying their decisions. This is the most important facility that an expert system should have, and it's one of the hardest parts to program independently into an expert system.

Implementation

It's important to ensure that the application you have for an expert system is one that will work well, and you'll also need to have easy access to the expert or source of information that is to be the basis for the system. Mainframe and mini-based expert systems are likely to be 'real' expert systems and, as such, powerful enough to be able to simulate a real expert. But the cost of using these is great enough that serious consideration should be given to whether or not you can afford to create, maintain and use the expert system.

Some fields, such as mineral exploration, are good candidates for expert systems and have already been successfully implemented. This is because mineral exploration is a field in which a few experts have limited ranges of knowledge, and such experts (usually companies) charge heavily for their services.

The final piece in the jigsaw is that successful prediction of areas good for mineral exploitation can be highly lucrative for the company that eventually exploits rights to the minerals. An expert system that can successfully predict areas suitable for mineral exploitation has, for example, already pinpointed a



Example in tree form

	Use	Software	Hardware	Cost
Big Blue Computer	B	All	All	High
Small Black Computer	H	Limited	Disks	Low
Cheap Green Computer	S	Limited	Disk Printers	Low
Baby Brown Computer	G	Games	Disks	Low
Glossy Grey Computer	A	Limited	All	Medium

Note:

B — Business; H — Home; S — Small business; G — Games; A — All

Hypothetical consultation table

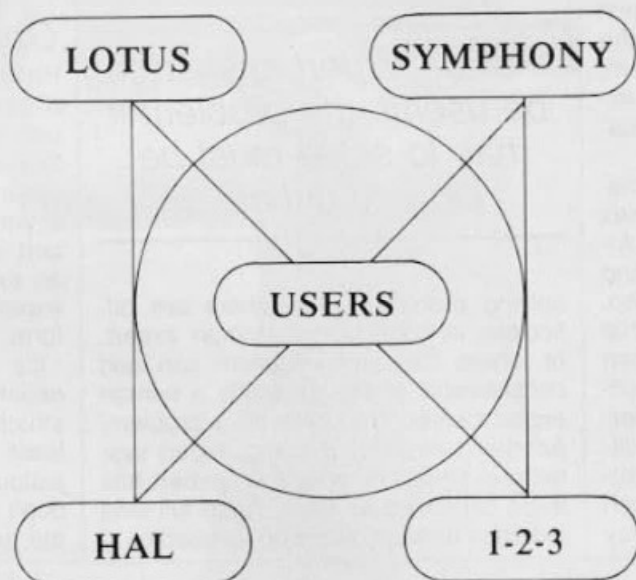
ing. Either way, the program has to be able to detect this and come up with an appropriate response.

The hypothetical consultation table here is a drastically shortened version of what would actually be used. It does, however reflect real life in that the full range of possibilities is *not* represented, since there are only a limited number of computer manufacturers. The expert system would be told to

program acts as if that particular piece of information is true. If that is subsequently found not to be true, the program assigns that piece of information as false and continues.

This reflects real-life decision-making in that there are usually several possibilities at any one point, each of which is more or less likely than the others. Finding more information changes these probabilities until eventually

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PROGRAMMING

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Another successful (and famous) expert system is used to diagnose infections and suggest treatment. This can be done by any doctor, of course, but the expert system comes into its own when diagnosing complex multiple illnesses and obscure illnesses that occur infrequently. In these cases, the expert system can, in collaboration with a doctor, sort out and separate the different symptoms, and suggest drug treatments that will not affect the other illnesses. This expert system, called MYCIN, is one of the earliest expert systems to show real sophistication.

These expert systems are mainframe-based and are large, complex programs based on a great deal of Artificial Intelligence research and programmed in languages like Lisp. The code includes special routines that attempt to carefully emulate human thought processes — these can be difficult even for AI researchers to understand, and even the authors have difficulty implementing them on other computer systems. Consequently, such programs have not yet found their way

onto micros and are still rare, although some micro-based programs such as Expert-Ease are based on high-level research.

It's interesting to note that nearly all the best expert systems are *not* constructed using an expert system shell, since these inevitably put restrictions on what the expert system can achieve. Therefore, it's sensible to only consider using an expert system for

'For an expert system to be useful, the problem it has to solve must be easy to define ...'

solving problems when there are difficulties in consulting a human expert, or where the expert system can add considerably to the expertise a human expert can bring to bear on a problem. Another possibility is using expert systems in situations where an expert has to be consulted so often that a full-time expert is needed, but is not available.

There are many fields where human knowledge and judgement cannot be quantified or defined precisely. In such cases an expert system would be useless, as it would be impossible to provide it with the information it would need to arrive at a reasonable conclusion. For an expert system to be useful in a particular situation, the problem it has to solve must be easy to define and must have definite rules that can be applied to its solution.

Opportunity

Having decided that you have an application that you could use with an expert system, there are still other points to consider before creating the expert system. The structuring of information is very important, but even more important is being sure that you can insert an expert's opinions and rules into the expert system in a coherent and useful form.

It's surprisingly difficult to persuade experts to express this knowledge in a structured and reasonable way, not least because many experts are jealous of their specialised position and don't want to reveal their knowledge to the world. Expert systems have be-

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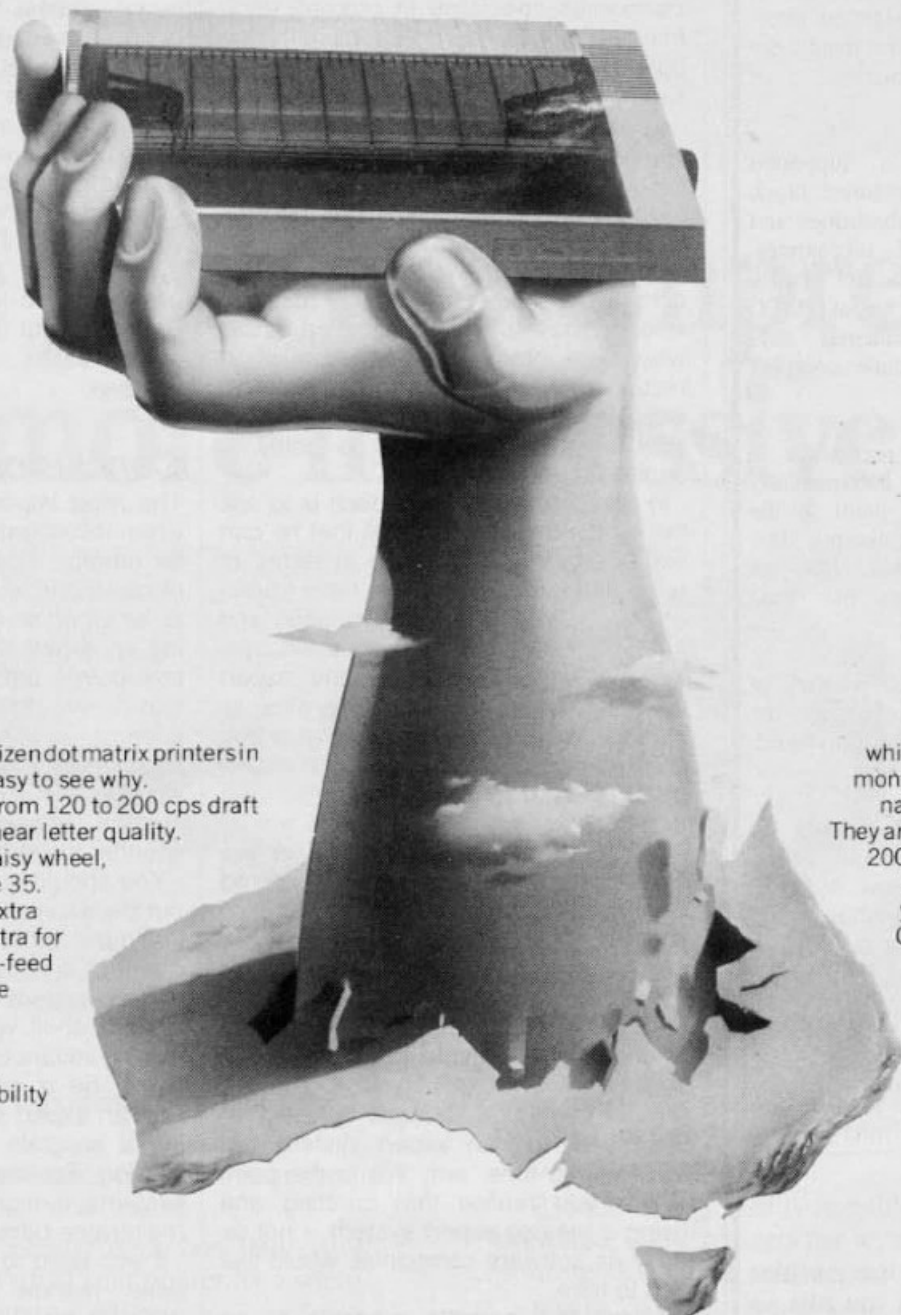
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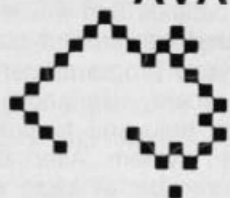
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come so widespread that an industry has grown up around the difficulties in representing and structuring experts' knowledge. 'Knowledge engineering' companies specialise in coaxing information out of experts, structure it and pass it on to the expert system in a sensible form.

This process is the most difficult and important part of setting up an expert system. If it is incomplete or flawed, then the final expert system will be useless. In fact, a poorly constructed expert system may seem to be fine for certain problems, but will be useless when it has to concentrate on areas where the information has been incorrectly entered. This could be very dangerous, and shows why it is necessary for an expert system to justify its decisions.

In practice, a good approach is to ask the expert to write down all that he can express of his knowledge in terms of rules and experience, then have someone else structure this information and use it to start building the expert system. Any inadequacies of the expert system will force the expert to express his knowledge in a clearer form which can then be used to modify the expert system, and the process will be repeated. Eventually the expert will be satisfied with the performance of the system, and it can be considered finished or exposed to another expert's scrutiny for further refinement. When you are satisfied that you understand the finer points of preparation, you can be fairly confident that your application is one that is suitable to be an expert system.

There is only one thing to consider — time. Planning an expert system can take a long time, and this is the point where you realise that creating and using a reliable expert system is not as easy as software companies would like you to think.

Taking the 'animals' program as an example, the tree-based structure is a good one in this case since it reflects the branching structure of animal classification very well. One advantage of this program is that the subject is already familiar to people. Therefore, the questions and structure of the expert system do not need to be so carefully formulated since the users won't be too confused, even by misleading questions.

A point in expert systems' favour is that when a good expert system is available in any given field, human experts in that field are free to work in more advanced areas — research, and so on — that will increase their

knowledge and expertise. Also, expert systems make experts themselves redundant to some extent. Although this sounds like a bad idea, it does guard against human accidents which might cause a disaster.

The very best expert systems can be given raw data from a subject and can then extract their own rules.

Expert-Ease is one such program, but it uses only one method to extract its own rules and can miss relatively simple ones. This ability gives expert systems far more flexibility and enables them to find rules that human experts might miss — making them in some cases, better 'experts' than humans.

Conclusion

The most important thing to remember when investigating expert systems is to be careful. There are a large number of questions whose answers boil down to whether or not it's worth constructing an expert system. The most important points are: whether a real expert can provide knowledge and rules on a subject; whether you can put that knowledge into a structured form; whether the expertise is necessary to warrant making the system; and whether the system will be used at all.

You should consider how you want to put the expert system together. For fairly simple applications where it's important that it should be easy to make the expert system, a micro-based expert system shell would be adequate. For more advanced expert systems, it would be a good idea to experiment with an expert system shell before writing a program to implement the final version. For large and important expert systems, it might be worth investigating mainframe-based expert systems.

If you want to explore the expert systems market to see the kind of program you want to use, there are several options. There are numerous public-domain expert system shells that are nearly as powerful as those on sale for considerable amounts of money; these are for the IBM PC or compatibles and would be an extremely good way to find out what currently available programs can do. Moving up the scale, Borland's Turbo Prolog would help you to program your own expert system. Alternatively, an excellent version of Lisp, called XLisp, is available in the public domain for several machines.

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Prolog power

Although Prolog is ten years old and has found a niche in the world of artificial intelligence, its unconventional appearance has prevented people from fully exploiting its programming abilities. Mike Liardet helps to allay fears with an introduction to the language.

Prolog is a programming language that has been around for nearly 15 years. It has only recently come to prominence, with a number of excellent implementations becoming available for micros. Its name stands for PROgramming in LOGic. In theory, at any rate, it enables computer users to effortlessly program their thoughts and reasoning about a problem directly into the computer. In practice, Prolog programming is not quite as effortless as this might sound, but no other programming language comes closer to this ideal than Prolog.

Prolog is tailor-made for programming applications in a number of interesting problem areas, and during the course of this series I'll be proving this point with some appropriate, illustrative sample programs. Prolog is especially connected with the field of artificial intelligence (AI), and expert system, natural language understanding and intelligent databases are probably the most widely recognised types of application to which it is suited. It is also a natural choice for mathematical problem-solving, artificial (that is, computer) language understanding and network-based problems. And, for the hobbyist, it can also be a lot of fun for coding cognitive games and recreations.

One of the reasons for Prolog's burgeoning popularity is the huge surge in popular interest in AI with which it is so closely associated.

Also, the last few year's unprecedented increase in microcomputer power has helped to promote usage of the language, since the powerful processing facilities that Prolog needs are now widely available in inexpensive personal computers. Its recent adoption by heavyweight US software marketing companies, most notably

Borland, has given Prolog the ultimate seal of approval, with some US reports claiming that Borland's Turbo Prolog is even outselling Lotus's perennial best-sellers such as 1-2-3, Symphony and Jazz.

Because of Prolog's highly unconventional appearance, it is worth emphasising that, like all of the well-known programming languages, it is completely general purpose and could, potentially, be used anywhere that a more conventional language, like Cobol or Pascal, might be. That is not to say unequivocally that it *should* always be used — although some Prolog users would argue this — but its complete generality might come as a surprise to some experienced conventional programming language users. After all, Prolog has no FOR loops, conditionals, DO- WHILEs, GOTOs or any of the other constructs which commonly appear in the usual languages.

Getting started

The starting point for most readers will be to obtain a version of Prolog. Fortunately they will be fairly spoilt for choice, and competition is pulling down prices rapidly. Table 1 shows a list of Prolog suppliers from which readers should get good value for money.

Here, and in the articles to follow, most of the example programs will be written in Borland's Turbo Prolog (reviewed in *APC*, July 1986). This should not preclude users of other Prologs from following the series. Most of the examples come very close to the standard Edinburgh Prolog, adhered to by many of Turbo's rivals, if the predicates and domains declarations are omitted.

One of my main reasons for choosing

to work with Turbo Prolog is that it is ideally suited to the Prolog beginner. It is inexpensive and simple to use; and it provides a very fast version of the language for the IBM PC, with a fully integrated program development environment which includes an editor, a compiler and debugger. It has all this *plus* sufficient power and capacity to outlast the user's learning phase, being quite capable of supporting full-size applications as well.

Turbo Prolog's major deficiency is the aforementioned deviation from the Edinburgh standard. Apart from the declarations, the more significant differences lie in its omission of some advanced features which are not absolutely essential, and certainly are not likely to be required by a beginner.

Assuming you are sitting in front of a Prolog system for the first time, you will probably want to do something quickly just to reassure yourself that the system is alive and well. If it were Basic, and not Prolog, that you were working with, you would just type `PRINT 20 * (4 + 5)` and expect to see the answer 180. In Prolog, this kind of interaction can be slightly more long-winded, and depends to some extent on the particular version of the language you have.

For a fast initiation into Prolog, first ensure that the system is at the command level, where you can type in Prolog instructions and have them executed directly. Many Prologs offer nothing but command-level interaction, but in Turbo Prolog you need to select it from the main menu, by pressing 'R' for 'Run'. Unless you have a program already loaded (zap it or comment out its goals statement if you have), Turbo will respond with the message 'GOAL:', indicating that it is ready to do your bid-


```
Goal : X = cos ( log ( 1 + 2 + 3 + 4 ) ).
X=0.54030230587
1 Solution
```

```
Goal : X = 1 + 2, Y = X * X
X=3, Y=9
1 solution
```

Fig 1 Expression evaluations

```
Goal : 1 + 2 = X.
X=3
1 Solution
```

```
Goal : X = 1 + 2, X = 4.
No Solution
```

```
Goal : 1 + 2 = 2 + 1.
True
```

Fig 2 Expression evaluation = solving goals

ding. From there you can type:

```
X = 20 * (4 + 5).
```

Don't forget the full stop, and the system should respond:

```
X = 180
```

```
1 Solution
```

From other Prologs try:

```
X is 20 * (4 + 5) or
```

```
X is 20 * (4 + 5), pr(X)
```

If neither of these work then it's back to your manual, I'm afraid.

When this simple example is working, you may care to experiment with a variety of expressions or evaluate more than one expression at a time.

Fig 1 gives a typical interactive session along these lines. Make sure the variables, X, Y, and so on, are in upper case — Prolog identifies variables by an initial capital letter, and the results will be rather different if lower case is used. For multiple evaluations, just separate each evaluation with a comma.

Something different

After you have done a few examples like the ones given, you will probably be wondering what is so remarkable about Prolog as, barring the mysterious '1 Solution', its responses are fairly much like those from a standard language. Now try the commands shown in Fig 2.

Although the examples in Fig 1 appear to show Prolog evaluating an expression, just like Basic, the underlying actions that it is actually taking are fundamentally different, as the examples in Fig 2 show. What actually has been going on, in both Figs 1 and 2, is that Prolog has been trying to *solve goals*.

In Prolog, the command line you give it is treated as a sequence of goals, with the commas separating them. If Prolog succeeds in solving all the goals on the command line, it prints out the values of the variables that did the trick. If it fails to solve all of them, it prints out 'No Solution'. If there were more than one way of solving all the goals (I'll come to this later) it will print out all the possibilities, along with the number of solutions found.

The only type of goal we have considered so far is that of showing equality (denoted by the '=' sign). If you have experience of other languages, you might have thought that the '=' was an assignment — it isn't. In Prolog '=' stands for equality, just like in mathematics.

Equality, in Prolog, is an example of a *predicate*. All goals in Prolog involve a predicate to express some relationship between objects, and eventually we will encounter many different predicates. In this case, equality is a built-in facility in Prolog (rather like a library

function in any other language), so it isn't necessary to write any code to tell Prolog how to go about showing equality.

Prolog will succeed in showing equality for the two sides of the '=' if, following the calculation of any expressions, it can match the two sides (the technical term is 'unify'). Referring to Fig 2 again, Prolog solves the goal $1 + 2 = X$ by calculating $1 + 2$ to be three, and making X equal to three in order to achieve a match. It solves the goal $1 + 2 = 2 + 1$ because calculating both sides produces the same result. And if it fails to solve the joint goals $X = 1 + 2$, $X = 4$ because, after solving the first goal, X is made equal to three, and the second goal cannot then be solved because three and four cannot match — in effect, Prolog is saying that there is no value for X such that X can equal $1 + 2$ and equal 4.

Having experimented with command mode, it's time to start writing some simple programs. Suppose it were necessary to periodically calculate a complex expression for different input values. You would just retype the expression at command level each time it were needed, but it would be less tedious to set it up once and for all under a name, and then just type the name whenever the calculation was needed. The code to do this is shown in Fig 3.

When typing in the program, be careful not to omit any of the punctuation, and be sure that the variables X and X2 are in upper case. It isn't necessary to adopt an identical layout to the one shown: Prolog is not line-orientated like, for example, Basic, and programs can be arranged in whatever layout you prefer. If you are using Turbo Prolog, you can enter the program directly with Turbo Prolog's editor by pressing 'E' for 'Edit' at the main menu. If you are using another Prolog you may need to modify the code slightly, and in some cases you may

```
predicates
    do_calc

clauses

do_calc :-
    write("Type a number: "),
    readreal(X),
    write("Here is the result of the calculation: "),
    X2 = (sin (cos (X - 12.3))) * 2,
    write(X2).
```

Fig 3 A first program

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need to work with a separate editor program, independent of your Prolog system.

To run the program from Turbo Prolog, exit from the editor and press 'R' to 'Run' (for other Prologs, consult the manual). After a brief commentary, while it compiles the program, the system should respond with the now familiar Goal : prompt. Type in 'do_calc', and when it asks for a number, type in a number. The dialogue should look something like Fig 4. (There is no automatic X=... X2=... printout at the bottom of this dialogue, because Prolog only prints out the values of variables actually entered as part of the command line, and the command line do_calc does not have any variables).

The program you have just been running contains just a single 'clause'. (A clause is a rule which the program adheres to, to find solutions to goals). The clause is everything that occurs after the word 'clauses' in Fig 3. In general, Prolog programs are almost completely built out of clauses and, totally alone, the Prolog clause provides all the functionality of other languages' GOTOs, DO-WHILEs, FOR-TO statements and function definitions, and so on.

```
Goal: do_calc.
Type a number: 9.87
Here is the result of the calculation: -1.3739568
True
```

Fig 4 Running the first program

In this example, the means for solving all six of the goals listed is built in Prolog, so there is no need to further specify how any of them should be solved — Prolog already knows. But, in general, the body of clauses may contain goals which call upon further clauses — we'll come across these later.

When Prolog is given the initial single goal to solve, do_calc, it replaces the task of solving that goal with the task of solving the six goals indicated. As each is attempted, the appropriate action is taken, and the effects can be witnessed on the screen as information is written, or input requested. In fact, goals involving reads or writes always succeed, and cannot directly affect the outcome of a clause; but these input/output goals have useful side-effects, and without them it would be impossible for the user to communicate with a program.

As an exercise, add two or three further clauses to the example program,

do_calc3 contain variable names in common, they still work in unison and there is no interference between them. This is because Prolog's variables are always 'local' to a clause. The effect is as if Prolog had spotted the same variable name occurring in two different clauses and (privately) renamed one of them to make it different. If you wanted to be pedantic about it, you could take any Prolog program of any length and change all the clashing variable names so that they were different. As long as you consistently changed every occurrence of a variable name within its clause, the program would still work exactly as before.

The easy way

The simple program examples that we have considered so far are very much the type of examples that would be used to introduce a conventional language. This is convenient here, because most readers will be familiar with these types of example, and their numeric bias should also allay any fears about Prolog being unable to do number-crunching. But the examples are a little bit unfair on Prolog, as they do not emphasise its strong points.

In this section I shall redress the balance, and show Prolog on its home ground. In fact, I'll show how a simple Prolog program can solve a fairly complex route-planning problem, and be able to deal with a multitude of different questions that might be posed.

Up to now I have been describing Prolog in a procedural way, informally, describing clauses in an 'in order to do this, do that' fashion. One of the interesting features of Prolog is that it is quite frequently equally valid to think of its clauses in a declarative way — 'this is true IF that is true'. The advantage of thinking about Prolog programs in a declarative way is that all the clauses can be considered in complete isolation from each other, and if they are all manifestly true, then the program is guaranteed to produce correct results. I am introducing the notion of a declarative interpretation here because that is how the following example will be described; and any doubters will be able to see the correct results themselves.

Suppose you are a travel agent, offer-

I shall show Prolog on its home ground. In fact, I'll show how a simple Prolog program can solve a fairly complex route-planning problem, and be able to deal with a multitude of different questions that might be posed

Notice that the clause has two parts, separated by the ':' symbol — the 'head' (do_calc) and the 'body'. We can read this particular clause as saying:

(Head:) In order to solve the goal do_calc (notice that do_calc is a predicate), solve the following goals...

(Body:) 1 Write 'Type a number:' on the screen
 2 Match X with a real number read from the keyboard
 3 Write 'Here is...etc...' on the screen
 4 Match X2 with $(\sin(\cos(X - 12.3))) * 2$
 5 Write the value of X2 on the screen
 6 Write a new line to the screen

doing similar calculations tasks. Let the head of these new clauses be, say, do_calc2, do_calc3, and so on. In Turbo Prolog, you will also have to add do_calc2 and do_calc3 to the list of predicates at the top. Just add the names immediately under do_calc. From the Goal : command mode, check that each clause works on its own, then try:

```
Goal : do_calc, do_calc2, do_calc3.
The system should first of all solve the do_calc goal, producing the same response we have already seen, then work its way through the solution of do_calc2 and do_calc3. If you like, you can introduce another clause:
do_all_calcs :-do_calc, do_calc2, do_calc3.
```

and then 'do_all_calcs' on the command line will save having to type in the names of all three goals.

Notice that, even if do_calc2 and

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```

domains
    city = symbol
    duration,takeoff_time = real

predicates
    flight(city,city,takeoff_time,duration)
    route(city,city,takeoff_time,duration)

clauses

flight(melbourne,sydney,12,1).
flight(melbourne,brisbane,11,2).
flight(melbourne,perth,10,3).
flight(sydney,wellington,10,3).
flight(wellington,papeete,11,5).

route(City1,City2,Takeoff_time,Duration):-
    flight(City1,City2,Takeoff_time,Duration).

route(City1,City2,Takeoff_time,Duration):-
    flight(City1,Somewhere,Takeoff_time,Duration1),
    route(Somewhere,City2,Takeoff_time2,Duration2),
    Takeoff_time + Duration1 <= Takeoff_time2,
    Duration = Duration1 + Duration2.
    
```

Fig 5 Planning your holidays with Prolog

```

route(melbourne,sydney,Departure,Duration).
route(melbourne,wellington,Departure,Duration),Departure > 10
route(City,City,Departure,Duration).
route(City1,City2,Departure,Duration),Duration < 2.
route(sydney,christchurch,Departure,Duration),
    Departure + Duration < 20.
route(City1,City2,Departure,6).
    
```

Fig 6 Some possible route enquiries

ing a range of local and international flights. You need to be able to deal with a variety of customer queries about these flights, and these queries can get quite difficult to handle, especially when flight connections are involved. Typical questions might be:

- What are the options for travelling from Melbourne to Christchurch?
- What flights arrive in Sydney before 10:00
- What journeys from Brisbane take less than four hours?
- Can I get from Melbourne to Christchurch before 14:00?

The program listing in Fig 5 shows the basics needed to handle all the above questions, and more besides.

Ignoring the declarations at the top of the listing, the program starts immediately after the clauses statement. The first part of the program specifies the information about the flights which are available. In another programming language this kind of information might be set up in data statements, but in Prolog the clause is used, like it is for everything else.

In this example, flight information is

specified by a 'flight' predicate which expresses a relationship between four things: a city of departure, a city of arrival, a take-off time, and a flight duration. The standard Prolog syntax for specifying a relationship is to give the predicate name immediately followed

'an extremely short program is able to handle a wide variety of complex queries'

by brackets, and within the brackets to put each of the things being related, separated by commas. Thus, the first clause gives the information that there is a flight from Melbourne to Sydney departing at 12:00 and taking one hour. The next clause states that there is a flight from Melbourne to Brisbane departing at 11:00 and taking two hours. The remaining flight clauses have a similar interpretation for the other cities, times and durations given.

Notice that, in these clauses, words

like 'melbourne' and 'sydney' are used without an initial capital letter. This is necessary because Prolog treats words with an initial capital letter as variables, and names of cities are clearly not variables but constants. If we were to write:

```

flight(Melbourne,Sydney,12,1)
then it would be identical in effect to:
flight(X,Y,12,1)
    
```

and have the interpretation that there is a flight from anywhere to anywhere at 12:00, and it takes one hour!

Another point to note is that, unlike the clauses we have seen so far, these flight information clauses have no body — that is, the ':' and the rest is missing. If we were to extend the Fig 5 example, it would be quite feasible to introduce some flight clauses with a body, for example:

```

flight(melbourne,coolangatta,18,2):-
season(summer)
    
```

This would be interpreted as: 'There is a two-hour flight from Melbourne to Coolangatta departing at 18:00 IF the season is summer'. Contrasting this with the bodyless flight clauses, it can be seen that a bodyless clause is simply an unconditional fact — it is true without any conditions — and 'fact' is the Prolog terminology for bodyless clauses.

After the flight clauses, there are only two clauses still to be considered: these are the 'route' clauses. The route predicate expresses a relationship between the same four objects as the flight predicate, but routes are obviously different from flights — we can have a route which has a departure and arrival point not connected by a single flight. This is the major point of the exercise: we want the system to be able to work out routes involving, possibly, many connecting flights.

Both clauses are more easily read in reverse. The first route clause states that:

IF there is a flight connecting City1 and City2 with the same take-off time and duration;

THEN there is a route connecting City1 and City2 with the same take-off time and duration.

IF there is a route between City1 and somewhere AND there is a route between somewhere and City2 AND the flight lands before the route's departure time;

THEN there is a route between City1 and City2 with the same departure time as the flight and duration being the sum of the flight and (original) route's duration

Using this program, it's possible to handle all sorts of different queries by

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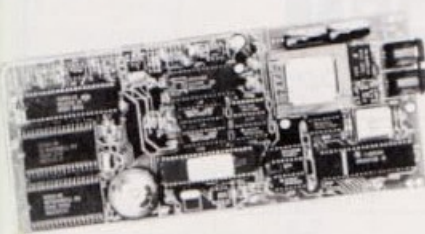
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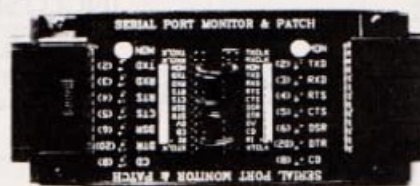
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LANGUAGES

specifying various different goals in the command line — Fig 6 shows some example goals to try. The first example given is a request for information on all possible journeys between Melbourne and Sydney. The second example involves two goals, and is a request for information on any possible journeys between Melbourne and Wellington which leave after 10:00. The third example is asking if there are any round-trips from anywhere at all (there aren't with the flights given). Interpreting the remaining examples is being left as an exercise for readers.

Conclusion

In this first article on Prolog programming I have shown how powerful Prolog can be for dealing with some problem areas: in the example given, an extremely short program is able to handle a wide variety of complex queries.

Homework: Extend the route enquiry program to handle pricing information as well; for example, it should be possible to specify a minimum acceptable price for a journey.

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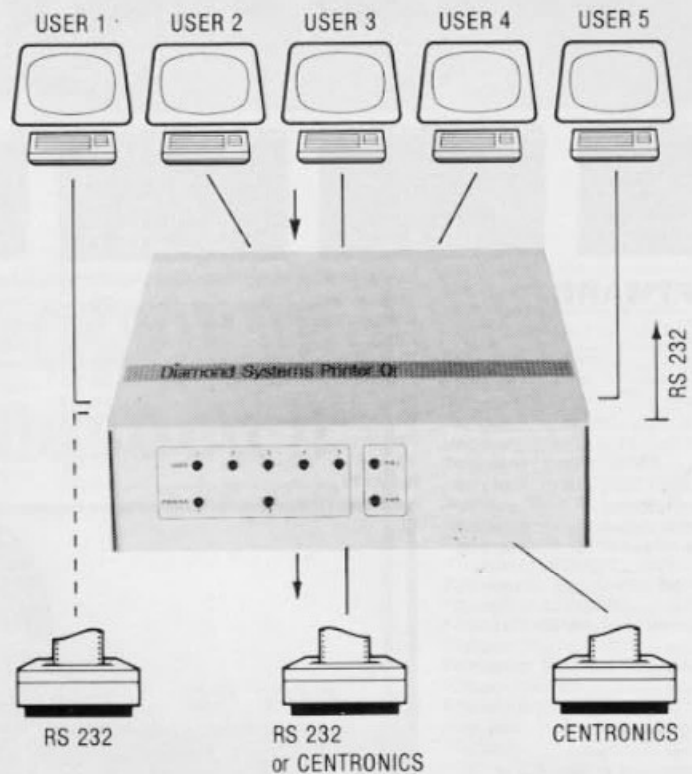
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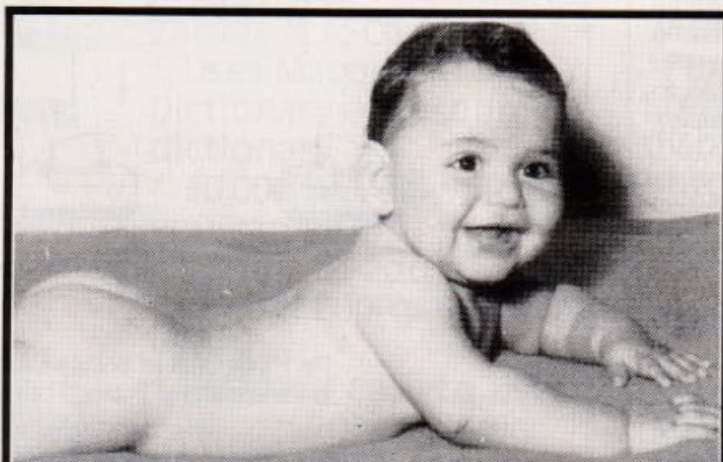
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SCREENTEST

PC-Write

When is a word processor not a word processor? When it lacks basic facilities and can only be described as user-hostile. Robert Schifreen reviews what he considers to be just such a package — PC-Write.

A strange thing happens when you show someone a new word processing program: within five seconds, they've usually decided whether they love it or hate it. It's hard to explain what makes the ideal word processor — ask a hundred people and you'll get two hundred different answers. Perhaps the most popular opinion is that 'it has to feel right.' All that a software company can do therefore, is to keep churning out new packages and hope that they 'feel right' to enough people.

For me, PC-Write doesn't 'feel right'. As soon as I loaded it, I felt that it lacked that certain 'something'. After around 40 hours of using it I still feel the same way — although, to some extent, my reasons have changed. My original thoughts, particularly that PC-Write doesn't feel like a professionally-written program, remain.

There's no doubt that PC-Write is a complex piece of business software. It was designed to be a word processor, and it does its job fairly well. However, it isn't something that I would use regularly and, when I've finished writing this review, I'll get my copy of Word Perfect out of the cupboard and delete PC-Write from my hard disk.

History

PC-Write began life in the US as a user-supported program. Anyone could copy it, give copies to their friends, put it on bulletin boards or do whatever they liked with it. If you were given a copy and you didn't like it, you just

reformatted the disk and no-one said any more about it. If you liked the program, however, and intended to keep it, you were asked to send a donation of up to \$US75 to the author. This bought you proper documentation and two free upgrades, or the Microsoft Pascal source code.

This method of software distribution works well in the US and some people have become very rich as a result. Around 80,000 PC-Write users have registered their copy, and Quicksoft — the company which wrote the program — now employs ten full-time staff to deal with PC-Write alone.

In Australia though, things are different. There is a huge amount of user-supported software around, but almost all of it comes from the US via bulletin boards. For a number of reasons, American software authors don't make any money out of Australian users. One reason is that, when you've paid the donation, you are usually entitled to telephone support, which is too expensive from Australia anyway.

Another reason is that the idea of users donating money for products is not something the Australian public is used to. In the US, for example, there is Public TV, where the existence of the station depends solely on donations from satisfied customers.

PC-SIG is now selling PC-Write version 2.74 in this country, although the product is still distributed by the user-supported method in the US. It's possible to find PC-Write version 2.4 on bulletin boards and this is quite legal;

with higher versions, though, it isn't. Although version 2.4 lacks the spelling checker that version 2.74 provides and has fewer facilities, it works in a similar way, and I strongly recommend that you track down a copy of 2.4 to try, before shelling out for the latest version.

Version 2.74

Version 2.74 of PC-Write is a complete word processor for IBM PCs and compatibles with at least 256k of RAM. The package contains two disks, the first of which is the program disk and the second contains the spelling checker and updates.

Start-up

Installing PC-Write is quite simple, as everything is automated into a single batch file which is activated by typing WORKDISK. This creates either a working PC-Write disk on a single floppy disk, or a directory on a hard disk. It's difficult, though not impossible, to use the program on a machine with just a single floppy drive, but the dictionary will need a separate disk.

Installation is when you tell PC-Write which printer you will be using. The program then configures itself accordingly by creating a printer control file for you (more on this below). You can choose from numerous makes and models, including laser printers.

PC-Write comprises two programs: ED is the editor, and PR is the printer

program that prints a file created with ED. You can run PR from within ED if you wish.

To start the program you type ED followed, optionally, by the name of the file you want to edit. If the file already exists, you have a choice of two keys to press before you can start to edit it: keying F9 will back up the file, while pressing ESC will not.

The initial screen is blank, except for a status line at the top. This contains such information as the current file, whether word-wrap and automatic reformatting are switched on, and the position of the cursor within the file.

A useful feature of the status line is the word Read, which indicates that the file being edited hasn't changed since it was last saved. As soon as it does change, the word becomes Edit. (Incidentally, 'Push' stands for Push-right, the name used for 'Insert' mode. The opposite is 'Over', which stands for Overtyping).

As supplied, the menu at the top of the screen is in green (on a colour monitor) and your text appears as white on blue. These colours can be changed, as I'll explain later. It's also possible to hide the status line by changing its colour to black on black. Doing this gives you a totally clear screen, but doesn't increase the number of lines available for text.

Most functions are accessed through combinations of function keys and the Shift, Ctrl and Alt keys. The majority of function key combinations lead to further menus, which appear at the top of the screen and take up two or more lines. The bottom of the screen is

never used by PC-Write and is free for text. Most word processors take up about six lines to show you what's going on; PC-Write doesn't, which is certainly a point in its favour.

Like any word processor, PC-Write allows you to move the cursor round the screen in steps of varying sizes. You can delete, copy and move blocks of text around the current file or into any other. There are also find and replace facilities.

Control files

A working installation of PC-Write consists of six disk files — the editor program, the printer program, the help text, the dictionary and two control files. These control files are called ED.DEF and PR.DEF, and contain commands governing the way that the editor and printing programs work. The disks supplied contain short but usable control files, though you can use PC-Write itself to alter these. The basic ED.DEF file contains the default ruler line and tab and margin settings, while a customised PR.DEF file is created when you install a printer.

ED.DEF configures the editor to your exact specifications, and while PC-Write is undoubtedly the most configurable word processor I've ever used, the way that commands are specified in ED.DEF is far from ideal. There are 16 different commands to specify the colour of the screen, for example. The screen is divided into 16 parts including the text, the cursor, the status line, the menus, the help screens, and so on. Using various com-

mands in ED.DEF, each part of the screen can be in a different colour. Moreover, you can — indeed, you have to — specify different colour combinations when the program is used with colour and monochrome monitors.

A variety of control files serve a variety of documents. For example, you can set up the system so that all files with a DOC extension are subject to one edit control file, while those with a BAS extension are governed by another.

Putting the command %D in the ED.DEF file prevents the screen from flickering while the cursor moves. A %G command tells PC-Write not to load the online help file into memory, while %I loads the help text into the spare RAM on the colour graphics board, thus saving 12k. For security, %X sets the editor so that a back-up will always be created when you exit; while %Y prompts the editor to remind you to back up the file after every 2000 characters that you type. If 2000 is too large or small for your taste, you can change that too.

The print control file, PR.DEF, controls the way that PC-Write handles your printer. \$P, for example, is used to specify one or more commands that are to be sent to the printer before each document is printed. Equally, \$Z tells the printer what to do after each print run. \$V lets you specify the commands to be placed at the end of each printed line; normally, this would just be a carriage return, and a line feed, though you may wish to have more elaborate options.

Any printer character can be

```

Esc:Menu-Push-Heap+Sp- 97% Free. 0X Thru. Read "Aled.voc"
-----X (ruler line)
d,X:2 (top margin 2 lines)
d,XB:3 (bottom margin 3 lines)
d,L:72 (page length 72 lines)
d,X:4 (page offset) (equivalent to WordStar .P0)

dC (use colour monitor)
dY (remind to save document every 2000 characters)
dA (printer can do accent characters itself and doesn't need
to overprint for ASCII characters 128-255)

d8:112,112,48 (make top line on screen display as black on cyan)

d27:309 (HOME key moves cursor to top of text)
d35:290 (END key moves cursor to top of text)
d29:388 (F6Up does para up)
d37:374 (F6Dn does para down)
d83:425 (redefine Ctrl-C to do word count)
d35:156 (redefine shift 3 to do pound sign, not hash)
d16:315,321,264,324,324 (redefine Ctrl-P to print file being edited)

dP:027,067,070 (codes to send to printer before each document)
(Sets Epson printer to use 70-line paper)

```

PC-Write can be customised for any printer, by including the correct commands in PR.DEF

```

Esc:Menu-Push-Heap+Sp- 97% Free. 0X Thru. Read "Aled.voc"
-----X (ruler line)
d,X:2 (top margin 2 lines)
d,XB:3 (bottom margin 3 lines)
d,L:72 (page length 72 lines)
d,X:4 (page offset) (equivalent to WordStar .P0)

dC (use colour monitor)
dY (remind to save document every 2000 characters)
dA (printer can do accent characters itself and doesn't need
to overprint for ASCII characters 128-255)

d8:112,112,48 (make top line on screen display as black on cyan)

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d37:374 (F6Dn does para down)
d83:425 (redefine Ctrl-C to do word count)
d35:156 (redefine shift 3 to do pound sign, not hash)
d16:315,321,264,324,324 (redefine Ctrl-P to print file being edited)

dP:027,067,070 (codes to send to printer before each document)
(Sets Epson printer to use 70-line paper)

```

Part of the edit control file. This shows margin, page and colour settings, among others

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redefined so that it becomes another character or a whole series of characters. Whenever PC-Write sends a character to the printer, it checks first to see if that character has been redefined and, if it has, the new definition is sent instead.

There are dozens of commands that can be placed in the control files — some useful, some less so, though all of them are impossible to remember without the aid of the manual. Changing the default pathname for files, for example is achieved by use of a &428: command.

PC-Write files

Word processors usually work in a form known as 'what you see is what you get', or WYSIWYG. When you use a WYSIWYG word processor, you know that the onscreen display is a vague representation of what will appear on the printer. Of course, there will be differences but, if you want bold print then the text on the screen will appear bolder (brighter, usually) than normal.

PC-Write has none of this. All special effects are achieved by entering special characters in the text, and are interpreted according to how the control files are set up. To initiate bold text, for example, you press Alt-B which produces a bright, smiling face onscreen, and everything typed thereafter comes out in white on blue. When you turn off bold, again by typing Alt-B, another smiling face appears and the text reverts to its normal colour, leaving your bold text on a blue back-

ground accompanied by smiling faces at either end.

The smiling faces don't actually make it as far as the printer, but they do make your screen look rather strange. The allocation of symbols and colour changes to fonts is specified in the control files, so you can produce displays as garish or muted as you wish.

Typing Alt-Space will turn off the smiling faces and any other special characters that surround blocks of text. A symbol on the status line tells you whether special characters are turned off or on.

If you are producing documents with little or no fancy effects, the PC-Write screen is acceptable. An example of what can happen if you become too daring, though, is provided on the PC-Write disk in a file that is intended to test your printer by printing in a variety of fonts. Displaying the file onscreen shows just how unreadable a screen can be, as shown in the screendump.

Apart from the weird colours and smiling faces, the biggest drawback to PC-Write is that it can only cope with a file of up to 60,000 characters. Unlike other word processors, PC-Write keeps all the text in memory instead of paging in and out of disk files. This makes editing functions work much faster, especially when moving the cursor from top to bottom of a long document, but the limitation of 60,000 characters is ludicrous. (Many people will probably tell you that it's bad practice to have such long files, and that you should split the work up into shorter segments. I agree, but would like the decision of whether to split files to be mine, not the software's.) Even if

you have a full 640k on your machine, the limit doesn't increase. The clipboard — the area to where deleted text is banished in case you change your mind — is separate, though, and is in addition to the editing workspace. Rumours abound that this limit will be removed in future version of the program.

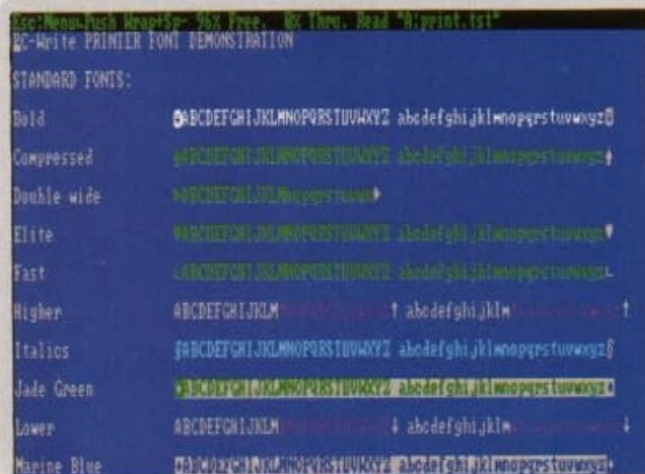
It's possible to edit files that are longer than 60k, but the procedure is cumbersome and disconcerting — even more so if disk space is tight.

The keyboard

PC-Write relies on function keys to get commands from the user; these ten keys are used in conjunction with Ctrl, Alt and Shift in various combinations. To quit the program without saving the current file for example, you press F1, F9, F2 in that order. No function key overlay is provided, so you'll need to keep the manual handy.

To save time, you can 'record' sequences of keystrokes and play them back into a document at any time. These definitions can be placed in the edit control file, in which case they apply whenever you use PC-Write; or they can be defined locally so that they apply only in the file currently being edited.

Insert and Overwrite mode are toggled by use of the Scroll Lock key. The Insert key is used to insert a blank space, regardless of which mode you are in. This is useful, but takes some getting used to. I would rather have these two keys used the other way round.



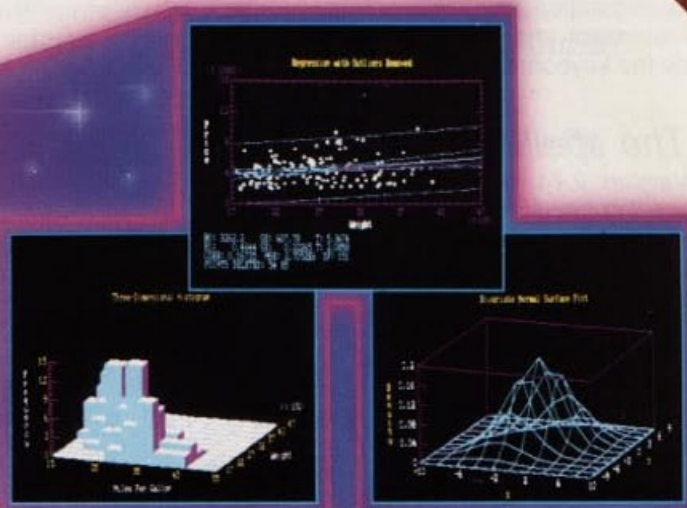
Mixing fonts onscreen produces some weird and wonderful character and colour combinations



The online facility provides half a screen of help text covering 43 aspects of PC-Write

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SCREENTEST

PC-Write recognises a number of WordStar control codes — like Ctl-KD to save a document.

PC-Write can be used with a mouse. Configuration files, which map mouse movement and buttons to certain keys on the keyboard, are provided.

The spelling checker

Version 2.74 of PC-Write includes a spelling checker for the first time. This works in two ways. Firstly, you can check a document as soon as it has been written; alternatively, you can have the dictionary loaded into memory and have your spelling checked as you type. In the latter mode, the computer beeps whenever you type a word it doesn't recognise.

Such a facility is not unique to PC-Write. Turbo Lightning, from Borland, adds similar capabilities to just about any word processor and works much faster. With PC-Write, if you type too fast, misspelled words are not beeped at.

The dictionary is supposed to be an English version, as opposed to American, yet the word 'cheque' isn't recognised. Neither, for some strange reason, is the word 'his'. You can add these words to the dictionary if you wish.

If you ask it to, the spelling checker will suggest a correct spelling for a word that isn't recognised, but I found PC-Write to be a bad guesser. For example, if I typed 'becuase' (deliberate error!), the program guessed the correct spelling as bed, bedazzle, beaches, begs, beaks and beseech, before arriving at the correct word.

If the computer fails to guess the correct word, you have to exit the spelling checker to correct the word, then starting the spelling checker again. An option to correct a word manually and then return to the spelling checker

would have been appreciated.

The word counter is very handy. At the touch of Alt-F4, F3, you get a count of the number of letters and words in the current document, as well as the average number of letters per word. Like all of PC-Write's functions, the word counter can be made to operate on a marked block of text instead of the whole file.

Online help

An online help facility presents you with one of 45 help screens, selected from a menu. The help file is loaded into memory when you start PC-Write, unless you specify in the control file that you don't want the help file to be loaded. Most of the things I needed to look up weren't in the help text, but I suppose a selection of 45 screens are better than none at all. I would like to be able to press a function key while in help mode, and have information displayed that tells me what that key does. Unfortunately, PC-Write can't do that.

Documentation

PC-Write's documentation is included on disk and may be printed out if so desired. PC-SIG also provides a hotline number for technical support.

Conclusion

I have already stated that PC-Write is the most configurable and flexible word processor I know. It was written, originally, by a software hacker who seems to have had a bet with a friend as to how many useless features could be crammed into one program. It is evident that, whenever the author had a spare 10 minutes, he would ask himself which feature could be added. If you aren't careful, you'll end up with

control files that are enormous and un-maintainable. You could, for example, have complete character sets and width tables for half a dozen fonts in the printer control file. You could also redefine every key on the keyboard, and change the name of all the commands. Although this amount of customisation may produce the perfect word processor for your own particular needs, it also means that no-one else will be able to use your version of PC-Write, and you won't be able to use anyone else's copy.

As the product stands, I couldn't recommend PC-Write to anyone. It doesn't look and feel like a professional product. If you want to try it, obtain a copy of version 2.4 and see what you think. If you like that, you'll probably like version 2.74 as well.

It's hard to decide exactly who the product is aimed at. Most of its features will be wasted on someone who just wants to use it for word processing, and doesn't want to have to spend hours setting the various configurations. The high level of configurability may appeal to professional writers and journalists, but the poor quality of the spelling checker and the total absence of a thesaurus should be borne in mind.

It may be assumed, then, that PC-Write is aimed at programmers who are writing source code for input to a compiler. If this is the case, the 60,000-character file limit is a serious problem.

I have my doubts as to whether someone in a non-computer industry would feel comfortable with what really is a very technical and user-hostile piece of software.

END

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Musical interlude

Although musicians may be shocked to discover that musical composition by dice-throwing has its roots back in the 18th century, computer enthusiasts will understand that the very 'random' nature of the computer lends itself easily to this style of musical composition. David Levy does some fine tuning.

The composition of music by computers has its origins in the late 18th century, when various authors showed how it was possible to compose melodies using dice. The technique was based on the use of printed tables; for example, the *Ever-ready composer of Polonaises and Minuets* published by Bach's pupil Johann Philipp Kirnberger required dice to assist in making certain random choices. Similar publications made it possible for anyone to 'compose' an almost unlimited number of musical works, and some of these were of sufficient quality to pass for the genuine article — the Haydn composition *Gioco filarmonico* (Philharmonic joke) was only recently found to be a fake.

In 1792, one year after the death of Mozart, a book was published and attributed to the great composer explaining how the reader could use a pair of dice to compose as many German waltzes as desired — without the slightest knowledge of music. Mozart's *Musikalisches Wurrspiel* has been reprinted in many languages and it provides a system which could easily be emulated by any personal computer enthusiast. (Interested readers should obtain a copy of the *Melody Dicer*, Carousel Publishing, Brighton, Massachusetts).

Whether or not this particular method was invented by Mozart is doubtful, but it does allow the creation of musical works that have a distinctly Mozart flavour. The system consists of a set of 176 measures, each of which is eight bars long. Tables are provided which have eight columns, each column containing the eleven numbers 2-12. A pair of dice are thrown eight times, and the total obtained from each throw of

the dice is used as an index into the corresponding column in the table. Thus, if the first throw of the dice shows '4' and '3', the reader refers to entry '7' in column '1' of the table; if the second throw shows '2' and '6', the reader next refers to entry '8' in column '2'; and so on. Each table entry contains one bar of music, and having thrown the dice eight times, the reader has the first eight bars of his 'composition'. Remember that the totals 2, 3, 4 . . . 12 do not occur with the same probability, so some bars are more likely than others to be chosen. Exactly the same procedure is adopted for the next eight bars, but using a different table.

The tables are constructed in such a way that the 'waltz' opens with the keynote (or tonic), changes to the dominant key and then changes back to the keynote at the end. The eighth and final column of each table contains the same bar in each of the 11 table entries, and so the eleven choices are available for only 14 of the 16 bars, which *restricts* the number of different waltzes that can be created to 11^{14} . Dr Tom O'Bierne, of the Computer Science Department at Glasgow University, programmed a SOLIDAC computer more than 25 years ago to create and perform Mozart waltzes based on these tables, and he even published a commercial recording of some of the music.

Origins

The Mozart dice was the forerunner of present day computerised composition. The principle of selecting musical bars on a pseudo-random basis may readily be extended to the selection of the

other musical variables — the notes themselves, the rhythms, the melodies. In 1956 Lejaren Hiller, who was a research chemist at the University of Illinois, conceived the idea of adapting some of his chemistry research to the creation of counterpoint in music! He had been working on the statistical computation of polymer molecules in solution, in which he had used Monte Carlo (or Markov) methods controlled by the geometric conditions that are applicable in this type of chemical research. (These methods are based on generating random numbers in such a way that each number, or each part of the range, occurs with a specific predetermined probability. Throwing a pair of dice is a good example: the totals are randomly created but they occur with the probabilities 2/36 (for 2,) 2/36 (for 3,) 3/36 (for 4,) 4/36 (for 5) and so on.

Hiller's idea was to change the controlling conditions from geometric to contrapuntal, and then to use the same computer program to write counterpoint exercises. He discussed the idea with Leonard Isaacson, another chemist working on the same research project, who was interested in the idea. So the two of them started some experiments which led to a string quartet called the *Illiac Suite* — the first musical work created by a computer to receive recognition using a Markov process. The use of Markov methods was examined further by Brooks and his colleagues in 1957, when they analysed church hymns. This analysis resulted in probabilities which were used to generate many new hymns, with varying degrees of success. The method by itself appeared to be insufficient to create good



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hymns, but with human judgement to make the final selection, it is adequate.

Composition

It is possible to extend the use of Markov processes in music composition to make use of certain rules of composition and other heuristics. Gary Rader, from the Moore School of Engineering at the University of Pennsylvania, investigated the use of such rules during the mid-1970s to compose musical 'rounds'. Rader's program used some music theory together with various heuristics. He devised a number of production rules together with other rules which determined when they *could be* applied, and he also used a set of weight rules to determine how often these rules *should be* applied.

Rader's composition method was divided into two parts. Starting with an empty set of staves his program first generated a harmonic framework, and then it superimposed its own composed melody on this framework. The methods for creating the harmonic framework and the melody were similar, and were both based on sets of rules which stated how notes or

chords could be put together. The method is iterative in the sense that a set of production rules specify the choice of the next chord or note. The program also contains a set of applicability rules which govern when a particular production rule may or may not be used, and there is a set of weight rules which indicates the probability that a particular applicable production rule is used. These weights are variable and may be changed before any composition.

The harmonic framework of the composition is the sequence of chords that will occur on each beat. This harmony does not indicate the exact position of the chords, which is something determined later by the melody generator.

The harmony generator consists of the following rules (in what follows, chords are denoted by I, II, III, IV, V, and VI, and are the tonic, supertonic, mediant, subdominant, dominant and submediant, respectively. Appoggiaturas are denoted by I, II, III, IV, V and VI and are dissonant notes which move one step while the non-dissonant notes remain stationary. Do not worry about the terminology. You will soon understand the idea, even if the details confuse you).

PRODUCTION RULES

- H1** I may follow any sequence of chords (even the null sequence)
- H2** A chord may be followed by the chord a 'third' below (a third is an interval of two steps, a second is an interval of one step, and a fourth is an interval of three steps)
- H3** A chord may be followed by the chord a 'second' above
- H4** A chord may be followed by the chord a 'fourth' above
- H5** A chord may be followed by itself
- H6** I and IV may be followed by V and I respectively
- H7** V and I may be followed by V and I respectively
- H8** I may precede any chord except V and I

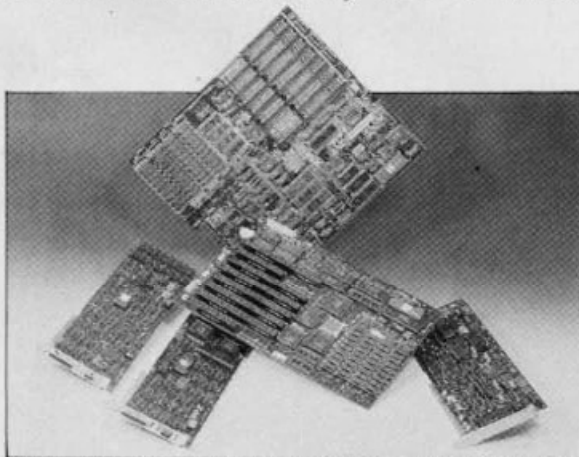
APPLICABLE RULES

- H9** No rule is applicable after the chord pattern reaches an initially specified length

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- H10** The first chord must be I
- H11** The last two chords must be I
- H12** I and V cannot occur on the second and fourth beats
- H13** IV, I and VI may not follow VI, III and III respectively

WEIGHT RULES

There is only one weight rule for each production rule, which assigns a fixed weight to that production rule.

Rader's program generates the notes of the melody within the constraints of a chord pattern and according to various accepted rules of music and a collection of heuristic rules of melody. The program accepts all notes from the 'g' below middle c to the 'g' two octaves above it, and it accepts the 'rest' (a null note). Each computer-generated note has a fixed duration of an eighth or a musical note, and the program may indicate notes of longer duration.

To generate a round the melody generator is first supplied with a chord pattern, the maximum permissible number of octave jumps and the maximum permissible spread between the highest and lowest notes in the round. The program also has the following rules:

PRODUCTION RULES

- M1-M2** An eighth note on middle c, or an octave above it, may be added to any sequence of notes (even to a null note)
- M3** The last note of the round may be increased in duration by a quarter note
- M4-M13** The last note may be in-

creased in duration by an eighth note and followed by an eighth note which is 1, 2, 3, 4, or 5 steps above or below the last 'stepwise note' (see rule M37)

- M14-M19** The last note may be increased in duration by an eighth stepwise note 1, 2 or 7 steps above or below the stepwise note
- M20-M21** The last note may be followed by two eighth stepwise notes moving stepwise up or down from the last stepwise note
- M22-M23** The last note may be followed by two eighth notes moving up (or down) one step and then back down (or up) one step from the last stepwise note
- M24-M25** The last note may be increased in duration by an eighth note and followed by an eighth rest or an eighth note in the same position
- M26** The last note may be increased in duration by an eighth note

Rader also used a number of application rules, such as:

- M28** Rule M1 or M2 must be applied initially and never again
- M29** M26 must be the last production rule applied and never before
- M37** (The most important of these application rules).

The 'Melodic rule' — beginning with the first note, the melody must progress stepwise or, if it jumps, it must either return and continue the stepwise movement from the point at which it jumped, or it must move back towards this point until it does continue the stepwise motion. An octave jump displaces the stepwise motion by a similar amount. An octave jump may occur only when the last note was a stepwise note (that is, part of a stepwise motion). If continuing by two stepwise eighth notes (rules M20 and M21) would result in an unpermitted 'parallel' motion (that is, 'fifths', 'octaves' or 'twelfths' from the first half of a beat to the second half of the same beat to the first half of the next beat), then the melody may progress by the interval of a stepwise 'third'

Rader's weight rules governed the probability that the length of a note would be changed, and if so, by how much. He employed the three types or rules in an APL program running on an IBM 370/165, and created some 50 short rounds whose quality was mediocre from the point of view of the professional musician, while being 'generally quite acceptable' for the layman.

Conclusion

The concept of a rule-based system for music composition is one which can be applied by any personal computer owner who wishes to compose his or her 'own' works. The programmer may take these rules as simple or as complex as desired, and could even model them on the works of a particular composer.

A computerised analysis of similar questions could easily be programmed, and then fed with the notes and their durations from the work of a particular composer. This technique makes it possible for the reader to create music 'in the style of' any desired composer.

END



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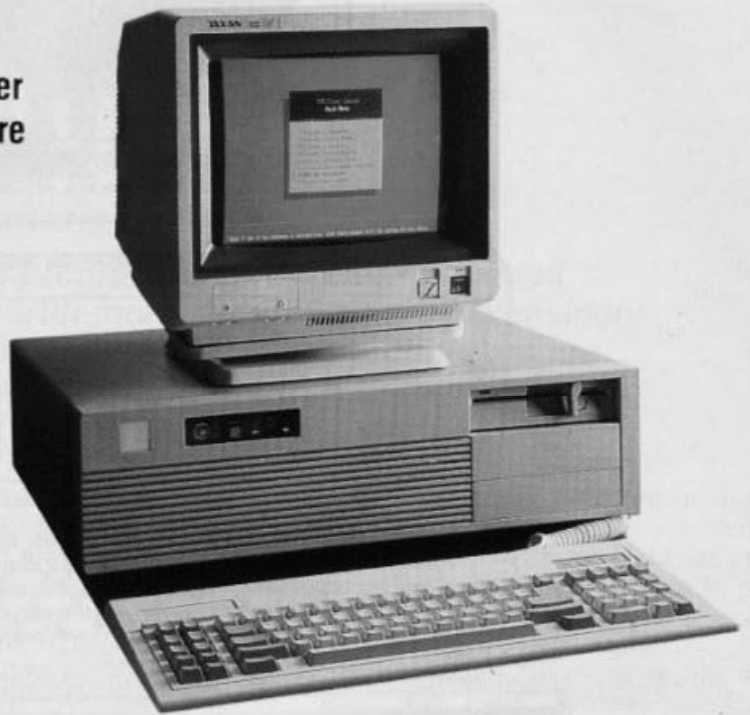
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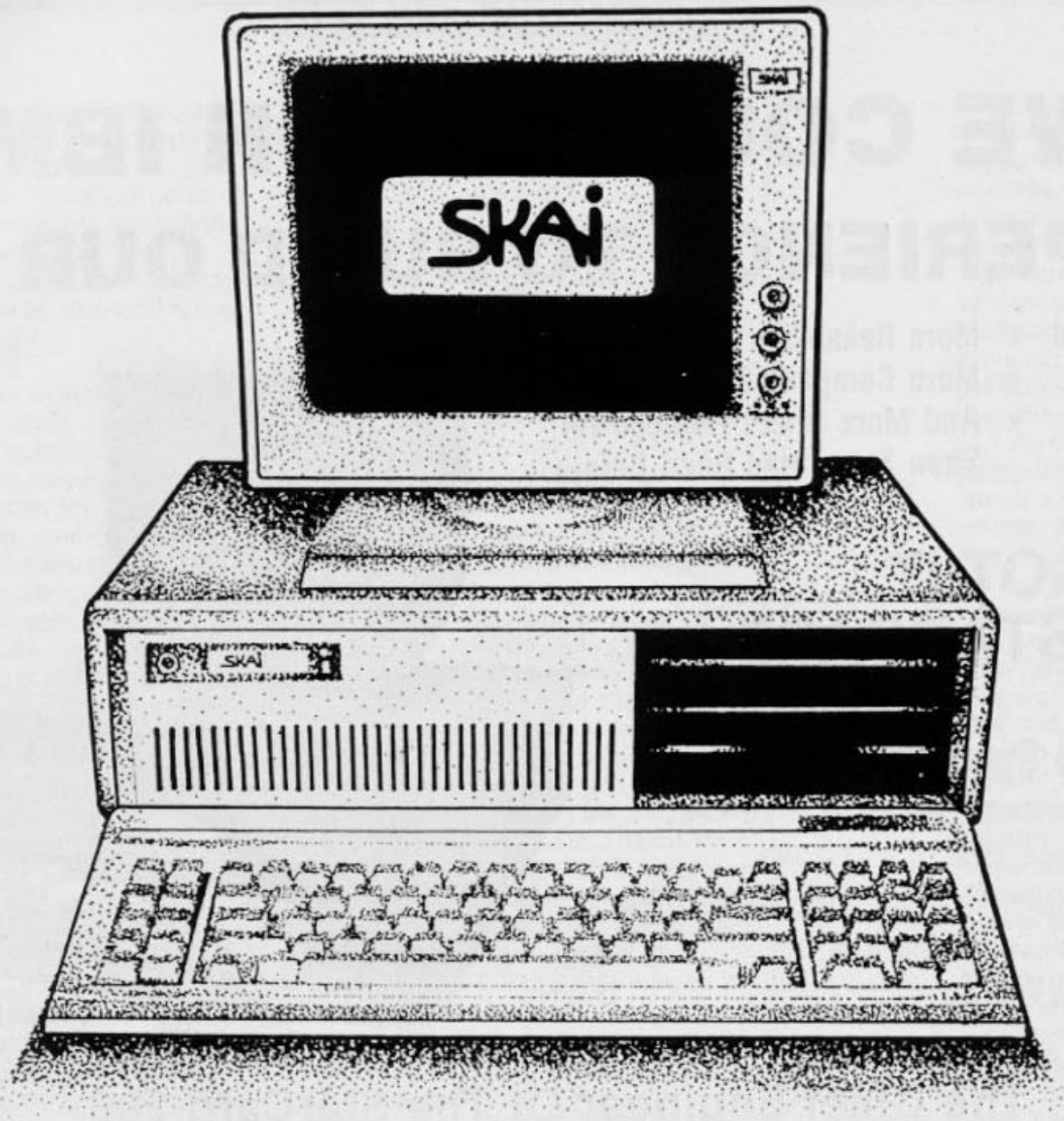
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MS-DOS programming

Ian Davies' series on system programming for MS-DOS-based computers continues this month, with more details on memory resident software and how to avoid conflicts with DOS. The techniques are illustrated through a self-contained 'print to disk' utility.

Last month we introduced the idea of memory resident software, and showed how to actually place a routine in RAM so that it joins the operating system as a customised extension. We did, however, comment that attempting to perform anything at all ambitious from a memory resident routine will generally crash the machine. For DOS's purpose, 'anything ambitious' is defined as trying to call DOS.

This seems incredible, but true. The hardest thing to do from a DOS approved memory resident program is call DOS. One might think that since DOS provides the mechanism by which memory resident software exists, that it should be broad-minded enough accept requests from that software at a later date. Sadly, this is not so, and has become one of the greatest sources of frustration to anyone trying to hack out resident utilities.

The problem exists because the DOS 'kernel' is non-reentrant. That is, DOS is not written in such a way that a DOS function may start while another DOS function is proceeding. For example, an application program might request DOS to open a file, using a DOS function call. DOS could then run off and start performing the lengthy process of opening the file. If, while DOS is doing the directory searches and I/O that are a part of opening the file, a memory resident module interrupts DOS and issues a DOS function request of its own, then DOS reinitialises its environment. The second DOS call completes successfully, and the resident program thinks all is well. It then finishes what it has to do, cleans up all of its work

area, restores the registers, and passes control back to whatever the system was doing before the resident routine became active. This is the catch. The resident program interrupted DOS, and has passed control back into the middle of DOS. The DOS function issued by the resident program, however, has destroyed the stack and other work areas being used by the original DOS call. The original DOS call, of course, does not know

'Since the function call is undocumented, there is a certain amount of risk associated with its use'

this, and continues on, thinking nothing has happened. The end result is a system crash, either immediately or soon after.

This situation seems unworkable, and indeed is likely to change in DOS 5.x, whether it be multi-user or just multi-tasking. In the meantime, however, that is the situation in which a frustrated programmer finds him or herself.

One solution would be to save the DOS stack and all of its work areas. Of course, these things are deeply hidden mysteries, and there is no known way of determining exactly what to save. Locating the DOS stack is easy enough, as is locating *most* of the data areas. However, DOS does not seem

to keep all of its data areas in the same place, and even if it did, saving *everything* can be as bad as not saving enough. This technique is one of the absolutely best ways of attaining unparalleled frustration.

An alternative technique is the one used by most memory resident products. Very simply, the rule is 'don't interrupt DOS'.

This does not work out as easy as it sounds. Firstly, how does one determine if one would be interrupting DOS? Secondly, if DOS is active at that instant, what should the resident routine do? Does it just give up, does it wait, or does it try something clever?

Waiting achieves nothing, as the memory resident routine has control of the machine, and will only relinquish it to other memory resident routines. DOS is the foreground task, and cannot complete its current function until the memory resident routine passes control back to it.

There is, however, a solution.

The Solution

An undocumented DOS function call can be used to determine whether or not DOS is active at any point in time. Since the function call is undocumented, there is a certain amount of risk associated with its use. However, everyone does it, it's absolutely necessary, and it seems to work on all versions of PC-DOS and MS-DOS 2.x and 3.x.

The function is number 34h (hexadecimal), and similarly to other DOS functions, it is invoked by loading

register AH with the value 34h, and executing an INT 21h instruction. Upon return, the register pair ES:BX will point to a flag deep within the bowels of DOS which can be used to detect DOS function calls in progress. Every major DOS function call increments the flag when it commences, and decrements the flag when it completes. Thus a value of zero means that no DOS calls are currently running in the machine. That seems easy enough, but only partially solves the problem, as we shall see.

DOS places its functions in two categories — trivial and non-trivial. The trivial functions do not reinitialise the DOS stack and environment. The non-trivial do. Therefore, it is possible to issue trivial DOS function requests from almost anywhere, even as an interruption to a non-trivial function. But, of course, the trivial functions really *are* trivial. Function numbers zero through to 0ch (hex) are considered trivial, and these are only concerned with screen and keyboard I/O. Everything else (even 34h) resets the stack. Certainly any attempt to access the disk (without

sinking to the Bios sector read/write level) will involve a non-trivial function and hence cause problems.

The pointer returned by function 34h can be saved and used to interrogate the DOS 'recursion counter', or 'critical flag' as it is sometimes known, as it shows whether DOS is in a 'critical' state and not to be interrupted.

Yet another curious aspect of DOS, and one that assembly language programmers come to appreciate, and often include in letters to their mothers, is that the critical flag is set when DOS is doing absolutely nothing. That is, when the system is idle and the screen shows the DOS prompt and there is no keyboard activity, DOS claims it is not to be interrupted. This means that a memory resident program utilising only the critical flag will work under almost all application programs, except when the system is idle.

Fortuitously, there is yet another undocumented DOS facility which can be used to detect when the system is idle. For when the system *really* is idle, the critical flag may be ignored.

This feature is interrupt vector num-

ber 28h (hex), not a function call. Whatever routine is pointed to by this vector will find itself repeatedly called whenever the system is idle. This facility is probably used by print spoolers and the like.

That might sound simple, as it might seem as though it's merely a matter of checking 28h as well as 34h (the critical flag), and if 28h says it's ok to proceed, then ignore 34h. Far from it.

The memory resident program we are trying to create is a background or 'asynchronous' (you-never-know-when-it's-going-to-happen) task. The routine might be called many times per second, or might exist for minutes or hours between activations. It cannot be started upon demand, but is reliant upon external influences in order to execute (serial I/O, timer tick, key press, etc).

When the routine finds itself executing, DOS function 34h provides it with a pointer to a flag which can be used to determine if it is safe to call DOS. But interrupt 28h is a vector to another asynchronous routine which executes when the system is idle, not a pointer to a flag. The obvious approach (and one that does not work) is this.

- Provide a customised interrupt 28h handler which sets a flag to say that the system is idle.
- Set the flag upon entry to the 28h handler, and reset it upon exit, as we will be given no warning when the system leaves the idle state, merely calls to 28h will cease.
- Within the memory resident program, test the flag set by the 28h handler, and if it is set, ignore the DOS critical flag.

This approach does not work because the system does not run the two tasks simultaneously, merely concurrently. This means that in the brief instant the 28h handler has its flag raised to say the system is safe, it is highly unlikely (for some interrupts, impossible) that our memory resident routine will happen to find itself in control of the CPU.

The solution is to interpose an interrupt 28h handler which is an integral part of the memory resident program. When the resident routine is called and finds the DOS critical flag set, indicating it is not safe for a DOS call, the routine loads up buffers in preparation for the DOS call, and then sets a flag within itself to indicate that it would like to call DOS, but it is not safe to do so. The program can then return control to the operating system, knowing that it may not be called again for possibly several hours. More to the point, it may not be called for the same reason

Function number	Input conditions	Output conditions
34h	None	ES:BX Points at DOS Critical (Busy) Flag.
3ch	DS:DX points to ASCIIZ file name	File is created, or emptied if it existed. Carry set if error, otherwise AX returns file 'handle'.
3eh	BX hold file handle	File is closed, or carry set if error.
3dh	DX:DX points to ASCIIZ file name AL = 0 — read access AL = 1 — write access AL = 2 — read/write	File is opened, but must already exist. Carry set if error, otherwise AX returns file 'handle'.
40h	BX holds file handle DS:DX points at buffer CX holds buffer size	Buffer is written to file. Carry set if error, otherwise AX returns number of bytes written.
42h	BX holds file handle AL holds seek method 0 — from start of file 1 — from current position 2 — from end of file CX:DX holds offset	Read/Write pointer is moved. Carry set if error.

Table 1: DOS Functions used in this example (other functions used explained in last issue)

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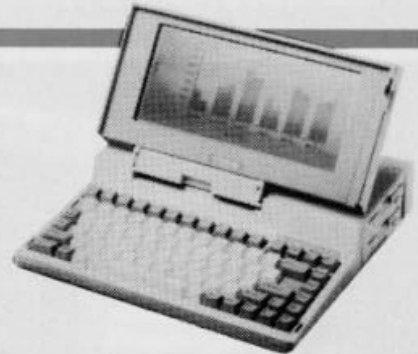
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(serial comms, key press, etc). Other interrupt handlers built into the resident module may be linked into other interrupt systems which execute more frequently, and these can interrogate the buffers left by the main handler, and call DOS on its behalf when it is later safe to do so.

An obvious interrupt to patch into is the timer tick. The primary interrupt handler might find the system is not in a suitable state, set a flag to say that it would like to execute, and the ticker handler could monitor the system 18.2 times per second and pass control back to the primary handler as soon as the system is in a suitable state.

This requires very careful synchronisation of flags and interrupt enables, as it is entirely likely that the primary routine may find the system in a suitable state, commence calling DOS, only to be interrupted by the timer tick. The ticker handler must know not to pass control over to the primary routine. Indeed, for any complex function, it can be guaranteed that a timer interrupt will occur before it completes. Many types of memory resident interrupt handlers will have to be reentrant, that is, they will have to be able to handle a second interrupt before they have finished servicing a previous one. Inadequate control and synchronisation in these cases can lead to a program which quickly finds itself in the 'Twilight Zone'.

Of course, the timer tick achieves nothing when the system is idle, as it will simply find the DOS critical flag to be set 18.2 times every second. But a program which utilised both the interrupt 28h vector and the ticker vector could deal with an outstanding desire to execute when the system is idle and when applications are running.

For many types of interrupt handlers, patching into the ticker vector is an over-kill, and a combination of the 28h vector and the original (primary) interrupt vectors will suffice.

The Challenge

The example used to illustrate these techniques is one often required by DOS users. It provides the ability to 'print to disk'. Rather than redirect all printer output to disk, which would illustrate techniques not yet covered in this series, the program intercepts 'print screen' requests and directs only that printer output to disk. Print screen requests are generally made by pressing the Shift and PrtScr keys, or may be requested specifically by application software. This program will deal with either.

This ability can be useful in system documentation, or including screen dumps in word processor documents.

The example does not really warrant the use of the timer ticker, but does illustrate how multiple interrupt handlers can be tightly woven into a single memory resident module, and opens the way for our memory resident programs to call DOS without crashing the system.

The Program

The program PrtDisk is shown in listing one, and assembles to form a 412 byte .COM file. Like all good memory resident programs it consists of resident and initialisation portions, with the initialisation code situated at the end so that it may be disposed of after use.

The program makes primary use of interrupt vector number 05h, which is

... nevertheless, it works ... very efficient stuff, but I wouldn't run an airline that way'

called by the operating system when a print screen operation is required.

Two macros, PUSHES and POPS are used to make stack manipulation more concise. These macros accept a list of register names, enclosed in angled brackets, as their parameters. They then utilise the IRP pseudo-op to repeat the macro lines down to the next ENDM, substituting each register name in the list. A final ENDM pseudo-op terminates each macro. The end result is identical to coding individual PUSHes and POPs for each register in the list, but serves to make the code more readable. The .SALL directive suppresses the assembler from listing the macro expansions.

Looking briefly at the resident portion of the program, we see two main entry points, one from vector 05h and another from 28h. Then follows the resident data area and some dynamic work space to be claimed at run time. These will be examined later.

The initialisation portion commences in much the same way as the SPEED utility presented last month. It uses DOS function 35h to find the current setting for vector 05h, and follows the pointer provided to see if it is already installed, terminating with a message. If all is well, it calls DOS function 34h, which returns a pointer to the critical flag in the register pair ES:BX. This

pointer is stored in the resident portion of the program.

A call to Bios interrupt number 11h is then made. Note that since it is Bios interrupt number 11h we need, rather than DOS function 11h, we execute an INT 11h instruction, not an INT 21h with AH set to 11h, as would be the case for a DOS function. This is the first Bios routine we have used to date. Whereas all MS-DOS and PC-DOS machines are guaranteed to provide the DOS functions via INT 21h, plus a few other interrupts, only true IBM compatible machines implement the Bios, and even then to different degrees. As you may recall from the introductory articles, the Bios (Basic Input Output System) is implemented largely in ROM, and serves as the interface between DOS and the hardware. All Bios calls are made by issuing explicit interrupts, with different interrupt numbers for the different DOS functions. Other parameters may be passed through the registers.

Interrupt number 11h is the Bios equipment determination call, and returns various details of the hardware configuration. The program masks out two bits which are used to indicate whether a monochrome display is attached. If both bits are set, then a monochrome display adapter card was being used at boot time, otherwise it is a graphics adapter. The distinction is important because the display adapters memory map the screen image into different locations. If the display is graphics, the program stores the value 0B800h into a common location, this being the segment at which the graphics adapter keeps the screen image (sometimes called the regen area). For monochrome monitors, the value 0B00h is used.

Using the same technique as in last month's SPEED utility, the program segment prefix (PSP) is used to access the command line parameters, and the parameters are copied into a dynamic work area. If no parameter is given, the program terminates with a message.

Dynamic work areas are created as a side effect of the 'terminate and stay resident' DOS function covered last month. When a program requests DOS to keep it resident, it passes DOS a pointer to the last byte of itself which it needs to be kept in memory. By situating this pointer before the end of itself, programs may dispose of their initialisation code. By situating the pointer past the end of itself, as program may obtain private memory to use a work space without that space being loaded

PROGRAMMING

from the .COM file. For example, this program uses a 2000 byte screen buffer. If the buffer were defined to the assembler as "DB 2000 dup (?)", then the .COM file would include 2000 bytes of uncommitted junk. By defining these work areas relative to the current IP in the assembler, that is, relative to the '\$' symbol, the work areas do not have to be written to the object file. The resultant work area will overlay either program code or other areas in memory, and it is the programmers responsibility to ensure that nothing comes to harm.

The PrtDisk utility not only redefines its initialisation code to be work area, but also extends the work area past the physical end of the program. The astute reader will have noticed that the program is actually making use of a data area which overlays the initialisation code before the initialisation code has completed. This is risky stuff, and therefore the very essence of any decent assembly language program. Nevertheless, it works, simply because *that* area of the initialisation code which is being overwritten *should* have been finished with by the time it gets overwritten. Very efficient stuff, but I wouldn't run an airline that way.

The dynamic work area is used to hold the file name specified on the command line. This file name must be fully qualified. That is, it must include the drive, directory and name of the file to receive the output. This is because the user may change directories, or even default drives between screen dumps, and we need the output to be written in the one place regardless of default setting. That is, the program should be started with a command such as:

```
PRTDISK C:\DUMPS\SCREENS.DAT
and not just:
```

```
PRTDISK SCREENS.DAT
```

Once the file name has been copied along with a terminating zero to make it a valid DOS ASCII string (ASCII delimited with a zero), function call 3ch is invoked to create the file. Any existing file of the same name is emptied of its contents. If the create fails (carry flag set), then the program prints a message and terminates. Otherwise function 25h is used to set vector 25h to the new print screen handler, the existing vector 28h is saved, and replaced with a pointer to the new INT 28h handler. Finally a completion message is printed, and the program loads register DX with the offset of its last important byte, plus 80h paragraphs to reserve dynamic work space, and terminates while staying resident.

Bios INT Number	Input conditions	Output conditions
11h	None	AX set with hardware configuration: Bits 14,15 — Number of printers Bit 12 — Game port Bits 11-09 — Number of RS232 ports Bits 07,06 — Number of diskettes Bits 05,04 — Initial video mode 01 40x25 graphics 10 80x25 graphics 11 Monochrome Bits 03,02 — RAM on motherboard Bit 00 — Diskettes present
10h	AH=00 AH=01 AH=02 AH=03 AH=04 AH=05 AH=06 AH=07 AH=08 AH=09 AH=0a AH=0b AH=0c AH=0d AH=0e AH=0f	Graphics mode set to AL Cursor size set to CL Cursor position set to BH,DX DX,CX returns cursor position CX,DX,BX returns light pen position Active page set to AL Scroll up by AL,CX,DX,BX Scroll down by AL,CX,DX,BX AX holds byte and attribute at cursor AL,BL is written at cursor CX times AL is written at cursor CX times Palette set to BX Pixel written at CX,DX Pixel read from CX,DX Print character in AL Current video state in AX

Table 2: Bios functions used in this example

The existing value of vector 28h is stored since the new handler should chain to whatever used to be the INT 28h handler, thus providing more chance that other resident software will coexist with PrtDisk. The existing vector 05h pointer is not stored, as we do not want to chain to it. To do so would result in the screen being both written to disk and dumped to the printer.

From this point, we can look to the resident portion of the program, particularly the INT 05h (print screen) handler. This portion commences by saving all the registers (using the PUSHES macro) and enabling interrupts thereby ensuring that serial communications and timer interrupts will be serviced during the potentially lengthy routine. It also copies the CS code segment register to the DS data segment register to establish addressability, as seen last month.

Its next step is to see if it has a full buffer already. The buffer can hold only one screen full, and hopefully should be emptied immediately. However, it is possible that DOS will not have been in a suitable state when the INT 05h first occurred, and it is also possible that the buffer will not have been emptied before the next INT

05h occurs. For this reason, if the routine is called when the buffer is still full, it simply beeps at the user and returns, popping the registers from the stack and executing an IRET (return from interrupt) instruction.

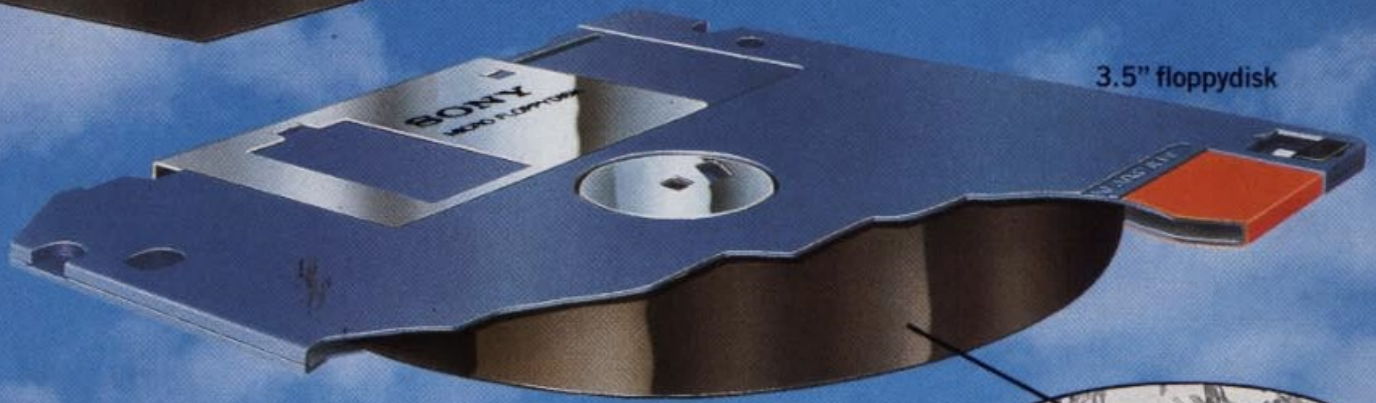
There are many ways in which a beep may be produced, the easiest of which is using DOS function 09h (print) to display the ASCII code 07h. This is a definite 'no no', as we can be sure that the system is in an unstable state, and so should avoid issuing a DOS function call, even a trivial one.

The hardest way to generate a beep is manipulating the timer and speaker ports directly. Perhaps the easiest and most robust method is to call the Bios print routine. This is performed by executing an INT 10h instruction, accessing the Bios video I/O handler, loading register AX with 0eh (the command code to print a character), and AL with 07h (the character to print). The Bios video I/O handler is quite powerful, providing a graphics interface, display attribute control, and all sorts of other nifty features missing from DOS except through the unwieldy ANSI.SYS.

If the buffer is not already full, the program loads registers DS:SI with the address of the first byte of the 'regen'



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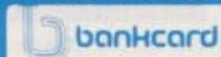
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area, and ES:DI with the address of its own buffer. The register CX is loaded with the number of bytes to copy, with is 80 times 25, or 07d0h. The MOVSB instruction is then used to copy the memory mapped display into the buffer, which takes care of incrementing SI and DI, and decrementing CX. The SI register is incremented again, manually, to skip over every second byte in the regen area, as these are attribute bytes. Finally, a flag in the local data area is set to indicate that the buffer is loaded, or 'hot'.

The routine then attempts to flush the buffer to disk. First, however, it must check the DOS critical flag. This is done by using the pointer previously saved. If the flag is not zero, the routine returns, hoping that the DOS function in progress will soon finish.

If DOS is in a suitable state, the program sets the DX register to point at the ASCIIZ file name previously set up, and called DOS function 3dh to open the file, with register AL set to 01h, indicating write access.

To append to the end of the file, it uses DOS function 42h, loading AL with 02h which means 'relative to end of file'. The register pair CX:DX is set to zero so that the 'seek' is zero bytes relative to the end of the file. The program then points DX at the buffer, loads CX with the size of the buffer, and calls DOS function 40h to perform the write. When the file is first opened, DOS passes back a 16-bit file 'handle' or 'token' by which the file may be known until it is closed. All the other functions expect the file handle to be provided in register BX, so the handle returned following the open is copied to BX. Finally, the file is closed, using function call 3eh, again with the handle in BX. The buffer is then marked as empty.

The above caters for an entire print to disk system, except for the case where DOS was busy on the first try, such as at the DOS prompt level. To deal with this, an INT 28h handler is provided. This handler will find itself called when DOS has nothing else to do, and corresponds to a 'short term scheduler' on a normal multiprocessing system.

The INT 28h handler also saves its registers, and first daisy chains to the original INT 28h handler, whatever it (or they) might be. Before chaining, it pushes the flags onto the stack, so that when the original INT 28h handler finds itself awake, the stack will contain the flags as well as the return address. This would be the normal state of the stack if the new INT 28h handler were not there at all. It also means that

```

1000 DATA "prtdisk.com"
1010 DATA 1, E9, 99, 00, 44, 70, 50, 53, 51, 52, 06, 1E, 56, $, 5240
1020 DATA 2, 57, 55, FB, 0E, 1F, 80, 3E, 97, 01, 00, 74, 0B, $, 5012
1030 DATA 3, B8, 07, 0E, CD, 10, EB, 4B, 90, 1E, 07, C5, 36, $, 7382
1040 DATA 4, 93, 01, B9, D0, 07, BF, BC, 01, FC, A4, 46, E2, $, 1432
1050 DATA 5, FC, 06, 1F, C6, 06, 97, 01, 01, 90, C4, 36, 8F, $, 7666
1060 DATA 6, 01, 26, 80, 3C, 00, 75, 27, BA, 9C, 01, B8, 01, $, 6614
1070 DATA 7, 3D, CD, 21, B8, D8, B8, 02, 42, 33, C9, B9, D1, $, 359
1080 DATA 8, CD, 21, B9, D0, 07, BA, BC, 01, B4, 40, CD, 21, $, 9044
1090 DATA 9, C6, 06, 97, 01, 00, 90, B4, 3E, CD, 21, 5D, 5F, $, 7625
1100 DATA 10, 5E, 1F, 07, 5A, 59, 5B, 58, CF, 9C, 2E, FF, 1E, $, 8829
1110 DATA 11, 9B, 01, 50, 53, 51, 52, 06, 1E, 56, 57, 55, 0E, $, 4652
1120 DATA 12, 1F, B0, 3E, 97, 01, 00, 74, DE, FB, EB, B4, 00, $, 260
1130 DATA 13, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00, $, 0
1140 DATA 14, 0E, 1F, B8, 05, 35, CD, 21, 26, B1, 7F, FE, 44, $, 8719
1150 DATA 15, 70, 75, 0C, BA, 4F, 02, B4, 09, CD, 21, B8, 00, $, 7064
1160 DATA 16, 4C, CD, 21, B4, 34, CD, 21, B9, 1E, BF, 01, 8C, $, 7513
1170 DATA 17, 06, 91, 01, CD, 11, BA, 00, B0, 24, 30, 3C, 30, $, 5768
1180 DATA 18, 74, 03, BA, 00, B8, 89, 16, 95, 01, BE, B0, 00, $, 70B5
1190 DATA 19, BA, 0C, B0, F9, 01, BA, B3, 02, 72, CC, 32, ED, $, 57
1200 DATA 20, 49, B3, C6, 02, BF, 9C, 01, 1E, 07, FC, F3, A4, $, 300
1210 DATA 21, C6, 05, 00, BA, 9C, 01, B4, 3C, CD, 21, BA, 6A, $, 8971
1220 DATA 22, 02, 72, AF, B8, D8, B4, 3E, CD, 21, BA, 05, 01, $, 7769
1230 DATA 23, B8, 05, 25, CD, 21, B8, 28, 35, CD, 21, B9, 1E, $, 7140
1240 DATA 24, 9B, 01, 8C, 06, 9A, 01, BA, 74, 01, B8, 2B, 25, $, 6337
1250 DATA 25, CD, 21, BA, 39, 02, B4, 09, CD, 21, BA, 9C, 01, $, 7735
1260 DATA 26, B1, 04, D3, EA, 81, C2, B0, 00, B8, 00, 31, CD, $, 9114
1270 DATA 27, 21, 50, 72, 74, 44, 69, 73, 6B, 20, 6E, 6F, 77, $, 7667
1280 DATA 28, 20, 72, 65, 73, 69, 64, 65, 6E, 74, 2E, 24, 50, $, 6595
1290 DATA 29, 72, 74, 44, 69, 73, 6B, 20, 61, 6C, 72, 65, 61, $, 7574
1300 DATA 30, 64, 79, 20, 72, 65, 73, 69, 64, 65, 6E, 74, 2E, $, 7461
1310 DATA 31, 07, 24, 46, 69, 6C, 65, 20, 63, 61, 6E, 6E, 6F, $, 7386
1320 DATA 32, 74, 20, 62, 65, 20, 63, 72, 65, 61, 74, 65, 64, $, 7582
1330 DATA 33, 2E, 07, 24, 53, 70, 65, 63, 69, 66, 79, 20, 66, $, 6903
1340 DATA 34, 75, 6C, 6C, 20, 66, 69, 6C, 65, 20, 6E, 61, 6D, $, 7252
1350 DATA 35, 65, 2E, 07, 24,
1360 DATA END, 412

```

Listing 2: Basic DATA statements for use with the loader to create PRTDISK.COM

when the old INT 28h handler executes its IRET instruction, it can happily automatically load the flags off the stack (for this is one of the actions carried out by the IRET).

The new INT 28h handler then establishes local data addressability through DS, enables interrupts, and if the buffer is non-empty, jumps into the INT 05 handler, just past the point where it tests the Critical flag. In other words, if the INT 05h handler is not able to write the buffer to disk, then the INT 28h handler will notice when next it is activated, and pass control back to the INT 05h handler allowing it to complete its task.

The whole operation works rather smoothly. For example, requesting a print screen in the middle of a scrolling directory list will cause the screen regen area to be immediately copied into the local buffer, where the image will remain until the directory list is complete or pauses, at which time it will be written to disk in the form the screen was when then print was requested, not when the disk I/O could finally be done.

The resulting screen image file may be printed, typed, or read into a word processor at any time. The file is

automatically erased when the utility is first loaded, but should not be manually erased while the program is resident. The file consists of 2000 bytes, organised as 25 lines of 80 characters with no separation between lines.

The system works with Lotus and other major software products, although using it with other memory resident utilities may involve the same fun and games one is subjected to with commercial products.

Enhancements

The example presented here is quite minimal. Readers may like to enhance it to meet their individual requirements; for example, dealing with bit-mapped graphics screens, adding a timer tick entry point to aid buffer flushing, handling multi-screen buffers and perhaps writing out the screen attribute bytes as well.

Writing the attribute bytes is not necessarily a good idea unless you plan to use them, as it makes the resultant file pretty much useless for word processor usage or typing out on the screen.

More importantly, the program should really cater for critical errors (drive not

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ready, seek error, etc) which might occur as it is performing its disk I/O. It may not be appropriate to allow the current (or default) critical error handler deal with the situation. This is a simple modification, however, the program really should not try to do I/O at all if another task has caused a critical error which is still being sorted out at the instant the routine becomes active. This is non-trivial, and becomes highly dependent upon specific versions and

vendor customisations of DOS.

Creating the Program

Creating the example program is exactly the same as last month. Readers with access to an assembler should simply enter the source code shown, assemble it and convert it to a .COM file. Instructions for doing this were presented in the previous issue.

Readers with access to a GW-Basic interpreter can enter the Basic DATA

statements shown in listing two, and MERGE them with the loader program also previously presented. Running the resultant program will produce the COM file.

But most reliable of all, readers with a modem might like to dial up Microtex 666 on Telecom Viatel and download the version of their choice without lengthy keying and no errors.

The series will continue next month.

END

```

TITLE Screen Dump Print To Disk

;
; PC Screen dump print to disk
; *****
;
; Australian Personal Computer Magazine, March, 1987.
; Should be assembled as .COM file.
; Usage is: PRTDISK (drive):(directory)\(filespec)

;Call
Pushes Macro List
;rg Reg, (List)
; Push Reg
; Endm
; Endm

; Pops
; Macro List
;rg Reg, (List)
; Pop Reg
; Endm
; Endm

; Codeseg
; Segment Para
; Assume CS:Codeseg,DS:Codeseg,SS:Nothing,ES:Nothing
; Org 100h

; MainProg
; Proc Far
; Jmp Init ; Perform initialisation

; *****
; * New PrtScreen Interrupt Handler (MSH) *
; *****

; Markers
; Db 'Sp'
; Handler: Pushes (Ax,Bx,Cx,Dx,Es,De,SI,DI,Bp)
; Sti ; Enable other interrupts
; Push Cx
; Pop Ds ; Local data addressability
; Cap [Buffer_loaded],0 ; Is Buffer already loaded
; Jc Buffer_ok
; Mov Ax,007h ; BIOS Beep
; Int 10h ; Call the BIOS
; Jmp Return

; Buffer_ok
; Push Ds ; Copy screen into buffer
; Pop Es
; Lds Si, Dword Ptr Scr_Offs ; Point SI at screen
; Mov Cx, 0700h
; Mov Di, Offset Buffer ; Point DI at screen buffer
; Cld

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; * B10C Buffer equ 0+32 ; Dynamic screen buffer

; *****
; * Initialisation *
; *****

; B10C NE Init: Push Cx
; B10D IF Pop Ds ; Addressability via DS
; B10E DD 3505h Mov Ax,3505h ; Find INT 05 Vector
; B10F CD 21 Int 21h ; Result in ES:BX
; B1A3 26: 01:7F FE 7844 Cap Word Ptr Es:[0x-21], 'p0' ; Follow it and peek
; B1A4 75 0C Jne Not_Loaded ; Are we resident?
; B1AB BA 024F R Mov Ds, Offset Msg2
; B1AE 04 09 Abort: Mov Ah,9 ; Message if so
; B1B0 CD 21 Int 21h
; B1B2 DD 4C00h Mov Ax,4C00h
; B1B3 CD 21 Int 21h ; And Terminate, so TDR

; B1B7 04 3A Not_Loaded: Mov Ah,3Ah
; B1B8 CD 21 Int 21h ; Find DOS Critical Flag
; B1B9 0F 1E 010F R Mov Word Ptr Critical,0s ; and save for later
; B1BF 0C 06 0195 R Mov Word Ptr Critical+2,Es
; B1C3 CD 11 Int 11h ; Equipment determination
; B1C5 BA 0000h Mov Ds, 0000h
; B1C8 24 30 And Al,30h ; Mask out display type
; B1CA 3C 30h Cap Al,30h
; B1CC 74 03 Jc Mono_Screen
; B1CE BA 0000h Mov Ds, 0000h
; B1D1 0F 16 0195 R Mono_Screen: Mov [Screen],Ds ; Set Screen address

; B1D5 0E 0000h Mov Si,00h ; Point at command line
; B1D6 BA 0C Mov Cl,[SI] ; and find length
; B1DA 00 F9 01 Cap Cl,1
; B1DD BA 0203 R Mov Ds, Offset Msg4
; B1E2 72 CC Jc Abort ; Abort if no para
    
```

Listing 1: Assembler source for PRTDISK.COM

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PROGRAMMING

```

B1E2 32 ED      Ior  Ch,Ch
B1E4 49        Dec  Ex
B1E5 83 C6 B2  Add  SI,2          ; skip into text
B1E6 9F B19C R  Mov  DI, Offset Filename
B1E8 1E        Push Ds
B1EC 87        Pop  Es
B1ED FC        Cld
B1EE F3/ A4     Rep  Movsb          ; Copy to dynamic buffer
B1F8 C6 B5 B0   Mov  Byte Ptr [DI],B ; Add ASCII terminator

B1F3 9A B19C R  Mov  Dx, Offset Filename
B1F6 94 3C     Mov  Ah, 3ch
B1F8 CD 21     Int  21h          ; Create file
B1FA 9A B26A R  Mov  Dx, Offset Msg1  ; Print message and
B1FD 72 AF     Jc   Abort        ; abort if not created
B1FF 9B 06     Mov  Bx, Ax        ; Copy handle to B1
B201 94 3E     Mov  Ah, 3eh
B203 CD 21     Int  21h          ; Close file

B205 9A B185 R  Mov  Dx, Offset Handler ; Set PtrScreen vector
    
```

```

INT20 . . . . . L NEAR B19C CODESEG
INT2B . . . . . L NEAR B174 CODESEG
INT2B_DFS . . . . L WORD B19B CODESEG
INT2B_SEG . . . . L WORD B19A CODESEG

MAINPROC . . . . F PROC B188 CODESEG Length = B19C
MARKER . . . . . L NEAR B183 CODESEG
MOND_SCREEN . . . L NEAR B1D1 CODESEG
MSG1 . . . . . L BYTE B23F CODESEG
MSG2 . . . . . L BYTE B24F CODESEG
MSG3 . . . . . L BYTE B26A CODESEG
MSG4 . . . . . L BYTE B283 CODESEG

NOT_LOADED . . . . L NEAR B1D7 CODESEG

RETURN . . . . . L NEAR B16A CODESEG

SCREEN . . . . . L WORD B195 CODESEG
SCR_DFS . . . . . L WORD B193 CODESEG

WRITE_BUFFER . . . L NEAR B143 CODESEG
    
```

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```

B208 9B 2585   Mov  Ax, 2585h      ; to Handler
B209 CD 21     Int  21h

B200 9B 3528   Mov  Ax, 3528h      ; Find INT20 Idle vector
B210 CD 21     Int  21h
B212 89 1E B19B R  Mov  [INT20_Off],bx ; Save old vector
B216 8C 86 B19A R  Mov  [INT20_Seg],es
B21A 9A B174 R  Mov  Dx, Offset INT20
B21D 9B 2528   Mov  Ax, 2528h
B220 CD 21     Int  21h          ; And reset vector to us

B222 9A B239 R  Mov  Dx, Offset Msg1
B225 94 09     Mov  Ah, 9
B227 CD 21     Int  21h          ; Display message

B229 9A B19C R  Mov  Dx, Offset Inits ; Find size of resident portion
B22C 81 84     Mov  Cl, 4
B22E 53 EA     Shr  Dv, Cl        ; Convert to paragraphs
B230 81 C2 B808 Add  Dv, 80h       ; Create Dynamic Buffer
B234 9B 3188   Mov  Ax, 3188h     ; Set return code to 0
B237 CD 21     Int  21h          ; Terminate & Stay Res.

B239 58 72 74 44 69 73 68 Msg1  db  'PrtDisk now resident.',
28 6C 6F 77 28 72 65
73 69 64 65 6E 74 2E
24

B24F 58 72 74 44 69 73 68 Msg2  db  'PrtDisk already resident.',',',', '
28 61 6C 72 65 61 64
79 28 72 65 73 69 64
65 6E 74 2E 87 24

B26A 46 69 6C 65 28 63 61 Msg3  db  'File cannot be created.',',', '
6E 6E 6F 74 28 62 65
28 63 72 65 61 74 65
64 2E 87 24

B283 53 78 65 63 69 66 79 Msg4  db  'Specify full file name.',',', '
28 66 75 6C 6C 28 66
69 6C 65 28 6E 61 63
65 2E 87 24

B29C          Mainproc  EndP
                Codeseg  EndS
                End      Mainproc ; Set entry point
    
```

288 Source Lines
236 Total Lines
48 Symbols

49254 Bytes symbol space free

0 Warning Errors



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Screen Dump Print To Disk Symbols=1

Macros

Name	Lines
POP	3
PUSH	3

Segments and Groups

Name	Size	Align	Combine	Class
CODESEG	B29C	PARA	NONE	

Symbols

Name	Type	Value	Attr
ABORT	L NEAR	B1AE	CODESEG
BUFFER	NEAR	B18C	CODESEG
BUFFER_LOADED	L BYTE	B197	CODESEG
BUFFER_OK	L NEAR	B128	CODESEG
COPY_LOOP	L NEAR	B12D	CODESEG
CRITICAL	L DWORD	B18F	CODESEG
FILENAME	NEAR	B19C	CODESEG
HANDLER	L NEAR	B185	CODESEG

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Copywrite	92	Microline ML 293	1150	STORAGE BOX 3.5" DISK W/LOCK	30	
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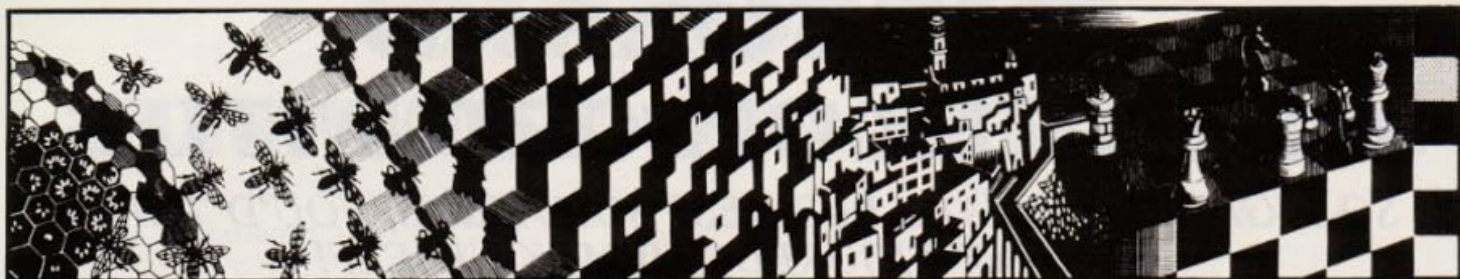


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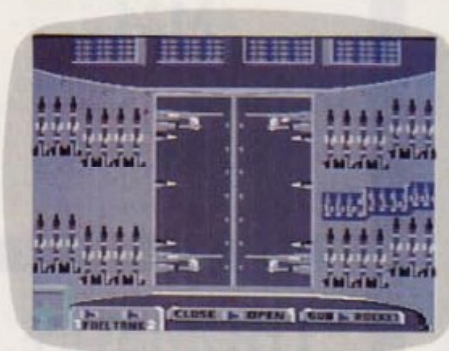
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Stephen Applebaum shoots 'em up over the bomb-ravaged landscape of wartime Germany, deactivates — and detonates — bombs in buildings — and he's only reviewing this month's games!



Mosquito mission

TITLE: Ace of Aces
COMPUTER: Commodore 64
SUPPLIER: Ozi/Soft
PRICE: \$39.95 (tape); \$49.95 (disk)

In 1943, Luftwaffe chief Hermann Goering made the mistake of telling the German people: 'No British aircraft will ever bomb Berlin'. Today, history tells us that not only did British planes bomb the German capital, but that they did so as Goering made his arrogant pronouncement.

The humiliation suffered by Goering and his misguided votaries must have been tremendous; almost as great, even, as the elation of those who perpetrated that fantastic deed of boldness.

Ace of Aces tries to capture some of the spirit of bombing raids like the one on Berlin, by putting you, the player, in the seat of a Mosquito fighter bomber.

As with nearly all the games of its genre, Ace of Aces represents the war according to Ealing Studios and Hollywood, and not that endured by countless millions of people. In other words, it glorifies that inglorious and sordid period of human history that should be remembered for the suffering it caused rather than for those who emerged as heroes; most of whom would never have been heard of had there not been a war.

Subject matter aside, Ace of Aces is an exciting mixture of strategy and mindless shoot 'em up which includes some of the best graphics seen on the Commodore 64.

The game opens to the stirring refrains of *Land of Hope and Glory*. Somewhat tasteless, though, is the synthesised machine gun fire that rat-tat-tats over the music. As soon as that's finished, the game's first menu appears.

There are four missions in Ace of Aces which can be compounded into one epic enterprise or tackled separately. The missions are: to bomb a POW train, heading from Munich to Berlin; to destroy V1 launch sites near Paris; to sink German U-Boats; and to shoot down a squadron of JU-88 bombers.

On selecting a mission, bomber command furnishes you with an intelligence report containing information on the locations of the various targets and the directions you must take to reach them, plus the weather conditions over the German mainland.

After receiving the report and noting its orders, you move on to the weapons store. Bombs, rockets and shells are available here, but not all are necessary for every mission: what you choose depends on the target and its distance from your take-off point. The reason for this is two-fold: redundant weaponry adds weight, which in turn increases the rate at which fuel is used; and the heavier the load being carried over a long distance, the

greater the likelihood of an engine catching fire. You must be judicious in your selection.

Orders read, weapons taken on board and pre-flight checks made, it's finally time to scramble, and for one of Ace of Aces' choicest moments. Notwithstanding its lack of animation, the scramble sequence is brilliant in its simplicity. A siren wails stridently, urging pilots to board their aircraft. Then there's the sound of running, followed by the whirr of propeller blades. During each phase a small picture appears, drawn as a photograph in an album, to show what's going on. Chaste as this sequence is, the mixture of realistic sound and static pictures works well, producing a moment that is quite entralling.

That, then, is the take-off sequence — simple and unchallenging. When you're in the air, the display changes to a view of the Mosquito's flight controls which include a compass, a speedometer, an artificial horizon, an altimeter and a radar-like instrument. In front of the main panel is a joystick which simulates the movements you make as you fly the plane.

Pressing the 2, 3, 4 and 5 keys on the Commodore's keyboard changes the display to other parts of the aircraft, while 1 returns it to the original forward view. Keys 2 and 3 produce views of the left and right sides of the cockpit, and the rest of the Mosquito's instruments, respectively. Key 5 dis-

plays the bomb bay and the weapons that were selected earlier.

As you soar up through the clouds, tiny black dots appear in the distance. These soon emerge as JU-88 fighters which, as they close, home in on you with their machine gun sights. Then, when the time is right, they let rip, showering you in lead. Going quickly to the bomb bay screen you select either rockets or cannon, then return to the cockpit from where you reciprocate the JU-88's shells with a hail of your own. A flash of red indicates a direct hit. Much the same happens with V1s ex-

cept that they can't fire back, being no more than flying bombs.

Using your bombs is rather different. When you near the POW train or a U-Boat, you open the bomb bay doors to reveal a view onto the ground below. Both the train and the submarines make difficult targets, though the former is the easier to hit since it is longer.

Sadly, I don't know what happens when you complete a mission because I didn't manage to avoid running out of fuel or crashing to the ground. In these cases you're presented with proof of the number of enemy vehicles

destroyed, alongside which is the damage inflicted on your own aircraft.

Even without being able to complete a single operation, I still found playing Ace of Aces a wholly enjoyable experience. Flying games aren't normally something I go for but this one strikes just the right balance between a flight simulator and a no-nonsense shoot-out, giving inept pilots a chance, if not to win, then at least an opportunity to practise their pilot's skills and enjoy themselves.

The force of gravity

TITLE: Deactivators

COMPUTER: Commodore 64/128

SUPPLIER: ECP

PRICE: \$34.95 (disk); \$24.95 (cassette)

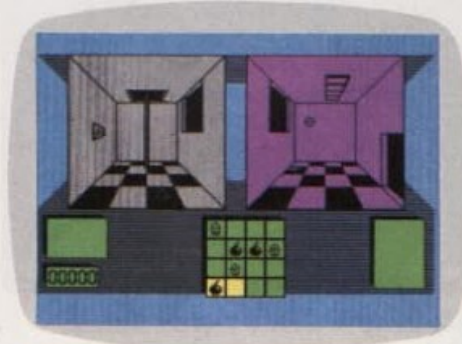
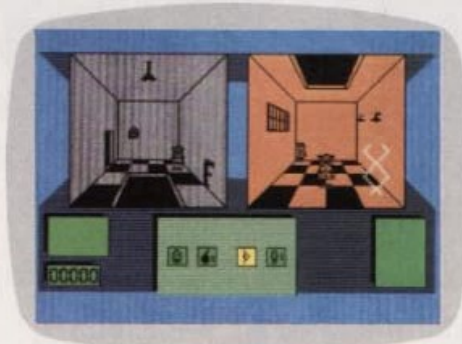
Someone, somewhere, doesn't like the work being carried out at the Gravitational Research Institute (GRI) — time bombs have been found dispersed throughout the rooms of its five buildings. And, in addition, the robots which usually safeguard the security of the project have been reprogrammed, turning them against those who normally control them.

Such a state of affairs is intolerable, not to mention highly damaging to the project and the reputations of those involved in it. Deactivator droids must be mobilised immediately to locate and defuse the bombs — before it's too late.

There's just one problem. . .well, several problems, really. Due to the nature of the research being done at the Institute, some of the rooms are rather unusual in their design and could restrict the movements of each droid to only a small area within a particular building. Doors do not necessarily connect in the normal way, since in some rooms floors may be ceiling while in others ceilings may be walls.

Furthermore, each room has its own gravity generator. These are each set to one of four different strengths, depending on the orientation of the room. For safety each room has been colour-coded in accordance with its setting.

The layout problem can, to a certain degree, be overcome by the use of matter transmitters. Sadly not all of these are operational due to a slight hiccup in staff/management rela-



tions. However, they can be reactivated by plugging a circuit board into the building's central computer. This is handy to know because it isn't only some of the matter transmitters that are out of order, but also the complete lighting system in building four and some electrically sealed windows.

As you are probably aware, the Deactivator droids are not automatic: someone — you — must control them manually.

Thankfully the security cameras in each room are still working, so you'll at least be able to keep a check on the position of the droids, as well as the now-hostile robots, which patrol the buildings.

When you look at your monitor you will see the transmitted pictures from two cameras located in adjacent rooms. Below these images is a small block diagram showing the building's layout, and the locations of the bombs and the Deactivator droids. You'll notice that the robots are missing — that's because at this stage, there's no pretty icon to represent them.

To the left of the map is a small box which shows whether any auxiliary droids happen to be on hand. For most of the game that box remains empty. And just to give you an idea of how near to detonation the bomb being carried by a particular droid is, a small picture of a bomb with its fuse fizzling appears on the left of your picture.

Rather amusing, don't you think?

The aforementioned map can be replaced by a special control window, in which are four icons: a droid, a bomb, an arrow and another droid.

The first icon allows you to select a different droid to the one that you are controlling. Activating this function reproduces the map from where you can make operational any of the droids shown there.

The second icon provides the invaluable service of enabling you to control the angle at which a droid throws a bomb. Although this sounds rather dangerous, it's a manoeuvre which must be performed many times. But so what if it's dangerous? You're not the one who's going to be splattered over a room if the bomb goes off.

Bomb throwing is an art well worth cultivating since the successful clearance of a building depends, to a large extent, on cooperation between your three droids. Bombs, or even circuit boards, quite often have to be thrown through a window from one droid to another, as the route to the outside world might be inaccessible from the room that the droid originally carrying the object is in.

The arrow icon denotes a function that allows you to scan all the rooms in a building. This is your only method for seeing where the robots are, so it's well worth using. Due to yet another technical hitch, the scan mode is non-



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SCREENPLAY

operational in building five; or, at least, it is until you replace a faulty circuit board that's lying in one of the rooms.

Finally, the second droid icon returns you to movement control of the currently activated droid.

Before I leave you to it, I think you should know a bit about the robots. Since their re-programming these once amiable thralls of the GRI have become psychotics, and can now kill with the merest touch of their metal claws —

any Deactivator that comes into contact with one will have little chance of escape. Their one Achilles' heel is their inability to withstand more than a few falls in a short space of time. Remember this — it could mean the difference between success and failure. Your task is not an easy one. As you progress from one building to another, the number of bombs can only increase because each successful building is larger than the one before. For ex-

ample, building one is a simple 4 x 4 matrix but some of the others are as big as 12 x 4.

Deactivators isn't simple — it wasn't designed to be. Although you will probably be able to remove most of the bombs from a building, it's always the last one or two that cause all the problems.

Good luck.

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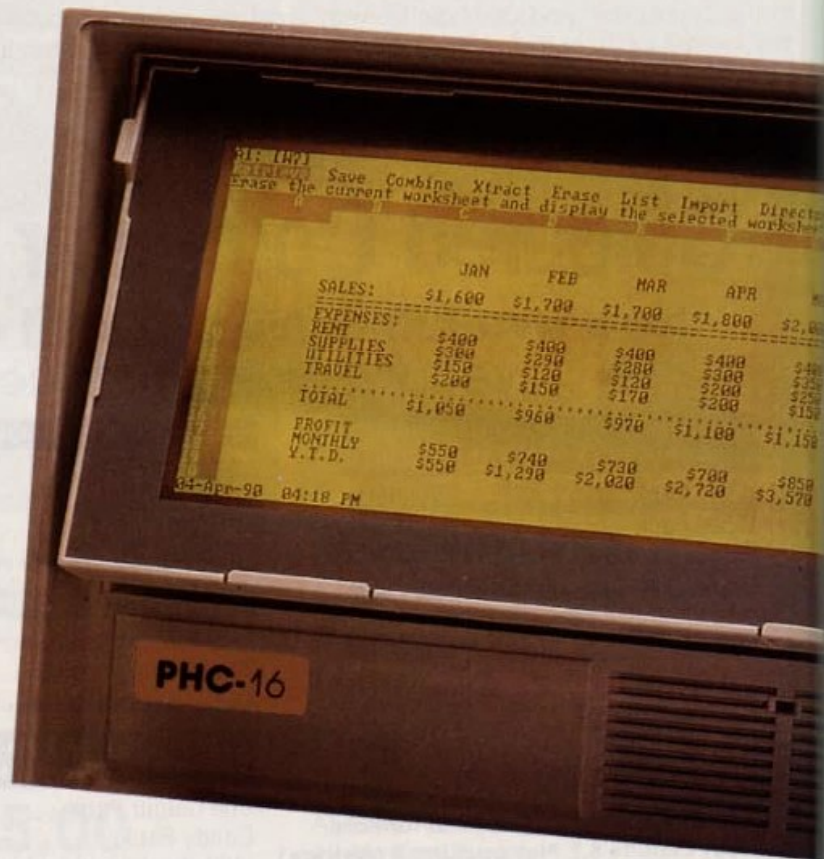
With a 20 Mb hard disk and available as a 5 1/4" or 3 1/2" configuration, the car adaptor allows the PHC-16 to be used in the car, while the battery pack gives the businessman the flexibility to use the PHC-16 in a plane, train or boat.

Dynamic state-of-the-art technology introduces the infra-red cordless keyboard and new plasma effect screen, which can be read from any angle.

Able to read and write the formats of IBM PC/XT, IBM convertible, Zenith, Toshiba and NEC the Kohjinsha Sotec corporation has priced the PHC-16 at an affordable and competitive level.

The PHC-16 will be featured at the PC show at Sydney Centrepoint at stand 925 from March 17-20, where the supplier will provide a few more special surprises.

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PHC-16

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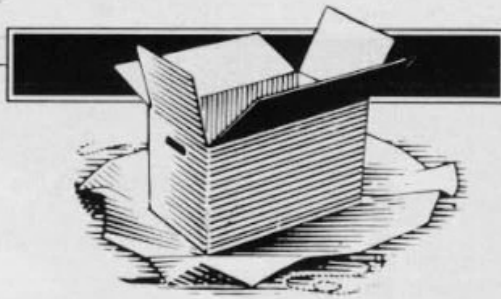
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WHAT'S NEW

Ian Davies has news of more ultra-cheap PCs, plus the latest in the race to produce 'bio-chips'.



Baby Blue PC

Following hot on the heels of Dick Smith's PC price drop is the Baby Blue, another 'sub \$1000' machine.

Barrington Corporation of Adelaide has announced the machine with a recommended retail price of \$995, including tax, but *excluding*

monitor. The PC features a '16 bit 8088' (?), 256k RAM, diskette, AT-style keyboard and expansion ports. The machine is bundled with Homebase, a desktop organiser said to be similar to SideKick.

Barrington Corporation is on (08) 232 1333.

Epson AT

Although not yet available in Australia, Epson (the printer company), has released a new AT-compatible machine.

The Equity III+ sports an 80286 processor running at 6, 8 or 10 MHz, all with a single wait state, thereby encompassing the standard AT speed for compatibility, a

medium speed offered by many compatibles, and a higher performance mode where fleetness of foot really counts. The clock speed is configured through a front panel switch.

Unusually, the main RAM and ROM is situated on a removable board, perhaps a

sign of planned enhancements. The motherboard can be removed through a slot in the front of the machine. All the normal AT configurations and options are available. Oz pricing is not yet through, but the U.S.

market is paying \$US2695 for a machine with no hard disk, or \$US3895 with a 40 Mbyte winchester. Not the cheapest, but Epson does have a reputation for quality goods — just ask a certain Mr. Dibble.

80386 Multitech

Also not yet available in Australia, but you can be sure Dick Smith won't be holding this one back. It might even explain why the Multitech 500s are currently such a terrific bargain at less than \$1000.

The Multitech 1100 features an 80386 CPU, 1 Mbyte of RAM, 1.2 Mbyte floppy, two serial ports, printer port and a 40 Mbyte

hard disk drive. Three of its eight expansion slots are full 32-bit ports, three are 16-bit AT ports, with the last two being 8-bit XT compatible slots.

Again, Australian pricing is not available, but the American price should be a good indicator at just US\$3995 complete with winchester, or \$US5995 with an 80 Mbyte disk.

20 Mip board

A 20 Mip expansion board for PCs sounds too good to be true, but that's exactly what's around the corner from the US company Data Flow Imaging.

The board features four 5 Mip NEC PD7281 processors, chips designed specifically for data-flow or token-passing applications. DFI expect that the solid 'grunt' combined with parallelism should prove useful for array

processing, signal processing, simulations, image processing and graphics. The five processors are supported by a 17-bit by 17-bit hardware multiplication unit.

While it's not Lotus 1-2-3 at 20 Mips, the board may be attractive to developers involved in any parallel problems such as AI. The board costs \$US995, and more information is available from DFI on (201) 666 7970.

80386 C compiler

Intel has released a C compiler to take advantage of the new 80386 chip. Stealing a jump on Microsoft, the new compiler requires DOS 3.0 or higher, and runs in conjunction with the RLL 386 Relocation Linkage and Library tools.

No doubt Intel will be making good use of the compiler on its own 80386-based machines in addition to spurring along 386 acceptance in the PC market. The compiler costs \$US900, and the RLL 386 package is an additional \$US600.

Software CRO

A CRO (Cathode Ray Oscilloscope) is an essential item of workshop equipment. Everyone should have one if they plan to take the cover off anything — even a toaster. But CROs don't come cheaply, certainly not good ones with storage capability and all the other bits and pieces one eventually drools over.

So Hansen Instruments has released PCGen, a

software product which can turn your PC into a digital oscilloscope and spectrum analyser. Analogue data is acquired in real time, stored, and displayed historically. Even Fourier analysis is provided. The software is function key driven, and requires a graphics card data acquisition board.

It is priced at \$US250, and Hansen may be contacted on (415) 846 7925.

Turbo numerical toolbox

PC Extras has announced the availability of a numerical toolbox for users of Turbo Pascal.

The toolbox consists of ten modules containing routines for equation solving, interpolations, calculus, matrix operations, Fourier trans-

forms and approximations. Complete source code is provided, and the package does not require the assistance of an 8087 numeric coprocessor.

The product is priced at \$235, and is available from PC Extras on (02) 319 2155.

RPG II compiler

RPG II is alive and well at Fagan Microprocessor Systems, which has secured the rights to distribute the Lattice RPG II compiler.

The compiler can accept source code in either ASCII or EBCDIC, and is compatible with the IBM system III, 34 and 36 RPG com-

pilars. No runtime royalties are required, and external calls to assembler and C routines are supported. The compiler costs \$1495, with options such as source code entry and sort utilities available.

Fagan Microprocessor Systems is on (03) 699 9899.

Multitasking Pascal

With Turbo Pascal enjoying such a dedicated following, and the promised multitasking MS-DOS yet to arrive, the Mystic multitasking Pascal compiler from Microway might just be in the right place at the right time.

Adhering to the 'development environment' idea, the

product comprises editing and debugging features in a single package. The multitasking ability is utilised in the development environment, allowing users to compile one program while editing another. Since the compiler is incremental, minor alterations to source code

necessitates only the changed lines being recompiled. The compiler emits

direct machine code. Microway is on (03) 555 4554.

Just a step to the side...

Vault Corporation, the Prolog people who started looking so worried when the trend began moving away from copy protected software, have found a new way of protecting software investments.

Bordering on 'vapourware', the new scheme features a Prolog protected diskette which is not used in day to day operation of the software product. Instead, the protected disk is only re-

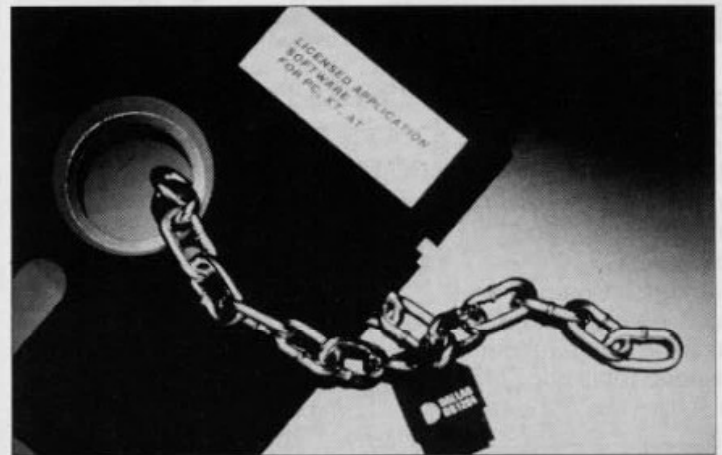
quired when the user rings the vendor for support. In addition to authenticating the user, 'Techline' also displays the current hardware configuration, thereby assisting in the support process. Of course, the concept is only valid for vendors who provide telephone support, and only thwarts those pirates who have difficulty in using the stolen software, and are brazen enough to ring the supplier for help.

New from Borland

Never one to be caught standing still, Borland International has released the Eureka problem solving software package. Similar to TK!Solver, Eureka can accept a series of algebraic equations, constraints, unit conversions and generate a set of solutions for unknown variables. The unknown variables do not have to be made the object of the for-

mula prior to evaluation.

The product features pull-down menus, context sensitive help, calculator, 8087 support, financial functions, graphics, and can deal with polynomials and inequality solutions. It is priced at \$US99.95, and will probably sell for around \$150 in Australia. Borland can now also provide a Turbo Prolog toolbox.



Dongle

Addressing the ever changing software security market, Alfatron has announced the availability of the DS 1204 Electronic Key, or 'dongle' in the vernacular.

The product is a hardware device which uses a 64-bit identification code to allow

access to 128 bits of read/write non-volatile memory. The unit is programmed with a secret security code which application products may then use to confirm authorisation.

Alfatron is on (03) 758 9000.

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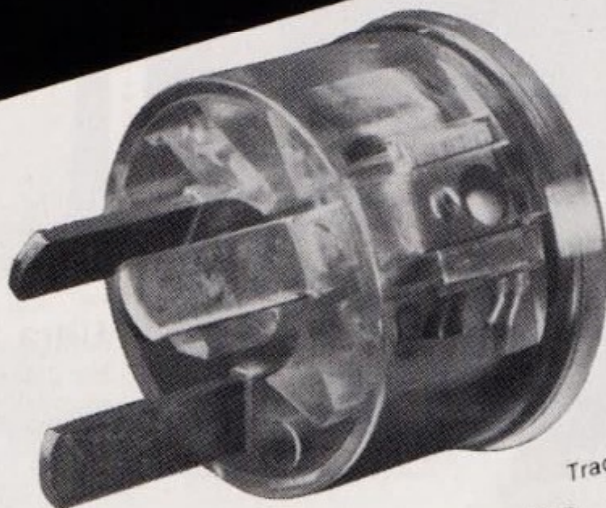
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and Latin extractions. A connotation menu allows the user to indicate what attributes the name should reflect. For any set specifications, Namer can produce several hundred possible suggestions.

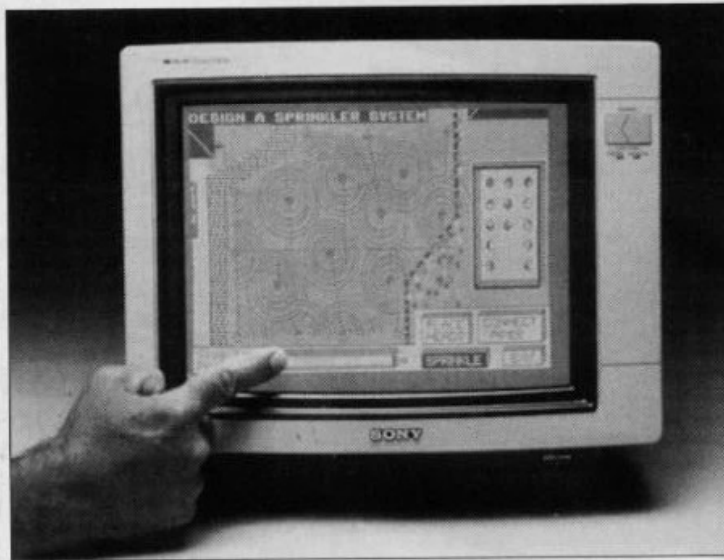
Namer is priced at \$340 (including postage). For more information call the distributors Hearne Marketing Services on (03) 497 4276.

PCX Fax interface

A Californian company, Microtek, has developed an expansion board which turns a PC or compatible into a group 3 Facsimile machine. Combined with an optical scanner from Microtek, the board occupies a single expansion slot and becomes a fully functioning Fax system

with additional capabilities such as delayed transmission. The Class 3 Fax standard operates primarily at 9600 bps, with slower speeds automatically selected over marginal lines.

The board costs \$US 995, and Microtek may be reached on (213) 321-2121.



PC touch screen

Who remembers the good old HP-150?

Apart from being quite a decent machine, the 150 had one major feature which sticks in everyone's mind, and made it a popular attraction at exhibitions and demos — the touch screen.

Now vertical marketeers and others can add this capability to a stodgy old PC using the Personal Touch TouchMonitor, distributed in

Australia by Monex. The screen consists of transparent membrane switches on a glass protective backing which fits over a normal monitor. The screen may be interfaced through an analogue or RS-232 port, and provides a minimum resolution of 256 by 256 with 7ms response time.

Monex may be reached on (07) 832-0345.

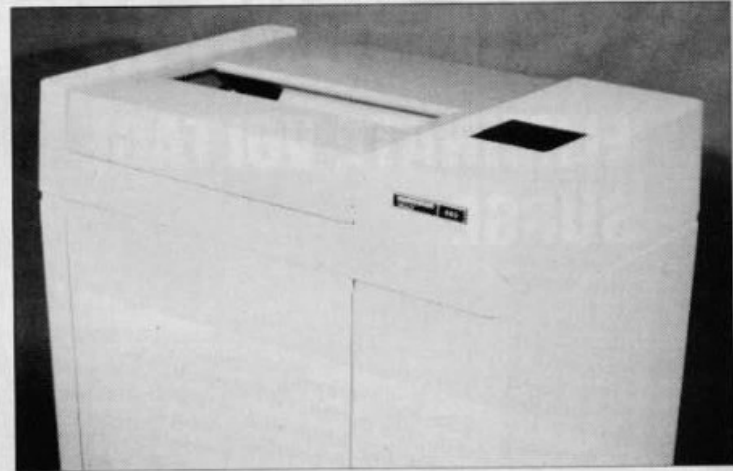
Enhanced scanner

Remington now offers an enhanced version of its popular page reader, PC-Scan.

The new model, PC-Scan Plus, is capable of reading both text and graphics with halftones in 16 shades of grey, and forms a very effective front end for desk top

publishing ventures. The scanner features an 80186 processor and 768k of RAM. It is able to scan a page in as little as nine seconds, at a maximum resolution of 300 dots per inch.

More information is available from Remington, on (02) 269-0925.



Ultra fast printer

For those really big print jobs, MPA has announced the Mannesmann Tally MT690 line printer.

This device is capable of printing up to 900 lines per minute, or 450 lines per minute in correspondence quality, and can also produce graphics and bar

code labels. Text output may be up to 198 columns per line. It is rated at 100,000 pages per month, and operates at 60 dB. Print options include character quality, double width and triple height.

For more information, call MPA on (03) 894 1500.

Biochips — the race is on

It seems like the idea of biological computers is being taken quite seriously. The concept is based around using organic enzymes and molecules to create digital logic, as previously described in these pages.

Several companies, including IBM and AT&T are actively researching the area, expecting gains in higher densities, greater speeds, increased parallelism and more accurate simulations of brain activity. The work is progressing on two fronts — some researchers working with organic materials and trying to make them do what

existing silicon technology can do, while others use silicon technology to experiment with massive parallelism. The two fronts will eventually merge, and some researchers expect final developments to utilise silicon (or gallium arsenide), organic processing as well as light.

The race is on, and the technology should open the way to another couple of orders of magnitude in performance and functionality. Some industry pundits do not expect the technology to be generally applied for another ten or fifteen years, while others project that



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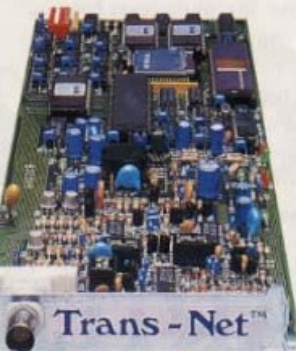
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- Distance: 2.5 KM Maximum
- Operating Systems: PC-DOS 3.x
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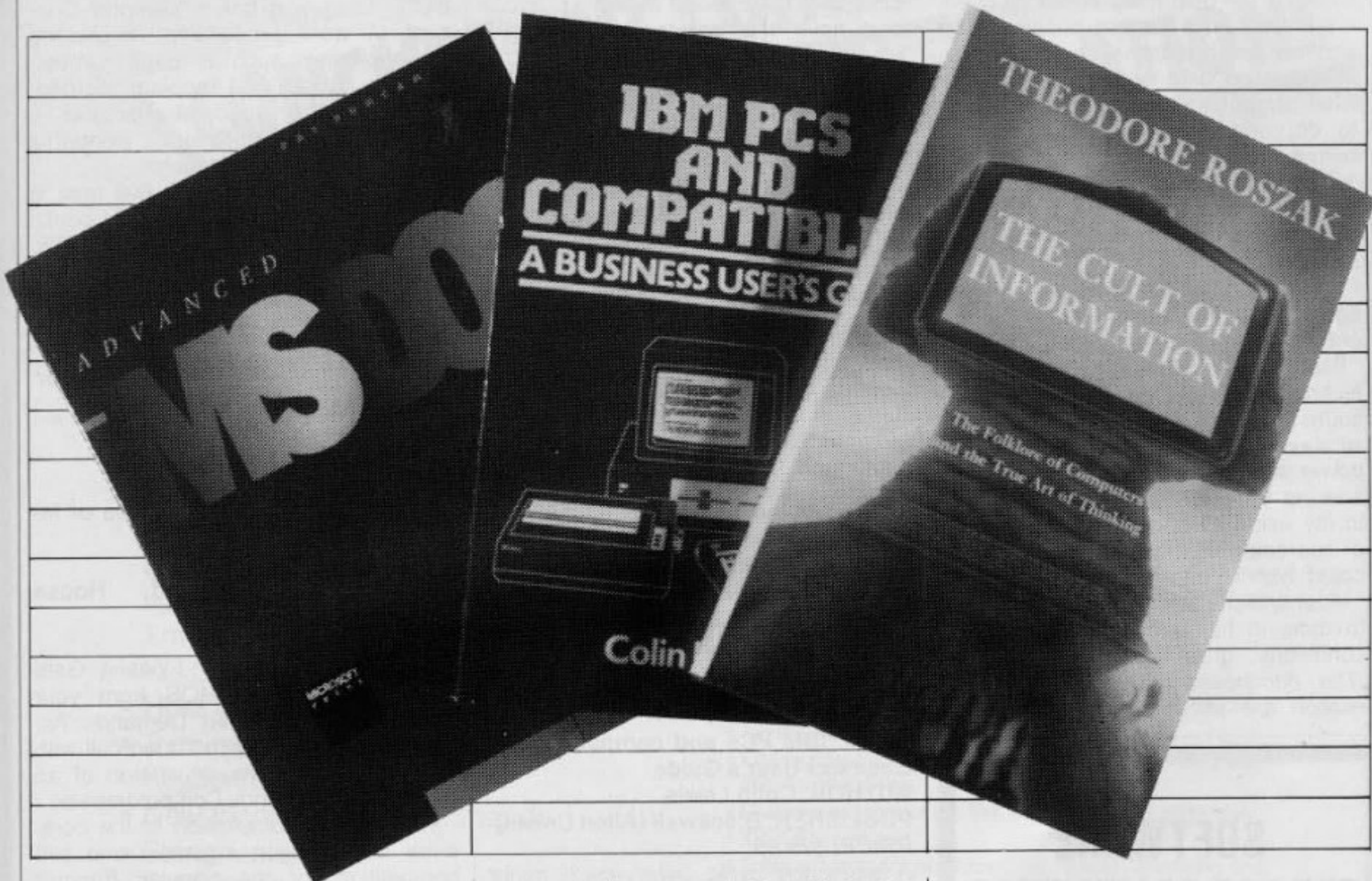
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Higher education in MS-DOS, computing as a cult and understanding your IBM PC or compatible take the stage in this month's book selection.



Great aspirations

TITLE: Advanced MSDOS
AUTHOR: Ray Duncan
PUBLISHER: Microsoft Press (Penguin)
PRICE: \$35.95

'We assume a certain level of familiarity with the architecture and instruction set of the Intel 8086 microprocessor family, and with assembly language programming in general.'

That sentence really does set the pace for this book. If you can `C:\TEMPS>cd c:\` with the best of them, fine; if you can quite happily `A:\TEMPS>COPY TEST.* C:\TEMPS`, super; but this book is to the true programmer what a Silver Cloud Rolls Royce is to a rag-and-bone-man. For example, there is a five-page description on how MS-DOS is loaded! *'Then it moves the DOS kernel, MSDOS.SYS, from its original load location to its final memory location, overlaying the original SYSINIT code*

and any other expendable initialisation code that was contained in the IO.SYS file.' It's pretty heady stuff.

Altogether, there are over 400 packed pages of detailed MS-DOS, with complete chapters devoted to using MS-DOS programming tools: disk internals, memory allocation, interrupt handlers and installable device drivers. While hardly bedtime reading, it is a detailed and absorbing reference book for the 'advanced' programmer, with clear diagrams, plenty of program listings and examples, and chapters sectioned into logical reading blocks.

Section II is devoted entirely to MS-DOS programming references, describing every interrupt from 20h through to 2Fh, while the remaining two reference sections cover the IBM PC Bios and the Lotus/Intel Microsoft Expanded Memory Specification.

At \$35.95, the book does not come cheap, but if you are pushing at the boundaries of your 'elementary' MS-DOS manual, it might well be worth investing in.

Lorna Kyle

I think, ∴, I publish

TITLE: The Cult of Information
AUTHOR: Theodore Roszak
PUBLISHER: Lutterworth Press (JM Dent)
PRICE: \$39.95

Listen, you know what? Computers aren't so smart. Oh, sure, they can stash data and process it. But what do they know about God? Are quality and justice the kind of ideas any computer understands? Could a computer have figured out that $e=mc^2$ or written a Bach cantata? There you are, then. The things are overrated.

You may have gathered that Theodore Roszak, acclaimed author of *The Making of a Counter Culture*, is very computer-smart, very thoughtful, very academically intense and very American. He does *not* believe computers can *think* — not what he'd call 'thought'. And that's that.

But we should all watch out. Far too many people think computers *do* know everything. It's a cult, insists Theodore, and he isn't half convincing once you

get accustomed to his languid style.

Theodore is a Professor of History and General Studies at California State University, but he word-processes the same as the next man. When he does, it bothers him a lot that people go on and on about information technology, manipulating data and the wonders of what computers can do, or will be able to do, any day now. It's a cult of bemused excitement at their ingenuity *'which makes every computer around us what the relics of the True Cross were in the Age of Faith: emblems of salvation'*.

You may have problems with his imagery, but the sentiment is sound enough. It has such a civilised ring.

Fact is, we're dizzied by the pace of technological change Theodore continues; we are too ready to believe whatever apologists for computer power say. Words like 'information' are now up for grabs, used so liberally as to lay aside all concern for the quality or character of what is being communicated, blurring intellectual distinction.

Most artificial intelligence experiments to date, in highly contrived laboratory conditions, may seem ludicrous, but *'The domineering exponents of pure reason are still with us today in the*

form of computer scientists, wielding the age-old mystique of mathematics for all it is worth. And having invented a machine that embodies that mystique, they have found the social forces that have the power to make their utopia a political proposition'.

In short, we have here the quiet voice of humanist reason, kicking against what he sees increasingly as a *sinister* cult of admiration for IT.

Professor Roszak presents a plausible nightmare of a new generation who might be tempted to bypass the methods of original, creative thought and insightful ideas because we have been so steeped in procedural, mechanistic analysis.

'The art of thinking', he re-asserts, *'is grounded in the mind's astonishing capacity to create beyond what it intends, beyond what it can foresee'*. A computer would not understand what he means.

David Taylor

Another one along in a minute

TITLE: IBM PCs and compatibles: A Business User's Guide

AUTHOR: Colin Lewis

PUBLISHER: Blackwell (Allen Unwin)

PRICE: \$29.95

A seasoned cynic (*who, me?*) might mischievously suggest that any paperback which grabs attention with the magic words 'IBM', 'Business' and 'Guide' on the cover, will shift copies even if it does no more than paraphrase the IBM DOS and *Guide to Operations* manuals.

This slim paperback doesn't do that. In fact it doesn't do much at all, really, except list boggling specifications and scoot through the barest of essentials on some popular applications packages. It's only 150 pages in all and it's set in nice big type.

Nine pages in, a baffled business tyro who's wondering what an IBM PC is for, is supposed to digest this sentence: 'Whilst precessing at 16-bits, the 8088 relies on the 8-bit pathway to read and write data to its memory, and so compatibles such as the Compac (*sic*) Deskpro, ITT Extra and Olivetti M24 and M21, which offer the 8086 chip which uses a true 16-bit pathway and thus reads and writes to memory more quickly, are able to improve overall processing speeds.'

Remember that for your next dinner party, folks. It's pretty straightforward if

you know your way round the PC's motherboard to start with, but meaningless if you don't.

Chapter Two, oh Gawd, is a guide to DOS. Then you get a 'General Concept of word processing', explaining esoteric things such as 'page numbering', a chapter on popular spreadsheets, another on databases and — wait for it! — a squint at the wonderful world of PC Communications.

It is sounds familiar, it is. I've tried to stay awake through *hundreds* of books which hold hands around IBM PCs. They have got to be *really* good now to make an impression in this jam-packed corner of the market. This book isn't, so it doesn't.

David Taylor

Ask me another

TITLE: Concise Encyclopaedia of Information Technology

AUTHOR: Adrian V Stokes

PUBLISHER: Wildwood House (BellBird Books)

PRICE: \$21

If you don't know your Floating Gate Avalanche Injection MOS from your Fixed Priority Oriented Demands Assignment, Doctor Stokes 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 silly. 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*. 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.

David Taylor

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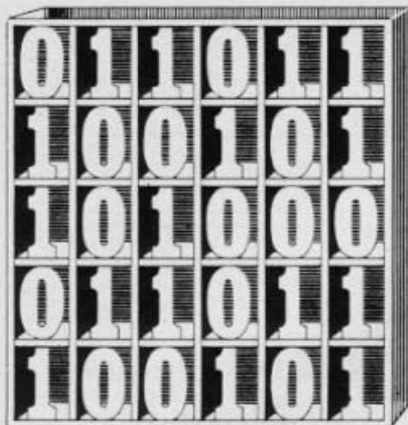
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David Barrow presents more documented machine code routines and useful information for the assembly language programmer. If you have a good routine, an improvement or conversion of one already printed, or just a helpful programming hint, then send it in and share it with other programmers. Subroutines for any of the popular processors and computers are welcome but please include full documentation. All published code will be paid for. Send your contributions to Subset, APC, 2nd Floor, 215 Clarence Street, Sydney 2000

6592 SHELLSORT

There is just one Datasheet this month, DIBS, a 6502 diminishing increment bubble-sort routine from Philip Honour.

DIBS, like SHELLZ (August 1986), leaves the actual variable length strings unmoved and sorts the fixed length string descriptors, which, in this case, contain

only the 2-byte addresses. This is not only quicker than moving long strings, but also allows non-adjacent records to be exchanged without any need to shuffle up intermediate records.

However, DIBS differs considerably from SHELLZ in the way that it uses the diminishing increment method first proposed by Donald Shell in 1959. In fact, DIBS does not use the

method as intended by Shell and consequently suffers the penalty of greatly increased processing time. Philip says that the routine will sort 500 randomly generated strings in about 21.5 seconds, and this is far slower than a good machine code sort should be. What has gone wrong?

Fig 1 shows the intermediate results and the number of comparisons and exchanges

set between the pointers before each pass. During each pass, both pointers should be incremented sequentially by one record at a time through the file.

DIBS may be partially corrected by changing the two code sections after label NOECHNG to increment the pointers by two (to index the descriptor next in physical sequence) instead of by the value INCREMENT. The

INCR PASS	16 RECORDS																CMPS SWAPS	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
15	GO BE IS AD RA DA PA EX KA FA CO HI JO LI ON NE																	
7 1	EX	BE	IS	AD	RA	DA	PA	GO	KA	FA	CO	HI	JO	LI	ON	NE	2	1
7 2	EX	BE	IS	AD	RA	DA	PA	GO	KA	FA	CO	HI	JO	LI	ON	NE	2	8
3 1	AD	BE	IS	EX	RA	DA	PA	GO	KA	JO	CO	HI	NE	LI	ON	PA	5	4
3 2	AD	BE	IS	EX	RA	DA	PA	GO	KA	JO	CO	HI	NE	LI	ON	PA	5	8
1 1	AD	BE	EX	IS	DA	PA	GO	KA	JO	CO	HI	NE	LI	ON	PA	RA	15	12
1 2	AD	BE	EX	DA	PA	GO	IS	JO	CO	HI	KA	LI	NE	ON	PA	RA	15	7
1 3	AD	BE	DA	EX	PA	GO	IS	CO	HI	JO	KA	LI	NE	ON	PA	RA	15	3
1 4	AD	BE	DA	EX	PA	GO	CO	HI	IS	JO	KA	LI	NE	ON	PA	RA	15	2
1 5	AD	BE	DA	EX	PA	CO	GO	HI	IS	JO	KA	LI	NE	ON	PA	RA	15	1
1 6	AD	BE	DA	EX	CO	PA	GO	HI	IS	JO	KA	LI	NE	ON	PA	RA	15	1
1 7	AD	BE	DA	CO	EX	PA	GO	HI	IS	JO	KA	LI	NE	ON	PA	RA	15	1
1 8	AD	BE	CO	DA	EX	PA	GO	HI	IS	JO	KA	LI	NE	ON	PA	RA	15	1
1 9	AD	BE	CO	DA	EX	PA	GO	HI	IS	JO	KA	LI	NE	ON	PA	RA	15	0
13	TOTALS																149	33

Fig 1

INCR PASS	16 RECORDS																CMPS SWAPS	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
15	GO BE IS AD RA DA PA EX KA FA CO HI JO LI ON NE																	
7 1	EX	BE	PA	AD	HI	DA	LI	GO	KA	IS	CO	RA	JO	PA	ON	NE	9	4
7 2	EX	BE	PA	AD	HI	DA	LI	GO	KA	IS	CO	RA	JO	PA	ON	NE	9	8
3 1	AD	BE	DA	EX	GO	PA	IS	CO	KA	JO	HI	ON	LI	PA	RA	NE	13	7
3 2	AD	BE	DA	EX	CO	PA	IS	GO	KA	JO	HI	ON	LI	PA	RA	NE	13	1
3 3	AD	BE	DA	EX	CO	PA	IS	GO	KA	JO	HI	ON	LI	PA	RA	NE	13	8
1 1	AD	BE	DA	CO	EX	PA	GO	IS	JO	HI	KA	LI	ON	PA	NE	RA	15	6
1 2	AD	BE	CO	DA	EX	PA	GO	IS	HI	JO	KA	LI	ON	NE	PA	RA	15	3
1 3	AD	BE	CO	DA	EX	PA	GO	HI	IS	JO	KA	LI	NE	ON	PA	RA	15	2
1 4	AD	BE	CO	DA	EX	PA	GO	HI	IS	JO	KA	LI	NE	ON	PA	RA	15	0
9	TOTALS																138	23

Fig 2

INCR PASS	16 RECORDS																CMPS SWAPS	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
1	GO BE IS AD RA DA PA EX KA FA CO HI JO LI ON NE*																	
1 1	BE	GO	AD	IS	DA	PA	EX	KA	FA	CO	HI	JO	LI	ON	NE*	RA	15	13
1 2	BE	AD	GO	DA	IS	EX	KA	FA	CO	HI	JO	LI	ON	NE*	PA	RA	14	11
1 3	AD	BE	DA	GO	EX	IS	PA	CO	HI	JO	KA	LI	NE*	ON	PA	RA	13	8
1 4	AD	BE	DA	EX	GO	PA	CO	HI*	IS	JO	KA	LI	NE	ON	PA	RA	12	4
1 5	AD	BE	DA	EX	PA	CO*	GO	HI	IS	JO	KA	LI	NE	ON	PA	RA	7	2
1 6	AD	BE	DA	EX	CO*	PA	GO	HI	IS	JO	KA	LI	NE	ON	PA	RA	5	1
1 7	AD	BE	DA	CO*	EX	PA	GO	HI	IS	JO	KA	LI	NE	ON	PA	RA	4	1
1 8	AD	BE	CO*	DA	EX	PA	GO	HI	IS	JO	KA	LI	NE	ON	PA	RA	3	1
1 9	AD	BE	CO*	DA	EX	PA	GO	HI	IS	JO	KA	LI	NE	ON	PA	RA	2	0
9	TOTALS																75	41

Fig 3

for each pass during a DIBS sort of 16 randomly arranged records. Fig 2 shows the corresponding results for a correctly implemented Shell bubble-sort. Obviously, DIBS is not doing enough work during the early part of the process when the increments are large, and too much at the end when the increment is reduced to one.

The problem seems to be caused by a misunderstanding of the term *diminishing increment* which is not intended as the value by which each pointer is moved forward between comparisons, but as the *initial distance*

corresponding part of the program's structure is marked in the far right column of the documentation.

Incidentally, the Shellsort's speed is not illustrated particularly well by a short sort — it is easily outperformed by even the humble bubble-sort. Fig 3 shows the results of sorting the sample file using a modified bubble-sort which limits the number of comparisons by setting an end marker (the asterisk on each line of Fig 3) before the last record exchanged on each pass.



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DATASHEET 1

```
CALL : D185
Diminishing Increment Bubble Sort to sort an array of
descriptors of variable length strings into ascending
order of the strings' ASCII values.
```

STRUCTURAL CONCEPTS

```
DATA STRING DESCRIPTOR ARRAY:
Simple list of string start addresses.
STRING:
Length: 1 to 256 bytes including terminator.
Terminator: must be less than ASCII space (20hex).
PROGRAM increment = array-length - 1.
UNTIL increment = 1
(
increment = increment \ 2.
UNTIL swap-flag = FALSE
(
swap-flag = FALSE.
pointer-1 = array-start.
pointer-2 = array-start + increment.
UNTIL pointer-2 > array-end.
(
address-1 = [pointer-1].
address-2 = [pointer-2].
index = 0.
WHILE [address-2 + index] = [address-1 + index]
AND [address-2 + index] <> string-terminator
(
index = index + 1.
)
IF [address-2 + index] < [address-1 + index]
[
[pointer-1] = address-2.
[pointer-2] = address-1.
swap-flag = TRUE.
]
pointer-1 = pointer-1 + increment.
pointer-2 = pointer-2 + increment.
)
)
)
```

SYSTEM REQUIREMENTS

```
PROCESSOR 6502
HARDWARE RAM containing string descriptor array.
Page zero: 8 words (16 consecutive bytes, M0-MF).
SOFTWARE None.
```

PROGRAMMING DETAILS

```
INPUT M0,1 = String descriptor array word length.
M2,3 = Address of string descriptor array.
OUTPUT String descriptors sorted in string ascending order.
Strings unaffected.
STATE CHANGES M0,1 = input M0,1 - 1.
M2,3 unchanged.
M4-MF changed.
CPU registers and flags changed.
I/O ERRORS Descriptor array length < 2.
String length > 256.
OPTIMISATION Increment used adjusted to descriptor size (2 bytes).
Index register and carry states of previous operations
used instead of specific setting.
INTERRUPT EFFECT May be interrupted (and re-entered from interrupting
program) only if registers, flags & M0-MF saved.
LOCATION NEEDS Not specific.
Object code is relocatable and PROMable.
PROGRAM BYTES 159
STACK BYTES 1
CLOCK CYCLES Not given.
```

```
...Define page zero pseudo-register use & constant.
```

```
ARRAYLEN = M0 ;Number of string descriptors in array.
ARRSTART = M2 ;Address of first string descriptor.
ARRAYEND = M4 ;Address of last string descriptor.
INCREMENT = M6 ;Difference between sort pointers 1 & 2.
POINTONE = M8 ;Sort pointer 1.
POINTTWO = M4 ;Sort pointer 2.
ARRELONE = MC ;Descriptor 1 store for comparison.
ARRELTWO = ME ;descriptor 2 store for comparison.
STRNGEND = *8D ;String terminator (carriage return).
```

```
...Sort routine entry.
```

```
D185 LDA #1 ;Prepare for 16-bit decrement. A9 FF
DEC ARRAYLEN ;Decrement array length to give C6 M0
CMP ARRAYLEN ;index to last element. C5 M0
BNE NOBORROW ;Take care of any borrow D0 02
DEC ARRAYLEN+1 ;from high order byte. C6 M1
NOBORROW LDA ARRAYLEN ;Set sort pointers increment A5 M0
ASL A ;to twice array size initially 0A
STA INCREMENT ;so array start + increment = 85 M6
LDA ARRAYLEN+1 ;address of last descriptor, and A5 M1
ROL A ;first increment halving sets 2A
STA INCREMENT+1 ;2nd sort pointer at halfway. 85 M7
CLC ;Prepare for subtract, no borrow. 18
LDA INCREMENT ;Calculate address of last A5 M6
```

```
ADC ARRSTART ;string descriptor in array 65 M2
STA ARRAYEND ;by adding initial increment 85 M4
LDA INCREMENT+1 ;to array start address. A5 M7
ADC ARRSTART+1 ; 65 M3
STA ARRAYEND+1 ; 85 M5
```

```
...Repeat with diminishing differences between sort pointers.
```

```
ORTLOOP LSR INCREMENT+1 ;Sort with reducing increments. 46 M7
ROR INCREMENT ;Halve increments, always to 66 M6
ROR INCREMENT ;even number to ensure correct 66 M6
ASL INCREMENT ;addressing of 2-byte descriptors. 06 M6
```

```
...Repeat until pass made with no exchanges.
```

```
... (This is a simple bubble sort at each reduced increment.)
```

```
SCANLOOP LDA ARRSTART ;Set sort pointer 1 to start A5 M2
STA POINTONE ;of string descriptor array. 85 M8
LDA ARRSTART+1 ; A5 M3
STA POINTONE+1 ; 85 M9
```

```
CLC ;Clear swap-flag (carry) 18
PHP ;and save on stack. 00
```

```
LDA INCREMENT ;(With no carry in) add increment A5 M6
ADC ARRSTART ;to array start to give initial 65 M2
STA POINTTWO ;address for sort pointer 2. 85 MA
LDA INCREMENT+1 ; A5 M7
ADC ARRSTART+1 ; 65 M3
STA POINTTWO+1 ; 65 MB
```

```
...Repeat until pointers past end of descriptor array.
```

```
PASSLOOP LDY #1 ;Prepare to get descriptors. A0 01
GETSTRDS LDA (POINTONE),Y ;Copy descriptors addressed by B1 M0
STA ARRELONE,Y ;sort pointers into page zero 99 MC 00
LDA (POINTTWO),Y ;for string comparison using B1 MA
STA ARRELTWO,Y ;indexed addressing. 99 ME 00
DEY ;Repeat for two bytes 00
BPL GETSTRDS ;each descriptor. 10 F3
```

```
COMPARES INY ;Start index 0, index next byte C0
LDA (ARRELTWO),Y ;and compare corresponding bytes B1 ME
CMP (ARRELONE),Y ;in currently addressed strings D1 MC
BNE DIFFRENT ;until different or D0 04
CMP #STRNGEND ;end of strings found. C9 0D
BNE COMPARES ; D0 F5
```

```
DIFFRENT BCS NOEXCHNG ;Don't swap if 2nd >= 1st. 00 12
PLP ;Else access swap-flag and 28
SEC ;set it to show swap occurred 38
PHP ;then re-save on stack. 00
LDY #1 ;Prepare to swap DESCRIPTORS. A0 01
```

```
EXCHANGE LDA (POINTONE),Y ;Swap 2-byte string descriptors B1 M0
TAX ;in string descriptor array AA
LDA (POINTTWO),Y ;(leaving strings alone) so B1 MA
STA (POINTONE),Y ;string indexed by descriptor 91 M0
TXA ;at sort pointer 1 is less than 9A
STA (POINTTWO),Y ;that indexed by descriptor at 91 MA
DEY ;sort pointer 2. 00
BPL EXCHANGE ;Repeat for 2-byte descriptors. 10 F3
```

```
NOEXCHNG CLC ;Prepare to add, no carry. 18
```

```
...Bump pointers by adding increment.
```

```
... (Shell's method should bump each pointer to next descriptor.)
```

```
LDA INCREMENT ;Bump sort pointer 1 up by A5 M6
ADC POINTONE ;current increment to index 65 M0
STA POINTONE ;descriptor currently indexed 85 M0
LDA INCREMENT+1 ;by sort pointer 2 (and A5 M7
ADC POINTONE+1 ;possibly just swapped with 65 M9
STA POINTONE+1 ;previously indexed descriptor). 85 M9
```

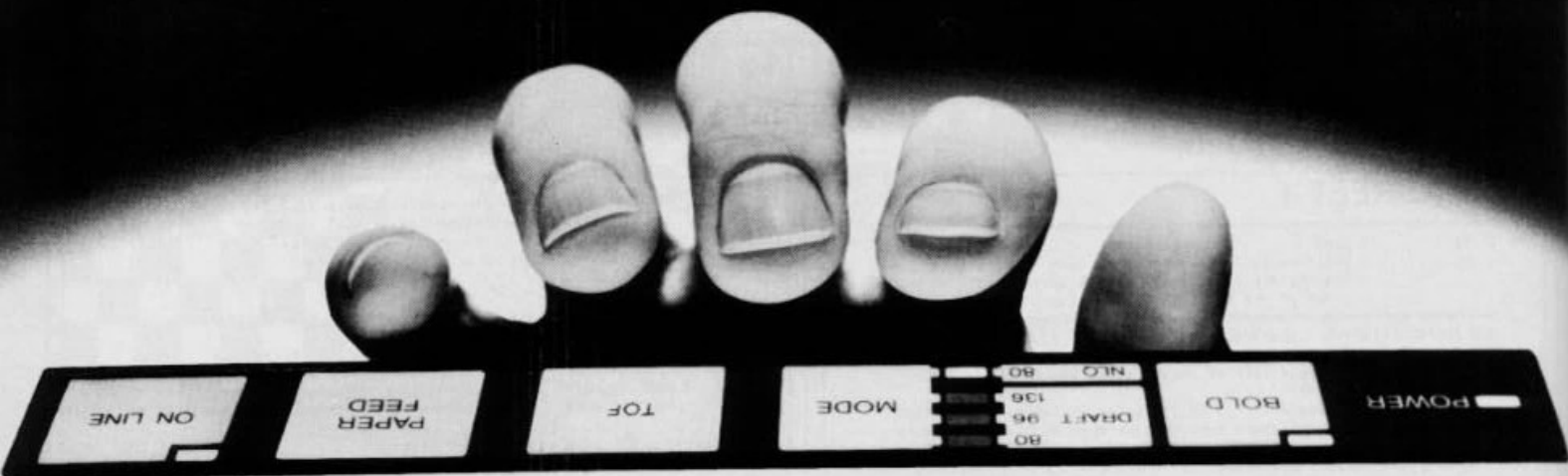
```
LDA INCREMENT ;(With carry=0 from previous add) A5 M6
ADC POINTTWO ;bump sort pointer 2 up by 65 MA
STA POINTTWO ;current increment to index 85 MA
LDA INCREMENT+1 ;next descriptor (for comparison A5 M7
ADC POINTTWO+1 ;of strings and possible swap 65 MB
STA POINTTWO+1 ;of indexed descriptors). 85 MB
```

```
SEC ;Prepare for no borrow compare. 38
LDA ARRAYEND ;Compare sort pointer 2 with A5 M4
SBC POINTTWO ;end of descriptor array. E5 M4
LDA ARRAYEND+1 ;Repeat comparisons this pass A5 M5
SBC POINTTWO+1 ;until 2nd pointer gone past E5 MB
BCS PASSLOOP ;end of array. 00 AE
```

```
PLP ;Restore swap-flag and do another 20
BCS SCANLOOP ;pass if any swaps have been made. 00 95
```

```
LDA INCREMENT+1 ;Repeat with reduced increment A5 M7
BNE SORTLOOP ;if increment hi-byte > 0 D0 09
LDA #2 ;or if increment > 2. A9 02
CMP INCREMENT ;Finish sort when last sort made C5 M6
BCC SORTLOOP ;at single descriptor increments. 00 03
```

```
RTS ;Exit, sort completed. 60
```

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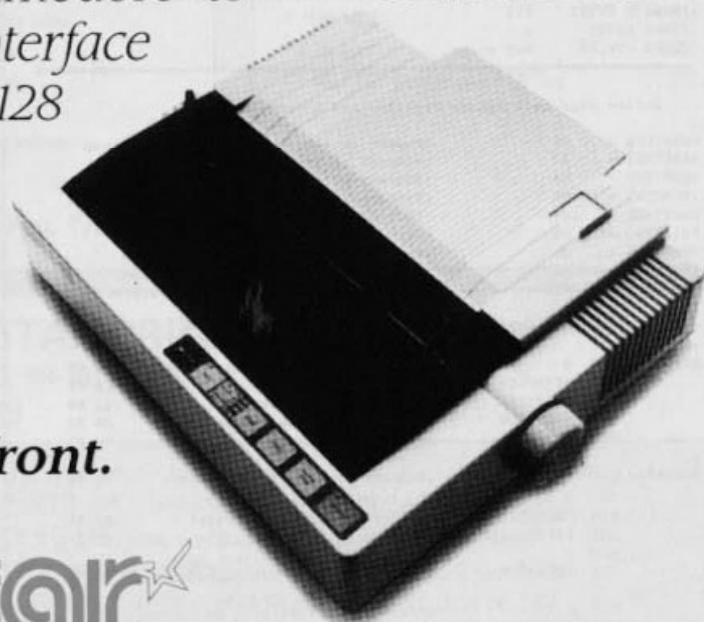
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SUBSET

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Shell's method (which can be applied to any of the exchange methods, though straight insertion is the easiest to implement) superimposes a binary indexing structure on the file. Instead of the two pointers being always set to address adjacent records, they are set to address records that are successively half a file apart on the first pass, a quarter on the second, an eighth on the third, and so on. Only on the

last pass do the pointers finally address adjacent records.

With a series of diminishing increments set to 2^{n-1} (that is, 31, 15, 7, 3, 1) and beginning at a value equal to or greater than half the number of records N, the number of exchanges in the worst case is only $2N$.

Knuth provides a basic algorithm and a complete analysis of the Shellsort in his book *Sorting and Searching* (volume three of *The Art of Computer Programming*). He also deals with other fast sorts such as Hoare's Quicksort, which is a true binary sort; and Batchier's parallel sort, which should receive greater prominence in the age of the transputer.

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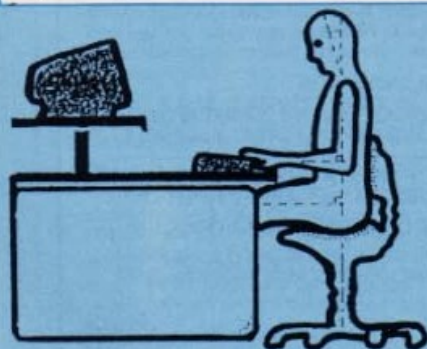
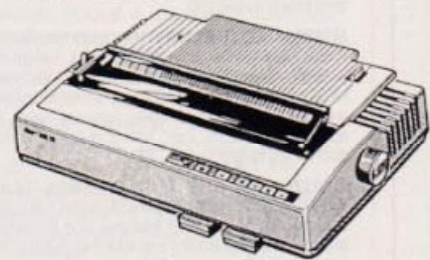
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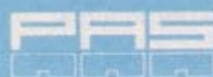
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Steve Withers discusses a new trend in bulletin boards — BBS advertising — in his monthly presentation of what's new in the world of PC communications

BBS Advertising

A few bulletin boards carry advertising material in order to offset capital and running costs, but placing an advertisement for a bulletin board is a fairly new phenomenon.

For \$3 per month, sysops can place an advert giving details of their systems on Viatel. This facility is provided by the Electronic Shopping Mall, and starts on page *22059#. The idea came from Greg Hope, sysop of Sydney's Sci-Fi BBS, and he reports that participating sysops have seen a substantial increase in the number of calls received.

Microtex 666 also has a list of bulletin boards which starts on page *6664205#. Although no charge is made for inclusion, only Microtex subscribers can access the list.

Information Express

Information Express sent me (and other former Teledata subscribers, I suspect) a brochure describing their services. The covering letter opened with the following paragraph:

'If you need easy access to telex and electronic mail via your personal computer, Information Express can provide it at low cost'.

The lowest-cost subscription to Information Express allows access between 6.30pm and 8.00am, and all day at weekends. Although there is no annual subscription for this level of service, there is a joining fee of \$126. Connect time is charged at the rate of 50c/min for the first four hours per month, and 27c/min thereafter, with a minimum of \$15 per month.

Compared with Viatel, that's hardly low cost! Information Express' agricultural and business information services may be good value for money, but their prices are out of line for those of us whose main concern is cheap and rapid communication.

Why Fido?

Some people think Fido is a strange name for a bulletin board program.

Tom Jennings (Fido's creator) recently explained how the name came about. In the late 1970's, he worked for a small company which had a \$100 computer that was named Fido because it was such a mongrel system. Tom started using the name 'for every object with more than one moving part — my car, my computers. . .', so when he needed a name for a bulletin board, Fido was his natural choice. The 'real' name for the software he developed was simply BBS, but people soon started referring to the program by the name of Tom's bulletin board.

Systems news

A little story to illustrate the problems of maintaining an accurate list of bulletin boards.

A couple of weeks ago, I was browsing through the computer magazines in a newsagency. An article about Commodore-oriented bulletin boards caught my eye, and I noticed a system that I hadn't heard about before. I made a note of the number, and decided to try it later that day.

When I did, the phone was answered by a person. I explained why I was calling, and the (former) sysop was brought to the phone. It turned out that the board went off-line some considerable time ago.

This tale isn't intended as a criticism of that other magazine — after all, I hadn't published the details of the system when it was running. The only way a magazine can publish accurate, up-to-date information is with the co-operation of its readers. The AED-Prophet registry is an excellent scheme — Larry Lewis and I exchange information each month — but ultimately we depend on reports from sysops and users around Australia.

The Illawarra BBS has a new phone number (see 'Updates', below).

John Simon is adding another disk drive to his system in order to cope with the growing range of downloadable software. Although the system is C64-based, the software collection covers about half a dozen popular computers. The bad news is

that an annual fee of \$15 is now charged for full access to the system.

Thanks to John Simon, Brendan Pratt, Rupert Russell, and Trevor Watson for contributing to the information summarised below.

New systems

Queensland

NICE (07) 285 5814. MV. Geoff Ryan. 24 hours daily. User Works Node 6.
SVI (075) 46 3252. MV. Brendan Pratt. 24 hours daily. User Works Node 7.

Updates

NSW

Illawarra (042) 61 8230. MV. John Simon. 24 hours daily.

Victoria

The Magic Pudding (03) 428 2178. P. Rupert Russell and James Milne. 24 hours daily.

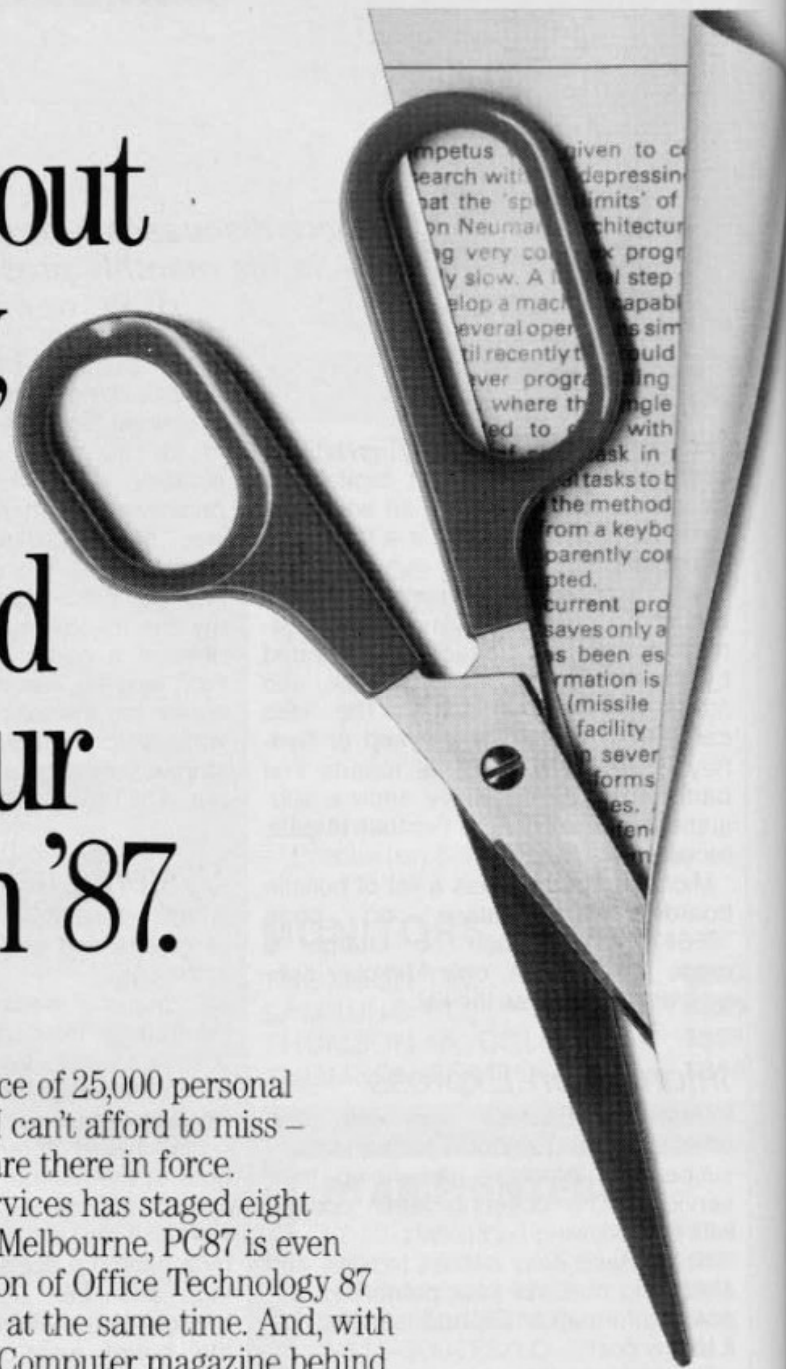
Queensland

Midnight Express. Off-line.

The material in this column is presented in good faith, but as it is collated from material provided by readers, APC cannot take responsibility for its accuracy. New information and corrections are always welcome (but please mention whether or not you can vouch for accuracy of the material provided), and should be sent to: Steve Withers, C/- Computer Publications, 47 Glenhunting Road, Elwood, Vic 3184 or to Viatel mailbox 063000030. Acknowledgements will normally be made through this column. You may also like to send a copy of the information to the Australian PAMS Coordinator at one of these addresses:

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NUMBERS COUNT

NUMBER ONE

Mike Mudge recognises the importance of reader participation in his column, so this month he sits back and listens while you do the talking.

Problem (i) (suggested by Professor Leo Alex of State University of New York) Solve in integers the equation

$$1 + x + y = z$$

where the primes dividing the product xyz are restricted to 2, 3 and 5. Professor Alex would like to assure readers that the number of solutions is finite!

Problem (ii) (suggested by the author, Mike Mudge) 1729 is the smallest number that can be expressed as the sum of two cubes in two different ways — that is:

$$1^3 + 12^3 = 9^3 + 10^3 = 1729$$

What is the smallest number that can be expressed as the sum of two cubes in three different ways? Notice that in 1912 W Lenhart obtained:

$$46969 = \left(\frac{95}{7}\right)^3 + \left(\frac{248}{7}\right)^3 = \left(\frac{149}{12}\right)^3 + \left(\frac{427}{12}\right)^3 \\ = \left(\frac{341899}{30291}\right)^3 + \left(\frac{1081640}{30291}\right)^3$$

This is readily converted to an identity in integers by multiplying throughout by the common denominator $(7 \times 12 \times 30291)^3 = 2544444^3$.

How readily can the smallest number expressible in a — ways as the sum of b-terms, each the c^{th} power of an integer, be computed for realistically small a, b and c? Estimates of computing power needed?

Problem (iii) (suggested by Donald Cross)

(a) 1729 is the smallest number that can be expressed as $a^2 + ab + b^2$ in four different ways with a & b positive (16-ways if negative a, b & c are allowed).

How many numbers less than a mil-

lion can be expressed as the sum of two cubes in two different ways and as $a^2 + ab + b^2$ in eight different ways with a & b positive (generalise by removing the restraint less than a million.)

(b) If a number is prime, can it be expressed as $a^2 + ab + b^2$ in more than one way with a & b positive?

Readers are encouraged to send their work, together with complete or partial attempts at the solutions to these problems, to Mike Mudge, c/- APC, 2nd Floor, 215 Clarence Street, Sydney 2000.

It would be appreciated if such submissions contained a brief summary of results; together with thoughts relating to these problems, in a form suitable for publication in APC. These submissions will be judged using suitably vague criteria, and a prize will be awarded by APC to the 'best' contribution received by the closing date.

Please note that submissions must arrive by 15 April and 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 computational mathematics. Particularly welcome are suggestions, either general or particular, for future 'Numbers Count' articles; all letters will be answered in due course.

September review:

Farey series

The subject of Farey Series produced an anonymous submission of Farey,

and Farey 2. Would the programmer who recognises ScanPointer and PosCount and who quoted Theorem 29 from Harty & Wright please contact me.

An estimate of 103 years, on a BBC Micro to construct F1025 using a crude bubble sort approach, is interesting...

A straightforward summary of Farey Series results together with a number of references is to be found in *Recreations in the Theory of Numbers* by Albert H Beiler (Dover 1964) — a book which all 'Numbers Count' readers should possess.

Most attempts at this problem established simple arithmetical methods of generating terms of Farey Series and identified the major problem as one of satisfactorily displaying the output.

Graphical routines included those for a Tandy TRS-80, and a very efficient print routine for an Epson LX80 displaying F256 on, effectively, three sides of A4.

However after application of 'suitably vague criteria' (here it is important to emphasise that the purpose of the 'Numbers Count' competition is *not* to rank professional or semi-professional mathematicians or computer scientists, but to encourage empirical number theory as an alternative to game-playing on a personal computer; and to reward enthusiasm) this month's prizewinner is Ben Coffison of North Rockhampton, Queensland. Ben programmed in Pascal, but due to local circumstances ran his programs on a VAX11 minicomputer; minor changes would make his routines available in TurboPascal.

MICROCHESS

It must be remembered that chess started out as a game for humans, but developed into something that computers were very good at. Fortunately Novag has not forgotten its roots, as Kevin O'Connell reports.

In the most recent Commonwealth Championship, two Novag computers took part and performed very creditably.

The following game was played in the sixth round.

White: Novag Constellation Forte. Black: S Sohel (Bangladesh). Open-

ing: Queen's Gambit Declined.

1	d2-d4	Ng8-f6
2	c2-c4	e7-e6

In the first round, the other Novag Constellation Forte was White against Levi (Eddy Levi of Australia, not my partner David Levy of computer bet fame) and fared well in

another ending that emerged from a Benoni Defence after 2 ... c7-c5 3 d4-d5 g7-g6 4 Nb1-c3 d7-d6 5 e2-e4 Bf8-g7 6 Bf1-e2 0-0 7 Bcl-g5 h7-h6 8 Bg5-h4 a7-a6 9 a2-a4 e7-e6 10 Ng1-f3 Rf8-e8 11 Qd1-c2 e6xd5 12 c4xd5 Bc8-g4 13 h2-h3 Bg4xf3 14 Be2xf3 Nb8-d7 15 0-0 c5-c4 16 Ra1-cl Nd7-c5

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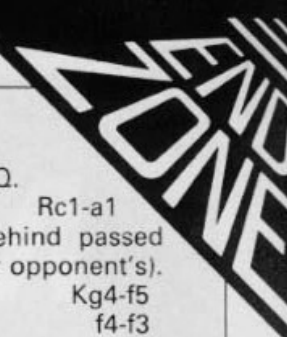
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17 Rc1-d1 Qd8-d7 18 Rd1-d4 b7-b5 19 a4xb5 a6xb5 20 Qc2-e2 Nf6xe4 (initiating a complicated sequence that wins the exchange) 21 Rd4xe4 Nc5xe4 22 Nc3xe4 f7-f5 23 Qe2-c2 f5xe4 24 Bf3xe4 g6-g5 25 Bh4-g3 Ra8-a2 (Black is after more material).

26 Be4-f5 Qd7-c7 27 Bf5-e6+ Kg8-h8 28 Qc2-g6 Re8-f8 29 Be6-f5 Rf8xf5 (the only way to deal with the twin threats of Qg6-h7 and Bg3xd6) 30 Qg6xf5 Qc7-e7 31 Qf5-e6 Qe7xe6 32 d5xe6 Bg7-f8 33 f2-f4 g5xf4 34 Rf1xf4 Kh8-g8 35 Bg3-h4 Ra2-a7 (Black must now admit that he will never be able to take the b-pawn) 36 g2-g3 Ra7-c7 37 Kgl-g2 b5-b4 38 Rf4-g4 Kg8-h7 (or 38 ... Bf8-g7 39 Bh4-f6 and 40 e6-e7) 39 Bh4-d8 Rc7-c8 40 e6-e7 Bf8xe7 41 Bd8xe7 c4-c3 42 Be7xd6 c3-c2 43 Bd6-f4 Rc8-d8 44 Rg4-h4 Rd8-d4 45 Rh4xh6+ Kh7-g8 46 Rh6-c6 b4-b3 47 Rc6-c3 Kg8-f7 48 Rc3xb3 Rd4xf4 49 Rb3-c3 c2-c1R (trying a last desperate attempt at creating some confusion) 50 g3xf4 and Black played on for a while longer before resigning.

3 Nb1-c3 d7-d5
4 Bc1-g5 Bf8-e7
5 e2-e3 0-0
6 Ra1-c1 c7-c6
7 Ng1-f3 Nb8-d7
8 Bf1-d3 Rf8-e8
9 0-0 Be7-d6?

This allows White to make progress in the centre with gain of time.

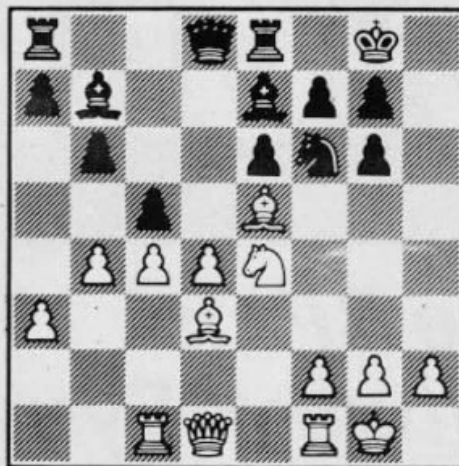
10 e3-e4 d5xe4
11 Nc3xe4 Bd6-e7
12 Bg5-f4 Nd7-f8
13 Nf3-e5 Nf8-g6

13 ... Nf8-d7 may be slightly better, but it is not really the sort of move (admitting that the previous move was a complete waste of time) that a human, surrounded by a group of onlookers, can bring himself to make, especially when playing against a computer.

14 Ne5xg6 h7xg6
15 Bf4-e5 b7-b6

Black must get his pieces developed, and this move creates some room for the bishop and also prepares c6-c5 which will help to free Black's game.

16 a2-a3 Bc8-b7
17 b2-b4 c6-c5



18 Be5xf6 g7xf6

So Black has acquired the bishop pair, but he cannot keep them.

19 d4xc5 f6-f5

20 Ne4-d6

20 Ne4-g3 b6xc5 21 Rcl-bl would leave White with a small advantage, but also with the danger that the bishop pair could become active.

20 ... Be7xd6

21 c5xd6 Qd8xd6

22 c4-c5

The most logical way of trying to capitalise on the queen-side pawn majority.

22 ... b6xc5

23 Bd3-b5 Qd6xd1

24 Rf1xd1 Re8-d8

25 b4xc5 Rd8xd1+

26 Rc1xd1 Bb7-d5

27 c5-c6 Ra8-c8

28 Rd1-c1 Rc8-c7

White has a passed c-pawn, but it is blockaded by the rook on c7 and has both White's pieces tied to its defence.

29 h2-h4 Kg8-f8

30 Bb5-a4 Kf8-e7

31 Rc1-c5 Ke7-d6

32 Rc5-a5 Bd5xc6

33 Ra5-a6

The only way to regain the pawn.

33 ... f7-f6

34 Ba4xc6 Rc7xc6

35 Ra6xa7 Kd6-e5

36 a3-a4 f5-f4

37 a4-a5 Ke5-f5

38 Ra7-a8 Kf5-g4

39 a5-a6 Rc6-c1+

Not 39 ... Kg4xh4?? 40 Ra8-h8+,

followed by a6-a7-a8Q.

40 Kg1-h2 Rc1-a1

Rooks belong behind passed pawns (yours or your opponent's).

41 a6-a7 Kg4-f5

42 g2-g3 f4-f3

Better 42 ... f4xg3+ — if White recaptures with the f-pawn, then Black might have some chances with his passed e-pawn.

43 Ra8-d8 Ra1xa7

44 Rd8-d3 Kf5-g4

45 Rd3-d4+ Kg4-h5

Everyone knows that computers are not supposed to be able to play endgames, so no doubt Black was beginning to be confident of victory. One of his problems was that the computer was obviously blissfully unaware of its disability.

46 Rd4-f4 Ra7-a3?

Either 46 ... f6-f5 or 46 ... g6-g5 would have been better.

47 Rf4xf6 e6-e5

Now 47 ... g6-g5 was needed to prevent the following manoeuvre.

48 Kh2-h3

Heading for g4 if it can, otherwise the pawn will advance.

48 ... e5-e4

49 g3-g4+ Kh5-h6

50 h4-h5 Ra3-a2

51 Rf6xg6+ Kh6-h7

52 Kh3-g3 Ra2-a1

53 Rg6-e6 Ra1-g1+

54 Kg3-f4 Rg1-g2

55 Re6-e7+ Kh7-h6

Or 55 ... Kh7-g8 56 Re7xe4 Rg2xf2 57 Re4-e3 and White wins.

56 Re7-d7

Almost all roads lead to Rome, but this is 'prettier' than, for example, 56 Kf4-f5 Rg2-g1 56 ... Rg2xf2 57 g4-g5+ Kh6xh5 58 Re7-h7 mate) 57 Re7xe4.

56 ... Rg2xf2

Is this perhaps an unfortunate case of a human following an inaccurate algorithm? There is an old Russian proverb that 'all rook endings are drawn'. Not if you allow mate, though!

57 g4-g5+ Kh6xh5

58 Rd7-d6! 1-0

Black has resigned since mate is now inevitable. **END**

LAZING AROUND

Brain-teasers provided by JJ Clessa.

Quickie

A golden oldie. A bottle and a cork cost 25 cents. The bottle cost 20 cents more than the cork. What did the cork cost?

Prize puzzle

The number 27 has the following property. It is the sum of three different sets of consecutive integers — each of which contains at least two integers

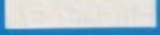
a) 2+3+4+5+6+7 = 27

b) 8+9+10 = 27

c) 13+14 = 27

The number 21 also has three such sets:

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- a) $1+2+3+4+5+6 = 21$
- b) $6+7+8 = 21$
- c) $10+11 = 21$

Can you find the smallest number that has 10 such sets?

Answers on postcards, please, or backs of envelopes only, to reach

		25	36			73	
	17				53	64	
4				49			81

APC, Prize Puzzle March, 2nd Floor, 215 Clarence Street, Sydney 2000, no later than 30 March 1987.

December prize puzzle

Less than 50 entries this month. Perhaps the problem was a bit more difficult than usual, or perhaps Bingo isn't

4				49			81
		25	36			73	
	11				59	64	

as popular as it used to be. Anyway, Fred's Bingo card could have looked like any of three shown opposite.

The winning entry, chosen at random from the pile, came from Kevin Dullard of Bendigo. To all the also-rans: keep trying, it could be your turn next month.

1						61	71
		25		49	59		
	16		36				81

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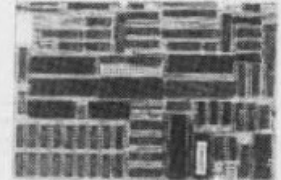
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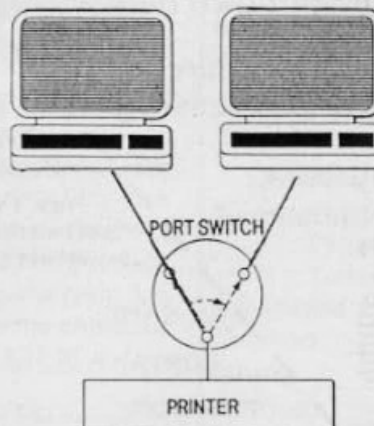
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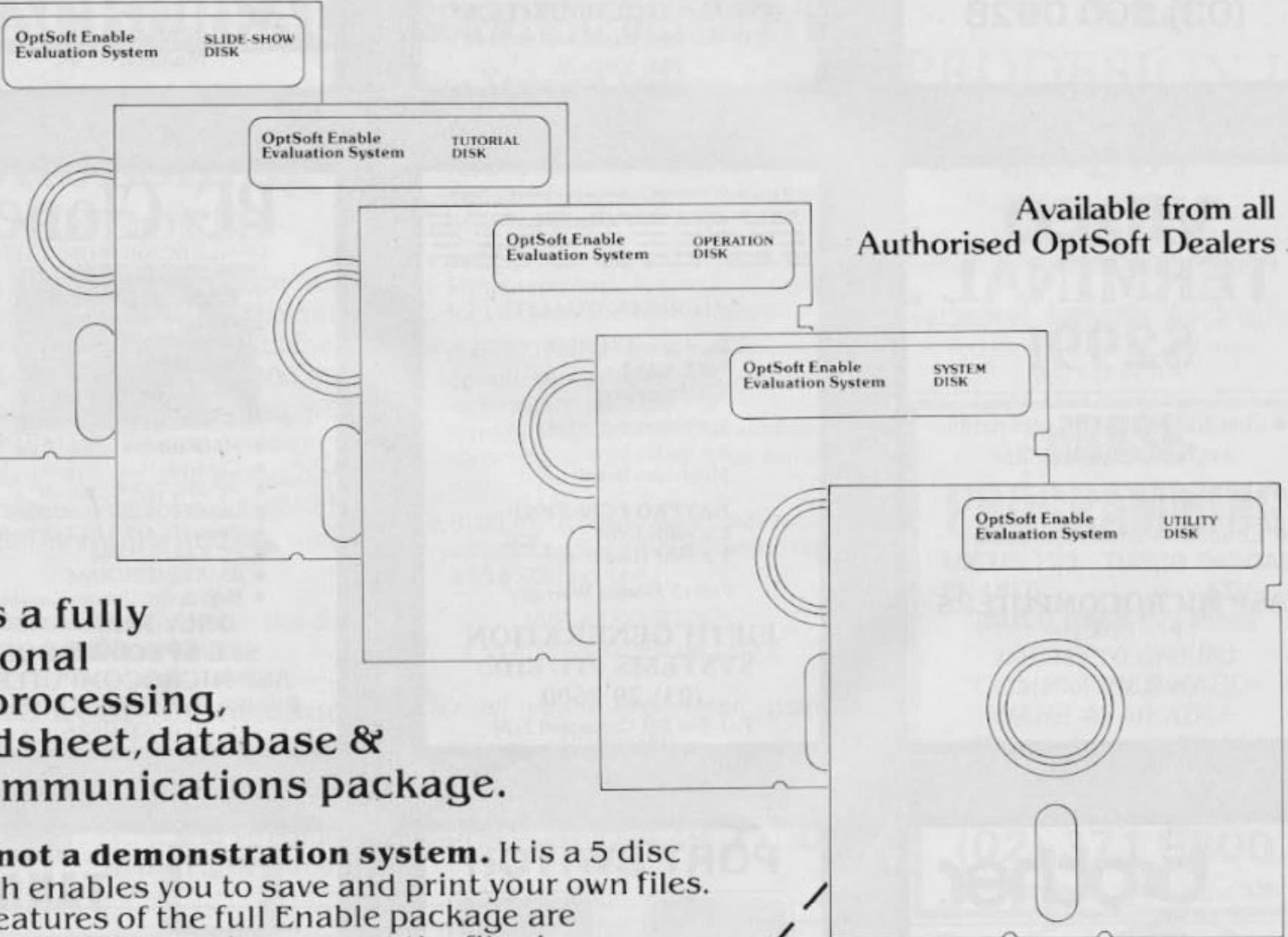
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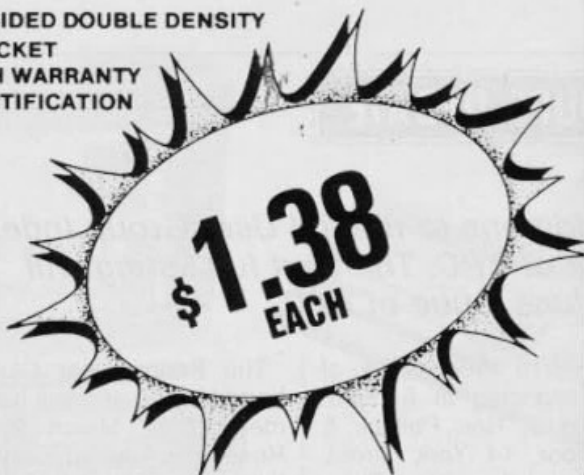
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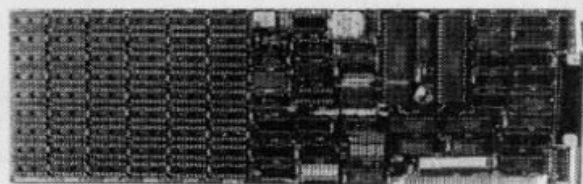
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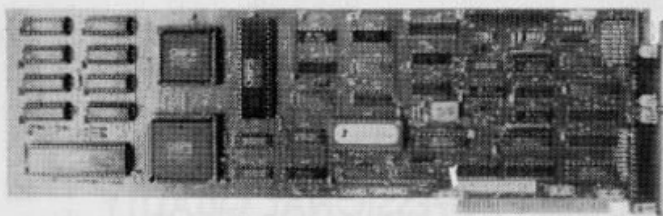


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Atlanta	The Seventh Annual Comdex/Spring at the Georgia World Congress Centre in Atlanta Contact: (02) 959 5555	June 1-4, 1987
Chicago	NCC'87 Contact: American Federation of Information Processing Societies 1899 Preston White Drive, Reston, Virginia 2209 (703) 620 8955	June 15-18, 1987

USER GROUPS UPDATE

Below is a list of updates and additions to the full User Group Index published in the January issue of APC. The next full listing will appear in the June issue of APC

The Sydney Macintosh Users Group has recently announced its amalgamation with the Sydney Apple Users Group. The combined membership of the user group is now in excess of 2000, and as such, a greater opportunity now exists to form more special interest groups. The amalgamation coincides with the Sydney Apple User Group becoming an incorporated body. For further details contact either Sydney Mcintosh Users Group, Box 152, Holme Building, Sydney University NSW 2006, or Sydney Apple User Group, PO Box 505, Bankstown NSW 2200.

The Sydney PC Users Group has announced a new special interest group for consultants and users in the personal computer environment. Meetings

are held on the third Wednesday of each month commencing at 6.15pm. Meetings are held at Ron Pollack & Company, 8th Floor, 14 York Street, Sydney. For more details contact Philip McKenzie (02) 290 3597.

The Campbelltown User Group has recently changed its name to the 16/+4 User Group. The address is 75 Lithgow Street, Campbelltown NSW 2560.

Vic

The Melbourne PC User Group now meets on the first Wednesday of each month at Clunies Ross House, 191 Royal Parade, Parkville, commencing at 6pm (Ground Floor Auditorium). Telephone enquiries are directed to (03) 569 6838.

The Prolog User Club has recently been formed and will have its inaugural meeting on March 9, 7pm. at 138 Rosebank Avenue, Clayton South. Further information may be obtained by phoning Mr Louis Belcourt on (03) 546 7413.

SA

A user group for Commodore computer owners has recently been formed to cover the southern districts of Adelaide. The club is called the Southern Districts User Club Inc, and meets on the last Monday of each month at the Noarlunga Salvation Army Hall, 186 Elizabeth Road, Morphett Vale.

For more information contact John Hancock (08) 381 7973.

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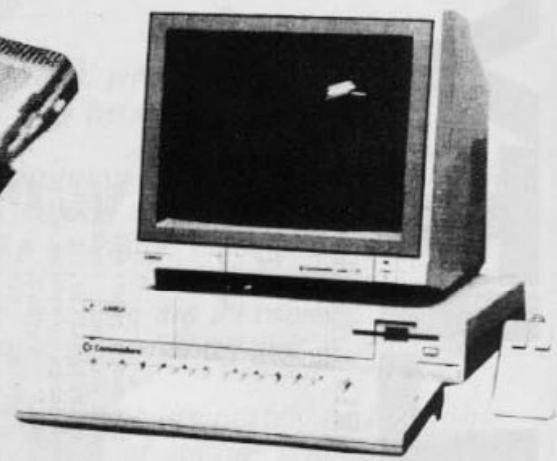
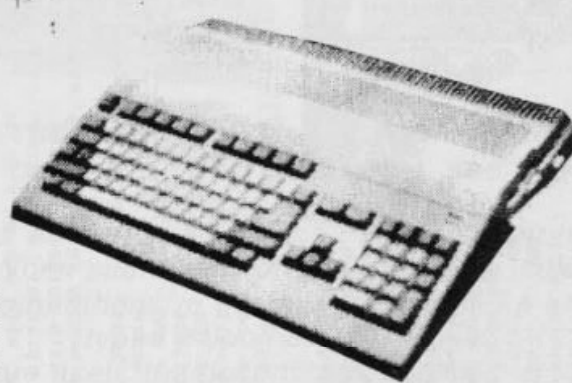
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 - DIABLO 630
 - IBM GRAPHICS PRINTER
2. Complete printer control at any time in any application.
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 - Number of copies.
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 - Manual feed selection.

3. Typewriter mode.

Direct connection between your keyboard and the laser. What you type is what you get.

4. Screen capture and graphics merge.

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5. Memory resident.

Operates like Sidekick i.e. it can be called up at any time in any applications.

6. Supports.

Enhanced Graphics Adaptor, Hercules, Colour Graphics and Mono Adaptors, PC Net and Novell compatible.

7. Embedded text commands.

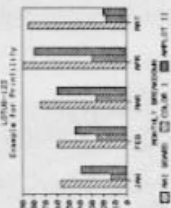
These attributes can be selected simply by embedding text.

PRINTILLITY with GRAPHICS MERGE

Perhaps the most powerful of the printer control features offered in Printillity is the ability to merge graphics with normal text output. Any screen, either text or graphics can be captured whole or in part and later merged in with any programs text output. A simple command embedded in your word processing or spreadsheet, or sent from the typewriter in Printillity will control the placement, size, and style of the merged image.



With the smaller sizes whole screens can be inserted where they will do the most good for the presentation. Sections of tables, text, and graphics will go where you want them for best



effect. If a portion of an image is unnecessary simply crop it when capturing to the disk. Any program which sends text to the printer can now include graphics in presentation quality.

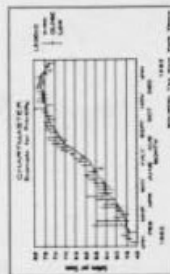
Since Printillity is memory resident, no external programs need to be run to produce output with merged graphics. Printillity examines all output destined for the printer and automatically places the files in the indicated location with one of 8 sizes. These features are also fully operational even when using the emulation modes available. These special features can be turned off from the pop up menus should you require it.

The simple embedded text commands give full control of type style, margins, pitch and other special printer features. The high level of printer control and utilization that is possible with Printillity lets you take full advantage of your software and hardware investment. Simply the best printer utility on the market.

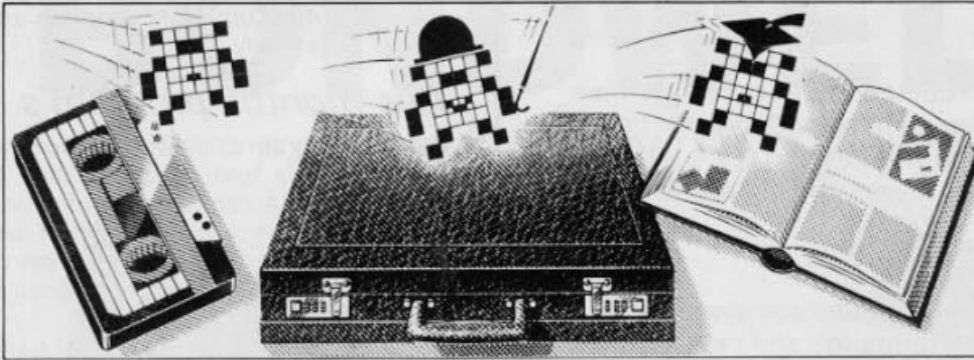
PCPaint Example






Printillity
using
PCPaint
Old
English

This graphic is size two



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 box below.**

APC is interested in programs written in any of the major programming languages from 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, self addressed envelope of the appropriate size, but please keep a copy of everything. Programs are paid for at the rate of \$20 per page of published listing.

Send your contributions to APC Programs, Att. Stephen Crowley, 77 Glenhuntly Rd, Elwood 3184.

**Programs may also be sent to APC through
Microtex 666's Direct Upload Facility
(DUF). It's available on (03) 419 0856,
accepts baud rates of 300, 1200 and 2400
(8 data bits, one stop bit, no parity), and**

**runs each week night from 5.30pm. The
system accepts ASCII and Xmodem file
transfer standards. It's not restricted to
666 members.**

Some readers may have noticed the changes in Program File that have been occurring over recent months. I have been trying to persuade authors to include more documentation and explanation with their programs. Although this means that fewer programs are published each month due to the extra space taken up by text, their quality has improved. Consequently, programs will be easier to understand and convert to other machines.

A new section on programming algorithms and techniques, and how to use them, is being planned. I hope to receive contributions for this section, as well as comments, improvements, and so on. The algorithms and techniques are intended to be general, and applicable to all

machines. I'll supply the routines in pseudo-code and Modula-2, and provide conversion tips for using the routines in Basic.

Program File will continue to supply the usual range of high-quality programs and hints and tips, hopefully with much-improved documentation.

Guidelines

Each month I explain the procedure for submitting programs to Program File, but it obviously has had little effect. I still receive huge numbers of submissions with inadequate documentations, no listing or no disk copies, no stamped, self addressed envelope . . . So, once again,

here are some general rules.

Always include a stamped, self addressed envelope with submissions or you won't get them back (or, indeed, ever hear of them again).

Please include twice as much documentation as you think necessary. Documentation *must* be double spaced (a blank line between each line of text) and should preferably be on disk, too. If possible, include diagrams. Listings should be as dark as possible on white A4 paper; they should also be carefully commented. A listing which consists of many short lines and a few long lines will be photo-reduced so that the long lines fit. Therefore, the listing will be condensed and hard to read, so ideally it should consist of lines of similar lengths which

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should contain between 60 and 70 characters.

Finally, *always* include a listing and a cassette or disk copy of the program, and source code if any.

This months program's

The first program deals with windowing, and adds this and other facilities to Commodore 64 computers. Unfortunately, the program consists mostly of data statements to be loaded into memory by a loader program, so it will be difficult to type in.

There's a reasonably intelligent game for the Spectrum called Triplets. This is a variation on noughts and crosses, played on an eight by eight board, and scoring the total number of times that three pieces in a row occur. The program uses some of the standard intelligent game-playing techniques, but could doubtless be improved.

Kevin Riordan contributes to the current general level of interest in the stock market with a share price movement analysis system.

Tips included this month are a screen-swap tip for the Amstrad CPC464/664, a tip for recovering text from BBC Wordwise if a crash accidentally occurs, tips on using the Amiga's RAM disk facility and a number-base conversion definition.

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Number Conversion Functions by Mads Dam-Larsen

Number-base conversion can be defined as a standard Basic function as follows:

To convert a decimal number from base 10 to another base B, use the following formula:

N_B = the sum as x changes from 0 to 8 of $10^x \text{ (IN DIV } B^x) \text{ MOD } B$
 N is the decimal number to be converted; B is the new base; N_B is the converted number; and x is the accuracy (eight digits in this case).
 To convert from base B to base 10, swap '10' and 'B' in the algorithm.

The actual function is of the form:
 DEF FNA=FNB(0)+FNB(1)+FNB(2)+...

DEF FNB(x)=(IN DIV B^x) MOD B)*10^x
 FNA will then hold the converted number.

To convert from base B to decimal:
 DEF FNC=FND(0)+FND(1)+FND(2)...
 DEF FND(X)=(IN DIV 10^X) MOD 10)*B^X
 These functions cannot convert numbers between bases which are greater than 10.



BBC Wordwise Text Recovery

by Terry Blunt



This program is available electronically through Microtex. 666's software downloading service. It is accessed through Viate! page *66637#.

See May 87, p 230.

This short utility program allows the user to recover text after a crash while editing in Wordwise or Wordwise Plus. The program, when run, generates and saves a short machine code routine that resides at &C00, which is a safe location for both tape and disk users.

To recover text when in Wordwise or after transferring to another language, *RUN the file. If working from

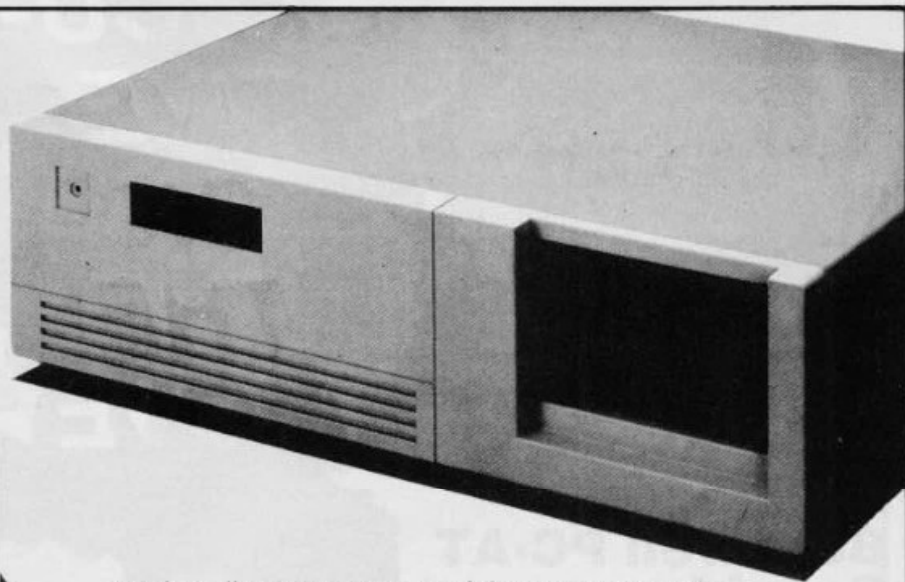
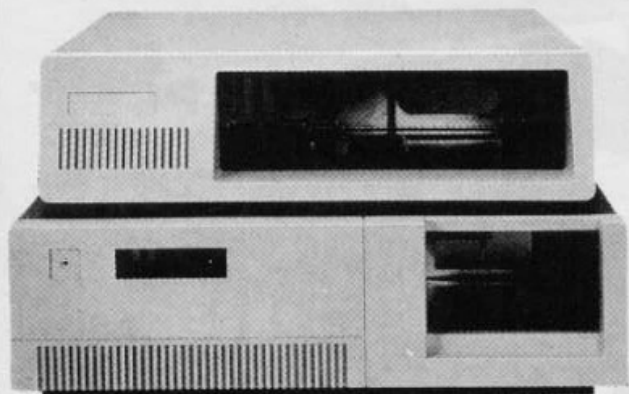
cassette, change to a new blank tape when the 'RECORD then RETURN' prompt appears.

The routine scans the working RAM area and builds up a file consisting of all ASCII characters, embedded command start and end codes, and TAB codes. This is saved as 'W.TEXT'.

The location memory to compile to can be changed in line 210.

```
10 REM Wordwise text recoverer
20 REM By Terry Blunt
30 REM 3 / 1 / 86
40 REM updated
50 REM 17 / 8 / 86
70 MODE 7
80 PRINT "To use this program RUN it and allow it to save the assembled code to disc."
90 PRINT "When you wish to recover a piece of corrupted text from WORDWISE re-insert the disc and type *RECOVER."
100 PRINT "A new file called 'TEXT' will be produced which can be loaded in the normal way and final correcting and deleting of unwanted text performed."
```

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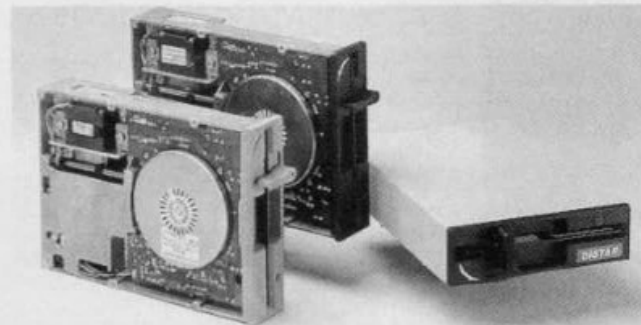
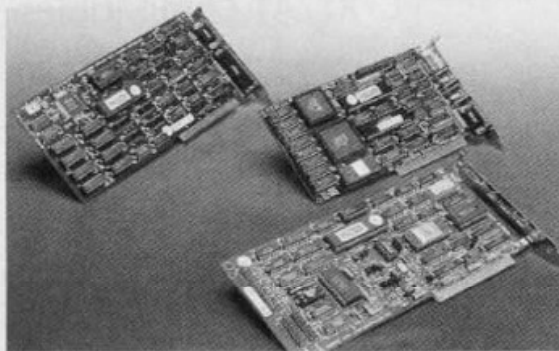
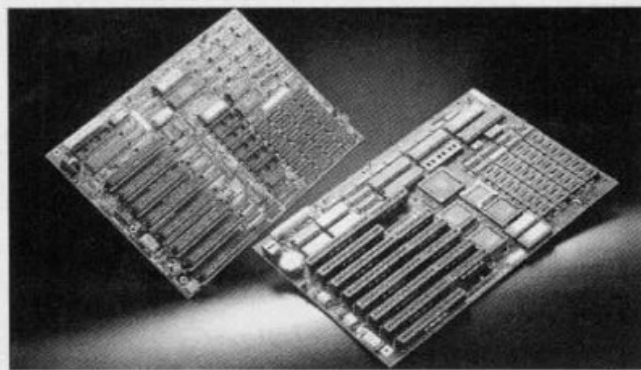
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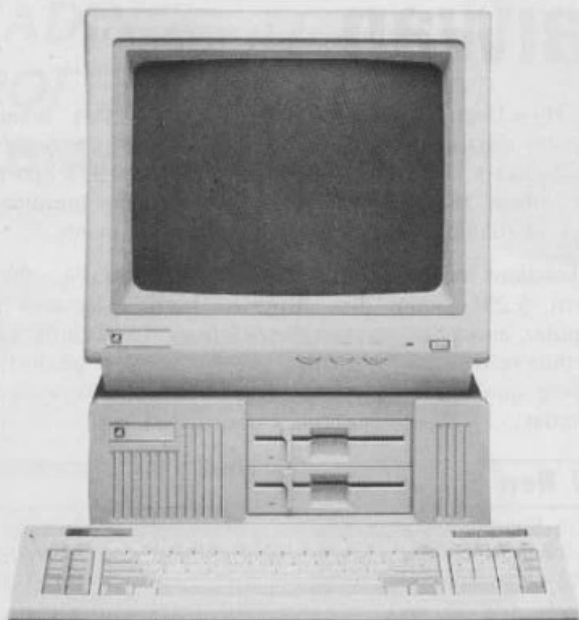
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```

110 PRINT "SPC10 "Press any key"
120 IF GET "SPC11" THEN GOTO 130 ELSE GOTO 140
130 PRINT "SPC12" Assemble for Wordwise Plus 7 "
140 IF (GET AND 95)=89 PRINT "M:;a;ar;h;l;-s;l;c ELSE PRINT "N";;a;e;r;h;i;-s;l;a
150 PRINT "SPC13 "WORKING"
160
170 DIM o$TEXT $80
180
190 addio=670
200 addhi=671
210 base=6C00
220 onewl=&FFFE7
230 o$wrch=&FFFE
240 ofind=&FFFE
250 o$but=&FFFD
260 o$cli=&FFFD
270
280 FOR IX=0 TO 2 STEP 2
290 PA=base
300
310 (OPT IX
320 LDA #160
330 LDX $TEXT MOD 256
340 LDY $TEXT DIV 256
350 JBR ofind
360 TAY
370 FOR #255
380 LDA addio
390 LDA #ar;h;l
400 STA addhi
410 LDX #45F
420 .loop
430 LDA (addio),Y
440 CMP #402
450 BEQ put
460 CMP #607
470 BEQ put
480 BEQ put
490 BEQ #E0D
500 BEQ put
510 CMP #E20
520 BEQ skip
530 CMP #40D
540 BEQ put
550 CMP #67F
560 BCS skip
570
580 .put
590 JBR o$but
600
610 .skip
620 INC addio
630 BNE loop
640 INC addhi
650 DEX
660 BNE loop
670 TZA
680 JBR ofind
690
700 .print
710 LDA text,X
720 BEQ end
730 JBR o$wrch
740 INX
750 BNE print
760
770 .end
780 JMP o$newl
790
800 .text
810
820 )
830 NEXT
840 $text="W:TEXT saved"+CHR$0
850 $o$text="S:RECOVER "+STR$ base+" "+STR$ (text+LEN$text)
870 YA=o$TEXT MOD 256
880 YA=o$TEXT DIV 256
890 CALL o$cli
900 PRINT "SPC9 "RECOVER" saved"

```

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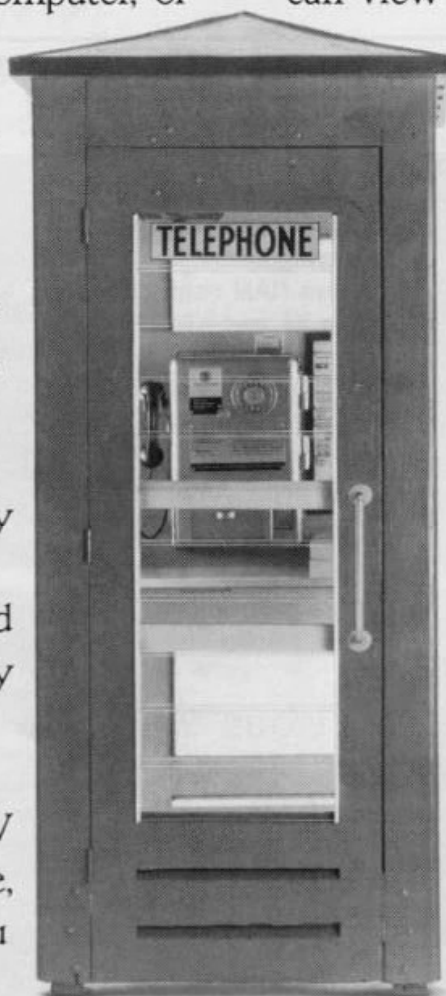
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Commodore 64 Enhancer by Shane Broadberry

**MICROTEX
666**

This program is available electronically through Microtex 666's software downloading service. It is accessed through Viatec page *66637#.

It is important that the M/C loader for the Enhancer is typed in *before* the demonstration program. Type the M/C loader in first, run it and when it has saved, type: SYS 49152 [return]. This will turn the Enhancer on.

When the start message appears, you can now proceed to type in the demonstration program which accompanies it. This program must be typed in or loaded when the Enhancer is in memory and operative, otherwise it will not work. The Enhancer saves to disk or tape the machine code needed to run the Enhancer, so that you won't have to compile it each time you wish to use it. To load it, type: LOAD "enhancer

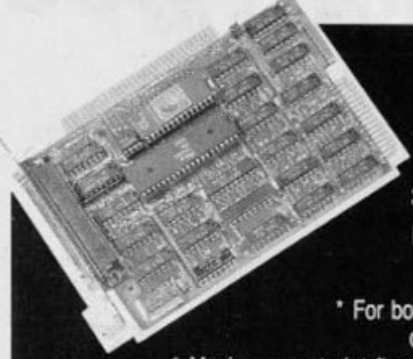
64", device, 1 [return]. After it has loaded, type: SYS 49152 [return]. The Enhancer was written to allow access from Basic to commands which allow windows on the screen to be scrolled in all directions, which in its turn allows information to come on or go off quickly. The program will allow boxes and borders to be drawn anywhere on the screen and in any size, colour or character. It will reverse the whole screen, or part of the screen. It will store eight screens of text (or colour graphics) for later rapid retrieval in memory that is unused by Basic and most machine code programs.

```

90 REM "ENHANCER 64 SHANE BROADBERRY
110 "FICHE# 34"
120 "*****COMPILING ENHANCER**"
130 "*****"
140 "*****"
150 PRINT "*****CURRENT LINE *****"
160 "*****"
170 "*****"
180 "*****"
190 "*****"
200 "*****"
210 "*****"
220 "*****"
230 "*****"
240 "*****"
250 "*****"
260 "*****"
270 "*****"
280 "*****"
290 "*****"
300 "*****"
310 "*****"
320 "*****"
330 "*****"
340 "*****"
350 "*****"
360 "*****"
370 "*****"
380 "*****"
390 "*****"
400 "*****"
410 "*****"
420 "*****"
430 "*****"
440 "*****"
450 "*****"
460 "*****"
470 "*****"
480 "*****"
490 "*****"
500 "*****"
510 "*****"
520 "*****"

```

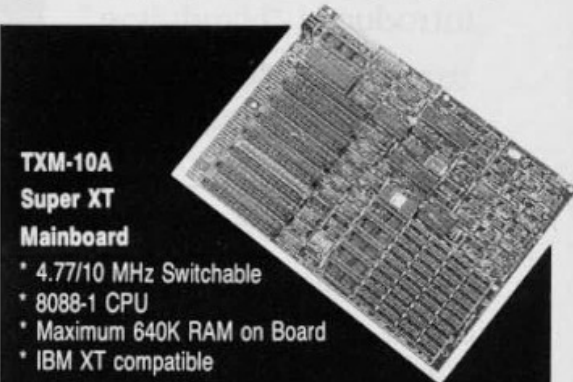
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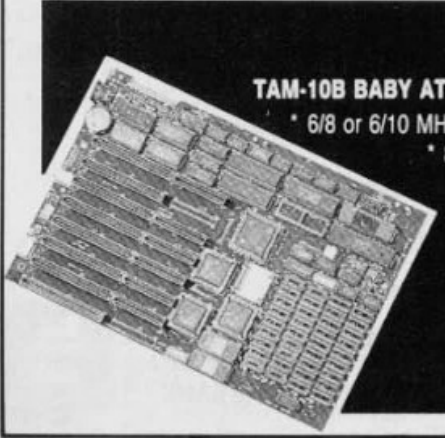
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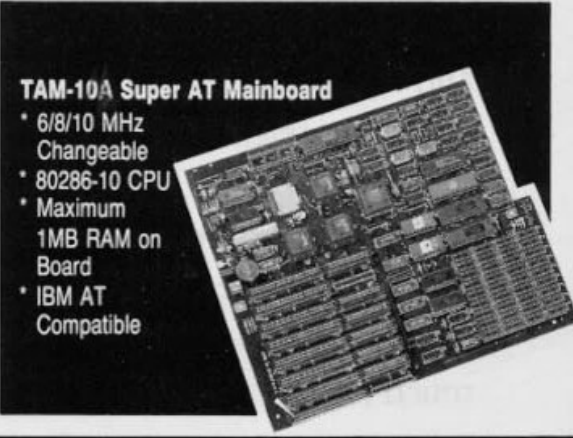
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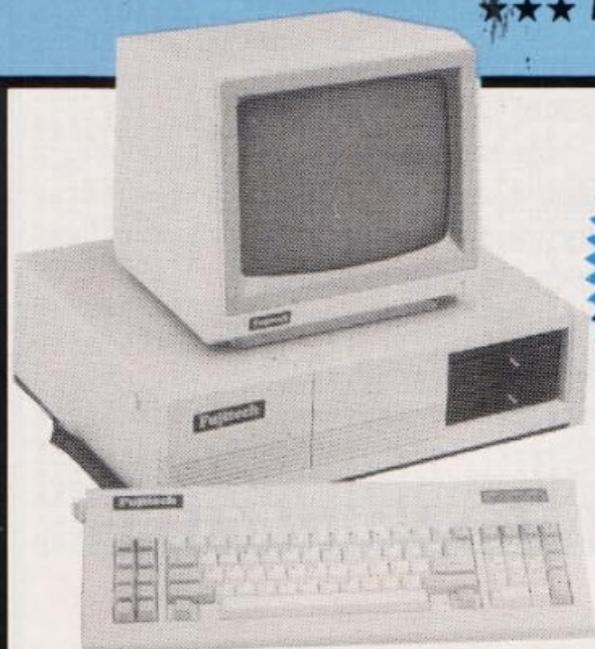
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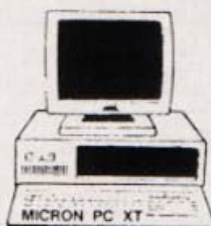
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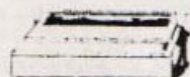
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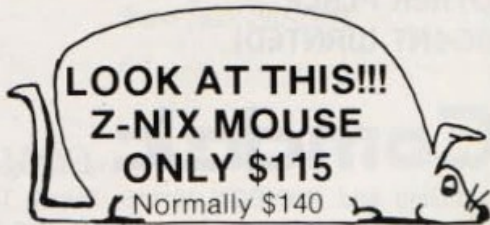
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550 DATH77 82.79.76.204.67.82.67.82.79.76.204.65.82.79.76.204.65.82
560 DATH78 82.79.76.204.65.82.67.82.79.76.204.67.82.67.82.79.76.204.65.82
570 DATH79 216.67.79.76.204.65.82.67.82.79.76.204.67.82.67.82.79.76.204.65.82
580 DATH80 163.84.65.83.200.70.69.84.67.200.72.69.76.204.65.82
590 DATH81 175.204.00.125.198.135.198.145.198.160.198.191.195.40.194
600 DATH82 145.17.195.15.195.140.194.197.194.205.193.81.228.162.80
610 DATH83 13.32.10.255.162.00.189.01.192.210.255.233.124.10
620 DATH84 245.240.169.45.32.210.255.202.266.250.169.233.210.255
630 DATH85 32.210.255.169.45.32.210.255.233.266.250.169.233.210.255
640 DATH86 32.210.255.169.45.32.210.255.233.266.250.169.233.210.255
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810 DATH03 32.210.255.169.45.32.210.255.233.266.250.169.233.210.255
820 DATH04 32.210.255.169.45.32.210.255.233.266.250.169.233.210.255
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920 DATH14 32.210.255.169.45.32.210.255.233.266.250.169.233.210.255
930 DATH15 32.210.255.169.45.32.210.255.233.266.250.169.233.210.255
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1360 DATA75,196,96,32,180,136,32,233,197,173,31,194,201,25,176,152
1380 DATA32,137,196,96,32,202,196,32,230,196,177,125,201,33,248,81
1400 DATA96,32,115,80,169,81,141,48,194,96,166,80,177,122,201,35
1410 DATA240,96,169,80,141,38,194,96,169,21,141,38,194,32,115,80
1420 DATA129,80,141,48,194,96,177,132,201,37,240,96,169,80,141,48
1430 DATA194,96,169,81,141,48,194,169,212,141,38,194,32,115,88,96
1440 DATA80,80,80
READY.

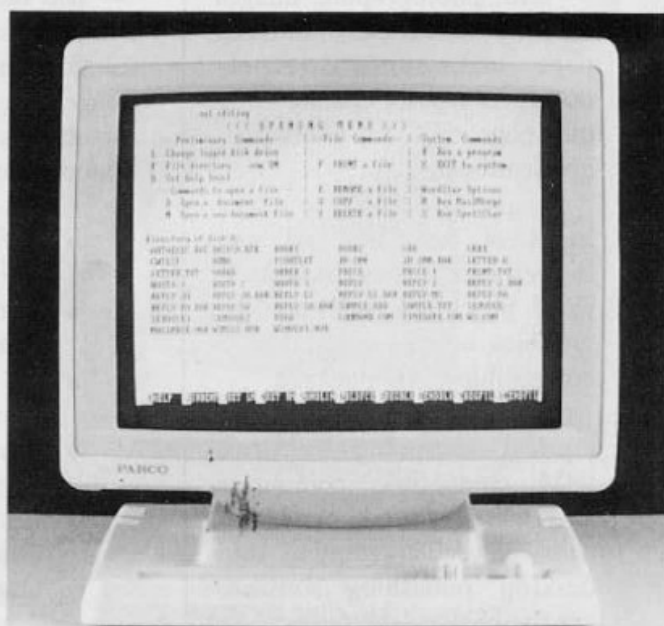
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100 REM ENHANCER DEMO, SHINE BORDERARY
101 REM THIS PROGRAM MUST TYPED IN
102 REM WHEN THE ENHANCER IS IN MEMORY
103 REM AND ACTIVE OR IT WILL NOT WORK.
110
111 REM MESSAGE FOR SCROLLING..
120 REM THIS SCROLLING EXAMPLE COULD BE COMING ONTO THE LEFT HAND SIDE OF "
130 REM THE SCREEN, SHOWING THAT IT WAS BEING SCROLLED; THEN AGAIN IT COULD "
140 REM BE COMING IN FROM THE RIGHT LIKE IT IS BELOW.....
150 C=2:POKE3272,23:POKE53281,7:POKE53280,C:POKE646,9
151 IFEEEK(733)GOTO THENPRINT"*****PLEASE UP" AND -// THE "***** FIRST" END
160 FOR X=1 TO 40:FOR Y=1 TO 160:BOX X,Y,1,40,25,C
170 FOR Z=0 TO 60: NEXT
180 FOR X=1 TO 101:STEP 1: BOX X,X,41-X,26-X,32,2: NEXT
190 PRINT"OK"
200 PRINTTAB(8)M;"***** 64 DEMO"PRINTTAB(6)M;" 1986 ***** BORDERARY"
210 BOX 1,1,40,7,43,8
220 BOX 1,8,40,25,160:BOX 1,8,40,25,2
230 FOR X=0 TO 5:FLIP 2,2,39,6:FOR Z=0 TO 10:NEXT Z:BOX X,1,1,40,7,42,8:POKE646,C
240 PRINT"*****THE "*****MORE 64 *****ALLOWS
250 PRINT"*****INTERESTING EFFECTS TO BE CREATED USING
260 PRINT"*****SIMPLE COMMANDS. *****SCREENS CAN BE
270 PRINT"*****SCROLLED, SCROLLED, FLIPPED AND BOXES
280 PRINT"*****CAN BE DRAWN OR ERASED, WITH THE MINIMUM
290 PRINT"*****OF EFFORT...."
300 GOSUB1830
310 REM PRINT UP "PRESS SPACE PLEASE"
310 GOSUB1840:FOR Z=0 TO 300: NEXT GETO: IFO#=""THEN310
320 BOX 1,13,48,12,32,C
330 FOR V=0 TO 12:USCROLL 1,48,11:SCROLL 1,12,48,24: NEXT
340 FOR X=1 TO 40:FOR Y=1 TO 160:FOR Z=1 TO 30:STEP 2:BOX X,1,X+10,19,X: NEXT
350 PRINT"*****TAB(27) *****THESE COLOURS"
360 PRINTTAB(27)*****"JOHN NON BE"
370 PRINTTAB(27)*****"SCROLLED"
380 BOX 1,11,40,25,C
390 FOR X=1 TO 11:FOR Y=1 TO 160
400 BOX 27,1,49,10,C
410 REM SCROLL LINE LEFT + OTHER RIGHT
420 FOR X=0 TO 125:USCROLL X,1,49,5:SCROLL X,1,49,11: NEXT
430 PRINT"*****AND THEY CAN BE SCROLLED IN ANY"
440 FOR X=0 TO 5:USCROLL X,1,49,9: NEXT
450 PRINT"*****USING THIS TECHNIQUE MANY STRANGE AND
460 PRINT"*****INTERESTING PATTERNS CAN BE CREATED...."BOX 1,11,40,25,C:GOSUB1830
470 FOR X=1 TO 64
471 REM PUT UP MESSAGE ONTO SCREEN.
480 FOR Z=0 TO 30:ASC MID$(TAB(X),1)X+128:POKE1744,ASC(MID$(TAB(X),1)X,1)X)+128
490 LSCROLL 1,17,40,17:SCROLL 1,19,49,19
500 GOTO 1: IFO=5 THEN GOTO 600SUB1840
510 GETO: IFO#=""THEN NEXT
520 FOR X=1 TO 6:BOX X,X,20-X,13-X,160,2:BOX X+19,X,41-X,13-X,160,2
530 BOX X,X+12,28-X,25-X,160,2:BOX X+19,12+X,41-X,25-X,160,2: NEXT
540 CLR:PRINT"*****"BOX 1,1,40,25,160:BOX 1,1,40,25,FEEL(53280)
550 FOR Z=0 TO 178
560 X=INT(RND(5)*25)+1:Y=INT(RND(1)*11)+1
570 X2=X+18:Y2=Y+10:V=INT(RND(25)*5)
580 BOX X,Y,32,Y2,2:Z=INT(RND(5)*15):NEXT:BOX 4,5,36,21,8
590 PRINT"*****TAB(10)*****BOXES, 10XES, 10XES, 11"
600 PRINT"*****THE "*****ALLOW IF"
610 PRINT"*****"*****THIS IS INSIDE AN OPEN" BOX"
620 PRINT"*****"*****FILLED, /OPEN" OR"
630 PRINT"*****"*****CLOSED, AS YOU SHALL SEE...."
640 GOSUB1830
650 FOR Z=0 TO 300: NEXT Z
660 GETO: IFO#=""THEN650
670 FOR X=1 TO 13:STEP 1: BOX X,X,41-X,26-X,160,6: NEXT
680 FOR X=1 TO 13:STEP 1: BOX X,X,41-X,26-X,160,2: NEXT
690 BOX 1,1,40,25,160,8:BOX 2,2,39,24,160,8
700 PRINT"*****"*****THIS IS INSIDE AN OPEN" BOX"
710 PRINT"*****"*****TO CLOSE A BOX WITH A SPECIFIED"
720 PRINT"*****"*****CHARACTER THE -IF+ COMMAND IS "
730 PRINT"*****"*****USED.
740 PRINT"*****"*****HERE ARE TWO BOXES."

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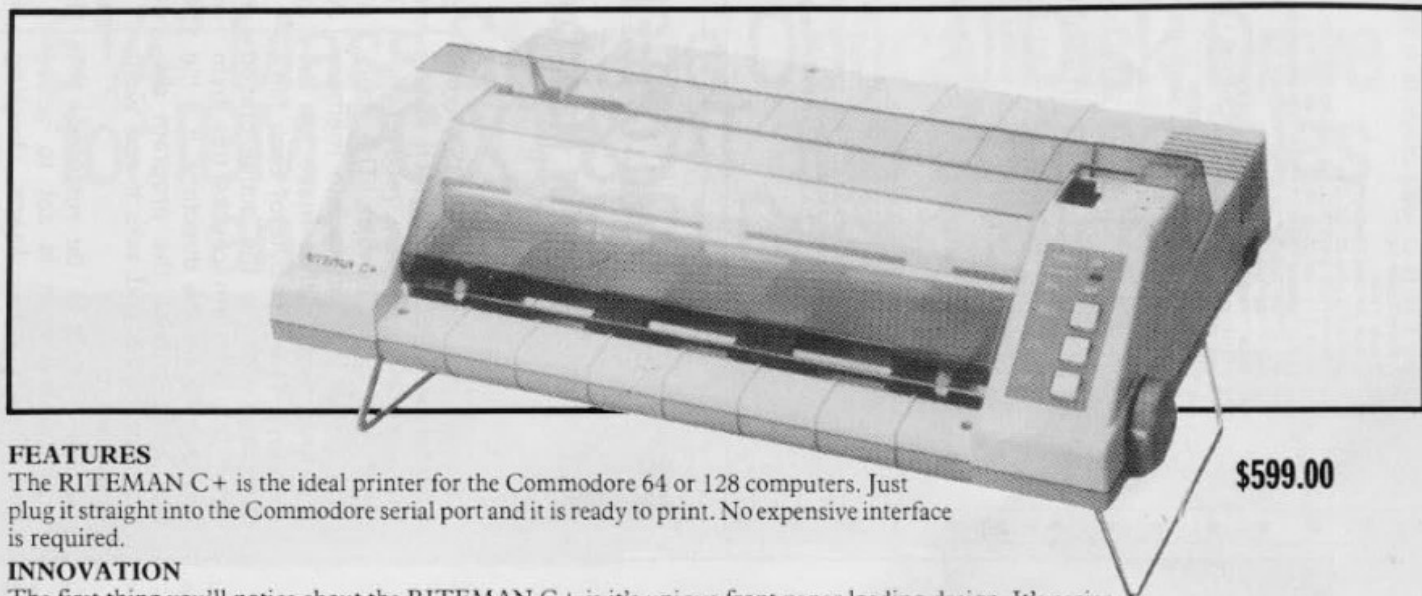


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FEATURES

The RITEMAN C+ is the ideal printer for the Commodore 64 or 128 computers. Just plug it straight into the Commodore serial port and it is ready to print. No expensive interface is required.

INNOVATION

The first thing you'll notice about the RITEMAN C+ is its unique front paper loading design. It's easier and more versatile, not just because paper feeds straight through without ever going around a roll bar (and bending it), but because now any thickness of paper can be used, labels never jam, positioning and aligning problems are eliminated, edges can now be printed on, and even envelope printing becomes practical. A built in printer stand raises the RITEMAN C+ over your desk, allowing you to store paper underneath, not behind, doubling your usable desk space.

INTELLIGENCE

Even more impressive is the print features of the RITEMAN. Turn it on and it becomes an enhanced Commodore MPS801, only faster and smarter. It'll then work fine with original Commodore software. Send it the right software instruction though (or change a dip switch) and it becomes Epson compatible. Use Doodle, Printshop or any one of the more advanced print programs or word processors. Because the RITEMAN C+ has the full implementation of PETSCII in ROM, it doesn't waste time individually drawing the dots that make up special symbols such as hearts and circles. RITEMAN C+ will sometimes print three or more times faster than conventional printers with conventional interfaces.

RITEMAN C+ also supports near letter quality printing, compressed, emphasized, italics, super and sub scripts, double emphasized, reverse and more. It even prints out hex listings automatically for machine code programmers and hackers alike.

CONSTRUCTION EXCELLENCE

The RITEMAN C+ comes sturdily built and backed by a full 12 month manufacturers warranty. Components such as steel head belts (not rubber as in other printers) add up to one of the most reliable, durable printers ever built for personal use. Not surprising since it's manufactured by C-Itoh.

The Australian Commodore Review described it as: "the printer of my dreams . . . I am in love with this well thought out, feature packed printer . . . The RITEMAN C+ is an attractively styled, thoughtfully designed printer which is 100% compatible with the Commodore 64 computer. By 100% I mean that this printer plugs right into the serial port and, except for the amazing print speed of 105 characters per second, behaves like an enchanted MPS801." (The new "Super" RITEMAN C+ now prints at 120 characters per second.)

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750 GOSUB 1030
760 BOX 9,15,19,22,160,0:CB0X21,15,31,22,0
770 FOR X=0 TO 300: NEXT
780 GOSUB 1040
790 GET #1: IF #1="" THEN #770
800 BOX 20,1,20,25,32,2
810 FOR X=0 TO 20: LSCROLL 1,1,20,25: RSCROLL 20,1,40,25: NEXT
820 CBX 1,1,40,25,2: FLIP 1,1,40,25
830 PRINT "*****TAB(5)*****"
840 PRINT "*****TAB(5)*****"
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1950 PRINT "*****TAB(5)*****"
1960 PRINT "*****TAB(5)*****"
1970 PRINT "*****TAB(5)*****"
1980 PRINT "*****TAB(5)*****"
1990 PRINT "*****TAB(5)*****"
2000 PRINT "*****TAB(5)*****"

```

Amstrad CPC File Recovery

by Mark Cummins



too large to fit in one directory entry, so another directory entry is used. This is called an 'extent' and is displayed with '(ext)' after the filename. All extents must be restored to properly restore a deleted file.

Another point to note is that files may have already been physically overwritten although the directory is still intact. Restoring these will have no effect.

When all the files have been displayed for recovery, the changed directory is written back to the disk. The program can be run by typing IRECOVER when the code has been loaded.

This program sets up an RSX command called IRECOVER which allows the user to selectively recover deleted files from the disk. The program works by reading into memory the four sectors that make up the directory. The first byte of each file's directory entry is the active/erased byte; the program checks this byte for each file in the directory. If a file has been erased, the program displays its name and asks if you want to restore it.

If the file is to be restored, the active/erased byte is set to active and the program keeps checking through the directory. Some files are

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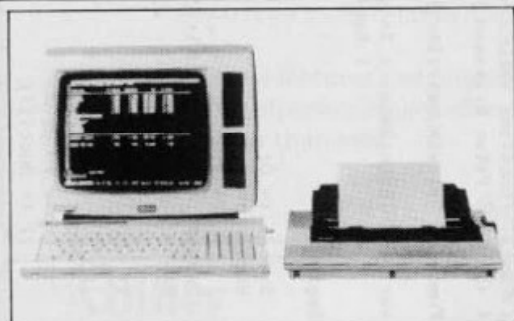
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```

f2      call $bb5a
        ld a,(hl)
        call $bb5a
        inc c
        inc hl
        ld a,c
        cp 12
        jr nz,f2
        ld ix,recov
        call sprintr
        ld a,(hl)
        cp 0
        jr z,flush
        ld ix,ext
        call sprintr
        call $bb59
        jr c,flush
        call $bb81
        call $bb86
        call $bb84
        cp "y"
        jr z,f4
        cp "y"
        jr z,f4
        cp "n"
        jr z,f5
        cp "n"
        jr z,f5
        jr f3
        ld a,"y"
        call $bb5a
        ret
f4      ld a,"n"
        call $bb5a
        ret
f5      unerase dec hl
        ld a,0
        ld (hl),a
        inc hl
        ret

;write back all four sectors that make up the directory
repair  ld a,133
        call bios

ld hl,buffer
ld e,$00
ld a,(track)
ld d,a
ld a,(sector)
ld c,a
ld b,1
rst 3
defw cmd_far_addr
jr nc,secton

inc c
push bc
ld bc,$11
adc hl,bc
pop bc
inc b
ld a,5
cp b
jr z,secton
jr r1

;set disk messages on again
secton ld a,$129
        call bios
        ld a,$00
        rst 3
        defw cmd_far_addr

;set retry count to default value
ld a,$137
call bios
ld a,16
rst 3
defw cmd_far_addr
ret

```

```

bios    ld (cmd_name),a
        pop hl
        ld (basic),hl
        ld hl,cmd_name
        call $bcd4
        ret nc

        ld (cmd_far_addr+0),hl
        ld a,c
        ld (cmd_far_addr+2),a
        ld hl,(basic)
        push hl
        ret

        ld a,(ix)
        cp 0
        jr z,call$bb5a
        inc ix
        jr sprintr

table   defw names
        jp RECOVER
names   defb "RECOVER", "R"=120
rstwork defb 0

cmd_name defb 0
cmd_far_addr defb 3
sect_value defb $41,$c1,$01,$00

track   defb 0
sector  defb 0
recov   defb " Recover? (Y/N) i",0
ext     defb " (ext)",0,0,0,0,0,0,0,0,0
if      defb 13,10,0
basic   defw $008
buffer  defb 2048

;A holds the BIOS command name.
;Store return pointer.
;HL points to the command name address.
;Ask the kernel where it is.
;Return to Basic if it is not found.
;Store the routine's address
;and ROM number.
;Restore the return pointer.
;Print a string routine.

;RSX table.

;Storage area for BIOS command name.
;Area for storing BIOS address and ROM no.
;System,Data,IBM sector values

```



Pascal VAL(n\$) Function by Peter Eriksson

This standard function implements VAL(n\$) in Pascal. It can easily be the equivalent of the Basic command converted to all versions of Pascal.

```

( Pascal Function: VALUE, version 1.30 )
( C) 1985 Peter Eriksson Productions )

Function Value(Numstr:String);Real;

Var I,J,P,Sign,Base : Integer;
    Svar           : Real;

Begin
    Svar := 0;
    Sign := 1;
    I := 1;
    Numstr := Concat(Numstr,' ');
    Base := 10;

    If (Numstr[I]='&')
    Then
        Begin
            Base := 8;
            I := Succ(I);
        End
    ( Number is in octal notation? )

```


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- DS Backup+ (IBM & Macintosh)


```

End;
If (Numstr[I]='Z')
Then
Begin
Base := 2;
I := Succ(I);
End;
If (Numstr[I]='-')
Then
Begin
Sign := -1;
I := Succ(I);
End;
( Let's read in the integer part of the number )
While ((Numstr[I]='0') And (Numstr[I]<Chr(48+Base))) Do
Begin
Svar := Svar#Base+((Ord(Numstr[I]) Mod 128)-48);
I := Succ(I);
End;
If Numstr[I]='.'
Then
Begin
I := Succ(I);
J := I;
( Let's read in the fractal part of the number )
While ((Numstr[I]='0') And (Numstr[I]<Chr(48+Base))) Do
Begin
Svar := Svar#Base+((Ord(Numstr[I]) Mod 128)-48);
I := Succ(I);
J := J#Base;
End;
Svar := Svar / J;
End;
Svar := Sign#Svar;
( Is the number written in scientific notation? )
If ((Numstr[I]='E') or (Numstr[I]='e'))
Then
Begin
P := 0;
I := Succ(I);
Sign := I;
If (Numstr[I]='-') ( Negative exponent? )
Then
Begin
Sign := -I;
I := Succ(I);
End;
( Let's read in the exponent )

```

```

While ((Numstr[I]='0') And (Numstr[I]<Chr(48+Base))) Do
Begin
P := P#Base+((Ord(Numstr[I]) Mod 128)-48);
I := Succ(I);
End;
If (Sign=1) Then Svar := Svar#Exp(P#Ln(Base))
Else Svar := Svar/Exp(P#Ln(Base));
End;
Value := Svar;
End;

```



Amstrad CPC464/664 Screenswap Tip

by Gavin Moffitt

This short program provides two programs. To store a screen in RAM RSXs which emulate the SCREEN- use 'SCREENCOPY, and to retrieve it SWAP commands on the CPC6128. use !SCREENSHOW. When in use, there is 26k left for

```

10 REM *****
20 REM * RSX LOADER *
30 REM * (C) 1986 Gavin Moffit *
40 REM * !SCREENCOPY - copy screen to RAM *
50 REM * !SCREENSHOW - redisplay screen *
60 REM *****
70 IF PEEK(42750)=1 THEN MODE 2:PRINT"RSX's Already Loaded":END
ELSE MEMORY 25999:check=0:FOR a=42750 TO 42816:READ
a$=VAL("&"a$):POKE a,b:check=check+b:NEXT
80 IF check>6502 THEN MODE 2:PRINT "Error in DATA":END
90 CALL &A6FE:MODE 2:PRINT"RSX's Initialised":END
100 DATA 01,08,A7,21,25,A7,C3,D1,BC,C9,10,A7,C3,35,A7,C3,29,A7,
53,43,52,45
110 DATA 45,4E,53,48,4F,D7,53,43,52,45,45,4E,43,4F,50,D9,00,00,
00,08,A7,11
120 DATA 90,65,21,00,C0,01,00,40,ED,B0,C9,11,00,C0,21,90,65,01,
00,40,ED,B0
130 DATA C9,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,
00,00,00,00

```


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Atari BOOTC by Ronaldo Sergio de Biasi

This short machine language routine automatically changes Atari 8-bit Basic revision B into revision C on booting. When it has been added to boot disks, the bugs in revision B are automatically removed. The program is useful for Atari owners who don't have revision C or have other uses for the cartridge slot.

When BOOTC is used as an **AUTO-RUN.SYS** file, it changes revision B into revision C and traps the System Reset key so that ROM Basic will not be switched on each time this key is pressed. As a bonus, the default screen colour is changed from faint blue to pink. This can be changed in lines 100 to 110 of the second listing:

```
10 OPEN #1,8,0,"D:AUTORUN.SYS"
20 PUT #1,255:PUT #1,255
30 PUT #1,0:PUT #1,6
40 PUT #1,69:PUT #1,6
50 FOR I=1 TO 70
60 READ A:PUT #1,A
70 NEXT I
80 PUT #1,226:PUT #1,2
90 PUT #1,227:PUT #1,2
100 PUT #1,0:PUT #1,6
110 CLOSE #1
120 DATA 169,148,141,197,2,169,0,141,68,2,169,1,133,9
130 DATA 173,48,2,133,203,173,49,2,133,204,160,4,177,203,133,205
140 DATA 200,177,203,133,206,162,0,160,82,189,58,6,145,205,232
150 DATA 200,224,12,208,245,169,12,141,252,2,108,250,191
160 DATA 50,53,46,2,36,26,34,47,47,52,35,2
```

```
10 FOR I=16284 TO 16427:READ A:POKE I,A:NEXT I:A=USR(16384)
20 DATA 104,169,0,133,203,169,160,133,204,162,32,160,0,177,203,72
30 DATA 169,255,141,1,211,104,145,203,169,253,141,1,211,136,208,237
40 DATA 230,204,202,48,6,208,230,160,0,208,226,96
50 FOR J=1 TO 16:READ A,B:POKE A,B:NEXT J
60 DATA 54017,255,43231,234,43232,240,43233,17
70 DATA 43234,234,47913,0,49139,0,49140,0,49141,0
80 DATA 49142,0,49143,0,49144,0,49145,0,5784,32,5785,196,5786,4
90 FOR K=1390 TO 1407:READ D:POKE K,D:NEXT K
100 DATA 169,64,141,198,2,169,255,141,1,211,173,106,22,96
110 POKE 709,202:POKE 710,64
120 ? CHR$(125):NEW
```



Amstrad PCW8256 CP/M Tip by Alan Haken

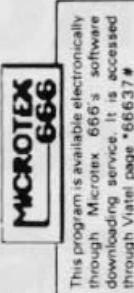
The CP/M manual for the 8256 has a section on page 133 about selecting a mixed print mode. This selection is made by issuing an escape sequence, **ESC ! n**, where n must be in the range 0 to 63. The manual states that the decimal numbers correspond to 5-bit numbers, which is untrue. In fact, they correspond to 6-bit numbers. The corrected values are:

Bit	Value(dec)	Turns-on
5	32	Enlarged
4	16	Double-strike
3	8	Emphasised (bold)
2	4	Condensed (17cpi)
1	2	
0	1	Elite (12cpi)

Add values together *ad lib* for any desired combination of features.



Share Trader by Kevin Riordan



Having trouble keeping track of Australia's fast moving stock market? Then key-in Kevin Riordan's share price movement storage and retrieval system. It's written

for the Commodore 64 with a 1541 disk drive. Full instructions are included in the listing.

```
1000 REM *****
1001 REM **
1002 REM **
1003 REM **
1004 REM **
1005 REM **
1006 REM **
1007 REM **
1008 REM **
1009 REM **
1010 REM *****
1011 :
1012 REM
1013 REM
1014 REM
1015 REM
1016 REM
1017 REM
1018 REM
1019 :
1020 REM
1021 REM
1022 REM
1023 REM
1024 REM
1025 REM
1026 REM
1027 REM
1028 :
1029 REM
1030 REM
1031 :
```

-SHARE TRADER-

(KEVIN RIORDAN 1986)

'SHARE TRADER' IS DESIGNED TO ASSIST STOCK MARKET INVESTORS TO KEEP TRACK OF THE PRICE MOVEMENTS AND DAILY SALES VOLUMES OF UP TO 100 STOCKS FOR A 12-MONTH TRADING PERIOD. IT CREATES TWO PRE-EXTENDED FILES ON EVERY DATA DISK WHICH IT FORMATS ON USER DEMAND FOR ITS OWN USE. SINCE THE USER MAY WISH TO WRITE ROUTINES TO EXTRACT STATISTICAL INFORMATION FROM HIS/HER DATA BASE, THE FOLLOWING IS A DESCRIPTION OF EACH DATA FILE AND ITS RECORD STRUCTURE:

THE FIRST FILE IS CALLED 'INDEX'. AS ITS NAME SUGGESTS, IT CONTAINS A LEXICOGRAPHICALLY-ORDERED LIST OF STOCKS, TOGETHER WITH LINKAGE POINTERS. THE RECORD LENGTH IS 20 CHARACTERS, OF WHICH THE FIRST 16 COMPRISE THE NAME OF A STOCK LEFT-JUSTIFIED WITH TRAILING SPACES. THE REMAINING 4 CHARACTERS COMPRISE A LINKAGE FIELD HELD IN STANDARD NUMERIC ASCII FORMAT RIGHT-JUSTIFIED WITH LEADING SPACES. THIS FIELD CONTAINS THE RECORD NUMBER OF THE FIRST ENTRY FOR THIS STOCK IN THE 'HISTORY' FILE.

THE INDEX ENTRY FOR THE BHP \$1 SHARE, FOR EXAMPLE, WOULD LOOK LIKE THIS (USING 'N' AND 'B' TO DENOTE TRAILING AND LEADING SPACES):

NEC APC IV TOPS IBM AT

"IBM has been toppled from top spot in the local 80286-based microcomputer market for the first time by a single machine — the NEC APCIV" — The Australian 9/12/86.

At A.T.S. COMPUTING we predict that this year NEC will emerge as the new market leader in the microcomputer and printer fields. Right now NEC is releasing a wide range of industry standard, totally compatible products combining legendary reliability with top value and superb quality throughout.

And to this A.T.S. adds personal service, prompt delivery and, we believe, the lowest prices around:—

- Every potential computer buyer may discuss his individual needs with our manager, Doug Cotton and benefit from over 16 years' experience.
- Large stocks held in 13 cities from Sydney to Perth, Townsville to Hobart help ensure availability and prompt delivery — why wait weeks when we have it now?
- Low prices mean NEC products can actually cost less than clones when you take into account service costs and software we package with printers and computers.

N.S.W. (02) 858 5999 • (042) 28 9990 • (043) 28 1859 • (049) 26 5484 •
(060) 41 1244 • (067) 66 7959

A.C.T. (062) 57 3420

VIC (03) 690 9196

QLD (07) 221 6198, (077) 72 4112

S.A. (08) 51 3947

W.A. (09) 328 2972

TAS (002) 31 1757.

Here are just a few examples:—

NEC P6 80 column 24 pin letter quality printer (216/72 c.p.s.) with 8K buffer, and A.T.S. Utilities software (System Menu, Letter Writing, Appointments, Address Labels, Note Pad, MS-DOS tutorial and General Ledger) all for \$697* (including a free cable for cash.)

NEC P7 136 column printer with features and software as above \$907*

NEC Spinwriters with thimbles (not daisy wheels) and speeds up to 55 c.p.s. from \$563*.

NEC APC IV 'AT' compatible system with 42 Mb (formatted) quick access hard disc, 1.2 Mb floppy, Advanced Graphics colour monitor, Integrated Accounting Package, Word Processing, Database and Spreadsheet, plus A.T.S. Utilities software (as above) all for \$6536*.

(Dealer enquiries welcome)

* Prices exclude tax —
add 16% if applicable.

A.T.S. COMPUTING

"Advanced Technology + Service"

Mail to: A.T.S. COMPUTING, 1039a Victoria Road, West Ryde, 2114
Please send information on
Name:
Address:
Tel:


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1832 REM BHP #1:*****22
1833 :
1834 REM THIS INDICATES THAT THE FIRST ENTRY FOR THE BHP #1 SHARE APPEARS
1835 REM AT THE 27TH RECORD OF THE 'HISTORY' FILE.
1836 :
1837 REM AS INFERRED, THE SECOND FILE IS CALLED 'HISTORY', ITS RECORDS ARE
1838 REM 21 CHARACTERS LONG AND THE FIELD CONTENT IS AS FOLLOWS:
1839 :
1840 REM CHARACTERS CONTENT
1841 :
1842 REM 1-3 TRADING DATE HELD IN 'YMD' FORMAT WHICH MAY BE
1843 REM READ BY THE 'ASC' FUNCTION (SEE 2010-2014).
1844 REM 4-8 OPENING TRADING PRICE EXPRESSED AS **.CC IN
1845 REM NUMERIC ASCII FORMAT RIGHT-JUSTIFIED.
1846 REM 9-13 CLOSING TRADING PRICE EXPRESSED AS **.CC IN
1847 REM NUMERIC ASCII FORMAT RIGHT-JUSTIFIED.
1848 REM 14-17 VOLUME OF DAILY SALES IN 1000S. THIS IS HELD AS A
1849 REM NUMERIC ASCII STRING RIGHT-JUSTIFIED WITH
1850 REM LEADING SPACES.
1851 REM 18-21 LINK FIELD CONTAINING A FORWARD POINTER TO THIS
1852 REM STOCK'S NEXT ENTRY IN THE 'HISTORY' FILE.
1853 :
1854 REM THE DATA LINES BELOW CONTAIN MACHINE CODE ROUTINES TO FACILITATE DISK
1855 REM FILE ACCESS - IA FULL DISCUSSION OF THESE FEATURES APPEARS IN THE
1856 REM NOTES TO MY PROGRAM 'PITTSBURGH PHIL', APC, APRIL 1986). THE USER
1857 REM WHO WISHES TO DEVELOP HIS/HER OWN DATA EXTRACTION/INTERPRETATION
1858 REM PROGRAMS FOR THE DATA BASE WHICH 'SHARE TRADER' CREATES MAY LIKE
1859 REM TO RETAIN THIS CODE, SINCE IT CERTAINLY REDUCES DISK ACCESS TIME
1860 REM AND GREATLY INCREASES DISK FILE CAPACITY.
1861 :
1862 REM PLEASE NOTE THAT IT IS NOT POSSIBLE TO USE THE EDIT OPTION TO CHANGE
1863 REM THE NAME OF A STOCK DIRECTLY. THIS IS A DELIBERATE OMISSION WHICH
1864 REM TAKES ACCOUNT OF THE FACT THAT THE INDEX FILE IS NEVER SORTED BUT
1865 REM ACQUIRES ITS LEXICOGRAPHIC ORDER BY MERGING ENTRIES AS THEY ARRIVE
1866 REM FROM THE KEYBOARD. WHEN IT BECOMES NECESSARY TO RENAME A STOCK,
1867 REM THE USER SHOULD FIRST RAISE AN ENTRY FOR THE STOCK UNDER ITS NEW
1868 REM NAME AND THEN USE THE 'MERGE RECORDS' OPTION TO LINK BOTH STOCKS'.
1869 REM HISTORIES INTO A SINGLE CHRONOLOGICAL CHAIN OF RECORDS AND DELETE
1870 REM THE OLD STOCK NAME FROM THE INDEX FILE AUTOMATICALLY.
1871 :
1872 REM THE REMARKS ABOVE ALSO APPLY TO 'PITTSBURGH PHIL'. IN THE NOTES THAT
1873 REM WERE PUBLISHED WITH THAT PROGRAM, I IMPLIED THAT THE EDIT OPTION
1874 REM COULD BE EMPLOYED TO ALTER A HORSE'S NAME DIRECTLY; THIS IS INDEED
1875 REM NOT THE CASE. 'PITTSBURGH PHIL' USERS SHOULD ADOPT THE METHOD I
1876 REM HAVE DESCRIBED IN THE PRECEDING PARAGRAPH TO ALTER AN INDEX ENTRY.
1877 :
1878 REM 1878 OPEN1,8,15:OPEN2,8,2,*,*SHARE TRADER,P,W::INPUT#15,A:IFA=63THEN1001
1879 PRINT#2,CHR$(192);IFORX=49102050243:READ#8:D=0:FOR#Y=1102
1880 A=ASC(MID#8,Y,1):*816+A*78(A*9):NEXT:PRINT#2,CHR$(D):NEXT
1881 CLOSE2:CLOSE15:IF#8=0THEN1196
1882 GOTO1197
1883 :
1884 REM FAST IN-MEMORY-SORT (SEE 'ZIPSORT', APC MARCH 1986, PAGE 203)
1885 REM 1891 DATA#9,08,05,02,20:FF,AE,C9,41,F8,87,C9,44,F8,86,4C
1892 DATA#8,AF,08,02,20:FF,AE,C9,41,F8,87,C9,44,F8,86,4C
1893 DATA#9,08,05,02,20:FF,AE,C9,41,F8,87,C9,44,F8,86,4C
1894 DATA#9,07,05,FD,A9,C2,85,FE,28,73,89,28,79,89,F8,68
1895 DATA#9,2C,06,C8,28,73,89,28,79,89,F8,68
1896 DATA#7,AS,48,E9,09,85,72,AD,84,B1,71,C9,81,F8,86,82
1897 DATA#8,2C,A2,16,4C,73,C2,C8,B1,71,A6,82,F8,85,CD,85
1898 DATA#2,8D,EF,8D,85,C2,C8,B1,71,A6,82,F8,85,CD,84,C2
1899 DATA#8,E8,8D,84,C2,AD,83,89,45,88,91,FB,88,18,F8,18
1900 DATA#5,FD,69,84,85,FD,AS,FE,69,89,85,FE,E6,82,08,98
1901 DATA#D,B4,C2,08,83,CE,85,C2,CE,84,C2,AD,84,C2,8D,82
1902 DATA#2,8D,85,C2,8D,83,C2,AD,82,C2,9,82,AD,83,C2,82
1903 DATA#8,88,81,68,4E,83,C2,6E,82,C2,38,AD,84,C2,ED,82
1904 DATA#2,8D,8C,AD,85,C2,ED,83,C2,8D,AD,83,C2,AD,89,85
1905 DATA#2,8D,FF,2C,84,C2,58,81,EB,8E,86,C2,8E,B1,C2,EE
1906 DATA#8,C2,06,83,EE,81,C2,AD,AC,C2,CD,88,C2,AD,AD,C2
1907 DATA#8,1,C2,88,86,AS,82,06,04,F8,AC,AD,83,8D,87,C2
1908 DATA#9,45,CA,18,F8,45,47,85,58,45,48,59,AD,80,C2
1909 DATA#5,71,AD,81,C2,85,72,28,2A,83,85,F8,84,FC,18,AD
1910 DATA#8,C2,AD,82,C2,8D,AC,C2,AD,81,C2,68,83,C2,8D,AF
1911 DATA#2,82,83,8D,87,C2,95,45,CA,18,F8,45,47,85,58,45
1912 DATA#8,85,59,AD,AC,C2,85,71,AD,AF,C2,85,72,28,2A,83
1913 DATA#2C,86,C2,38,51,24,45,38,1C,24,46,38,27,28,2A,83

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1114 DATA#C,28,A2,88,AS,47,AA,48,28,58,8C,F8,82,18,83,4C
1115 DATA#F,C8,4C,84,C2,AD,81,47,D1,FB,88,B1,47,99,51,80
1116 DATA#8,ED,99,EE,AD,82,B1,FB,99,4E,88,B1,47,99,51,80
1117 DATA#8,10,F3,C8,CA,4E,88,D7,CA,51,88,D3,B1,4F,D1,52
1118 DATA#8,CD,F8,EF,88,C2,44,58,38,18,24,46,38,23,AS,47
1119 DATA#4,48,28,AD,8B,AS,FB,AA,FC,28,58,8C,FB,B1,38,AF
1120 DATA#8,32,AD,81,B1,FB,B1,47,88,B1,FB,FC,47,88,AD,98
1121 DATA#3,AD,82,B1,FB,99,4E,88,B1,47,99,51,80,88,18,F3
1122 DATA#8,C4,4E,88,8C,C4,51,80,88,B1,52,81,4F,F8,F1,88
1123 DATA#8,9C,EF,C8,AD,81,85,82,AD,87,85,14,AD,C2,85,15
1124 DATA#8,93,B1,14,99,45,88,88,18,F8,AS,47,85,38,AS,48
1125 DATA#8,59,AD,86,C2,85,71,AD,B1,C2,85,72,28,2A,83,85
1126 DATA#2,84,23,AD,AE,C2,85,71,AD,AF,C2,85,72,28,2A,83
1127 DATA#2,45,38,87,24,46,38,86,AD,84,C2,AD,81,2C,AD,82
1128 DATA#1,22,AA,B1,47,91,22,8A,91,47,88,18,F3,18,AS,14
1129 DATA#6,84,98,82,16,15,85,14,CS,FB,AS,15,ES,FE,98,AD
1130 DATA#C,8F,C8,8D,B1,C2,F8,86,28,D2,FF,EB,D6,F5,4C,74
1131 DATA#4,8D,54,4F,28,4D,41,4E,59,28,44,49,4D,43,4E
1132 DATA#3,49,4F,4E,53,8D,88,8D,41,52,52,41,59,28,53,49
1133 DATA#A,45,53,28,44,49,46,46,45,52,8D,88,88,88,88
1134 DATA#8,88,88,88,88,88,88,88,88,88,88,88,88,88,88
1135 :
1160 REM CODE TO TEST FOR 'RESTORE', 'READ' AND 'MIDB'
1161 DATA#8,73,88,88,C9,8C,F8,8C,C9,87,F8,2C,C9,CA,F8,28,4C,E7,A7
1162 :
1163 REM CODE TO PERFORM 'RESTORE' (OLD AND NEW VERSIONS)
1164 DATA#8,28,73,88,88,88,20,1D,AD,4C,AE,A7,28,9E,AD,28,F7,87,28,13,A6
1165 DATA#4,68,AD,5F,30,81,80,CA,06,41,84,42,4C,AE,A7
1166 :
1167 REM CODE TO PERFORM 'READ' AND 'READB'
1168 DATA#8,28,73,88,C9,23,F8,86,86,AC,4C,AE,A7,28,98,87,28,1E,E1,28
1169 DATA#F,AE,28,9E,87,8A,48,20,FD,AE,28,88,88,85,49,84,4A,28,AS,86,68
1170 DATA#8,75,8A,AD,82,89,61,88,91,49,88,18,F8,C8,28,12,E1,91,62,CB,C4
1171 DATA#1,80,F6,28,CC,FF,4C,AE,A7
1172 :
1173 REM CODE TO ENABLE 'MIDB' AS BOTH FUNCTION AND KEYWORD
1174 DATA#8,28,73,88,C9,23,F8,86,86,AC,4C,AE,A7,28,98,87,28,1E,E1,28
1175 DATA#8,88,B1,64,84,84,28,52,AA,88,81,81,49,85,85,C8,B1,49,85,86
1176 DATA#8,FD,AE,28,9E,87,8A,F8,17,CA,86,84,28,79,88,C9,29,08,84,AF,FF
1177 DATA#8,8C,28,9E,87,8A,88,83,4C,48,82,85,83,68,38,ES,84,C5
1178 DATA#8,88,82,85,83,28,F7,AE,AD,82,28,FF,AE,28,9E,AD,28,AS,86,AD,82
1179 DATA#1,64,85,51,88,81,64,85,58,88,81,64,85,83,83,88,82,85,AS
1180 DATA#8,18,65,84,85,85,98,82,86,84,83,88,81,58,91,85,C8,88,88,86,F7
1181 DATA#C,AE,A7
1182 :
1183 REM CODE TO PERFORM 'ESTR*' (SIMULATES MICROSOFT 'STRING*' FUNCTION)
1184 DATA#A,88,85,8D,28,73,88,C9,5C,F8,86,28,79,88,4C,8D,AE,28,73,88,C9
1185 DATA#A,88,85,8D,28,73,88,C9,5C,F8,86,28,79,88,4C,8D,AE,28,73,88,C9
1186 DATA#E,AD,24,8D,38,8C,20,AA,B1,AS,48,24,AS,65,4C,16,C4,28,82,87
1187 DATA#8,1A,AD,88,B1,22,85,83,68,20,7D,84,AD,88,87,AS,83,88,91,62,88
1188 DATA#8,28,CA,84,C7,AE,4C,46,82
1189 :
1190 REM CODE TO ENGAGE THE FOREGOING FEATURES
1191 DATA#A,88,AD,C2,8D,83,8C,89,83,AD,AD,AD,C3,8D,8A,83,8C,88,83,68
1192 :
1193 REM ENGAGE MACHINE CODE ROUTINES
1194 IF#8=0THEN#8=1:LOAD"-SHARE TRADER",8,1
1195 REM DISPLAY MENU
1196 CLR:PRINTCHR$(142):OPEN1,8
1197 PRINT:CLS:INPUT AND FILE NEW DATA:PRINT*2,VIEW A STOCK'S HISTORY*
1198 PRINT*3,EDIT A STOCK'S RECORD:PRINT*4,FORMAT NEW DATA DISK*
1199 PRINT*5,MERGE RECORDS:PRINT*6,DISPLAY INDEX:PRINT*7,EXIT PROGRAM*
1200 PRINT:CD:IDENTER REQUIRED OPERATION (1-7):INPUT#1,OP#1:PRINT
1201 CLOSE1:ONOP#GOTO1388,1488,1588,1688,1788,1888,1988
1202 GOTO1288
1203 :
1204 REM INPUT AND FILE NEW DATA
1205 CLR:PRINTCHR$(142):OPEN1,8
1206 PRINT:CLS:INPUT AND FILE NEW DATA:PRINT*2,VIEW A STOCK'S HISTORY*
1207 PRINT*3,EDIT A STOCK'S RECORD:PRINT*4,FORMAT NEW DATA DISK*
1208 PRINT*5,MERGE RECORDS:PRINT*6,DISPLAY INDEX:PRINT*7,EXIT PROGRAM*
1209 PRINT:CD:IDENTER REQUIRED OPERATION (1-7):INPUT#1,OP#1:PRINT
1210 CLOSE1:ONOP#GOTO1388,1488,1588,1688,1788,1888,1988
1211 GOTO1288
1212 :
1213 REM INPUT AND FILE NEW DATA
1214 CLR:PRINTCHR$(142):OPEN1,8
1215 PRINT:CLS:INPUT AND FILE NEW DATA:PRINT*2,VIEW A STOCK'S HISTORY*
1216 PRINT*3,EDIT A STOCK'S RECORD:PRINT*4,FORMAT NEW DATA DISK*
1217 PRINT*5,MERGE RECORDS:PRINT*6,DISPLAY INDEX:PRINT*7,EXIT PROGRAM*
1218 PRINT:CD:IDENTER REQUIRED OPERATION (1-7):INPUT#1,OP#1:PRINT
1219 CLOSE1:ONOP#GOTO1388,1488,1588,1688,1788,1888,1988
1220 GOTO1288
1221 :
1222 REM INPUT AND FILE NEW DATA
1223 CLR:PRINTCHR$(142):OPEN1,8
1224 PRINT:CLS:INPUT AND FILE NEW DATA:PRINT*2,VIEW A STOCK'S HISTORY*
1225 PRINT*3,EDIT A STOCK'S RECORD:PRINT*4,FORMAT NEW DATA DISK*
1226 PRINT*5,MERGE RECORDS:PRINT*6,DISPLAY INDEX:PRINT*7,EXIT PROGRAM*
1227 PRINT:CD:IDENTER REQUIRED OPERATION (1-7):INPUT#1,OP#1:PRINT
1228 CLOSE1:ONOP#GOTO1388,1488,1588,1688,1788,1888,1988
1229 GOTO1288
1230 :
1231 REM INPUT AND FILE NEW DATA
1232 CLR:PRINTCHR$(142):OPEN1,8
1233 PRINT:CLS:INPUT AND FILE NEW DATA:PRINT*2,VIEW A STOCK'S HISTORY*
1234 PRINT*3,EDIT A STOCK'S RECORD:PRINT*4,FORMAT NEW DATA DISK*
1235 PRINT*5,MERGE RECORDS:PRINT*6,DISPLAY INDEX:PRINT*7,EXIT PROGRAM*
1236 PRINT:CD:IDENTER REQUIRED OPERATION (1-7):INPUT#1,OP#1:PRINT
1237 CLOSE1:ONOP#GOTO1388,1488,1588,1688,1788,1888,1988
1238 GOTO1288
1239 :
1240 REM INPUT AND FILE NEW DATA
1241 CLR:PRINTCHR$(142):OPEN1,8
1242 PRINT:CLS:INPUT AND FILE NEW DATA:PRINT*2,VIEW A STOCK'S HISTORY*
1243 PRINT*3,EDIT A STOCK'S RECORD:PRINT*4,FORMAT NEW DATA DISK*
1244 PRINT*5,MERGE RECORDS:PRINT*6,DISPLAY INDEX:PRINT*7,EXIT PROGRAM*
1245 PRINT:CD:IDENTER REQUIRED OPERATION (1-7):INPUT#1,OP#1:PRINT
1246 CLOSE1:ONOP#GOTO1388,1488,1588,1688,1788,1888,1988
1247 GOTO1288
1248 :
1249 REM INPUT AND FILE NEW DATA
1250 CLR:PRINTCHR$(142):OPEN1,8
1251 PRINT:CLS:INPUT AND FILE NEW DATA:PRINT*2,VIEW A STOCK'S HISTORY*
1252 PRINT*3,EDIT A STOCK'S RECORD:PRINT*4,FORMAT NEW DATA DISK*
1253 PRINT*5,MERGE RECORDS:PRINT*6,DISPLAY INDEX:PRINT*7,EXIT PROGRAM*
1254 PRINT:CD:IDENTER REQUIRED OPERATION (1-7):INPUT#1,OP#1:PRINT
1255 CLOSE1:ONOP#GOTO1388,1488,1588,1688,1788,1888,1988
1256 GOTO1288
1257 :
1258 REM INPUT AND FILE NEW DATA
1259 CLR:PRINTCHR$(142):OPEN1,8
1260 PRINT:CLS:INPUT AND FILE NEW DATA:PRINT*2,VIEW A STOCK'S HISTORY*
1261 PRINT*3,EDIT A STOCK'S RECORD:PRINT*4,FORMAT NEW DATA DISK*
1262 PRINT*5,MERGE RECORDS:PRINT*6,DISPLAY INDEX:PRINT*7,EXIT PROGRAM*
1263 PRINT:CD:IDENTER REQUIRED OPERATION (1-7):INPUT#1,OP#1:PRINT
1264 CLOSE1:ONOP#GOTO1388,1488,1588,1688,1788,1888,1988
1265 GOTO1288
1266 :
1267 REM INPUT AND FILE NEW DATA
1268 CLR:PRINTCHR$(142):OPEN1,8
1269 PRINT:CLS:INPUT AND FILE NEW DATA:PRINT*2,VIEW A STOCK'S HISTORY*
1270 PRINT*3,EDIT A STOCK'S RECORD:PRINT*4,FORMAT NEW DATA DISK*
1271 PRINT*5,MERGE RECORDS:PRINT*6,DISPLAY INDEX:PRINT*7,EXIT PROGRAM*
1272 PRINT:CD:IDENTER REQUIRED OPERATION (1-7):INPUT#1,OP#1:PRINT
1273 CLOSE1:ONOP#GOTO1388,1488,1588,1688,1788,1888,1988
1274 GOTO1288
1275 :
1276 REM INPUT AND FILE NEW DATA
1277 CLR:PRINTCHR$(142):OPEN1,8
1278 PRINT:CLS:INPUT AND FILE NEW DATA:PRINT*2,VIEW A STOCK'S HISTORY*
1279 PRINT*3,EDIT A STOCK'S RECORD:PRINT*4,FORMAT NEW DATA DISK*
1280 PRINT*5,MERGE RECORDS:PRINT*6,DISPLAY INDEX:PRINT*7,EXIT PROGRAM*
1281 PRINT:CD:IDENTER REQUIRED OPERATION (1-7):INPUT#1,OP#1:PRINT
1282 CLOSE1:ONOP#GOTO1388,1488,1588,1688,1788,1888,1988
1283 GOTO1288
1284 :
1285 REM INPUT AND FILE NEW DATA
1286 CLR:PRINTCHR$(142):OPEN1,8
1287 PRINT:CLS:INPUT AND FILE NEW DATA:PRINT*2,VIEW A STOCK'S HISTORY*
1288 PRINT*3,EDIT A STOCK'S RECORD:PRINT*4,FORMAT NEW DATA DISK*
1289 PRINT*5,MERGE RECORDS:PRINT*6,DISPLAY INDEX:PRINT*7,EXIT PROGRAM*
1290 PRINT:CD:IDENTER REQUIRED OPERATION (1-7):INPUT#1,OP#1:PRINT
1291 CLOSE1:ONOP#GOTO1388,1488,1588,1688,1788,1888,1988
1292 GOTO1288
1293 :
1294 REM INPUT AND FILE NEW DATA
1295 CLR:PRINTCHR$(142):OPEN1,8
1296 PRINT:CLS:INPUT AND FILE NEW DATA:PRINT*2,VIEW A STOCK'S HISTORY*
1297 PRINT*3,EDIT A STOCK'S RECORD:PRINT*4,FORMAT NEW DATA DISK*
1298 PRINT*5,MERGE RECORDS:PRINT*6,DISPLAY INDEX:PRINT*7,EXIT PROGRAM*
1299 PRINT:CD:IDENTER REQUIRED OPERATION (1-7):INPUT#1,OP#1:PRINT
1300 CLOSE1:ONOP#GOTO1388,1488,1588,1688,1788,1888,1988
1301 GOTO1288
1302 :
1303 REM INPUT AND FILE NEW DATA
1304 CLR:PRINTCHR$(142):OPEN1,8
1305 PRINT:CLS:INPUT AND FILE NEW DATA:PRINT*2,VIEW A STOCK'S HISTORY*
1306 PRINT*3,EDIT A STOCK'S RECORD:PRINT*4,FORMAT NEW DATA DISK*
1307 PRINT*5,MERGE RECORDS:PRINT*6,DISPLAY INDEX:PRINT*7,EXIT PROGRAM*
1308 PRINT:CD:IDENTER REQUIRED OPERATION (1-7):INPUT#1,OP#1:PRINT
1309 CLOSE1:ONOP#GOTO1388,1488,1588,1688,1788,1888,1988
1310 GOTO1288
1311 :
1312 REM INPUT AND FILE NEW DATA
1313 CLR:PRINTCHR$(142):OPEN1,8
1314 PRINT:CLS:INPUT AND FILE NEW DATA:PRINT*2,VIEW A STOCK'S HISTORY*
1315 PRINT*3,EDIT A STOCK'S RECORD:PRINT*4,FORMAT NEW DATA DISK*
1316 PRINT*5,MERGE RECORDS:PRINT*6,DISPLAY INDEX:PRINT*7,EXIT PROGRAM*
1317 PRINT:CD:IDENTER REQUIRED OPERATION (1-7):INPUT#1,OP#1:PRINT
1318 CLOSE1:ONOP#GOTO1388,1488,1588,1688,1788,1888,1988
1319 GOTO1288
1320 :
1321 REM INPUT AND FILE NEW DATA
1322 CLR:PRINTCHR$(142):OPEN1,8
1323 PRINT:CLS:INPUT AND FILE NEW DATA:PRINT*2,VIEW A STOCK'S HISTORY*
1324 PRINT*3,EDIT A STOCK'S RECORD:PRINT*4,FORMAT NEW DATA DISK*
1325 PRINT*5,MERGE RECORDS:PRINT*6,DISPLAY INDEX:PRINT*7,EXIT PROGRAM*
1326 PRINT:CD:IDENTER REQUIRED OPERATION (1-7):INPUT#1,OP#1:PRINT
1327 CLOSE1:ONOP#GOTO1388,1488,1588,1688,1788,1888,1988
1328 GOTO1288
1329 :
1330 REM INPUT AND FILE NEW DATA
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1551 PRINT:CD:IDENTER
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PC-SIG is the world's largest distributor of User Supported software with a library containing over 600 disks. Anybody can purchase diskettes for just \$13 each or join as a member. A membership includes a listing of the library on diskettes or in book form, regular newsletters, and discounts on bulk purchases. The following is a small selection from the library . . .

Disk No 5 PC-FILE III V4.0

One of the widest employed user-supported programs, PC-File III is a general purpose menu-driven database manager. Designed for business, professional and home users, it allows you to retrieve data, change it, resequence it and perform queries quickly. It also prepares reports for display, printing or subsequent retrieval by your word processor, all through menus. Reports can be generated in many different layouts.

Disk No 10 CHASM V2.13

This full-featured assembler is ideal for learning assembly language and powerful enough for production coding.

Disk No 78 PC-WRITE V2.6/5

This powerful word processor supports most printers and incorporates 46 printer control files. Notable features include nine help screens, fast edit and save functions, split-screen editing and user configuration of keyboard, display and printer.

Disk No 184 DISKETTE UTILITIES V1.1

The utilities on this disk are grouped into three distinct categories. In the first category, COVER makes a disk-sized directory for easy storage. The second category contains a variety of utilities dealing with functions as diverse as altering file attributes and the creation of RAM disks. The third category has a wide range of unprotected utilities to help make backup copies or transfer copy-protected programs to a hard disk.

Disk No 199 PC-CALC V3.0

This spreadsheet program comes with a tutorial and many advanced features. Math functions include natural logs, power of x, averages and tangents. There are 26 columns by 255 lines with 64 characters per cell. It supplies numeric precision to 14 decimals and flexible print options with onscreen prompts.

Disk No 254 PC-DOS HELP V1.1

These programs offer on-line help capability for DOS commands. Type HELP for a master list of DOS functions. This disk is especially convenient for hard disks where it can be called on at any time.

Disk No 273 BEST UTILITIES V1.0

This is a compilation of the better utilities from the PC-SIG library. Most of the programs require DOS 2.0 or above.

Disk No 274 BEST GAMES V1.0

This is a compilation of the better games from the PC-SIG library.

Disk No 293 ARCADE GAMES V1.0

An assortment of colourful arcade games that will catch and hold the attention of game fans for hours.

Disk No 310 QMODEM V2.0e

This telecommunications program supports, among others, Hayes and Racal Vadic modems. It runs up to 9600 baud and features windowing, screen colour definition XModem protocol, autodial/redial.

Disk No 344 & 345 PC-KEY DRAW V1.0

This disk is composed of programs offering keyboard to screen drawing, graphics printing, and slide show capability. Built-in technical functions allow it to be used as a CAD system. It requires colour graphics.

Disk No 376 PATCHES V1.0

The programs on this disk allow the placement of specifically indicated programs on hard disks and the creation of backup copies.

Disk No 403 PC-TUTOR V4.2

This disk contains tutorials that cover the basics of a first course in computer usage and the IBM PC disk operating system. It also has a program that reads coded text files.

Disk No 405 PC-DESKMATES V1.1

The memory-resident accessory program can be called from any program or from DOS. It includes alarm clock, calculator, calendar, selected DOS commands, notepad, phone dialer, printer control and typewriter.

Disk No 480 PC-OUTLINE V1.04

PC-OUTLINE is comparable to ThinkTank. Users can outline and organise items by arranging and rearranging them using different classifications.

Disk No 523 SIDE WRITER

Side Writer allows printing of reports and other materials that do not fit in the number of columns across a page because it prints down the length of the sheet instead of across the width.

Disk No 599 to 603 DREAM

DREAM (Data Retrieval, Entry and Management) is a relational database program that comes in 5 diskettes. It has extreme power and flexibility. It can be used to custom design data base systems, reports, sorting agilities, query abilities and data entry and retrieval abilities. Complete with over half a diskette of manual and help facilities. It could be called an application's generator with over 32,000 records per data file and over 1,500 characters per fixed record length.

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2100 :
2109 REM DECODE LINK TO NEXT RECORD
2110 NDX=VAL(RIGHT$(K$,4)):RETURN
2111 :
2112 REM UNPACK INCOMING HISTORY RECORD
2113 :
2114 REM UNPACK INCOMING HISTORY RECORD
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2116 REM UNPACK INCOMING HISTORY RECORD
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2197 REM UNPACK INCOMING HISTORY RECORD
2198 REM UNPACK INCOMING HISTORY RECORD
2199 REM UNPACK INCOMING HISTORY RECORD
2200 REM UNPACK INCOMING HISTORY RECORD
2201 REM UNPACK INCOMING HISTORY RECORD
2202 REM UNPACK INCOMING HISTORY RECORD
2203 REM UNPACK INCOMING HISTORY RECORD
2204 REM UNPACK INCOMING HISTORY RECORD
2205 REM UNPACK INCOMING HISTORY RECORD
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2207 REM UNPACK INCOMING HISTORY RECORD
2208 REM UNPACK INCOMING HISTORY RECORD
2209 REM UNPACK INCOMING HISTORY RECORD
2210 REM UNPACK INCOMING HISTORY RECORD
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2218 REM UNPACK INCOMING HISTORY RECORD
2219 REM UNPACK INCOMING HISTORY RECORD
2220 REM UNPACK INCOMING HISTORY RECORD
2221 REM UNPACK INCOMING HISTORY RECORD
2222 REM UNPACK INCOMING HISTORY RECORD
2223 REM UNPACK INCOMING HISTORY RECORD
2224 REM UNPACK INCOMING HISTORY RECORD
2225 REM UNPACK INCOMING HISTORY RECORD
READY.
    
```



Amiga RAM disk tip by Mark Kelly



This program is available electronically through Microtex 666's software downloading service. It is accessed through Viatel page *66637#

The simplest way to create a RAM disk is the well-known
MAKEDIR RAM:C
COPY SYS:C TO RAM:C all quiet
ASSIGN C: RAM:C

The problem with a complete copy of the C directory to RAM is, of course, its size (about 128k), but most of the copied commands are rarely used.

To reduce the list of C commands copied to RAM slims the RAM disk, but it causes problems when an uncopied command is needed. In such cases it's necessary to give the full pathname of the command, for example:
 1> sys:c/filename
 to force AmigaDOS to use SYS:C rather than the ASSIGNED RAM:C to get the

command.
 The new PATH command on Workbench 1.2 solves the problem. By adding RAM:C and SYS:C to the PATH searched by DOS, commands in RAM:C are executed if available, otherwise a copy is taken from SYS:C on disk.
 This means the RAM: disk can be kept to the bare minimum of-used commands (DIR, COPY, CD etc.) but the others are still easily available without you giving elaborate path names or even having to remember which commands are in RAM:C and which aren't.
 My RAM disk, batch file is as follows. I put an EXECUTE RAMDISK in s/startup-

sequence on my CLI disks.
 Note about invoking RAM disk under Workbench 1.2.
 To get the RAM icon when operating under Workbench, add the following lines:
 CD RAM:
 CD SYS:
 in s/startup-sequence anywhere before the ENCLI > NIL: line. This will invoke the RAM icon when Workbench is loaded. As a side note, do not try to remove RAM window icons into the Trashcan! It gives you unnecessary copies of the file on disk. Use the menu DISCARD command instead.

```

; RAM disk by Mark Kelly
echo "CREATING RAM DISK"
path reset

; need to reset path if it's necessary to DELETE an existing
; RAM:C. You can't delete it if it's in use.
if exists ram:c
echo "Deleting existing RAM:C"
delete ram:c all quiet
endif

makedir ram:c
path add ram:c
path add sys:c
cd sys:c

copy copy to ram:c ;bare bones CLI needs
assign c: ram:c ;use RAM:C/copy to speed the process
copy rename to ram:c
copy cd to ram:c
copy delete to ram:c
copy dir to ram:c
copy execute to ram:c
copy info to ram:c
copy list to ram:c
copy makedir to ram:c
copy run to ram:c
copy type to ram:c
cd :
echo "Current path is"
path show
    
```

RAM disk by Mark Kelly
 echo "CREATING RAM DISK"
 path reset
 ; need to reset path if it's necessary to DELETE an existing
 ; RAM:C. You can't delete it if it's in use.
 if exists ram:c
 echo "Deleting existing RAM:C"
 delete ram:c all quiet
 endif
 makedir ram:c
 path add ram:c
 path add sys:c
 cd sys:c
 copy copy to ram:c ;bare bones CLI needs
 assign c: ram:c ;use RAM:C/copy to speed the process
 copy rename to ram:c
 copy cd to ram:c
 copy delete to ram:c
 copy dir to ram:c
 copy execute to ram:c
 copy info to ram:c
 copy list to ram:c
 copy makedir to ram:c
 copy run to ram:c
 copy type to ram:c
 cd :
 echo "Current path is"
 path show

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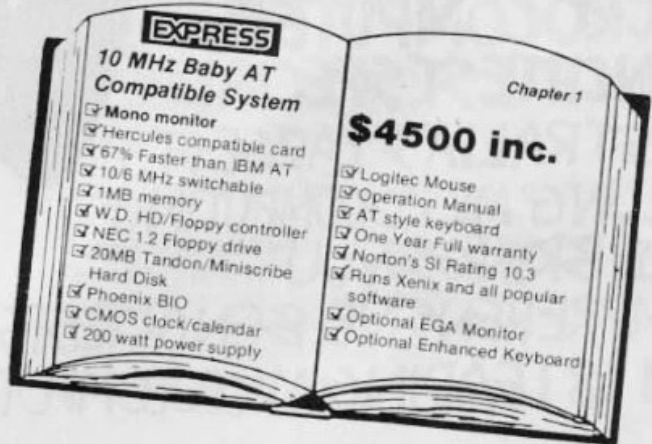
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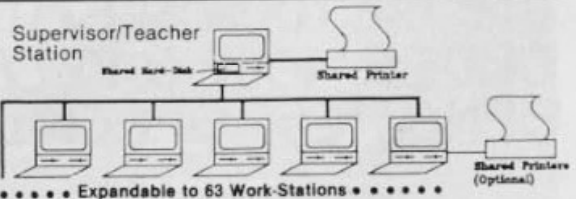
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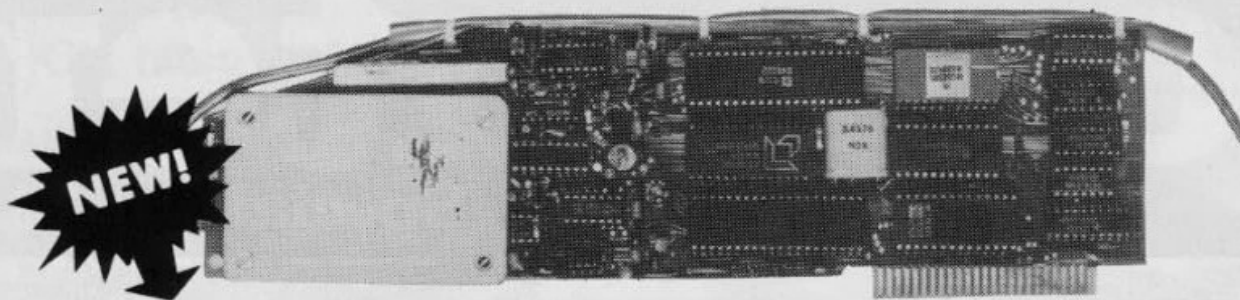
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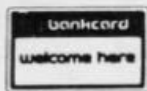
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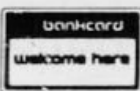
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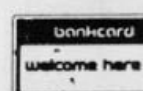
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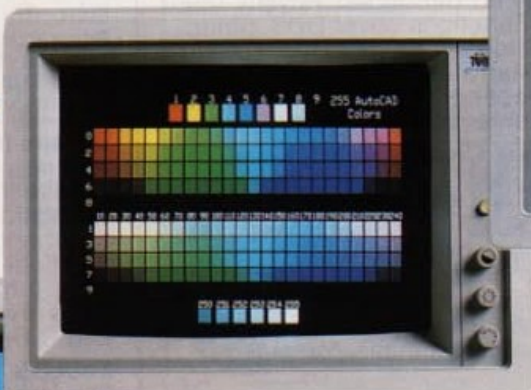
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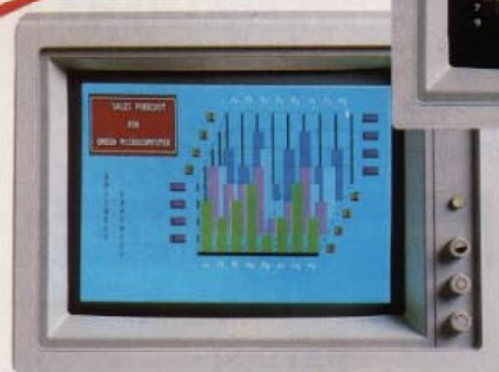
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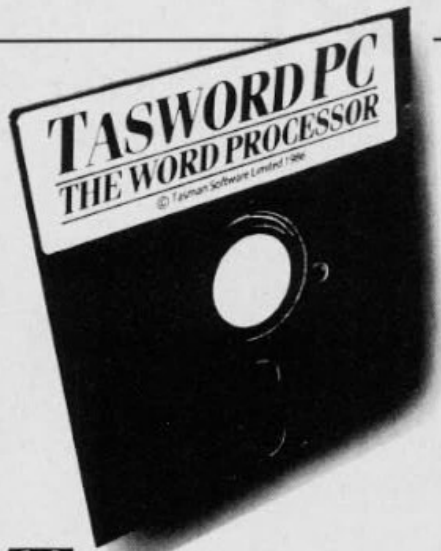


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