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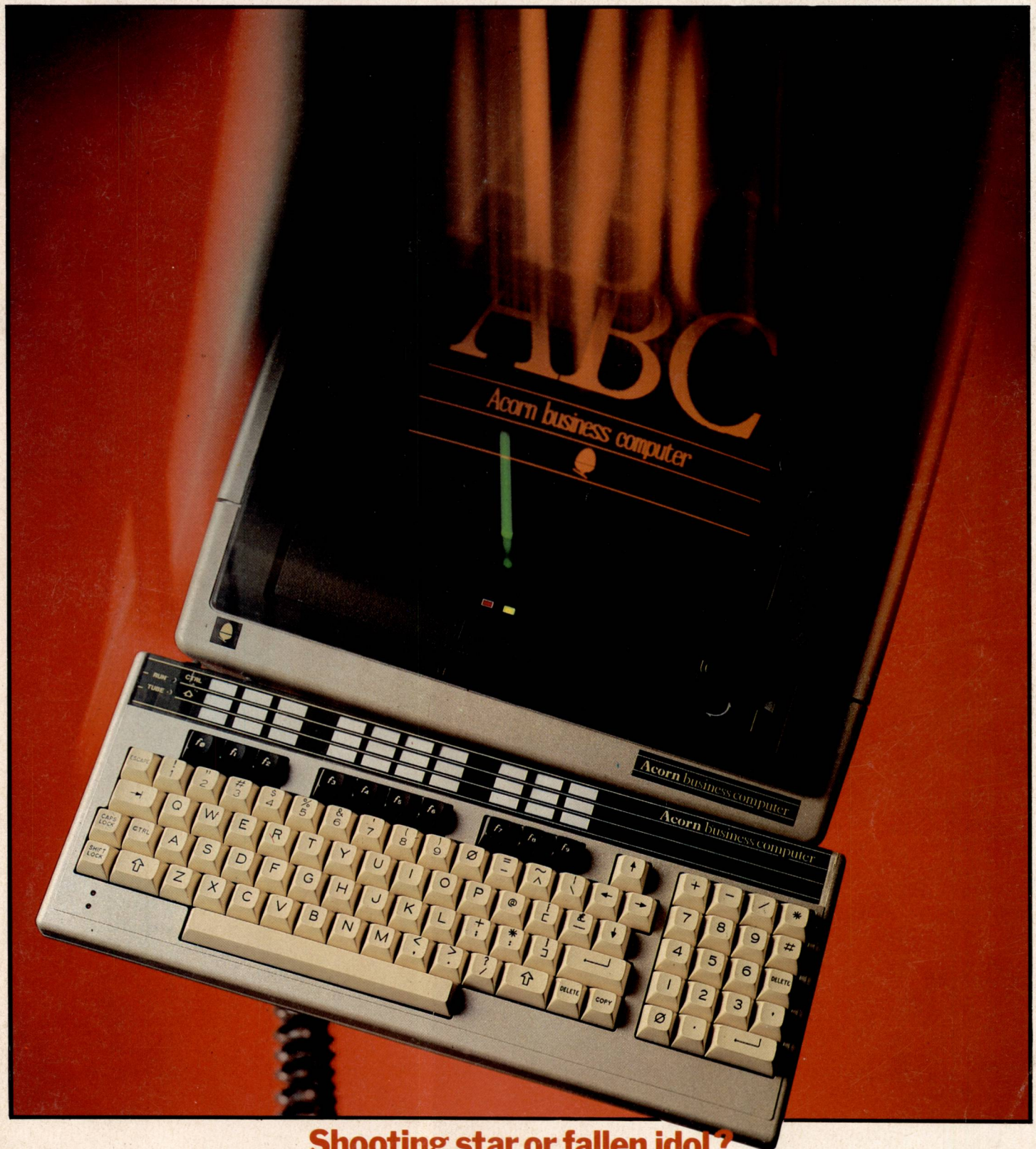

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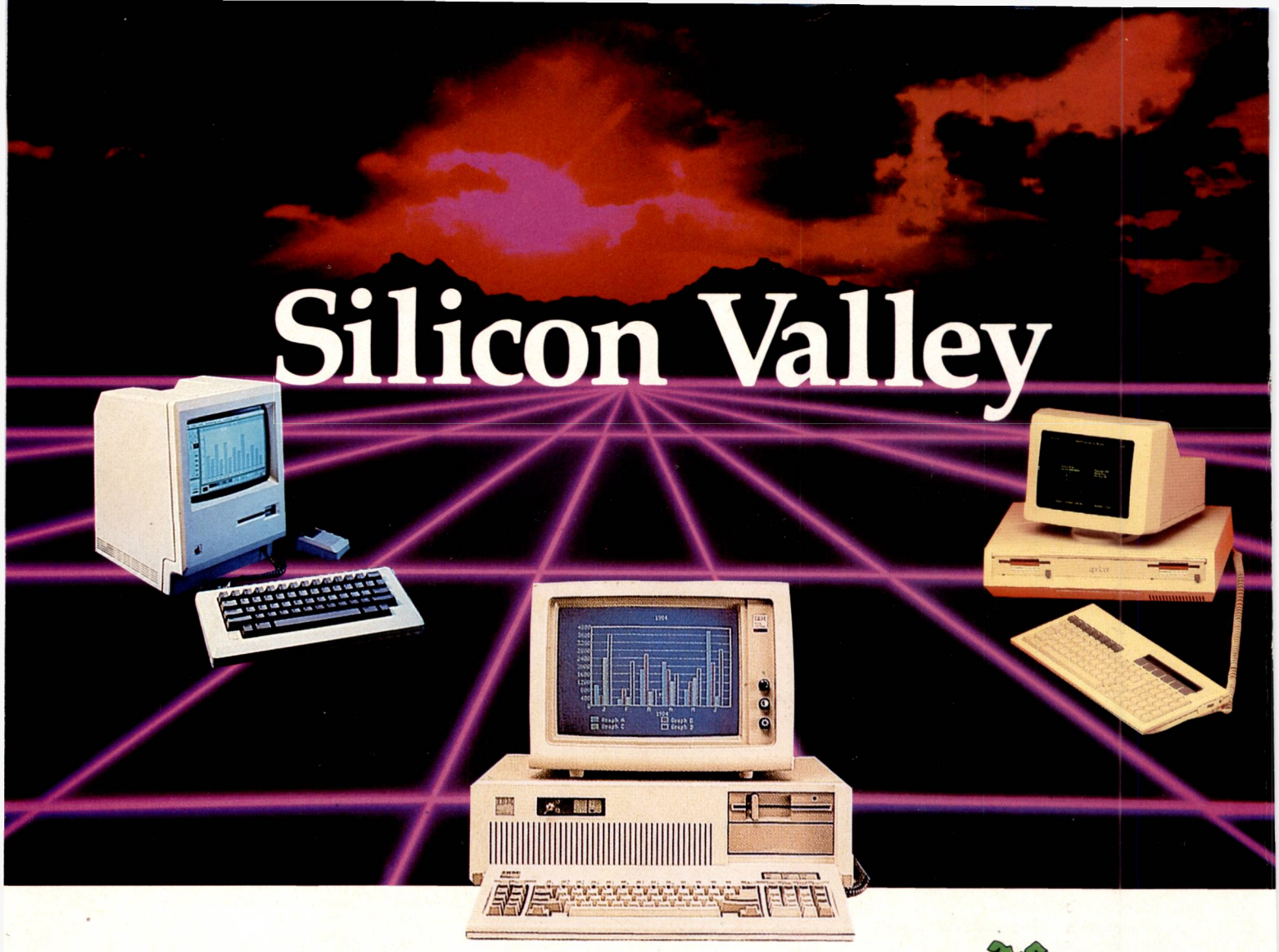

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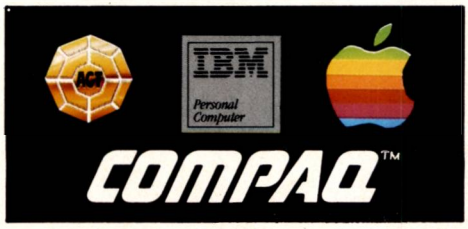

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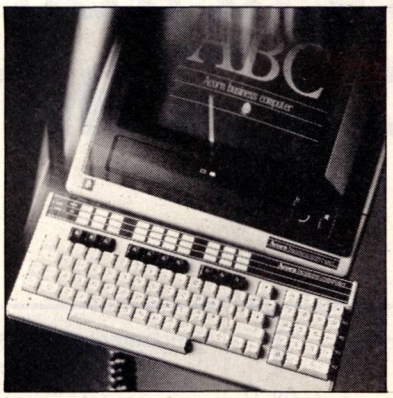

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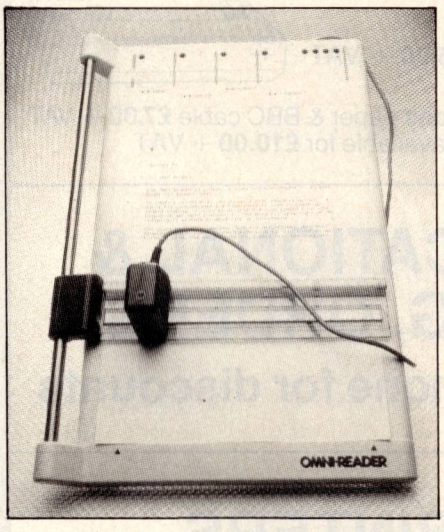

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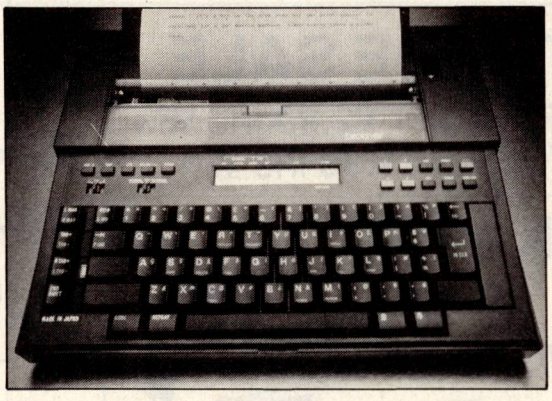

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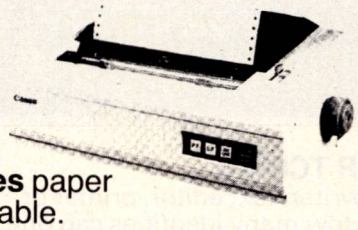

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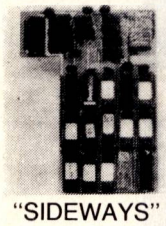

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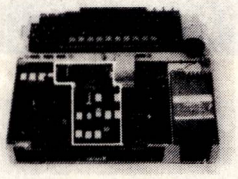

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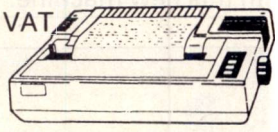

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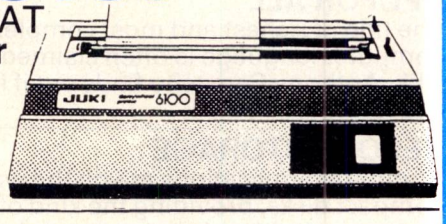

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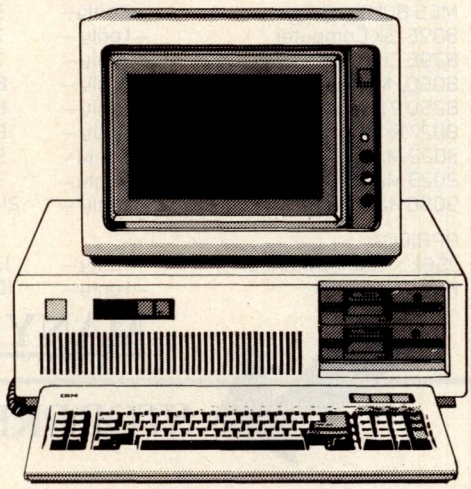

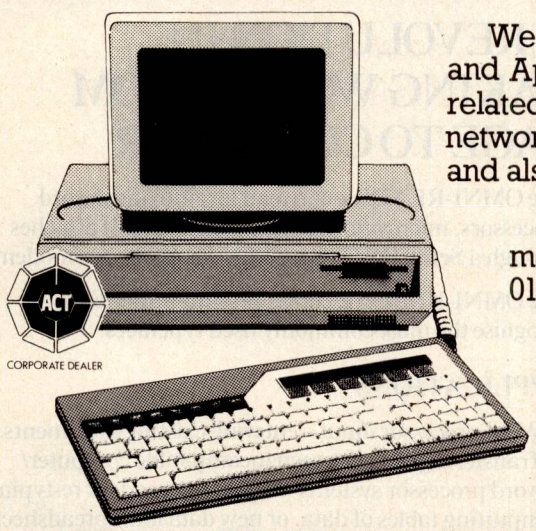

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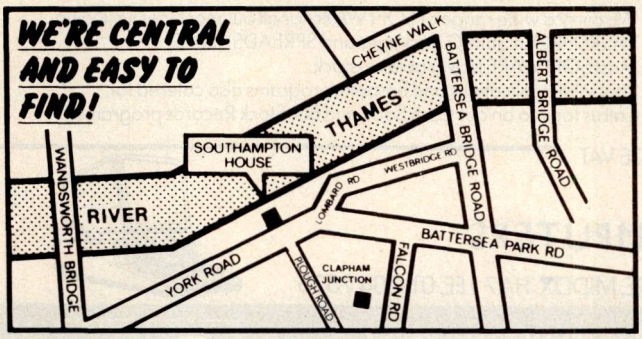

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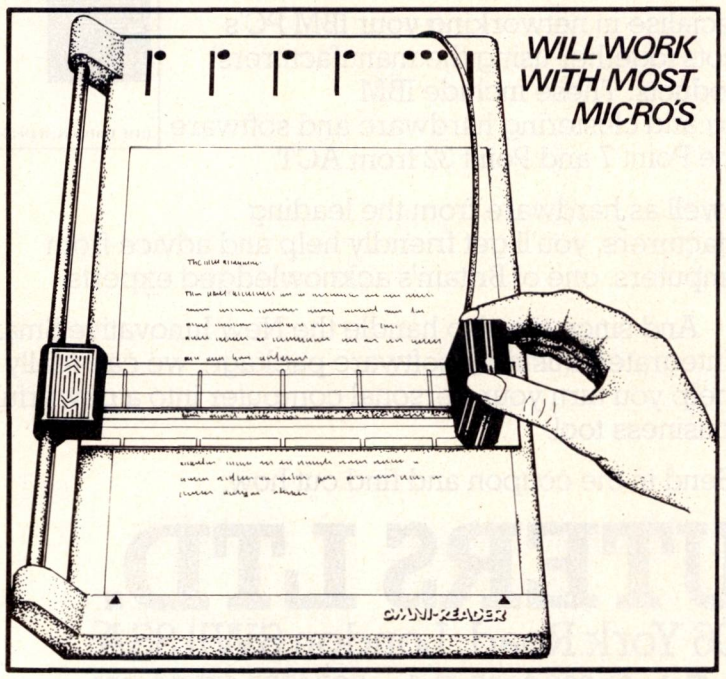

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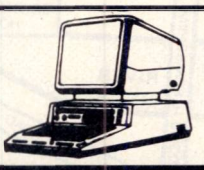

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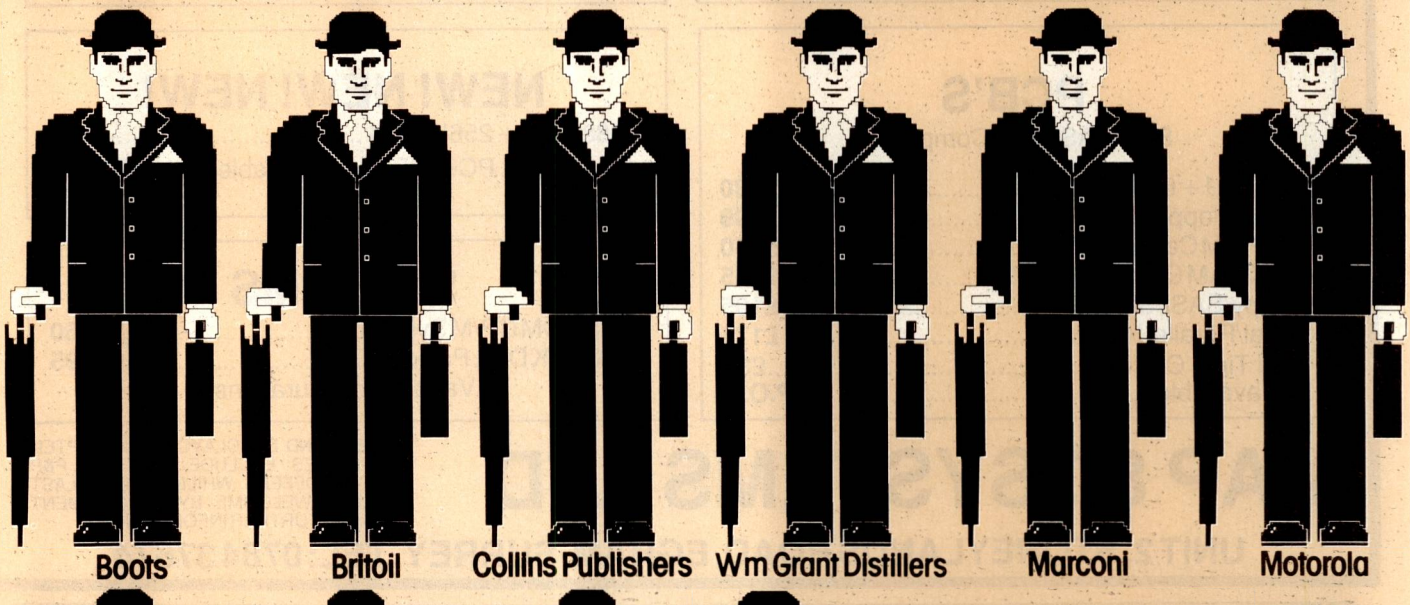

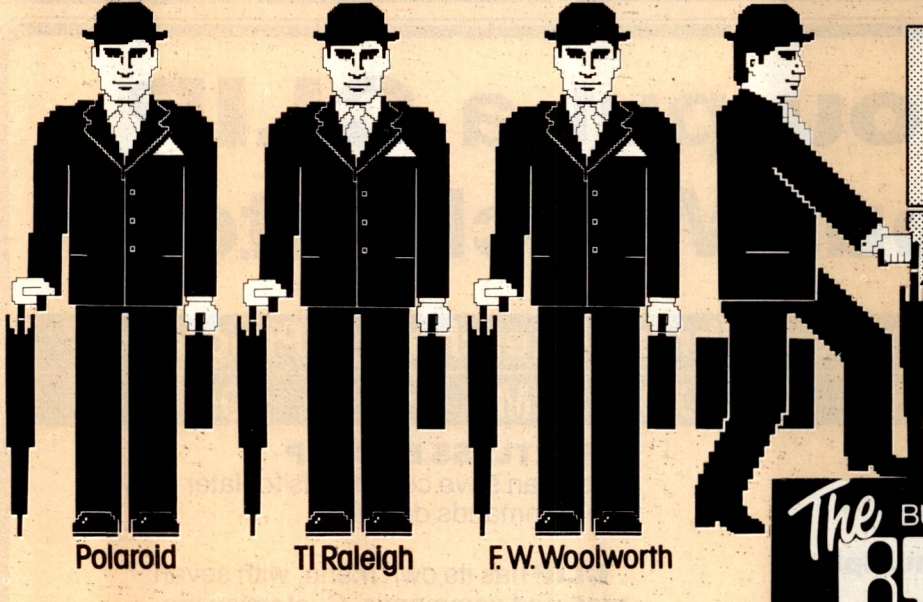

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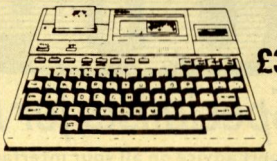

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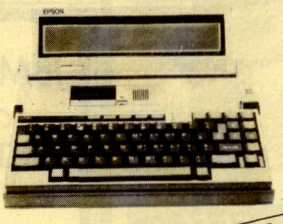

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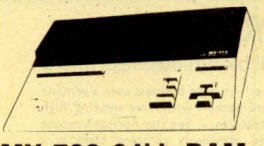

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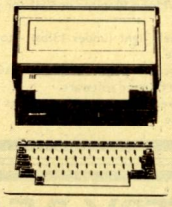

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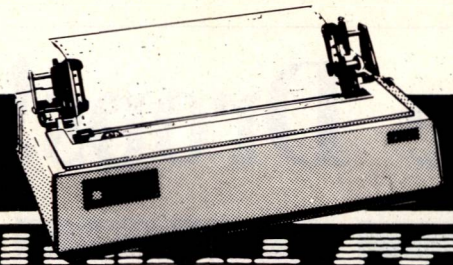

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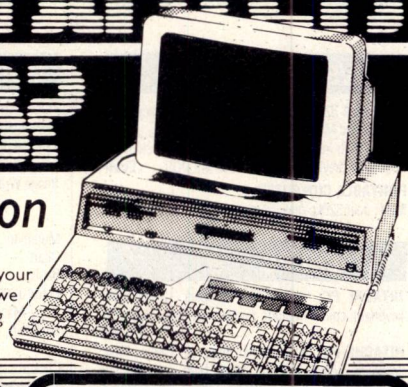

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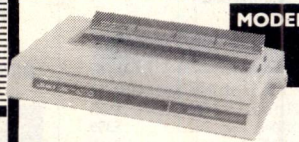

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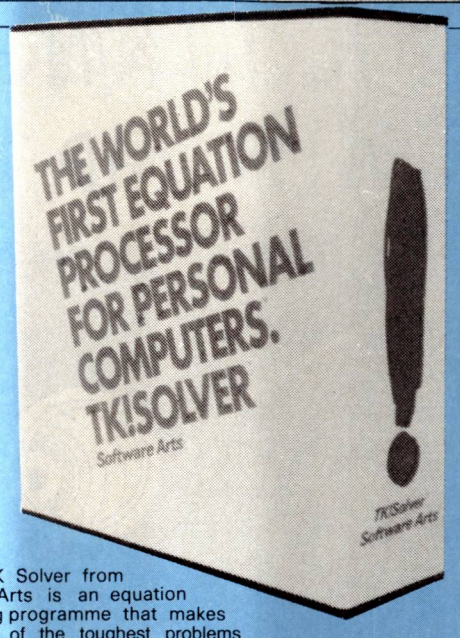

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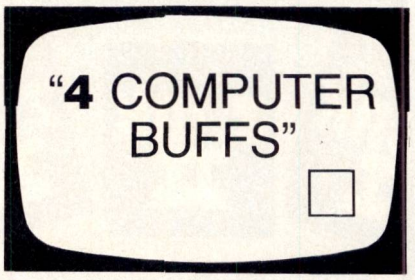

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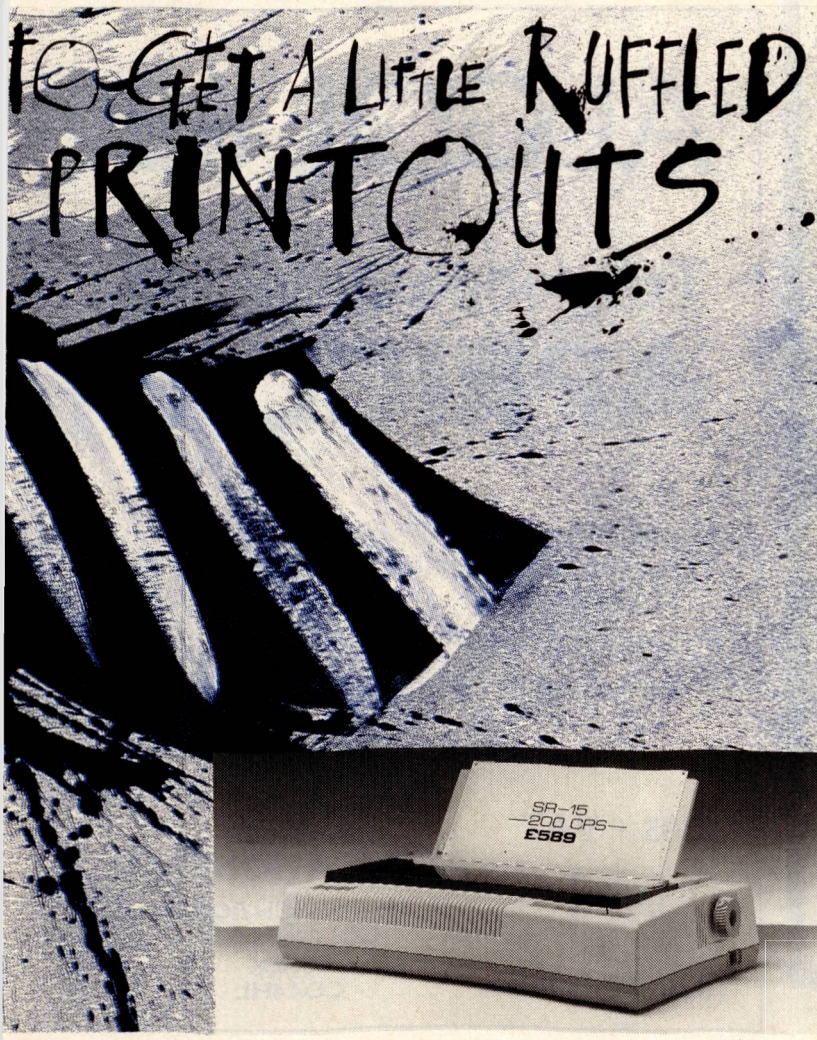

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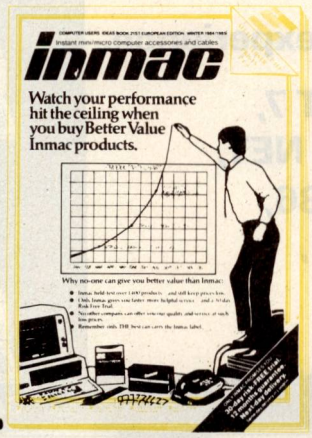

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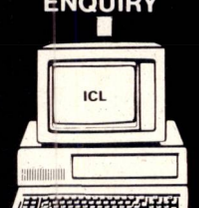

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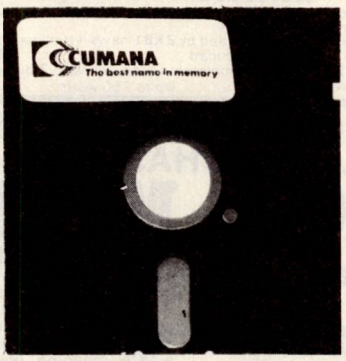

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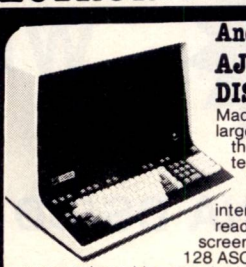

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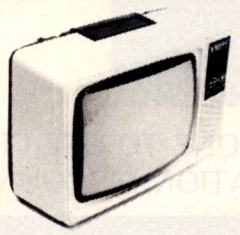

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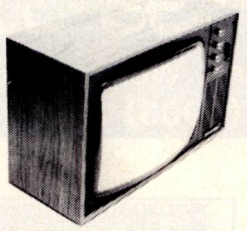

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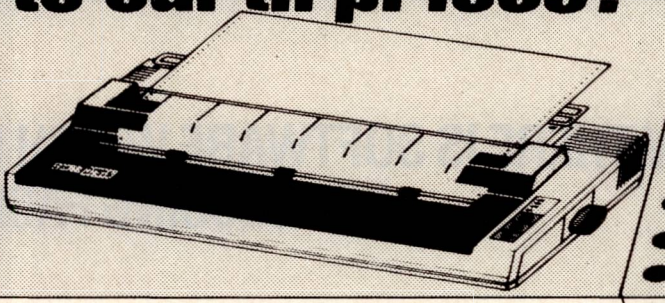

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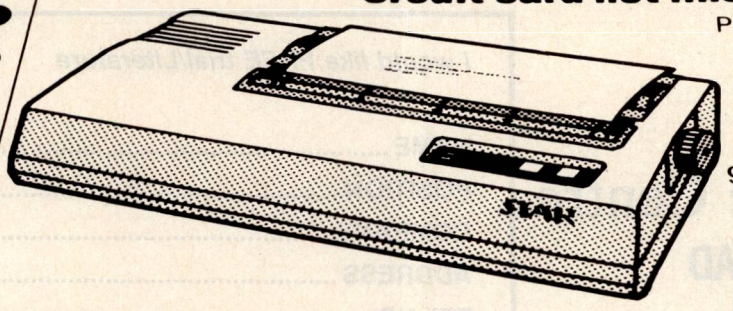

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INTEGRATED SYSTEM SOFTWARE Lotus 1.2.3.	IS01	1 day
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Framework	IS05	2 days
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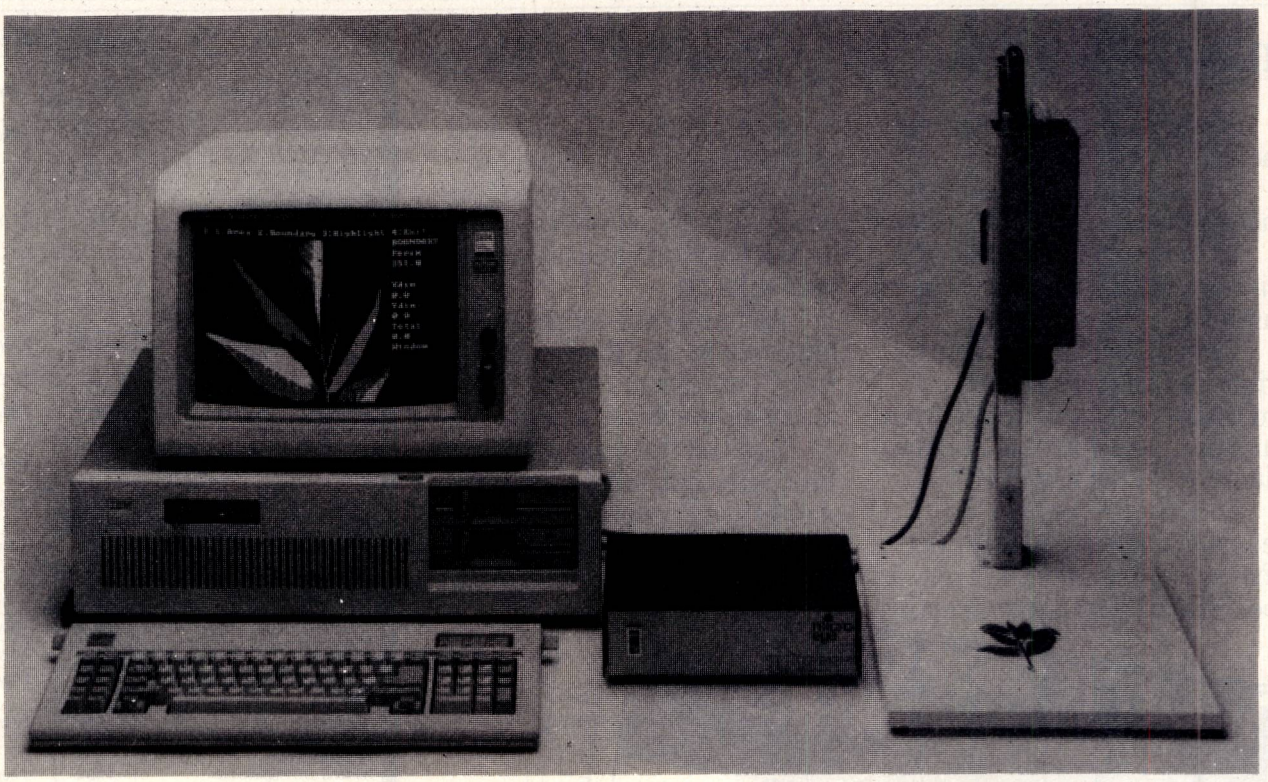

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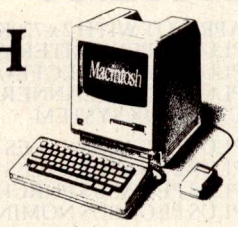

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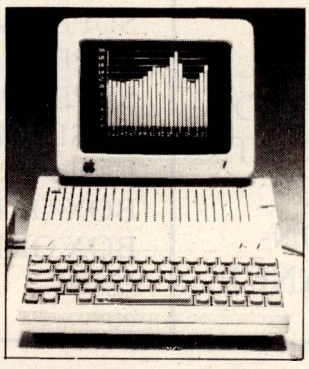

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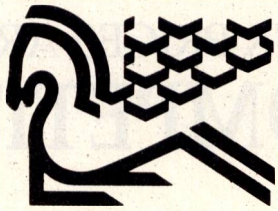

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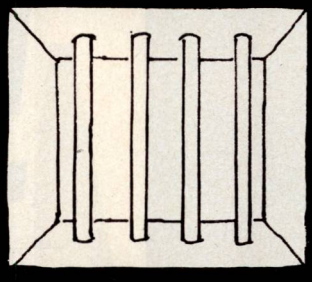

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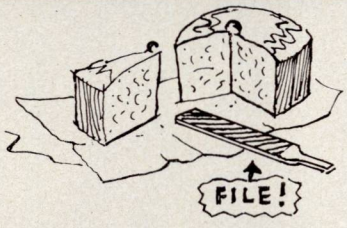

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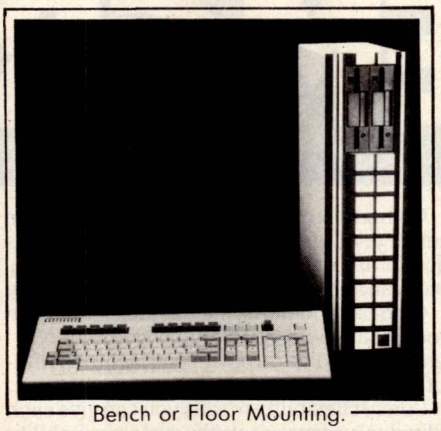

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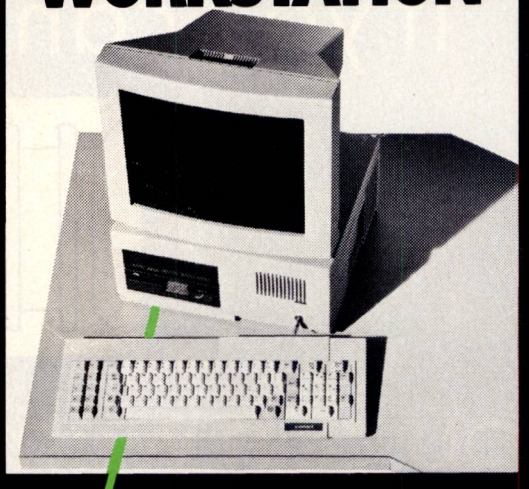

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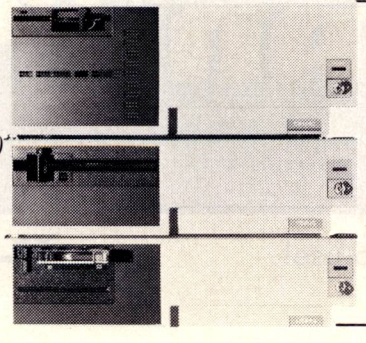

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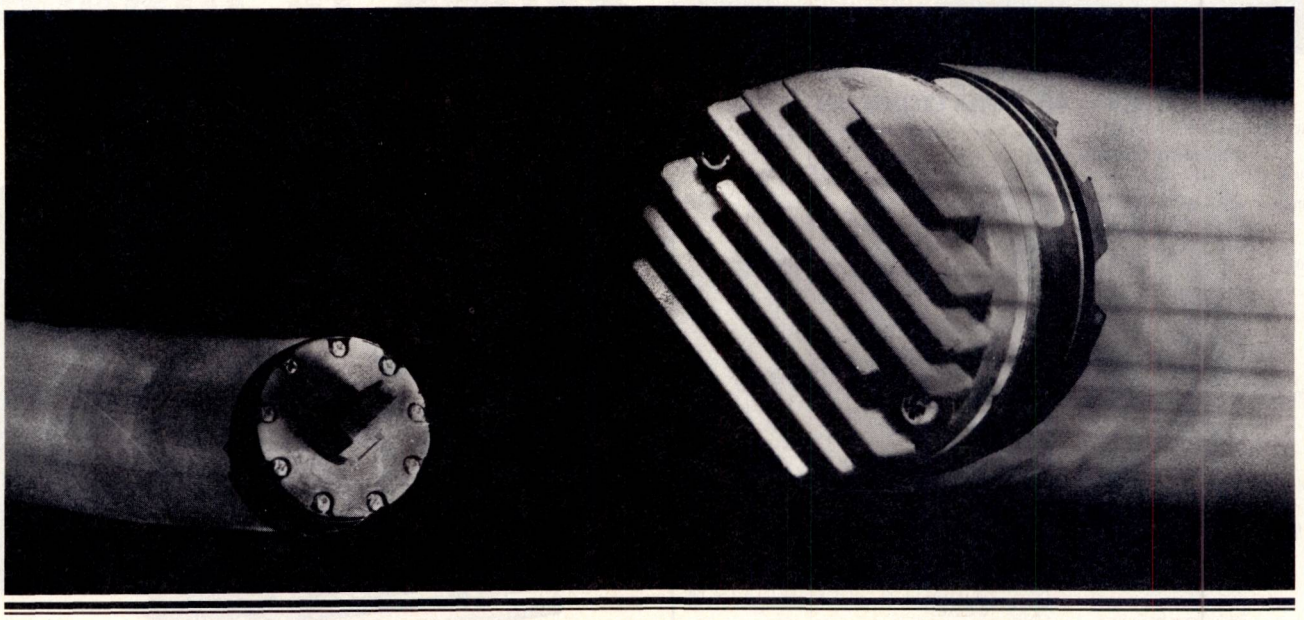

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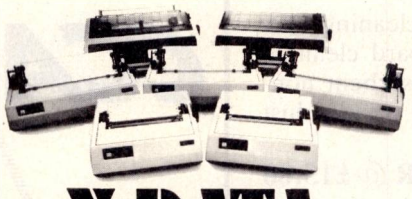

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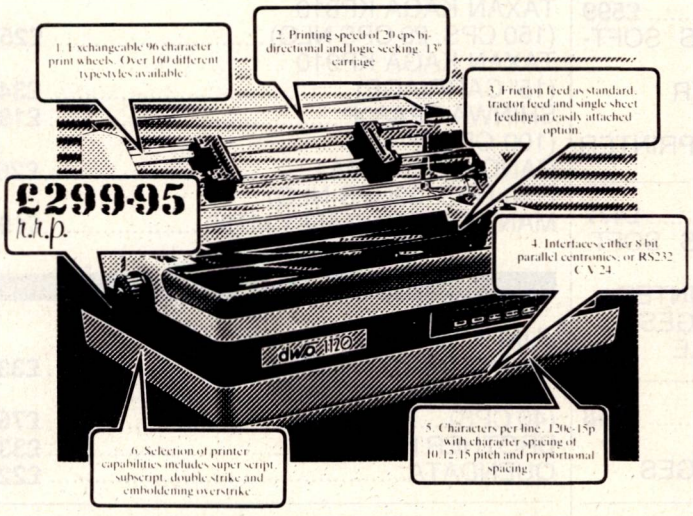

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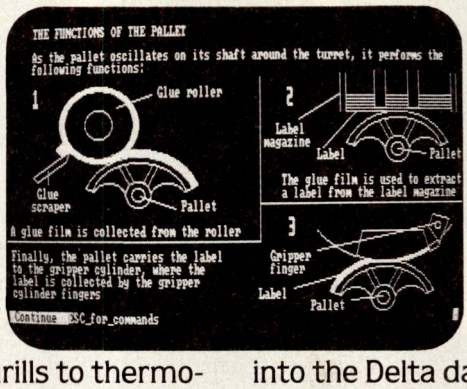

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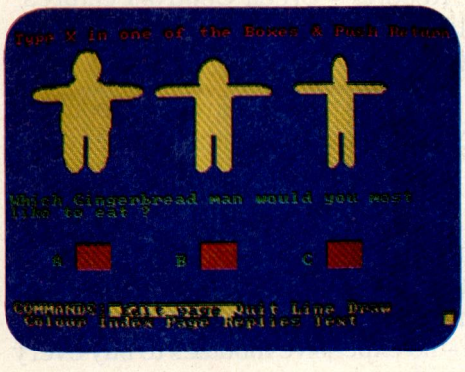

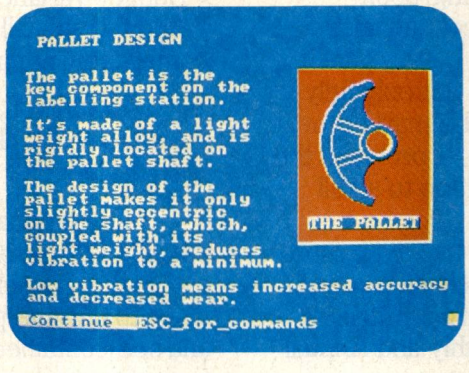

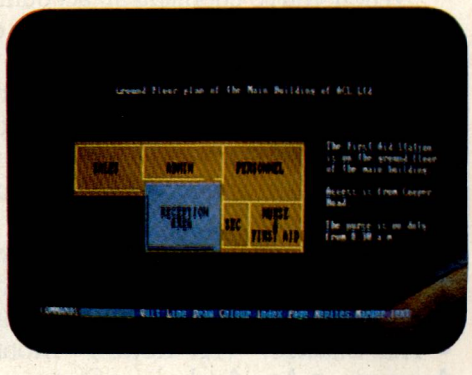

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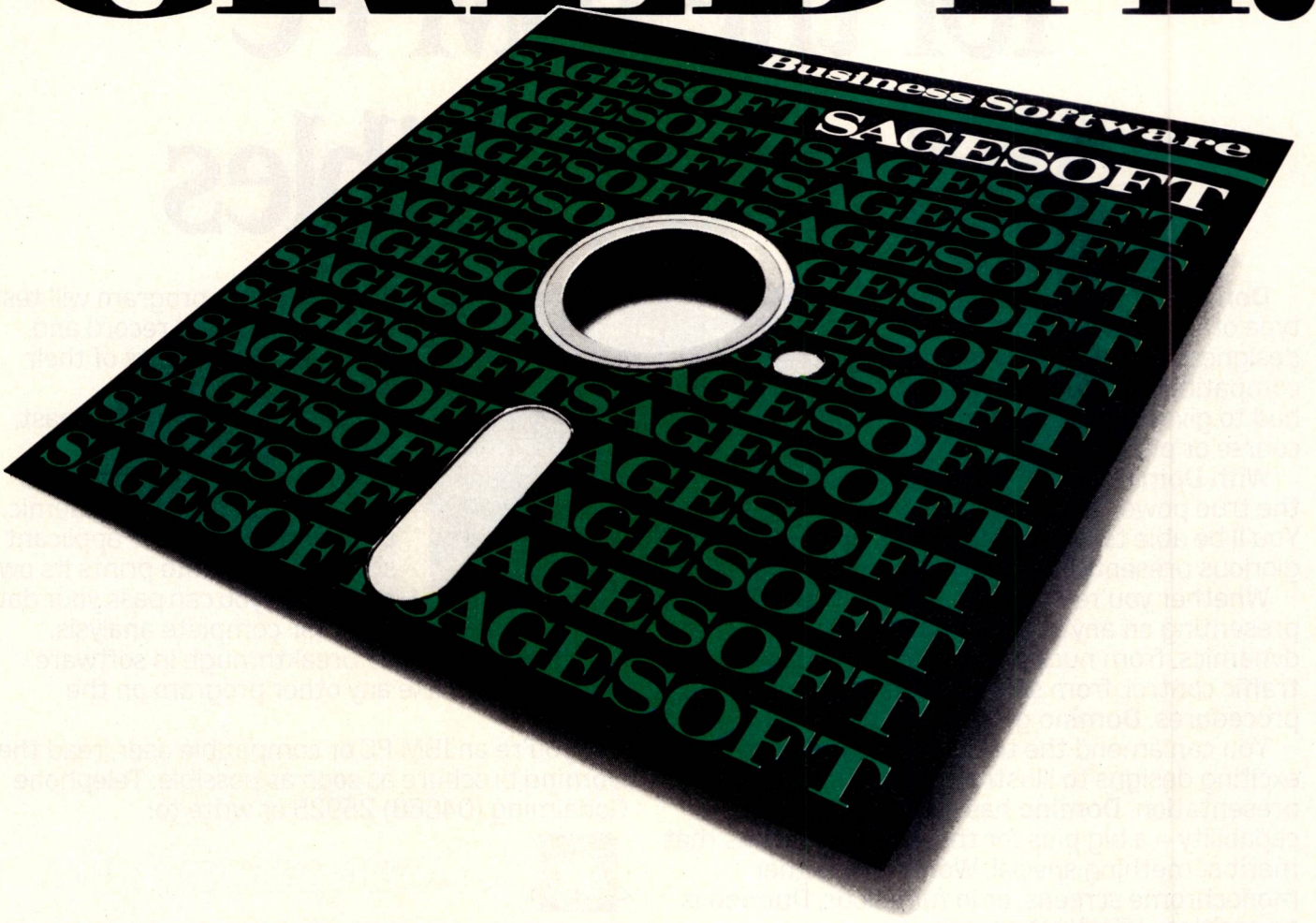

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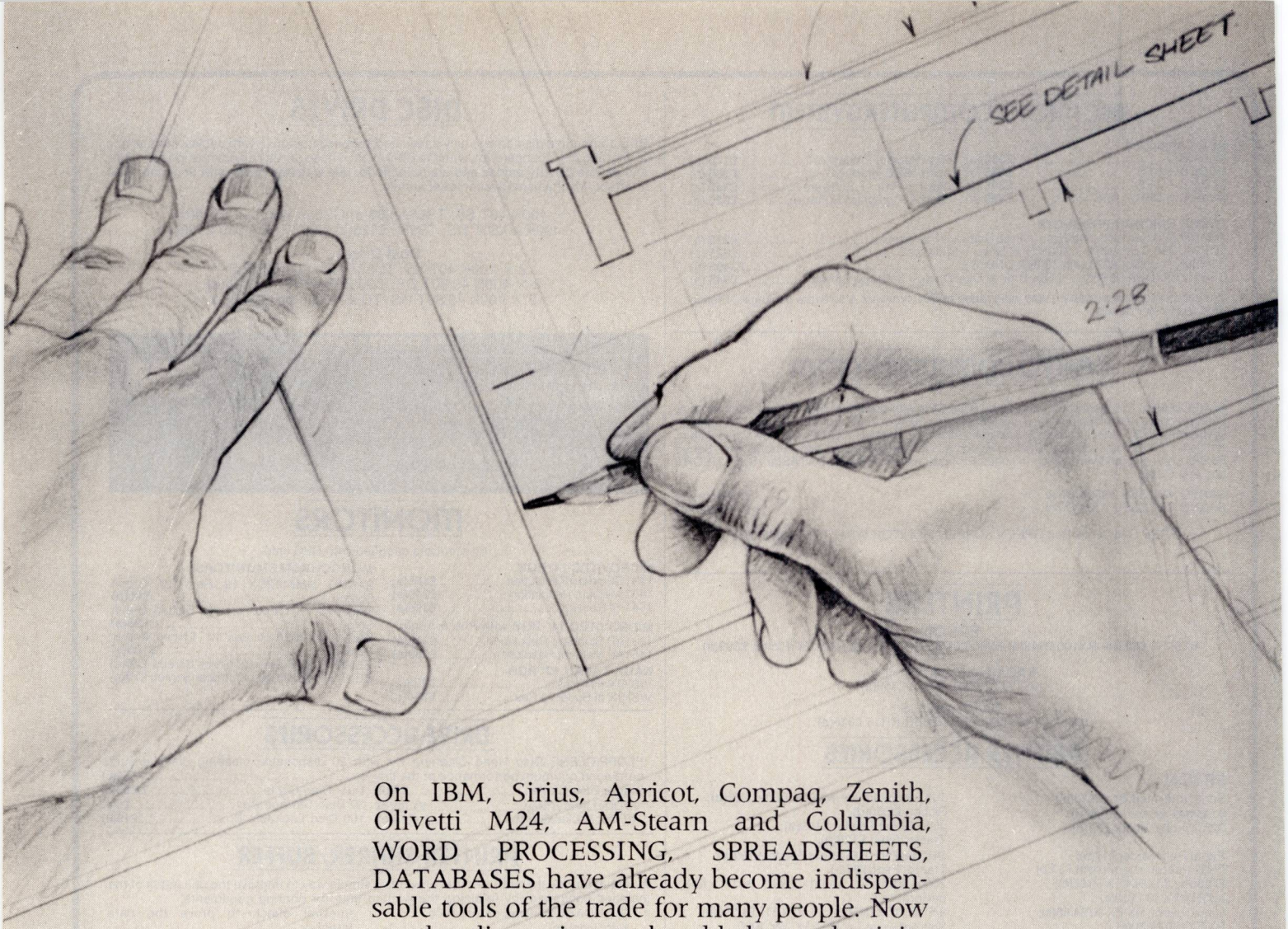

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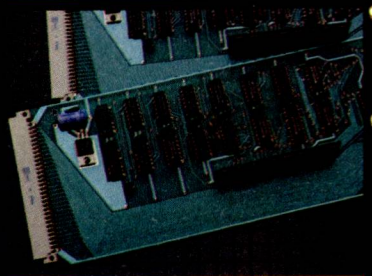

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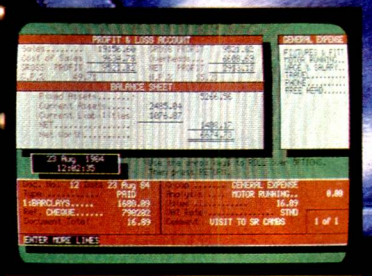

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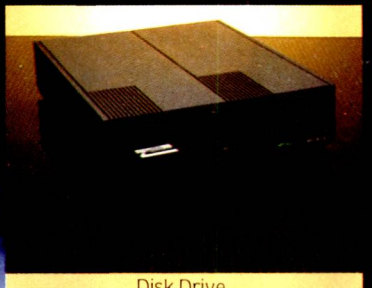

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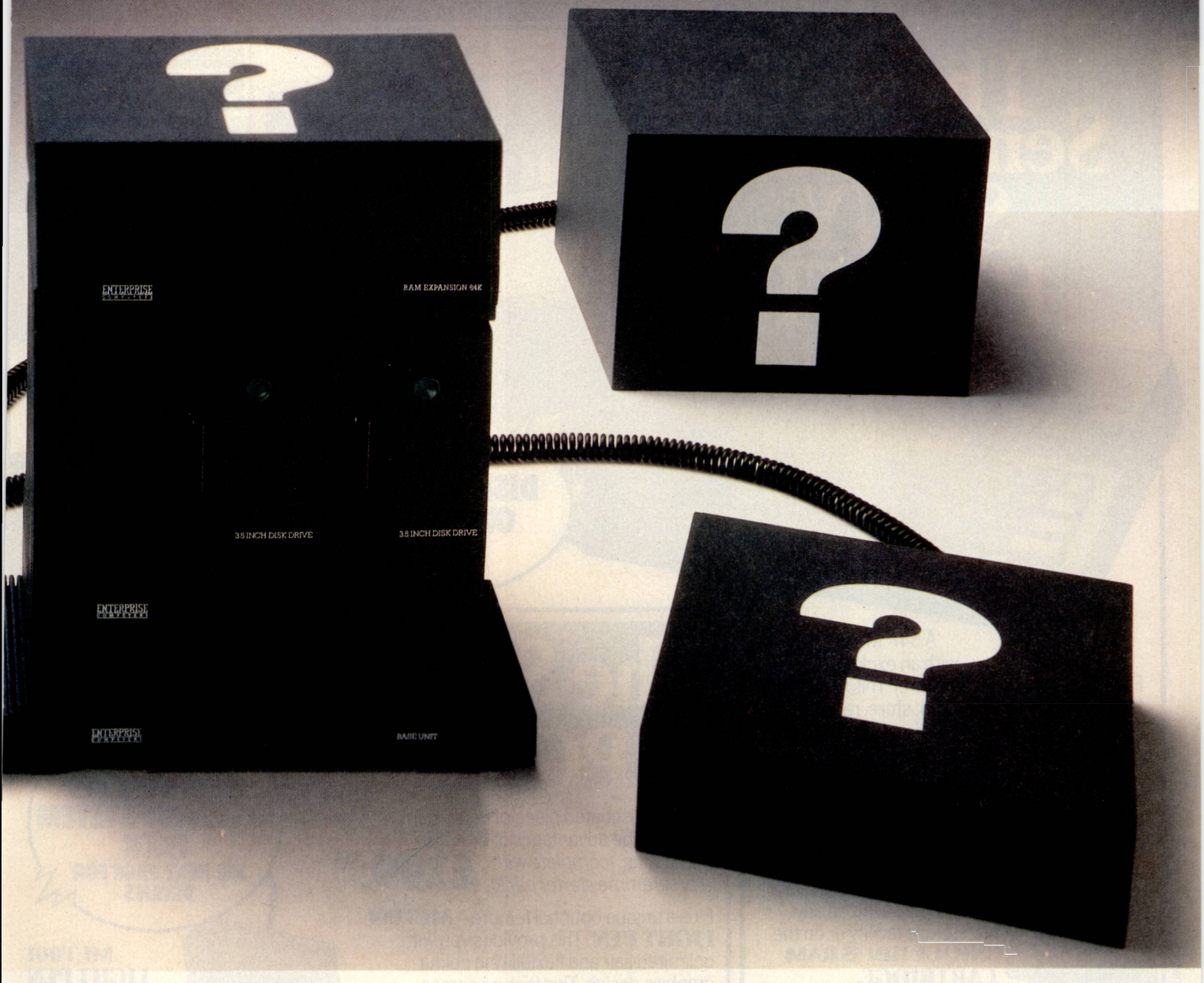

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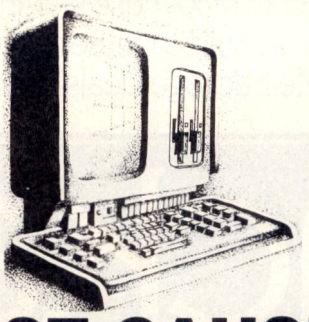

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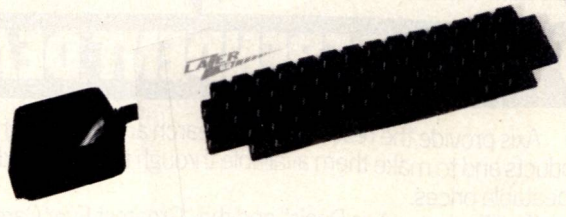

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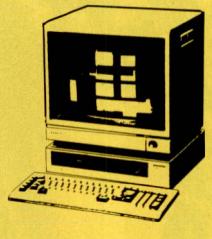

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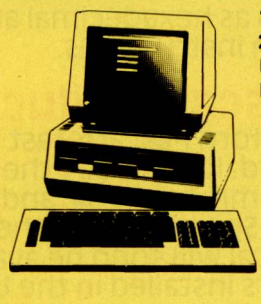

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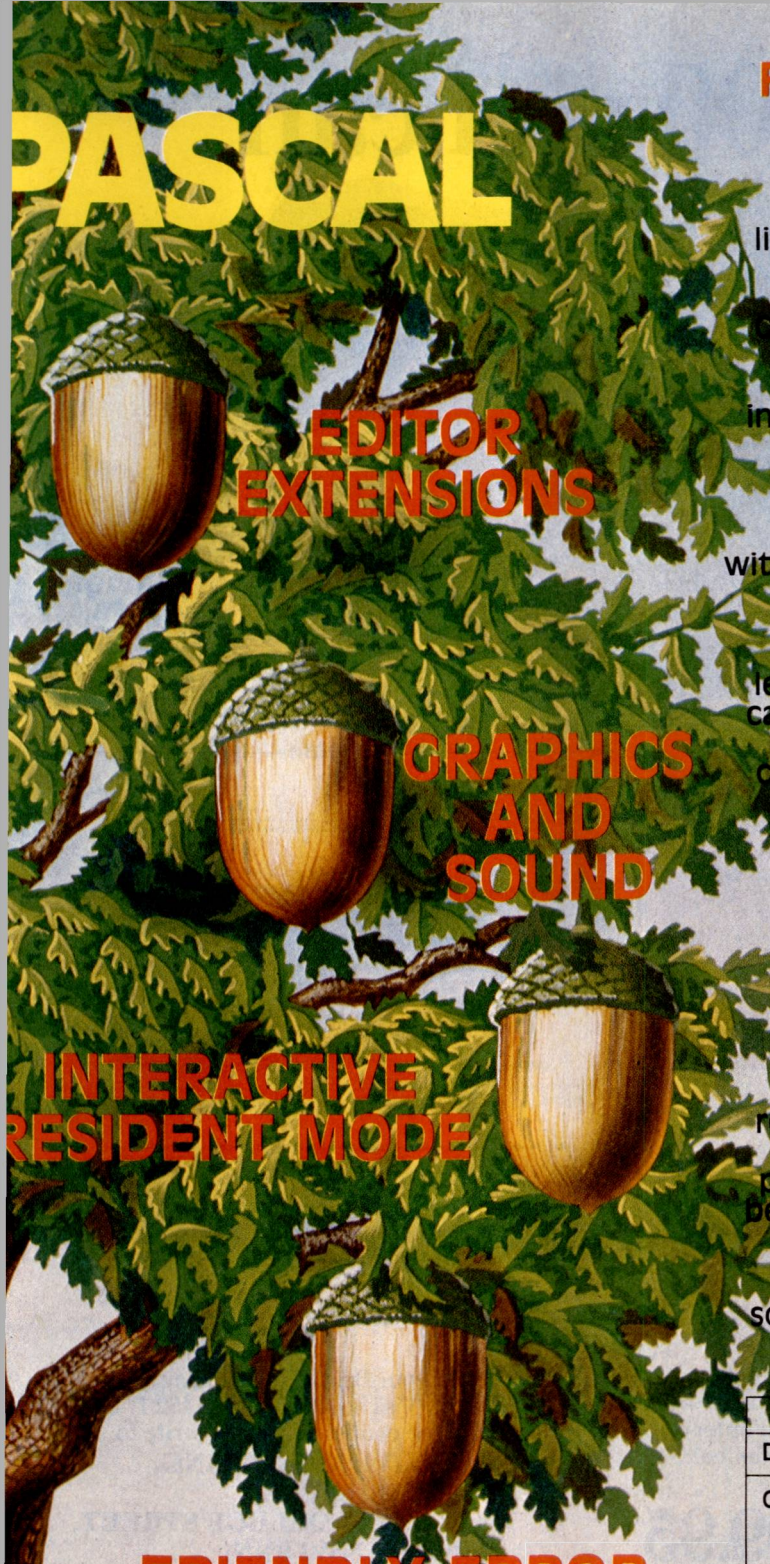

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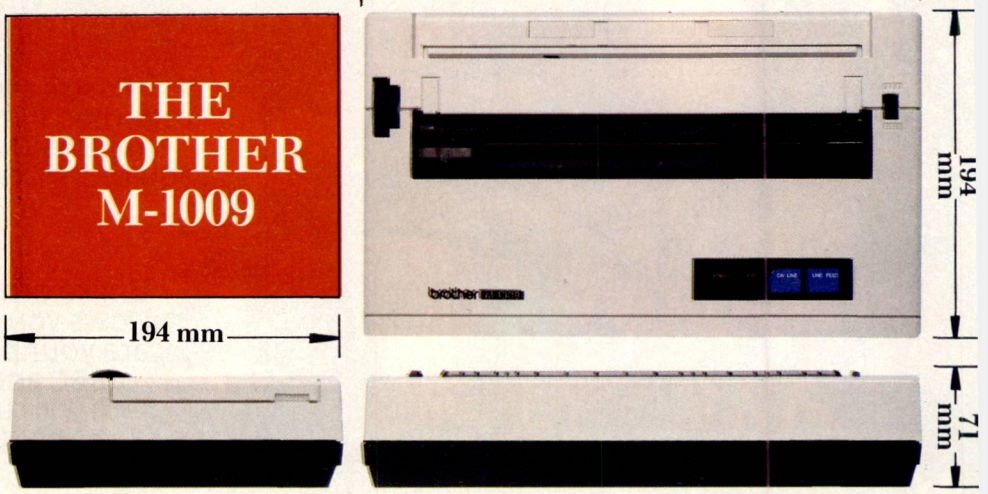

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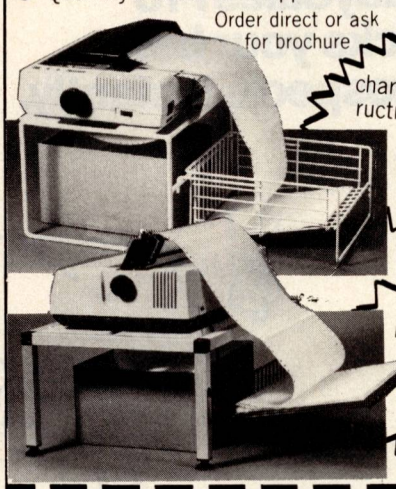

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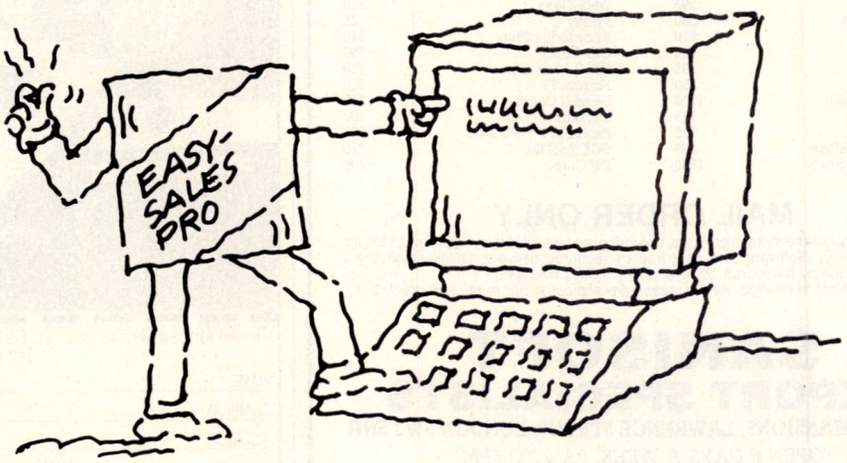

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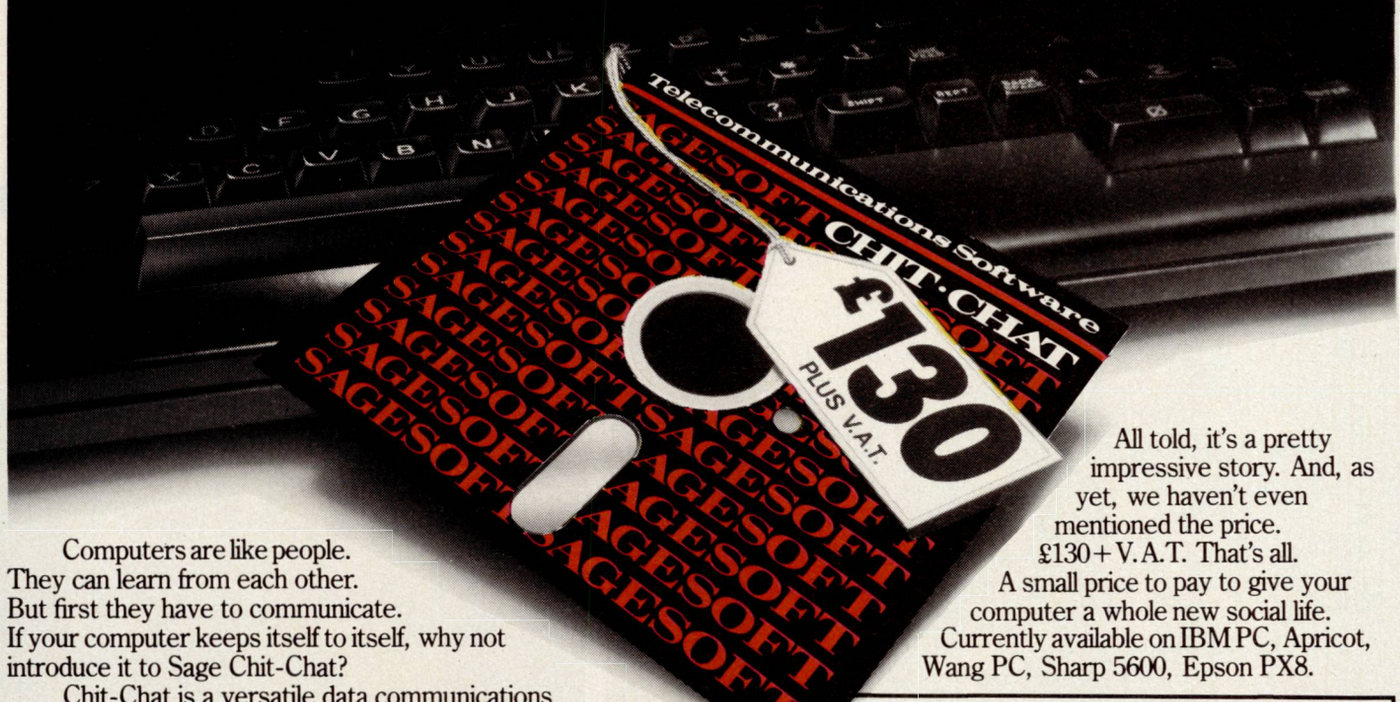

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PCW

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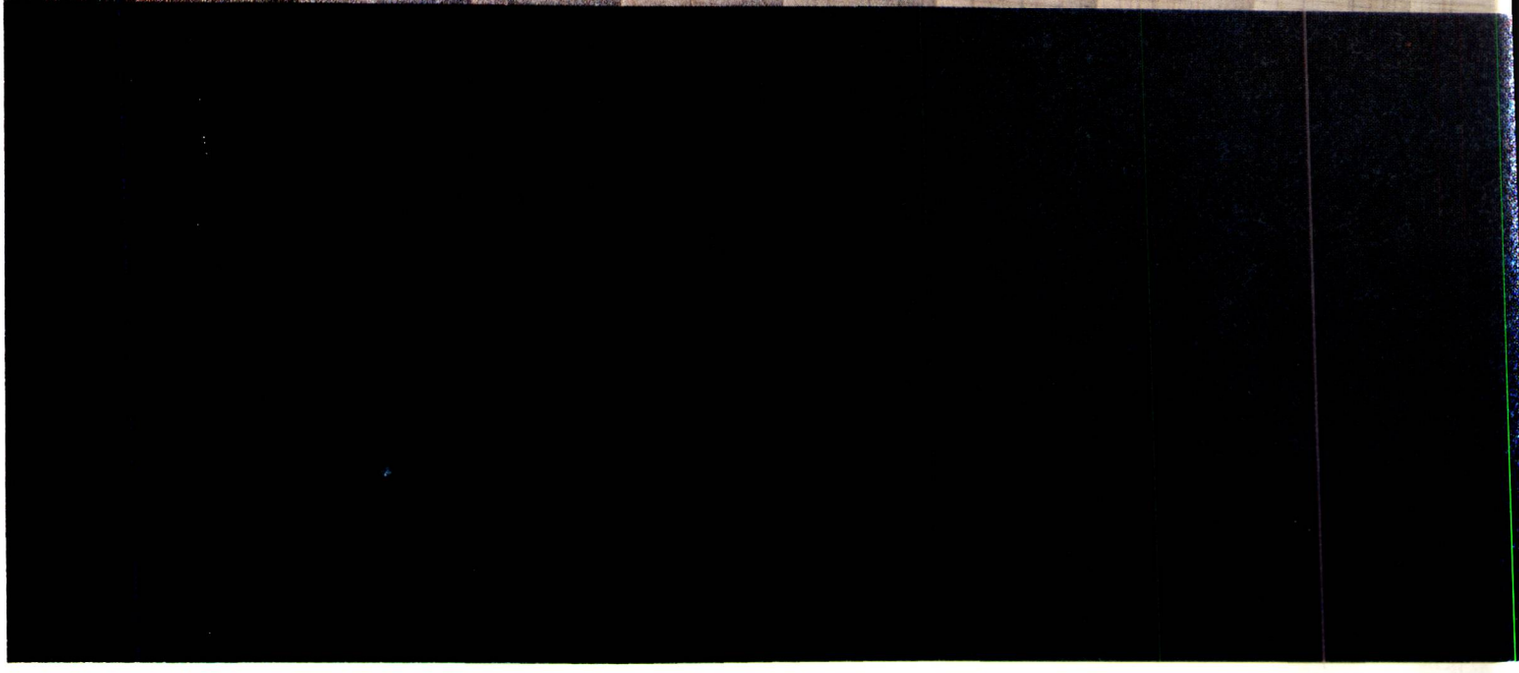


Some people choose a particular computer because it's a safe choice.

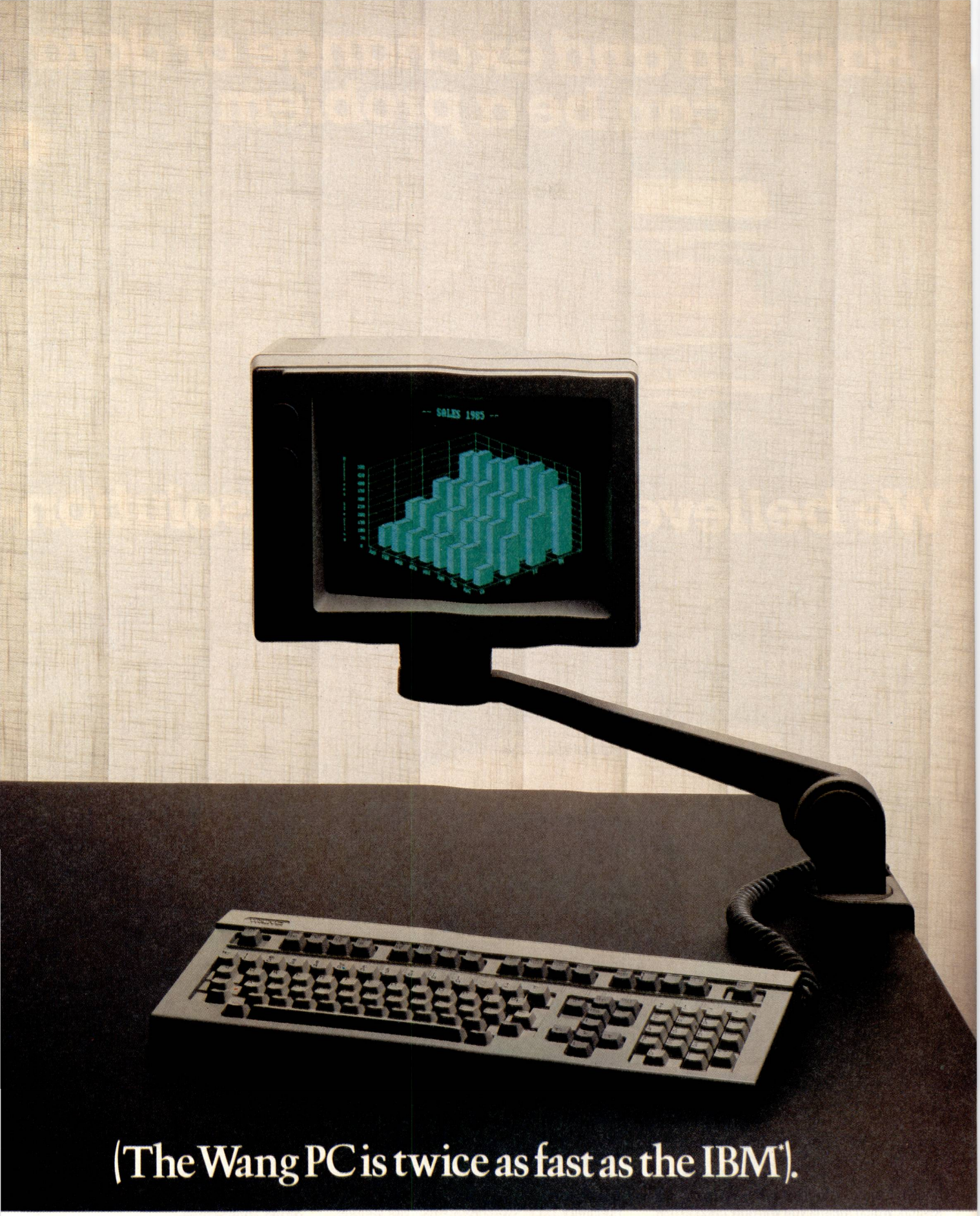
A choice that no-one is likely to query.

Which is not a bad criterion as long as you don't mind a computer that works at half the speed of the Wang.

Or a computer that takes up half your desk. Or one that hasn't a 'help' key like the Wang.

Playing it safe may also appeal to the odd person who prefers to memorise cryptic commands, rather than choose from a menu.

It may even find favour with the more dextrous who, when the occasion demands,



(The Wang PC is twice as fast as the IBM*).

e happy pressing several keys to select a ngle function.

But choosing a computer should be ased on more than the first name that pops to your head.

Because in computers, as in everything, e biggest tend not to be the quickest.

For further information on the Wang PC phone Teledata on 01-200 0200.

*Practical Computing 'Benchmarks' (Jan 1984)

WANG

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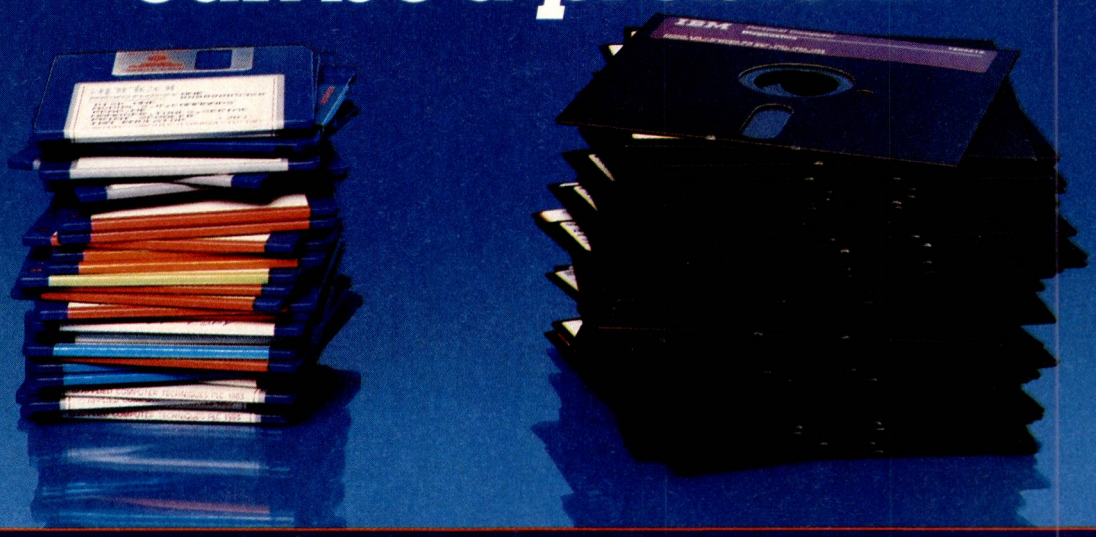

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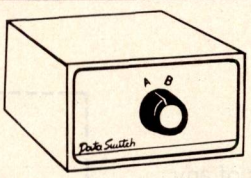

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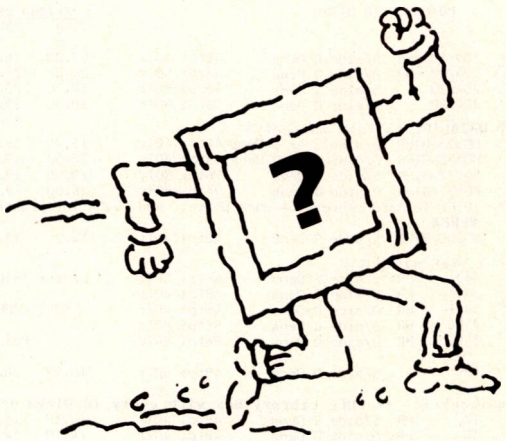



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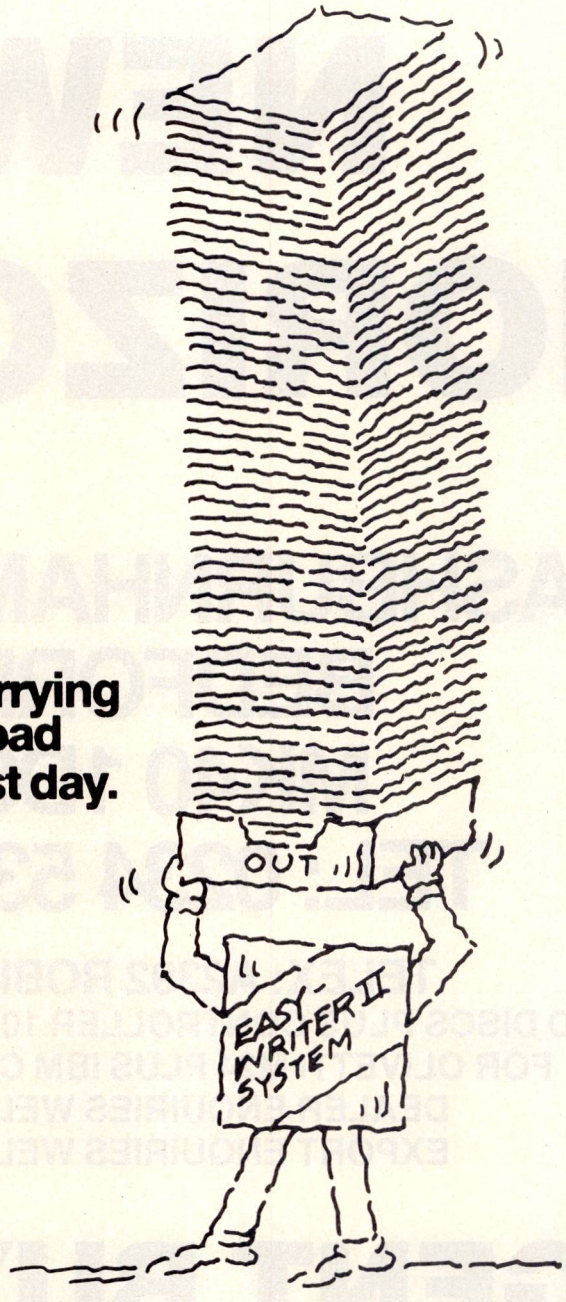

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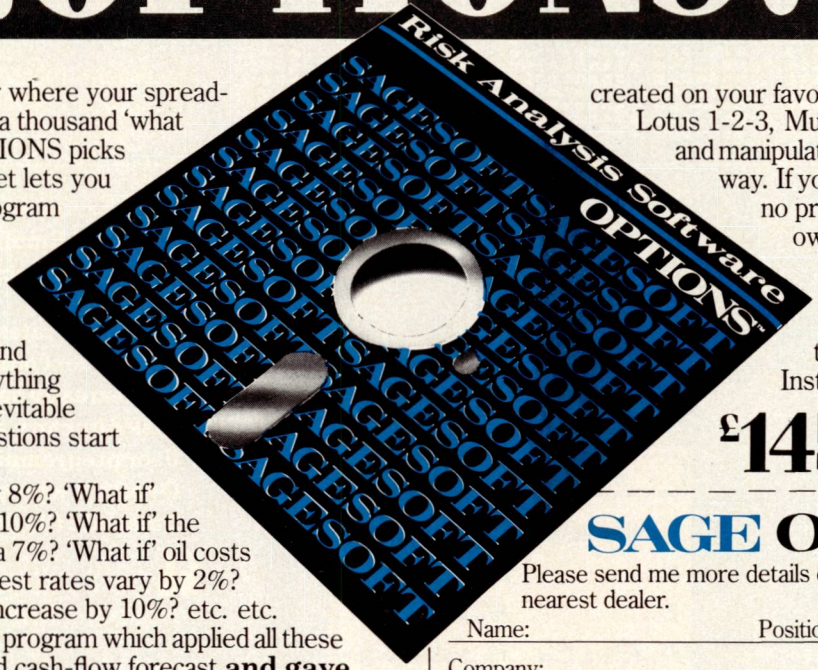

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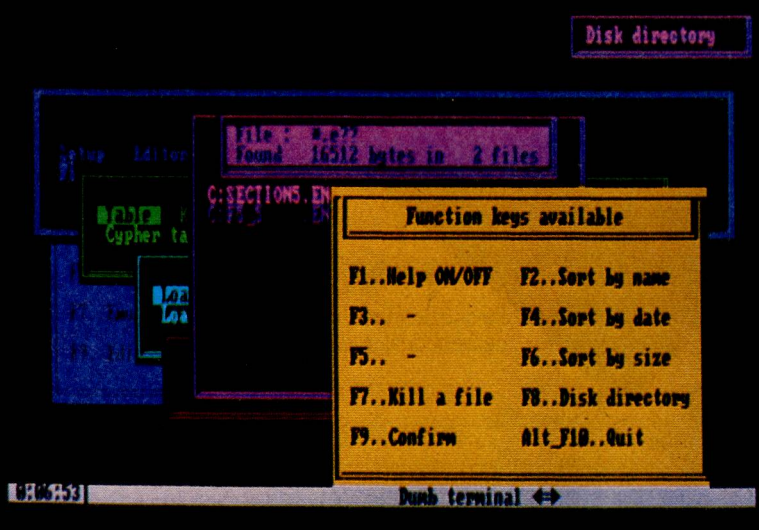

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Why Q COM is everything you could wish for in communications.

The QL is now communicating – via Q COM! This exciting three-part peripheral presents QL users with a multitude of ways to exploit the world of communications.

Once connected to the QL, Q COM allows you to access the considerable number of phone-in databases, such as Prestel and QNet.

Q COM enables you to communicate with other computer users. Its facilities include electronic mail, data transfer from Microdrives and bulletin boards.

Through it you can link your QL to larger minicomputers. Q COM has full capability in this area, and allows the QL to talk to powerful mainframes.

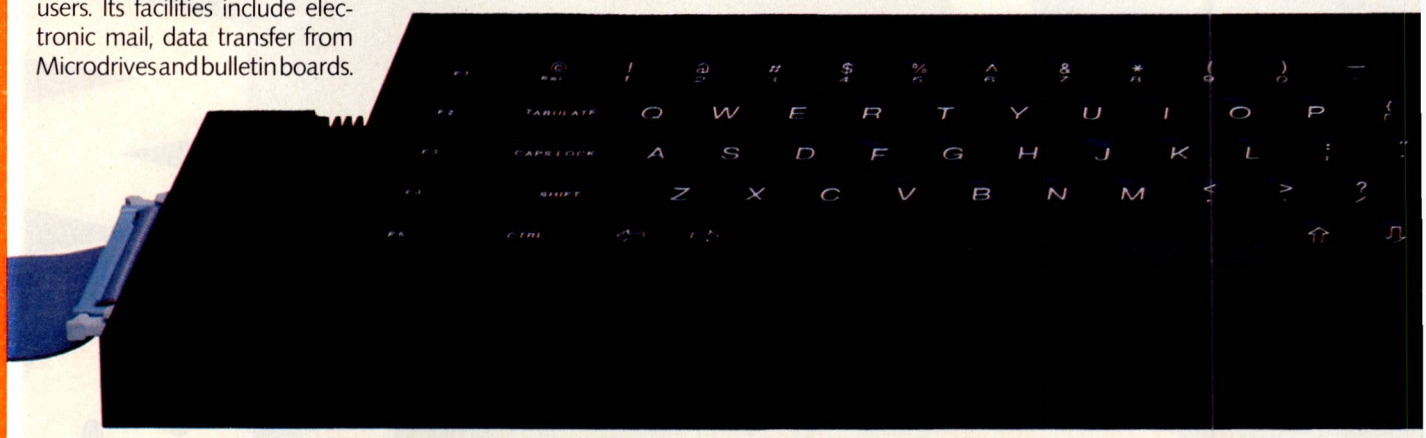
Q COM's automatic dialling and call acceptance facilities, together with the storage of messages from other modems, will revolutionise the way you use your telephone.

The next few pages of QL News tell you much more.

It's enough for me to say here that with the QL and Q COM, you'll be exploring new ope ings in communications f some time to come!

David Karlin

David Karlin,
Chief Design Engineer.



The Q COM package
Three special parts to stack!

QL communications interface

Q CON

This multi-speed interface contains the sophisticated software used to set up QL communications – and to control the Q CALL and Q MOD units.

Q CON also comes complete with Microdrive-based software. This enables the QL to link to larger computers using VT100 and viewdata protocols.

The software will also run *any* standard modem – connected via Q CON's built-in RS-232-C port.

Most importantly, Q CON allows the QL to transmit and receive at rates switchable from 75 to 9600 baud (encompassing the widely-used 75/1200 Prestel rates, and 1200/1200 half duplex rates for user-to-user exchange).

Q CON is specially styled to suit your QL – with similar fluting and ribs – and forms the base module of a vertical-stacking system.

It's supplied with full instructions, software on Microdrive cartridge, and connecting leads.

QL auto dial/answer unit

Q CALL

Q CALL gives every QL user something out of the ordinary.

It's a module which links directly to your telephone, and allows auto-dialling at the push of a single key. In the same way, it will permit incoming calls to be accepted automatically . . . an even trigger pre-programme activity from the QL!

Q CALL is the central unit c the package. It plugs directly int Q CON – so there are no con necting cables to worry abou

QL modem

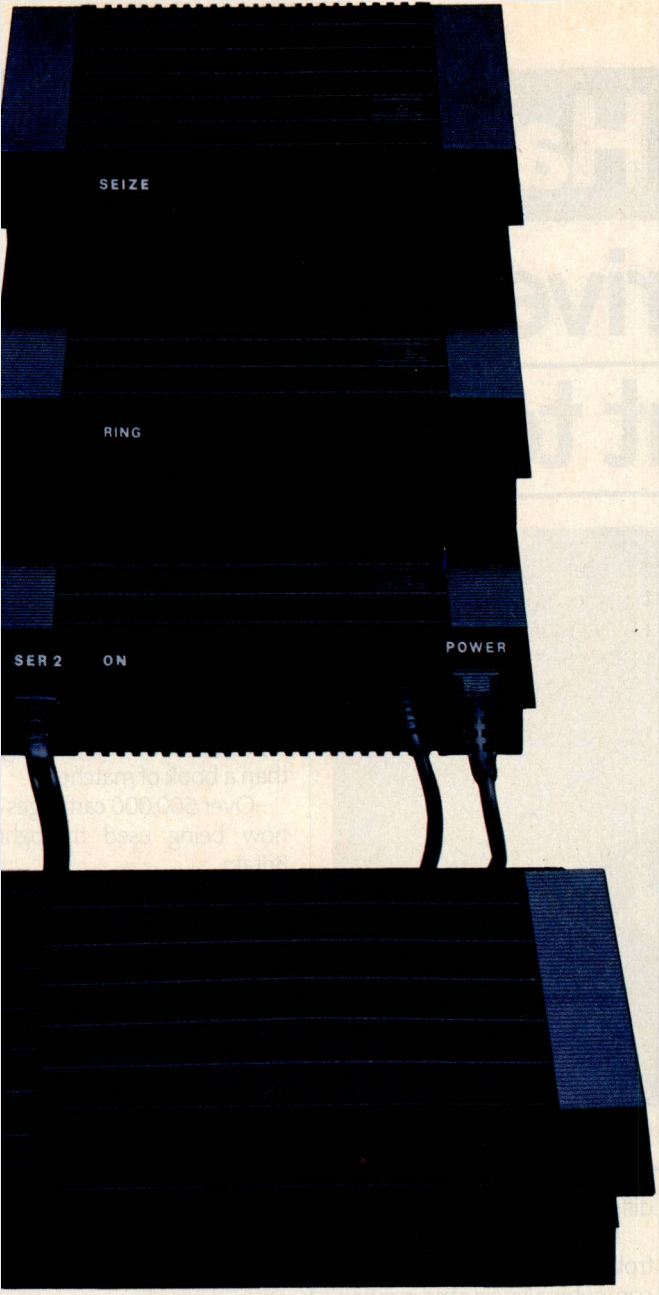
Q MOD

Q MOD has all the powerful facilities expected of a modem, in a neat and simple unit.

It uses either V23 75/1200 or 1200/1200 baud rates, for Prestel, Micronet 800 and all the viewdata services describe alongside.

It also incorporates a tele phone extension socket fo manual dialling.

Q MOD is the top unit o



COM, and comes with a 9'
ilt-in telephone cable.
All three units are available
m OEL on (0276) 66748 and
m selected Sinclair stockists.

he QL hooked
n voice and data

e QL can now act as your
rsonal address book and
ephone operator!

Q COM allows you to store hundreds of personal or business numbers.

You can store lengthy passwords and account numbers – and recall them – at the touch of a single key.

And any information that's sent to you from other modem-owners can be gathered and stored on Microdrive cartridge, or incorporated into your QL Quill documents!



Exploring the world of QNet, Prestel, Micronet and more!

Thousands of QL users already enjoy the excitement of linking to a nationwide mainframe.

Q COM turns your QL into an intelligent terminal, allowing you to access many thousands of pages of information, software and communications facilities.

The services brought to you through Prestel can include Micronet 800, Viewfax 258 and QNet, the new QL database.

Membership of QNet will bring you free software, QL news and features, and all the wide-ranging services of viewdata!

If armchair shopping is more your style, that's easy too. It's often possible to place a direct order using your QL! For dedicated QL owners, there's a daily selection of software reviews, chart toppers... and all the facts and figures you need to make buying peripherals simple.

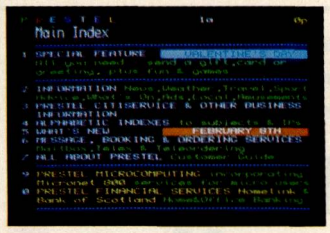
With Q COM you can also 'download' software from the system directly into your QL and either use it immediately, or store it on Microdrive cartridge.

In fact the only problem you'll face with a viewdata service is finding enough time to explore its many features!

You can find out how to join QNet by phoning 01-278 3143.









News... information... banking services and QNet. And only a fraction of the QL's new viewdata capability.

QL meets the mainframes!

The Q CON unit of Q COM turns your QL into a VT100 terminal, providing instant access to in-house computing services, both mainframe and mini.

Whether you are using your QL at home or at work, Q COM gives you access to electronic bulletin boards which provide help and advice 24 hours a day. You can leave messages or notices for friends or business contacts and even hold live discussions with them.

Additional benefits for the QL business user include easy access of in-house company software, and the interrogation of other data bases around the country.

There's also the opportunity of linking to British Telecom Gold – the widely-publicised and popular messaging service.

sinclair

QL Hardware

Microdrive cartridge price cut to only £1.99



Sinclair Microdrive cartridges – up to 100K of programs and data on a medium so compact you can pop it into your pocket.

On February 1, the cost
Microdrive cartridges car
down from £4.95 to £1.99 ea

Microdrive cartridges are t
QL's own unique storage me
ium. Each stores up to 100K
information (that's 40 pages
A4 text), on a cartridge no bigg
than a book of matches!

Over 500,000 cartridges a
now being used throughc
Britain.

You can store up to 50 diff
ent data files per cartridge, ider
ified by titles of your ov
choice.

And QL Microdrives ther
selves are standard equipme
on the new ICL One Per De
micro, and British Telecom's ne
Merlin Tonto.

IEEE-488... the instrument connection

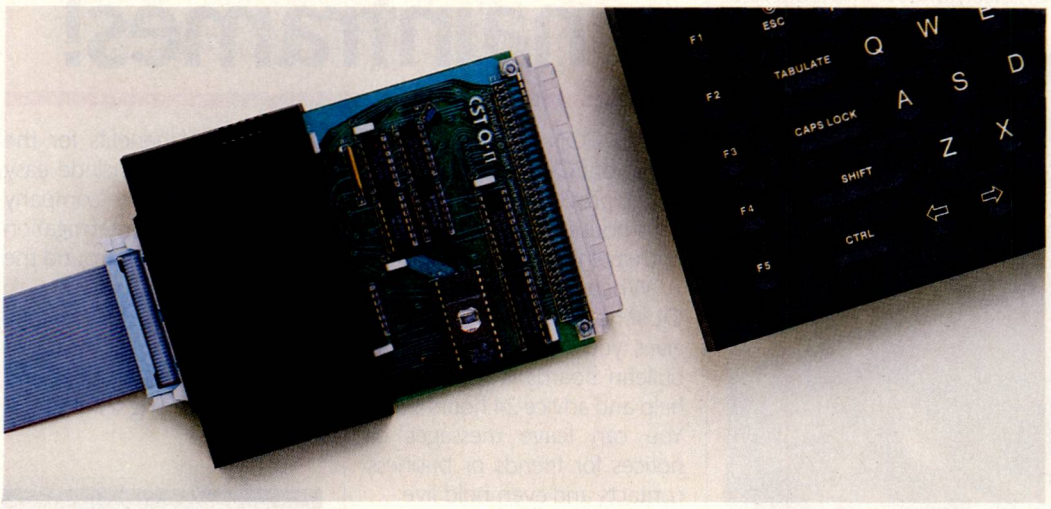
IEEE-488 is the interface standard set by the Institute of Electronic and Electrical Engineers for instrumentation control.

IEEE-488 – or General Purpose Instrumentation Bus – is a parallel interface specifically designed for high speed data transfer between a number of different types of device.

It is commonly used for controlling instrumentation via a computer, allowing the creation of laboratory data acquisition systems, industrial control schemes, etc.

The QL now has a fully-fledged IEEE-488 interface from CST. It plugs neatly into the QL's RAM expansion port, and can control up to 16 instruments simultaneously.

It's available from CST on (0223) 323302.



An IEEE-488 interface slips discreetly into place.

New int 3½" or 5

With new Q-Disk, you ca
transform the QL into a powe
ful small business system
comprising QL, monitor, di
interface, twin disk drives ar
printer.

Q-Disk upgrades the QL
disk storage. Fitting easily in
the QL's left hand RAM expa
sion port, without the need fo
special expansion box, it co
tains a Western Digital disk co
troller chip. Software is held
an on-board EPROM (so litt
of the QL's RAM is used).

Plug in Q-Disk, and the C
accepts one or two disk drive
sized 3 in, 3½ in, 5¼ in, eith
40 or 80 track, single or doubl
sided. Even when two drives a
used, they can be different type

Q-Disk offers up to 1
Mbytes of quick, reliable storag
with a compatible disk drive.

It's made by Computamat
who also offer a full range



QL to link students

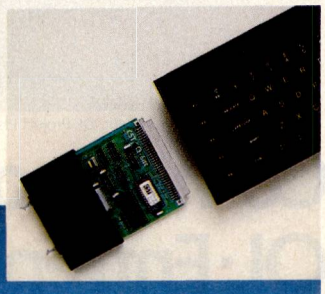
Strathclyde University, in sgow, plans to have a cam- network of 7,000 QLs linked ı central VAX minicomputer. That's one QL for every dent . . . a major investment ject in a university which is v a leading centre for artificial lligence work.

Sinclair is giving support rth £250,000 to the project. d it's likely that QL users everywhere will benefit – the students plan to develop AI programs to run on the QL!

The QL has impressed Prof. James Alty of the University's Computer Science Department, who says *'only the QL could offer the computing power, range of applications, and above all the portability, at a realistic price.'*

ce to connect 3", sk drives

nplimentary QL disk drives. To contact Computamate, one (0768) 811711.





le disk unit fitted with 5¼ inch drives and *(inset)* the Q-Disk controller.

The QL's high-tech spec

Dimensions
138 x 46 x 472mm
(5⅜" x 1¾" x 18¾")

Weight
1388 gms (3.055 lbs)

RAM
Massive 128K standard RAM, externally expandable to 640K. Extra RAM is available in 64K, 128K, 256K and 512K units, from third-party suppliers.

ROM
48K, containing Sinclair SuperBASIC and the Sinclair Qdos operating system.

CPU
Motorola 68008 (running at 7.5 MHz) for all principal functions. (Architecturally, the 68008 is a 32-bit processor with an eight-bit data bus. One megabyte of non-segmented address space is available.)

In addition, an Intel 8049 controls the keyboard, generates the sound, and acts as an RS-232-C receiver.

Operating system
Qdos (developed by Sinclair Research) is a single-user multitasking, time-sliced system using Sinclair SuperBASIC as a command language with display handling for multiple screen windows; and device-independent input-output.

Language
Sinclair SuperBASIC, with the advantages of procedure structuring; extendability (including syntax); interpretation speed independent of program size; clean machine code interface; operating system facilities accessible from SuperBASIC; equal capability for strings and arrays; and full error-handling facilities.

Microdrives
The QL incorporates twin QL Microdrives, each with a minimum 100K capacity, 3.5 seconds average access time. Typical loading rate of machine code programs is 2-3K per second.

Video
High resolution graphics capability with colour or monochrome monitor (or TV) in two modes – 512 x 256 pixels (four colours available) and 256x256 pixels (eight colours available). Normal character display format of up to 85 x 25 with choice of character sets available (TV format of up to 40 to 60 columns depending on the software).

Keyboard
Full-size, 65-key QWERTY keyboard featuring a space bar, left- and right-hand shift keys, five function keys and four cursor control keys. The keyboard can be angled by means of detachable feet.

Expansion
Excluding RGB monitor, power socket and TV port, eight peripheral/expansion ports are provided – one internal expansion, one Microdrive expansion, one ROM cartridge, two serial and two control channels, and the local area network.

Serial
Two standard RS-232-C communications interfaces for printers, modems, etc. Transmission at rates from 75- 19200 baud or full duplex transmit/receive at seven rates up to 9600 baud.

LAN
For up to 64 QL computers. Data transmission over the net can be achieved at 100K baud.

Power supply
9V DC at 1.8A, 15.6V AC at 0.2A.

Joysticks
Provision for one or two devices for games or cursor control.

Applications Software
QL Quill – word processor
QL Abacus – spreadsheet
QL Easel – graphics
QL Archive – database
All four packages supplied with the QL.

Price
£399 including VAT, QL programs, full A4 manual, power supply, 4 blank cartridges and free Helpline service.

sinclair

QL Software

Updated versions of Psion software now available!

QL Abacus, Archive, Easel and Quill are the four Psion programs supplied with every QL. They're now converted to 100% machine code, and as a result they load from Microdrive cartridge much faster.

The overlays present in Version One software have been removed, resulting in noticably quicker on-screen performance.

With the compactness of machine code, there's a big saving in QL memory too – all four programs now cope with larger, more professional applications!

Version Two software is now supplied with every new QL. Existing QLUB members – see back page.

QL·Quill

QL Quill makes it easy to type in, correct and store your letters, memos and reports.

No training is needed – a beginner can be using QL Quill for word-processing within minutes!

QL Quill has the facilities of professional word processing packages: including word wrap, search and replace, justification, page headers and footers.

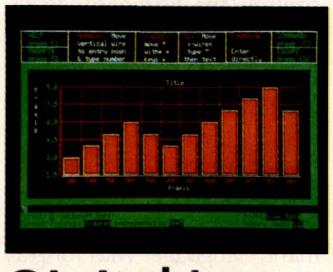


QL·Easel

QL Easel allows you to create graphs, bar charts and pie charts – at the touch of a key.

The program handles anything from lines and shaded curves to overlapping or stacked bars.

QL Easel designs and scales automatically or under your control. Text can be added and altered as simply as data.

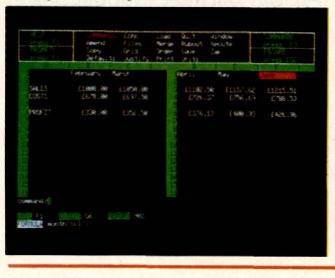


QL·Abacus

QL Abacus is a powerful, yet easy-to-use spreadsheet.

The program allows you to manipulate the contents of whole rows and columns by the names you assign them. There's no need to depend on confusing letters and numbers.

QL Abacus also incorporates a range of functions which let you carry out rapid 'what if' analyses on your data.



QL·Archive

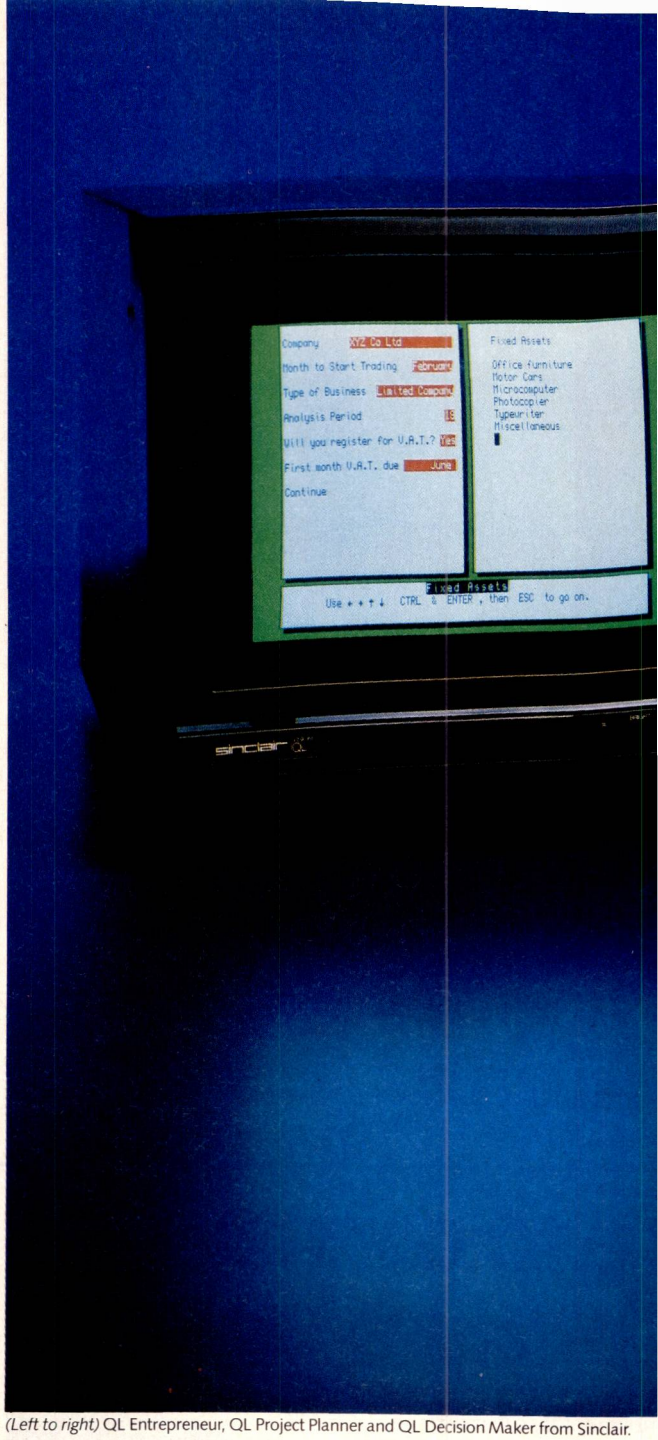
QL Archive is a sophisticated, powerful database program.

It includes a screen editor which allows you to design your own screen and format your reports, and a procedure editor which lets you tailor QL Archive to your own requirements.

QL Archive is ideal for all database uses, yet it's powerful enough to be used by many software houses to generate specific database applications.



Non-members of QLUB can purchase new versions of the above software for £15 per title, or £50 for all four programs. Phone (0276) 686100 for details.



(Left to right) QL Entrepreneur, QL Project Planner and QL Decision Maker from Sinclair.

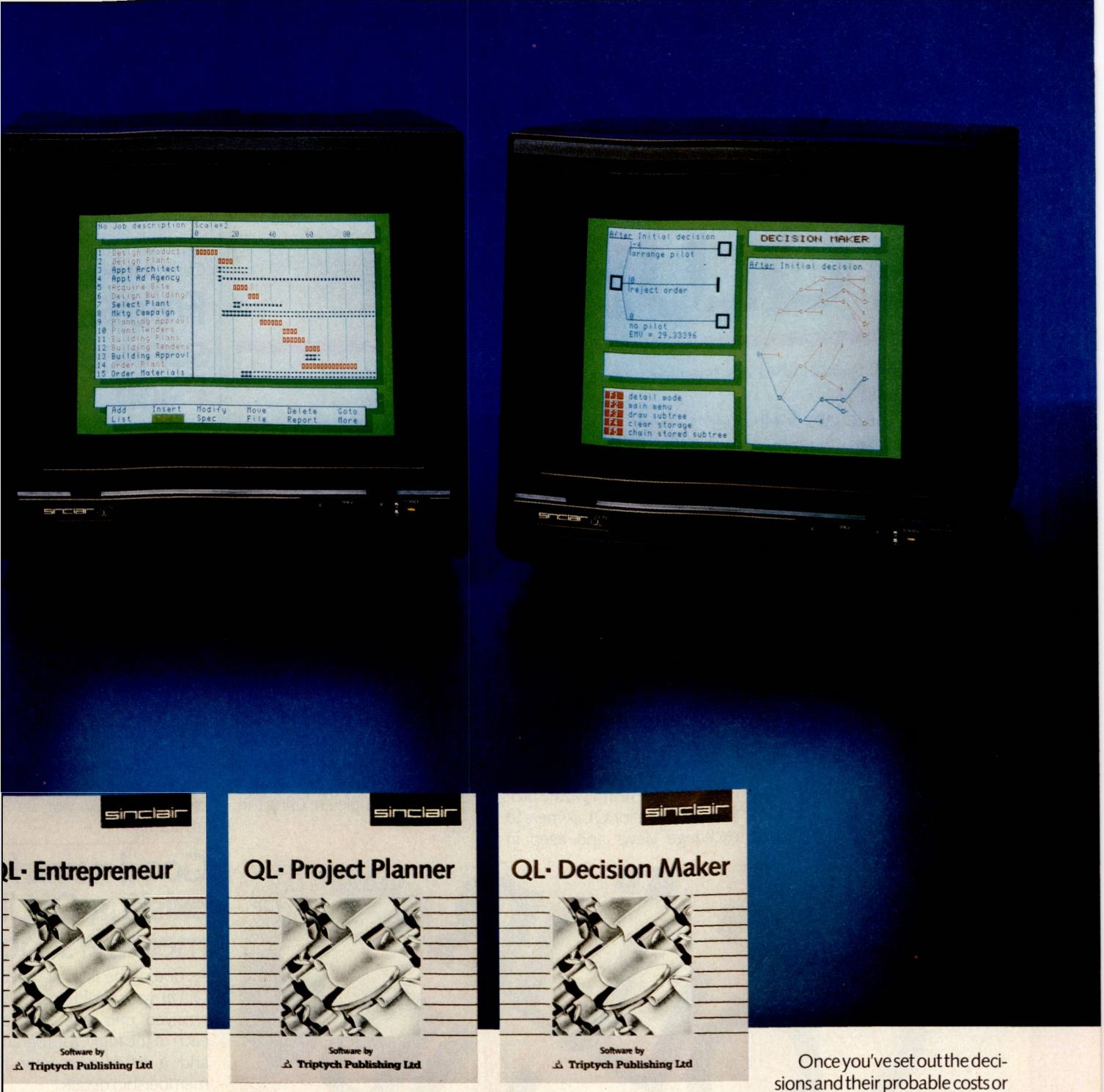
Coming soon- QL·Entrepreneur, QL·Project Planner, QL·Decision Maker!

Three new QL business programs – with a difference!

QL Entrepreneur, QL Project Planner and QL Decisi Maker train you to apply new and exciting management skill through original and powerful means!

An interactive teaching program gives you a thorough ar enjoyable understanding of each subject – backed by a te book and 'self-test' facilities - and an applications program he you to use your new expertise for specific problems a projects.

All three titles will increase your understanding and exte your control – making involved subjects easy, stimulating a useful!



:Entrepreneur

Entrepreneur is an essential ram for anyone preparing art a new business – what- it may be!

uses a 'question and ver' format to help you build rkable business plan.

With the input you give, it ks out the break-even point he business; the first 18 nths' cash flow, the type of nce needed; the year end nce Sheet and Profit and accounts... and more!

QL Entrepreneur builds your and techniques.

's flexible too, so that you ask complex 'what if' tions at any stage!

The program comes with a d, blank Microdrive cartridge and a comprehensive A5 manual.

QL·Project Planner

QL Project Planner will produce plans you can understand, monitor and more easily achieve.

First, you break the project down into its individual activities, telling QL Project Planner how long each takes and which are inter-dependent.

When you decide on a starting time/date QL Project Planner will tell you when each activity must start and finish and when the project will be completed.

Each activity is divided into its critically important stages – those which can safely be moved around without altering the time taken by the project and those where movement will affect the completion deadline.

Whether or not you've used project planning systems before, you'll be amazed at the difference QL Project Planner can make.

The program comes with a third, blank Microdrive cartridge and a comprehensive A5 manual.

QL·Decision Maker

Whether you're thinking of buying a house, or taking on a new business contract, QL Decision Maker makes the choices clearer!

It lets you look at the possibilities – and their implications – through a decision tree.

Once you've set out the decisions and their probable costs or results, QL Decision Maker shows the outcomes which would occur from each particular route.

You can see how much money a decision could make for you... or cost you. Complex 'what if' questions are dealt with swiftly and graphically.

You can depend on the QL to highlight the best possible route!

QL Decision Maker comes with a third, blank Microdrive cartridge and a comprehensive A5 manual.

All three programs are available from Sinclair stockists, price £39.95 each, or Sinclair Research. Tel: (0276) 686100.

sinclair

Now, buy a QL and you're a member of the QLUB-free!

QLUB is the special Users Bureau for Sinclair QL owners.

Already, there are well over 10,000 QLUB members . . . enjoying a whole range of information and advisory services.

Until now, joining QLUB cost £35 per year. From March 4, every new QL owner can become a member – free of charge!

With your new QL, you'll find a post-paid form. Complete and mail it, and you'll soon be a member of the fastest growing computer club in the country.

And you'll enjoy all the helpful services listed here!

What QLUB membership offers you

Regular newsletters delivered to your door

One of the most important QLUB benefits is the special news magazine, appearing six times a year. The magazine provides a forum for QL owners to exchange views and keep in touch with all the latest developments.

Each issue is packed with updates on QL hardware and software, tips on applying the four QL programs, and news of how other people are using the QL.



Special discounts

QLUB members also receiv range of special discounts, w savings of at least 20% on sel ted software products.

There are also special su scription rates for Perso Computer News and QL Us

Free Helplin service from Psion

All QLUB members are entit to 12 months special assistar from Psion.

They're at the end of the te phone to answer any questio on using the QL Abac Archive, Easel and Quill p grams supplied with the co puter.

Help is also available on a aspect of using Sinclair Sup BASIC, Qdos, or linking your with major peripherals.

Psion will normally answ any queries within 48 hours.

QL program updates are longer available free to QL members. They will be s separately.

Good news fo existing QLUB members too

As one of the first members QLUB, you should already ha received one *free* update each of the four QL program and a letter with your n membership details.

If for any reason you have you should ring (0276) 6861

You're a QL owner, but not QLUB membe

Then joining QLUB is easy a free! Ring (0276) 686100 for details. You can be a full QL member within a few days.

Where to find the QL

The Sinclair QL is available at selected branches of Dixons, WH Smith, John Lewis Partnership, Currys, Greens in Debenhams and Ultimate, and larger branches of Boots, John Menzies and specialist computer stores nationwide.

sinclair, QL, QLUB, Qdos, and SuperBASIC, are Trade Marks of Sinclair Research Ltd. Quill, Easel, Archive and Abacus are Trade Marks of Psion Ltd.

Sinclair Research Ltd
Camberley, Surrey, GU15 3BI
Tel: Camberley (0276) 6861

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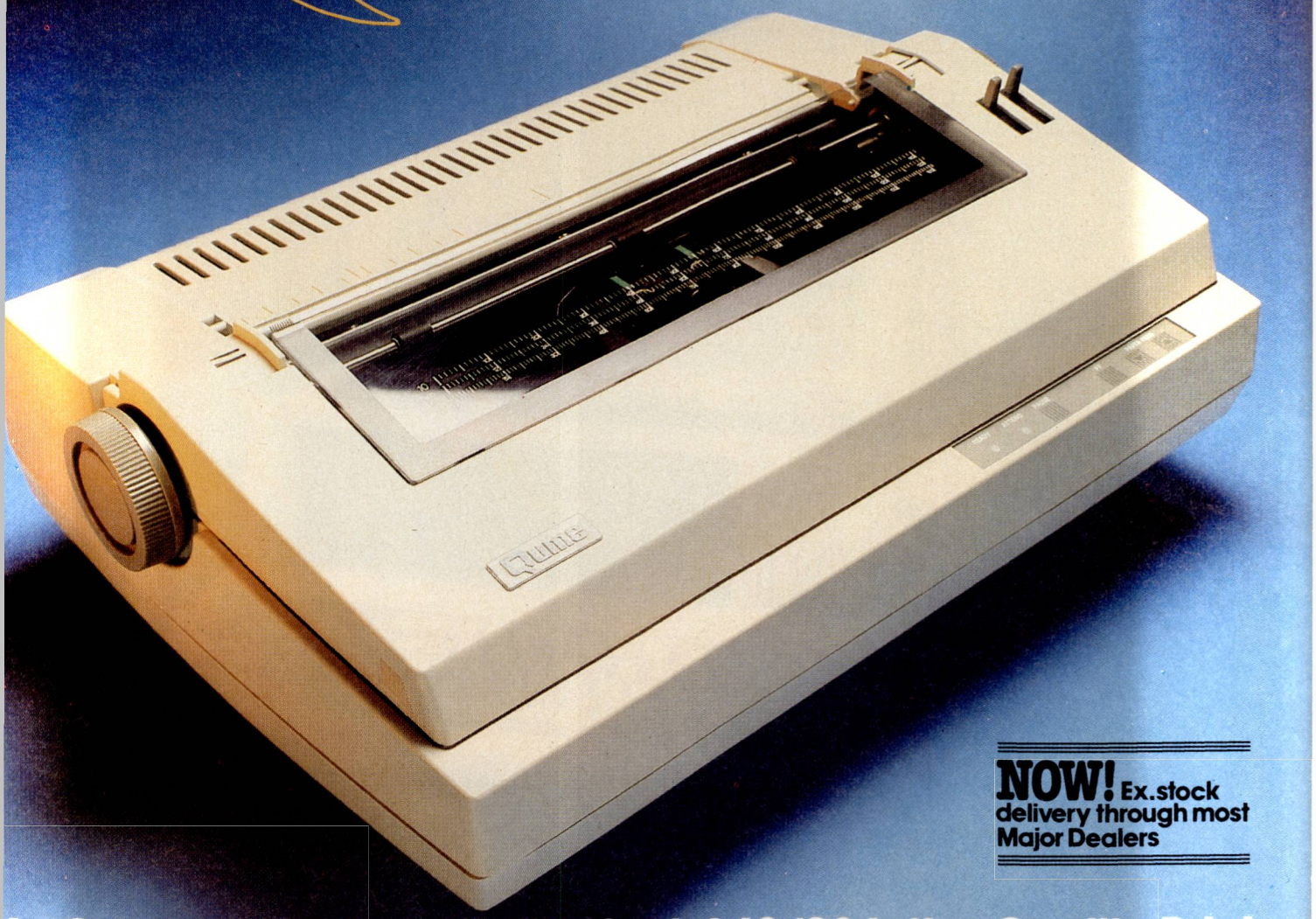
NEW from QUME



NOW! Ex.stock delivery through most Major Dealers

"No Compromise" – with the Sprint 12/20 letter Quality Printer from the World's leaders in word-processing printers

A good speed for business and professional use,

Engineered by Qume for superb print quality and reliability for years of every day use

– and the price is right

Other important features –

1. Interface compatibility with most popular desktop computers i.e. Serial, Centronics Parallel or Qume Sprint 3

2. Compact design – user friendly

3. The widest range of easily interchangeable typefaces in the industry

4. Uses Qume standard Printwheels and Ribbons the most accessible range available

Accessories include –
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Backed by Qume's proven World-Wide Sales and Service organisation

Qume®

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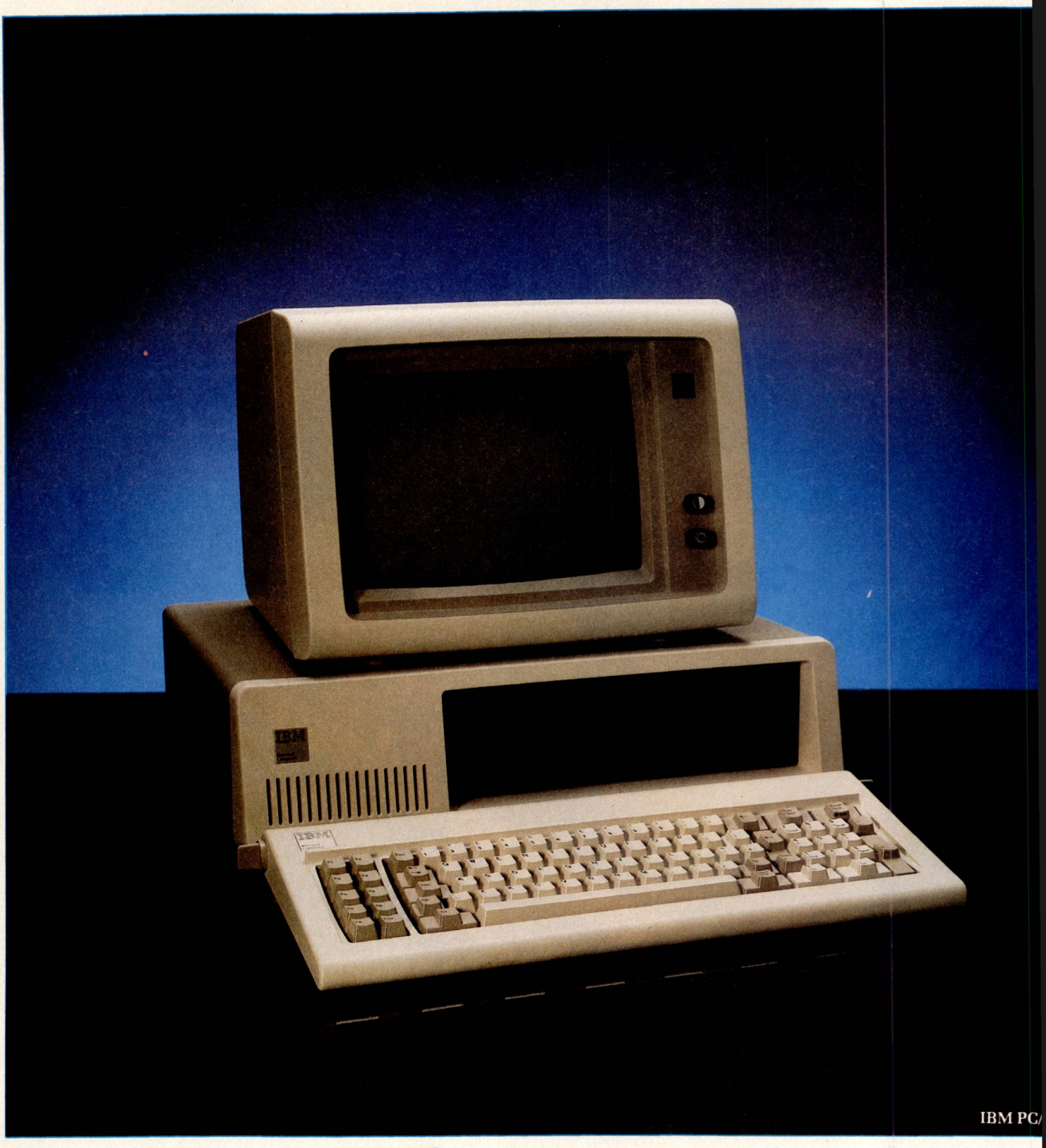

IBM PC/

9 Places to get t

Most people want straight answers to straight questions - in short, jargon-free helpful advice from experts.

When considering a business micro system, we at SBC understand that you don't want to be overwhelmed with a confusing plethora of product, whether that be hardware, software or peripherals.

So we cherry pick.

We cherry pick dealers and we cherry pick product, offering a range of brand leaders (just a few are shown above).

SBC is a growing network of professional independent dealers individually vetted against stringent criteria, with the backing of a multi-million pound public company.

So why not check us out? Give your nearest dealer a ring or complete the coupon now

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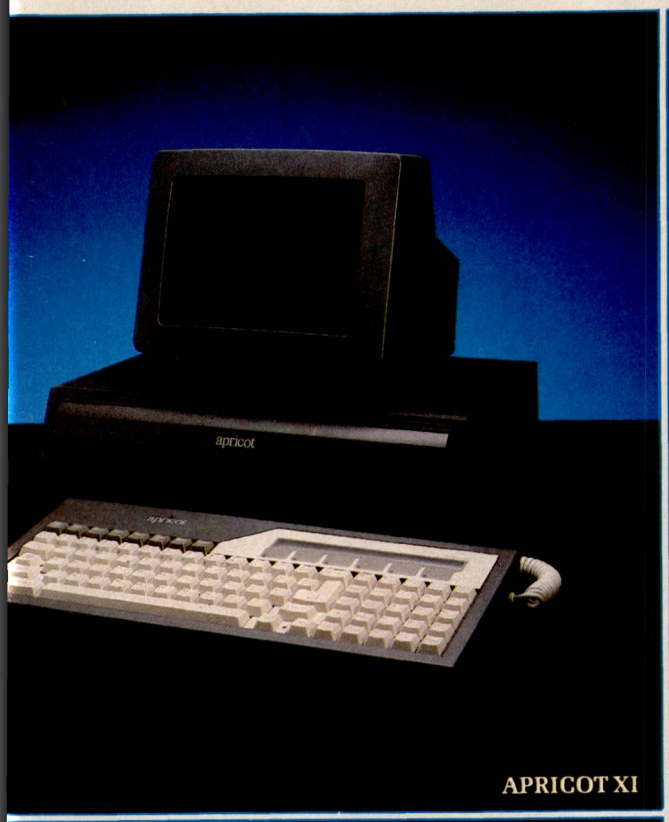

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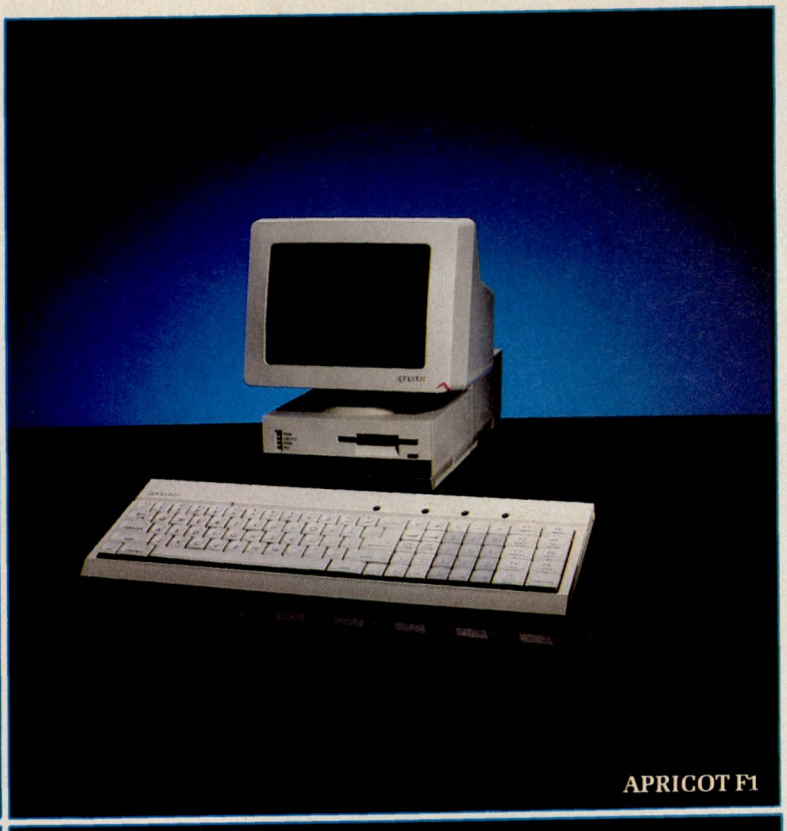

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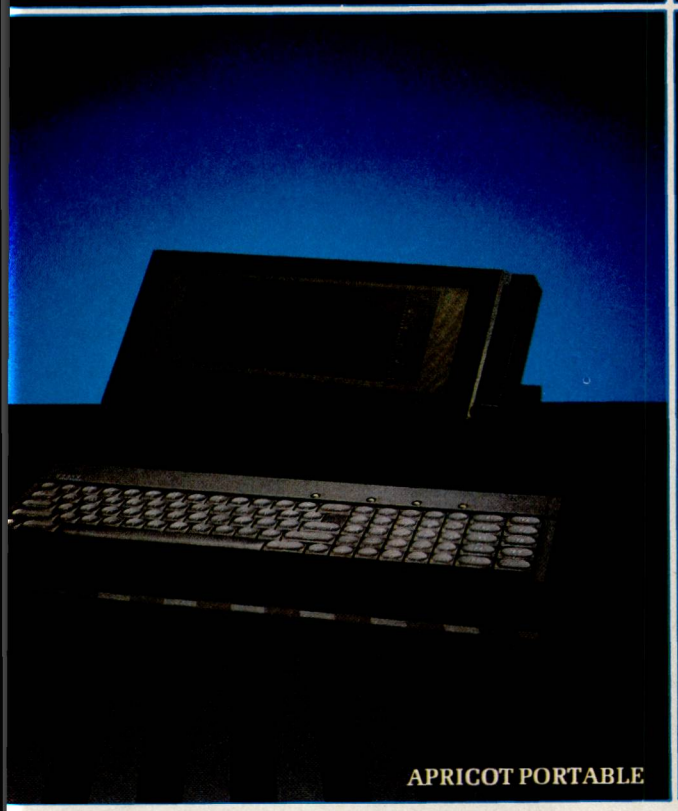
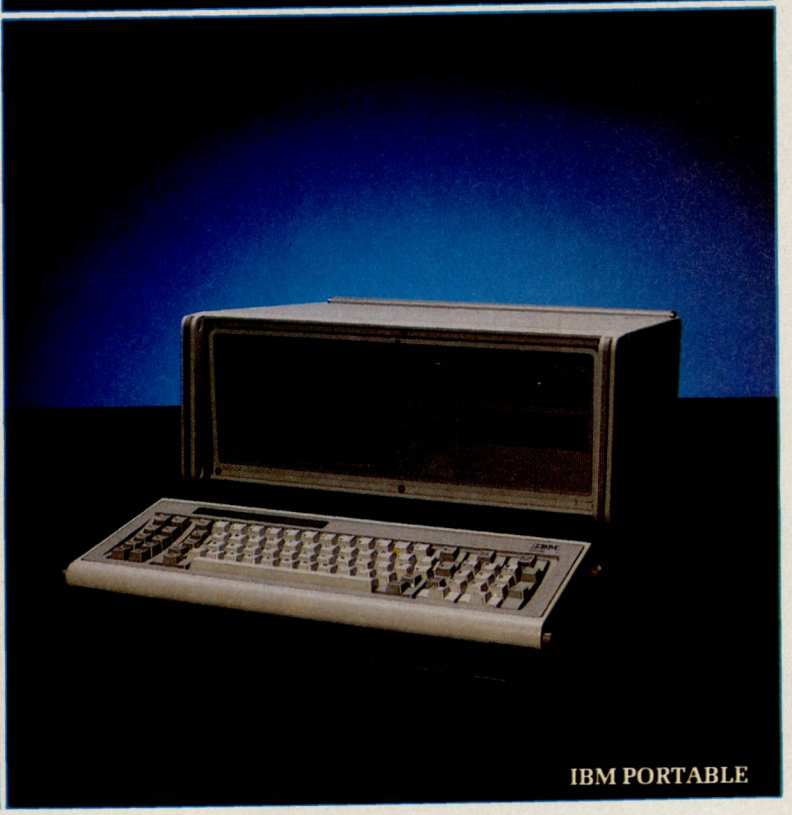


APRICOT PORTABLE



IBM PORTABLE

e right answers.

mouth mtax siness puters a House, nada Way, mouth. PL1 1LB 52) 23190	**Dudley** Central Computers 35 Churchill Precinct, Dudley, West Midlands DY2 7BL Tel: (0384) 238169	**London W1** Pilot Software Ltd. 32 Rathbone Place, London W1P 1AD Tel:01-636-2666	**Lancaster** Mipac Services 63 King St., Lancaster Tel: (0524) 62033	**Cardiff** Unique Solutions Ltd. 17-21 Castle St., Cardiff CF1 2BT Tel: (0222) 390714
ventry elphi siness puters Ltd rty Street, ventry, Midlands 1 1FJ 03) 553944 ointed Dealer	**Hull** SBC (Humberside) Ltd 56/58 Anlaby Road, Hull, Humberside HU1 2PA Tel: (0482) 24346 IBM Appointed Dealer	**Herts.** Spectrum Business Centre Hunting Gate, Hitchin, Herts. SG4 0TJ Tel: (0462) 37171 IBM Appointed Dealer	**Oxford** Oxford Data Systems 29 Pound Way, Cowley Centre, Oxford OX4 3XX Tel: (0865) 717720 IBM Appointed Dealer	**DEALERS** For more information contact Nick Ray or Andrew Doxsey at SBC Hitchin **(0462) 37171**

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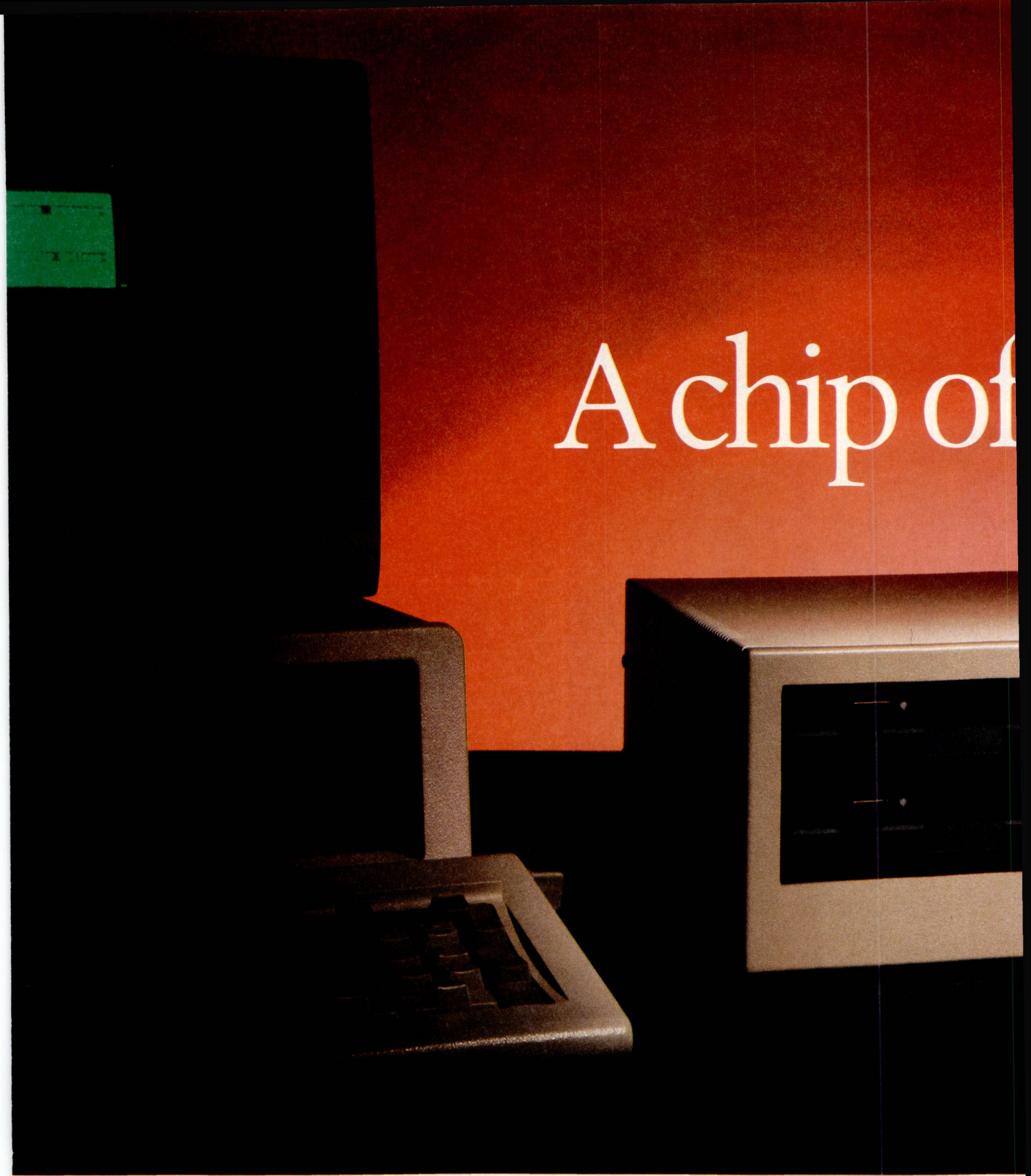

A chip of

The chip, of course, is the 8088 as used in the IBM®PC. The operating system is customised to MS™-DOS compatibility. The user memory is 256K RAM, that's four times as much as big brother. The floppy disc storage is 720 Kbytes, that's more than double the basic PC. We've only got two expansion slots, but there again we use them for expansion and don't need to tie them up with basics such as colour graphics or printer ports.

We are disc compatible to Lotus 1-2-3 and most other popular business software. And hardware compatible, accepting auto dial/auto-answer internally housed modems, networki and memory expansion cards, plotters and just abo any board level product developed for the IBM®PC.

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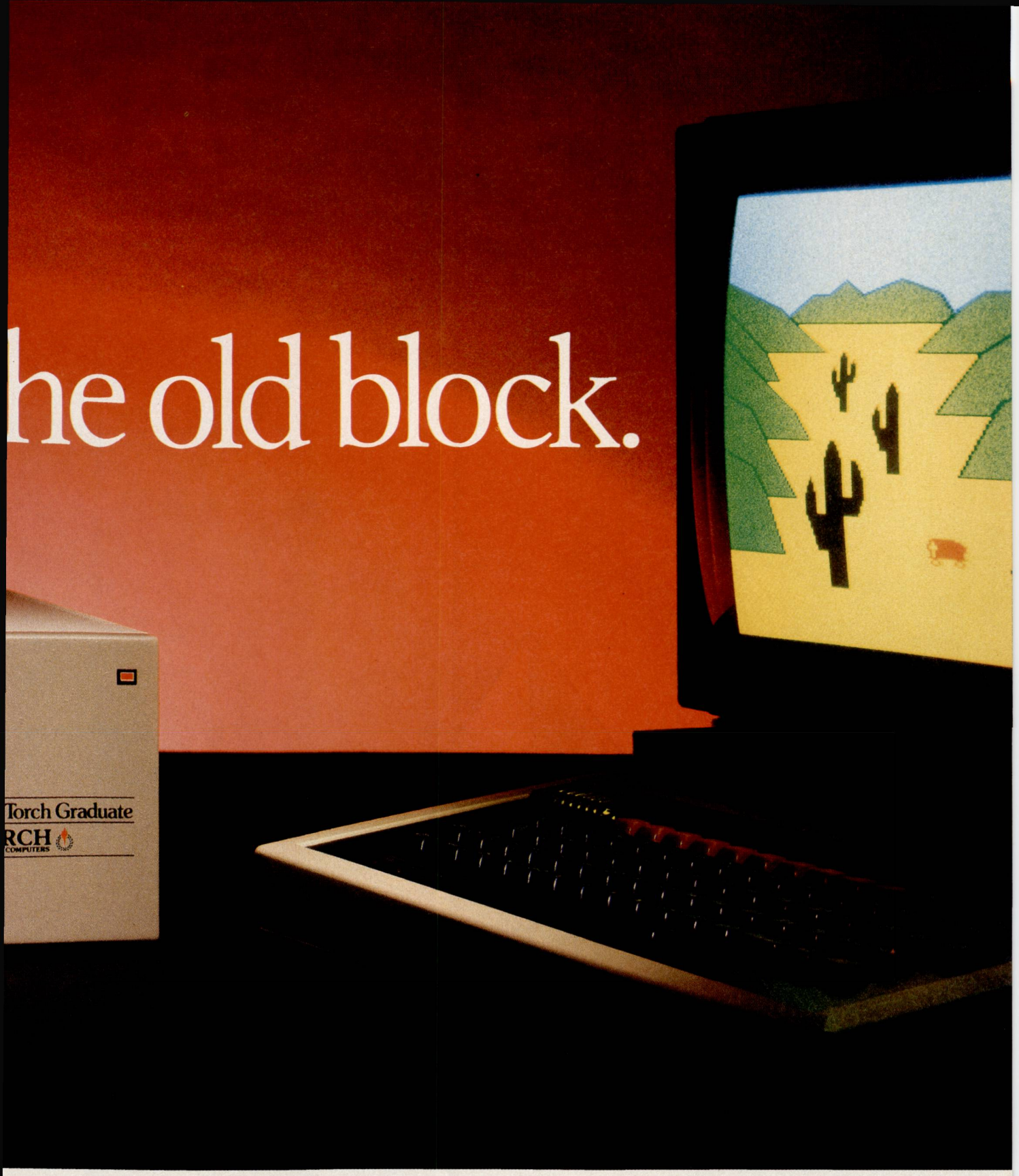

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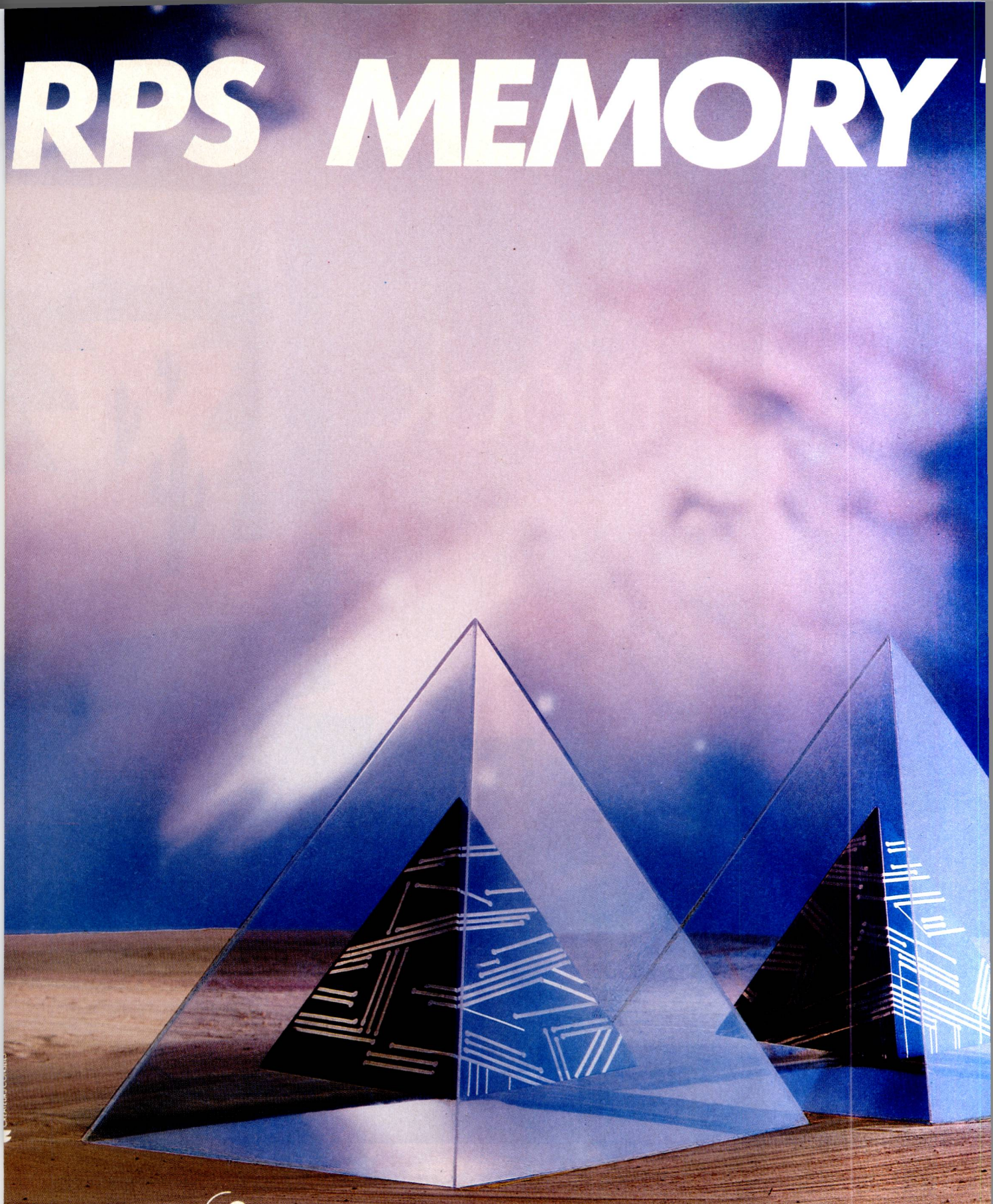



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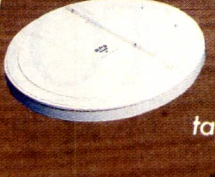

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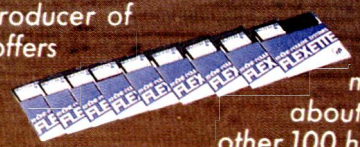

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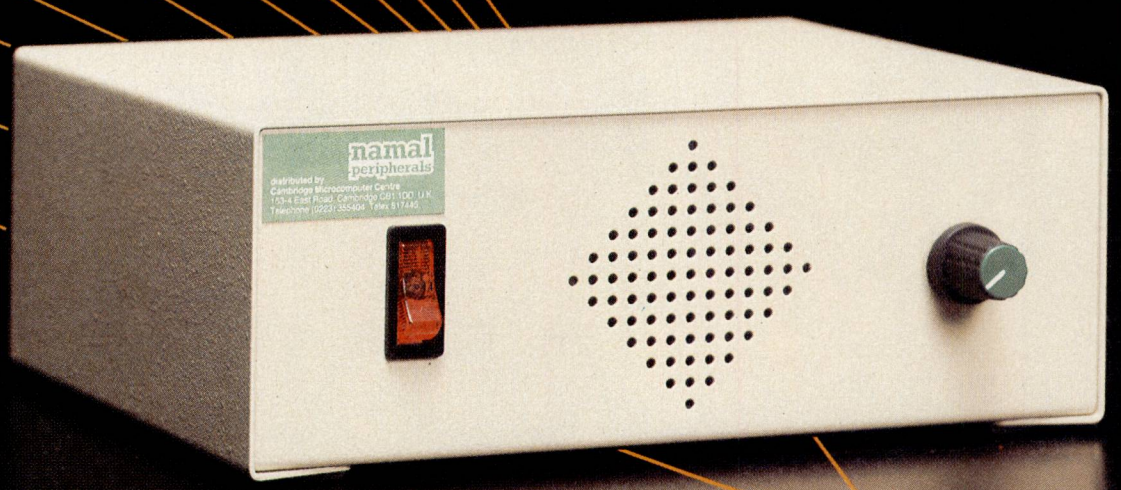

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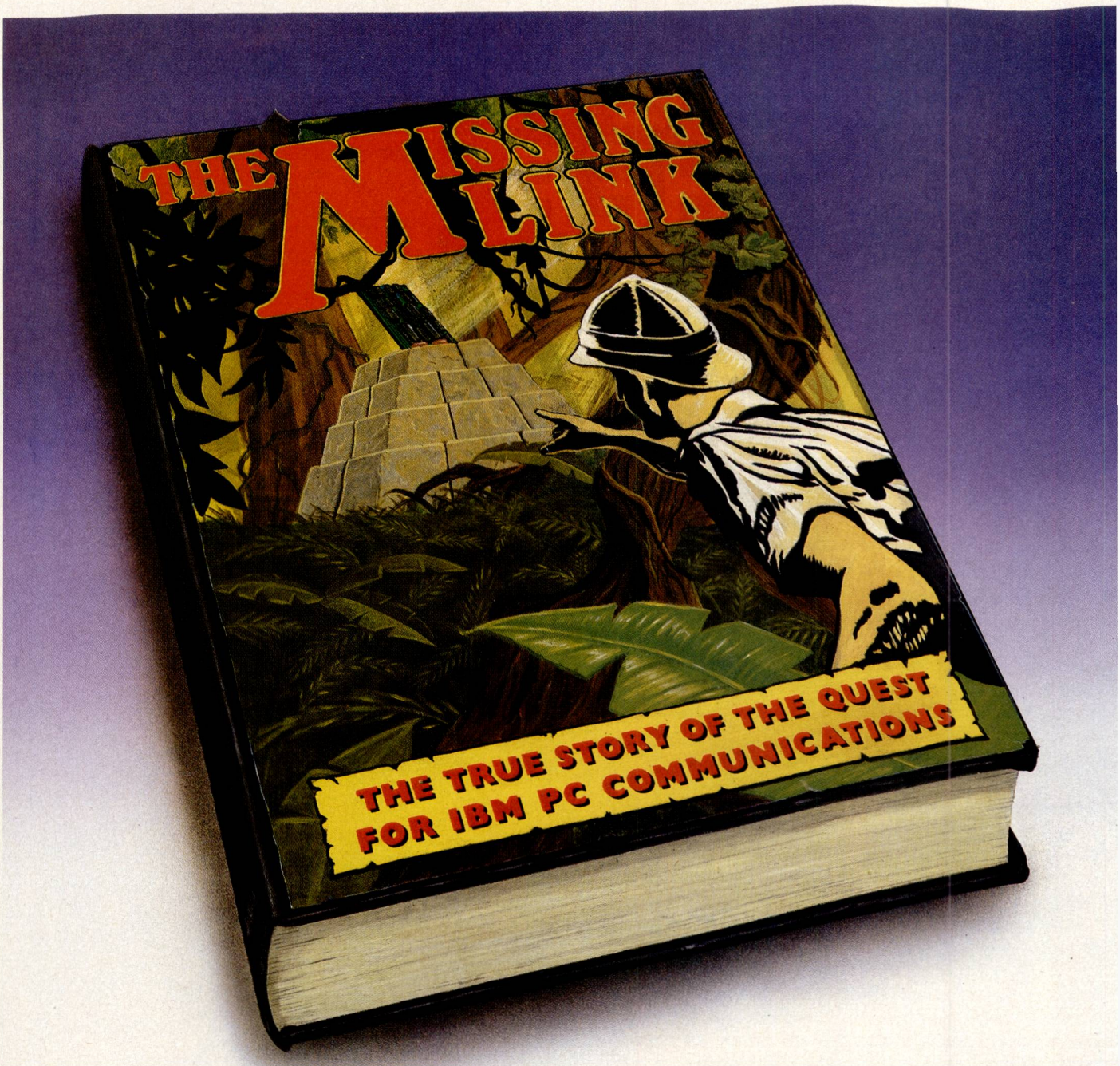

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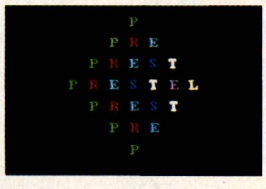

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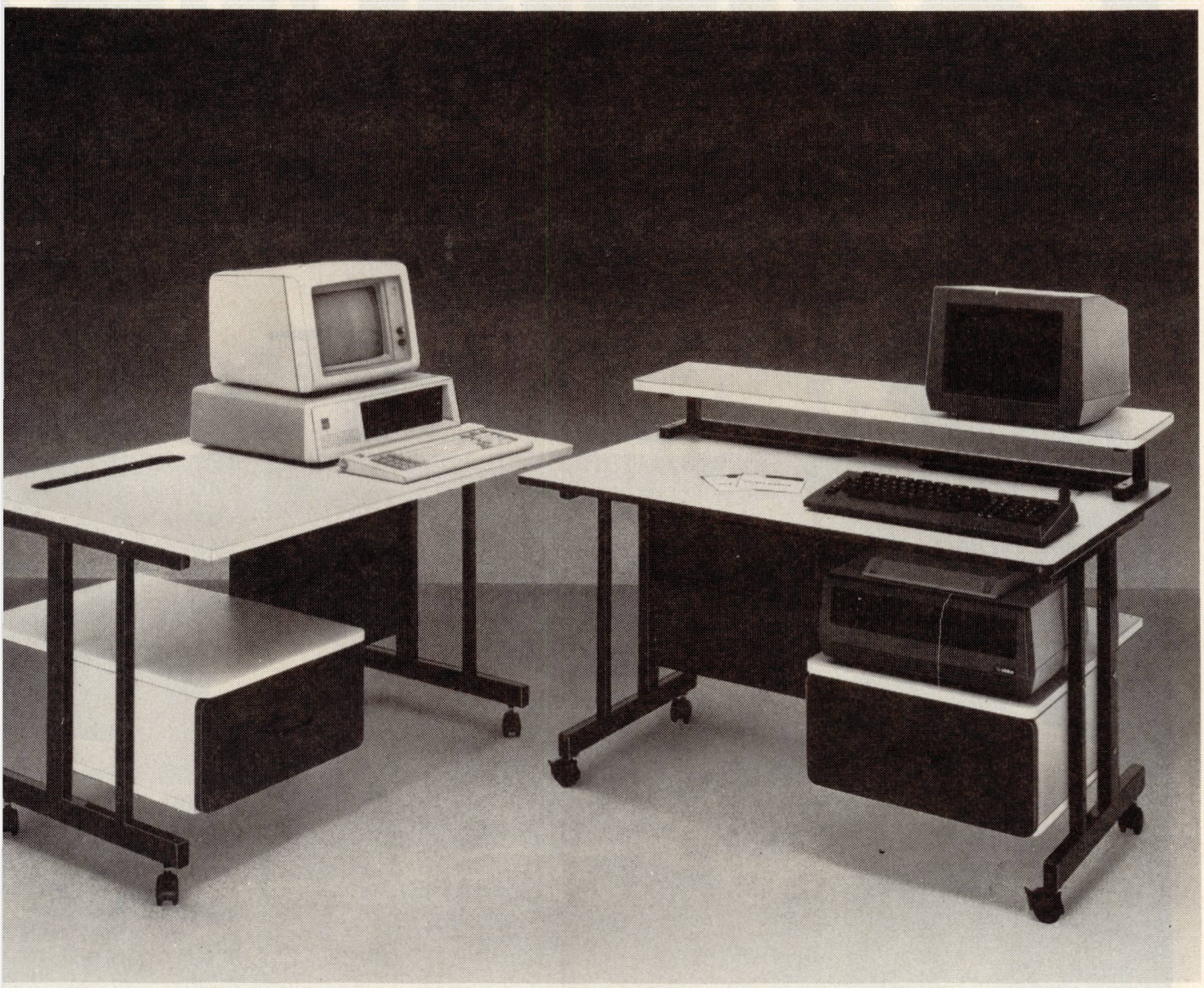

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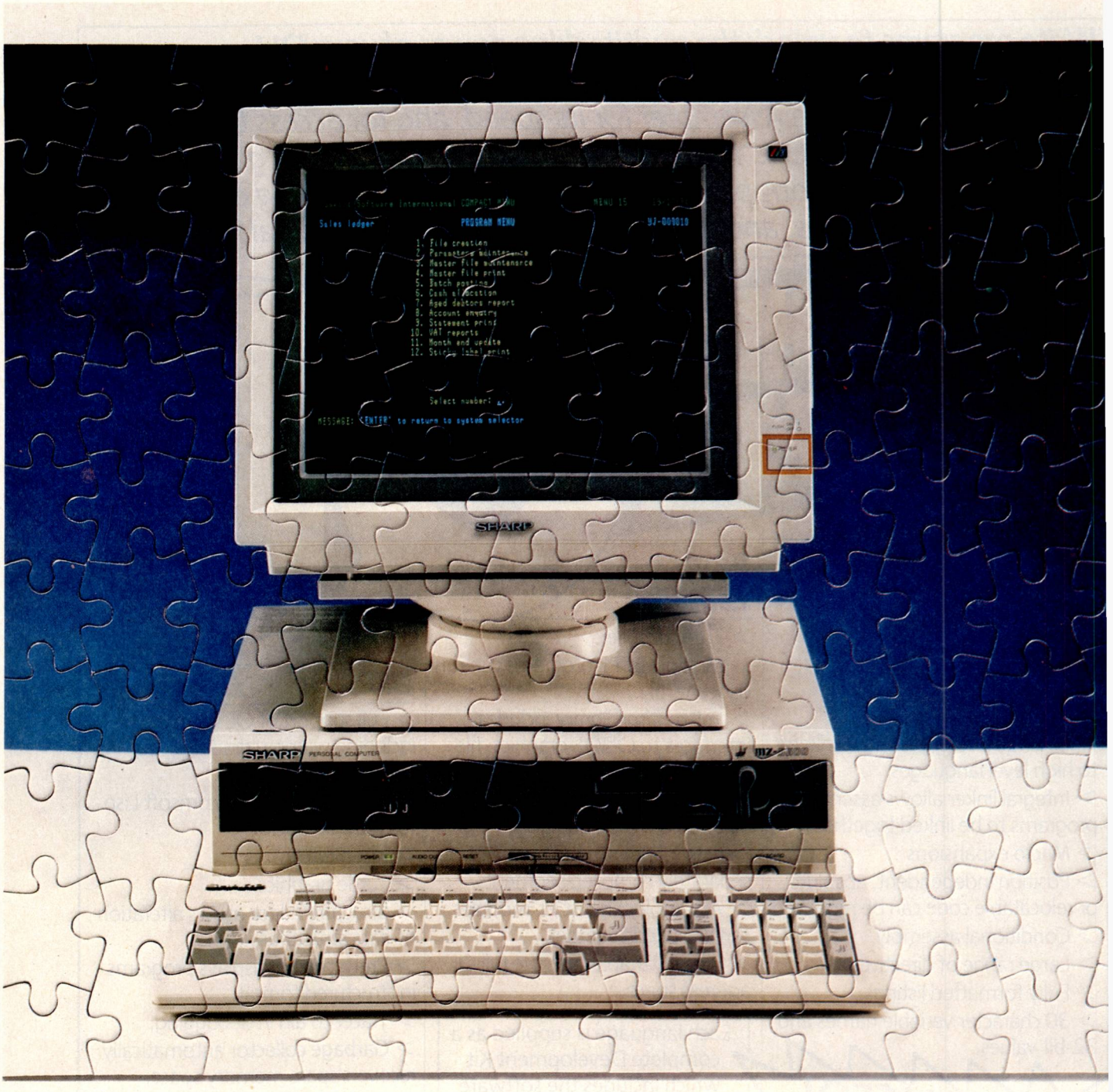

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NEWSPRINT



Guy Kewney gets to the bottom of the Acorn upheaval, rumours of the PCjr in Britain, and the tussle between Apple and Apricot in this month's round-up of news and views.

Jumping the gun

Panic warnings that IBM was planning a huge announcement of a new micro turned out to be misguided when the company released details of its biggest range of commercial mainframes, code-named Sierra, instead.

But no one is laughing about the idea of seeing the PC displaced in the company's affections any more. The PC Two is becoming a stronger and stronger series of leaks, and it could easily happen (in the States, at least) before the third quarter. What looks more likely to happen here in the UK is that the Junior may be announced.

The arguments against it, say my sources, are that it isn't profitable to build at the price ($800 or so) that it needs to be cut to, to sell. From what little I know about IBM's production line technology, it would be profitable at $600 and worth making at $500, so I don't buy that theory.

But the other argument against the Junior (UK) is that the Two will make it obsolete. It would do that if the Two used a substantially bigger chip, either the 80186, or even the 80286, as in the PC/AT. And my sources suggest that either or both these chips are indeed the ones that form the heart of the next range of IBM micros. The fact that IBM has launched the JX computer in Japan, with the forecast 3½in Sony disk instead of current 5¼in technology, leads many to believe that this is the way the future goes. Rumours of big changes in orders to disk drive makers suggest the same thing.

My own money is on an 80186 family, since the 80286 is still not available in very high volumes or at very low prices. But, if IBM waits until after October, that may become irrelevant.

New fruit sweeps clean

Apple's cut of the price of the IIe to just over £400 — if you are a school — is welcome, and none too soon. Most people have seen this as an attempt to steal the market from Acorn, which is going through a few problems.

Apple publicised its schools program (Our Kids Can't Wait) as being a move to step in where the Government has drawn back. Unlike the Government's schools programme, Apple's doesn't stop after you buy a single machine. And the Government's program is now over, with the triumphant rubbish announcement that there are something like one computer to 600 pupils.

Look deeper into the significance of this announcement and you will see that Acorn is not the target.

A highly successful British computer company, Apricot, has just launched itself in the States, with a cheeky two-page advertisement in newspapers like the *Wall Street Journal*. It shows an apricot next to an apple (the fruit, not the computer) and as the story unfolds, the apricot gets juicier, and the apple drier.

Apple sees the battle to overthrow IBM as a single combat, not a war. It is not happy about the way Apricot Inc has pinched Apple's excellent US retail representatives. And word has gone out from Cupertino to the effect that there are to be no little Apricots growing in the Apple orchard. The best way to stop it is to chop down the Apricot tree back home. And Apple UK, therefore, has been given rather more commercial freedom than the money-hungry parent normally gives subsidiaries. One dealer put it to me succinctly: 'Whatever they say to you officially, Apple UK doesn't have to make a profit until ACT is no longer a threat.'

Whether his opinion is correct or not is more than I can vouch for. But the fact that he (and other distributors of Apple products) see the company's actions in that light is revealing.

And certainly the machine now challenging for a place in the education market is not the old BBC Micro, but the new Apricot F1E. It's a useful MS-DOS machine, low-priced, and was (until the Kids Can't Wait campaign) cheaper than the Apple II.

Ideal micro appeal

Attentive readers who leave work early may have noticed that an expanded version of the *PCW* Benchmarks made their TV debut on the Channel Four micro program *4 Computer Buffs*, with David Tebbut putting the QL, the Beeb and the Amstrad through the tests.

But what the TV Benchmarks don't do is to give some idea of the cost of buying the wrong machine. Let's assume that, on the strength of the Benchmarks, you buy a BBC Micro because of the peripherals and software available (the crucial factor in its victory on TV).

Then, let's assume you discover, too late, that you want disks, and that's another £150. Or that you just have to have a modem, or a mouse interface, or you want to do something special like play with video tape drivers.

How much does it cost you to upgrade your system?

What I am trying to do is to find out what *PCW* readers consider to be the 'standard' micro of the 1985-86 period. Does it have a built-in disk? Two screens (one black and white)? Built-in Prestel? Multi-tasking?

You may recall the excitement that was felt when the BBC Micro came out, running an operating system that compared with everything else on the

Notice board

PCW has three announcements to make this month, so take a deep breath and . . .

First up is an opportunity to work on *PCW*: we're looking for someone to oversee TJ's Workshop and Program File. A look at both these sections in the magazine should give you an idea of what we're after — a knowledge of Basic, organisational ability and an obsession with accuracy.

If you're interested in the job write to Graham Cunningham, *PCW*, 62 Oxford Street, London W1, enclosing your cv and a brief covering letter outlining your areas of interest and expertise.

Number two is a new publication from the *PCW* stable. If you've been searching for a book which tells you how to buy the right computer and how to make the most of it once you've bought it, then *Business Computing: the Survival Guide* is worth a look at only £2.95.

We called on former *PCW* editor David Tebbutt to gather together a group of experts and experienced users to explain just what's involved in setting up a successful system. The resulting guide is aimed at the professional and business person who is considering the purchase of a microcomputer system. Ideal for busy people, the book can be dipped into as each subject captures your interest. Whether you are buying a lapheld machine or a network system, a fully integrated package or a word processor, *Business Computing: the Survival Guide* has something to offer.

Start looking in your newsagents in mid April or order direct from *PCW* Circulation Dept, VNU Business Publications, 53-55 Frith Street, London W1.

Last (and definitely not least) is a drop in our subscription rates. For this issue only the rate is down from £15 to £13 for one year's subscription. The rate for two years has gone down from £25.50 to £21.50, and for three years from £39 to £32. And if magazines do become subject to VAT, this offer will turn out to have been an even better bargain. More details in the ad on page 112.

prizon. I'd like to produce a milar specification. You'll nd my electronic mail ddress at the bottom of the olumn (page 107), and you n write to me here at the *CW* offices if you aren't nline — but please, do let me ave your thoughts.

ion challenge

ACT is really planning to eep up with the Macintosh, ne of the realities it will have face sooner or later is that it n't very good at writing ystem software.

So says Andrew Margolis, ead of Lion Micro Systems. largolis has just completed a ommunications package for IS-DOS micros (it also runs n CP/M 8-bit systems) called omm, and he recommends, rcefully, that you don't use ne Apricot modem if you use n Apricot. 'The performance f the program with the nternal modem depends ntirely on the quality of the CT internal modem driver,' Margolis states trenchantly n the distribution disk.

'The ACT routines are xtremely slow and umbersome, and do not ork very well at all. In articular, the lack of any acility for obtaining status of the modem itself without resorting to a driver call slows the program down alarmingly while online and in answer mode.'

Lion, says Margolis, 'are confident that we could improve immensely on this, were we to be given access to the necessary information regarding the hardware interface of the modem itself.'

Thereby hangs the inner tale of disaster. It is only partly ACT's fault, because the approvals procedures of the approvals board, BABT, are somewhat stringent. However, ACT's ability to find excuses for the slowness of its operating system software has failed to impress Margolis.

The facts of the dealings between Lion Micro and ACT are hidden from me, because ACT's press office can't find anyone inside ACT who spoke to Lion.

But the theory, as explained to Margolis, for ACT's inability to provide the hardware details won't wash.

It is quite true that the BABT approval is for hardware and software combined. And it's also true that, if you use a system without the approved software, it becomes illegal. The rationale behind this is that your modem might start pulsing the line too fast for the exchange to keep up, or too slow to work at all. Since the only one who suffers would be you, not the exchange, it's hard to see why BABT sticks its nose so far in, but illegal it jolly well is.

However, theoretically there is nothing to stop ACT from providing low-level information about the hardware, and for other people to sign legal agreements to say that they wouldn't infringe the ACT approval.

So what has really happened? Does ACT not want to see Lion Micro produce a rival to its own comms software? Or is it simple confusion? As far as I can gather from my research, the problem comes down to a fault, unannounced, on the first thousand Dacom modems supplied to ACT. It was a bug in the firmware, and it has been fixed, but in order to cope with it (in the words of one comms software writer), 'ACT slugged their software all over the place to slow it down.'

The result is that anyone who tries to drive an early modem at full speed will have unexplained problems. And if they try to use ACT routines, which slow things down to cope with the problem, they will have unacceptable delays.

ACT will, if you send a modem back and it has a low serial number, replace the faulty software without charge.

All of which is fair enough, and just one of those things.

What is not fair enough is that ACT insists that: a) there are no problems on the modem; b) no-one there has spoken to anyone from Lion House; and c) the company will always give out interface information if it is asked.

Someone has to be mistaken here. Is it Lion Micro, a small company which does all its work in a couple of offices? Or could it be that ACT is no longer a fast-moving small company, and is getting a little heavy on its feet?



This is the Goupil 3PC, which is the entry system of the Goupil range of micros Benchtested in* PCW *in December 1983. This leading French micro is now being sold in this country by SMT International, which can be contacted on (01) 785 2411.

The entry system consists of 128k, 8088 processor, twin 320k 5¼in disk drives and a 640 x 400 resolution monitor, and costs £1955.



Our old friend, micro pioneer Robin Bradbeer, has at last launched his £80 robot, Zero 2, pictured above.

With its ability to function as a Logo turtle, Bradbeer predicts the thing will be useful for, among other things, dress-making. 'You just feed in your measurements to a program, and the machine will take a standard pattern and draw your fitting on a piece of paper.'

Bradbeer's company, Intergalactic Robots, did at one stage say it aimed to do for robotics what Sinclair had done for computing. It does have one or two very interesting little things in the pipeline, but the untold story is that it has already done a Sinclair, in one sense at least. The machine announced last month was presented to Thames TV back in summer, 1984, as a project for viewers to the Channel 4 series,* 4 Computer Buffs. ***Bradbeer faithfully promised that it would be ready by October. It wasn't, and a last-minute panic ensued when it was apparent that it wouldn't be ready for the series in February, either.

Hence the development of the Trundle which was outlined in last month's issue.

I await Robin's offer to ship 'within 28 days of receiving your order' as proof that he has indeed followed faithfully in Sinclair's footsteps.

As good as new

You may have trouble finding a buyer for that old Apple EuroPlus, or sub-standard SuperBrain, or slightly dented Osborne, or less than new NewBrain, or original Oric, or whichever used computer you currently want to swap for a shiny new Plus 4.

It isn't because no-one wants to buy them — it's that you'll have trouble finding a buyer. Apart from a strange giveaway magazine seen in a few newsagents, I don't recall seeing anyone who is organising second-hand computers on a national basis.

But this could all change, if plans currently being worked on by Fred Brown come to fulfilment. Brown was the man who was made famous in Adam Osborne's book, *Hypergrowth* (which described the rise and fall of Osborne Computer), by trying to save the company. He found a cash buyer for all the old stock — $16 million worth of Osborne 1 machines.

This talent for moving old stock still remains with him in his new venture, *The Brown Book*, a trade guide to used computer prices. The book gives full details of a wide variety of computers on the market, from pixel count to

disk capacity, to byte size, to the type of chips used in memory, plus three prices for each computer. It shows the recommended retail price, the actual 'street' price which everyone is really paying, and the typical 'used machine in good order' price.

'Right now, there is something like $300m worth of excess inventory piling up in the US,' Brown told me, 'from people like Eagle, Televideo, Commodore, Fortune, and a variety of others. Everyone built machines for this tremendous growth pattern, and it's stalled. And the reason is that people who want the new machines can't "trade up" from their old equipment the way they can with cars.'

The book costs a thumping $375, but that's a subscription for six quarterly issues.

Brown is trying to find someone to produce a UK edition which will include much of the US information, but with a different approach. Anyone keen to work on this project should contact him on (805) 687 1140 in Santa Barbara, California, or write to PO Box 3490, Santa Barbara, Ca 93130.

The small print

Users of the QL tell me that there are new versions of the four Psion programs supplied free with the system. They aren't free, these new ones, unless you belong to QLUB, they say, but all agree that they're worth having — because, they claim, there ar serious problems with version 1.00 of the software.

Leon Heller, head of the Independent QL Users' Group, has finally managed do a proper test of them, and says that he had to get disks before he could do this. 'It took too long to build up larg test files before, using microdrives,' he told members in the club newsletter — something I ca concur with. 'And now that

Confession time: I too dismissed the Apple laser printer with a yawn when first told about it. 'It uses the same laser engine as the Hewlett-Packard but costs $7000 instead of $3400,' was an obvious end-of-argument observation.

It isn't like that.

Two things about the latest Macintosh industry announcements from Apple — the 'work group' network, and the printer — make it look, to me, like a very powerful plus for the machine. Firstly, the printer is so good that it makes the Hewlett-Packard (HP) look like a clumsy dot matrix attempt to imitate a typewriter. If this worked, it would still be pretty awful because typewriters aren't all that special.

The Apple printer is nearly print-works quality. Many people will use it for typesetting, and their customers won't know it.

At $7000, however, that would be the end of it, except that, should you be a Mac user, you will covet it. It will occur to you, very quickly, that if your colleague in the next office had one, you could share the printer and it would be down to the cost of the HP. And if you both have one, and could talk your other colleagues in the group into buying Macs, then the printer would cost . . . hmm, $7000 divided by eight . . .

Here's a shot of the output of this printer, actual size, and then enlarged, just to show how accurate and smart it is.

Apple's net, Apple Talk, is not a local area net. It's a way of passing files from one Mac user to another, of sharing things like disks, and, of course, the printer.

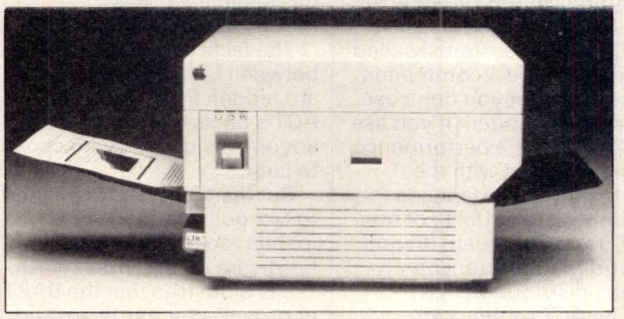
By the end of the year, the company reckons that it will have a plug-in card for the IBM PC ready. This will connect an Apple Talk group of workers into the PC Net of the official computer network in a company, thus saving the face of data processing executives who oppose 'rival, incompatible' standards springing up. The whole Apple Talk net will look just like another node on the main net.

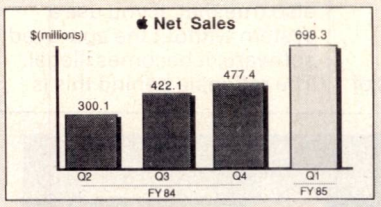
The question which still needs to be answered is simple. What software is there, that runs on the Apple Talk net? At this stage, virtually nothing. No one at the Cupertino launch could agree on any one version of how much software you got with your $50 network connection, if any. John Sculley (not in a good mood) said 'lots' and 'none' to shareholders in consecutive paragraphs of a press briefing the day after the launch.

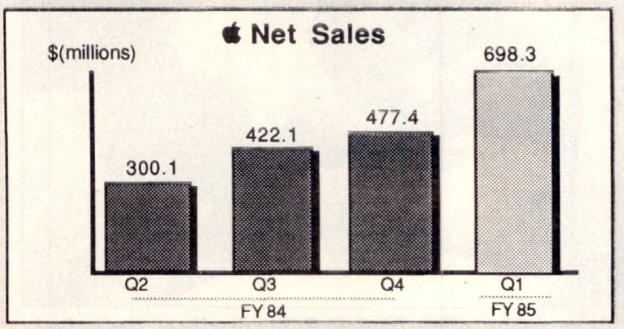
That's nothing special. There is virtually no software, on any net, that can really cope with the power that the net could make possible. For example, even on an old network like Nester's Plan 4000, you can't have two people editing the same document — it's theoretically possible, but no one has done it.

But Lotus' Jazz, when it arrives, will make limited use of the Talk net and will soon be expanded to make full use of it. Other programs were demonstrated, such as a multi-machine database, which already works on trial sites of Apple Talk, and a typesetting machine from Linotype is also available.

For the technical, the printer is 'the most powerful computer Apple has ever launched,' according to Steve Jobs, Apple founder and chairman. 'It has a 68000 processor running very fast, with half a megabyte of read-only memory and 1.5Mbytes of RAM,' he said, and it uses a 'resolution-independent graphics language developed by Adobe Systems, called Post Script.'



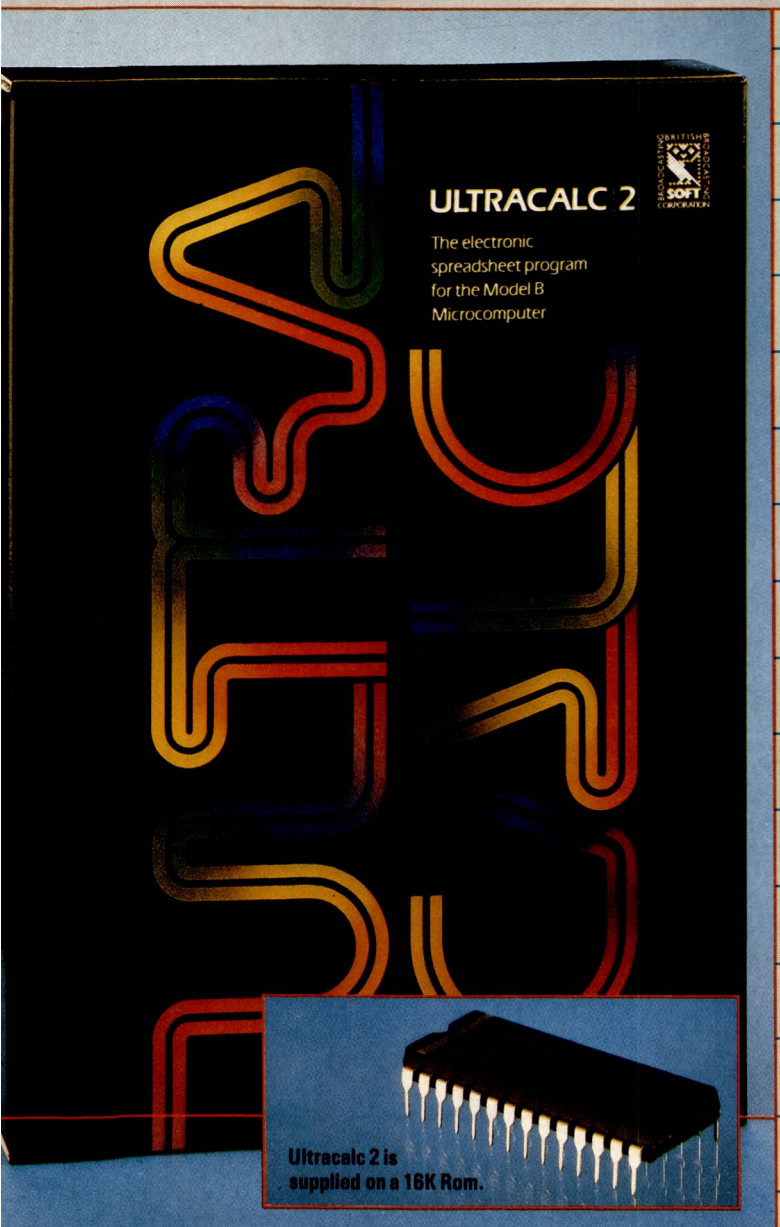




The thing is a knockout, and it has to be. The advertising campaign chosen by Apple shows a long line of grey-suited executives, blindfolds over their eyes, marching relentlessly over a cliff, one following another. At least, says the commentary, look into the alternative.

A neat idea, but hopelessly wrong for corporate America, who to a man/woman reacted negatively. 'I personally found that very insulting,' said a far from conservative computer hacker who happens to be in charge of data processing for a large pharmaceutical company. 'And I know that other people doing this sort of job, who have bought IBM PCs, feel very much the same way.'

Apple will have to hope that its subversive tactics work, and that departments who want to share the printer will buy its hardware without consulting the official authorities. The authorities are not eager to be won over.



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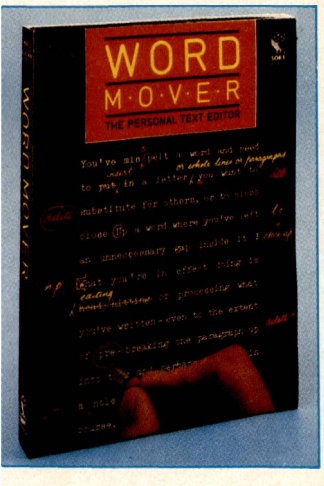

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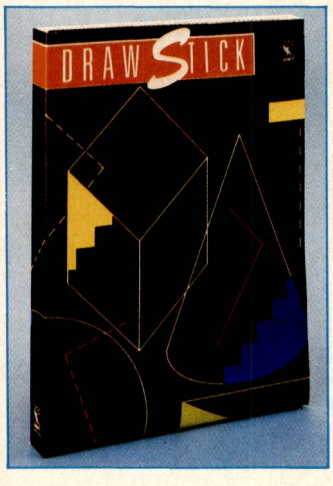

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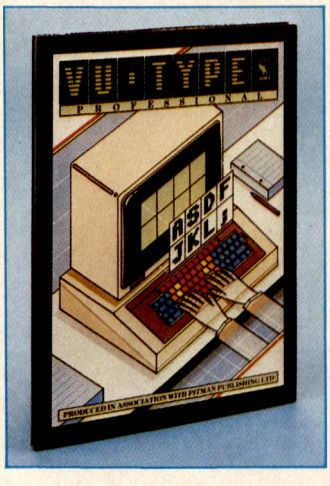

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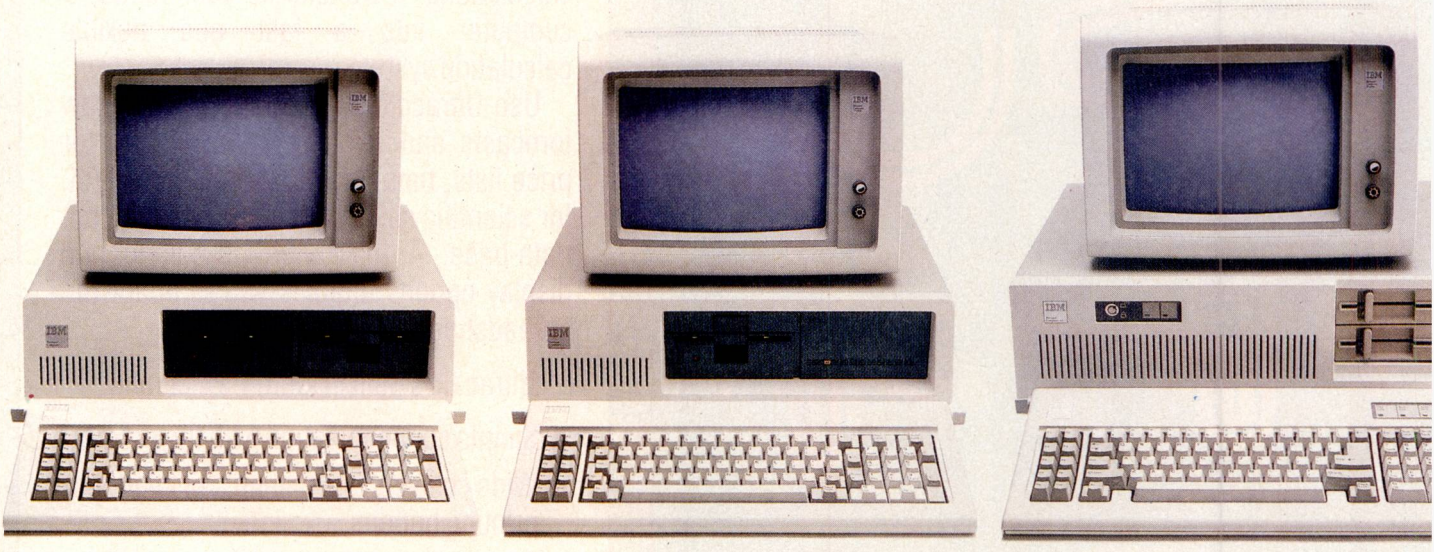

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I've done it, I'm able to confirm that the first version has serious problems which, in my opinion, makes it unsuitable for serious use.'

Heller reports a typical Sinclairism — he wanted the chess program, and ordered it through QLUB. QLUB does cost money to join (around £30) and so he (and other QLUB members) expressed some annoyance when he found the chess program available in shops, and still hadn't got his own copy. 'They drew my attention to the list of QLUB benefits,' reports Heller.

This states that members may *order* software before it is generally available, but, Sinclair pointed out, it doesn't state that they will *receive* it any earlier than anyone else!

One of many

Inbetween writing Benchtests for this magazine, organising business specials and appearing on TV, David Tebbutt also works at Caxton Software. The company's latest package is SmartKey which allows you to redefine your keyboard to 'produce words, paragraphs and sets of software commands with just one keystroke.' As a result, you'll never need to type the same old lengthy command sequences again — and you can have a lot of fun customising your keyboard and software to do exactly what you want.

SmartKey is available now for the full IBM range and true compatibles for £99. Less sophisticated MS-DOS and CP/M versions are on the way for £79.

Previous software from Caxton includes Cardbox, BrainStorm and Touch 'n' Go, but it faces competition over SmartKey. US firm Borland International, producer of Turbo Pascal and Sidekick, has a rival PC product called SuperKey which Altor Computer Systems intends to supply in this country for £49.95.

Caxton is on (01) 379 6502 and Altor's number is (041) 226 4211.

Exercising a prerogative

Adam Osborne has spoiled the fun of reading his book, *Hypergrowth*, by announcing that even he no longer believes the sensational mystery in it.

His book was an expensive piece of research designed to illustrate the possibility that the collapse of Osborne Computer was engineered by one man — the man he hired at a million dollars per year to run it — Robert Jaunich.

He now tells me he's changed his mind.

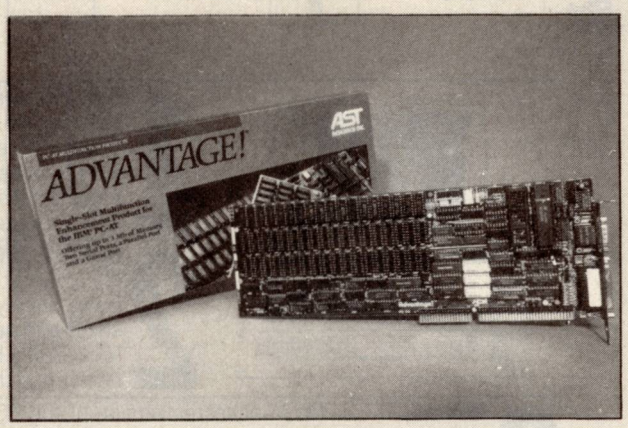
'Evidence coming out in the depositions concerning the collapse has shown that two of the bits of evidence which led me to suppose that Jaunich was the instigator of some of the strange events are not evidence pointing to Jaunich at all,' said Adam. 'It seems that one was a letter from the financial backers, which he was obliged to sign, and the other was something he had nothing to do with.'

West Coast gossip suggests that Adam's opinions may not have changed as much as he publicly says. 'There was almost certainly a mega-lawsuit in the pipeline,' says John Dvorak, co-author of the book and, by his own claim, the person who 'toned down' many of Adam's more outrageous allegations in it.

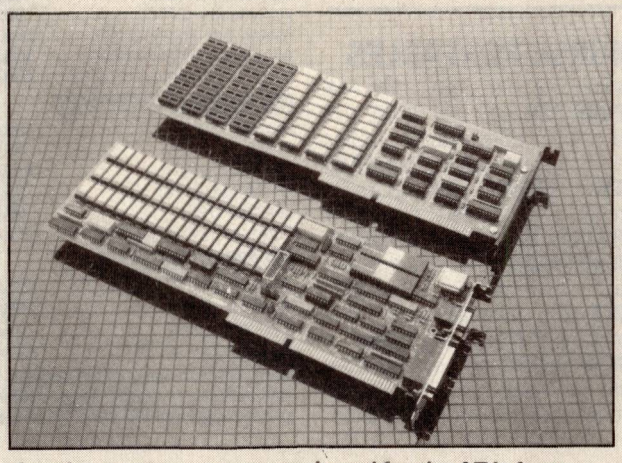
In the book, Adam says that if Jaunich was not acting out of malice, then he must have been incredibly stupid. Adam refused to be drawn on his own opinions of Jaunich's stupidity now that he officially believes in his innocence of all malice.

His new venture, Paperback Software, is flourishing sufficiently for him to have hired 12 staff, and to have signed contracts for two of his programs with hardware suppliers who will bundle them in with their products. The products are Executive Writer, normally selling for $70, and Number Works, a $40 VisiCalc-style product, and they'll be supplied with upgrades for the PC Junior, by Tecmar.

We won't see anything from him in this country unless Bruce Everiss manages to rescue Tansoft from the collapse of Oric and sign up as Osborne's agent. Adam tells me they are in discussion.



For anyone with a bare IBM PC/AT and £524 to spend, the Advantage expansion board seems to meet all requirements. It has space for up to 1.5Mbytes of memory, two asynchronous serial ports, a parallel printer port, and an optional game adapter port. It's distributed by P&P (Pete and Pam) on (0706) 217744.



Another enormous memory board for the AT is from X-Data, and is called Grande Byte. It can carry from 128k to 2Mbytes.

X-Data also sells the Rio Grande, which includes a pair of serial ports, a parallel printer port, plus an unspecified amount of memory. Details on (0753) 72331.

Surprise, surprise

They were a little surprised at Oric to find how little fuss was made about the news that the receivers had been called in. I'm a bit surprised they were surprised. By the time it happened, most people had taken it for granted that it would.

The company had a well-documented rotten time last year. Blaming its lack of success on Prism, on the advertising agency, and on the stupidity of British micro buyers, it clocked up something between £3 million and £4.5 million worth of debts.

Oric then persuaded its creditors to give it until after Christmas, when (it assured them) the Atmos would take off like a stratocruiser, while, in France, the Stratos would do unheard of things. And, if those failed, it had a huge lawsuit in the pipeline against Prism.

Lawsuits against Prism, of course, turned out to be rather like 'vapourware' in nature — a nice idea but not very tangible, and about as bankable as a scheme to harvest wheat around the North Pole.

The City columnists will have their theories about why the company mismanaged its marketing, but the fact of the matter is that from the days of Tangerine, the various incarnations of that 6502 family of micros have always served mainly to make another micro look better.

And its qualities always impressed me as being irrelevant. It was cheaper than the BBC, but what wasn't? It was better quality than the Spectrum, but everything was. It had more software than the NewBrain, a better disk system than the Commodore 64, a friendlier Basic than the Atari, faster graphics than a TRS-80 Model I, and better sound than an

MORSE: THE TOP TEN SYSTEMS

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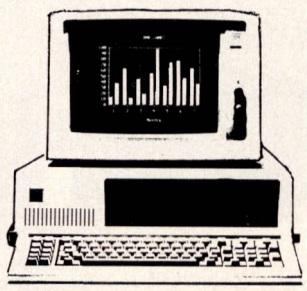

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5 **COMPAQ PLUS.** Compaq Portable + 10Mb Winchester = strength + value. This 256K computer has a reputation for being really tough and reliable. Morse are packaging the Plus with the popular Pfs software series. Pfs Write, Graph, File and Report, **worth £452, free!** Only: **£3945**

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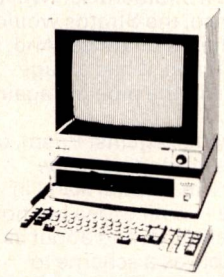

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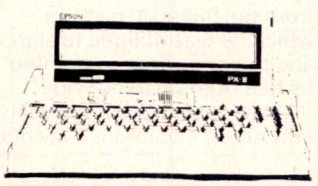

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Apple.

Finally, in January 1985, a year after Sir Clive announced the 16-bit (?) QL and when even Acorn was moving up from 8-bit micros, Oric announced a new 8-bit design, the IQ 164!

Without its £3m current debts, at the time of writing, it would be a going concern in France, and I am expecting it to be bought for a bargain price.

But that doesn't solve the problem of what Tansoft will do.

Scraping the barrel

It would be idle to pretend that I'm not sceptical about IBM's claim to be short of cash.

In case you don't watch television, I should begin my explanation by reporting that I've been involved in the Channel 4 series on micros, *4 Computer Buffs*.

The plan was that I should read the news, coming in from around the world to the screen of my micro from far-flung electronic mail systems. And, because it seemed unfair to use just my own terminal, I arranged to set up the system on a different machine each week.

Or, at least, I tried to.

At the time of writing, Apricot still hasn't found a software package to log onto anything other than its own Micromail system, Apple has still to produce the MacTerminal disk for the Macintosh, and IBM — well, IBM can't afford to let me have the machine.

It started just before November, when I said I'd like to borrow an AT to review some software; when the machine didn't show up, I phoned. 'It proved impossible to get one for you,' said the bureaucrats of IBM. 'We'll try to get you one in the New Year.'

'What would be more useful,' I suggested, 'would be the loan of an XT at around the time the Channel 4 series starts.' And I put my TV proposal to them.

They sounded quite excited. They could arrange a loan before then, they told me, and they did. I was pleased, because it takes time to get an XT behaving the way you want it. You have to find the manuals, format the hard disk, partition it, and then find all the extra bits and pieces of hardware that have to be accumulated before you can drive a modem.

'Officially, we can only lend a machine for two weeks,' said the bureaucrats, 'but what happens is that you ring up and ask for it to be extended for two weeks, and usually we agree.'

Two weeks before we were due to broadcast the first show, they rang. They said they wanted their XT back. I suggested extending the loan. They said they already had.

'We need all our loan machines,' they explained. 'We really don't have enough to spare one for the TV series.'

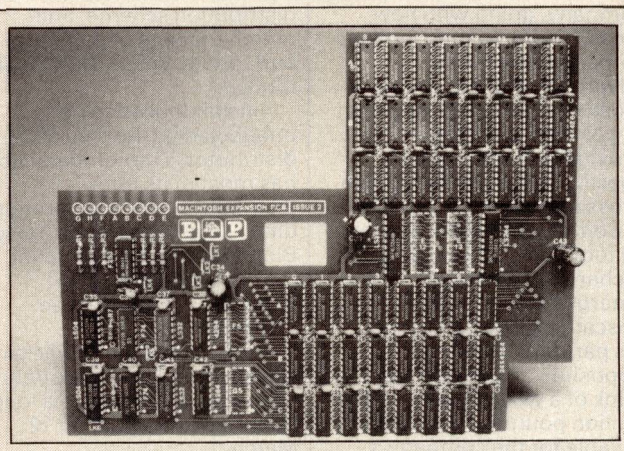
I suggested the obvious, that they bought another XT, and added it to their loan stock. 'We can't afford that,' they explained sadly.

I know the XT is overpriced, but I hadn't realised that it was out of the reach of IBM's own staff, too.



Honestly, if I had spent a couple of thousand pounds on a tape drive for my PC, I would find somewhere a little less precarious than has Larry Lee, who has balanced the disk backup unit between the PC and the screen. Apart from giving you a crick in the neck, it looks unsafe. That said, the main advantage of the PC Megastore from Ampex is that it is file addressable. And it does include the hard disk, too.

Details on (0734) 875200.



As forecast, the UK-designed expansion for the Macintosh has been announced by P&P (Pete and Pam). But it goes a bit further than expected, because the £500 board takes 64k chips. Pete Fisher tells me he hopes it will prove possible to use 256k chips and give 1.5Mbytes, but he hasn't announced this until software tests are complete. The upgrade does affect your warranty, however, and P&P has to do the work, so it warrants it for a further 13 months after you send the machine.

Details on (0706) 217744.

Still waters

Prism was such a 'prominent' company in the micro world that it seems unthinkable that it could have died so soon.

The company was originally the sole distributor of Clive Sinclair's Spectrum to shops (apart from W H Smith) and carried a wide range of software, too.

Yet only a year after the most fantastic laser-and-lights-and-dancing-girls show at the Hippodrome entitled Perspectives on the Future, and only six months after the head of one of Britain's biggest computer companies, Scicon, was tipped to take over as managing director, the receivers are in and the lawyers are fighting over the pieces.

No-one I spoke to shares the optimism of the company founder, Richard Hease, who believes that the collapse was unnecessary.

Hease reckons that there was a cash problem brought on by 'too much stock' in software and modems, coupled with a reduction in the amount of Sinclair Spectrum business. 'You have to make allowances for stock, and once we'd done that — even though it was stock that was starting to shift — we were theoretically insolvent. And when that happens, you have to call in the receiver even if you would eventually recover.'

The question of whether the modems and software would ever have sold is now just a matter for debate, because the receiver looks certain to flog the bits off at a song. With competitors like the Unicom getting into gear, that's about the top price for Prism modems.

The question of how things got to that state is one with a more pertinent answer.

Hease has told friends that he 'should have stuck his nose in earlier,' which appears to be a reference to his own preoccupation with the Wren Computer offshoot. Wren never made it big, and one reason for this was the failure to get started in manufacture. 'We bought the cheaper moulding tool,' one of the directors told me, 'and then had such problems with it that we ended up buying the expensive one, too, and being several months late.'

Perhaps now the people who run Wren will be able to buy the company from the receiver, and make a living out of it — but never, I'm afraid, the big time.

Hease was probably also thinking, when he referred to 'sticking his nose in,' to the disagreement he had with former managing director Bob Denton over how the finances should be managed. Denton wanted to run an agile

company, going with new ideas. Hease, suspecting that someone was taking advantage of the company's loose structure, was anxious to get his accountants to provide more accurate, specific figures on things like gross margins.

Contrary to the opinion of all too many in the industry, Richard Hease hasn't emerged from the crash unscathed, having dumped his partners. Quite the opposite — unless he can think of a way of raising three million pounds, he personally is liable for the company's overdraft. 'I'd never have guaranteed it personally,' he told a friend, 'unless I'd thought the figures showed we were in a good position.'

Hease reckons, say my sources, that figures didn't show that, and this is the reason why Prism's backers called in another accounting firm, Price, Waterhouse (fresh from their tussle with the miners' union) to check the work done by Arthur Anderson.

My friends in the City have advised me not to try commenting on this one, but they did go so far as to agree that 'this sort of thing doesn't happen often,' and, when pressed, failed to recall the previous occasion on which 'this sort of thing' ever had happened.

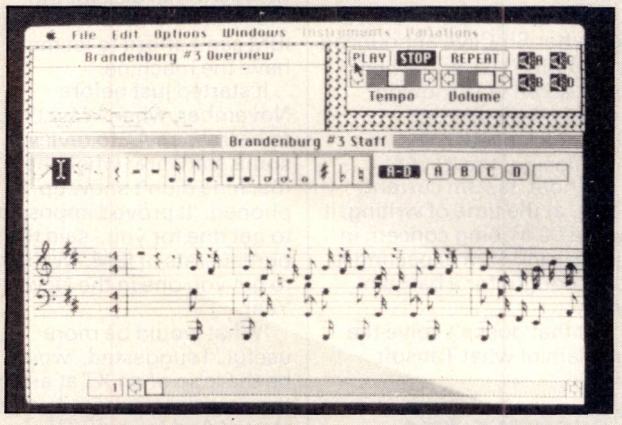
One comment worth remembering, by an ex-director of Prism: 'I think what went wrong was just that Bob Denton and Richard Hease had one profitable activity, which was Spectrum distribution. And I think they kept trying other daft ideas like the Romox software distribution scheme, and merchandising of software and robots, which didn't make money.'

Sinclair looked to be unaffected by the loss of the distributor. The company now has most of its retail distribution sewn up through direct sales, or through Terry Blood Distribution. But that isn't to say that Sinclair Research is happy to see Prism die.

On the contrary — Sinclair was planning a public offering of shares, according to a long-schemed timetable, on 12 March.

With the final rites for Oric, the collapse of Prism, and the farce at Acorn, his financial advisers drew Sir Clive to one side and told him sadly that the City was not in the right mood for a microcomputer company's shares.

You can bet that Sir Clive would not be trying to go public unless he thought he could use the cash. Whether he needed it urgently on 12 March, that was the optimum time chosen, and being forced to choose another time is a blow to his plans for the many advanced projects going on in the group.



Keyboard maestro Rick Wakeman (once with Yes and others in the rock business) has been playing with the Yamaha MSX computer plus keyboard/synthesiser, and has revised his early, hasty opinion that it was an expensive toy.

He now suggests that it's a very good instrument, and extraordinarily cheap for the price.

This isn't the machine which he now wants from Yamaha, however. It's another program for the Macintosh that plays music. There are four voices in Music Works — but even so, I bet Wakeman isn't as impressed. It's available through Softsel dealers, and its main feature is the music 'toolbox' which lets you pull notes off the top of the screen.

What number, please?

This cellular radio-phone fad has its drawbacks, as a fellow journalist found recently, racing back to a London appointment from Cambridge.

Late for the next press conference, he picked up his phone and asked for directory enquiries. 'The Howard Hotel, please,' he said.

'Is that a mobile?' enquired the operator, puzzled.

'No, it's a ruddy hotel', said my colleague with admirable restraint.

'Well! We don't have numbers for land lines!' said the operator.

'Oh, I didn't know. Connect me to directory enquiries on the ordinary phone system, then.'

'I'm sorry, but I can't do that.'

I'm looking forward to truth in advertising. I want to see that lovely commercial with the two bearded gents, cycling sedately across the country landscape on a tandem, remade. I want to see it showing the 16 land line phone directories for all the nearby localities, which they obviously are expected to drag behind them in a separate trailer.



At last, a computer game competition with a sensible prize worth having. The game is Moon Cresta, which has been in the arcades for a while, and Incentive Software, which has bought the rights to the game, is launching it.

The prize is the actual Moon Cresta arcade machine. All you have to do is score 30,000 points on the Commodore or Spectrum . . .

Propaganda

Mr Geoffrey Pattie, the Minister in charge of computers, urged American businessmen to locate high technology industry in Britain.

He did not say some of the following things.

He didn't say, for instance: 'You will be untroubled by any form of local competition. The Government and the City between them ensure that anyone making money in electronics quickly moves out of computers. The Government has a policy of sponsoring only those companies too complacent, overpriced, and slow-moving to make a living any other way. These we give preferred status to. This ensures stagnation, and leaves the way open to rivals. The City, for its part, cuts the price of shares in any electronics group that considers doing anything beyond supplying the Ministry of Defence.'

Pattie further didn't say: 'We have a policy of educating the best of our students to a high standard, but of finding no jobs for them. Since we are now still a rich nation, but at the bottom of the list of rich nations, our best brains are able to double their incomes by taking their degrees to America, Holland, or just about anywhere they speak English. The people left behind are usually dumb, or timid. The few adventurous types with the guts to start up their own firms usually turn out to be incompetent to manage them. Those smart enough lack the necessary courage to break out of a nice safe job as design engineer for a software factory.'

He could have gone on to say (but he didn't) that our procurement policies were the delight of our competitors. 'We have a useful habit of protecting a

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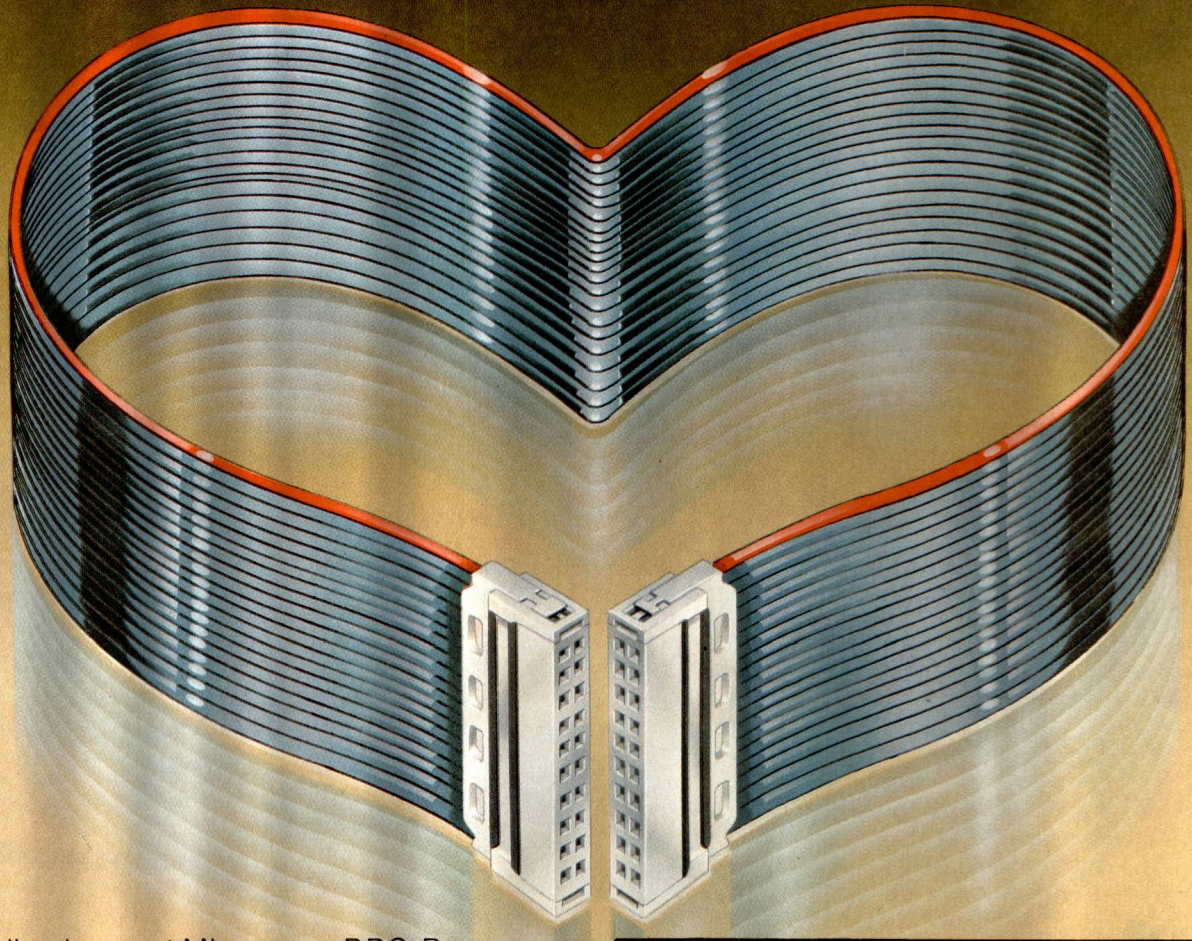

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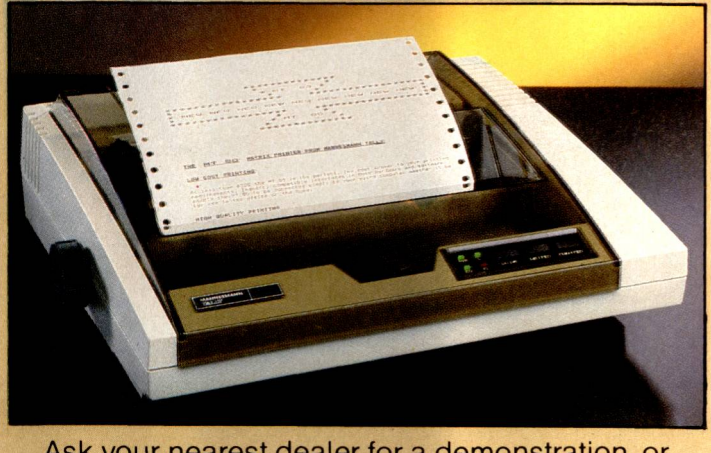

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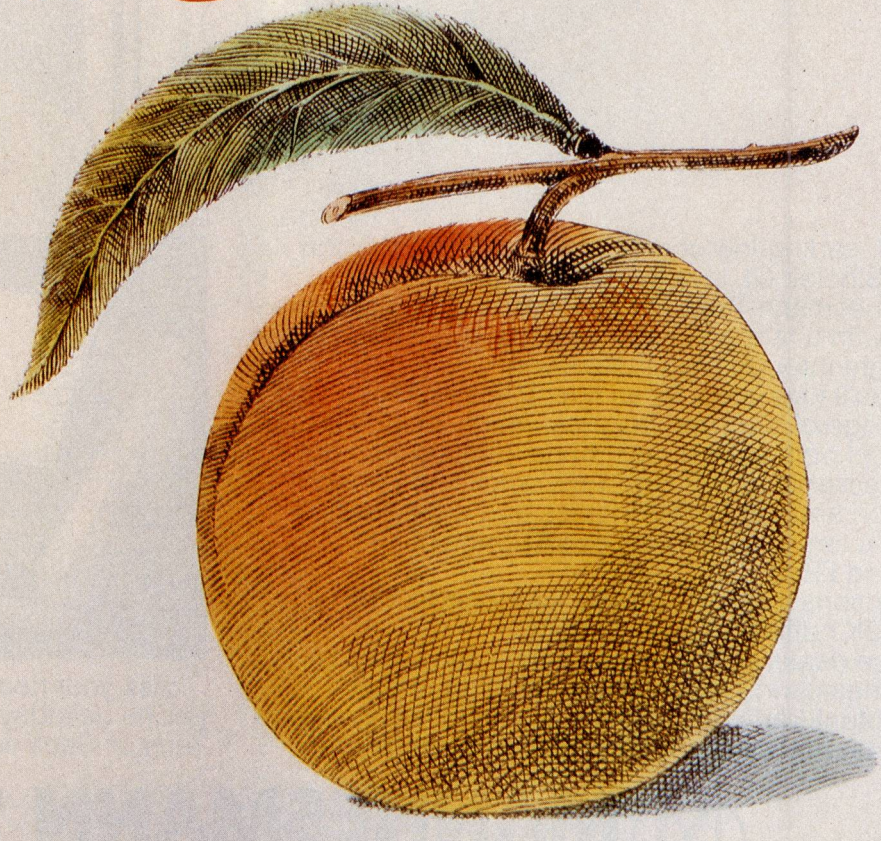

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Not content with that, there's a huge 720k disc capacity and a range of add-ons to increase processing and storage.

If that sounds like gobbledegook to you, fear not. A tutorial is included in the free package of business software which explains all.

Suffice to say that the Apricot's memory can easily keep pace with your business growth and won't become quickly obsolete like so many of our competitors.

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Even our keyboard beats the others hands down. We have 92 keys (our competitors short-change you with as few as 58) which includes a numeric pad for rapid calculations.

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These work on infra-red beams just like your telly's remote control so you don't have lots of wires getting in the way.

To home in on a particular part of the screen you simply point the mouse at your F1 and twiddle the control.

Yet another feature worth looking at is the fact that the Apricot F1 can drive either a colour or monochrome monitor, or even your TV set.

You can display up to 16 colours simultaneously or 16 levels of greyscale.

As your business develops you can plug the F1 into one of our new net-work systems which allows more than 30 computers to talk to each other.

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Computers & Communications Limited, Bradford. Tel: 0274 499122.

Microworld Distribution Division, Edinburgh. Tel: 031 557 4196/2087/3345.

Micro Systems (Distributors) Limited, Kettering, Northants. Tel: 0536 520910.

Hugh Symone Distribution Services Limited, Bournemouth. Tel: 0202 26535.

Quest International Computer Systems Limited, Chandler's Ford, Hampshire. Tel: 04215 66321.

apricot F1

*PRICE EXCLUDES MONITOR AND VAT.

ACT (UK) LTD., HALESOWEN, WEST MIDLANDS B63 3NT.



This is the first word processor for the IBM PC that I've seen which comes on a board. It includes an extra 64k of memory, which is available to the IBM when it isn't running the built-in word processor.

The board and software together cost £495. Details are from NBI, and if the word processor has a name, the company will have to tell you what it is, because it didn't tell me. Phone (01) 568 4242.

market by decreeing the products dangerous, and either banning them altogether or insisting on a new (but less safe) standard. We keep this up for a couple of years so that overseas producers can manage to get the bugs out of their systems, perfect their factory organisation, and get the price right down. Then, when the market is mature, we can open up our under-developed firms to the cut and thrust of international competition, leaving our own market's ready-ploughed fields for you to harvest.'

Pattie further missed the opportunity to add: 'In the few areas where we do have a substantial advantage over our rivals, we have a unique system of stifling development. We set up a Government support system. Then, anyone who doesn't get aid under this system is clearly below par and can't get City finance. And then we change the support policy in mid-stream, at crucial financial points in the development of the technology, so that the development is constantly going nowhere at all.'

What Pattie did say, in Los Angeles, was that 'the strength of the UK market speaks for itself.'

I suppose he must be serious. With the dollar at the level it is, a country which imports nearly all its microcomputers from America obviously has more money than sense.

He outlined 'the Government's work in the field of communications.'

This presumably refers to the failure to put cable television down, the failure to start laying optical cable instead of copper wire, the failure to organise satellite communications, and the failure to spend Telecom's inordinate profits of the last decade on something as simple and obvious as multi-frequency (touch-tone) dialling, or as necessary as a set of modem standards which distinguish between a carrier signal and an engaged tone.

I particularly liked his suggestion that the Government's work in 'total access communications systems would give 90 per cent of the UK population the opportunity to make telephone calls from their cars by 1990.'

This is splendid news! We can expect a long queue, as the UK population lines up to collect not their phones, but their cars — presumably supplied by the Department of Trade and Industry, who sent me this pathetic attempt at propaganda in the first place.

Acorn reprise

Olivetti *is* being a busy little world-wide computer company, isn't it? It has collected bits and pieces in America and Europe, and now Acorn is giving it probably the highest profile, after Apple, against IBM in the micro business.

The Acorn announcement — that Olivetti effectively has control of Britain's most popular school micro — doesn't solve as many problems as remain to be faced.

But most observers will agree that the key decision has been faced, and that is to give control of the company to more effective decision makers than the joint founders, Chris Curry and Herman Hauser. Both men have been remarkably effective, despite their limitations, in taking Acorn to the top. But unfortunately, the limitations were totally undiluted — they seem to have had total control, not only in financial terms, but in day-to-day management terms.

Attempts to verify this by press time failed, but unimpeachable sources assure me that such was their grip that even financial controller Peter Wynn was not authorised to sign Acorn cheques. In the words of one disgruntled ex-executive: 'If Chris and Herman couldn't agree on a thing, it didn't happen. Nobody else had a say.'

The main problem which led to the cash crisis was not (as suggested on the BBC's *Microlive* program by Ian McNaught-Davis) a 'press vendetta' against the company. Far from it: the Press followed the City six months behind. It wasn't until the City had all but abandoned its holding in Acorn that a couple of news pieces were published in the *Sunday Times*, attempting to explain the reasons behind the loss of faith.

Reasons for the crisis were many.

1) Acorn didn't do well over the summer months. It set its sights on recouping this over Christmas, and saw the Electron as the ideal Christmas micro. It was already overstocked before Christmas, and extra production during the Christmas season took the warehouse stocks to an enormous figure.

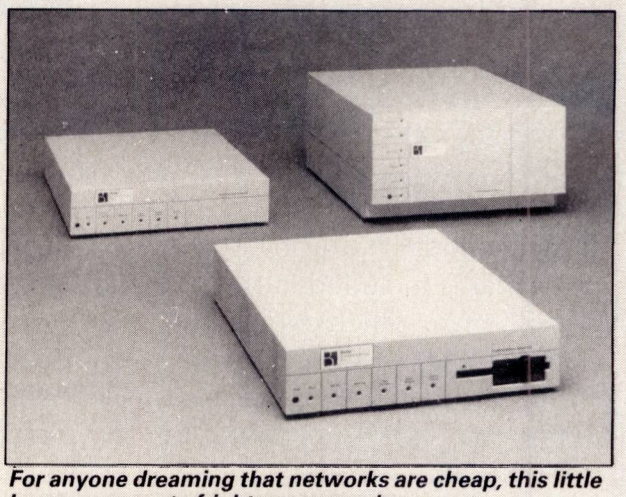
2) Even its flagship product, the BBC Micro, was under pressure during the pre-Christmas period. I personally spoke to dealers who said they were thinking of abandoning the Acorn range because it wasn't selling, but Acorn refused to accept this information. After Christmas, stocks began to be discounted, and rumours of a new, cheaper version meant that some dealers began discounting heavily.

3) To outsiders, the position was obviously unstable. The company's financial advisers put forward a restructuring plan which would have given Curry and Hauser (my sources say) a considerably better deal than they have now. They rejected it, and dismissed their advisers.

When it became blindingly apparent that a new company structure was needed, precious time was wasted in a futile rearguard action.

That said, the City has only itself to blame for the predicament.

When the micro business



For anyone dreaming that networks are cheap, this little box may serve to frighten you awake.

It's a network management server. It provides 'complete ongoing records of all network activity at the individual session level,' according to its maker, Bridge Communications.

'As networks are configured for hundreds of users, having precise information about the activity of those users becomes essential,' commented a senior executive. 'For example, it's desirable to know who's connecting to whom, for security reasons or accounting purposes. And to balance the network load properly, you need to know if an individual server is handling too many sessions . . .'

It makes you realise why Apple has put so little into its 'work group' network, Apple Talk, doesn't it?

started in this country, there were several serious, enterprising businessmen who were anxious to start micro companies. Their attempts to raise finance foundered on the City's ignorance, and indifference to instruction. The City didn't want to know, and companies like Sintel, Comart, Pericom, Casu and Rair had to go the slow, self-financing route, taking low-risk, high-price products into the existing data processing markets.

Revolutionary ideas had to go for the do-or-die approach, and Nascom, Sinclair, Tangerine, Acorn and Oric all took this route. It was an unstable route, and only Sinclair (at press time) managed to walk the tightrope with any skill.

When money was forthcoming for these whizz-kids, it came in an uncontrolled, irresponsible manner which failed to insist on proper business plans because the financiers wouldn't have known what a business plan, in micro terms, was.

Acorn's next battle is to convince business buyers that its ABC range is supplied by a sober, respectable company with stamina. The ABC range is a very nice range, and if Acorn is working on a re-design now, it will be able to make it profitably when 16-bit prices collapse in 12 month's time.

Details of the new Acorn are that Olivetti has 49.3 per cent of Acorn, with an option to take this up to 50.1 per cent. Curry and Hauser have virtually given these shares to Olivetti.

The company will now be split into four operating divisions. Something like 120 to 150 people will lose jobs, but what remain will be split into Education and Training under Jim Merriman; Scientific and Industrial under Jeff Tansley (a Unix expert) with the ABC range forming part of the enterprise; Business under John Horton (an OEM range); and Consumer Products — the BBC and new versions — under Peter O'Keefe.

Most important, Alex Reid becomes chairman, and a new group managing director will be hired to control the company with him.

I don't blame Chris and Herman for not trusting anyone else to run their company. No one else has, really, shown much talent at running fast-growing micro businesses in this country. But at the same time, the company is now just too big and unwieldy to be run by two people. END

Guy Kewney can be contacted on electronic mail. His numbers are Source TCK 106, and Telecom Gold 81: JDS018.

A question of law

Many readers are doubtless aware of the uncertain legal position of computer software, which is not expressly protected by any branch of the law. A Private Member's Bill has recently been introduced to the House of Commons to extend copyright protection to software. The Bill is strongly supported by the Federation Against Software Theft (FAST), which is concerned that the level of unauthorised copying may be damaging the UK software industry.

The Legal Informatics Group at Newcastle Polytechnic has been researching the effect of piracy on the industry for the past two years in liaison with The Computer Trade Association and The Society for Computers and Law. An important aspect of this research is to discover how effective users perceive the proposed legislation to be as a deterrent in comparison with technical protective devices.

You can participate in this research, which may ultimately affect the way in which the industry is regulated, by completing this questionnaire. To prevent any confusion, we'd like to point out that this questionnaire is for the purposes of research only and no individual items of information will be divulged to other parties. The research is being conducted by the Polytechnic and *not* by *PCW*.

Please tear out or photocopy the completed questionnaire and send it to: Anne Staines, School of Law, Newcastle Polytechnic NE1 8ST.

Name .....

Address .....

.....

Age .....

1 Which type of machine do you have?

.....

2 What year was it bought? .....

3 Do you expect to buy a replacement in the next two years? *Yes/No*

4 Approximately how many programs do you have? .....

5 How much do you spend on software per month? £.....

6 Do you swop copies of programs with friends? *Yes/No*

Please tick

7 Do you use your machine for:

Business	___
Games	___
Education	___
To learn about computers	___
Other (please specify)	___

.....

.....

8 Do you think swapping programs is wrong? *Yes/No*

9 Do you think that copying programs and selling them is wrong? *Yes/No*

10 Do you think that copying programs should be made illegal? *Yes/No*

11 Which of the following would deter you from copying a program and passing it on to friends? (Please rank from 1 for most deter to 4 for least deter)

A law against copying which made the person copying liable to a fine	___
A software device which made copying difficult	___
A law against copying which made the person copying liable to imprisonment	___
A hardware device without which the program would not operate	___

12 Do you write your own programs? *Yes/No*

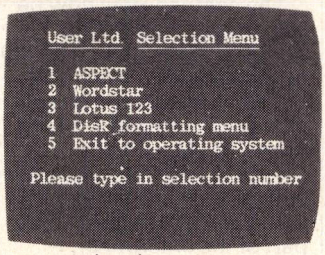
13 If you wrote a program and tried to sell it, and then found someone had copied it and was selling it themselves, what would your attitude be? (Please tick one box only)

It wouldn't bother you	☐
You would want some of the money paid to you	☐
You would want all of the money paid to you	☐
You would want all the money paid to you and the copier punished	☐

14 If you wrote a program and tried to sell it, and then found someone had copied it and was swopping copies among friends, what would your attitude be? (Please tick one box only)

It wouldn't bother you	☐
You would want the person stopped and some money paid to you	☐
You would want all the money lost paid to you and the copier punished	☐

The 'Classic' Menu Generator.



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YANKEE DOODLES



It wasn't just the big names that made an impression at this year's CES: our US man-on-the-spot David Ahl dug a little deeper . . .

Commodore and Atari attracted all the attention at the Las Vegas Consumer and Electronics Show earlier this year, with the result that the software and peripheral companies were unduly neglected. So to redress the balance, here's a round-up of the best of the rest.

Activision, once king of the Atari 2600 VCS game world but now a much slimmed-down company, was not showing a single 2600 game. An open letter from president Jim Levy said: 'We believe that 1985 is the beginning of a new era for home computers and home computer software . . .' On the bright side, Activision was showing some of the most playable computer games on the show floor.

The most effective product demonstrators at CES? No contest. The kids, aged eight to 14, who were demonstrating the line of games from **Epyx.** President Mike Katz, one of the best promoters in the business, happily stood back and let these youngsters steal the show. 10 new entries from Epyx included two excellent games from Lucasfilms: a sci-fi game, Moreta, and Dragonlady of Pern; and high-tech versions of Barbie, Hot Wheels, and GI Joe. These latter three games provide non-structured creative play for children four to 10 years old.

Wico introduced the SmartBoard, an intelligent keyboard/trackball peripheral for the IBM PC and Apple II. Each of 10 function keys can be programmed to contain as much as 126 data characters, while the trackball can be used for cursor movement or mouse emulation.

Flyers favourites: the new **SubLogic** Flight Simulator II and the **MicroProse** F-15 Strike Eagle games. The F-15 is fabulous, with its radar and infra-red guided missiles, bombs, cannons, ECM, flares and full aerobatic capabilities. Cut in the afterburners and watch this one move out! I hear that some fanatics have hooked two computers together and staged interactive dogfights. I didn't see any, but I did see a similar set-up with the Nexa MSX flight simulator program.

Sherwin Steffin, formerly of EduWare, showed the first products from his new company, **Brainworks.** Most interesting in this 'discovery learning' series is Chipwits, a game which features robots that can be programmed by illustrated chips (icons). Once programmed, the robots are placed in one of eight environments where they must survive a number of situations and tests.

A unique new entry from **EduWare** is Wilderness, a survival adventure which uses state-of-the-art graphics coupled with accurate, detailed models of the environment and human physiology to recreate a true-to-life wilderness survival experience. Dr Wesley Huntress, a scientist at JPL, and Charles Lohlhase of the Voyager Project, developed the program. Dr Huntress demonstrated it to me and, although my scouting days are a dim memory, this program rekindled a strong desire to return to the wilderness.

One of the nicest Apple shape table packages is Pixit by **Baudville.** The company has produced Blazing Paddles (a draw, paint and print program) and Take 1, an animation program that allows you to define shapes and movements, 'shoot' scenes, add text, and combine scenes to make a complete movie. And in case you need more help, Baudville has three animation libraries of backgrounds, actors, and scenes — Actors & Actions, Heroes & Villians, and Business. Easy to use and barrels of fun!

Niftiest product that will never reach the market: **Toki**'s biometal robot. This minature robot is controlled by a titanium-nickel alloy which 'remembers' a shape or position. Heating the joints by a pulse current extends them, but when they cool, they return to their original shape and position. Toki was also showing an innovative light-driven interface that could control the robot or other motors and household appliances. I'm rooting for you Toki, but . . .

Springboard Software (formerly Counterpoint Software) introduced several fascinating products, foremost of which is The Newsroom; this program allows users to create and print an actual newspaper. Users can call upon a library of more than 600 pieces of 'clip art', and the program, and its 90-page manual, help students in editing, layout, copywriting and production.

Woeful is the troll that doesn't act quickly in Trolls and Tribulations, a new strategy/action game from **Creative Software.** The player must lead trolls through treacherous underground caverns to recover treasures.

In Break Street, players guide game characters through breakdancing movements such as the tut, scorpion, windmill and moonwalk. The DeRoxy Crew, a Seattle breakdancing group, were consulted on the game's development.

Going for the big names is the strategy of **Simon & Schuster**'s Electronic Publishing Group. Initial entries include computerised IBM PC versions of JK Lasser's Your Income Tax and Your Money Manager, Webster's New World Spelling Checker, The Great International Paper Airplane Construction Kit (for the Macintosh), and a non-celebrity clip art program for the Mac, The Mac Art Department.

Electronic Arts displayed several new items including a Mac version of its Financial Cookbook, a Racing Destruction Set which allows players to design their own tracks and race cars, the Adventure Construction Set, and Mail Order Monster (a robot kit in which creatures can be designed and pitted against each other in three levels of combat).

Random bits

Business Communications of Stamford, CT, forecasts 20 per cent annual growth over the next five years in business micros, 22 per cent in peripherals, 38 per cent in maintenance, 41 per cent in communications, and 46 per cent in software . . . AT&T claims that its Unix System V is gaining support, particularly now that Microsoft has agreed to make its Unix-type system, Xenix, compatible with System V. Nevertheless, some software vendors are shying away from Unix because of AT&T's recently announced more restrictive licensing policy . . . Televideo Systems has just signed an agreement with three Chinese companies to manufacture and market PC-compatible machines there . . . Looking for a winner in 32-bit Unix systems? Charles River Data Systems is shipping products, and has just signed OEM deals with both Datapoint and Sord of Japan. Financial backers include EG&G, Analog Devices, Meditech, and now Datapoint . . . Apple's fourth quarter earnings leapt nearly eightfold to a record $46.1 million on strong Christmas sales of the Apple II line . . . IBM earnings also climbed 17 per cent in the fourth quarter while Tandy's fell 24 per cent . . . Analysts see the home computer market returning to more orderly growth in 1985. Infocorp projects 1985 sales of 5.7 million units, up from 4.4 million in 1984 and 3.4 million in 1983 . . . On the horizon: a graphics entry device called Space Tablet which lets you draw in 3D space . . . The top priority project at Pioneer is a writable videodisk for the home market . . . Peter Leppik, a 15-year-old hacker who had been accused of breaking into the computer files of a Minneapolis bank, recently helped police crack the disk protection code on a sex offender's electronic diary. Peter claimed the bank break-in was 'accidental' . . . Mother Jones' Son's Software Corp has an unusual way of combating piracy. Its sales agreements state that if the buyer copies the program illegally, 'ownership of your eternal soul passes to us, and we have the right to negotiate the sale of said soul.' The agreement adds: 'Our attorneys will see to it that life on earth, as you know it, is completely ruined.' . . . END

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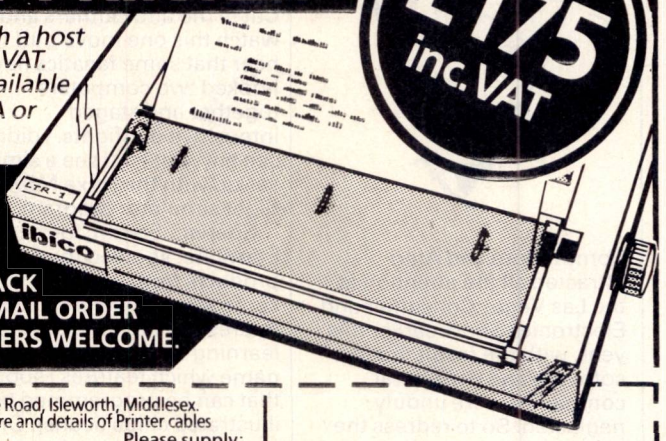

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From Family Computers to fifth generation research, Shinichiro Kakizawa rounds up the latest news from Japan.

The Family way

Japan has a hidden million-seller machine — 2,300,000 units have been sold in a year and a half. The manufacturer is at present shipping 10,000 daily and all are immediately claimed by waiting, enthusiastic customers.

The machine is The Family Computer manufactured by Nintendo. The name may be familiar. Together with other popular brands like Casio, the firm is one of the major suppliers of popular pocket-sized game-watches. The model name Family Computer is slightly misleading, however. At first sight the machine looks like any ordinary games computer. The standard model costs £48 and has no keyboard, but it does have a slot for the software ROM cartridge, a few buttons (start, reset) and two joystick controllers. If you want to use the FamiCom (its nickname) as a micro, you will have to buy a separate keyboard that contains Basic ROM.

As far as the functions are concerned, the standard FamiCom model is no different from machines like the Atari 2600.

So what is the secret of the 2.3 million sold in this era of sophisticated home computers? To find out, I went to buy the machine. I tried four shops in my neighbourhood — FamiCom was out of stock in all four. They could not even tell me when they would receive their allocation of the next shipment. But one of the shops, a toy shop, had a demo machine.

The machine has incredible speed — the graphics are faster than anything else I've seen. The FamiCom's speed is so superb that the actions of the game's characters look very realistic and smooth. The colours are also very good and the combination of these two features appears to have created a new games computer which has been keenly accepted by even arcade players.

Most industry observers thought that the games-only market was almost dead, as Atari saturated the market, and has subsequently been replaced by low-cost home computers such as the Spectrum and MSX. However, the success of the FamiCom has proved that this is not the case. Users are certainly tired of low-quality video games but not of these high-quality products.

Nintendo currently offers 30 games programs, all developed in-house; the cartridges cost £15 each. The programs are all standard types such as golf, tennis, car chase and Pacman, and Nintendo has sold 14,000,000 cartridges in total — half a million copies of each game. The only difference between Nintendo's and other games is the quality.

Nintendo was a latecomer to the games/home computer market so it had time to study the market; it has designed fast customised chips and set the right price level. The result is a phenomenal two-million seller. Nintendo believes that it can sell at least another three million machines here, and the only limiting factor in achieving this goal seems to be the speed of chip production which is subcontracted to Ricoh.

Nintendo plans to start exporting the FamiCom to the US in July, and entry to the UK market will certainly follow in time.

The fifth generation – personally

Mitsubishi Electric is planning to mass-produce a personal AI workstation developed by ICOT, the Japanese Government agency for developing Fifth Generation Computer Systems.

The AI system is called PSI — Personal Sequential Inference Machine — and was the highlight of the Fifth Generation Computers International Conference '84 held in Tokyo last November. The PSI is the world's first dedicated Prolog machine. The fact that the operating system (SIMPOS) is written in a specially developed non-procedural language called ESP was considered unique by many researchers. PSI features a 32-bit ALU and 40-bit internal bus architecture.

The system description language is called KL0 — Kernel Language Zero — and is basically an extension of Prolog. ESP is written in KL0; execution speed of PSI is 45k LISP (Logical Instruction Per Second). The commercial version of the ICOT-developed machine will be available during the next year, and will cost from £35,000 to £70,000.

As many researchers are interested in KL0 and ESP, the Ministry of International Trade and Industry (MITI) — the sole proprietor of research results from the fifth generation project — is considering making the source codes publicly accessible on a limited scale, prior to the commercial availability of the Mitsubishi machine.

In addition, NEC is working on a back-end processor which can process KL0 six to eight times faster than PSI. Also, in its second stage research programme, COT will develop a VLSI version of SIM — Sequential Inference Machine — in order to reduce the machine's cost and size.

MSX moves on

MSX version II will be ready in May. ASCII, which originally developed the MSX concept and organised the MSX manufacturers' group, is now working on an improved version.

A new range of improved MSX machines will be announced at the Tokyo Business Show on 22 May, and most of the suppliers currently offering MSX micros will announce new models.

The new MSX will still have the same 8-bit CPU but will include a more powerful graphics capability (the display resolution of the existing MSX is 256 × 192); this will be upgraded to 512 × 200. A floppy disk system will also be provided as standard.

All existing MSX software will be compatible with the upgraded machines. The new micros will cost £60-£80 more than the existing models.

Analysing disks

A system which analyses, displays and prints physical formats of any floppy disk type has been developed by Nippon Office Communications, which is based in Tokyo.

This powerful aid for software developers can also modify any necessary part of the format and data contents in the disks. Its main functions include analysis of track formats, display of gap, sync, track dump listing, sector dump listing, disk zap, ID dump, modification of ID, data dump listing, data modification and parameter dump. If required, the machine can produce exact copies. Any type of 3-8in disk drive may be connected to the system.

The system costs £2200. END



'Fine, fine — now, wave the claws around a bit . . .'

LETTERS



This is the chance to air your views — send your letters to Communications, Personal Computer World, 62 Oxford Street, London W1A 1HG. Please be as brief as possible and add 'not for publication' if your letter is to be kept private.

Don't panic

It's really hoopy of you froods to feature the ex-president of the galaxy and renowned spaceship stealer, Zaphod Beeblebrox, on the cover of the January *PCW*. However, I think that your artist must have had too many Pan-galactic Gargle-blasters, or else was drawing while wearing peril-sensitive sunglasses and sitting near the Ravenous Bugbladder Beast of Traal. The number of heads is right, but where is Zaphod's third arm?

Roger Bamforth, Stockport, Cheshire

(Our defence is that the illustration is of Zaphod before he took up ski-boxing. To quote The Hitch-hiker's Guide to the Galaxy*: 'He steered with an extra arm he'd recently had fitted just under his right one to help improve his ski-boxing.')*

Philvas defence

Following your article 'Living in the Real World' (*PCW*, February 1985); I was part of the Philvas development team during 1983 and can only mourn Philips' lack of initiative in marketing it, as it has been in a saleable form for over a year.

Philvas provides a complete environment for the would-be video programmer. He is protected from the cold world of the microcomputer operating system, even down to the level of backing up his diskettes — it's all built-in. Programming is carried out in ALLVA (Author Language for LaserVision Applications) and an example routine might look like this:

```
100  PLAY — start playing
     from frame 100
500  TEXT A_MENU — show
     contents of text fragment
     A_MENU when frame 500
     is reached
800  ENDPLAY — stop at
     frame 800, then:
        SELECT ON DIGIT — wait
     for a key
     IF 1 DO KEY_1_PRESSED,
— KEY_1_ PRESSED, KEY_
1_PRESSED
     IF 2 DO KEY_2_PRESSED
— are other ALLVA routines
ENDSELECT
```

A 'test fragment' is formatted separately from the ALLVA code with a screen-based text editor, and makes use of the teletext encoder in the LaserVision player. No special Gen-lock hardware is required, but only primitive computer graphics are possible. The author can run his programs under control of the 'simulator' (a type of debugger) which lets him halt execution and look at the contents of his variables, and traps and reports his more cardinal sins before he commits himself to Eprom or LaserVision disk.

Before I get carried away, the point is that Philvas is a complete, integrated system and not a hotchpotch of bits and pieces where the micro doesn't even know what frame number the player is on. I just hope that Philips doesn't price itself out of the market.

H P Sanders, London

Plotting Penman

I read Simon Craven's review of the Penman plotter with great interest. With such a novel product, mis-apprehensions are bound to occur, so I would like to take this opportunity to comment on some of Simon's statements.

Penman comes with a standard serial interface and a built-in command set so it can be used with any suitable PC or terminal. Simon reviewed Penman with the BBC utility disk, and some of his comments are obviously restricted to that environment. In fact, Penman is equally at home plotting business graphics or land survey statistics as it is in the laboratory plotting experimental results or at school plotting from Logo.

On software availability he noted that Acorn had yet to release plotter drivers for its popular Bitstik program. The drivers are now available, and include support for Penman. Readers will no doubt be interested to hear that programs are also available for the Apple II and Macinosh computers, and will shortly be available for the IBM PC and compatibles.

Finally, I'd like to correct a misunderstanding over Penman's commands. Like other plotters Penman has absolute and relative cartesian moves, with pen selection, pen-up/down and an inbuilt character set (none of which interfere with homing or cable-untangling as Simon stated). In addition, Penman has a unique polar mode that permits plotting of smooth circles and arcs. This mode requires the program to update its coordinates before homing will function, and Basic routines are included for programmers that accomplish this.

Dave Taylor, marketing director, Penman Products Ltd, Worthing, W Sussex

Faster Beeb

In the Letters column of the January issue of *PCW*, there were some statistics to 'prove' that the Sinclair QL is almost as fast as the BBC. While I am not an unqualified enthusiast of the BBC, it is a very fast computer, and so I doubt the conclusions of the letter.

Clearly any decision about a computer arising from a timing test must be viewed with caution. As a general rule, the more friendly and helpful that a Basic is, the slower it is likely to run. A lack of precision will speed up the Benchmarks (particularly number 8), but may not be desirable. The tests on GOTOs and GOSUBs only apply to a short program, and a Basic which converts line numbers to addresses will not have the same advantage in the Benchmark programs. A Benchmark that involves screen scrolling might also be a useful guide to time. Given all this, it is possible to criticise the table as printed.

Firstly, a minor point. LOG means base 10 on some computers and base E on others. The former usually have LN for base E, thus LN should be used on the test where available. On Benchmark 8, the Einstein gave a fairly close correspondence using LOG but it did knock off 0.8 seconds when LN was used instead.

Far more important, however, is the weighting given to the test. A computer that does the simple, everyday things quickly, but is slow on arrays or mathematical functions, is hopelessly handicapped in the race. A simple and effective answer is to take the geometric mean instead of the arithmetic mean and this weights all the Benchmarks equally. Readers may be interested in the main differences this causes to the ratings of the 68 computers tested.

Using the geometric mean, spectacular rises come for the Macintosh — up from 12th to 3rd — and the Sharp MZ-700 from 37th to 16th.

Other rises of four or more places are; BBC 18th to 14th, Osborne 01 34th to 29th, TRS 2 36th to 32nd, Spectravideo 59th to 55th, and Atari 65th to 60th. The losers are Future 7th to 11th, Sirius 20th to 26th, Apricot F1 30th to 37th, Epson PX-8 51st to 57th and Epson HX 61st to 65th.

Finally, the two that started me off: the old placing was BBC 18th and Sinclair QL 32nd. The revised placings are BBC 14th and QL 35th, the difference now being more in line with what I suspect users of both machines already know.

G T Childs, Winchcombe, Gloucs

Calling all hams

Martyn Croft's useful article 'Is anybody there?' in February's *PCW* included a mention for radio amateurs. There is a specialist keyboard communications organisation called the British Amateur Radio Teleprinter Group (BARTG). While the majority of members are radio amateurs, membership is open to all who are interested in data communications: RTTY, AMTOR, packet radio, mailboxes, digital repeaters, FAX, and so on. The quarterly

magazine *Datacom* averages 100+ pages, and covers a wide range of tutorial and practical matters. The annual subscription for 1985 is £7 which should be sent to Mr and Mrs J Beedie, Box 3, Llandeilo, Dyfed, Wales — the cheques to be payable to 'BARTG'. *Please* write name and address details *clearly*. If we cannot read what you have written, we are unable to post your *Datacom* to you, or indeed contact you in any way.

Ingemar Lundegard, BARTG President (G3GJW) Sevenoaks, Kent

Fly the flag

After reading Banks' Statement (*PCW*, February 1985) I felt compelled to do a little research. If the threat from foreign competition is well known in this country, how do we fare abroad? The answer is, in my rapid persual of the ads in *Byte*, November 1984, that we don't exist — at least I couldn't find any names that were recognisably British, although I believe that Sir Clive does fly the flag as best he can (three cheers!).

But all is not gloom. In the same edition is a review of three Forth systems on the IBM PC with the inevitable Benchmarks. Out of curiosity I ran the Eratosthenes Sieve (screen 16 P309 using : FILL rot dup 4 roll + swap do dup I c! loop ;) on that splendid machine, the Jupiter Ace. In fast mode I found the Ace to be faster than two of the implementations on the PC. Either I've boobed or the Ace can in some respects beat some very expensive opposition.

The only connection I have with Jupiter, RML, ACT and Sinclair is that I have bought, and been impressed by, their machines. There are many other British manufacturers whose products are probably equally good, but now there seems to be a real prospect of many being caught in the pincer between the Big Blue and MSX. It must not happen!

The cavity magnetron was invented in Birmingham, yet how many British microwave ovens do you see? We no longer produce (in volume) motorbikes or cameras, and the penetration of our hi-fi and car market is deep. If buyers cannot be wooed away from the advertising and hype of foreign sales campaigns, then it is time for the big boys in British electronics to stop chasing their costs plus plums from the MoD and start repelling boarders on the commercial front.

It's high time we stopped playing cricket and read the first few chapters of *Think* by W Rogers to find out how the Watsons made IBM great.

I urge all prospective buyers of computers to scan the pages of *PCW* well — I would be very surprised if you could not find a British machine to suit your needs.

M Hamer, Ullingswick, Hereford

Diskmarks

In the November issue you asked readers to supply Diskmark test results of their own systems. The table in Fig 1 lists the results for both the standard Dragon 64 (DragonDOS) and OS-9-based Dragon 64 (with Basic09).

As you can see, the Dragon OS-9 system results are about average for floppy-based business machines, but DragonDOS takes an amazing second place in the floppy league.

Notice in particular that in test 12 DragonDOS is only beaten by Future Technology Systems' hard disk system. In test 4, Dragon + OS-9 takes a joint position, only being beaten by the IBM XT hard disk system. Once again, the effect of a different operating system is starkly shown by the widely varying results.

All the tests were manually timed and triple checked against error.

Jason Shouler, National Dragon User Group, Poole, Dorset

Brave new future

There is currently much speculation about the future of the home/personal computing business. The seasonal lack of 'positive' news inevitably causes idle hands to do the devil's keyboard work.

At the April 1984 launch of the CPC464 range, Amstrad chairman Alan Sugar reminded the assembled throng that the future of consumer computing was moving away from the specialist fringe towards mainstream consumer principles and mainstream consumer manufacturing considerations.

Coleco's departure from the market at the start of the year was the first in a series of moves that bear out this prophecy.

So consider a future where consumer electronics principles apply, and just how ineffectively the home/personal computer market has managed to address itself to the consumer as opposed to the enthusiast. MSX seems to have shot itself squarely between the toes, because it tried to launch itself through a justifiably sceptical specialist press.

Wait until some bright firm produces some products with genuine consumer 'acquisition justification/rationalisation' that manages to bridge the chasm between the present saturated specialist market and the untapped 'genuine' consumer market.

William Poel, general manager, Amsoft, Brentwood, Essex

Computer attractions

In two respects your reader L Krancioch (Letters *PCW*, February) and myself appear to be similar. One, we both had our initial love affairs with the late and much lamented Dragon. Two, we both had (initially) sublime contempt for anything other than 'serious' applications on any computer.

Since my Dragon days, I have been allowed access to ACT's bluff and friendly Sirius and, more latterly, the sexy and desirable Apricot (ACT aren't paying me a penny for this!).

Having experienced both fields, I feel L Krancioch and, indeed, some of the gurus of the computer industry have missed the point. As a member of *homo sapiens computeris*, I crave and demand colour and interest. I feel that many business-type applications could benefit from the excellent presentation of some of the games. It also appears to me that anyone with the wit to design and write a good game should have little trouble with mastering the more mundane 'serious' applications. It follows that anyone who wishes to write a game must also be a player — if only to keep up with the competition.

In my view the British motorcycle industry effectively committed suicide by producing only 'serious' machines. Fortunately the computer industry doesn't seem to be going the same way, but it does seem an extraordinarily easy attitude of mind to get into. With the greatest respect to the L Kranciochs of this world, I sincerely hope they are not throttled by their own halos.

D L George, Farnham, Surrey

Half a brain!

I'm not a writer, but this time I feel that I have to say something! It concerns the advertisement that appeared in the February issue of *PCW* on pages 24 and 25, which shows a man with one finger and half a brain.

I grew up in the toughest neighbourhood in East LA (California) and if someone had given me the finger then, one of us would not have been capable of walking away under his own steam, to say the least.

I would like to give the same finger to the guy who dreamed up the advertisement, and the half a brain to the people of Island Logic, whoever they are. 'Intelligent Entertainment' — is this an intelligent advertisment? You can be sure that I'll be intelligent enough not to buy the product!

Frank N Vallotton, Vaud, Switzerland

I think Island Logic should be grateful for your offer of even half a brain as it seems to be more than it's got at the moment. An earlier ad from these exemplars of good taste featured the line: 'Mr Beethoven, as you decompose, we compose.'

(Disk Benchmark results in seconds (by total time order))

COMPUTER	T0	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	Total
Apricot 320k	18	6	8	19	10	20	2	21	2	7	13	103	46	7	282
DragonDOS 184k	2	17	32	13	11	66	9	86	20	8	12	142	18	25	461
FTS 616k	12	4	5	21	27	45	15	49	16	8	43	229	35	39	548
Compaq 320k	24	11	16	24	24	36	8	67	16	7	13	319	125	49	739
IBM PC 320k	21	10	21	21	20	30	8	65	17	7	15	311	145	51	742
Wren 200k	14	5	9	21	21	38	14	37	16	9	19	385	200	21	809
DragonOS9 184k	29	24	10	13	4	131	19	137	20	10	26	495	122	147	1187
Rair 3/20 780k	33	9	18	94	97	31	13	39	15	19	33	1009	235	37	1682
Future FX30 800k	20	6	6	23	24	35	13	49	20	25	52	1132	311	50	1766
Sirius 600k	27	11	9	57	28	52	18	42	20	32	67	1669	466	39	2537
Epson QX10 320k	21	8	13	34	20	49	21	62	27	35	70	1762	486	45	2653
Xerox 820k	39	14	22	83	84	103	53	156	74	55	66	1686	317	165	2917

Fig 1 Comparison between Dragon and other floppy systems

TDI Pinnacle Benchtest

So you think your Benchmarks are fast, huh? Well hold onto your chair and get out your book of superlatives as you take a look at my *PCW* Benchmarks for the Sage II and TDI Pinnacle running Swifte-Basic Version 2.0 under the Mirage

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OKI	OKI 2410P 350cps	£1535.00
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SMITH CORONA	TP1 12cps	£154.00
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LETTERS

operating system.

Sage II

	Without floating point unit	With floating point unit
BM1	0.281	0.156
BM2	0.344	0.219
BM3	1.328	0.688
BM4	1.250	0.563
BM5	1.312	0.609
BM6	2.860	1.578
BM7	4.188	2.891
BM8	0.906	0.156
Average	1.559	0.857

Pinnacle

	Without fpu	With fpu
BM1	0.20	0.13
BM2	0.25	0.18
BM3	0.90	0.55
BM4	0.80	0.45
BM5	0.90	0.51
BM6	2.00	1.25
BM7	2.90	2.15
BM8	6.20	0.65
Average	1.80	0.74

I agree that the Pinnacle is a 'blindingly fast' machine, but I do think that the Sage II redeems itself with the assistance of the Swifte-Basic compiler. Incidentally, these Benchmarks were supplied by TDI.

Other machines which are able to benefit from the speed of Swifte-Basic and Mirage are: MicroAPL Spectrum, Sage IV, Newtons Laboratories Accron, Sam 68k, Microcraft Dimension, Optim Option, Hewlett Packard 200 series, Sord M68, and Stride 400 series.

Gerard Paul-Clark, Sahara Software Ltd, London SW8

Back and forth

I have read advice in your magazine on the marketing of software, particularly games, and I wonder if you would extend your comments to cover the marketing of a new programming language.

My knowledge of computing is limited to what I have taught myself during four years using a small range of home micros. I therefore lack a global view of the market, and have little idea which sector to aim at.

The language in question is called 'Back', so named because of its affinity with the plain language aspect of Basic, but mostly due to its highly complementary relationship with Forth. In fact, it is usually possible to run Back and Forth simultaneously on the machines at my disposal, a feature I expect to be of interest to arcade games programmers.

A good illustration of the relationship between Back and Forth is provided by the stack operations. In Back the stack grows vertically from the top of memory — in practice a steel spike on the top casing, which can double as a joystick — and the required result is first placed on the stack. It might, for example, be a piece of bread. The programmer enters at the keyboard (or using the voice attachment) the question 'What is it?'. The item is popped from the stack and reappears in the top right-hand corner of the screen together with the words 'A piece of bread', or whatever is appropriate.

One critic describes Back as 'an image-recognition system masquerading as a programming language.' I feel criticism of this kind belongs in a class with the early dismissal of radio as 'merely induction'. Back is a true language with powerful general features, some of which may even be innovative. Moreover, it is extremely fast as I discovered when I impaled my hand on the spike. Almost immediately the synthesizer cried 'ouch!' and on the screen the response 'A man's hand' was quickly followed by the words 'Why did you do that?', a question which so preoccupied me that I left for the surgery without retrieving my hand. I did so using the 'image retrieval utility' which, incidentally, I propose to make available as part of a separate package together with the 'necro-assembler', currently a subject of litigation between myself and Madame Tussaud's.

When it comes to marketing their product, most amateurs are vulnerable to the approach of unscrupulous professionals who are primarily interested in money rather than in computing. I should, of course, like to reap the reward for any merit found in Back, but my worst fear is that it may be suppressed, only to appear later in a corrupted form by someone else.

Any help you can offer with regard to precautions will be gratefully received.

Adrian Taylor, Twickenham, Surrey

Bouquets for Sanyo

I was particularly interested in the review of the Sanyo 550-2 (*PCW*, January) as I have been operating a 555 since April of last year and I find that the majority of your remarks are pretty accurate.

Some three years ago I was made redundant and set up in business on my own as a sales agent, offering my services to manufacturers and importers. This business has blossomed to such an extent that I decided I would have to come to terms with installing a computer and learning how to operate it.

This decision was made at the beginning of 1984, and systems that fulfilled my requirements were few and far between. Most of those systems which fell into my price bracket came with very little or no software bundled with the machine.

The MBC 555 with disk drive upgrade (two × 320k) was suggested, and this is the system I purchased and have been operating.

I would like to take issue with you over one or two points in the article. The silver finish to the keyboard, processor and VDU is as acceptable today as the day I took delivery of the equipment.

Your remarks concerning the on/off button puzzle me: I have never come near to accidentally knocking this button. But even so, it takes a concerted push on this button to turn off the machine. And on my model, turning the power on immediately illuminates the LED in the A drive, indicating the machine is on, regardless of whether a disk is in the drive or not.

I totally disagree with your remarks concerning the keyboard supplied with this package. Without exception, everyone has remarked how elegant the keyboard is and how well it operates.

However, I do agree with your criticism regarding the NUM LOCK key, which is a real pain. The only advice I can offer your readers is that it is always 'off' when you load any of the bundled software.

Regarding the database, the whole package is known as Infostar. Infostar is divided into three parts: Datastar, Reportstar and Formsort (not Filesort as you mention). Datastar consists of two programs: Formgen, the form generating part of the program; and Datastar, the data entry section. Reportstar has three parts: Rgen, the report generating program; Redit, which allows you to edit the form; and Report, which prints the actual data. Formsort does just what its name says — it sorts the files!

Brian Pogson, Worthing, Sussex

Strangely strange

As a member of the Association for the Scientific Study of Anomalous Phenomena, I am interested in cases of anomalous computer effects.

Can I appeal to readers for any information, at first or second hand, no matter how bizarre, concerning unexplainable malfunction or unexpected output?

All accounts will be treated in strictest confidence, and should be sent to:

Roger C Morgan, 15A Kensington Court Gardens, London W8 5QF END

BLUDNERS

Our looping has been slipping in the Benchmarks. The January round-up should have given the Einstein 1.17 for Benchmark 1, and the Commodore 715 should have had 72 seconds for Benchmark 8. This gives the Einstein an average of 19.11 and moves it up four places in the table. The 715's average should have been 21.94, which drops it down to the bottom half of the table.

And February's Pascal Benchmarks were also out by a factor of 10 on the maths test. So the Spectrum figure should have been 93, the Amstrad's 90 and the QL's 102. Apologies for the missing zeros.

Line 2060 of the Commodore Screendump program (*PCW* Jan 1985) is incomplete, suddenly ending mid POKE. The full line should read:

```
2060 OPEN1,3,0,
     'SCREENDUMP':
     POKE781,D:
     POKE782,0:
     SYS65466
```



BANKS' STATEMENT

Swansong?

So long, farewell . . . Is it curtains for the independent dealer? Martin Banks tells a cautionary tale.

Now, remind me: how does that song go? Ah yes, I remember: 'So long, its been good to know you.'

The writing is on the wall about your departure, you've bought your tickets and are retiring to the West Country to reminisce about how things were and remember the good times. I shall miss you. Well, some of you anyway.

What do you mean, you didn't know you were going? You mean you are going to stick around and fight it out? That's suicide in a big way. You can either walk out now, and keep some dignity, or be brought out later with your toes turned up. I don't think I would be a computer dealer now for love nor money.

Soon, the way things are going, there won't be anywhere left where it is worth being an independent computer dealer.

What's the reason for such a negative attitude? It is for reasons which make bad business sense, bad marketing practice, and in the end give me (as an average punter in the street) a degree of choice in selecting a computer or software package that I probably wouldn't know I needed until I hadn't got it.

To demonstrate the point before moving on I will tell a short but true story. The other week a picture fell down in my home; one of the hooks in the frame had come out and promptly got itself lost. I went to a local hardware store expecting to have to pay 50 pence or so for a pack of at least half a dozen of the things, just to get the one I needed (I have done this twice before and always lost the redundant ones by the time I have needed them). The owner of the store, however, dug in a box and brought one out. Joking about the effect on my bank balance, he charged me 3p for the single hook. That is what I call service.

It has been this type of service that many of the dealers in computer systems and software have attempted to offer, or have at least aspired towards (yes, I know they are *all* sharks, but there are good sharks and bad sharks). The customers, especially those that were after the slightly more expensive products, got some attention, and there was an attempt to relate the products to the user's specific needs.

Now, however, many of these dealers are doomed to go out of business. This will happen even if they are currently doing well. The reason is the arrival of the big boys into the playpen — the manufacturers are muscling in.

In December 1984 two big names in manufacturing micros, ACT and Tandy, announced a new joint venture company. This will take the ACT Computer-World chain, and Tandy's Computer Centres, and combine them into a new, European-oriented retail chain. Within a year, they hope to increase the start-up figure of 50 shops in Europe to 150.

There is one key, fundamental and all-pervasive reason for the two companies to be in retailing, either individually or together. That reason is because it makes financial sense. There is a second, related reason — it is sound marketing tactics — but it's the first which is most important. A successful dealer can get up to 35 per cent margin on the computers sold, and from this the costs of the business must be made and the holiday in Tenerife paid for. If the manufacturer owns the retail outlet, then that 35 per cent is not going into someone else's pocket.

This is all extremely sensible, financially speaking, but it does seem to have one or two potential drawbacks for the rest of the dealer/retailer fraternity and, as a knock on effect, the end users and potential customers. These drawbacks are the same as can be deduced from the growing trend towards big, national dealer chains that, by definition, have tremendous purchasing power with their supplying companies and can operate the economies of scale to their own advantage.

The main drawback for the smaller, independent dealer is if one of these major chains or manufacturer-owned outlets moves into the same town or area. The newcomer will want to attract business and make an impact, that is obvious. One way he can achieve this is by making his prices . . . what's the word? . . . ah yes, 'competitive'.

Now, perhaps the dealers can compete by offering specific skills or services, by locating a vertical market niche in their serviceable area that will provide them with good revenues and margins because they are adding real value to the basic computer box. I think this is the way most independent dealers should go, but even here the odds are being stacked against them. Apple, for example, has announced its new dealer scheme which has, as its central core, an undertaking by a dealer to order £60,000 worth of kit. For a small, specialist dealer, selling systems worth £10,000 all up into vertical market slots, the computer may be only 15-20 per cent of that price. The rest is specialist product and knowledge, and that can't be sold quickly, *a la* supermarket tactics.

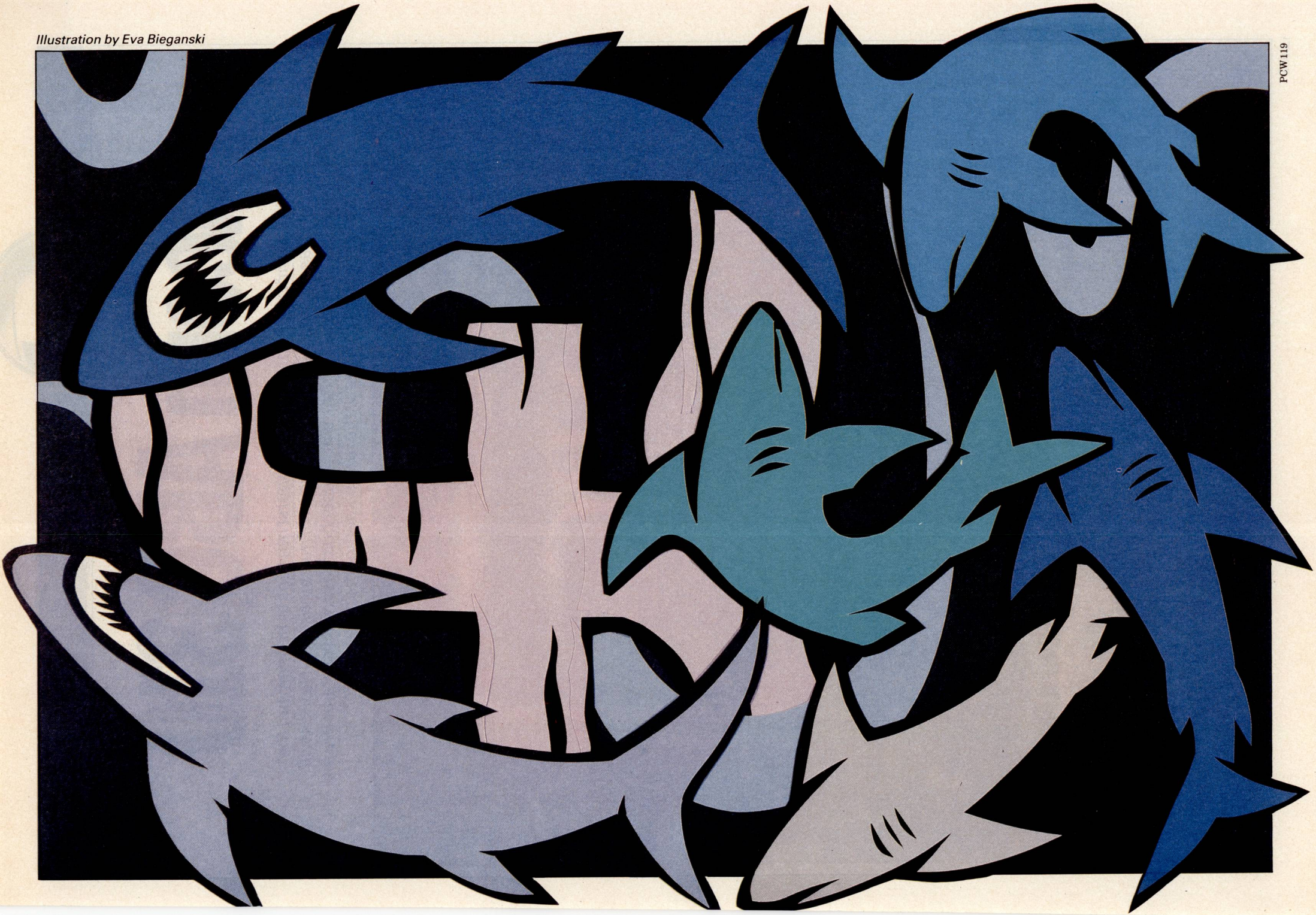
If such companies are keen to get their hands on all the margins that can be made from the personal computer business then they are going about things in entirely the right way. However, as happens with a lot of this competitive spirit stuff, the poor punter often ends up with a restriction of choice in the end, for eventually all the options are whittled down to be small enough to fall through the drain cover of liquidation.

Yet getting rid of the independent dealers is not entirely sensible. Yes, some are real crooks and need to be shot, but the majority serve a good purpose, and that purpose is getting better. I have written before that the business is changing from a 'bought from' to a 'sell to' market-place, and that the manufacturers are going to need all the outlets they can get if they are to maintain continued growth in business. They particularly need a variety of outlets staffed by people who know what they are talking about, as nearly all the potential customers who have even thought they might need a computer will have already bought one by now.

To continue growing, the industry now needs to sell to those people who think they probably don't want one, or who aren't at all sure. Such people need help, advice and careful nurturing to be won over, and that takes time and money.

The other alternative for such people, which will probably happen anyway, is that they will go with what seems safest. Over the next year or so, 'safest' is going to mean IBM. 'Big Blue' wants all the business and means to get it. Then, I suppose, there won't be any choice at all. END

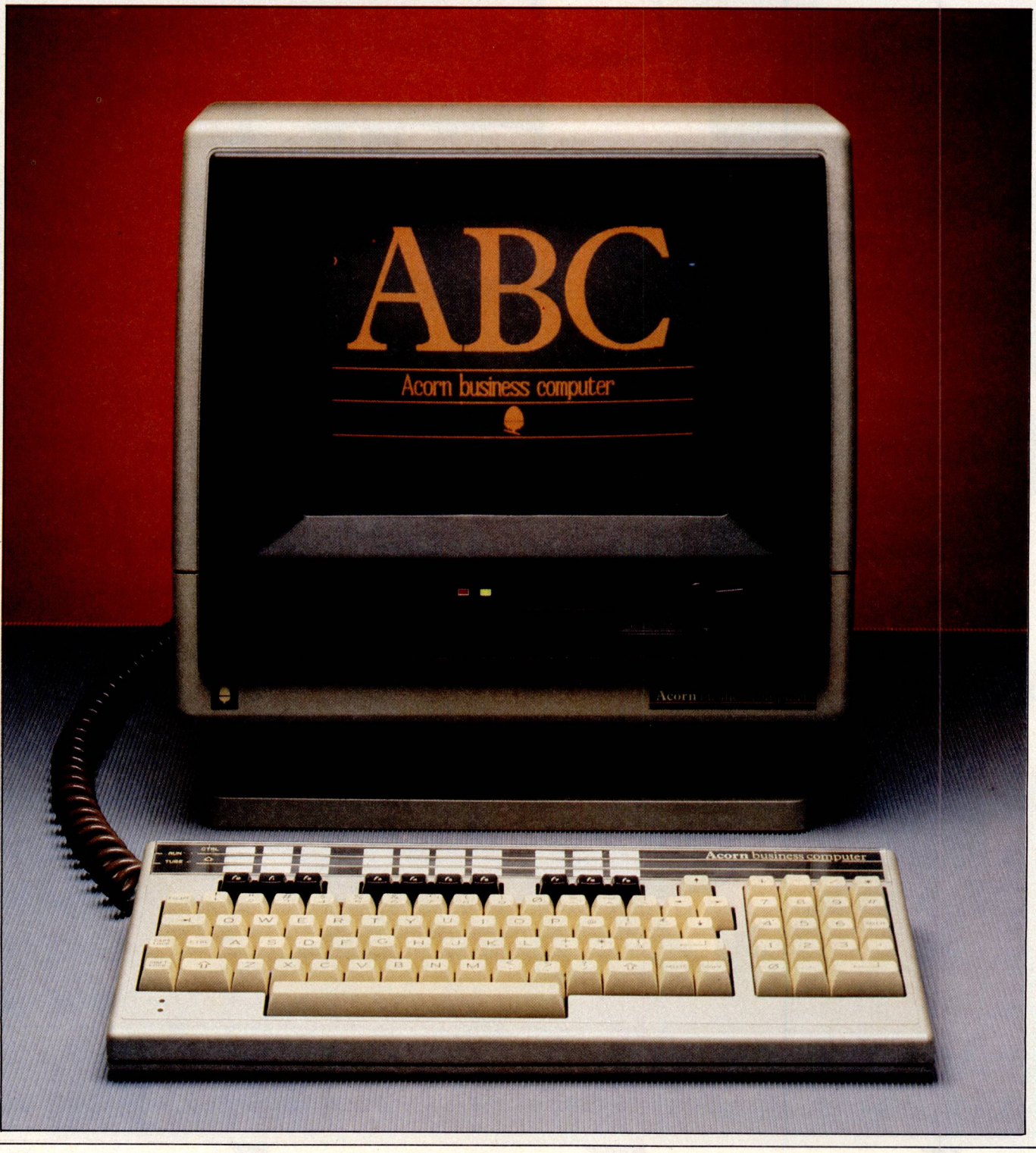
Illustration by Eva Bieganski



PCW 119

Acorn ABC 310

Whether or not the Acorn bubble has burst remains to be seen, but the company has resolutely produced a range of machines that it hopes will attract users at the top end of the single-user business market. Peter Bright assesses the capabilities of the range's senior model, the ABC 310.



Acorn Computers has been one of the success stories of the British home computer market. After the company was awarded the contract to build the BBC Micro it went from strength to strength, especially in the educational market where the BBC machine dominates in the lower levels of schooling.

But recently the good times have turned sour for Acorn: most schools now have their quota of BBC Micros, and the Electron home computer hasn't sold as well as the company hoped. This led Acorn to a financial crisis which, with the aid of Olivetti, it is trying to resolve in an attempt to get back on the straight and narrow.

A major part of Acorn's strategy, at least prior to its financial problems, was its new range of business machines, designated the ABC range. This spans from a basic terminal, through scientific machines based on the National Semiconductor 32016 CPU, to the 300 and the 310 — powerful business machines based on the Intel 80286 processors.

Reviewing the machines while the company's financial position is being reorganised makes it hard to give a final opinion. But the machines themselves are interesting enough to warrant close inspection — so we decided to look at the top-of-the-range model, the ABC 310.



The ABC310: 'a vastly oversized monitor on a tilt-swivel stand'

Hardware

The main difference between the 300 and the 310 is that the 300 comes with two floppy disk drives whereas the 310 has a hard disk.

The overwhelming first impression of the ABC 310 is one of sheer ugliness. Instead of the traditional design of separate boxes for the processor/disks, display and keyboard, Acorn has housed all the electronics, the disk drives and the display in one box. The result is a machine which looks like a vastly oversized monitor on a tilt/swivel stand.

The main problem is the sheer size of the unit. Complete with the stand, it measures 16ins high by 15¼ins wide by 15¾ins deep, which makes for a very bulky casing that isn't helped by a slab-like grey and black colour scheme.

It's also interesting to note that those who saw the unit in the office commented on how old-fashioned it looked, especially the keyboard which looks very dated. Again, this is partly due to the size of the machine.

The net effect of this design is that the machine completely dominates any desk it is placed on. While this is also true of other powerful micros like the IBM PC/AT, you usually get the option of placing the main system unit on the floor to free desk space. The ABC 310 gives no such option.

Most of the front of the machine is dominated by a black panel that surrounds the display tube, beneath which are the disk drives and below them, the Acorn badges. The back panel houses a wide range of I/O ports which are arranged on four levels in an apparently random order.

From the top, there is a nine-watt DIN



The keyboard has an old-fashioned, chunky appearance which deviates from modern styling trends

socket designed to take a mouse, and a British Telecom-style socket marked 'BT Link'. Presumably this is for an internal modem, but it wasn't connected to anything on the review machine.

Next there's a Centronics printer connector which, unfortunately, is of a non-standard design and requires a special cable.

At the third level are two large D sockets. One 37-way socket is labelled '1MHz Bus'; the other is a 25-way socket for the keyboard connection.

The fourth level provides four round DIN sockets and a 15-way D socket. The four DIN sockets give RGB monitor output, an RS423 serial port, a cassette tape port and an Econet network port. The D socket is labelled 'Analogue In'.

Those who are familiar with the BBC Micro will have noticed that many of the interfaces are exactly the same as those found on the ABC 310. There's a good reason for this — one of the boards inside the unit is very close in design to that on the BBC.

Getting inside the ABC 310 is simplicity itself. All you do is unclip a couple of quick-release straps on the back, unclip the front and pull off the top casing. For all inquisitive types, a word of warning should be issued here. The first thing you see when you take off the top casing are the electronics for the monitor, most of which are uncased. Some of these electronics use very high voltages and can hold their charge for some time after the unit has been switched off, which makes messing around inside this machine more dangerous than it usually is on a business micro.

The basic architecture behind the whole ABC range is broadly the same: all the machines are based to some extent on the electronics of the BBC Micro. The BBC comes with a special I/O port called the 'tube' built in, which allows a second processor to be connected to the computer. When this is done, the BBC 6502 processor is only used to handle I/O, disks, keyboard, and so on. It's the second processor which actually runs the applications program. By using the tube, Acorn has been able to design boards based on a wide range of processors and so develop different products which contain very powerful co-processors but which are based on the Beeb.

The second processor on the ABC 300 and 310 is an Intel 80286 as used in the IBM PC/AT.

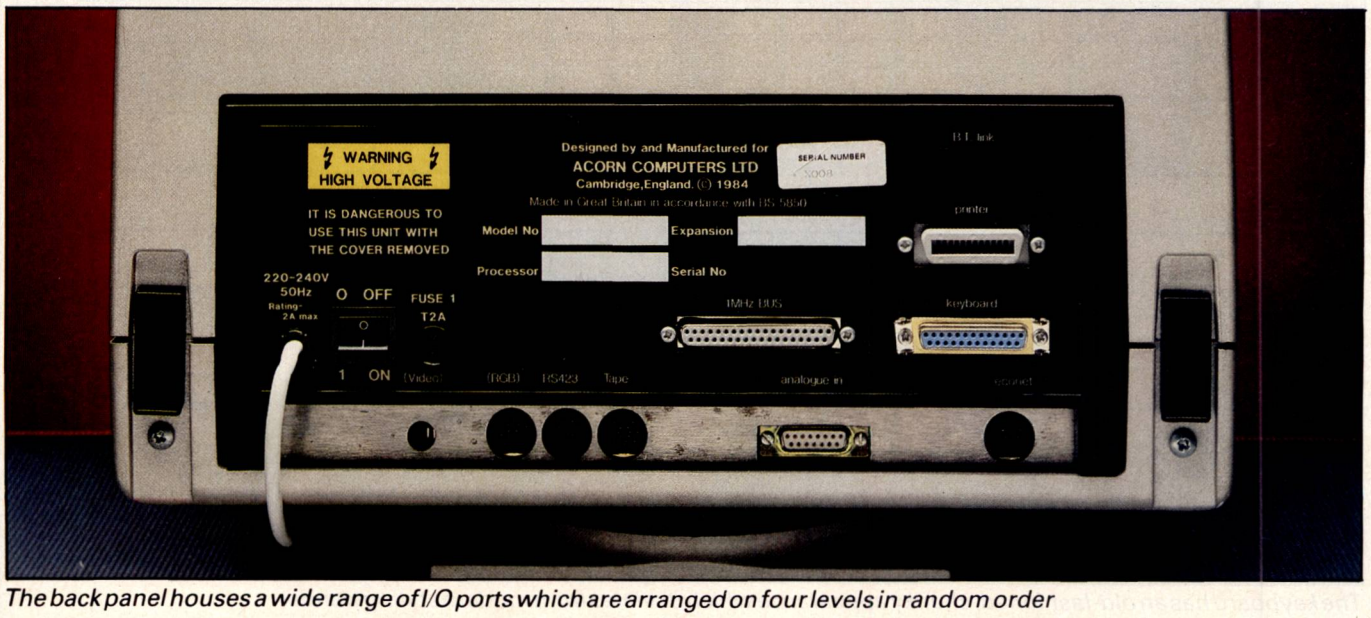
Gaining access to the ABC 310's computing electronics is quite straightforward once you have discovered where Acorn has hidden the boards.



The disks can read and write many different formats

As stated, the majority of the space inside the casing is taken up by the monitor electronics and the tube; this is all housed in its own substantial chassis. The computing electronics live in three main areas. The BBC PCB lies below the monitor chassis, and the co-processor and various I/O controller boards lie in two panels, one each side of the monitor chassis. To gain access to the co-processor and I/O controller boards, you release four quick-release studs and the wings housing the PCBs hinge outwards.

To get at the BBC circuitry, you release two more studs and hinge up the whole monitor chassis. When the unit is opened up in this fashion, it looks as if it has been dropped from a



The back panel houses a wide range of I/O ports which are arranged on four levels in random order

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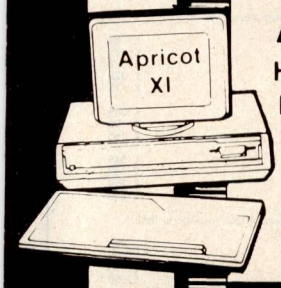

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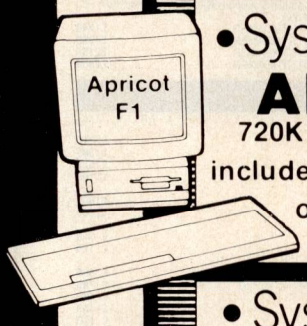

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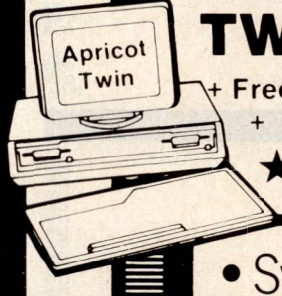

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great height and has disintegrated!

The review ABC 310 contained no less than five PCBs, all connected by lengths of ribbon cable glued onto them.

As is so often the case with review machines, my ABC 310 was a pre-production lash-up; I don't expect the production versions to have the cables secured in place with Araldite.

Close inspection of the BBC PCB revealed that it isn't a BBC PCB! Acorn re-designed the PCB and the whole layout has changed, so the board in the ABC 310 has no less than eight sideways ROM sockets and provision for double-density disk drives. On the review machine, four of the ROM sockets were filled by an advanced DFS ROM, utilities ROM, network controller ROM and an old OS 1.00 ROM.

The 80286 co-processor board is a very minimalist affair. Apart from the main processor, the PCB just holds some discreet TTL logic, RAM, 32k of ROM and a Ferranti ULA which controls the tube. The review machine came with four banks of eight 256k RAM chips, making a total onboard capacity of 1Mbyte.

The ABC's modular approach is both an advantage and a drawback. The advantage is that it's easy to upgrade the system by plugging in the appropriate co-processor and controller boards. The disadvantage is that the system becomes a messy cat's cradle of ribbon cable which makes it physically larger than it would otherwise have been.

The review machine came with one 790k 5¼in floppy disk drive and one 10Mbyte half-height hard disk. The floppy disk drive can read and write a number of different formats, including 360k IBM and 380k CP/M (for compatibility with lower-end ABC machines). Although the hard disk worked OK, it combined with the built-in fan to make this system one of the noisiest I've ever tested — it drove me mad.

The keyboard is another odd feature. While most modern machines are moving towards low-profile styling, this keyboard looks old-fashioned and chunky.

The keyboard unit attaches to the main unit via a coiled cable and a 25-way D plug, and has enough cable to allow it to be used on a desk or on your lap. Although the casings are made out of plastic, the keyboard is quite heavy and feels sturdy enough to take a fair amount of abuse. The keys are laid out in a fairly standard manner. The main qwerty typing section takes up most of the left side of the unit; to its right is the numeric keypad, and above it are 10 programmable function keys.

The keyboard also comes with three LEDs. Two of these indicate that CAPS LOCK and SHIFT LOCK have been activated, but unfortunately they are not labelled and it's up to you to determine which means which.

On the back of the keyboard unit there's a rocker switch and a button: the button resets the system and does a warm boot; and the rocker switch is used to switch the 80286 co-processor on and off. Normally it would be switched on, but if you want to use the machine as a BBC, you can switch off the co-processor and the ABC turns into a very expensive BBC Micro. An LED on the top of the keyboard indicates that the co-processor is switched on or off.

Apart from its old-fashioned looks, the keyboard operated well enough. The keys feel and sound rather loose, but generally it looks as if it can take long-term usage.

The display monitor is built into the main unit. A quick look inside at its electronics reveals that it is built by Microvitec, which makes a wide range of monitors, and as such it's a fairly standard 80-column by 25-line colour monitor. Brightness is controlled by a small thumbwheel under the front of the main unit.

When the machine is running CP/M, the screen's graphics resolution is the same as mode 0 graphics on the BBC. However, if you do use the machine in BBC mode, you have access to all the different BBC modes and resolutions.

In use, the monitor worked well. The whole system unit is mounted on a tilt/swivel stand, so it's possible to adjust the viewing angle to suit you. The tube has been treated with an anti-glare coating which worked well.

System software

System software on the ABC 310 depends on the mode the machine is working in. If you have the co-processor switched out, then the machine behaves in a similar way to the BBC. When I typed *HELP, I was told that the review machine was supplied with the out-of-date OS 1.0 and various ROMs, including an advanced DFS. As the BBC board's cassette port is accessible from the rear panel, I tried to load some cassette-based BBC software to see if it would run. Acornsoft's Elite was my first attempt. This quickly bombed out with an error message to the effect: 'This isn't a real BBC, sonny.' I persevered with other random BBC cassettes and scored a 50 per cent success rate.

Obviously, few people will fork out for an ABC 310 and then use it as a BBC Micro.

The standard operating system of the 80286-based ABC 300 and 310 machines is Digital Research's (DR) Concurrent DOS 286. Unfortunately, when I was writing the Benchtest, DR hadn't finished writing DOS 286 so I had to make do with Concurrent CP/M version 3.1.

At this stage, it might be useful to explain the current state of DR's operating systems. Its current main 16-bit operating system is Concurrent CP/M; this allows you to run up to four different programs at the same time (concurrently — hence Concurrent CP/M). Concurrent CP/M also goes some way towards emulating PC/DOS and MS/DOS, so programs written for the IBM PC or MS-DOS machines can sometimes work on machines using Concurrent CP/M. Version 3.1 of Concurrent emulates the old version 1 of PC/DOS, and version 3.2 of Concurrent emulates the more popular version 2 of PC/DOS.

Now enter the Intel 80286 processor as used in this machine and the IBM PC/AT. The 80286 can work in two modes under software control: it can either emulate an 8086 family processor as used in the IBM PC; or it can work in its own native mode which includes an enhanced instruction set and advanced memory management facilities.

When IBM launched the PC/AT, it also launched PC/DOS version 3 to work with the new processor. This uses the 80286 in 8086 emulation mode and doesn't take advantage of its enhanced facilities. In an attempt to cash in on this weakness, DR is soon to launch Concurrent DOS 286, which will make full use of the 80286's new features and will offer enhanced IBM emulation. This is the operating system that the ABC 300 and 310 will be shipped with.

But, as stated, the review machine was supplied with a lashed-up version of Concurrent 3.1. However, even in this state, the machine showed some degree of IBM compatibility. It happily read IBM disks and even ran friendly, well-behaved IBM format programs such as WordStar.

Another feature of the ABC 300 and 310 is that they'll be shipped with DR's Graphics Environment Manager (GEM), which is an extremely user-friendly Macintosh-like front end to the operating system.

Using GEM, you shouldn't ever have to resort to the unfriendly operating

Benchmarks

BM1	0.4
BM2	1.5
BM3	3.4
BM4	3.4
BM5	3.9
BM6	6.7
BM7	10.7
BM8	8.6
Ave	4.82

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

system command line.

GEM makes heavy use of the mouse, ikons and pull-down menus to make life as easy as possible for the user. I looked at the system in more depth in February's issue, so I'll only make some brief points here.

The interesting thing about using GEM in conjunction with a concurrent operating system is that you can have up to four applications programs running at the same time, as well as having a friendly user interface. Concurrent CP/M handles concurrency by having four 'virtual screens' which you can switch between at will. Each virtual screen has its own piece of memory where the program is loaded, and shares processor time with the other virtual screens.

When you use GEM on a concurrent system, the obvious thing to do is to load a copy of GEM into each of the four virtual screens. Then, when you switch screens, you will be greeted by GEM rather than the CP/M command line. The problem with this is that it would need a hell of a lot of memory to take four copies of GEM, and it would be very wasteful. Instead, the system loads one copy of GEM which is 'shared' by each of the screens.

This technique is known as 're-entrancy'. Its advantage is that it is more efficient, but its disadvantage is that programmers have to be more careful when they are writing re-entrant programs because each of the four virtual screens will be doing different things within the GEM program. The programmer must make sure that all the entrances and exits from the program are properly controlled in order not to mess up the system.

Applications software

The only pieces of applications software supplied with the review machine were WordStar and Locomotive Basic (Locomotive also provides the Amstrad's Basic). If you take a look at the Basic Benchmark table, you'll see that the ABC 310 is a very fast machine indeed. This is hardly surprising when you consider that it has an 80286 processor and was running Locomotive Basic, which has a reputation for speed anyway.

As far as third-party software is concerned, a great deal depends on how many independent software vendors Acorn persuades to translate software to the ABC machine. Acorn says it hopes to sell the machine into vertical markets, which means that it will have to persuade specialised software writers to write for the machine.

It will be interesting to see how many write for the GEM environment and how many just write for unfriendly old CP/M.

As far as IBM compatibility is concerned, DR says that Concurrent DOS 286 will have extensive IBM emulation capabilities. If this is the case, the ABC should benefit considerably, but I can't say more until I see the operating system.

Documentation

At the time of writing, Acorn hadn't finished the documentation for the machine so there was none supplied. The company did, however, supply DR's generic manual for GEM, but even this was pre-release and so not representative.

Prices

The same type of machine as the one reviewed here with an 80286 processor, 512k of RAM, a colour screen and a 10Mbyte hard disk costs £3999.

Conclusion

I can't quite make up my mind about the ABC 310. Technically it is fine — the 80286 processor combined with the 6502 on the BBC board make it a very fast system indeed. But the sheer size of the thing makes it an intimidating sight in the average office.

The inclusion of Concurrent DOS 286 rather than the more traditional MS-DOS is a brave idea. It looks as if Concurrent DOS 286 will be much more powerful than MS-DOS, and it has the major advantages of making full use of the 80286 and the ability to run more than one program at once.

The only problem with the operating system is the comparative lack of 16-bit software. If the IBM emulation capabilities of DOS 286 are as good as claimed, then it should be possible to run plenty of IBM applications software on the machine.

Acorn says that it has also commissioned specialist independent software writers to write for the machine. This is fine, but I expect it will take some time for the software to come through.

The inclusion of the GEM friendly user interface with the ABC 310 is a nice addition. There's no doubt that GEM is much easier to use than the traditional CP/M command line; the only question is whether software developers will make full use of its facilities, or just write their applications in the traditional way.

But even assuming that the right applications software is available for the machine, I still say that I wouldn't like it on my desk. It's just too big. END

Technical specifications

Processor:	Intel 80286, 6502
ROM:	32k co-processor, BBC board, eight sideways ROM sockets
RAM:	512k, up to 1Mbyte onboard
Mass storage:	790k floppy disk, 10Mbyte hard disk
Keyboard:	92-key full-function
Size:	16ins x 15¼ins x 15¾ins
I/O:	Parallel printer, 1MHz bus, RS423 serial, Econet, analogue port
DOS:	Concurrent DOS 286

In perspective

Selling for a shade under £4000, the ABC is positioned firmly at the top end of the single-user business market. In terms of price and performance, it's bound to be compared with machines like the IBM PC/AT, but at the moment it doesn't have the same multi-user capability as the PC/AT.

Acorn is planning to sell the ABC range through 50 or so dealers under the 'Business Centre' banner. It wasn't clear at the time of writing how many dealers are already signed up and how many are still thinking about it. Most of Acorn's current dealers are geared more towards home machines than £4000 business micros, and wouldn't be suitable.

Acorn also seems to be hedging its bets by attempting to sell the machine into vertical markets as well as the general-purpose machine market, but I'm not sure if this is the good idea it seems. The trouble with the vertical market tactic is that the same idea seems to have struck all the 'second division' business micro manufacturers at the same time.

It isn't hard to see the reason for this: the general-purpose business market has become very competitive with the real money being made by the likes of ACT, Apple and IBM. Most of the rest have been having a hard time, and have turned to other areas in which to sell.

I have the feeling that this mass attack on the vertical market will eventually reduce the returns in this area, thereby forcing the likes of Acorn to specialise even further.

The company can, of course, fall back on the university-type educational market, but here the 300 and the 310 will be competing with Acorn's National Semiconductor 32016-based ABC machines as well as products from other companies.

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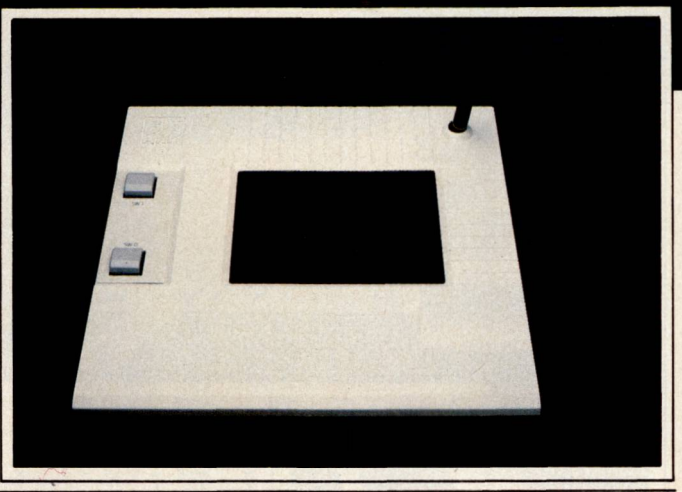

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Research Machines' Nimbus

The Research Machines' Nimbus is a full-function, 16-bit micro which, bolstered by some advanced design features, is aimed at the business and education markets. Peter Bright assesses its chances in the light of concurrent releases from business-oriented competition.





The keyboard suffers from not having the construction quality of the IBM PC: the keys don't have the ultra-positive click

Research Machines (RM) is a name which is probably better known by people in schools and colleges than by out-and-out business users.

RM has a long history of supplying its micros to education starting back in 1977 with the 380Z bus-based 8-bit micro; this was very popular in colleges and was, incidentally, the first micro I ever used.

The 380Z was followed in 1982 by the more compact 480Z, which was originally designed to be a workstation on RM's local area network.

The latest in the line of machines from RM is the Nimbus. This is a full-function, 16-bit, business-type micro which sports Intel's new advanced 80186 processor running at 8MHz, and a host of advanced design features which are designed to appeal to the business market as well as education.

Hardware

For a machine with business pretentions, the Nimbus is quite an attractive unit. Its overall dimensions are 405mm wide × 352mm deep × 132mm high, and it certainly looks compact when compared with something like an IBM PC.

The casings are made of very high-quality plastic. The lower mouldings are a dark beige colour while the upper mouldings are a standard cream. The system has vents on the front and sides which add to the angularity of the machine.

The keyboard and monitor are colour coded to match the rest of the system, but the large Microvitec monitor supplied with the review system looked out of place.

On the far left side of the main unit are four diagonal slots which hide the speaker for music and voice output. To the right are the disk drives; below these are three spring-loaded flaps.

These flaps are unusual for a business-type machine. The two flaps on the right cover slots designed to take plug-in ROM packs, so you can have ROM-based software as well as disk based. The far left flap hides a slot designed for RM's dongle; this is a software security device — software will only run if the dongle is present. RM says the main reason for the inclusion of the dongle is to help keep software licensing costs down if the machine is part of a network.

If you have a single-user micro, the software you buy is normally sold on condition that you only use it on one machine. However, if you're on a network, the software can theoretically be accessed by any user on the network. This has led some software houses to demand multiple-user licences when their software is used on a network system, which can get very expensive. The RM dongle ensures that the software can only be used on your machine even if you are on a network, therefore a single-user licence will suffice.



The disk drives are surrounded by a very high-quality casing

Returning to the hardware, each side of the unit has a carrying handle moulded into it to make movement easier. The rear panel houses a rather strange assortment of I/O devices. The power cable is part of the unit, so there's no need to plug it in. There is, however, a 240-volt power output plug, so you can plug the monitor into the main unit and get away with just one wall power plug.

Running from left to right along the rear panel we have a joystick / mouse interface, and connectors for the keyboard, colour monitor, and black and white monitor. We also have: a TTL-level RS232 port; a Piconet / RS422 port; a 12volt and 5volt power out; and a network connector. Finally, there are four blanking plates for expansion cards.

'RM has a long history of supplying its micros to education starting back in 1977 with the 380Z bus-based 8-bit micro; this was very popular in colleges and was, incidentally, the first micro I ever used.'

Both the RS232 and the RS422 / Piconet ports use 6watt Telecom-style micro sockets rather than the traditional 25-way D plugs. The RS232 port is primarily intended as a printer port; if you have a parallel printer, you'll have to pay extra.

The Piconet port is especially interesting. At its lowest level, you can use it as an RS422 serial port to connect to serial printers and the like. However, if you use it in Piconet mode, you can plug up to 30 peripheral devices into it.

This is how it works: RM produces a number of different interface boxes which allow you to plug RS232 and Centronics-based peripherals into the Piconet link. The controller boxes daisy-chain together up to the maximum 30 controllers. Each controller box is intelligent and contains an 11MHz 8051 microcontroller (the main system unit also has an 8051 to control the whole network).

Although business users are unlikely to want to control 30 devices from one system, this ability might prove useful in schools and laboratories where a large number of data-logging peripherals could be controlled.

At the time of writing RM hadn't set a price for the Centronics controller box, but it plans to sell the RS232 controller box for less than £100.

In addition to the Piconet peripherals controller, the Nimbus also comes with RM's network hardware built in. The network has been well proven in schools over the years, and RM claims to have in excess of 1000 systems installed.

The network can support up to 64 workstations on a maximum of 1200 metres of co-ax cable. The system works at 0.8 megabits per second which isn't high by Ethernet standards, but which should suffice for educational use. Software support for the network is achieved by the use of MS-Net.

Unusually for a business-type machine, the Nimbus gives access to 12volt and 5volt power supplies at the back of the machine. These could be useful in schools and colleges where a regulated power supply is needed for home-brew electronic circuits.

The mouse / joystick port takes the form of a nine-way D plug. The Nimbus can be supplied with a mouse for £87; this could prove to be a necessity, as some of the software tools make use of mouse input. The mouse itself is very similar to the Microsoft mouse and worked well during the Benchtest.

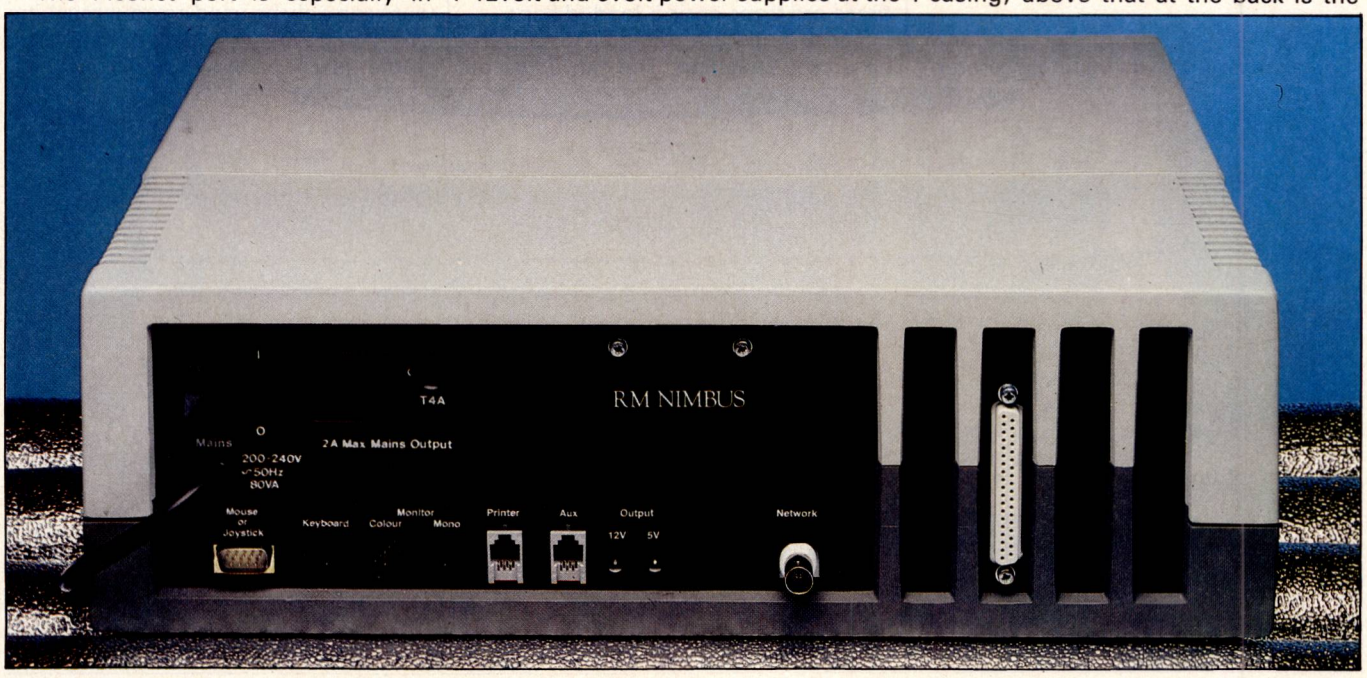
Getting inside the Nimbus is simple:

'. . . RM has used no less than three custom-designed gate array chips on the main board, which has drastically cut the chip count and the size of the main board . . . there are very few chips on the main PCB.'

you slacken four Phillips screws and slide off the lid.

The basic design philosophy seems to have been to keep the machine fairly compatible with the IBM PC without compromising on performance. The result is a machine which doesn't have much in common with the PC in hardware terms, but which offers a reasonably straightforward software conversion job.

A look inside reveals that there's quite a lot of empty space, even though the casings are compact. The main PCB takes up just over half the surface of the casing; above that at the back is the



The rear panel houses a rather strange assortment of I/O devices, including a Piconet RS422 port and a network connector

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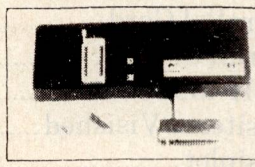

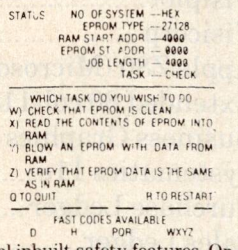

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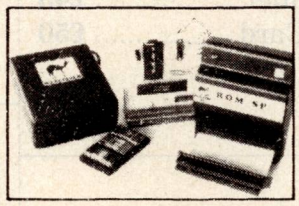

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power supply and fan. At the front are the disk drives which, incidentally, are very well shielded in their own small Faraday cage — presumably this is necessary because of the proximity of the coils in the colour monitor.

To the left of the main PCB is the RAM board and holders for up to four expansion cards. On the review machine only one expansion card was present (the disk controller). Unlike machines like the IBM PC, the expansion cards don't plug into a hard-wired motherboard, but are linked by multi-way ribbon cable.

'Targetted towards the educational market, the Nimbus will be available with a range of programming languages (and) was supplied (for review) with Microsoft Basic, Prospero Pascal and DR Logo.'

The first thing that struck me about the main PCB was how compact it was. This is mainly due to the fact that RM has used no less than three custom-designed gate array chips on the main board, which has drastically cut the chip count and reduced the size of the main board. In fact there are very few TTL chips evident on the main PCB.

The three gate array chips are easy to spot, simply because of their size. The first two look like conventional DIL chips, and are used to control the peripherals and the RAM.

The third gate array is very large, and resembles the new Intel 80186 and 80286 processor chips in that it is square with legs on all four sides. This chip was specially designed to handle the display in order to provide features far in advance of traditional bit-mapped screens.

RM is proud of the fact that all three chips worked first time without the need for any re-masking, and says this is due to its extensive use of computer aided design and modelling tools.

The chip count on the main PCB is also reduced by the fact that the Nimbus uses an 8MHz Intel 80186 main CPU. The 80186 is one of Intel's new generation of CPU chips which includes the 80286 used in the IBM PC/AT.

The 80186 is similar to the popular 8086 16-bit processor; the main difference being that as well as having the processor on the chip, it also has a DMA controller and some timing circuits onboard. This means that micro designers need to use fewer support chips to get a working system.

In addition to the main processor, there is also provision for an 8087 maths co-processor chip for when you are performing heavy number-crunching operations.

The entry-level Nimbus is supplied with 192k of RAM, which can be expanded up to one megabyte. Of this, 64k is used as video RAM leaving 128k as user RAM. The system is also supplied with 64k of ROM, as well as the usual bootstrap and O/S routines. It also contains over 50 graphics routines which can be called from applications programs.

Finally on the electronics side, the Nimbus comes with a sound generation chip and voice synthesis circuits. Again, these are of more use to the educational market than to businessmen.

The Nimbus is available either with or without disk drives. The diskless machine is only of real use when it is used on a network and can access the fileserver's disks.

The standard disk drive supplied with the Nimbus range is a 720k Sony-compatible 3½in microfloppy unit, and the system can be supplied with either single or twin disks. It is also available with a range of hard disk drives. You have a choice of either 10Mbyte or 20Mbyte 3½in Rodime drives built in, or 40-and 80Mbyte external hard disks.

You also have the option of an external IBM-compatible 5¼in floppy disk drive. This is a multi-format unit, and is useful for transferring data from IBM PCs and other RM kit.

The Nimbus can work with either monochrome or colour RGB monitors. The review machine was supplied with a colour-matched Microvitec colour monitor which worked well enough, even if it was rather large.

As stated earlier, the display on the Nimbus is handled by a large custom-designed gate array chip. This has its own primitive instruction set so you could access it directly, but there is an easier route. RM has provided over 50 ROM-based primitive graphics routines which can be accessed from high-level programming languages.

The major advantage of the graphics gate array is that it has been specifically designed to handle windowing, multiple fonts and fast drawing, which are necessary for modern 'friendly' systems. It can also handle the high-res animation needed to make the movement of mouse-controlled cursors very smooth.

The system also supports large user-definable sprites; this is a feature more usually found on home machines that business/education systems. I had great fun making up sprites using the sprite editor software and then watching them move around.

'If you look at the Benchmarks, you'll see that (the Nimbus) is the third fastest we have ever tested, beaten only by a couple of Motorola 68000-based machines. This speed is reflected in use . . .'

The graphics screen can work in two modes — 640 × 250 pixels with four colours, or 320 × 250 pixels with 16 colours. In either case you can choose from a palette of 16 colours.

These facilities will be very popular with the educational types who will be the prime users of this machine. They are also useful for business applications where friendly mouse-based software should be easy to implement.

The only problem as far as business is concerned is that software houses are standardising on GSX-type graphical interfaces. Although the RM system is probably more powerful than bog-standard GSX, it has the disadvantage of being a non-standard system.

The Nimbus keyboard is basically a copy of the IBM PC unit. According to the label on the back, it is made by a company called Alphameric which is based in Woking.

The keyboard unit is attached to the main unit via a length of coiled cable and a five-way DIN plug. The unit has a plastic feel, although it's quite heavy. Two plastic feet at the back hinge down to alter the typing angle. The keys are set out in standard IBM manner. The unit has a total of 83 keys, separated into three functional areas.

To the left are 10 programmable function keys; to their right is the main qwerty typing area with the traditional IBM-style layout. To its right is the numeric keypad/cursor control area.

The main criticisms of the keyboard are the same as for the PC keyboard —

Benchmarks

BM1	0.7
BM2	2.2
BM3	4.2
BM4	4.4
BM5	4.9
BM6	8.8
BM7	13.5
BM8	12.9
Ave	6.45

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

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no indication of whether CAPS LOCK or NUM LOCK is engaged, '/' key between the 'Z' and the SHIFT key, and so on. This unit also suffers from not having the same construction quality as the IBM. The keys feel loose compared with the PC's ultra-positive click.

I didn't like using the Nimbus keyboard — I constantly compared it unfavourably with that of the PC. But keyboards are a very personal thing and there are other Benchtesters who would probably love this unit.

System software

The operating system of choice for the Nimbus is MS-DOS version 3.0. The machine will also run CP/M-86, but it's unlikely that you'll find a lot of applications software running under it. Both MS-DOS 3.0 and CP/M-86 were supplied with the review machine.

MS-DOS version 3 is the very latest version of MS-DOS. Although its user interface is virtually the same as good old version 2, it has built-in provision for record locking and password protection which is needed on a networked machine. If you do use the Nimbus on the network, you will also be supplied with Microsoft's MS-NET network driver software.

Unfortunately I could only test the single-user version, so I can't comment on the operation of MS-NET.

The review machine was supplied with a range of software designed to show off its graphics and sound capabilities. Most of these were standard demo files, but one — the sprite editor — was quite useful.

The graphics are driven by a sophisticated custom gate array. It doesn't, however, directly support sprites, so RM has written separate sprite support software.

Part of this software is the sprite editor. Instead of the normal home computer method of using a matrix to describe your sprite, the Nimbus uses a MacPaint-like editor. This allows you to use the mouse to draw your sprite and then generate a disk file containing the definition data.

As befits a machine targetted towards the educational market, the Nimbus will be available with a range of programming languages. The review machine was supplied with Microsoft Basic, Prospero Pascal and DR Logo. The Pascal was supplied with an enhanced library to allow it to control the advanced graphics capabilities of the machine.

Microsoft Basic was available for Benchmarking purposes only. If you look at the Benchmarks, you'll see that this machine is the third fastest we have ever tested, beaten only by a couple of Motorola 68000-based machines. This speed is reflected in use where the system response is always good.

Although Microsoft Basic will be available when the machine is shipped, it's likely that most people will go for RM's own enhanced Basic which will be able to take advantage of the advanced graphics and hardware features of the Nimbus.

Interestingly, RM also says that it is looking at ways of making it as easy as possible for users to run BBC Basic programs on the Nimbus. This has obvious implications for the educational market.

Applications software

One of the basic design concepts of the Nimbus was to make it close enough to the IBM PC to make re-writing PC software a reasonably straightforward proposition while not being constrained in hardware terms by the PC's outmoded design.

As examples, the review machine was supplied with Microsoft Word and MultiPlan as well as Caxton's Brainstorm and Touch N Go.

Documentation

As is often the case with review machines, the documentation supplied with the Nimbus was incomplete.

The *User's Handbook* was a word processed A4 ring-bound folder. Although the text was largely complete, some of the illustrations were missing. The text took a friendly tone without going over the top to the gee-whizz style that used to be favoured by some home computer makers.

I found the draft *Owner's Handbook* easy to use, the main trouble being that it sometimes described features that the programmers hadn't got around to writing!

Prices

Considering its technical sophistication, the Nimbus is very competitively priced. Prices start at £1123 for a network workstation with 320k of RAM but no disks. The review machine with twin 720k disks and 192k of RAM comes in at £1695. When you consider that this includes the built-in network driver, this has to be good value.

In addition, educational establishments qualify for a discount scheme which brings the prices down even further.

Conclusion

The Nimbus is an impressive machine. It offers high-resolution graphics and a built-in network, all integrated into a fast hardware design.

It has all the features built in which are necessary to endear it to schools that want to program the traditional graphics and sound programs, but which also want to run popular business packages to give the kids a taste of what real programs are like.

I'm not sure how relevant the Nimbus is as a business machine. It certainly has the functionality, but RM is wise to try to sell it through OEMs rather than compete in the mass market. END

Technical specifications

Processor:	Intel 80186 8MHz
ROM:	64k
RAM:	192k (including 64k video RAM)
Mass storage:	One or two 3½in 720k microfloppy drives
Keyboard:	IBM-compatible layout
Size:	405mm × 352mm × 132mm
I/O:	Mouse interface, RS232 printer interface, Piconet interface. Up to 30 devices, network controller
DOS:	MS-DOS version 3.0, MS-NET, CP/M-86

In perspective

In terms of hardware specification and price, the Nimbus is a very competitive machine. I can only think of one other machine at the price, the Future FX-20, which offers high-res graphics and a built-in network coupled with a high-performance design.

Unfortunately, it now takes more than just having a good product to be a success in today's business market. The mass market is a jungle controlled by IBM, ACT and Apple, and it would be extremely difficult for a new company to break in.

RM has recognised this and says that it isn't going for the mass business market. Instead, it is concentrating on its traditional educational market with occasional forays into vertical business markets through OEMs.

But RM has launched the machine at the same time that the likes of ACT and Texas Instruments are making a strong bid for both these areas. This doesn't mean that the Nimbus will fail, it just means that its job will be harder than it would have been had it been launched six months ago.

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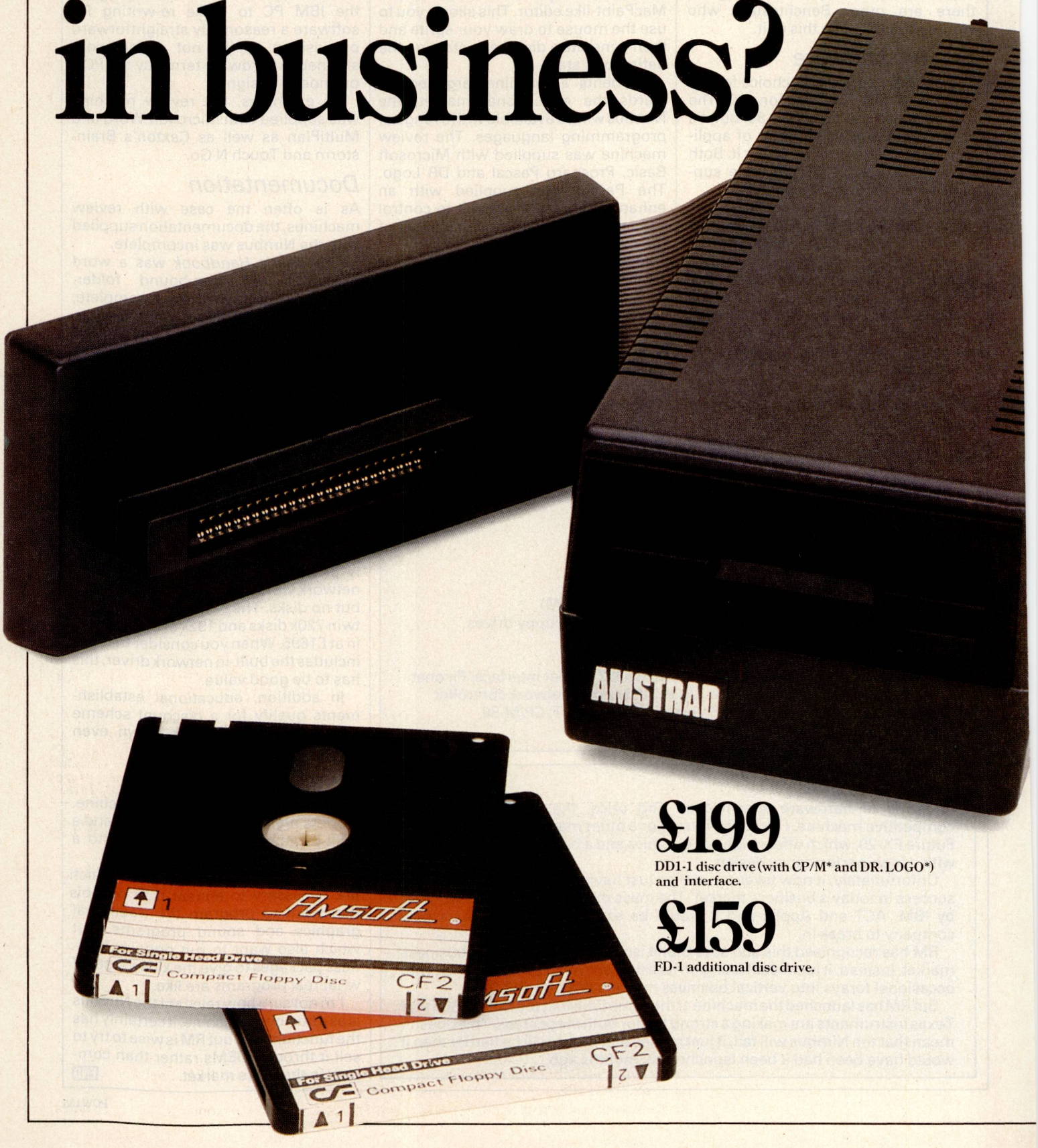

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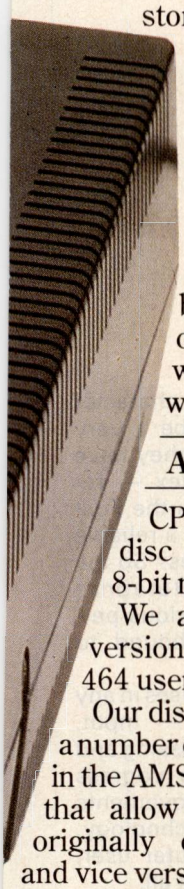

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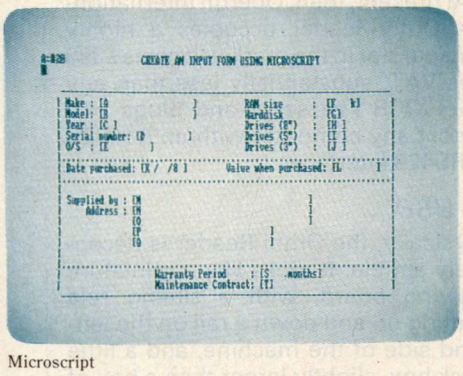

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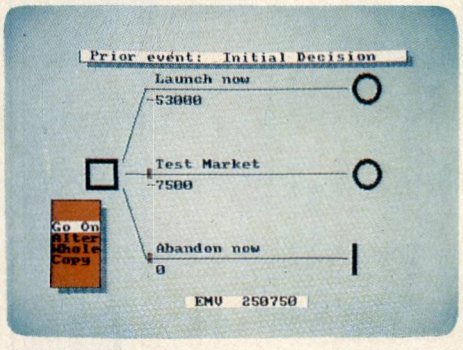

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The CPC 464.

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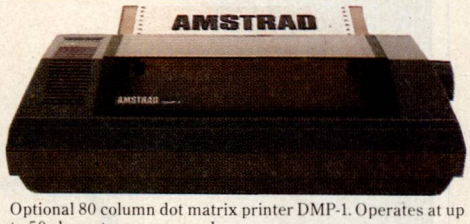

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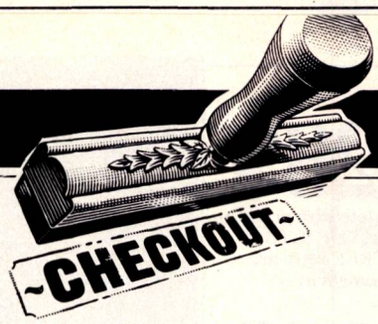
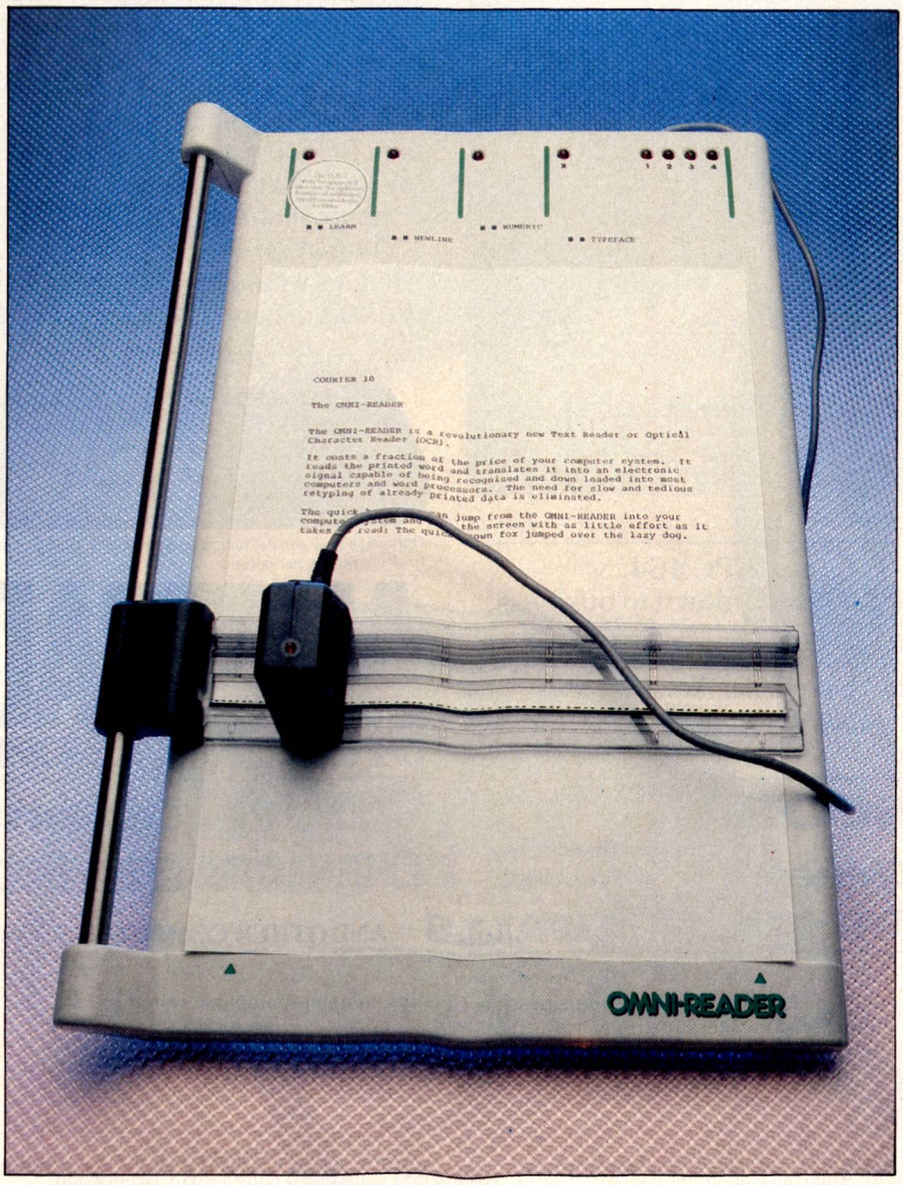


Oberon Omni-Reader

Oberon's Omni-Reader is intended for use by those who can't justify the cost of its heavy duty peers. But does it offer the same capabilities? Simon Craven takes a look.



On the face of it, an optical character reader (OCR) is bound to be a very useful device. Traditionally they have been expensive and complex — remember how many millions the Post Office spent trying to devise a reliable system to identify post codes? So the introduction of a practical OCR at a price within the reach of most serious personal computer users is bound to arouse great interest.

There are three distinct phases in any data processing operation — input, processing and output. Processing and output have made enormous progress in recent years thanks to improvements in printer and computer technology, but for the personal computer user, data input has not changed at all.

The limiting factor is usually the speed at which a skilled typist can work, and unless the qwerty keyboard is displaced by a more ergonomic arrangement, that speed is unlikely to increase from present-day levels. Speech input has been tried, but even the most advanced speech recognition systems can cope with only a small vocabulary.

At present, then, Oberon International's Omni-Reader occupies a highly unusual slot in the market. It costs £399 plus VAT, substantially less than any other OCR I've seen, and plugs into almost any computer with an RS232C or RS423 interface.

In use

Physically, the Omni-Reader is deceptively simple. It looks like a miniature drawing board, with a sliding rule running up and down a rail on the left-hand side of the machine, and a little black box, slightly larger than a box of

matches, which slides left and right along the ruler.

This is the read head, the bit which actually converts the text on the page into ASCII codes to be squirted along the serial interface. The idea is that you put your sheet of original copy on the tablet where a pair of slightly tacky plastic strips hold it in place. Sheets of A4 size or smaller are fine for use with the basic unit; if you want to scan larger documents, a longer plastic rule is available.

With the external home computer-style power supply plugged into the mains, operation can begin. Starting at the top of the page, the text is scanned from left to right by aligning the rule with the text, holding down the rocker switch on the read head and smoothly moving the head across the line. The rule is then moved down one line and the process repeated — words appear on your computer screen as if by magic. The rocker switch works as a scan switch in one position, and as a control switch in the other. It is spring-loaded to a neutral position.

As this is a manual operation, you might expect the Omni-Reader to be very critical about human variations in the speed of the scanning run, but in practice it works surprisingly well. There are 'too fast' and 'too slow' limits, signalled by the unit's row of light-emitting diodes, but anything within about one and three seconds is acceptable. Oberon claims a minimum scan time of half a second. An experienced operator might be able to match this, but your fumble-fingered hack found it rather uncertain.

A little arithmetic reveals the maximum scanning speed to be about 160 characters per second. This should be regarded as an 'ideal' figure, obtainable only with perfect data arranged in the best possible way. In the same way as a printer rated at a nominal 160cps only manages about 100cps in real life, we would expect a rather lower figure than 160 to be the reliable maximum, page in, page out.

The wide range of scanning tolerances is produced by an ingeniously simple method. Along the plastic guide rule there is a 'clock track' printed just below the text which is being read. The Omni-Reader scans this at the same time as the text, and can judge the speed at which it is being moved. Allowances for the rate at which characters are popping up is then automatic.

Even with all the ingenuity in the world, there is only so much you can do for £399, and the Omni-Reader does have limitations. It is sensitive to variations in typeface and print quality in particular. If the device copes adequately with a line, it happily beeps at the end of the line. If it beeps twice, it has had problems. The line can be re-read, or if the operator accepts the line, any ambiguous characters are replaced by the ampersand character (&).

Even if the 'good read' indication is given, you are advised to quickly check the line as it's not unknown for the machine to mistake characters such as capital I and the numeric 1.

If the data being entered is restricted to numerics and the special symbols associated with numeric data, the chances of a misread line are greatly reduced by setting the machine into its numeric data mode. This could certainly be a boon for some applications.

The simplest way of receiving this information into the computer is just to use the operating system or Basic to open a file which is filled direct from the serial port. However, the machine is much more useful if it can be used to import data into applications programs, replacing or supplementing the keyboard. Interfacing software is available for some machines (mine was for the IBM PC), and this enables the user to merge the keyboard and the serial port so that they look the same to the application program. Thus a WordStar user can read continuous text, and WordStar will take care of line breaks and word wrap. If any editing commands need to be typed in, the keyboard is available as usual.

Carriage returns, to mark the end of a paragraph, can be inserted from the Omni-Reader by flicking the read head rocker switch the other way. If the data being entered is made up of short lines, the OCR can be set to automatically add a carriage return at the end of each successfully read line.

The typefaces which can currently be read are four in number — Courier in 10- or 12-pitch, Letter Gothic 12, and Prestige Elite 12. These encompass most office typewriters and many daisywheel printers, but unfortunately dot matrix printing is off the menu at the moment. The four existing typefaces are held in ROM, and there is room for an additional typeface that the user will enter as part of a 'learn mode' which Oberon plans to add to the Omni-Reader as a future development. The extra typeface is held in RAM onboard the Omni-Reader, and will have to be saved to the host computer before the system is powered down.

Interfacing

Interfacing the Omni-Reader is fairly straightforward, using a two-way RS232 cable (an RS232 printer cable isn't suitable). The standard IBM modem cable works fine with an IBM-compatible serial card. Setting the baud rate on the Omni-Reader is simply a matter of flipping one of six DIP switches with a range of between 300 and 9600 baud. The IBM was able to operate quite happily at 9600.

Another row of DIP switches handles various options: selecting 10-pitch or 12-pitch; turning the beeper on and off; determining whether a pound sign or hash sign is to be expected; and determining handshaking protocol.

The documentation supplied is in two parts — a simple, well-illustrated *User Guide* explaining the machine itself, and a rather more technical work going into the interfacing hardware and software required. An index wouldn't go amiss. All the information you need is there, although the interfacing manual is a little impenetrable in places. One feature which is a great help is a comprehensive troubleshooting guide. This actually tells you what to do in the event of various non-events, in contrast to most equivalents in the computer world which drone repetitively 'Consult your dealer'.

Conclusion

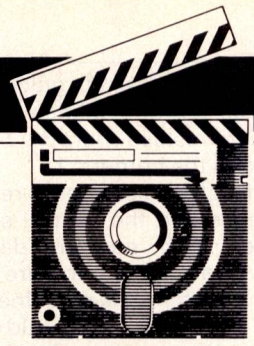
So it works . . . but is it useful? As someone who spends a lot of time playing around with personal computers, I could certainly find enough uses for it to justify the purchase but only when the 'learn mode' enabled me to read dot matrix printing. As a tool for entering program source code from the printed page, its potential is great.

If your application mainly involves the entry of coherent text, then the alternative of a skilled typist still has many attractions, including the ability to cope with handwritten copy or dark-coloured paper. But the cost is low enough for it to be worth a try anyway. You could save £400 worth of skilled typist's time fairly quickly.

The ideal application, though, would be one in which the data to be entered was difficult to understand, such as lists of codes or numbers. The major improvement in this case would not be in the time taken, but in the accuracy of the work. The Omni-Reader doesn't get tired or let its attention drift. It does make mistakes from time to time — experimentation with some sample data revealed about one incorrect character every couple of A4 pages, but with data which has little or no human meaning, this is better than most human typists could achieve. They certainly could not match this performance if they were going at the same speed as the Omni-Reader.

There is no doubt that the Oberon Omni-Reader represents a big step forward in the cost of this type of equipment. Anyone who uses a more conventional optical character reader is likely to sneer at its limited capabilities, but to do this is to miss the point. The Omni-Reader is not intended as a replacement for the heavy-duty OCRs already in service — it is intended to search out a new group of users who have not been able to justify major expenditure on such an item.

That is a brave marketing posture, as the market for low-cost OCRs is by no means well-documented. However, the history of the personal computer industry is littered with examples of companies inventing potentially useful equipment at prices which make it available to new groups of users, and doing very well by virtually inventing their own markets. Oberon could well follow in their footsteps. END



SCREENTEST

Turbo Pascal

Borland International's Turbo Pascal was given a warm reception when it was first announced — if only for its price. Tanj Bennett considers whether its welcome was deserved.

Turbo Pascal (TP) is a compiler designed solely for use with a personal computer. In addition to converting Pascal programs into machine code, it acts as a user interface between edit and compilation, and includes a useful editor which is closely linked to the compiler. Borland sells TP for CP/M, CP/M-86 and MS-DOS.

This review is based on the MS-DOS version, running on a Sirius 1. If the manual is accurate, the CP/M-86 version is closely related, while the CP/M version lacks a few features but is still fairly complete. Versions for the Acorn, BBC and Torch micros are also available, and all cost around £50.

Probably every micro owner has seen or used Basic computer programs. Basic is an 'interpreter', which means that it operates in only two steps: you type in the program, and then the computer runs what you typed. It is called an interpreter because the Basic language you type in is not the same as the machine code language built into the hardware, so an interpretation from Basic to machine code is occurring as the program runs. This principle applies to most computer languages.

Compilers work by planning everything in advance. They must work through the typed program (the 'source'), planning the space for all the data and variables, and preparing the interpretation of the statements as machine code. The result is tied together with a 'run-time library' — machine code and data prepared for such things as reading disk files or calculating exponentials — and the whole result is a program ready to run (the 'object'). This is generally stored on disk and called up to run whenever needed. The compilation activity makes programming a three-stage effort: type the source program, compile source into the object, and run.

The object program can be re-run any number of times, independently of the first two stages, and can be sold as a product separate from the source. The neatness of the source, the length of variables, or the comments, have no effect on the way the data is spaced out or the machine code is prepared, so good style costs nothing when the program is in use.

Starting up

Turbo Pascal comes on a single diskette, with a manual and newsletter sheets. An installation program, TInst, is provided to tailor the keyboard and screen control for a variety of terminals; the range is wide and the tailoring seems effective. My copy came properly set up for the Sirius. If you need a terminal which is not on Borland's list of more than 20 common types, the program will allow you to specify a new type. A printing program is also on the diskette which will paginate your text, supply line numbers, and underline keywords.

When you have checked that Borland has shipped the proper keyboard and screen definition, you are ready to begin with TP.

TP takes control of the screen and keyboard. It asks if you want to load error messages (so that it can explain problems, instead of just giving an error number). Unless you are cramped for memory, answer 'y'. Next, the main menu comes up. All TP's menus use single keystrokes, which are brightened, and the menus are generally good but you do need to read the manual before using some of the options. Response is as fast as the screen can be written.

To begin programming you will need a work file — that is, a source program text. You can name this by using the W option. If you type E for edit when you have no work file, TP will first ask you for a work file, then switch to editing.

Borland claims that its editing is based on a subset of WordStar. It is a fairly good full-screen editor but not a word processor, as it lacks any formatting control. The features include searching, replacement, auto-indent, block operations, and reads and writes to outside files. It is a little slow and sometimes clumsy to use. The tab function deserves special mention for peculiarity. Tab stops are defined by the words in the preceding line. This is presumably intended to give an attractive layout, but is likely to be exasperating if you are accustomed to any other editor. It is interesting that none of the example texts provided by Borland are laid out using tab stops like these! The redeeming feature of the editor is the close tie it has to the compiler, and on balance it serves its purpose.

All the editor's text must fit into memory. TP is unusually small, requiring around 50k of RAM for non-text purposes. With a 128k Sirius about 48k is left for text: the editor warns you just before you reach the end of memory. The compiler has several techniques, such as including subordinate files or structuring a program as a set of overlays, which should allow you to reorganise a program to avoid this limit. There is a limit of 64k on the size of your text file irrespective of how much memory your computer may have, and a limit of 64k on the object program which can only be escaped through overlays.

Compiling

When you have prepared a program, you exit from the editor back to the main menu, and you might wish to save the program before running it. Saving a program takes one keystroke and a normal length of time to write the file to

disk. TP does rename the last version to a .BAK extension as a backup file in case you regret a change.

TP can compile a program either to memory or to disk. When TP is started, it takes the available memory and organises it for its own purposes. The editor requires each source file to fit within memory, and so does the compiler — in fact, it seems reasonable to assume that the compiler and editor share the text. If you have enough space left over, the compiler will place the object code in memory as well. This mode of compilation is very quick — on a Sirius the compiler regularly compiles at 2500 lines per minute (around 1000 characters per second).

Of course, you can't hold an arbitrarily large program in memory. On the Sirius, a program of 600 to 700 lines is the largest that fits; to go beyond this, you must compile programs to disk. The Calc example program supplied by Borland runs to more than 1200 lines and compiles at a slower 600 lines per minute. This figure is disk-limited, since a trial with a fast 'fixed' disk ran nearly as fast as compiling to memory.

The option of compiling to disk is manually selected. One neat trick is that if you have successfully compiled a program to memory and then decide to compile it to disk, TP detects that it has the compilation in memory and writes it directly to disk without recompilation.

The slower compilation to disk can be frustrating with longer programs. TP only compiles up to the first error. Each time it compiles, it starts from the beginning. When an error is found, an error message is displayed. You are asked to press a key, and the mode swaps into the editor with the cursor at the position of the error (the message disappears, so make sure you read it). The messages are usually appropriate, although there are times when the real problem is not obvious to the compiler and it stops in confusion, so you may need to hunt backwards to find the true problem. This is not Borland's fault: it occurs with all Pascal compilers.

TP produces only .COM files (.CMD for CP/M-86) which are complete programs. These generally load faster than .EXE programs and are advantageous as long as the compiler can produce them. There is no way of using TP to produce object modules for later linkage into complete programs, and only the most rudimentary of mechanisms for making use of outside objects from TP programs. There is a mechanism for planting machine code in-line within TP programs, but unless you are very fond of hexadecimal numbers this is not a useful method.

Documentation

TP comes with a manual and some examples. The manual is paperback, 300 pages thick, mostly written for version one but with about 40 pages of appendix to describe version two. Each section has a table of contents and an index. The manual is written in more or less the order you need to get started. It includes a description of the editor, the installation program, the Pascal language, and the appendices describe extensions to the language or the system. I have mainly used the book for reference, for which the index proved rather weak, although the required information was usually there somewhere.

The examples consist of one medium-sized program for a toy spreadsheet and a few smaller examples of how to call into the MS-DOS operating system. The spreadsheet is the most important since it's the most interesting to try, and uses the widest variety of TP features. However, the program as supplied supports only 20 rows and six columns, so you can't even squeeze your home finances onto it. If you are already familiar with Pascal, you might consider it to be a useful starting point for creating a better spreadsheet. The one thing it does immediately demonstrate is the nice screen control you can achieve with TP built-in functions. All the examples worked first time, although the Calc program does contain a number of bugs.

Performance

The real test of a compiler is the quality of programs that can be developed with it. I compared it with the Microsoft Pascal version 3.11 (last year's version) which is fairly widely used and several times more expensive. Turbo Pascal begins with a head start — its run-time library. The library helps with filing, floating-point arithmetic, screen handling, starting and stopping the program, and so on.

TP's library is written in assembler and occupies around 9.5k of space. This 9.5k is apparently an identical copy of the first 9.5k of the TP program itself, which becomes the first part of any

```
s ('move');
FOR k := 1 TO 10000 DO p := q;

s ('sets');
somenumbers := [2,3,5,7,11,13];
FOR k := 1 TO 10000 DO
    BEGIN
    j := k MOD 16;
    IF j IN somenumbers THEN somenumbers := somenumbers - [j]
                        ELSE somenumbers := somenumbers + [j];

    END;

s ('opts');
a := 2; b := 3; c := 5; d := 7;
FOR k := 1 TO 10000 DO
    BEGIN
    j := k MOD 10;
    l := k DIV 10;
    matrix [j] := (a * b - c) - (a * b + d);
    l := matrix [j];
    END;

s('....');

END.
```

Fig 1 Three new Benchmark tests



SCREENTEST

.COM generated by TP. For MS Pascal, the library is approximately 26k of code which is taken from a separate disk file. With that extra 16k Microsoft provides more filing facilities, powerful floating point arithmetic compatible with the 8087, and automatic assignment of program parameters.

The *PCW* Benchmarks were merged into one program for convenience. Three new tests (Fig 1) have been added to the existing ones published in December 1983. Two of these tests check important features of Pascal not found in the Benchmarks. Structured variables are records which may contain a mixture of characters, integers, reals, or other variables. The 'move' test checks the assignment of one such structure to another. Sets are bit maps which can be used to model classic set operations such as union intersection and disjunction. The 'sets' test gives a work-out to three of the more important set operations. The third new test, 'opts', is to find out whether the compiler is clever enough to do any optimisations. This test contains a variety of common opportunities for a clever compiler to reduce the amount of work needed in a program, mainly by recognising expressions and variables which can be used twice or held in registers.

The Benchmarks were run with equivalent run-time checking. The compiler switches were the default (no switches chosen) for Turbo Pascal, which corresponds to the selection of a stack overflow check for MS Pascal. With the exception of the sets test, TP trailed in all sections. In all tests which do not use the run-time library, TP was about 30 to 40 per cent slower. In floating point, the ratio was similar, even though MS Pascal calculates to a higher precision and takes on overheads to ensure compatibility with the 8087 standard. Both compilers provide binary arithmetic, not decimal.

Only in the sets test was TP (very much) the faster. The code size for the test itself (subtracting the run-time library) was 2512 bytes for Turbo Pascal and 1716 for Microsoft Pascal. An inspection of the object code under debug revealed that TP does not perform any optimisation.

Overall, the .COM file produced by TP was 11,838 bytes long and ran the suite of tests in a total of 304.5 seconds, excluding load time. The .EXE file produced by MS Pascal was 35,414 bytes long and ran in a total of 263.7 seconds, excluding load time. Unless you are planning to write programs of 5000 lines or more, the finished Turbo program is likely to be smaller. If your program has a lot of calculations, in Turbo Pascal it may be slower and less accurate. For small programs TP is a clear winner, with its convenient development environment, compact overall programs and useful speed.

Both Benchmarks were run with stack check enabled. TP also provides range checking, plus a selection of switches for the control of I/O error handling and operator interrupts from the keyboard; these worked effectively. When errors are detected, the program prints an error type number and the program counter at which the failure occurred. If you are running from memory under TP control, TP immediately starts searching your source for the equivalent position. If you were running a .COM file, you could invoke TP, select the source as a work file, and ask TP to find the program counter. You must look up the error type number in the manual for an explanation.

Standardisation

There must be something missing, you're thinking, so maybe it isn't real Pascal? Yes, in the sense that it is not quite standard (neither BSO 6192 nor Jenson and Wirth versions), but no, in the sense that this is an implementation of a powerful member of the Pascal family with many extensions. Let's look at the standard features which are missing:

Get and Put Borland has not provided accessible file buffers, so Get, Put, and file pointer types are not available. The explanation given is that you can do the same things more conveniently with Read and Write, which is true: it does wonders for keeping the run-time library small (these can be expensive to implement). This has affected about half the programs which I tried to port to Turbo from other Pascals

No functional or procedural parameters This is one of the more tricky and rarely used parts of Pascal, and many compilers do not implement it. You can stimulate these with a CASE switch to select which procedure or function to call.

String width on writing in standard Pascal, you can use the record type

```
lstring = RECORD
  len : 0 . . stringTop;
  s   : PACKED ARRAY [1 . . string
        Top] OF char;
  END;
```

to do string processing. It is not quite as powerful as the string facilities built into Turbo or other Pascals, but it does have the advantage of portability.

A key part of this technique is the use of the Write statement

```
Write ( aString.s : aString.len);
```

to write a string neatly trimmed to its proper length. Unfortunately this does not work correctly with TP, which always prints the whole string.

No program parameters You should be able to declare file parameters in the program statement. TP allows you to put whatever you like in the program parameters, but ignores it. You are expected to control your own file assignments, though there are built-in connections to the console and printer which do not require any effort.

Errors not caught in the WITH and FOR statements WITH was designed as a form of optimisation hint but TP uses it only as a convenient shorthand. Therefore, TP does not complain if you

Benchmarks

	Turbo Pascal 2.0	MS-Pascal 3.11
Magnifier	.2	.2
FOR loop	2.5	1.9
WHILE loop	3.3	2.5
REPEAT loop	2.9	2.1
Literal	3.2	2.7
Memory	3.4	2.9
Real arithmetic	87 (11-digit)	64 (15-digit)
Real algebra	77 (precision)	59 (precision)
Vector access	5.9	3.9
IF, balanced	4.8	3.9
Procedure calls	4.0	3.1
IF, unbalanced	4.7	3.8
Call by value	4.5	3.6
Call by reference	4.8 (32-bit pointer)	3.6 (16-bit pointer)
Transcendentals	80	58
Structure move	1.1	.6
Set operations	12.8	46
Optimisables	2.5	1.8

All results are in seconds

change the location of the WITH structure within the WITH statement, as is gratuitously done in the Calc examples from Borland. The Calc program also shows FOR loops with non-local control variables. In Pascal and some other languages the value of the control variable is undefined at the finish of the loop, so the control variable must be local to limit the potential for mistakes. **Keyword** ELSE is used where the standard will use OTHERWISE for the branch on the CASE statement which catches all non-specific cases.

Borland's attitude to standards seems to be 'use the standard except where we don't like it.' I disagree. The usefulness of a Pascal standard lies in the transfer of programs between machines, and as a common ground for teaching or sharing programs. Unfortunately Borland has clipped a few important corners off of the standard, just enough to prevent practical use of standard programs. You will need to change programs you find in textbooks, and may have trouble with programs you give to other people.

Beyond the standard

Borland has provided a large and useful set of extensions; the outstanding extensions are in the declaration area. Constant, Type and Variable sections can be in mixed order, and constants can be assigned to be of any type. This has been elegantly done. You should have no trouble creating tables or lists of constants, which is a major problem with standard Pascal.

This is a form of string handling similar to UCSD Pascal. There are operators for searching, comparing, extracting and concatenating strings. String input and output facilities are provided.

The filing facilities include random access to files. The Reset operation opens a file for Write as well as Read (without deleting the file, as ReWrite would) so that files can be edited. There is an important limit to random access, the seek pointer. You may Assign new files and Close old files, so your programs can work with many files and change among them.

Various 'type escapes' are provided. One of the features of Pascal is that every variable has a type classification, and like apples and oranges they are kept distinct. The purpose of this is to help prevent logical errors (the compiler will helpfully prevent you from adding apples into the oranges) and does annoy some people by forcing them to plan ahead. However, it cannot be denied that sometimes, as you plan to make fruit salad, the rules must be relaxed. TP will allow you to specify that apples be considered as oranges, or to pass both as parameters to a procedure expecting fruit.

The screen control facilities include cursor positioning, insert line, delete line, clear screen, and normal/bright intensity control. The screen controls for your programs are the same as those used by TP's editor, and are changed using the TInst program. These are fast and effective.

Extensions for machine control provide access to I/O ports, and a memory array allows you to access any byte in memory. TP uses 32-bit pointers so you can use all the memory in your machine. There is a mechanism provided for using software interrupts; these allow you to get direct access to the operating system, BIOS, and OS extentions such as graphics. You can embed machine code within your programs, but this is minimally supported and practical only for very short sequences.

For structuring large programs you can include standard procedures or declarations which you need to use in many programs. An overlay mechanism is provided to allow you to create a program with several phases, where the code for only one phase is in RAM at any time and each is pulled from disk as required. All overlaid code can share a common base of data and subroutines.

Calling outside assembler programs looked even more primitive than the call facility in Basic. In practice I found that I didn't need assembler, especially since direct software interrupts can be done within TP.

Problems

TP is a robust program, but it does have errors and annoyances: for example, the cancellation of type-ahead on the console input file. TP offers either line-edited input (allowing you to erase and re-type before the carriage return) with echo, or direct input without echo. For most casual input the line-edited input would be the obvious choice — but for some strange reason, TP wipes out all type-ahead for this mode. If you work with a computer with a type-ahead buffer this becomes aggravating, as it is second nature to type ahead when using familiar programs.

TP provides only 16-bit signed integers and so the seek pointer in theory stops at 32k records. Some types of file have many records so the 32k limit may be awkward. The solution is to use software interrupts direct to the OS if you need advanced filing.

It should be a simple matter for Borland to close open files at the end of a program, which most Pascals do.

If you use _ (underscore) to separate words within identifiers, the word search feature in the editor (which should only match complete words to the pattern you provide) sometimes treats it as a space. Therefore, a word search for 'two' will match at 'two_ words', although a word search for 'two_words' will not match 'two words'.

The ideal

Apart from fixing the bugs, what more could you expect from Turbo Pascal? Here are a few things to yearn for.

A fast syntax check for programs too big to compile to memory.

Unattended operation. At the moment, TP is entirely interactive. Suppose you have a standard procedure to ask the date, and you change it to accept US format as well as European. If you have 10 programs which include that procedure, you can't create a batch file to recompile them all. You have to do them one by one, interactively.

A debugging switch to catch references to heap records which have been deleted.

DOS-2 filing. TP at the moment uses only DOS 1.25 features. If you wish to use files in a DOS 2.0 or 2.11 system, you must either code your own interfaces to DOS and ignore TP's filing, or ensure that all the files you need are in the current directory.

Learning

TP must be one of the best compilers available for people learning their first compiled language. Results are immediate and TP can protect itself against mistakes. However, there are some cautions. All Pascals are non-standard to some extent, but TP is one of the few I have seen which leaves out parts of the standard important for practical programs. Hence, you will come to depend on features which might not be available on other compilers or machines.

The second problem with using TP is that the manual is not sufficient for beginners. It is a good idea to work with a book designed for teaching rather than reference, and keep in mind that examples in standard Pascal may need changes for TP.

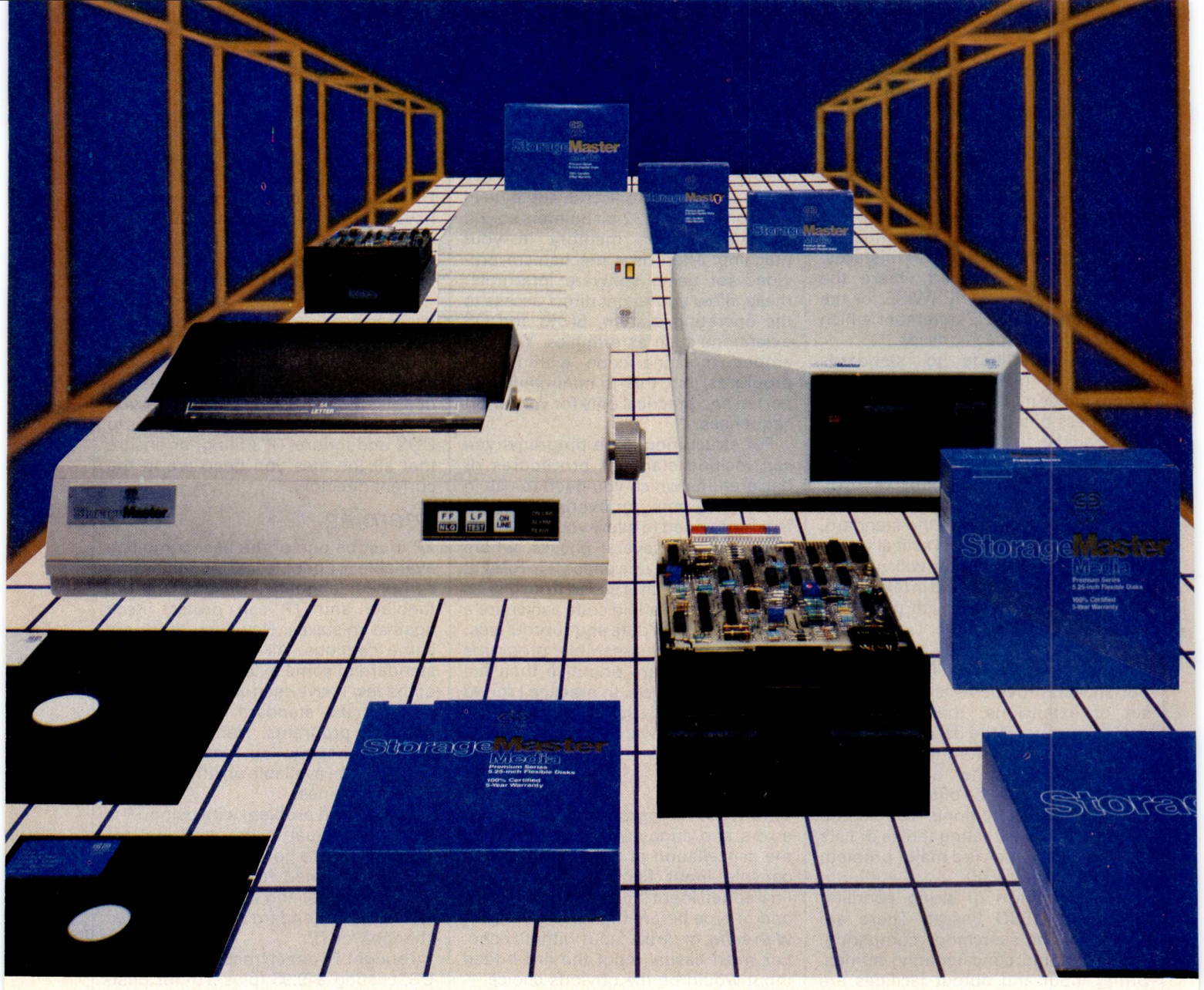
I bought TP direct from Borland in the US, costing $49.95 (plus $15 for postage, plus bank charges, plus UK import duties — total about £54). It was delivered in approximately 25 days. You can buy it from dealers in Britain, from Altor Computer, Conguin Software, and from Grey Matter, all at prices of about £50. There is also a more expensive version which makes use of the 8087 chip for arithmetic, which is better and faster than the (incompatible) software arithmetic in ordinary TP.

Conclusion

TP is a complete and practical compiler for small to medium projects. It scores poorly on points such as code optimisation and standardisation, but scores so strongly on convenience and the compact run-time library that you might revise your thinking on what features a compiler should have. The built-in editor is good but slow; the error detection and handling is effective; the extensions are useful. Errors are present in proportion to the price; the value-for-money is outstanding.

It may permanently cure you of Basic, although I do leave you with one final point to ponder — Borland apparently writes its products in assembler!

END



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David Elworthy looks at different types of lists, and presents routines and examples to illustrate this programming form on a BBC Micro.

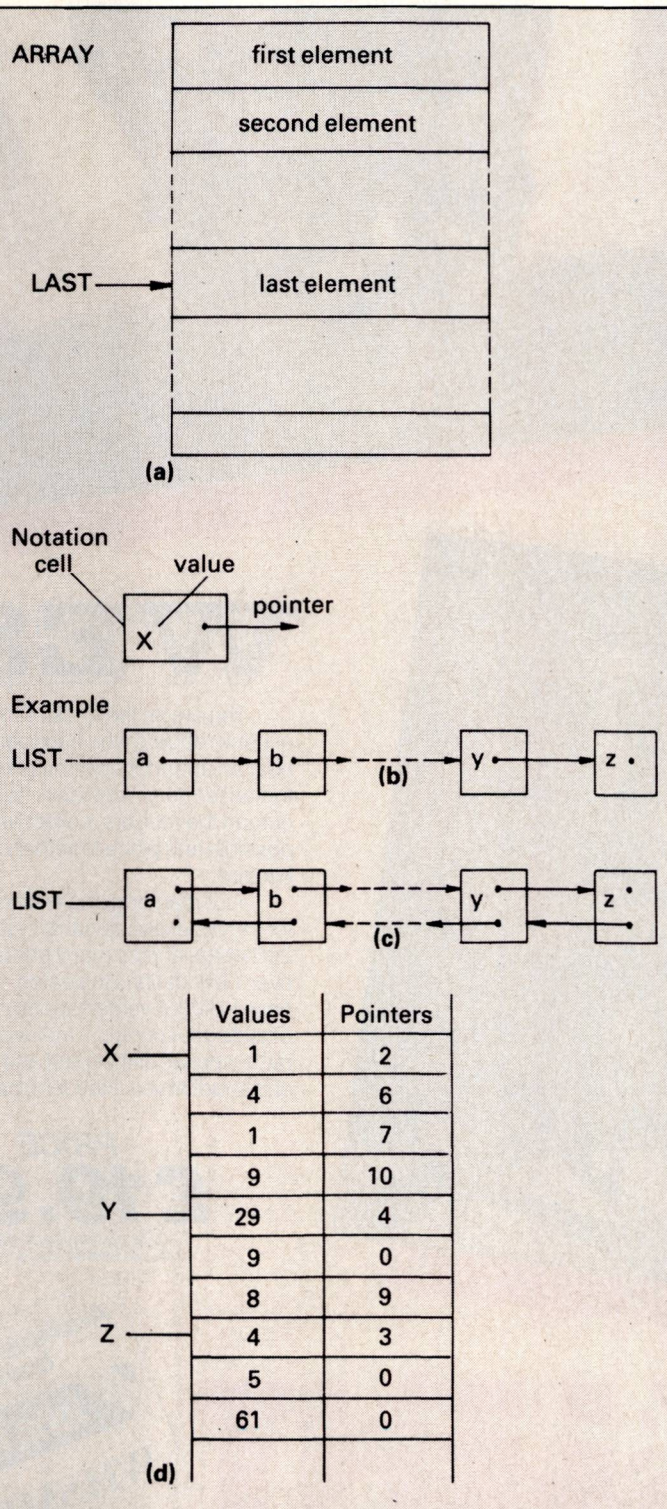

Fig 1 List representations: a) array; b) singly-linked; c) doubly-linked; d) cursor-based

In Basic we are provided with essentially just two ways of storing data: as numbers, and as strings. They can be built up into arrays, but the lack of a facility to create other kinds of data-type can lead to a certain degree of myopia for those programmers who were 'brought up' on Basic. Pascal, for example, provides a means of creating new ways of organising the data, and these may be neglected by Basic users simply because they don't realise how useful they are. In the other direction of sophistication, Basic users learning how to program at machine level may find themselves floundering because they don't know how to organise their data.

Let's look at a data type called the list. Lists may be familiar if you've come across the programming language Lisp, but they're far more general than that. In fact, your Basic interpreter almost certainly holds the program in this form, and I'll suggest some other places where they're useful later on. Although this is just one specific data type, some of the principles used in implementing it apply equally to other data types.

What is a list?

A *list* is of a sequence of zero or more elements. Normally, the way we identify a list is by where it starts, and this is all we need to know about it until we start working through it. Each element of the list can have a value associated with it, the restrictions on this value depending only on the implementation chosen. As an analogy to this, think of arrays: we can have arrays where each value is an integer, or a string, or a floating point number, but they are all just different types of array. Similarly, lists are independent of the type of the values contained in them.

There are three main ways of representing lists within the computer. The easiest is as an *array*, in which the first element of the array is the first element of the list, and so on. The principal disadvantage of this method is that we must know the maximum size of the list when the program is written. If the array is too small, then the list won't fit in, and if it's too large, the unused parts of the array are wasted.

Another problem with using arrays is

```
300
310 *** LIST PACKAGE ***
320
330 DEFFNassign(last%,value%)
340  LOCAL M%
350  DIM M% 2
360  M%=FNadd(M%,last%)
370  M%?2=value%
380 =M%
390
400 DEFFNtail(list%)
410  IF list%THEN =!list% AND &FFFF ELSE =0
420
430 DEFFNadd(new%,list%)
440  new%?0=list% AND &FF
450  new%?1=(list% AND &FF00)/&100
460 =new%
470
480 DEFFNnew(in$)
490  LOCAL ptr%,I%
500  ptr%=0
510  FOR I%=LEN(in$) TO 1 STEP -1
520     ptr%=FNassign(ptr%,ASC(MID$(in$,I%,1)))
530    NEXT
540 =ptr%
550
560 DEFFNprint(start%)
570  LOCAL M$
580  IF start% THEN =CHR$(start%?2)+FNprint(FNtail(start%)) ELSE =""
590
600 DEFFNtransfer(from%,to%)
610  LOCAL M%
620  M%=FNtail(from%)
630  to%=FNadd(from%,to%)
640 =M%
650
660 DEFFNfind(value%,list%,last%)
670  IF list%=0 THEN =0
680  IF value%=list%?2 THEN =last% ELSE =FNfind(value%,FNtail(list%),list%)
690
700 DEFFNcut(cell%,free%)
710  LOCAL M%
720  M%=FNtail(cell%)
730  IF M%=0 THEN =free%
740  cell%=FNadd(cell%,FNtransfer(M%,free%))
750 =M%
760
770 DEFFNremove(value%,list%,free%)
780  LOCAL M%
790  M%=FNfind(value%,list%,-1)
800  IF M%=-1 THEN =-1 ELSEIF M% THEN=FNcut(FNfind(value%,list%,0),free%) ELSE
=free%
```

Fig 2 Low-level routines

that of removing an element from the middle of a list. To do this, it would be necessary to move up all the following elements in the array, which for large lists may take a long time. Obviously, by using arrays, the act of finding that element in the middle is fast since we can get at it just by knowing its position in the list and taking this as the index to the array. This rarely outweighs the disadvantages, however.

A second method is the *linked list*, or *singly-linked list*. Here each element is represented by a 'cell', which consists of the value of the element and a pointer. The function of the pointer is to tell us where the next cell in the list is to be found; typically, it is a memory address. In addition, there will be a special pointer value which indicates that the end of the list has been reached. This is often zero, and is commonly referred to as 'nil'.

Finally, for each list, there is an extra pointer which contains the address of the first cell. Sometimes this is kept in a cell itself, called the header cell. The header cell of a list will be at some location known to the program; it is not a true part of the list, and since we are only interested in its pointer, there is not usually a meaningful value to the cell.

Generally, this is a good way of representing lists, provided there is a means of allocating new cells of memory when we want them so that the list can be easily extended. Linked lists of this type have the disadvantage that they only work in one direction—from a given cell it's impossible to find the previous one without working through the list from the start once more. Sometimes *doubly-linked lists* are used, in which there is a second pointer that points back to the previous cell. Obviously, doubly-linked lists require more memory, and for this reason are not always justified.

The final method is a hybrid of the first two, known as a *cursor-based implementation*. Again, the list is held in an array, but this time the elements of the list need not be in the same order as those of the array. To do this, we have a second array in parallel, which contains pointers operating in much the same way as for linked lists. The index of the first element of each list is kept in some variable outside the array, known as the cursor. Clearly, this has some of the problems of the simple array approach, but, since we can have several cursors, a number of lists may be kept in the

```
  810
  820 *** DRAW PACKAGE ***
  830
  840 DEFPROCdrawcell(value$)
  850  VDU5
  860  MOVE0,0:DRAW95,0:DRAW95,47:DRAW0,47:DRAW0,0
  870  MOVE63,39:PRINTvalue$;
  880  MOVE28,20:DRAW36,20:DRAW36,28:DRAW28,28:DRAW28,20
  890  VDU4
  900 ENDPROC
  910
  920 DEFPROClink(x1,y1,x2,y2)
  930  MOVEx1+32,y1+24:DRAWx2,y2+20
  940 ENDPROC
  950
  960 DEFPROCdrawrest(node%,x0,y0)
  970  LOCALnext%,index
  980  y=y0-96
  990  IFy<96THENy=864:x=x0+550 ELSEx=x0
 1000  lastx=x:lasty=y
 1010  VDU29,x;y;
 1020  index=node%?2-64:loc(index,1)=x:loc(index,2)=y
 1030  PROCdrawcell(CHR$(node%?2))
 1040  VDU29,0;0;
 1050  next%=FNtail(node%)
 1060  IFnext%<>0THENPROCdrawrest(next%,x,y)
 1070 ENDPROC
 1080
 1090 DEFPROCdrawlinks(node%,x0,y0)
 1100  PROCdrawlinks0(node%,x0,y0,"")
 1110 ENDPROC
 1120
 1130 DEFPROCdrawlinks0(node%,x0,y0,p$)
 1140  LOCALnext%,xto,yto,temp$
 1150  value%=node%?2-64
 1160  temp$=CHR$(value%+64):IFINSTR(p$,temp$)THENPRINT"Warning: list '";p$;"' c
ircular to ";temp$:ENDPROC
 1170  xto=loc(value%,1):yto=loc(value%,2)
 1180  PROClink(x0,y0,xto,yto)
 1190  next%=FNtail(node%)
 1200  IFnext%<>0 THENPROCdrawlinks0(next%,xto,yto,p$+temp$)
 1210 ENDPROC
 1220
 1230 DEFPROCdrawall
 1240  PROCdrawlinks(a%,0,940)
 1250  PROCdrawlinks(b%,400,940)
 1260  PROCdrawlinks(c%,800,940)
 1270 ENDPROC
```

Fig 3 Graphics package

same array which often makes a better use of space. Cursor-based implementations are commonly used in languages — including many dialects of Basic — where pointers into memory are either not available, or too awkward to use.

Each of these methods is illustrated in Fig 1. Fig 1a shows a general example of an 'array' list; 'Last' is a variable containing the index of the last used element. Fig 1b is a singly-linked list, and Fig 1c a doubly-linked list. Fig 1d is an example of three cursor-based lists, in arrays 'Values' and 'Pointers'. The variables X, Y and Z indicate the start of the lists, and a pointer value of 0 shows where they end. (The lists are X:1,4,9; Y:29,9,61; Z:4,1,8,5.)

BBC Basic

If we were using Pascal, singly-linked lists would be the most obvious choice. The language includes pointers, and there are functions New and Dispose which allocate new cells of memory when we need them, and release them for other purposes when they are finished with. In Basic such facilities are not usually available, so we would have to fall back on the array or cursor implementations. They are both quite straightforward to program, but are rather inefficient in their use of memory. Of course, we could use PEEK and POKE (or their local equivalents) to handle pointers and memory cells, but there is always the danger of operations on the lists going wrong and something important being overwritten.

BBC Basic conveniently provides simple ways of both allocating cells and creating pointers. There is no Dispose function, but by using a trick described later, deallocated cells can be re-used. The command we use to allocate new cells is the second form of DIM:

DIM <num-var> <numeric>

This means: allocate an area of <numeric>+1 contiguous bytes, and set the value of <num-var> to be the address of the start of this area. The area is safe from being overwritten by the system, nor will it overwrite anything vital.

Now we can go ahead with writing the routines to handle lists. Some functions which might be useful are:

Assign a new cell with a given value
Add an (existing) cell to a list
Locate the next element of a list (its *tail*)
Create a new list of given values
Print out the values in a list
Transfer a cell from one list to another
Find a cell with a given value
Cut an element from the middle of a list

```
>LIST
   10 REM ** A GRAPHIC DEMONSTRATION OF **
   20 REM ** SINGLY LINKED LISTS         **
   30 REM ** David Elworthy - Sept.1984 **
   40 REM
   50 DIMloc(26,2),arg$(3)
   60 MODE4:VDU24,0;96;1279;1023;:VDU28,0,31,39,29
   70 VDU24,0;96;1279;1023;:VDU28,0,31,39,29
   80 VDU19,1,3,0,0,0
   90 ON ERROR GOTO 280
  100 a%=FNnew("ABCDEFGHIJKLMNOPQRSTUVWXYZ"):b%=FNnew("@"):c%=b%
  110 null%=b%
  120 VDU5:MOVE10,1000:PRINT"a%";:MOVE 400,1000:PRINT"b%";:MOVE800,1000:PRINT"c%
";:VDU4
  130 lastx=20:lasty=960
  140 GCOL0,1:PROCdrawrest(a%,lastx,lasty)
  150 PROCdrawrest(b%,lastx,lasty)
  160 GCOL0,1:PROCdrawall
  170 INPUT LINE "Command";I$
  180 IFI$="stop" THENMODE7:END
  190 IFLEFT$(I$,5)="print" THENPRINT"Value is:";EVAL("FN"+I$):GOTO170
  200 GCOL0,0:PROCdrawall
  210 var%=ASC I$:IF var%>99 OR var%<97 THENPRINT"Unknown assignment variable":G
OTO240
  220 ret%=EVAL("FN"+MID$(I$,4)):IFret%<1 THENPRINT"Strange value returned: ";re
t%:GOTO240
  230 ONvar%-96 GOSUB250,260,270
  240 GCOL0,1:PROCdrawall:GOTO170
  250 a%=ret%:RETURN
  260 b%=ret%:RETURN
  270 c%=ret%:RETURN
  280 REPORT:PRINT" at ";ERL'"Press s to stop, other key to resume"
  290 IFGET$<>"s" THEN170 ELSE MODE7:END
```

Fig 4 High-level routines

Find an element of given value, and remove it from the list

A listing of Basic functions to do each of these is given Fig 2. In these routines, the value of the element is a single character. This is an arbitrary choice, and the routines could be modified without too much difficulty for other types of value. One interesting possibility is to have values which can represent either, say, two printable characters, or a pointer to another list. It would then be possible to have lists nested within one another.

The only other general point is that the end of a list is represented by a pointer of value zero.

Now let's take a look at each routine in turn.

FNassign first reserves three bytes for the cell. The first two of these will contain the pointer (as a 16-bit address) to the cell which follows the one we are creating. Since Basic holds integers as four bytes, we must cut them down to two by means of logical ANDing and division to produce the 16-bit pointer. The value is placed in the new cell in value%, and the pointer is set to last%; this means that the function has two uses. If last% is zero, then it creates a new list of one cell (since a pointer of zero means the last cell of the list); otherwise, the new cell is linked to the cell at address last%. FNassign may thus be used to carry out both creation and extension of lists. The value returned is the address in memory of the new list.

FNadd is similar to FNassign, but is used when a cell which already exists is to be added at the start of a list. It can also be used to concatenate two lists, by setting new% to the address of the last cell in one list, and list% to the address of the first cell in the other. The address of the added cell is returned.

FNtail finds the address of the next element in the list by returning the pointer contained in the cell at address list%. The IF line is to avoid errors in some later functions: it stops us going beyond the end of a list.

FNnew assigns one cell for each character in in$ and links them together, returning a pointer to the first cell of the list. Note that since FNassign puts the new *before* the one specified by its argument last%, the FOR loop must work backwards through the string. The initial setting of ptr% to zero means that the cell containing the last character of in$ is the end of the list.

FNprint exactly reverses FNew, returning the string built of the characters in the list at list%. BBC Basic's ability to handle recursion is useful here.

FNtransfer removes the top cell from the list starting at from% and places it at the beginning of the list starting at to%. The value returned is the address of the rest of the from% list. This does not tell us directly where the to% list now starts, but a moment's thought will show that it must be the same as the value from% had on entry. Since we can only pass one argument out of a function, the rest of the program must handle the assignment of this value to the to% argument.

FNfind looks for a cell containing the given (ASCII) value% in the list starting at list%. If there is no cell containing this value, it returns zero; otherwise, it returns the address of the cell *before* the one containing this value. This may seem like an odd thing to do, but it will be useful in FNremove.

(One special case should be noted: if the cell containing the value is the first of the list, then clearly there is no cell before it, and so no sensible value can be returned. In this case, the value of the argument last% will be returned instead. Again, recursion is used.)

FNcut is a combination of FNadd and FNtransfer. It moves the cell after the one at cell% from the list it is currently in, to the start of another list at free%. The value returned is the new start of the free list. Since cell% is the address of the cell before the one being moved, the routine cannot be used to cut off the first cell of a list. Also, if cell% is the address of the last cell in a list, nothing will be cut from the list.

FNremove combines FNfind and FNcut. It looks for a cell with value% in the list at list% and, if found, adds it to the start of the list at free%. The value returned is the new start of the free% list; the new start of the list at list% must be found by subsequently using FNtail outside this function. Note that FNremove will not remove the first cell from a list. If asked to do so, it will return the value −1.

In several of these routines, there are arguments called free%. This idea of a 'free list' arises from the solution to the lack of a Dispose function. Whenever

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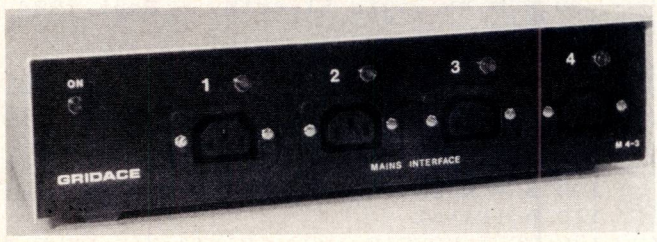

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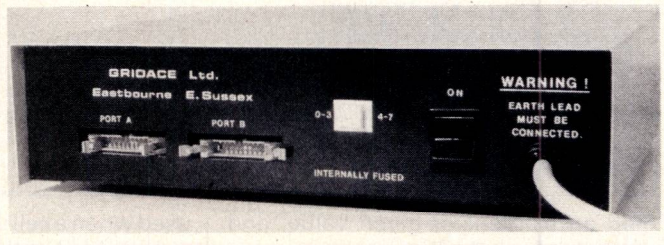

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we have finished with a cell, we use FNtransfer to put it at the head of a list which we call the free list. Then, when we next want a new cell, we first look to see if this list has anything in it. If it has, we can then FNtransfer it off the free list, instead of using FNassign. This saves memory going to waste.

Test program

These routines are very useful, but unless you have good powers of visualisation, you probably don't have an intuitive grasp of what they do. The program described in this section is an attempt to get round this. It allows you to try out various functions on three lists, with a graphic display of how the various cells are linked after each operation. There are three parts to the program: the low-level list routines already described (Fig 2); a set of routines to draw lists on the screen (Fig 3); and a high-level command interpreter, plus initialisation (Fig 4).

The three lists are identified on the screen and in commands as 'a%', 'b%' and 'c%', and 27 cells have been assigned. 26 of these have the values A to Z; the last one is a special cell with the value @ and is used as an 'empty' list, referred to as null. Initially, both b% and c% are empty lists (that is, they point to null), and a% is a list of the letters ABC . . . Z.

The high-level system allows you to enter commands and functions which (with the exception of STOP) directly call low-level routines. The difference between a command and a function is in the way they are called. For a command, you enter the name of the command and any arguments it may have; for a function, you enter a line of the form:

<variable>=<name>(arguments>)

Here, <variable> is a%,b% or c%, <name> is the name of the function in the low-level package with the 'FN' removed, and the <arguments> obey the same rules as if this were a line in a Basic program. This means, for example, that you can use Basic functions in the arguments.

Here are the commands and functions available. 'l' denotes a list variable (a%, b% or c%), 'c' the ASCII value of any single character, and 's' a string.

Commands

STOP — leave program
PRINT (l) — print the value of the list

Functions

Tail (1) — return the tail of the list
Add (1,1) — add one list to another
New(s) — create a new list
Transfer (1,1) — transfer a cell from one list to another
Cut (1,1) — cut out a cell from one list, putting it in another
Remove (c,1,1) — remove a cell from one list to another

Functions to use with care

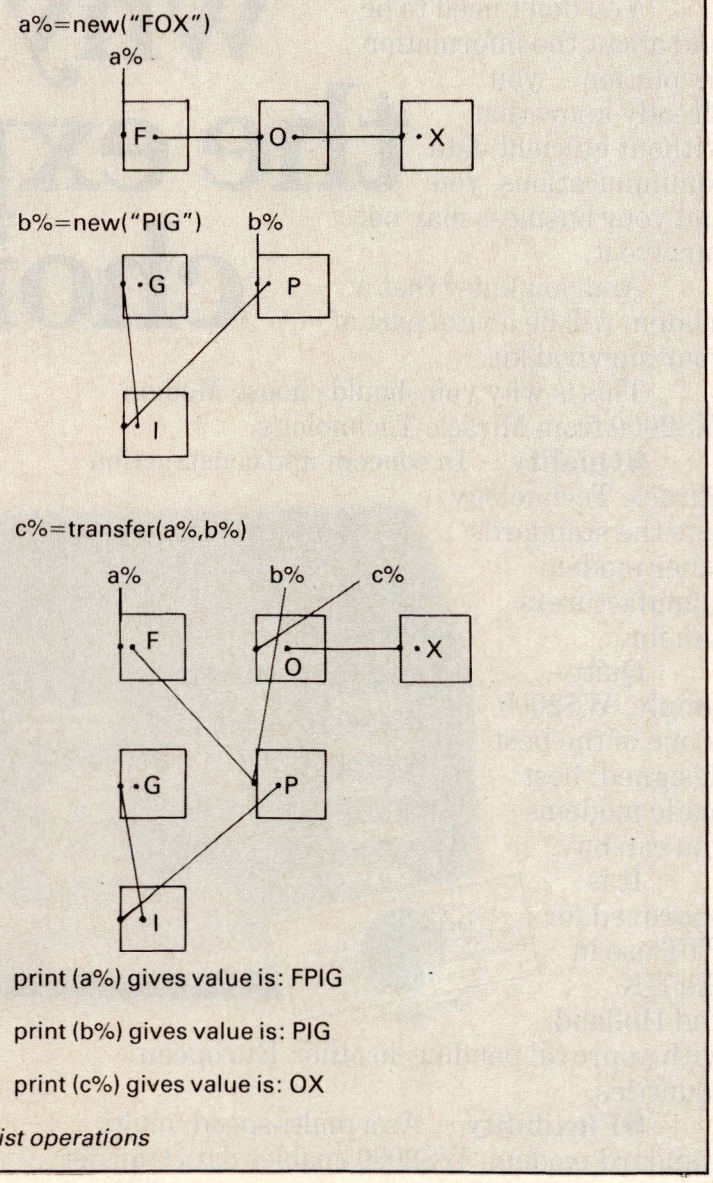

Fig 5 Some list operations

Assign (1,c) — create a new cell
Find (c,1,1) — locate a cell in a list

There is only very limited error checking. When a value which clearly does not refer to a sensible memory location is returned, or if the variable specified for the result of the function is not a%, b% or c%, an appropriate message will be issued, but otherwise the only error checks are those provided by Basic. Also, after a while the screen appearance will become rather ragged, as links are erased and redrawn.

It's possible to have convergent lists, which start at different places but run together later on and share some cells. In addition, some sequences of functions may produce a pathological case called circular lists. In this case, a cell somewhere in the list points back to one earlier on. The drawing routines check for this and will issue appropriate warnings, but the low-level routines can get into trouble with them (see Example 3). This is different from the use of lists in a language such as Lisp, where the system prevents such problems from arising.

Omit the spaces and comment lines when typing the program in. Incidentally, the lines at the start of various parts of the program have the REM statement omitted; since execution never goes there, this is perfectly valid.

Have a look at the examples to try, which demonstrate the effects of the various commands. Sketches for each step of the second one are given in Fig 5.

Real applications

Lists are used in a wide variety of applications. Two general areas are: where there is a need to easily insert or delete data; and where the order of data items may need to be changed quickly.

Typical of the first of these are Basic interpreters and text processors. In both cases, we are likely to need to be able to insert and delete lines at will. The lines themselves are usually accessed in a definite order, so lists — with their

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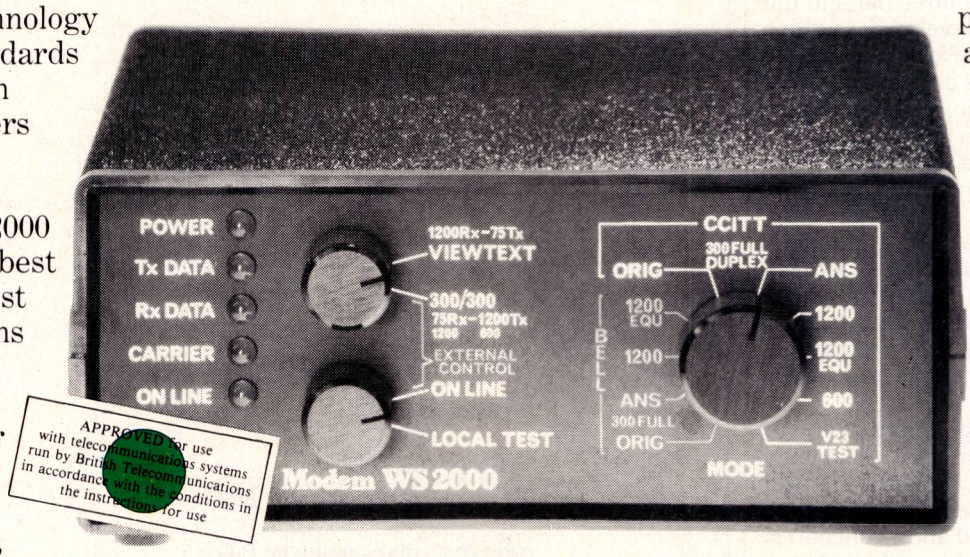

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sequential properties — are suitable. Deleting lines is easy: it's just the Cut function. Inserting is slightly trickier, but examination of Example 1 should suggest how to do it.

To insert a new element (in this case, having a complete line as its value) into a list at some position, all we need do is make the pointer from that position go to the new element, and the pointer from this element go back into the list at the element following the position we inserted at. This is illustrated in Fig 6a.

With this type of system, the lines may appear in memory in a different order to their numerical one since we can always follow the pointers to get at them in the right order. One problem with deletion is that already noted: the memory occupied by the deleted element may be wasted. Free lists are not always convenient, particularly if the values take differing amounts of memory. One common solution to this is a routine called a 'garbage collector', which works out if any areas of memory can be reclaimed and repacks the list into them, changing pointers when necessary.

The other example often arises in sorting. Much has been written on which algorithms for sorting items into order are fastest, but it's often overlooked that what limits the speed is the time taken to perform the 'swap' operation, especially if the items being sorted are complete records or long strings. With lists, swapping is simple. We don't actually move the data at all, but instead interchange the pointers; this is illustrated in Fig 6b. As an example of how much quicker it might be, suppose the data items were held in a list, and consisted of a two-byte pointer and a 100-character record. The swap operation is defined by a sequence of commands such as:

```
DEFPROCswap(a$b$):LOCALtemp$:
temp$=a$:a$=b$:b$=temp$:
ENDPROC
```

This clearly involves three data moves. For 100-byte records, we thus move a total of 300 bytes. To just interchange pointers of two bytes each, we only need to move six bytes. This does not mean that the sort routine will be 50 times faster, but speeding up this step might just make the difference.

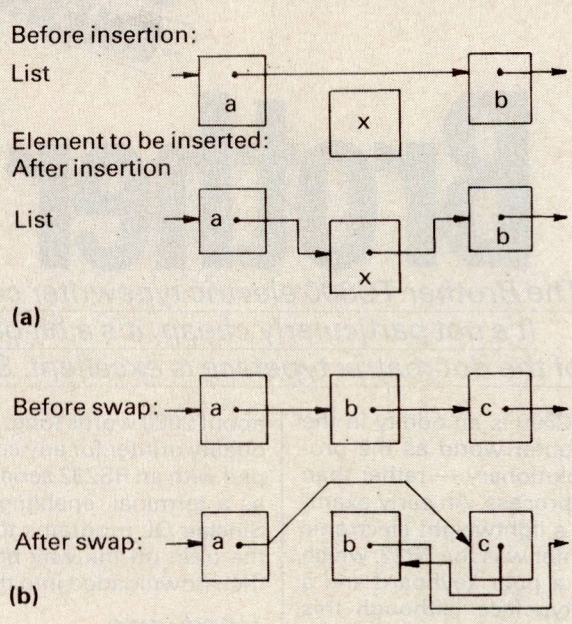


Fig 6 Two interesting examples of lists

There are numerous other places where lists are used: information retrieval, simulation, memory management . . . If you're interested in trying to write a program using them, here are a couple of suggestions (both based on sections in the Aho, Hopcroft and Ullman book):

1) Write routines for a stack. Unlike machine stacks, the elements can be in any relative positions in memory and can have any value you like. You'll need routines to create a new stack, to push and pop elements, and to tell if a stack is empty.

2) Write routines to implement a mapping: that is, a function M(d)=r such that, for a given value of d, there is no convenient way of calculating r, and it must be 'looked up' instead. The functions needed are: create an empty mapping; define the value of r for a given d; and return the value of r for an input of d, or some special code if no such value has been defined.

Examples

Example 1 Removing a cell from a list

```
a%=("ABCD")                  Create a new list
b%=remove(ASC"B",a%,0)       Remove the "B" from list a% into
                             list b%
a%=tail(a%)                  Cut off first cell of list a%
print(a%)                    Value is "CD"
```

Example 2 Shifting around parts of a list

```
a%=new("FOX")
b%=new("PIG")                Create lists
c%=transfer(a%,b%)           Transfer the first cell of list a% to list
                             b%, and set list c% to the rest of list
                             a%
print(a%)                    Value is "FPIG"
print(b%)                    Value is "PIG" (no change)
print(c%)                    Value is "OX"
```

Example 3 A pathological example

```
a%=new("ABCD")               Create list
b%=find(ASC"D",a%,0)         Set list b% to the cell before "D"
a%=add(b%,a%)                Add this onto list a%. Both lists are
                             now circular
print(a%)                    After a short delay the program runs
                             out of memory, as it goes through
                             deeper and deeper recursions of
                             FNprint.
```

Conclusion

Implementing a data type outside those provided in a language can be achieved without too much difficulty, provided (a) you know what functions you want, and (b) you start plainly and work up. Writing a program to give a picture of what's going on is often a big help.

Bibliography

Aho, Hopcroft and Ullman: *Data Structures and Algorithms*, Addison-Wesley 1983.

BBC Basic manual (for DIM command, and so on).

(Thanks to Mike Abbott Jr for his help during the programming.) END



Brother TC600

The Brother TC600 electric typewriter cum printer is in a class of its own. It's not particularly cheap, it's a bit on the slow side but the quality of the dot matrix typeface is excellent. Simon Craven takes a closer look.

The Brother TC600 is an oddity in the personal computer world as the product of an evolutionary — rather than revolutionary process. An early example of Brother's lightweight electronic typewriter/printer was the EP22, which suffered from a poor keyboard and a rather crude typeface (although this was fairly typical of cheap dot matrix printers at the time.)

The EP44 came out about a year later, and offered a relatively classy print style thanks to a high definition 24 × 18 matrix. On this latest model the dreaded button keyboard has been replaced by a conventional typewriter-style unit, and the machine's text editing facilities have been improved.

The TC600 has four distinct personalities, as a typewriter, a simple portable text editor suitable for producing reasonably complex documents up to about 2000 words long, as a near letter quality printer for any computer equipped with an RS232 serial interface, and as a terminal, enabling, for example, Sinclair QL programs to be written on the train on the way back from work, then downloaded into the QL and run.

Hardware

Despite its modest size and low weight, it's an imposing beast on first acquaintance, with 59 full-size keys and 19 buttons, switches and other controls to bewilder the first-time user.

The keyboard is excellent, with a light over-centre action and a reasonable layout. The profusion of keytop markings brings the Spectrum Plus irresistibly to mind, but is accounted for by a 'second shift' key. This enables the TC600 user to call up the entire character set directly from the keyboard — a much more convenient arrangement than the slow and error-prone IBM PC solution, which has the user laboriously keying in three digit character codes while keeping the ALT key depressed.

The remaining legends relate to the use of the CODE key, equivalent to the control key on a personal computer.

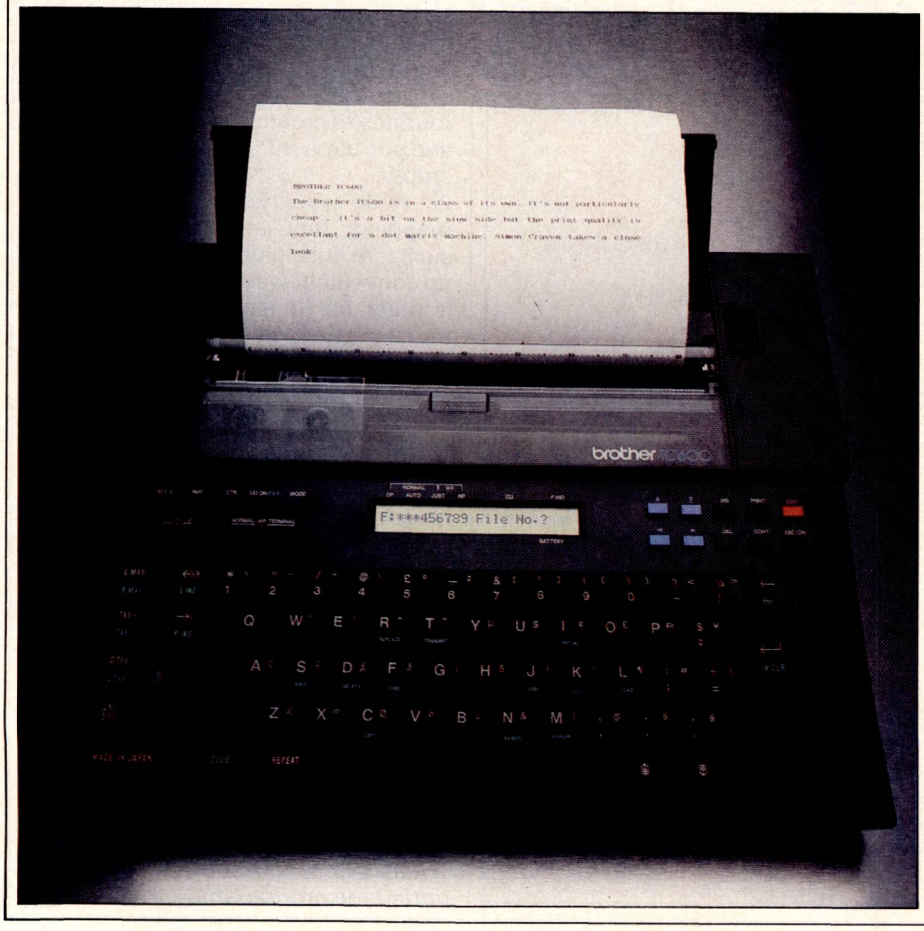
The display is a simple 24-character LCD screen of one line, which is rather too small for the kind of self-indulgent editing processes most regular word processing users require. As a means of catching spelling errors before they are committed to paper, however, it is excellent. The display is just above the top row of keys, where inexperienced typists can keep an eye on it as they proceed. *Real* typists, of course, are not supposed to look at the keyboard at all — they stare rigidly at the paper on VDU, and catch their infrequent mistypings instantly, but it's nice to see a writing machine which caters equally well for experts and fumblers alike.

Each of the three major modes of operation — normal, word processor and terminal — has a number of sub-modes which let the user configure the TC600 to personal taste. The simplest mode, labelled 'normal', turns the machine into an unusually sophisticated typewriter. Left and right margins can be set anywhere, as long as the typing width is over 25 characters, and one-key operation allows automatic centring and underlining of text. Text can be set with a ragged right margin, fully justified, or right flush with a ragged left margin.

One often-overlooked feature is the provision of temporary left margin settings for hanging indentation — that is, setting a whole paragraph a few characters further in than the rest of the text.

One of the biggest factors increasing the speed of a word processor user over the operator of an electric typewriter is automatic wordwrap, eliminating the need to insert manual carriage returns at the end of each line. Even in normal mode, this feature is available on the TC600.

Text can be printed out as it's typed in, but a better way of working for anyone



unsure of his keyboard skills is to have the text printed a line at a time as work progresses. This lets you correct mistakes which are present on the LCD before they are printed.

In word processing mode, the facilities are not vastly superior, but the text is stored in memory instead of being printed. This means that any part of the document can be changed at any time, (the 'normal' mode restricts editing to the current line of text) and also lets you work without the twin distractions of the printer noise and its insatiable appetite for paper.

The editing facilities have been greatly improved over those of the earlier EP44, and include a FIND function and a SEARCH AND REPLACE option.

Moving, copying or deleting blocks of text is now possible, but still hard work. Each line of text is numbered, and block operations are carried out by defining the line numbers which make up the block.

Editing operations of this kind are simplified by the logical choice of keys to initiate each task (CODE-D for delete, CODE-C for copy, and so on), and in case even this proves too much to remember, the functions are inscribed in small green letters on the relevant keytops.

Nine separate files can be held within the TC600's memory, but their total combined length may not exceed 14,200 characters — equivalent to a piece of text not much longer than this Checkout. The Brother's architecture is CMOS, and the low power consumption of the chips makes battery back-up for the memory contents a practical proposition. As long as the four hefty D dry cells are in place, or the mains adaptor is connected, switching the Brother off will not make it forget anything. Even changing the batteries need not be hazardous, as deterioration starts about 25 minutes after the batteries are removed or the AC power supply unplugged.

An increasing number of home and professional computers are now appearing equipped with only the RS232 serial interface. This makes printing from these machines rather inconvenient. Most of the low-cost printers which are popular in the UK use the centronics-type parallel interface as standard. To owners of machines like the Sinclair QL and the Spectrum with its Interface One attached, the prospect of a typewriter which can double as a letter-quality printer must be attractive.

RS232 devices are traditionally strewn with pitfalls for the unwary, as the standard is rather loosely defined and no two serial interfaces ever seem to be exactly the same. With the Brother, however, I was pleasantly surprised. The QL plugged straight in using a BT 600 series jack at the QL end and a standard 25-pin D connector at the Brother end, and after a couple of seconds spent setting up baud rates and protocols I was able to transmit files both ways without corruption.

Brother provides a separate manual for the RS232 interface fitted to the TC600, and this covers connection to a wide variety of personal computers, modems and printers in detail.

This is a sample of the Brother's typeface, which is unusually tidy for a dot-matrix printer. The dots can be seen, but only on very close inspection. The line spacing on this sample is 1 1/2, and single and double spacing are also available. The optional justification is here in automatic operation, and some underlined text is also included.

Example of Brother TC600's dot matrix typeface

Documentation

The documentation isn't wonderful, but it does require a little creative interpretation. 'FORWARD' heads the imperious foreword of the RS232 booklet. 'In this guide book it is described, as a rule, under the status that TC600 is in memory-full.'

Piquant outbursts of Japanese English add interest and amusement as long as you can understand them, but, on the whole, it's a treat I would rather live without.

If you bought a TC600 to use as a general purpose computer printer, you would probably find yourself shopping for something a little faster to use for program listings or draft copies. The Brother's beautiful print quality may bring tears to the eyes of the opposition, but waiting almost fifteen minutes for a 2000-word article is about as much fun as watching the grass grow. Don't think you can slope off for a cup of tea, either — you have to be there, carefully feeding in sheet after sheet of paper.

Another drawback is the high cost of operation. The printer can use thermal paper, or plain paper with a thermal ribbon making the impression. The ribbons are one-pass units and don't last long, and the thermal paper costs an uncomfortable amount of money (although prices do seem to vary widely —the major High Street retailers are not really the places to try for best value).

Price

The price of the basic unit is £415 including VAT. A disk drive (which I was not able to examine) is available for an additional £175. The pricing seems a little high, but it's hard to make comparisons as there is virtually no direct competition for the Brother. It would be a much more attractive buy if the printing process could be speeded up, perhaps by making the head print bi-directionally. At the moment, the printing is also disappointingly noisy— although thermal printing is not in itself noisy. As there is no impact between the head and the paper, the head does clatter and bang around to quite a degree; you would feel slightly embarrassed printing out a document on board a train, for example.

Conclusion

Despite the above-mentioned drawbacks the Brother TC600 is undeniably pleasant to use, and is rare among pieces of equipment received for review in that it was actually *used*, not just for the purposes of the test, but for other tasks as well. Look carefully into the costs before buying, but be sure to examine this unconventional machine.

END

Technical specifications

Number of keys:	59
Printing speed:	16 characters per second
Paper width:	247mm maximum
Printing width:	203mm maximum (80 characters)
Print head:	Thermal, 24 × 18 dot matrix
Display:	24 character LCD, 7 × 5 dot matrix
Paper required:	Thermal paper or smooth plain 40-50 gram
Power supply:	Four dry cells, size D, or AC adaptor
Dimensions:	340mm × 276mm × 58mm
Weight:	2.9kg
Interface:	RS232C
Memory:	14,300 characters total in up to nine text files.
Price:	£415, disk drive £175

APL for all

Use of APL has previously been limited to mainframes, but it is now becoming available on more micros. Anthony Camacho presents an introduction to this versatile language.

APL was designed to make it easy for people to specify procedures. It was used for several years to help design computers before it was implemented on a computer and became a computer language. It has proved superb for computer programming because it's the richest and most compact of all computer languages.

Although APL looks mathematical, it is as good with text and logic as any other language. It has a unique advantage in that it handles arrays without explicit loops; this means that programs in APL can take advantage of array processors without having to be converted. This array processing ability is ideal too for many graphical applications. APL has single-character commands by which arrays can be reflected, rotated, transposed and inverted.

APL was first implemented on big IBM mainframes, and for a long time you could not run APL programs anywhere else. As micros became more powerful, APL was implemented on many of them: Osborne, Superbrain, Televideo, Xerox, BASF, Gemini, Signet, Sirius and other CP/M micros, for example. APL is also available on various micros which are based on the 68000 CPU, and on the IBM PC (for which there are now at least five versions). Recent additions to the list are the BBC Micro (using the Z80 second processor) and the Sinclair QL.

Until the end of 1982, APL users were best described as 'The idle, thinking rich.' They, or their companies, had to be rich because only the rich could afford a machine of considerable power and size (with enough memory to give each user 100k or more for his workspace). They had to be thinking because APL removes a considerable part of the drudgery of traditional programming, so there is less keying and more thinking to be done. APL offers a much richer choice of operations than other languages, and some of these work on arrays of as many dimensions as you please; this is another reason why you have to think to use APL. Lastly, the typical APL user has the idleness of the man who seeks the perfect, most labour-saving tool for every job he tackles.

APL goes further than any other language in replacing programmer effort by machine power. The really determinedly idle programmers are always the first to find and use APL, and if they have no objection to the effort of thinking they stick with it — you won't find anyone willingly going from APL back to Cobol or Fortran (although you may find some backsliding into machine code or C for the sake of speed or detailed control of the computer registers).

Access

So, until the 80s, access to APL was more or less limited to those who worked for large corporations. APL would only run on mainframes and very few companies challenged IBM, which set the standard in APL as in so many other areas of computing. The spread of APL was also hampered by the need to display and print APL characters; in those days nearly all terminals were dumb and had to be specially equipped with character sets in ROM. Among printers, only the IBM golfball typewriter had an APL character set easily available.

At the end of the 1970s the big micro revolution began, and the price of processors and memory came down to within sight of their present levels. The versatile displays and printers provided to meet the demand for computer games, foreign character sets and graphics made it much easier to provide the characters that APL needs. Acornsoft APL, for example, on the BBC Micro with an Epson FX printer can display and print APL together with all normal characters, without a single change to any item of hardware.

In the early 1980s microprocessor implementations of APL began to appear. Subsets of APL, such as TisAPL and V80, suffered from severe space limitations because 8-bit micros can only address 64k directly. Then VIZ::APL implemented a complete IBM version of APL using virtual memory, which gives workspaces up to the capacity of the disk or of a megabyte, whichever is smaller. This runs under the CP/M operating system, so is available on many machines.

Since then there have been many more, mostly on 16-bit machines, where virtual memory wasn't needed. There are at least five APLs for the IBM PC (including APL*PLUS, IBM's own, IP Sharp's and PortaAPL), and there are versions that exploit true 16-bit machines such as APL 68000 and, for machines that can run Unix, Dyalog. There are also many mainframe versions of APL available, so this decade may well see APL come into its own.

APL has a reputation for greed in its use of computer store and processing capacity, but for practical purposes it is quite fast enough on an 8-bit micro. Memory is cheap, so even when a virtual memory is not available it's possible to buy a memory of adequate size. APL programs process arrays without specifying where to begin or what sequence to process them in, which makes it easy for a compiler or interpreter to spot what operations can be done in parallel by an array processor.

APL programs don't have to be rewritten to work on array processors; the analogic machine can process arrays at the rate of 10,000,000 floating point operations per second. Such supercomputer power is much less expensive than the traditional mainframe (and handsomely outperforms the big Cray, Amdahl and IBM machines at this kind of work).

In use

Once you become familiar with the main features of APL, it begins to be much more fun than most other languages because anything you don't know can be tried out; usually this will give the answer quicker than it could be looked up in the manual. The editing and amending of programs becomes a pleasure. As the language is so compact you have to be very clumsy to produce functions that don't fit within the screen, so it's easy to follow their action in your mind. And if you aren't sure, you can try out each line or each bit of a line as a command to see what it does in isolation until you get the results you want.

If a way can be found of doing a job without explicit loops (such as the sort example in Fig 1) then the APL interpreter only has to interpret the program once and all the loops are in machine code, which is efficient and fast. It is sometimes hard for a Basic program-

```
STORE IN X AND DISPLAY TWENTY RANDOM
      NUMBERS BETWEEN 1 AND 26
      □←X←?20⍴26
24 26 16 1 18 13 15 24 12 18 6 13 8 25 7
       25 13 4 25 23

PICK OUT THE LARGEST AND SMALLEST
      (⌈/X),⌊/X
26 1

DISPLAY THE NUMBERS FROM X IN NUMERICAL
      ORDER
      X[⍋X]
1 4 6 7 8 12 13 13 13 15 16 18 18 23 24
       24 25 25 25 26

CONVERT X INTO A TABLE OF FOUR ROWS AND
      FIVE COLUMNS
      □←X←4 5⍴X
 24 26 16  1 18
 13 15 24 12 18
  6 13  8 25  7
 25 13  4 25 23

ADD THE ROWS AND THEN THE COLUMNS
      +/X
85 82 59 90
      +⌿X
68 67 52 63 66

APPLY VAT
      1.15×X
 27.6  29.9  18.4   1.15 20.7
 14.95 17.25 27.6  13.8  20.7
  6.9  14.95  9.2  28.75  8.05
 28.75 14.95  4.6  28.75 26.45

CONVERT TO LETTERS AND STORE IN X
      □←X←□AVI 64+X
XZPAR
MOXLR
FMHYG
YMDYW

SORT INTO ALPHABETICAL ORDER
      X[' !'⍋X;]
FMHYG
MOXLR
XZPAR
YMDYW
```

Fig 1 Sort example

mer to change his mode of thought — flying is harder to learn than driving — but it's more rewarding and more fun when you can do it.

APL uses some unfamiliar symbols, and people make a quite unnecessary fuss about them. They are as easy to learn as the command key sequences or reserved words in any other language, and when they are learned they are quick to enter and read. It's true that getting a screen and printer to display and print them can be a nuisance, but it only has to be done once. Some people allow this to put them off.

There are now several versions of APL which allow you to work entirely in the standard character set; they use key words or combinations of punctuation and abbreviations to replace the APL characters.

APL doesn't belong to any 'generation' of computer languages: it is at once as old as the oldest of them and as new as the latest. It cannot be superseded any more than Euclid's geometry can be superseded — although an Einstein may well extend it. This is because the operations it performs are those of logic and mathematics (which I hardly need say are unlikely to change).

APL can do anything Cobol, Fortran, Pascal, Algol, PL1, Lisp, Forth, Prolog, Basic or Ada can do, and it does a wider range of things better than any other language. In the sense in which Cobol is a higher level language than assembler, APL is the highest level language of all these. It does not compete with assemblers or with C at working the hardware to its limits because it is interpreted, not compiled, but I expect APL compilers will be produced (I understand there is an experimental one in use for APL*PLUS).

APL is the preferred language for internal development in IBM — a fact that is not lost on the bigger corporations. Most of the giants of the industrial world such as ICI and Shell use APL extensively. It is the best language for an information centre because it enables the staff to give the user what he wants sooner, and then to change it with less pain. There are many excellent packages written in APL too: for example, the databases Frango, ADRS, ADI, ARMS and MABRA.

APL is ideal when the timing isn't critical and the cost of the programming is significant compared with the cost of the computer processing. This may be because the job is a one-off or is only run monthly, or less often. It may be because it is a prototype which will be amended every second run or so for a few months. It could be because the processing can be done in mainframe time that would otherwise go to waste or to a micro. With APL, the programming costs are commonly less than a fifth of the equivalent Cobol or Fortran and less than a third of the equivalent Basic (and, of course, well-written APL runs faster than Basic).

APL is particularly good at anything that calls for data in tabular or array form, and outstanding at multi-dimensional arrays. It has the best logical processing facilities of any language I know, and its handling of characters and numbers is exemplary. The programmer very rarely has to think about the way the computer holds his data. Acornsoft APL, for example, will hold numbers with up to 75 digits before the decimal point or with up to 75 zeros after the point, and it holds them with a precision of over 16 significant digits. This is the equivalent of the IBM double-precision floating point, and for most purposes will be accurate to one part in a hundred million million.

But a variable which contains only small integers will only take two bytes of memory per value. Boolean and binary data are packed eight to the byte. Conversion from one form to another is automatic and transparent to the user.

Because of the range of mathematic-

al functions in APL it is favoured by statisticians, and some of its most devoted exponents are in university departments of statistics. You can see why, too, from the examples in Fig 2!

Its versatility at handling arrays means that APL is very good at reading files recorded by other systems and processing the data in them, so APL has been used (notably by Inner Product Ltd) to read and transfer data between dBasell, and Multiplan and Wordstar. I have used APL to read IBM files of variable length records written in EBCDIC and packed decimal, and to convert the records and store them in a MABRA database. If you have APL and a package that won't do quite what you want, do as much as you can with the package and then complete the job with APL.

Readers' choice

APL is fun. It makes programmers more productive (one day the commercial world will begin to notice the difference between productive and less productive programmers).

APL is programmer-friendly: it has stop and trace facilities, and the convenience of a workspace which is stored as a unit and holds both data and functions. There are many other nice touches: naming a variable displays its value; you can interrupt processing, alter the values of any variables you choose, and then restart from where you stopped. You can even alter functions in the middle of a run and restart it successfully.

APL keeps an account of work in progress on a stack which holds all the currently uncompleted functions, and shows how far each has run. You can list this stack, plus the variables and labels localised at each level. There are system commands to list all functions, variables, system functions, system variables, workspaces and files. You can choose whether to count from zero or one in each function. There are also libraries of utility functions and books of idioms. (*PCW* reported in May 1984 that APL was readers' choice of programming language.)

Data processing managers should be interested in APL. The cost of programming is rising faster than inflation; APL gives much cheaper programming and this advantage is becoming more important.

Its main disadvantage used to be the memory and the processing it took, but as memory and processing get cheaper, its disadvantages disappear. It can deliver working systems faster, and when changes are required the amendments can be done more easily.

Users of data processing services expect more and more. As computer knowledge spreads, miracles are wanted more (not less) often. Robert Bittlestone's laws of project development apply to two jobs out of three nowadays. Here are three of his laws and one of mine:

1) Systems cannot be specified until they have been implemented.
2) Reports are required before the user has agreed the specification.
3) If the requirement doesn't change, the system is not being used.
4) There is no such thing as the end of a project.

Only with APL can an ordinary programmer produce a sample report in one layout after another, with the user looking over his shoulder until he is satisfied. Only with APL can you easily work with 'cut and try' methods when the user doesn't know what he really needs.

Users should be interested in APL: they should insist that their prototype and urgent work is done in this language. It's the only way to get the data processing department to tolerate systems that never stop changing.

Publications

For beginners I recommend *APL — An Interactive Approach* by Gilman and Rose. The IP Sharp Associates *Reference Manual* by Paul Berry is excellent. KE Iverson's books on APL are full of interest, as you would expect from the inventor of the language.

Adrian Smith's *APL — A Design Handbook for Commercial Systems* gives many insights into a growing area of APL use. These and other APL books can be obtained from APL Publications, 9 Koh-I-Noor Avenue, Bushey, Herts WD2 3EJ.

There is also a British APL Association, affiliated to the British Computer Society. It publishes a very good magazine called *Vector* (edited by Robert Bittlestone) and holds regular meetings. Further details can be obtained from 13 Mansfield Street, London W1M 0BP. END

```
PUT A ROW OF PASCAL'S TRIANGLE INTO S
      □←S←(¯1+⍳20)!20⍴19
1 19 171 969 3876 11628 27132 50388
       75582 92378 92378 75582 50388
       27132 11628 3876 969 171 19 1

DISTRIBUTE IN A RANGE OF 100 AND PUT
      INTO S
      □←S←⌈100×S÷⌈/S
1 1 1 2 5 13 30 55 82 100 100 82 55 30
       13 5 2 1 1 1

THE SUM OF THE NUMBERS
      +/S
580

LIST THE QUARTILES
      (S[⍋S])[5 10 15]
1 5 55

AVERAGE OF THE RANGE FROM THE MEDIAN UP
      TO THE THIRD QUARTILE
      (+/(S[⍋S])[10+⍳5])÷5
28.2

SUM OF THE SQUARES
      +/S*2
41700

VARIANCE
      (+/(S-(+/S)÷⍴S)*2)÷⍴S
1244

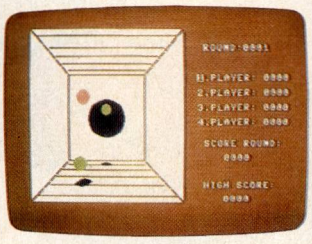
STANDARD DEVIATION
      ((+/(S-(+/S)÷⍴S)*2)÷⍴S)*.5
35.270384
```

Fig 2 APL's mathematical functions

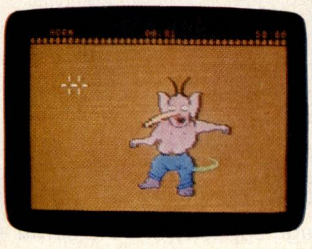
DRIVE A HARD SOFT BARGAIN.



'Buffalo Round Up'



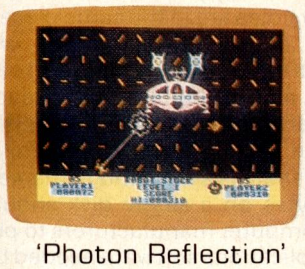
'Spatial Billiards'



'Dancing Monster'



'Save Me Brave Knight'



'Photon Reflection'

It's not every day you get offered a bargain as good as this: five games in one package for just £9.99.

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No other games collection comes anywhere near the 'Fantasy Five.' Each game is unique and demands very different talents of the player.

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Record storage

Paul Groves speculates on the implications of compact disk ROMs, a new and impressive mass storage medium.

Of all the amazing bits of digital gee-whizzery developed recently, the compact audio disk is perhaps the most astonishing. Nearly as astonishing is that it has taken until now — four years since compact disk (CD) technology came on the market — for a computer application.

When I was in Japan last November, the entire computer industry was awash with excited rumours, and industry pundits were speculating on revolutions in software development and marketing. The object of all the excitement was the so-called CD-ROM. Briefly, a CD-ROM takes advantage of the compact disk's massive data storage capacity to give computer users a quantum jump in read-only memory storage — 540Mbytes (one megabyte equals 1,048,576 bytes) of user data. The implications are obvious: audio compact disk players are available for £200-300, and audio compact disks sell for around £10. The CD-ROM equivalents' prices should be similar.

CD technology

CD audio recordings use an entirely new way of recording — storing and reproducing audio signals. Conventional records, whether old wax cylinders or modern vinyl pressings, store the original sound as direct analogue equivalents that modulate the wall of a groove. A stylus that may be made of thorn or steel, diamond or sapphire (depending on the age of the player) then traces the modulated groove and transfers these modulations to the air (via the horn or loudspeaker).

A compact disk uses digital processes throughout. The original sound is first converted to a stream of digital words which correspond to the instantaneous voltage or level of the audio signal. This stream of words is then stored on a disk as a spiral track which comprises bumps in the disk surface. By combining (relatively) non-reflecting bumps with areas of smooth disk surface, an optical laser system can then 'read' the surface of the disk to retrieve the digital information. A microprocessor-based computer system then re-converts the digital information into audio signals.

A compact audio disk is able to store, on one side of a disk less then five inches in diameter, all the information needed to store and reproduce over an hour's worth of music at a standard higher than a long-playing 'analogue' record can achieve. For acceptable fidelity, the analogue audio signal has to be sampled (for conversion to a digital equivalent) at twice the rate of the highest frequency to be reproduced. High-fidelity audio systems require an upper frequency limit of about 15KHz, so the sampling frequency needs to be at least 30KHz. An hour's worth of music would therefore require at least 60 (minutes) × 60 (seconds) × 30,000 (samples per second), or 108 million digitised samples. Each sample will require two bytes of data on the disk for adequate resolution, and error correction techniques will require several times this amount of data.

The colossal data capacity of the compact disk comes from the extreme narrowness of the tracks — less than a micron wide. The bumps themselves are roughly the same size as the wavelength of the laser light used to read them.

Although audio compact disks have data stored in a form for conversion back into audio signals, precisely the same technology can be used to store data usable by computers. Work on CD-ROMs has been done by both Philips in Holland and Sony in Japan, and a CD-ROM standard has been developed. The details of the computer interface developed by these two companies differ, but the data formats and data storage capacity are the same — 540Mbytes of user data per disk.



Massive data storage

Here we enter the realm of speculation. The mechanisms needed for reproducing CD-ROM disks are identical to CD players except that fancy D/A conversion circuitry is not required, and the players should retail at prices similar to floppy disk drives. Indeed, Sony has announced that its CD-ROM player will occupy exactly the same space as a standard 5in floppy disk drive and even the screw holes are in the same places. The cost of the CD-ROM disks will depend on the size of potential markets; as stated, audio compact disks already retail for around £10, so software disks should be able to sell for a similar amount if there is a big enough market.

540Mbytes on a single disk should enable computer manufacturers to put all the applications software needed by most customers on a single disk. Compared with the cost of recordable



magnetic media (disk or tape), CD-ROMs are inherently cheap. A single CD-ROM could easily store CP/M or MS-DOS (including the BIOS) as well as WordStar, SuperCalc, a Basic interpreter, Pascal, C and Fortran compilers, communications software, plus the entire text of Shakespeare. The problem stems from the fact that CD disks are read-only devices, just like silicon ROMs; provision would have to be made in the software for storing program-generated data files on separate, recordable media.

CD-ROMs can store huge amounts of data, but floppy or fixed disk storage would still be needed for most applications. A lot of existing software assumes that files can be written to the same medium that the program data is stored on: that is, OPEN <filename> statements usually assume that the source and destination mass storage medium is the same device. Modifying this kind of software in order that program and user-generated files are stored on different physical devices is no great problem, but care will have to be taken over the time taken to load overlays if excessively slow-running programs are to be avoided.

CD-ROM databases

Some types of databases need files to be frequently updated, others do not. If a database is used for keeping customer records or inventory control, updates will be needed for virtually every transaction. In this case, data management software may need to be extensively re-written, and most of the advantages of CD-ROM's huge data capacities would be lost.

On the other hand, many databases do not need to be frequently (or ever) modified. If the database consists of records comprising ASCII files of, for example, criminal law, the Bible, the works of Shakespeare, map grid references to the location of all the airports in the world, and so on, then the database data will not need to modified: a small update file on magnetic disk should suffice. CD-ROMs would be ideal for applications like this.

It is in this type of application area that the interests of traditional software houses and book publishers converge. The low cost of CD-ROMs, coupled with potentially very large markets for 'static' databases, should result in a major shake-up in the big names at the top of software publishing. Don't be surprised if such companies as Macmillan and MacGraw-Hill emerge as major software publishers in the next few years.

Information on databases is generally paid for by the minute. Customers dial up the appropiate telephone number, and hook up their computers via modem links. These databases are usually run on large mainframe computers and, as such, frequent updates to the database can easily be made by the suppliers. However, whenever the database data does not need to be frequently updated, CD-ROMs will come into their own. Why pay for

Illustration by Paul Margiotta

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computer and telephone time when you can have the information you need by slotting in a low-cost compact disk?

Although we are accustomed to thinking of databases as dynamic structures with constantly changing fields and records, it's surprising how much information is static and non-changing. Think of all the books in a typical library, not to mention vast bodies of scientific, statistical, legal and geographical data.

CD-ROMs make a new type of publishing possible, and it will be interesting to see how traditional publishers and software houses cooperate or reject it.

Technicalities

A CD-ROM disk stores data in 270,000 blocks; each block contains 2048 bytes of user data, plus a number of bytes of sync and header data not available to the user. Data can only be accessed in units of one or more blocks.

Each block of data on the disk has an absolute time address in its header block. The header comprises four bytes, each of which stores two BCD (binary coded decimal) digits for 'minutes', 'seconds', 'block #' and 'mode'. There are 75 blocks of 2048-byte data for each second of a 60-minute disk.

Neither the Sony nor the Philips versions of the CD-ROM players treat the device as a floppy disk. Both use extremely simple interfacing circuits, and data is accessed by sending a command to the device's command register that specifies the minute, second, block and mode parameters. In the case of the Sony device, the mode parameter will either be a number (indicating the number of blocks to be read) or zero (indicating that data should be read from the specified block to the end of the disk).

The Philips CD-ROM player uses a serial interface, while Sony has opted for a parallel interface. Sony uses eight bi-directional data lines: a DATA/COMMAND line that selects either the data or command registers in the device; a READ line used for strobing data or status reads; a COMMAND WRITE line that strobes command writes; a STATUS ENABLE line that shows when status information is available; a WAIT/DRQ line that shows when the data register has been updated; four DRIVE SELECT lines (up to four drives may be used); a RESET line to reset the system; and SELECT WT/DRQ that works with the WAIT/DRQ line.

Interfacing requirements are nothing more than common-or-garden TTL buffers, such as 74LS14s and 74LS125s on the computer side.

The command code set is also trivially simple: A0 means 'seek and read blocks one at a time'; A8 means 'seek and read blocks continuously'; and F0 means 'break'. The command codes A0 and A8 are then followed by the four parameters — 'minutes', 'seconds', 'block #' and 'N' (N = number of blocks to read).

The system status is available as an 8-bit word in the status register. The significance of each bit is summarised in Fig 1.

Bit	Significance
0	0: end of read 1: read next block
1	0: no data error 1: data error
2	0: no command error 1: command error
3	0: no seek error 1: seek error
4	0: disk OK 1: wrong mode of CD-ROM disk in drive
5	0: disk OK 1: audio disk in drive
6	0: disk OK 1: illegal disk in drive
7	0: disk OK 1: no disk in drive

Fig 1 Summary of the significance of bits

Disk diameter	12cm
Rotation speed	200-530rpm
User data capacity	540Mbytes
Max data rate	600k/second
Average data rate	150k/second
Worst case access time	1.5 seconds
Hard error rate	1×10 or better

Fig 2 Drive specifications

Error correction

The 'softer' the storage medium becomes, the more attention has to be paid to the problems of erroneous data being read. Many error correcting techniques have been developed over the years, ranging in complexity from simple parity checks to fancy redundancy methods. The subject is too big to consider here in depth but it is particularly important for CD-ROMs, so we'll consider it briefly.

Solid state memory, particularly solid state ROMs, is to all intents and purposes immune from hard errors. Occasionally, and the IBM PC is a case in point, manufacturers go to the trouble of adding an extra parity bit for each word of RAM storage. Generally, though, the error rate is so low that such precautions are not necessary.

Next down the league table comes magnetic media, which uses frequency-modulated recording techniques. The specification for a typical floppy disk drive is: seek errors — 1×10^{-6}; soft errors 1×10^{-9} bits; hard errors 1×10^{-12} bits. Error rates of this magnitude do not normally call for special error correction — the general policy is to keep your fingers crossed and hope for the best.

Data recorded acoustically (usually on cassette, occasionally on record) is much more prone to errors due to tape drop-out, speed variations and noise. The policy here is either not to bother, or to use simple checksums to verify that data has been correctly read. Cassette data storage is usually used in low-cost, non-critical applications such as home computers, where errors are not usually life-threatening.

Data stored digitally on video tape, and data (both audio and computer) stored on compact disk, would be so prone to corruption as to be unusable without special error correction techniques. The method adopted for CD-ROMs is called 'redundancy with interleaving'.

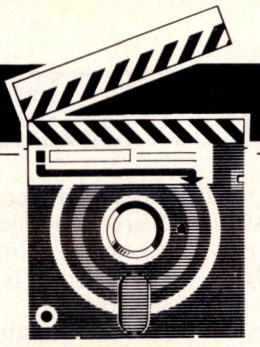
Each word of data is recorded several times, but not contiguously. The redundant words are scattered over nearby, but not adjacent, parts of the disk. Suppose that a bubble in the plastic coating of the disk, or a fleck of dirt on its surface, caused a data word to read incorrectly. Chances are that the cause of the problem would be big enough to corrupt all the redundant words too if they were recorded sequentially, so they are not. Instead, a small buffer memory holds a big enough block of words to perform a redundancy check on the scattered redundant words before passing the data to the host computer and updating the buffer. The result is that Sony claims a hard error rate of 1×10^{-12} for its CD-ROM, and Philips claims even better figures — at least as good as floppy disks. Error rates as low as this are more than adequate for consumer applications: after all, 1×10^{-12} is equivalent to one corrupted bit per trillion read, or one wrong letter in a text 20 billion words long.

Conclusion

Compact disk technology makes mass storage of the kind hitherto associated with large mainframe computers available at a price affordable by the home computer user.

This is bound to have far-reaching consequences. At the very least, we can expect to see massive databases becoming available for use with home systems at very modest cost. Specialist 'turnkey' systems for lawyers, scientists, and so on are likely to be radically transformed.

The next two or three years should witness a revolution in lowered bulk storage costs, and the only disadvantage of CD-ROMs is the inherent 'unwritability' of the medium. Meanwhile, work is well advanced on optically writable systems. The day of 'write-once' memory cannot be far away, with storage capacities of several hundreds of megabytes. END



SCREENTEST

Codewriter

Codewriter is a suite of programs that can create databases on a wide range of home and business machines. Tony Hetherington takes a look.

Codewriter is a suite of programs which allows non-technical users to design and write their own applications programs. It is available on an incredible range of 17 different machines, and costs from £209.95 for the IBM or Apricot versions down to £91.95 for a Commodore 64 or BBC package.

The package consists of three programs — Filewriter, Reportwriter and Menuwriter — all of which can be bought separately, each costing slightly more than a third of the total price.

The programs are self-explanatory: Filewriter writes a program that will create and manage a file; Reportwriter generates a program to print reports using the information held in the file; and Menuwriter generates user menus that can be used to run the programs written by the other two from a single key press.

I concentrated on the Commodore version but kept an Apple II close to hand for comparison. The Commodore package consisted of the three programs supplied separately in a plastic box: this contained each program on disk and a booklet-style manual.

The first stage in creating a Codewriter system is to use Filewriter to design the screen used for entering data into the file. This screen also tells the program how to structure the resulting file, so you must tell the program which fields are numeric, which are dates, and which are simply headings included to help the user. This is accomplished through a series of symbols: a heading is enclosed by two arrows; a text field (an address) is a series of dots, with each dot representing a character to be input. Numeric fields are identical to text fields, except that the last dot is replaced by a hash sign. Each field must be preceded by a field name which clarifies the information that will follow it. A field that will contain a customer's name could quite simply be called 'Customer's Name', thus making the final entry Customer's Name .....

When you have finished creating or altering your screen design, the program reads it. During this process it will inform you of any errors and allow you to correct them, as well as asking whether numeric fields are to be input by the user or calculated by the program. It's this ability to have program-calculated fields that gives Codewriter files their real power. As the user types in order details, the program can automatically add up the total value of the orders from the price and quantity ordered fields. It can even add VAT and postage and packing charges, as well as calculate agent's commission or dealer discount. You can also define a field as being a grand total field, which accumulates the value of a specified field throughout the file.

'The Codewriter system is complemented by its excellent documentation which, for the Commodore 64, is in the form of three booklets.'

Now that the screen is created and the fields defined, Codewriter is ready to produce the program that will create the file and manage it. It does this by allowing the user to simply enter or update records in the file.

Before Codewriter can proceed with generating the code for the new program, it requires a few more details such as the number of records in the file and which field you wish to use as a sort key. For most applications, this will be an account number or membership number.

You are given the chance to protect your file from incorrect data by utilising 'Accept IF' conditions for each field; these specify that the data entered must be, for example, numeric or alphabetic, or you can specify actual values or the range of values. You could specify that a membership number must be between five and 23, or that a person's age is over 21. You can add the final touches to your program by adding error messages in case bad data is rejected.

Codewriter will then write the program, and all that remains for you to do is to select the create file option the first time you use the program. This option writes blank records to the disk, and should only be used once as it wipes any existing data. It's extremely unlikely that this will happen accidentally, but it's a good example of how Codewriter protects itself from the user. Instead of responding to a simple yes/no question you have to enter the word 'clear', which isn't something you'd accidentally type.

This approach is consistent throughout the screen and application design stage, and makes the procedures easy to follow and therefore simple to use. At every stage you are allowed to change your mind, and if all else fails you can simply repeat the application generation phase with an already saved screen design.

Filewriter

Filewriter is not, however, without its limitations, which are exacerbated in the versions for the cheaper home machines. For example, these home versions use a 40-character display which can only handle 49 fields; this is doubled on the more expensive 80-character versions. The number of fields also affects the number of records that a file can contain, a situation which

is complicated by the storage capacity of the host machine's disks. (The Commodore 64 has an average maximum file size of about 1000 records.)

The calculations used to evaluate program-calculated fields are restricted to only 25 characters which, although it seems adequate initially, provides only enough room to sum the values of six other fields. This is despite the fact that the fields are referred to by abbreviations: for example, ke1 is the first keyboard-entered field. Consequently you may require a number of sub-totals which might confuse the screen design.

This problem can be eliminated by the creation of neat reports which are generated by Reportwriter programs.

Reportwriter

Reportwriter can generate programs which are capable of printing data created by Filewriter in a variety of ways, ranging from address labels through to sales reports complete with summaries.

By following the onscreen instructions, the user can quickly design a form from the fields defined in his file together with text and newly calculated variables. Should the user require a report summary, Reportwriter allows him to print maximum, minimum or average values of any of the fields in the report.

A typical Codewriter-generated system consists of a data entry system which controls a file of, say, club members and a number of report-writing programs which could produce address labels for mail shots, individually addressed letters and an accounts report. The letters are easily created: Reportwriter allows the inclusion of text along with the defined fields, so a letter can be created with the member's name and address substituted by the relevant Filewriter file field.

Menuwriter

As each Filewriter and Reportwriter program generated by the system is written on a separate disk, such a complete suite of programs could become unwieldly and awkward to use. The third program in the system, Menuwriter, generates menus through which the applications programs can be used by pressing a single key. To supplement this facility, Menuwriter also contains a copying utility to transfer all the programs onto one disk. Once this is complete, the system is ready for use without the Codewriter master disks.

Documentation

The Codewriter system is complemented by its excellent documentation which, for the Commodore 64, is in the form of three booklets. Users of more expensive machines get the same information but in single ring-file format.

Each booklet incorporates a general introduction to the program, a worked example and a reference section. All the instructions are easy to follow, and the text is supplemented by diagrams in the margin. A picture of a disk tells you that you should, for example, swap the Codewriter disk for a blank disk so that it can write your program on it.

Before you start to use Codewriter, you should read the user notes pertaining to the disk and amend your booklet accordingly; the disk contains alterations to the manual (which is used for a number of machines) to make it specific for your micro. This is somewhat irritating, but once you have worked through the examples given you won't need to use the manual anyway. If you have any problems, you'll probably use the onscreen help facilities or quickly run through the tutorials included on the disks.

Prices

The price of the Codewriter system will vary depending on your host machine. If you own an Apricot, Sirius, IBM PC or AT, Compaq, Kaypro or TI Professional then the sytem will cost £209 excluding VAT. £169 + VAT will buy versions for the Apple (and IBM PCjr) but home users of the BBC Micro, Atari and Commodore 64 will only pay £91.95.

As stated, the component parts of Codewriter can be bought separately, each costing about a third of the full price. For example, Filewriter and Reportwriter for the Commodore 64 cost £34.95 each, whereas Menuwriter is rather cheaper at £28.95.

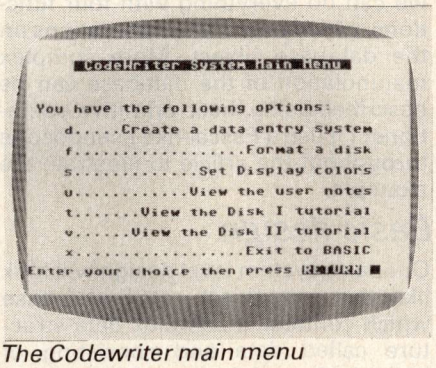
Codewriter is originally an American product and is sold in the UK by Codewriter UK, which was formerly ISP, the company that brought you Scope.

Codewriter is presently moving offices but can still be contacted via Codewriter Ltd, Codewriter House, PO Box 33, Basingstoke, Hampshire RG24 0UG.

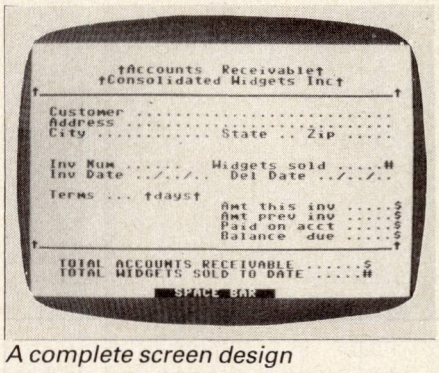
Conclusion

Codewriter isn't a particularly outstanding program, either technically or in performance, but it does work. The programs it generates can't compete with the more specialised packages, but then they don't try to.

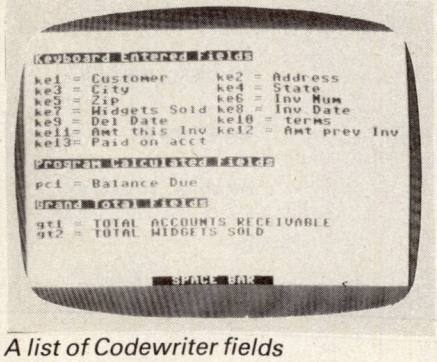
However, if you have specific applications in mind that could cope with Codewriter's limitations, then you'll find the program easy to use and efficient. END



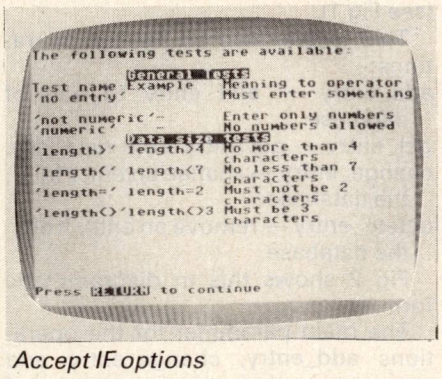
The Codewriter main menu



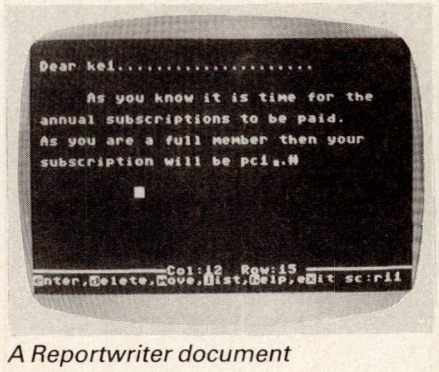
A complete screen design



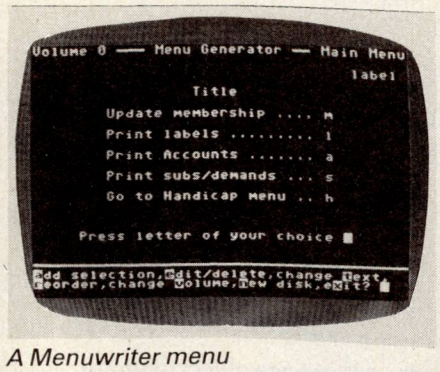
A list of Codewriter fields



Accept IF options



A Reportwriter document



A Menuwriter menu

Objective design

Brian Heywood looks at object-oriented design, a method of programming that is unusually flexible and more of a philosophy than a set of hard-and-fast rules

Historically, new software design methods are developed to overcome increasing complexity in computer programming tasks, thus saving programmers from having an unreasonable number of nervous breakdowns.

Object-oriented design is no exception to this rule and is basically a refinement of previous methods, and, as such, includes concepts like stepwise refinement and functional decomposition. However, you don't have to know what these methods are to use the object-oriented approach, since object-oriented design is more a philosophy of design than a set of hard-and-fast rules.

The purpose of structured design is to clearly define the flow of control in a program. This is done in languages like Pascal (and Sinclair SuperBasic) by the use of procedures and function calls. These calls allow the programmer to ignore details of the program code until the code actually needs to be written. This means that the program can be designed overall to have a sensible structure, and is known as stepwise refinement. This method also gives advantages in debugging a program, since the bits that don't work will be clearly defined areas (for example, the procedure/functions, and so on).

This sounds like a good idea, but it doesn't take into account the data manipulated by the program. Many bugs are caused by accidental multiple use of the same data, or uncontrolled access to data by the various parts of the program. The first problem often occurs in Basic since all data is global, and it is quite easy to mistype a variable name, or use the same variable name in different parts of the program. The second problem occurs if the data structure of the program is complex (say, a database program) and/or if you have more than one programmer working on a particular piece of code — they're unlikely to use the data in exactly the same way. The more 'public' data is, the greater the chance of this data becoming corrupt.

Ideally we need to restrict access to the data. One way this can be done is to encapsulate the data in an 'object', and only allow the data to be altered by a small number of well-defined routines or 'operations' associated with this object.

This is the crux of the object-oriented design philosophy. By limiting access to the data we can ensure that it isn't accidentally corrupted, and if by chance this happens we know which bit of code to check for errors. Object-oriented design can be applied to solve a particular problem: for example, designing a database.

Suppose we need a database to store names and addresses. We therefore need to store a variable number of items of data (names, address, phone number, and so on) and we need to access this data. The number of things we need to do with this data is limited to a few basic actions, such as add an entry to database, retrieve an entry from the database, alter or delete an entry. Thus we can do everything with four functions, which become our operations on the database object. More complex manipulation of the database can be described using these primitive operations; I'll use a Pascal-like pseudocode throughout the article to illustrate the example.

```
entry : RECORD
          surname
          first_names
          address
          phone_number
        END
```

Fig 1 Basic system level design

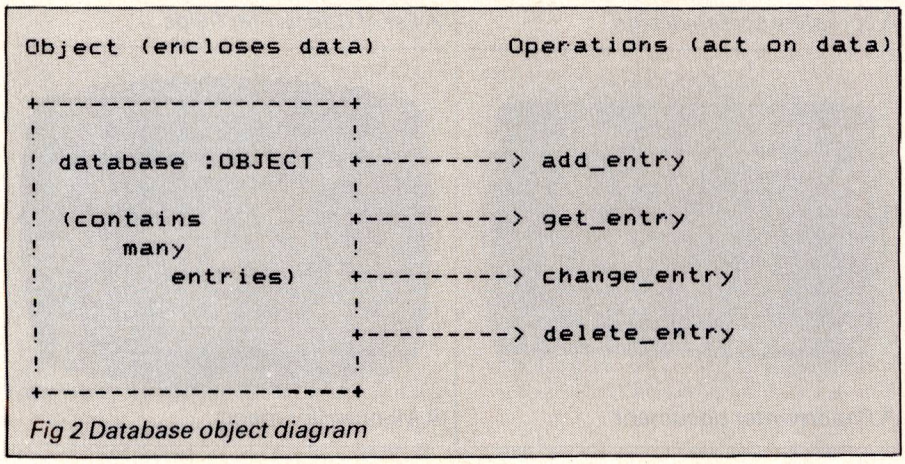


Fig 2 Database object diagram

Basic design

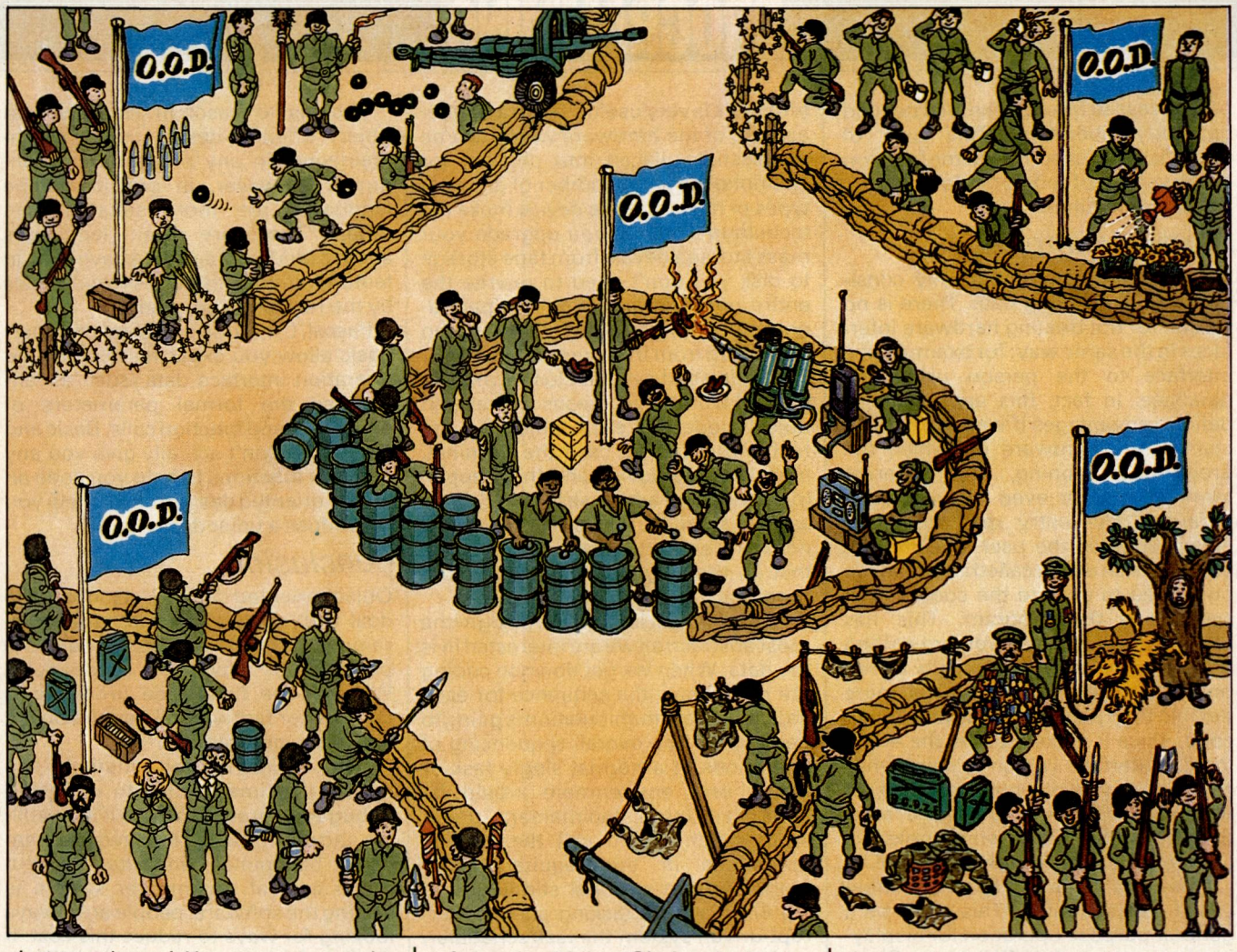
Our basic system level design will look like this: an object called database which contains a complex data structure called data and consisting of individual entries, each called entry (see Fig 1).

This is operated on by the operations:-

add_entry — add entry to end of database
get_entry — get entry from database,
change_entry — change an entry in the database
delete_entry — remove an entry from the database

Fig 2 shows this in diagrammatic form.

The main parameter for the operations add_entry, change_entry and get_entry is obviously going to be of



data type 'entry'. However, we are also going to need some way to reference a particular entry using an index. We can write the operations followed by the parameters in brackets. For example:

add_entry(entry)
get_entry(entry, index)
change_entry(entry, index)
delete_entry(index)

where 'index' is some variable which uniquely addresses an entry in the database.

The programmer doesn't need to know what the internal structure of the database is to use it, just the composition of a single entry. This is called information hiding. Obviously the data structure has to be formulated and the operations written at some point, but we can leave these tasks until the overall design has been completed. Furthermore, if at some later date we decide to change the internal structure of the database, we can do so as long as we keep the interface (parameters passed by the operations) to the rest of the system the same. This last point simplifies the problem of software maintenance considerably.

Using these primitive operations we can construct more complex manipulations of the database contents. Functions such as 'search', 'sort' and 'report' can be expressed as different combinations of add_entry, get_entry, change_entry and delete_entry. For example, if we wanted to access an entry by the contents of one of the fields in the entry (the surname, for instance), we could use the operations as shown in Fig 3.

However, note that entry_surname is the surname data field in 'entry', and display and input_string are general-purpose operations which belong to the VDU object.

With the example in Fig 3, you can see that the manipulated data is clearly visible at all times, as the database is

```
initialise index ;          /* it's good practice to */

initialise entry ;          /* initialise variables */

input_string( search_name) ;  /* get the name to search on */

while not end of database do

                            /* call the  primitive operation */
      get_entry(  entry,   index) ;

      if entry.surname = search_name then display( entry) ;

      increment( index) ;

end_while
```

Fig 3 Constructing complex manipulations from primative operations

Illustration by Martin Handford

only accessed through the well defined get_entry operation. This type of approach also ensures that the function of this section of code is obvious (that is, self-documenting).

Hardware interfaces

We have at the moment only considered encapsulating data. There is no reason for not treating hardware interfaces in the same way: for example, the interface to the person using the database. In fact, this approach has definite advantages if we ever need to change the hardware on which the program is running, to a different terminal type or even to an entirely different data entry method. If we encapsulate all the user-machine operations in an object called interface, we only need to change the code in that section of the program. This has obvious advantages if you are writing programs which will eventually be run on different computers and is more flexible than just having 'device driver' code, since it encompasses the entire logical interface (which is sometimes called the man-machine interface or user interface). You could have a range of user interfaces, one which looks like Unix, another which looks like PC-DOS.

I previously referred to an operation called display (entry). This could be a general-purpose operation for displaying one entry on the VDU screen. Since the screen formatting and special control codes and features vary from terminal to terminal, this method for simplifying the substitution of these terminals is very useful. There are other aspects of the hardware which can be successfully placed into objects; for example, the large number of different types of mass storage device make the technique useful. If you upgrade your mass storage device from tape storage to disk you don't need to rewrite the entire program, just alter the permanent_store object. An entire system can be built up from these modular objects.

The finished system closely models the real world. This means we have an object-model for each 'object' in the real world, in this case the terminal, mass storage device and the 'people' (or names and addresses) in the database. In addition, the above discussion doesn't mention the order of execution: that is, the sequential aspects of the program.

At the highest level of the design (the most abstract) all we are interested in is the data. When we get down to coding the operations, the sequence for each individual data manipulation is going to be defined. The overall sequencing of operations in a normal single task or single user environment would be controlled by a rudimentary driver loop, which would call the various operations in the required order (perhaps from external stimulus, see Fig 4). In a multi-tasking and/or interrupt-driven system the task scheduler, or interrupt handlers (simple procedures called by hardware interrupts), would be used to call the operations as required. The main aim is to keep it as simple as possible.

There is no reason in theory why an object oriented-design can't be implemented in any programming language. However, in practice, some languages are more suitable than others. The more recent languages such as Modula-2 and ADA have built-in features limiting the access to variables by the rest of the program.

Pascal, C, Fortran and Sinclair SuperBasic allow you explicitly to show the operation interface data (such as 'entry') as the formal parameters of procedure and function calls. Basic and assembler don't actually give you any inherent functions to help you code an object-oriented design, but do help you to produce a tidier design.

Conclusion

Object-oriented design is a tool used to deal with complexity in a large programming task. It can be applied to a problem of any size successfully. Whether the final code produced is compact or fast will still depend on the skill of the programme.

Used properly, this method will reduce the time needed to write and debug a program, increase it's reliability, and will make the finished program easier to maintain and alter. Since a major cost of a computer system is writing the software, people are always looking for ways to reduce this cost. If the time taken to write a program is not important, then the increased reliability and ease of maintenance is bound to be attractive in its own right.

END

```
repeat                          /* endless loop */

      display_menu ;    /* operations from interface object */

      input( option);

      case option of

            add_entry :

                  input_entry( entry) ;     /* provided by interface
                                                   object          */
                  add_entry( entry) ;       /* provided by database
                                                   object          */
            display_entry :

                  /* as described in example above */
                        .
                        .
                        .

            delete_name :        more functions etc .....

      end_case

until hell_freezes_over          /* end of driver loop */
```

Fig 4 Simple driver for database program

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On display

One of the most popular computer display devices is the cathode ray tube, but its dominance is under threat — the picture looks all set to change. Keith Brindley looks at the alternatives.

The cathode ray tube (CRT) is the most commonly used display device in computers. Until recently it was also the only device capable of displaying TV pictures. However, the advance of smaller, lighter, cheaper and tougher computers has prompted significant research and development work into non-CRT-based displays. The main contenders in the race to replace the CRT are:

— liquid crystal displays;
— electroluminescent displays;
— gas discharge displays; and
— vacuum fluorescent displays.

Let's start by looking at the CRT itself. The term 'cathode ray' refers to the beam of electrons generated by a heated electrode (the cathode) in the CRT's evacuated glass tube (Fig 1).

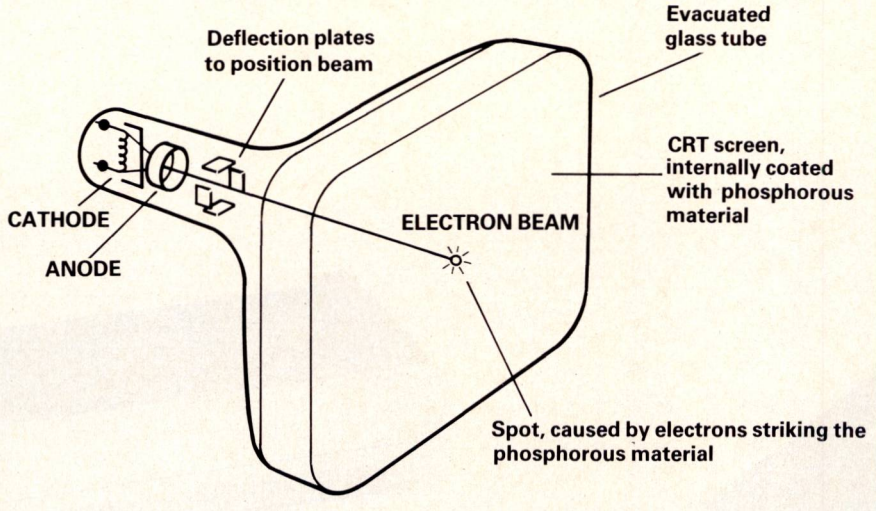


Fig 1 The CRT's evacuated glass tube

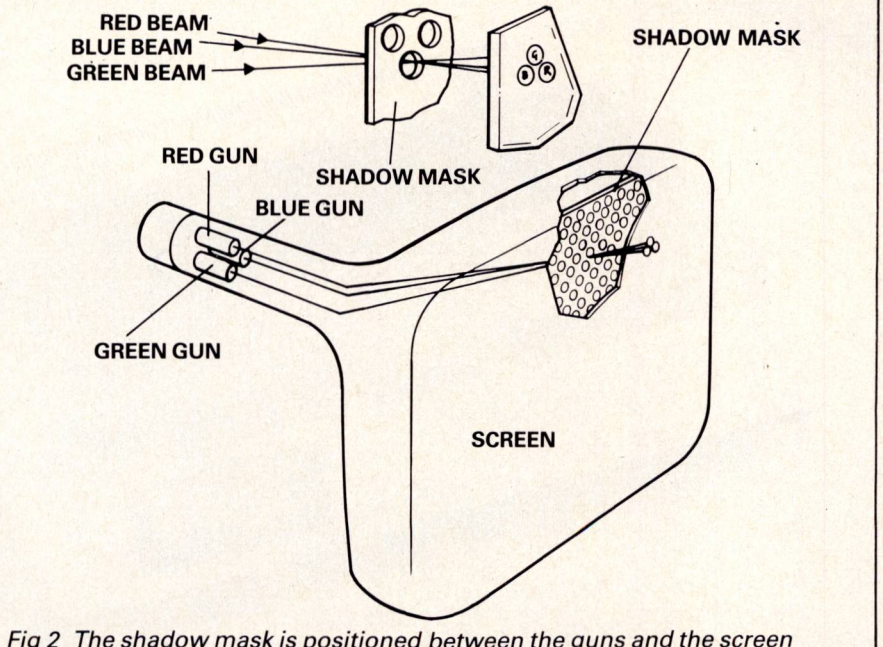


Fig 2 The shadow mask is positioned between the guns and the screen

The electron beam is focused and accelerated towards the internal surface of the screen of the tube, coated with a phosphorus material which glows when struck by electrons. A visible spot is produced on the screen, the brightness of which is dependent on the number of electrons in the beam.

By controlling the position of the beam and the quantity of electrons present, the position of the spot and its brightness is also controlled. Complete video pictures, graphics, alphanumeric displays, and so on, can be composed on the screen, with good clarity, in most lighting conditions, from a wide range of distances and from a wide range of angles, by moving the spot in a controlled way while altering its brightness to correspond to brightness variations in the displayed scene.

Spot brightness variation is a very important advantage of the CRT. Let's take the case where we can discern a definite number of possible individual spots (that is, pixels) on a CRT screen, in a matrix of, say, 600 × 450 down the screen. (Flat-panel displays have a similar matrix of pixels, but individual pixels in these cannot be varied in brightness — they're either on or off. A flat-panel display which has the same number of pixels as a CRT and which can display scenes with the same clarity still cannot match the CRT's contrast variation over the scene.)

Colour displays can be made by replacing the single electron gun with three. Each gun of a colour CRT produces an electron beam which strikes phosphor 'dots' of only one of three colours: red, blue or green. To make sure each beam only strikes dots of its allotted colour, a shadow mask is positioned between the guns and the screen (Fig 2).

A CRT's display accuracy — the resolution — is determined initially by the size or pitch of the phosphor dots on the screen. But, in turn, this is governed by the accuracy of manufacture and positioning of the shadow mask: it is, therefore, the shadow mask itself which is of prime importance to a CRT's resolution. Modern high-resolution CRTs are made with pitch sizes down to

about 0.2mm.

Compared with typical TV standard CRTs, which are at least three times the former's size, such high-resolution CRTs are capable of great clarity and detail. Needless to say, the extra accuracy required in the manufacture of high-resolution CRTs makes them much more expensive than standard ones; nevertheless, they are used with a number of personal computers — typically IBM and Apple models.

The CRT's ability to display virtually any kind of colour or monochrome image to a high resolution, in a wide range of environments, has meant that it has been, and will be for a long time yet, the most used computer and TV display device. But it does have a number of significant disadvantages.

For a start, a colour CRT can consume anything up to 200 watts of power. Secondly, it's big — its depth is often greater than its viewing area dimensions — and heavy. And thirdly, it's not particularly rugged and can be damaged quite easily in transit. All these factors prevent the CRT's use in truly portable computers — and portable micros are becoming increasingly popular so the race is on to find smaller displays with much lower power consumptions, which are more robust and lighter.

Indeed, in this respect, the CRT is undergoing a certain upheaval. You've only to consider the use of flat-screen CRTs in Sony's Watchman pocket monochrome TV and Sinclair's equivalent to realise this. The principle of Sinclair's CRT is to position the electron gun at the side of the screen, so that the electron beam moves parallel to the screen before being deflected back, away from the observer, to strike a phosphor-coated screen at the rear of the CRT. A cross-sectional plan view of Sinclair's device is shown in Fig 3.

A number of other manufacturers are developing flat-screen colour CRTs; notably Philips, and ITT with Siemens in a joint venture. The Philips CRT consumes only a few watts of power, too: a significant further advantage over conventional tube design. It will surely be just a matter of time before portable micros, portable TVs and even portable video recorders feature flat-screen CRTs. ICL's One Per Desk micro was originally conceived to use Sinclair's flat-screen CRT as its display device (see the Benchtest in *PCW*, December 1984).

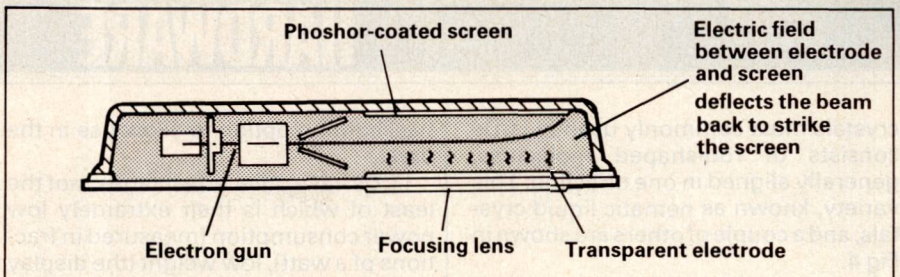


Fig 3 Cross-section of Sinclair's flat-screen CRT

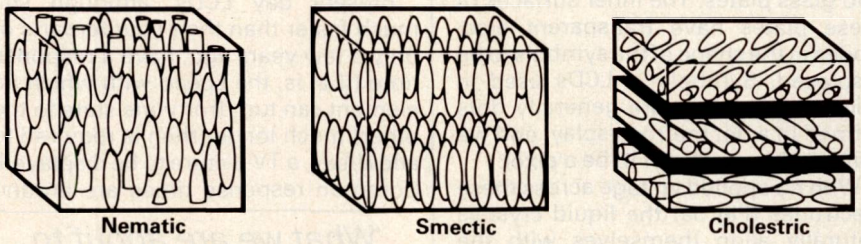


Fig 4 Differing types of liquid crystal molecule alignment

Liquid crystal

Moving on to the newer flat-panel displays, as opposed to the flat-screen adaptions of an old CRT technology, the first flat-panel technology to take off and find usage in portable computers was the liquid crystal display (LCD). LCDs were initially used in lapheld portable micros such as Epson's HX-20, the newer PX-8 and Tandy's Model 100, although these micros are limited in the size of their display (the Epson PX-8 can only display eight lines × 80 characters). However, the micro market has recently seen the introduction of larger LCDs featuring, for example, 25 lines × 80 characters. ACT's new Apricot Portable (although not a lapheld computer) was the first to use such a display. The first true lapheld micro using this size of display (both LCDs are from Hitachi, incidentally) is Data General's One (see the Benchtest in *PCW*, December 1984).

No doubt as display manufacturers produce larger and larger flat-panel LCDs, they will be incorporated into micros. Interestingly, the first manufacturer to build a 25-line × 100-character LCD was Epson.

Liquid crystals are organic materials which are influenced by electric fields. Their name arises from the fact that their molecules are free to move (as a liquid's) but grouped in orderly fashions (as a crystal's). The variety of

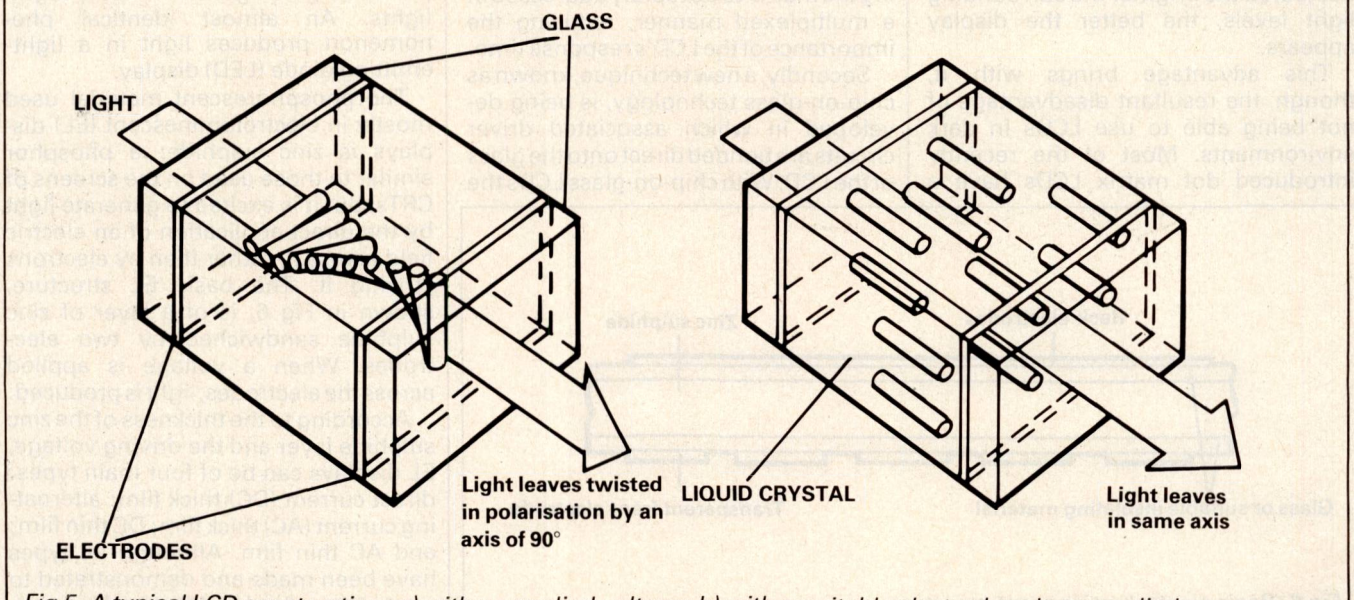


Fig 5 A typical LCD construction: a) with no applied voltage; b) with a suitable electrode voltage applied

crystals most commonly used in LCDs consists of rod-shaped molecules, generally aligned in one direction. This variety, known as nematic liquid crystals, and a couple of others are shown in Fig 4.

A typical LCD construction is illustrated in Fig 5. Basically, a layer of liquid crystal material is sandwiched between two glass plates. The inner surfaces of these plates have transparent electrodes in the shape of the symbols to be displayed. Symbols in LCDs used in micro applications are generally dots formed in a dot matrix display, and we can consider each dot to be a pixel.

With no applied voltage across these electrodes (Fig 5a) the liquid crystals naturally align themselves with the electrodes. In a twisted nematic LCD the electrodes are polarised at 90° to each other in the same plane, so the molecules closest to the electrodes are similarly at 90°. Successive layers of molecules gradually twist through the 90° difference between top and bottom. Light passing through the construction does so with a similar 90° of polarisation twist along the helix of the liquid crystal molecules.

When a suitable electrode voltage is applied (Fig 5b), the twisted nematic structure is broken and the molecules all become aligned along the light axis.

If a polarised filter is placed in front of the LCD, light of one axis will pass through and the pattern defined by the electrodes is invisible. In the other axis, however, the light will be blocked by the polarising filter and the pattern will appear dark. Thus, by turning the applied voltage on or off, the LCD symbol can be made invisible or dark.

Unlike most other display technologies, LCDs do not create light: they are passive and can only affect the way incident light is transmitted and reflected, so the brighter the surrounding light levels, the better the display appears.

This advantage brings with it, though, the resultant disadvantage of not being able to use LCDs in dark environments. Most of the recently introduced dot matrix LCDs have a backlighting option to allow use in the dark.

LCDs have other advantages; not the least of which is their extremely low power consumption (measured in fractions of a watt), low weight (the display used in the Apricot Portable weighs about 450g) and small dimensions (about 15mm deep).

Present day LCDs, although still much faster than their counterparts of only a few years ago, have a response time (that is, the speed with which an element can turn from one state to the other) much longer than is required to allow, say, a TV picture to be displayed. Common response times are around 300ms—which is fine for alphanumeric or simple computer graphics displays, but not much else. Even the latest Epson display, mentioned earlier, is reported to have a response time no faster than about 180ms.

'What we are about to see . . . is a break from the traditionally used CRT display device to the use of many other types of display. These displays will primarily be used . . . for a specific purpose . . .'

Future generations of LCDs, on the other hand, will probably include one or both of two additions which will reduce apparent response times and make them generally easier to use. Firstly, the addition of a thin-film transistor (TFT) at each junction between rows and columns of the matrix. The TFTs are used as fast acting bi-stable switches allowing the matrix to be rapidly addressed in a multiplexed manner, reducing the importance of the LCD's response time.

Secondly, a new technique, known as chip-on-glass technology, is being developed in which associated driver circuits are bonded direct onto the glass of the LCD. With chip-on-glass LCDs the external contacts will number only a handful: power supply and data. At present all the driving circuits are mounted on printed circuit boards placed immediately behind the LCD and many matrix connections must be made between the two.

Colour graphics LCDs are possible, operating by a number of methods. One of the most promising, pioneered by Seiko, uses coloured filters electro-deposited over each individual pixel's electrode. A pure white backlight shines through the LCD. Coloured pixels are arranged in groups of three: red, green and blue. By turning each pixel on or off, coloured light is transmitted or blocked.

It shouldn't take long to calculate that by turning on or off a total of three coloured pixels, only eight colours are possible, including black and white. Nevertheless, very good computer graphics displays are possible. The first display of this type is available from Seiko and it is inevitable that lapheld micros with colour display capabilities will soon be in the High Street shops.

Not to be outdone, Epson (which is, incidentally, a subsidiary of Seiko) manufactures a colour LCD based on this filter design which uses TFTs to turn on each coloured pixel. This display is used in Epson's pocket colour TV, recently launched in the US. Unfortunately the TV isn't being introduced in the UK, but the LCD itself is soon to be available on a component basis — so, we may still see a pocket TV to UK standards using this LCD.

Electroluminescence

Electroluminescence occurs when certain phosphorescent materials are influenced by an electric field. You may already have seen the effect used to provide a green glow in nursery nightlights. An almost identical phenomenon produces light in a light-emitting diode (LED) display.

The phosphorescent material used mostly in electroluminescent (EL) displays is zinc sulphide; a phosphor similar to those used on the screens of CRTs, but it is excited to generate light by the direct application of an electric field across it, rather than by electrons striking it. The basic EL structure, shown in Fig 6, is of a layer of zinc sulphide sandwiched by two electrodes. When a voltage is applied across the electrodes, light is produced.

According to the thickness of the zinc sulphide layer and the driving voltage, EL displays can be of four main types: direct current (DC) thick film; alternating current (AC) thick film; DC thin film; and AC thin film. Although all types have been made and demonstrated to work, it's only the AC thin film type which has been developed to the stage

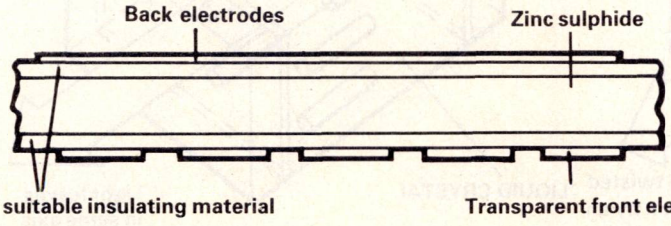


Fig 6 Basic electroluminescent structure

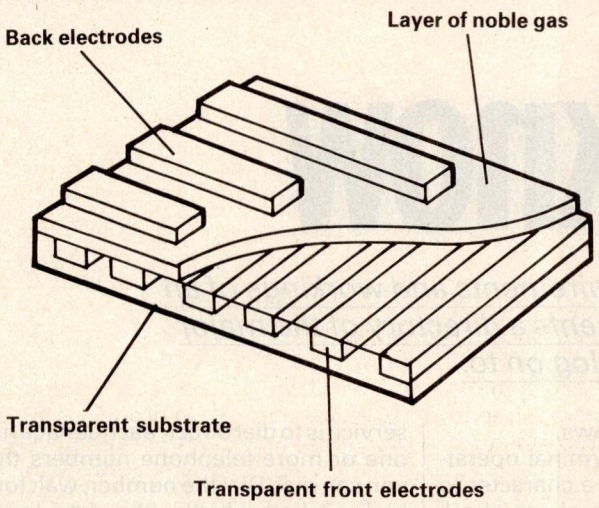


Fig 7 a *DC plasma display;*

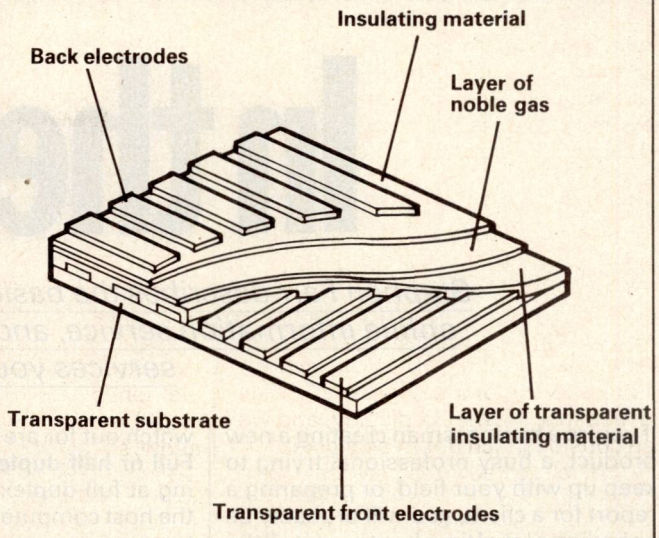


Fig 7 b *AC plasma display*

where reliable displays with sufficiently long life can be achieved.

The company predominant in the development of EL flat-panel displays is Sharp. Its most well known and successful EL display is used in the Grid Compass micro (see the Benchtest in *PCW*, June 1984), giving a dot matrix alphanumeric capability of 25 lines × 80 characters, and graphics.

There is significant developmental work going ahead with EL technology, and it looks plausible that it will soon be suitable for use as the basis for an alternative to the CRT as a TV display. One Japanese company has already reported an EL display made by overlaying three coloured EL thin films to produce a colour display, and Sharp has demonstrated a possible monochromatic EL TV display panel.

Plasma gas discharge

A number of different methods of making plasma display exists, but all work on the principle of the breakdown of a noble gas upon application of a high voltage across electrodes. The gas breaks down into a plasma and gives off light; the most common example of which is the neon indicator, used to show the presence of mains power in many electrical appliances.

The two main varieties of plasma display differ fundamentally in the voltage applied to break down the noble gas. In the DC plasma display (Fig 7a) the electrodes are in contact with the gas, while in the AC plasma display (Fig 7b) the electrodes are close to the gas but isolated from it.

Manufacturers such as Burroughs, Fujitsu and Sony have developed plasma technology to the extent that extremely high resolution displays can be made for alphanumeric or graphics purposes. Indeed, one DC plasma display is reported to have 256,000 pixels in a 640 × 400 dot matrix format, giving an on/off resolution equivalent to standard quality CRTs.

Despite such possibilities, flat-panel plasma displays have many disadvantages which have yet to be tackled. For example, the voltages required to cause gas breakdown are high. It's a non-solid state glass envelope nature and can't possibly be as rugged as LCDs or EL displays. Furthermore, manufacturing costs are high, although modern production techniques have already shown ways of getting around this problem.

Vacuum fluorescence

Vacuum fluorescent displays (VFDs) operate in essentially the same way as CRTs: that is, an electron beam is fired across an electron gun to strike fluorescent material on a glass screen. Also, the whole structure is contained within an evacuated glass envelope. The main difference between CRTs and VFDs is simply the fact that the fluorescent material of a VFD is positively charged to attract the electrons within the beam. A controlling grid close to the electron gun passes or blocks the electron beam, selecting which bit of fluorescent material is struck.

You could argue from this description that VFDs should be described as flat-screen displays, rather than flat-panel, but the fluorescent screen is of a dot matrix 'panel' form in which individual dots can be accessed and illuminated.

Dot matrix VFDs of up to about 75,000 pixel dots have been manufactured but the displays are quite expensive. The potential for high-quality graphics, if not TV capability and colour displays, exists for VFDs, and the fact that the brightness of each dot may be controlled is a distinct advantage over the flat-panel displays with their on/off dot illumination.

Whether or not manufacturers see this non-solid state, vacuum-and-glass technology as being worth improving, to the point of mass production and lower cost, remains to be seen.

Conclusion

What we are about to see over the next few years is a break from the traditionally used CRT display device to the use of many other types of display. These displays will primarily be used solely in equipment built for a specific purpose: for example, lapheld/portable micros, but this is only because the alternatives to the CRT are more expensive or of lower quality. Eventually, however, price will fall and quality will rise to the extent where flat-panel displays will be used in most situations where the CRT is currently exploited.

In the short term the CRT will be used at the bottom and top of the micro scale: as a TV-based display device for home or personal computers, or as a high-resolution display for graphics. During this time, flat-panel displays, as described here, will be more fully exploited as they reach their full potential.

In the long term, however, as TV displays become of non-CRT origin, the CRT will be 'kicked upstairs' to the very top-of-the-range systems, where highest resolution and detail are required. It is unlikely that new flat-panel displays will ever be able to outperform CRTs in these situations, but they will soon be able to compete with TV CRTs, and they can already be compared with CRTs for graphics and alphanumeric displays.

Which are the displays of the future in the computing world? There's no doubt that LCDs are hard to beat in terms of portability and low power consumption, and for the next few years at least they will form the heart of lapheld portable micros. But, in my opinion, it will be the EL display which eventually takes over from the CRT as the main computer display device.

In the know

Stephen Farr describes the basic requirements and workings of an online information service, and presents a directory of the major services you can log on to.

If you're a businessman creating a new product, a busy professional trying to keep up with your field, or preparing a report for a client, you will probably be spending a lot of time hunting out all the latest books, magazine articles, reports, statistics, and so on in order to glean essential information. Perhaps you take a professional journal or trade paper — are you aware that there are probably 50 others in your field? You know that the government has changed the regulations governing your area of business, but when do they come into force?

We are all caught up in the information explosion, the vast ocean of published material that is growing faster than our ability to seek it out and assimilate the information that is important to us. Increasingly, the information professionals — publishers, booksellers, librarians and others — have turned to computers to help them grapple with the intractable problems of taming the gush of printed information. Many of the systems and databases they use are available to you providing you have a telephone, a modem and some suitable communications software for your micro. Using the PSS network it is possible to access databases in Britain, Europe and the US at a reasonable cost. Most of these databases are not cheap to use and you will have expensive tastes in entertainment if you access them just for fun, but if time is money and the information is vital then the cost is worthwhile — don't forget, your time is expensive. Furthermore, many of these services only charge you for the use you make of the system, and make no subscription or standing charge.

The basic requirements are: a terminal; a telephone; a modem; access to the British Telecom Data Communications service, PSS; and access to one or more of the main online information services — Dialog, IRS, Datastar or Blaise.

The terminal

Most services were set up in the good old days of teletypes and teletype VDUs, so there are no graphics or fancy cursor movements to worry about and the terminal emulator software for your micro can be fairly basic. Points to watch out for are as follows.

Full or half-duplex: a terminal operating at full-duplex sends a character to the host computer which echoes it back to your screen so you can see that it has been received. Half-duplex sends the character to the screen straight away, so if your host computer is working at full-duplex and your terminal is set at half-duplex 'AALL TTHHEE IINNPPUUTT IISS DDOOUUBBLLEEDD.'

Parity: a fairly basic way of checking that characters have not lost a bit or two on their way to the computer. If you use the wrong parity setting you get a screenful of rubbish.

Speed: the speed at which you communicate with the main computer is measured in bits per second, otherwise known as the baud rate. The three main baud rates for accessing databases over the telephone network are 300, 1200 and 1200/75.

The modem

There are now a number of BT approved modems on the market for accessing Prestel, Micronet and other databases. Most of the cheaper modems operate at 1200/75 baud full-duplex which is the Prestel standard, and 1200/1200 baud half-duplex for communication with other micros.

In order to use one of these modems, your telephone must have one of the new plug and socket connection points. The alternative to a wired modem is an acoustic coupler which has rubber cups for the ear and mouth pieces of your telephone handset. Couplers often use the lower 300 baud speed, as the noise generated by poor ear and mouth pieces can cause considerable problems at the higher speeds. Only standard handsets will fit an acoustic coupler, so if you have a Trimphone or other non-standard phone you will have to use a modem. If you have a socket installed, for a little extra cost you can have an extension socket in your usual micro room so that you don't have to move the micro to the hall.

Logging on

Have your terminal software set up, and your modem and telephone at the ready. The simplest way to access a service is to dial direct; each service has one or more telephone numbers that you can dial. Dial the number, wait for a high-pitched whistle (the data tone), switch your modem to DATA and you will get straight into the service's logon procedure. Input your password and away you go.

However, direct dial can be an expensive option if you live any distance from the dial-up node of the service you are accessing. If you are going to use a variety of information services, it may well be worth the expense of getting access to British Telecom's PSS data network. PSS has nodes in a number of major towns around the country, and having dialled your local node and put in your NUI (network user identifier) you can access various services by inputting their NUA (network user address). PSS charges for your NUI and for the use you make of the network, but the charges are competitive with the telecommunication charges of the various information services.

Once you have got through to the computer you are accessing, PSS will confirm that you have made contact and will then leave you to complete the logon procedure of the computer in question. This is usually along these lines: the computer displays a welcome message and asks for your password — sometimes there is a user ID to input as well; you input your password, and so on; the computer accepts your password and you are logged on (you start paying from this point).

You will now be in the waiting area of the service you are accessing and should request the database you require. Having accessed the database, you can begin searching using the command language of the service you are using. When you have finished, you logoff from the service. This will automatically clear the PSS call (if you are using PSS).

Many services will automatically log you off if the telephone connection is broken, but beware! There are some systems that will make connect time charges until the computer times you out, which may be up to 20 minutes later. Remember the golden rule: don't

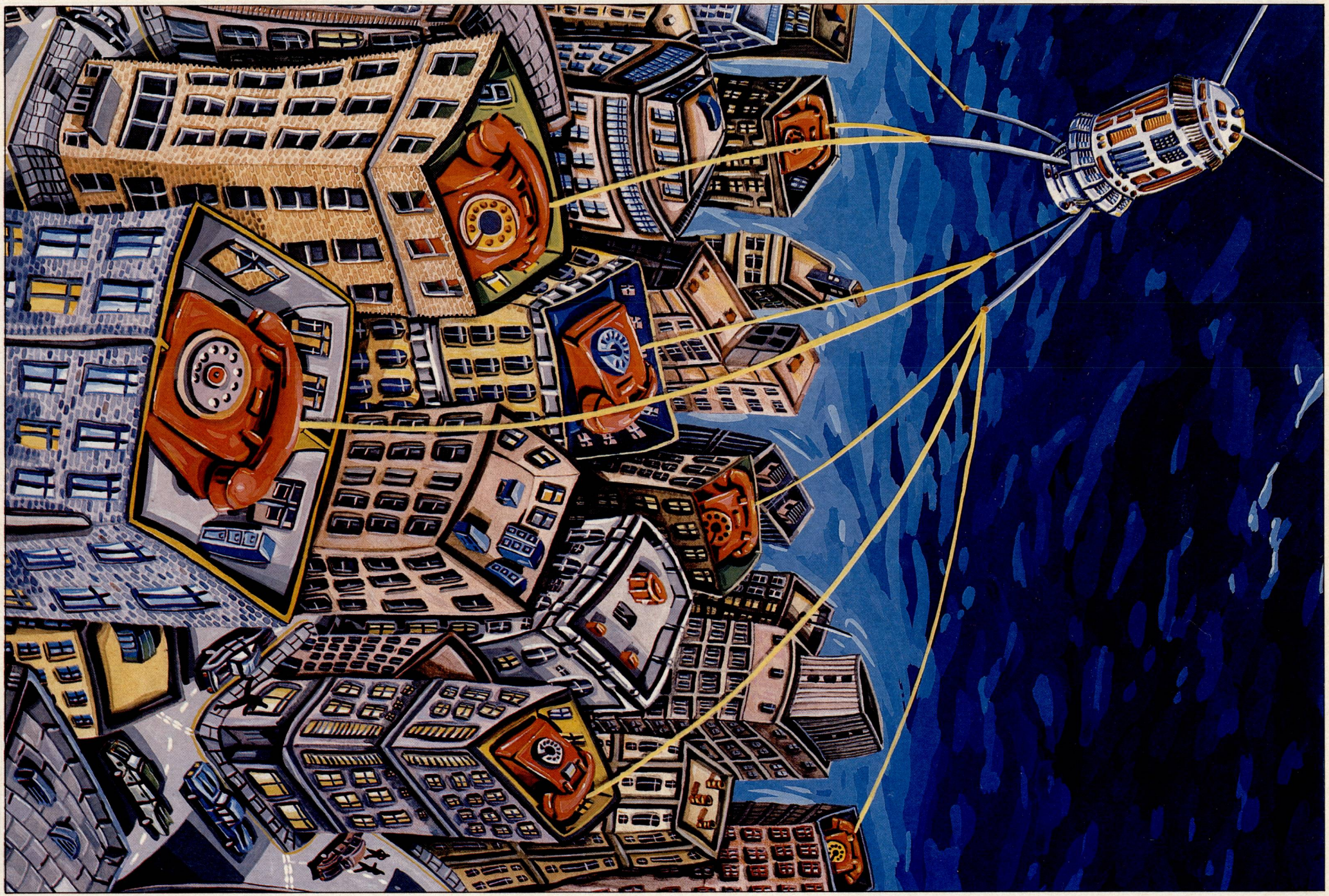


Illustration by Mark Rowney

get into anything that costs money until you are sure you know the command that gets you out.

Many online information systems are a lot less friendly than Prestel and are command rather than menu driven. There are online Help facilities, but as you are paying for every second you are online, you don't want to spend time using these if you can avoid it. Learn the basic commands of the system you are using, and keep the reference card that is supplied by most systems near you as you search. The basic commands are:
to enter the file you wish to search — Begin nnnnnn, Select nnnnn, and so on;
to search for a word in the database — Select, Find, Question, and so on (the system finds the records containing the word you have input, puts them into a set and tells you how many it has found);
to print out records at your terminal — Type, Show, and so on;
to print out records at the computer centre — Print, Printoff, and so on (printing records offline saves a lot of connect time and is economical if you have retrieved a lot of information);
to logoff the system — Logoff, Stop, . . Off, and so on.

Don't get into anything you can't get out of!

The basic unit of any database is a record, and a database or file in the systems we are looking at is a collection of records. *Note: we are not talking about DMBSs or relational databases.* Each record is split up into a number of sections or fields.

A typical record might look like that shown in Fig 1.

In simple terms, the system takes each word of the title, the abstract and the indexing terms, and puts them into an index. Each term in the index is cross-referenced to those records which contain the term.

When you input the search term at your terminal, the system searches the index and responds with the number of cross references of 'hits'. For example:
?SELECT MICROCOMPUTER
1 5013 MICROCOMPUTER
That is, 5013 records contain the term microcomputer and these records are held as set 1.

Due to the cross references from the index including details of which field within each record the term occurs in, it is possible to limit your search to just the subject headings or descriptors. For example;
?SELECT MICROCOMPUTER/TITLE
2 153 MICROCOMPUTER/TI
That is, 153 records contain the term microcomputer in the title and these records are held as set 2.

Usually, the relevance or accuracy of a search is improved by searching just the title or just the indexing terms, but conversely, the number of items retrieved, or recalled, is reduced.

So far we have searched for the term MICROCOMPUTER, but we might be interested in MICROCOMPUTERS in the plural as well. The use of a variable character symbol is useful in retrieving variant forms of a word. For example:
?SELECT MICROCOMPUTER?
3 5178 MICROCOMPUTER?
That is, 5178 records contain words with the stem MICROCOMPUTER and these are held as set 3.

Multiple term searching

Programmers and mathematicians will be familiar with the Boolean operators AND, OR, NOT; these may be used to combine a number of search terms into a comprehensive and specific search profile. The first step is to identify the main concepts of the enquiry. For example:
Marketing techniques in America
contains three concepts:
MARKETING
TECHNIQUE
AMERICA

Each of these can be expanded with associated terms. For example:

MARKETING, ADVERTISING, PROMOTION, SELLING
TECHNIQUE, METHOD
AMERICA, UNITED STATES, USA

We need not be pedantic about the associated terms but you have to be careful of terms that have a variety of connotations: for example, PROMOTION. Having identified the concepts and terms, the Boolean operator OR is used to link the associated terms, as in Fig 2.

SELECT MARKETING OR ADVERTISING OR SELLING
1 15113 MARKETING OR ADVERTISING OR SELLING
SELECT TECHNIQUE OR METHOD
2 568 TECHNIQUE OR METHOD
SELECT AMERICA OR UNITED STATES OR USA
3 10058 AMERICA OR UNITED STATES OR USA
Fig 2 OR being used to link associated terms

We appear to have retrieved far more references than anyone could reasonably wish to read, but here comes the clever bit. To answer the specific enquiry
Marketing techniques in America
we combine the three sets using the Boolean AND operator thus:
?COMBINE 1 AND 2 AND 3
4 32 1 AND 2 AND 3
That is, 32 records contain MARKETING or associated terms together with TECHNIQUE or associated terms together with AMERICA or associated terms.

It's not all that clever because although each record contains the required terms, there is no guarantee that what is retrieved is exactly what you want. The final stage, evaluating the results, is still up to you.

By now you are all agog to find out what the computer has found for you, so you must use the online print command which may be like this:
?TYPE 4/5/1
That is, type at my terminal the first record of set 4.

The digit 5 is a format code. Most systems will print a variety of formats, as many people do not wish to spend time printing out the full record when all they want to see are the title and publication details. If you have a printer you can print off all your results and use them immediately, but this can be an expensive option as you are paying for every minute and printers are notoriously slow.

The alternative is to request an offline printout which is produced at the host computer centre and mailed to you on the day of the request. This saves a lot of money on big printouts but you have to wait several days for your results, and some non-bibliographic systems like Textline and Eurolex do not have an offline print facility.

A third alternative, using a micro, is to download records into memory and out

Accession 78-08233 ABI/Inform Journal paper 7800233
Title Paradigm development in the social sciences: a proposed research strategy
Author Mackenzie, Kenneth D; House, Robert
Journal Academy of Mgmt Review v3n1. Pub date January 1978
Abstract The paradigm development strategy is a technique used to develop theories about difficult to define subjects, such as the social sciences. This technique involves obtaining generalised data and using it to identify general laws or theoretical framework . . .
Controlled terms: THEORY/Development/SOCIAL/STUDIES/TESTING/SOCIAL SCIENCES/RESEARCH/STRATEGY/Experiments/Control
Fig 1 A typical record

to disk which allows you to select and reformat records for various purposes: for example, for inclusion in a word processed report.

Online information systems are a powerful way of searching out information on a whole variety of subjects. Although not cheap, with careful technique and preplanning it can be very cost-effective when measured against the time needed for searching through paper indexes. Careful analysis of the enquiry is necessary before going online: an unstructured approach is liable to result in a mass of irrelevant information.

Major services

Blaise
2 Sheraton Street
London W1V 4BH
Tel: (01) 636 1544 ext 242
Blaise is the information service of the British Library. Its major file is the UK MARC file which is the official catalogue of all books published in the UK since 1950 and corresponds to the British National Bibliography. Other files of importance are: the Helpis catalogue of audio visual materials; and the new Whitaker file which corresponds to the major book trade publications of J Whitaker and Sons.

There is a subscription to Blaise which is currently £45 per annum, but connect charges are relatively low.

Datastar
199 High Street
Orpington BR6 0PF
Tel: (0689) 38488
Datastar's parent organisation is *Radio Suisse* in Berne. It is very similar to the BRS service in the US and is strong in biomedical databases, having Medline, Exerpta Medica, Psychinfo, Hoppenstadt and Martindales available. Business databases are also very well represented.

Good features of the Datastar system include a powerful query language, and the ability to search the whole of the databases of one organisation under one file: for example, the Predicasts databases can be searched under the PTZZ label. Offline prints generally arrive within three or four days of request.

Dialog
PO Box 8, Abingdon
Oxford OX13 6EG
Tel: (0865) 730969
Dialog is by far the largest of the host organisations with over 250 databases in its current catalogue. Dialog is based in Palo Alto, California, and began life as the information service of the Lockheed corporation. Dialog is a massive international operation, and is noted for the quality of its training and documentation. It also has document delivery arrangements with many of the database producers so that you can request documents online. The range of Dialog databases is so comprehensive that many people use Dialog exclusively.

However, slight disadvantages in using Dialog are: it is slightly more expensive to use than some services; and offline prints take a little longer to cross the Atlantic than prints coming from Europe. Of particular interest to micro users are the databases of computer software, and the Computer database which indexes literature on all aspects of computing.

Dialog has recently introduced a new off-peak service called Knowledge Index. This can be used after 6pm weekdays and after 1pm on Saturdays. The service allows access to a subset of about 25 of the Dialog databases at a greatly reduced connect hour rate, although there is a startup fee of £25. The databases are the same as their Dialog counterparts.

IRS-Dialtech
Department of Trade and Industry
Room 392, Ashdown House
123 Victoria Street
London SW1E 6RB
Tel: (01) 212 5638
Dialtech is the UK host of the European Space Agency Information Retrieval Service which is based at Frascati in Italy. ESA is one of the largest hosts in Europe and is very similar to Dialog, but has some interesting extra features including a zoom facility for text analysis which is very useful for identifying alternative search terms. ESA's query language also allows specification of fields to be searched after the establishment of a set, which is useful for making a search more precise when you have retrieved more material than you first bargained for.

Pergamon Infoline
12 Vandy Street
London EC2A 2DE
Tel: (01) 377 4650
Pergamon Infoline is another UK-based service with a good range of databases. It is particularly strong in trade databases like the packaging database PIRA and Electronic Publishing Abstracts. Business information is also well served with the online version of Dunn and Bradstreet's standard reference work, Key British Enterprises. There are also a number of patents databases.

Eurolex
European Law Centre
4 Bloomsbury Square
London WC1A 2RL
Tel: (01) 404 4300
Eurolex is a full-text legal information service, and contains the full text of many series of law reports together with a number of files on European Community legislation. Searching full-text databases is different to using databases with shorter records, as there are many more occurrences of the key words that you use as search terms.

A useful device for lawyers that is available on Eurolex is the ability to print out the context of a particular legal term whenever it occurs in the text of a law report.

Scicon
Brick Close
Kiln Farm
Milton Keynes MK11 3EJ
Tel: (0908) 565656
Scicon offers a number of databases, the most important of which is the POLIS parliamentary database; this gives access to all parliamentary publications including the full text of Hansard, Parliamentary Questions, Parliamentary Papers and Legislation. Scicon also offers the DHSS data and URBALINE databases.

Textline
Finsbury Data Services Ltd
68-74 Carter Lane
London EC4V 5EA
Tel: (01) 248 9828
Textline is a database assembled from a variety of international press sources, including major daily newspapers such as *The Times, Financial Times, Le Monde, Die Welt, El Pais,* and so on, and also major business journals such as *The Economist* and the *Wall Street Journal*. Items are indexed and summarised into abstracts. It is possible to search Textline using company mnemonics and standard industrial classification codes, as well as using keywords.

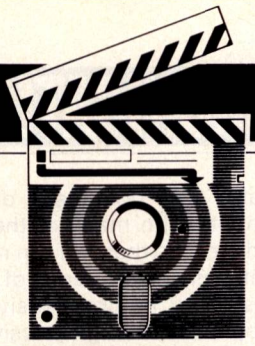
Finsbury Data Services also offers Newsline, a current awareness-type service, and Dataline, a database of company accounts information.

Conclusion

The services mentioned here are only some of the online information services currently available. There are a number of specialised services, such as Datastream and World Exporter, which are available for the cost of a substantial subscription and offer analysis as well as information retrieval.

Mention should also be made of the Lexis service for legal information, which is the UK version of the giant American Lexis service from Mead Data Central. Lexis is also a subscription service and uses a dedicated terminal for access.

Anyone seeking specialised database services should consult the *EUSIDIC Database Guide*, published by Learned Information, which is one of the more comprehensive directories of database services. END



SCREENTEST

Power-base

Power-base is a hefty data management package which includes facilities for handling complex problems. Aimed at the novice user, is it helpful? Kathy Lang finds out.

Most people who consider using a data management or database management package already have a manual system based on one or more conventional card indexes. You may have large numbers of clients' names and addresses which you wish to store, keep up-to-date and print, or you may be processing personnel or stock records — there are a thousand and one ways in which manual card indexes are used, and which are candidates for computerisation. Where you have a single card index to automate, the process should be relatively simple, and there are several good, inexpensive packages on the market (for example, DMS+ or Friday!) which will work well for you.

Such packages will not, however, meet your needs if you have several sets of related information. For example, you may need to keep files recording the names and addresses of all your suppliers, and also information about each product you sell. Every supplier supplies more than one product, and each product is available from more than one supplier. In a manual system you would probably have one card index of products, where each contained just the name of the supplier of each product, together with a second card index giving details of each supplier (address, delivery charges, credit information, and so on).

In a flat-file system such as DMS+ or Friday!, in which different sets of records may not be connected together, there is no easy way to handle this situation. You could have two separate files, and close one before you look up the other, which would lead to a lot of paper jottings — just what you were trying to avoid. Or you could store all the information in one file, keeping the full information about the supplier with every product; a solution which would be very wasteful of space and liable to error since much information would be duplicated.

Many packages now allow you to relate two or more files together in ways which would make this application much easier to implement. Examples range from Files & Folders, Pearl and Rescue 3 at the less expensive end of the market, to dBaseIII, Everyman and Sensible Solution at the upper end. On the whole, the more expensive packages have more facilities but are harder to use. No one package has all the features you really need to handle this type of problem, while at the same time being really easy to use for someone with little experience of computers.

So it was with considerable interest that I turned to Power-base, an American package which has been available over here for a short while, and which has just been issued in its second edition with the addition of several features vital to its success as a system for handling complex data management problems. In addition, Power-base appears to be aimed squarely at the novice user, using menus to give instructions, and with a full set of tutorials including example applications; the documentation is among the best I've seen.

'Power-base appears to be aimed squarely at the novice user, using menus to give instructions, and with a full set of tutorials . . .'

Power-base uses a technique called power-zoom to link sets of records together. This allows up to 10 levels of linkage to be active at any one time — there is no overall limit to the number of sets of records which can be linked. Zooming is permitted both onscreen and when printing reports.

In addition to the range of features you would expect from a package at this level — screen and batch amendment of information, formatted reports, links to a variety of other types of file used for spreadsheet analysis and word processing, multiple keys kept up-to-date — there are some neat and unusual features. For example, you can set up the system with two printers, and to specify which — draft or final quality — should be used for reports. Where you need your printer available most of the time, and must have a letter-quality printer for some of your work, the ability also to use a cheap and reliable matrix printer for the donkey work is very helpful. Not all packages make it possible to do this without, at the very least, switching plugs on the back of your computer.

At present, Power-base is available only for the IBM PC and AT (and needs a minimum of 256k memory), but there are plans to extend its availability. Since it does not use fancy graphics features, this shouldn't be too difficult.

Constraints

The major constraints and functions of Power-base are shown in Fig 1. Probably the most important concerns indexing, which is used to provide fast access to individual records, and to determine the order in which records are to be displayed. Three ways are provided to allow the system to look up in one file values which are to be used in another, namely the Look-up, Function and Table validation options. For example, when setting up invoices in a stock control/invoicing application, you might wish to find the price of a product by looking this up in a file of product information. The Function feature provides the ability to have a field whose value depends, not on the value of a field in another file, but on the average, sum, maximum, minimum or number of occurrences of that field across all records in the referenced file.

Table validation allows you to specify that only certain values are legitimate for a particular field, by referencing another file against which to check the value entered at the keyboard. In each of these cases, the field referenced for checking must be indexed, in addition to any fields which must be indexed for fast retrieval or to determine display order. A maximum of six fields in any file may be indexed; in complex applications, therefore, you might need to split information across files in order to give yourself sufficient index fields.

Other data types permitted include data, which take the American forms of MM/DD/YY or MM/DD/YYYY. In addition to the ability to look up in one file the values of fields to be used in another, you can also calculate fields from other fields in the same record.

File creation and indexing

The first step in setting up a Power-base data file is to specify the name, size and type of each field in the record; at the same time, you construct, by paint-a-screen techniques, the layout to be used when each record is displayed. You can add help messages for display during data entry. Since record definition and screen layout are firmly linked, you cannot have several different 'masks' for a file which contains a mixture of confidential and public information. Nor can you avoid the problem by keeping the two types of information in separate files and zooming between them, since Power-base provides no constraints against unauthorised access. The display of one record may not span more than one screen. The zoom features do, however, provide an alternative solution to the problems of screen handling of large files; you would split the information between the two files, with one display screen for each, and a zoom between the two.

Maximum file size	65,534
Max record size (ch)	1600
Max no fields	64
Max field size	80
Max digits	15
Max prime key length	80
Special disk format?	N
File size fixed?	N
Link to ASCII files?	YV
Data types	N,C,D,L,$,R,F
Fixed rec structure?	Y
Fixed record length stored?	Y
Amend rec structure?	CO
Link data files?	Y
No data files open	UL(10 deep)
No sort fields	5
No keys	6
Max key length (chars, fields)	80,80
Subsidiary indexes kept up-to-date?	UTD
Data validation	G
Screen formatting	P
Unique keys	No
Report formatting	D
Store calculated data	IN,BA
Totals & statistics	S
Store selecn criteria	N
Combining criteria	A,O
>1 criterion/field?	Y
Wild code selection?	SW
Browsing methods	AK
Interaction methods	M,C
Reference Manual+	****
Tutorial Guide+	****
Reference Card+	*****
OnLine Help+	***
Hot-line?	D

Fig 1 Features and constraints

When setting up a field definition, you may specify that the field must have a value entered, or that the value must be unique (in which case the field will automatically also be indexed, further restricting the number of indexes available). You may also specify a default value for a field, which may be a constant, or a repeat of the same field in the previous record, or the system date.

Fields whose values are obtained by being looked up in another file, via the Look-up and Function options, may either be stored in the target file or derived afresh each time. If they are not stored, they may not be used to provide the zoom link between two files, nor may they be indexed or used in criteria for selecting records when processing subsets. Calculated fields, which derive from fields in the same record, are never stored, but neither is their use restricted in these ways.

If you change your mind about the structure of a set of records, or wish to index on additional fields, you can make such changes after data has been entered, but to do this Power-base must copy the data file to the new format.

Data input and updating

Records may be entered or amended using full-screen editing facilities. When editing records which are linked to others through a zoom link, you can use zoom to move to the linked records and edit them, then zoom on or back, with nesting up to 10 levels deep. When editing a set of records with the same characteristics, Power-base allows you to save the current record and retrieve the next with a single keystroke. Retrieving records for updating can either be by means of individual indexed fields, or by stepping through a set of records. Stepping uses the order either of the first key field, or of the first key field in the current set of selection rules, thus you can effectively retrieve records by any field when editing in contrast with those packages which permit retrieval for this purpose only through the use of key fields.

In addition to screen updating, Power-base allows you to update a set of records in a batch. You can use this feature to recalculate the stored values of fields obtained via the Look-up or Function options (these fields normally reflect the current value of the Look-up source only if they are not stored, to prevent such undesirable events as increasing prices on the file copy of an invoice which has already been issued). You can also amend a batch of records in the same way, perhaps to increase the price of a range of goods by 10 per cent.

Screen display

Records are displayed for amendment using the format set up when the file is created; this format may also be used when viewing individual records. Sets of records may be displayed using the Power-base List option, which shows a specified set of fields from each record. Where the records will fit, using the length given for each field in the record definition, Power-base will display one record per line; otherwise, the records are shown with one field on each line. Or you may set up a formatted report, and have it displayed on the screen.

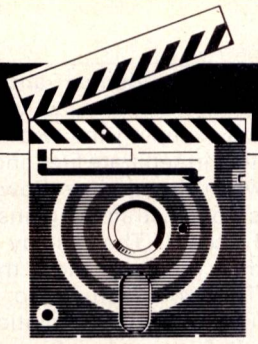
Printed reports

The basic formatted report features provided by Power-base allow you to have either one or two lines for each record, with the exact column widths determined by you if you wish. Where a character field will not fit on one line, Power-base will automatically wrap it round onto the next unless you countermand this. Where zoom links have been established, your report may include fields from more than one file. A report may include headings for the field columns, and a header and footer for each page. You can sort on up to five fields and have sub-totals printed when they change, as well as grand totals at the end. You can also specify, as an alternative, that each field in each record should be printed on a new line, or you can use the special option for producing mailing labels. Any report may be printed and displayed onscreen, or stored in a disk file. Report definitions may be saved for subsequent re-use and amendment.

Selection & sorting

When retrieving Power-base records for editing or inclusion in a list or report, you can set up a group of tests which must be passed in order for a record to be retrieved. These tests may be set up either by entering them in a *pro forma* record on the screen, or by entering a command line containing the necessary tests and combinations spelled out. Where you wish to include comparison of fields (rather than just testing fields against constant values), the latter method must be used.

The usual range of arithmetic operators are provided (less than, greater than, and so on), plus concatentation; for character fields, you can select using wild codes for both individual characters and for groups of characters. Tests may be combined with AND and OR, so you can specify that all must be passed, or any combination. Selection criteria cannot be saved except when set up for a report, when they are saved with the



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report definition. You may, however, either use the current set of criteria or revert to the set most recently used.

Power-base orders records in one of two ways. In reports, you can specify that the records be sorted on up to five fields, one within another. When Power-base stores records, they are indexed on the keys you specified when the file was created, and individual records may be retrieved for screen display in order on any one of these (keys may be a concatenation of several fields).

Calculation

Calculations are provided on entry and on update; you can also specify that results of calculations should be printed in reports. All calculations may use the usual arithmetic operators, with brackets to alter the order of evaluation if necessary.

Multiple files

I described earlier the Power-base features for extracting information from one file for use or storage in another, using the Look-up and Function options. The main method of relating files in Power-base uses the zoom features, which allow you to move among files by zooming along pre-established links. For example, if you had set up a system of files to deal with the supplier-product application referred to at the beginning, you would establish in the product record a field containing a supplier identifier, which would allow you to zoom from a product record to the record of one of its suppliers. Once there, you can step through all the records of suppliers of that product, then zoom back to the product record. Fields used for zoom links need not be indexed, but this does speed them up.

When working online you can zoom around your database at will, wherever the links allow you to go, constrained only by the limit of 10 consecutive zooms without unzooming.

In reports, however, there is a restriction: you can specify reporting on fields in the initial file, then zoom to another linked to it, and then on to another if such links exist. But you cannot unzoom to the initial record, and zoom again down another zoom path. Zooming also provides the only way of reporting on several files in the same report, so links must be established if only for this purpose.

Tailoring

Power-base provides a limited degree of tailoring for individual applications beyond the basic database facilities. You can set up menus to give access to individual files by creating a one-record file, each of whose fields zooms to a real file. There is also a simple testing feature which allows you to use the concatenation operator to determine whether, say, to print a debit or a credit message against a balance.

As it provides only a true/false test, this facility gives a very limited choice of action. There are no command language features, of the kind available in dBase or Sensible Solution, to allow you to store sets of actions and initiate them with a single keystroke through a menu option, and to choose different paths through these options according to flexible tests of the kind found in programming languages such as Basic.

Security & housekeeping

Power-base does not provide any protection against unauthorised access to data files.

It allows you to copy data files or file descriptions, and to delete data files within the current directory. You can change directories within Power-base, and the package automatically creates a separate sub-directory for each application under the directory in which the package is stored. (Normally this is called PB, but you can specify otherwise.)

All Power-base files in a single application must be in the same directory. There are provisions for accessing files from separate directories when importing or exporting files.

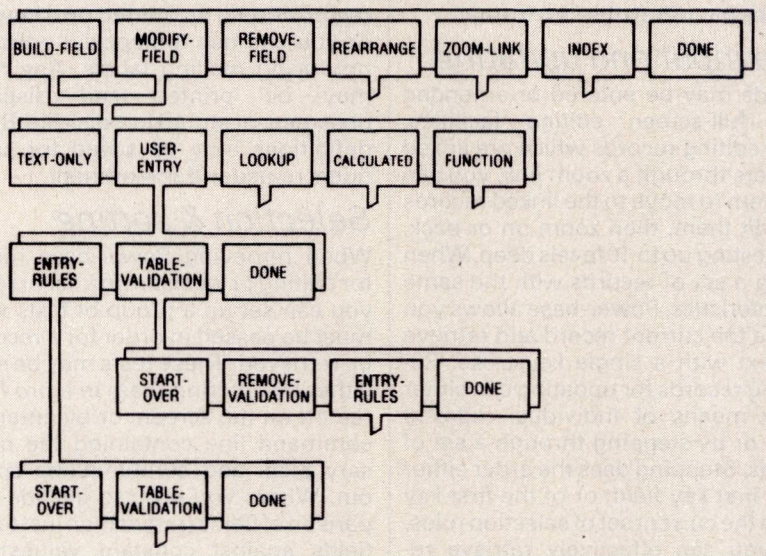
Links with outside

Power-base allows an unusually wide range of formats for files which are to be imported into the package or written out from it. The permitted formats include the usual comma-delimited format for mailmerge, the DIF™ format used by many spreadsheets, the SYLK format used by Multiplan, the dBasell file format, and others. Such flexibility should enable you to pass information in and out of Power-base more easily than with most packages—

Purpose

To define edit checks that data entered into a field must meet before Power-base will accept it, to enter a Help Message that will be displayed when ADDing-DATA or EDITing a field, and to define default values for a field.

Command Tree



Procedures

1. Select ENTRY-RULES.
2. The ENTRY-RULES screen appears. Default values are assigned to some of the parameters. Move the cursor to the parameter you want to use, and answer the question or enter a value, or a Help Message, if desired.
3. Select DONE to save the ENTRY-RULES specified and exit, or select TABLE-VALIDATION to save the ENTRY-RULES and define a TABLE-VALIDATION.

Fig 2 A typical page from the Reference Guide

even now there are many data management packages which cannot easily be linked with spreadsheets.

User image

For people who like using menus, Power-base is easy to use and provides its options in a sensible way. For example, at all times the options which could potentially be available are shown on the bottom of the screen, with those actually available brighter than those not at present applicable (for instance, because no zoom links apply to this file).

The currently chosen option is highlighted; options may be chosen either by moving this highlighting (with function keys or with the cursor), or by entering the first letter or two of the option name.

Function keys are used consistently: for example, F1 always means 'done', while the ESCape key can be used to abandon the current task. Another helpful provision for the error-prone is the START OVER option, provided during editing to allow you to abandon the changes made to the current record and refresh it with the filed version.

Some of the options are not very helpfully named: for example, EDIT-SCAN is the option for scanning data records and amending them, while EDIT-SELECTION allows you to enter or edit selection criteria (not choose which records to edit, as I at first thought). Such mistakes are actually not easy to make, since Power-base provides very good signposting of the menu options.

Documentation

The Power-base documentation is among the best I've seen. There is a good 'road map' to guide you through the location of the various menu options. The *Reference Summary* is a pocket card which includes not only a list of every menu option, but also various other items.

There are two manuals: the *Tutorial Guide* takes you through all the main Power-base features, using a set of example applications which come with the package, and also through setting up an application using several related sets of records. The *Reference Manual* includes an overview for people who already know a bit about data management, and a set of notes on 'advanced topics' (using particular aspects of Power-base which are more suited to experienced users), as well as a reference guide to each command. These are set out in a helpful and consistent manner. Fig 2 shows a typical page from the *Reference Guide.*

Conclusion

The developers of Power-base have made a valiant attempt to provide complex features for data management in a way that novice users can understand. On the whole they may have succeeded, although I fear that the sheer size (unavoidable for a package with such features) of both the package and the manual may put some off.

There are, of course, a few criticisms. The reporting features are still not as powerful as one would like, in particular the lack of a letter-writing feature, while the almost total absence of control features would prevent one from recommending Power-base as a system developer's tool.

Nevertheless, if you are relatively new to computing and a flat-file package is insufficiently powerful, you should find Power-base well worth a close look. Even for more experienced users, there is plenty of power there.

Benchmarks

BM1	Time to add one new record	Inst
BM2	Time to select record by primary key	Inst
BM3	Time to select record by secondary key	Inst
BM4	Time to access 20 records from 1000 sequentially on three-character field (same field as in BM2 key)	2secs/rec
BM5	Time to access record using wild code	Inst
BM6	Time to index 1000 records on three-character field	30m12secs
BM7	Time to sort 1000 records on five-character field	4m45secs
BM8	Time to calculate on one field per record and store result in record	5m17secs
BM9	Time to total three fields over 1000 records	7m43secs
BM10	Time to add one new field to each of 1000 records	30m37secs

Time to import a file of 1000 records: 13m28secs

Notes: NT=Not tested NP=Not possible +=including scrolling

Benchmarks recorded on an IBM PC/XT(H)

Summary

Supplier	Accent Computers Ltd
Telephone	(0444) 451324
Cost	£395
System	IBM PC
Version reviewed	2.0
Type	F,N
Features	Database management system allowing links among many files, up to 10 links active at once. Max six keys per file, kept up-to-date. Batch updating, reasonable reporting, excellent links to other file types: for example, spreadsheet (DIF and 1-2-3).
Drawbacks	Re-indexing tedious. Reporting not very powerful — no letter writer, limits on file linkage. No control structures.
Ease of use	Good: menu-driven, all options always shown. No extra online help, but usually self-evident. Manuals excellent.

In the February article on dBaseIII for dBaseII users, I made no mention of the small change to use of the ampersand variable convention. The documentation supplied with dBaseIII is highly misleading on this point, since it says (on page three of the Errata slip): 'In order to make dBaseIII as fast as possible, the ability to use &-macros in DO WHILE loops was eliminated.' This has been read by some as forbidding the use of &-macro variables in the code bracketed by DO WHILE . . . ENDDO statements, and by others as forbidding the use of &-macro variables in the conditions attached to DO WHILE loops. Neither interpretation is correct.

&-macro variables work normally when included in any statement within a loop. When used in a condition attached to a DO WHILE loop, they work correctly provided the name to which such a variable points is not changed during the course of the loop. (This small difference from dBaseII occurs because the condition is expanded to remove the indirection before the loop is executed.) The following examples should make clear the extent to which &-macro variables are permitted in conditions. My thanks to Mr Denis Udall of K Shoes for raising the point.

```
***This program works correctly,
   printing out "Hello" five times***
store "counter" to mtest3
store 5 to counter
do while &mtest3 > 0
store &mtest3-1 to &mtest3
? "Hello"
enddo
return
***This program goes into an infinite
   loop***
***because the new source for the &
   variable is ignored***
***in the Do condition, but is acted
   upon within the loop***
store "counter" to mtest3
store 5 to counter
store 2 to counter2
do while &mtest3 > 0
store &mtest3-1 to &mtest3
? "Hello"
store "counter2" to mtest3
enddo
return
```

END

Collective C

Les Hampson delves into arrays, pointers and structures as he examines C's data collection, in part four of our five-part Teach Yourself C series.

C provides powerful methods for handling collections of data. Arrays, as in most languages, can be used for items of the same type, but C goes further by providing structures to combine data of different types, and then arrays of structures or structures incorporating arrays, and so on. It also gives a very flexible way of manipulating data through the use of pointers.

At first acquaintance these might seem a bit of a mystery, not because the concept is especially difficult, but because they give complete freedom through direct access to memory.

Arrays

C allows arrays of any of the basic types and of items constructed from them, so multi-dimensioned arrays are simply arrays of arrays. Declarations:

```
int myarray[25];
  /* list of 25 int */
char str[256];
  /*a list of characters forming a
  string*/
int table[10][5]
  /*2-D array of int */
```

The brackets enclose the number of array elements; 10 arrays each with five int elements. Only constants can be used so the size of an array is fixed.

Elements of an array are referred to by indices giving the offset from the start, so the first element is table [0][0] and the last table [9][4]; this is the same as using OPTION BASE 0 in Basic. It may seem devious compared with using table [10][5] for the last element, but is natural if you think about how an array is stored. Although we think of a 2D array as columns and rows, it is held in memory as a continuous sequence Fig 1. The index used to locate an element is the number of items from the start.

What happens if you refer to an element beyond the end of a declared array, for example table [10][5]? The compiler won't complain and the program will run because in C it's assumed you know what you want. The place in memory where the element would be stored is calculated and used, so an array is just a general method of accessing data using indices. It might be useful to declare a sequence of ints and refer to them individually as an array; for this type of fancy footwork, or for arrays which effectively change size, you need to use pointers.

Arrays of characters are especially important because C does not deal with strings as units. All string arrays are terminated with a zero (the null character) to mark the end and look like:
|M|y| |m|e|s|s|a|g|e|NULL|

If this character array is named str, then the individual characters can be accessed as str[0], str[1], and so on, and the end marker located at str[10]. The standard library contains the most used functions for string manipulation.

You might want to set up an array with initial values and this can be done in the declaration with a list:

```
int array[10] =
  {1,2,3,4,5,6,7,8,9,10};
```

Because character strings are so widely used, C allows a short-hand method of initialisation rather than putting in each character and the null:

```
char str[10]= {'abcdefghi'};
```

The string must be long enough to include the null. In practice you could let the compiler worry about the size of an array and count the values by leaving the square brackets empty in the two examples. There is another use for such 'empty' array: in a declaration without initialisers to make it known that the name refers to an array. No extra storage is created and it does not indicate an array which can change in size. The basic use is for an argument passed to a function Fig 2.

With multi-dimensioned arrays you can leave the size of the principal array for the compiler to work out (remember its only an array of arrays of . . .). Then initial values are just grouped together:

```
int multi[][3]=
  { {1,2,3}, {4,5,6}, {7,8,9} };
```

Pointers

When you can handle pointers, you can make C fly. There's nothing very complex involved, but they give you complete freedom and enough rope to tie yourself in knots.

A pointer is a variable which holds the address in memory of a data item. You could look at the address, but almost always will be interested in what is being pointed at. Suppose the contents of a variable was stored at address 0×1200 in memory, then a pointer to the variable would have the value 0×1200. That's almost all there is to it. There's nothing magical about pointers — all languages use them but most don't make them directly available.

Of course, a pointer is a variable and has an address, so you can have

```
Bytes       ints    element

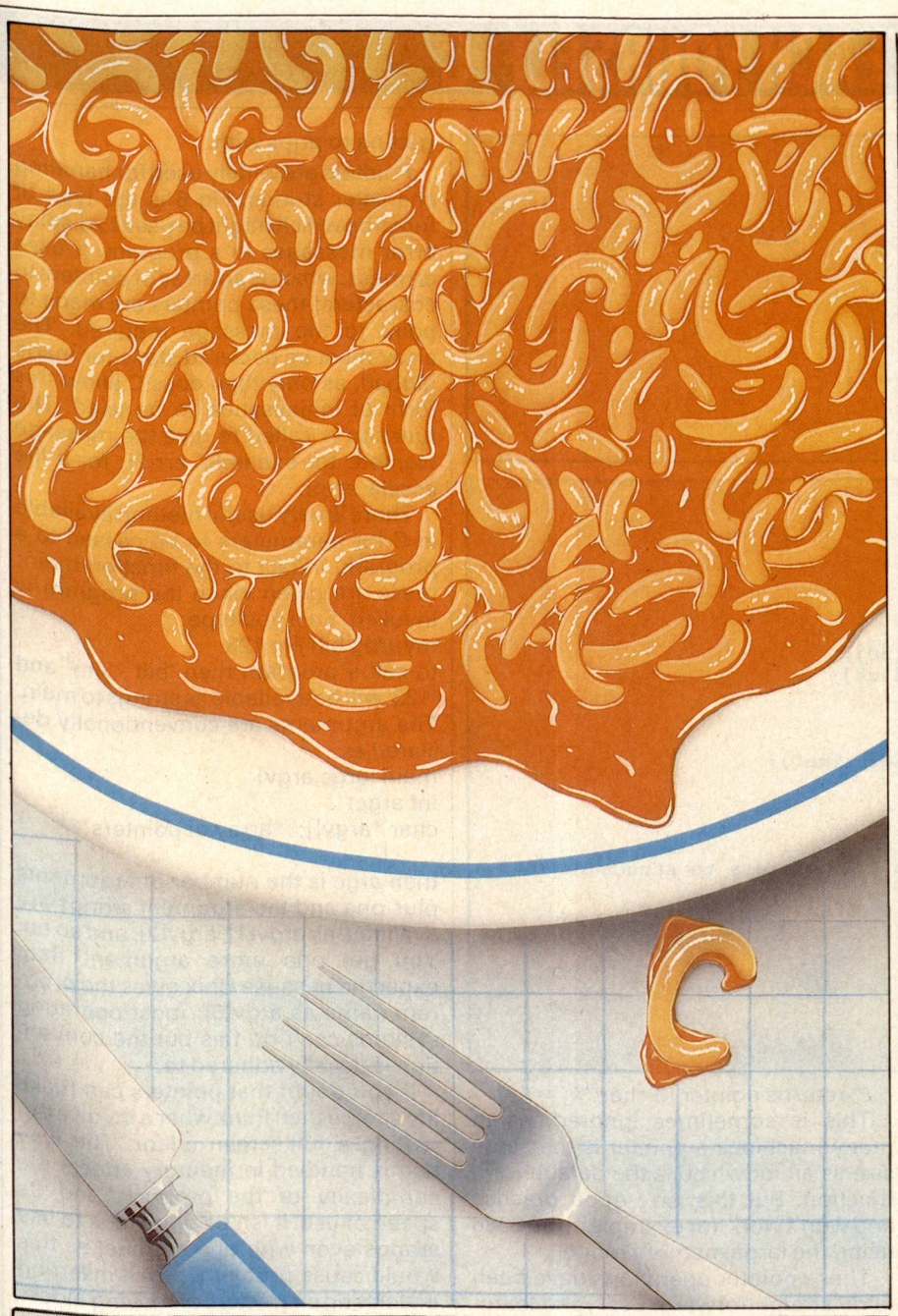
0           0       [0][0]      <--  address of start of table
1
2           1       [0][1]
3
4           2       [0][2]
5
6           3       [0][3]
7
8           4       [0][4]
9
10          5       [1][0]      <--  start of second sub-array
11
12          6       [1][1]
        etc
98         49       [9][4]
```

Fig 1 An array (declared as int table [10] [5]) in memory

```
int array[10];
doit(array);

doit(x)
int x[];
    {
    return x[3]*x[4];
    }
```

Fig 2 Array as function parameter



```
address      contents

1234           255        Variable varl with value 255

5678          1234        Pointer to variable varl
```

Fig 3 A pointer in memory

```
index(s,c)
char *s;          /* pointer to the string to be searched */
char c;           /* the character to search for */
    {
     while(*s!=0)                    /* stop at end of string */
         {
         if(*s==c)     return s;     /* pointer to the character */
         s++;
         }
         return 0;                   /* cannot find */
    }
```

Fig 4 Function to search a string for a character

```
main()
    {
    int *ptr;
    convert(ptr);
    }

convert(p)
int *p;
    {
    *p=0xFF;
    }
```

Fig 5 A problem with pointers

pointers to pointers as well as arrays of pointers or whatever else is needed. It is essential to grasp that a pointer does not provide any storage space for data apart from space for the address contained: it is an additional means of accessing data for which space has already been provided. Most C programs use pointers because it often proves convenient to access data indirectly in this way.

A pointer is declared by stating the type of data items it points to. The * operator is used to denote pointing, so you might say:

```
char *s;
  /* s is a pointer to a char */
int *p;
  /* p is a pointer to an int */
```

Before a pointer can be useful it must be 'pointed' at a specific item of data. This is done with an assignment statement such as:

```
s=&str[2];
  /* s points to the third element of str */
p=&varl;
p=0×1200;
  /* points at place in memory */
```

The & operator means 'use the address of'. It is allowable to set pointers to numerical values but this is only useful to access specific areas of memory, perhaps for memory mapped input/output. Normally pointers are used to point at variables (Fig 3).

The type of data pointed to is declared because it tells the compiler what type of object to retrieve and allows the automatic calculation of addresses required in manipulations. Using the example above, p++ will move on to point at the next int; similarly p+=2 will move the pointer by two ints. This holds even for pointers to complex data constructions and is an efficient way to step through an array.

So we can point at data and move between items, but this isn't much use without being able to access the data being pointed at. This is done using the * operator ('use the contents of'), both for reading data and changing it. For example:

```
int varl,var2;      /*declare integers*/
int *ptr;           /*declare pointer*/

ptr=&varl;          /*point at varl*/
*ptr=3;             /*set varl to 3*/
var2=*ptr;          /*set var2 to varl*/
```

At first sight it might look as if using * and & for pointers as well as other operations would cause confusion. In practice it never does because the context makes the meaning obvious.

Pointers are useful because they allow data to be manipulated in any way required. They are the only means by which local data in one function can be modified by a called function and get round the limitation of one returned value. Only values are passed as arguments, but if these are pointers then the function knows where to access local data. Hence the function in Fig 4 can be used to search a local or global string for a character. The

```
err(errnum)
int errnum;
{
static char *errmess[]=
            {
            "Insufficient memory",
            "Unknown command",
            "File operation error",
            "Printer not on-line"
            };
puts(errmess[errnum]);
}
```

Fig 6 Error messages

```
struct timeform {
                 char dayname[9];
                 int hours;
                 int mins;
                 int secs;
                };

struct timeform x={"monday",12,42,30};
struct timeform y={"tuesday",12,34,30};

main()
    {
    if(cmptime(&x,&y)==0) puts("same time");
    else puts("different time");
    }

cmptime(a,b)
struct timeform *a,*b;    /*a and b are pointers to structure*/
    {
    if   ( a->hours==b->hours
        && a->mins==b->mins
        && a->secs==b->secs)
                    return 0;
    else return 1;
    }
```

Fig 7 Structures and functions

address of the string is needed, so you might call the function with index(&str[0],'k'). However, it is possible to simply pass the array name using index(str,'k') because in C this is always automatically converted into a pointer.

Whenever an array name is used in an expression, C converts this into the address of the start of the array which has the same value as a pointer to the array. This means that arrays can be accessed either by pointer operations or by indexing. For example, the following do exactly the same thing:

```
c=str[2];
c=*(str+2);
```

Similarly it is perfectly reasonable to use an index with a pointer as in:

```
int *p;
p[21]=12;
  /*make sure s points somewhere
  before this*/
```

This is the basis for arrays which effectively change in size. With a function to allocate a section of memory of a requested size and report the address (that is, return a pointer to the allocated memory) then you could use it as an array. The standard library usually provides such a function, and another to release the memory when it's finished with.

Functions which return pointers should be declared in the usual way before use:

```
char *malloc();
  /* returns pointer to char */
```

This is sometimes ignored, as in many machines a pointer is the same size as an int which is the default for a function. But this isn't good practice and won't work, for example on an 8086 using the large memory model.

These pointer operations have been fairly straightforward. Everyone learning C makes mistakes in using pointers, and the results can be confusing and provide interesting debugging experiences. Sometimes a program runs as expected, other times data gets mixed up or the program aborts. What happens is that faulty pointer operations overwrite parts of memory; sometimes this doesn't matter because the area is not being used, other times crucial data or even the return address for a function is changed. If you get the impression that a program has a mind of its own or only works if the moon is full, then look to your pointers.

Fig 5 shows a condensed version of a typical problem. The function convert is fine; what is wrong is the data passed to it. The declaration of ptr creates a pointer but it does not point at any real data, so whatever happens to be at the address will be changed to 0xff.

Novice C programmers often try to manage without pointers and avoid any associated difficulties. Experienced programmers make extensive use of them which suggests they are worth getting to grips with.

Pointers are widely used for handling character strings. Fig 6 is the type of function which might be used to display error messages in a program. It uses errmess, which is an array of pointers to characters; these pointers are made to point to the message required. The array must be declared static (or made global), as only then does C allow this form of initialisation to be used. The function is called to give the message wanted: for example, err(2); for a file access error.

There is very useful method available in C for parameters to be passed to a program, in fact to the function main; these are given when the program is invoked. So if you type:

```
myprog bill jim 123
```

to call a program then 'bill', 'jim' and '123' will be available as strings to main. The arguments are conventionally declared as:

```
main (argc,argv)
int argc;
char *argv[]; /*array of pointers*/
    {
```

then argc is the number of arguments plus one and the argument strings are available as argv[1], argv[2], and so on. You get one more argument than expected because Unix gives the program name as argv[0]; most operating systems can't do this but the convention is usually adhered to.

If you doubt that pointers can make life simple then think what's involved in writing a full-screen editor. The way text is handled in memory affects the complexity of the program and its speed of use. It isn't a good idea to use strings even with one per line, as this would cause problems when inserting or deleting characters or moving blocks about. It is simplest to allocate a large section of memory and use pointers to record the start, end, current cursor position and perhaps the character at the start of the display. This memory contains the characters and end of line markers. With a function to move blocks of characters about you are well on the way to editing.

The standard string display functions can't be used but it's not difficult to devise something to do the job. A method sometimes used to simplify moves is to keep the text before the cursor at one end of the allocated memory, that after the cursor at the other, and the free area inbetween. Deletion, for example, is then simply a matter of moving an 'after cursor' marker which is, of course, a pointer.

Structures

It is very useful to be able to form combinations of different types of data (int, long, array, and so on) to suit the application. For example, pieces of information associated with each per-

son — perhaps name, telephone number, age — which are best considered as a unit.

The first thing to do is define the template for the structure. This declares the name of the template, and the names and types of the elements it contains. For example,

```
struct timeform {
        char dayname[9];
        int hours;
        int mins;
        int secs;
        };
```

This does not create anywhere to put data, but the template name can be used to declare structures to use.

```
struct timeform x,y;
```

will declare two structures, x and y, based on the template. The actual members are referred to as x hours, y secs, x dayname, and so on, using the 'dot' operator. These can be used as normal variables in assignments, expressions and function calls. Functions can manipulate the data, for example to calculate the difference between two times. By now you might guess what happens: the template records how much storage is required, the names to be used and the offsets needed to access them. The declaration reserves the memory, and when you refer to a member the compiler calculates the address.

To make a whole structure available to a called function, you send the address as an argument using the & operator. Fig 7 shows the way structures can be initialised. The operator → looks like something new; in fact, it means 'use the pointer to access a structure member.' a→secs is exactly the same as (*a).secs where the brackets are only required to get precedence right.

Structures come into their own when devising data models to suit needs exactly. You might want to store words using sections of memory allocated as a list grows (Fig 8).

```
struct neword   {
                char *pword;            /*pointer to word*/
                struct neword *place;   /*pointer to struct*/
                };
```

Fig 8 Storing words as a list grows

```
address   contents

1200       "first"      a word

1234        1200         pointer to  word
               0         pointer to previous structure

1256      "second"

1278        1256
            1234

1298      "third"

1320        1298
            1278
```

Fig 9 Linked list in memory

To record a new word, you get some space for the word and for the structure. You record where the word is stored in pword and where the previous structure is located in place. The start of the list could be marked by giving place a zero value, and then it's simple to scan through until the start. Fig 9 shows how this might look in memory.

It might be better to modify the structure to record both next and previous addresses, and so be able to move either way through. END

To help you get the best from the Teach Yourself C series, *PCW* has arranged special discounts on several C packages. Identify your machine or operating system from the list below and send the offer tab on the corner of this page with your order to the appropriate address. Enclose a cheque for the full amount, and make sure you state clearly which package you require. This list is not comprehensive. Other suppliers such as Conguin Software and Grey Matter are worth contacting for their prices. Conquin is at 14 Goodwood Close, Morden, Surrey and Grey Matter at 4 Prigg Meadow, Ashburton, Devon.

Company/Address	Machine/Operating System	Package	Price (includes VAT and UK p&p)
Hisoft 180 High Street North Dunstable, Beds	Spectrum	Hisoft C	£22.50 (normal price £25)
System Science 6-7 West Smithfield London EC1	CP/M-80	Software Toolworks C80, Mathpak and *C Programming Language* by Kernighan and Ritchie	£90 (normal price £119.15)
	CP/M-80, MS-DOS	DeSmet C and *C Programming Language*	£155 (normal price £185.40)
		Aztec C86 Compiler and *C Programming Language*	£190 (normal price £255.40)
	Apple DOS 3.0 or Prodos	Aztec C][Compiler and *C Programming Language*	£165 (normal price £220.90)
MLH Technology 14 Burgamot Lane Comberbach, Cheshire	CP/M-86, versions 1 and 2 of MS-DOS and PC-DOS	DeSmet C without debugger	£142 (normal price £170.78)
		DeSmet C with debugger	£199.50 (normal price £234.03)
	CP/M-80 version 2.2 and upwards, Apple IIE with CP/M card	BDS C	£136.25 (normal price £159.27)
	PC-DOS	'Introducing C' Tutor	£142
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SPECTRUM CALLS AND POKES

Here are a selection of POKEs and ROM calls for the Spectrum that produce some interesting effects without upsetting the machine.

Justin Moffitt

POKE 23756,0	Makes first line line 0
POKE 23756,1	Makes line 0 line 1
POKE 23609,25	Makes keyboard bleep
POKE 23609,0	Makes keyboard silent
POKE 23658,8	Turns CAPS LOCK on
POKE 23658,0	Turns CAPS LOCK off
POKE 23755,100	Disables list command
POKE 23755,0	Re-enables list command
1 POKE 23659,0	Makes 24-line screen
9999 POKE 23659,2	Makes 22-line screen again
POKE 23736,181	Stops the START TAPE prompt
POKE 23692,255	Stops the SCROLL ? prompt
POKE 23613,0	Disables BREAK key, so when it is pressed the program hangs up
POKE 23613,PEEK(23730)-5	Disables BREAK completely
LET t=USR 3582	Scrolls screen one line
LET t=USR 4757	Prints the Sinclair prompt, but does not clear the RAM
LET t=USR 3213	Stops and asks, SCROLL ?
LET t=65536-USR 7962	Prints free memory in bytes
LET t=USR 3583	Scrolls bottom half of screen one line
LET t=USR 3652	Clears top half of screen
LET t=USR 3330	Scrolls whole page to top line, must be followed by CLS
POKE 23617,236	Changes cursor to ?
OUT 10,colour	Changes BORDER colour to f, and gives a CLICK, useful for routine when a game has been won
POKE 23617,14	Changes cursor to _
LET t=USR 1331	Gives special border effect in magenta and blue
LET t=USR 1290	Gives special border effect in blue and red
LET t=USR 1269	Gives special border effect with special sounds
LET t=USR 1251	Gives border effect in green and magenta
LET t=USR 1551	Gives a list of programs on tape
LET t=USR 1248	Gives border effect in white and black
LET t=USR 1333	Gives border effect in cyan and blue
LET t=USR 1327	Gives border effect in white and blue
LET t=USR 1267	Gives border effect in blue and yellow
LET time=(65536*PEEK 23674+256*PEEK 23673+PEEK 23672)/50	Gives time in seconds since the computer was turned on, and only resets every four days

Using the 'border effects'

The border effects give the effect of the save bars in different colours. They only stop after SPACE has been pressed, but some contain a delay loop as well.

For example:

```
10 PAPER 1:INK 7:LET t=USR 1333:CLS
15 REM rest of program
```

COMMODORE SLOW DOWN

This program will alter the running speed of all Basic programs and a few simple machine code programs. The amount the program is slowed can be varied, and the screen can be frozen altogether. It can also slow and stop anything the computer does, including the listing.

The program works by setting up an interrupt routine on the TEST STOP vector and the break interrupt vector; the latter being the routine to slow the computer down, the former keeps resetting the vector values to prevent the routine from stopping.

The routine can be stopped by disabling the interrupts or by using the vector management routine in the kernal ROM.

I have tested it with a few commercial programs and had some success, but you will have to experiment with others. The control keys are explained at the end of the listing.

David Derrick

```
10 DATA 169,29,141,40,3,169,192,141,41
20 DATA 3,120,169,23,141,22,3,169,192
30 DATA 141,23,3,88,96,32,157,192,76
40 DATA 102,254,72,152,72,138,72,169,1
50 DATA 201,1,240,14,160,20,162,255,202
60 DATA 224,0,208,251,136,192,0,208,244
70 DATA 165,197,201,6,208,5,169,1,141
80 DATA 37,192,165,197,201,3,208,5,169
90 DATA 0,141,37,192,165,197,201,5,208
100 DATA 12,165,197,201,64,208,250,165,197
110 DATA 201,4,208,250,165,197,201,43,208
120 DATA 20,238,43,192,173,43,192,201,0,208
130 DATA 10,173,41,192,201,255,240,3
140 DATA 238,41,192,165,197,201,40,208,20
150 DATA 206,43,192,173,43,192,201,255,208
160 DATA 10,173,41,192,201,0,240,3,206
170 DATA 41,192,104,170,104,168,104,32,157
```

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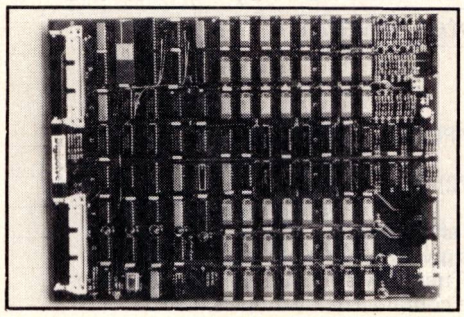

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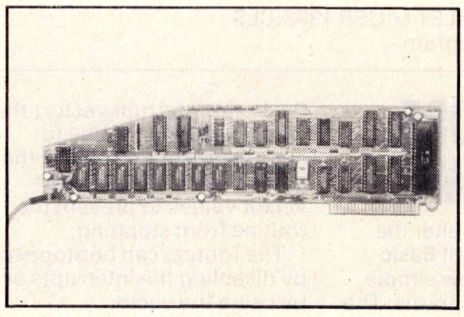

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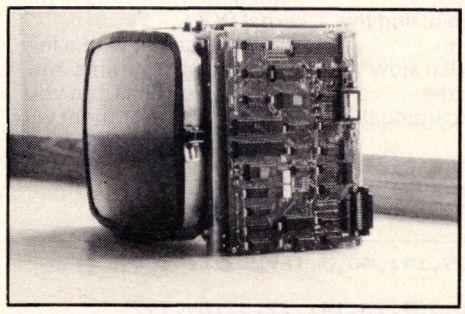

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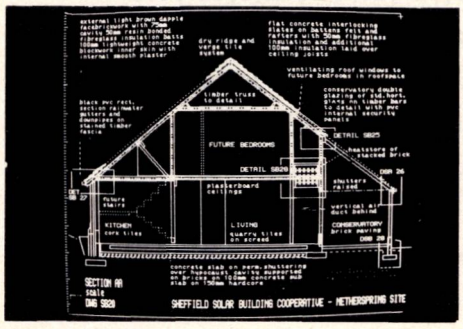

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```
180 DATA 192,76,237,246,72,152,72,138,72

190 DATA 32,0,192,104,170,104,168,104,96

200 FOR X=0 TO 170:READ A:POKE 49152+X,A:NEXT

210 SYS 49309


CONTROLS


F1 - Unfreeze picture

F3 - Freeze picture

F5 - Exit slow down mode

F7 - Enter slow down mode

+  - Speed up computer (in slow down mode)

-  - Slow down computer
```

COMMODORE AUTODATA-C64

This is a machine code utility for Commodore 64 users which allows you to turn sections of memory into data statements. It will also save data to be used in the definition of sprites, or for musical values or, in fact, any section of memory that you wish to save and subsequently load back.

Operation of the routine The routine itself is simple to operate. By default it is located in the 'rear' portion of the spare section of memory from $C000-$COFFF — it actually occupies the locations $CF08-$CFA7 (53000-53159 decimal).

To activate the routine, type in direct mode (after running the program):
SYS(Location) Start, End, First, Increment
where location refers to the first byte of the point in memory where the routine is located, start refers to the start of the section of memory to be saved, end refers to the last byte of this portion of memory, first is the number of the first line of your data statements, and increment is the increment between the lines. This last parameter must lie between a value of 0-255. For example: to make a series of data statements of AUTODATA-C64, starting at line 1000 in increments of 10, we would type:
SYS(53000)53000,53159, 1000,10

Relocating the routine In the event that you are already using this section of memory, then another line of data is given (line 127) to substitute for one of the original lines (line 119). The easiest way to make the change is to insert a REM into line 119 and remove the REM from line 127, not forgetting to change the value of S in line 6 to point to the start of the cassette buffer.

There are two sections of code that need to be changed if you are going to relocate elsewhere. One of them is the high byte and the low byte of the start of a string which is printed out by a machine code subroutine — this is always taken care of by line 12. However, you will have to alter the other section of code manually.

The re-entry point is 39 bytes further on from the start location of the code — hence, by default, it is at location 53039. If you study line 119 carefully, you will see that the first five values on this line are the ASCII codes for the numbers 5,3,0,3,9. Similarly, in the case of line 127, the re-entry point will be (828+39)=867 and hence the first three values on this line are the ASCII codes for 8,6,7 followed by a space,19 and a terminating 0. The value of 63 at the end of line 127 is completely artificial but is designed to ensure that the same checksum in line 9 will suffice for both versions of the code. If you decide to locate the routine in another (protected) area of memory, then you will obviously have to compute and place the ASCII values for start-of-code + 39 bytes into line 119.

Direct-mode If you have misplaced your AUTODATA-C64 tape/disk and you want to turn a small piece (less than about 180 bytes or so) into machine code, then here is a quick way to do it. It requires the entry of two lines in direct mode from the keyboard

```
S=(START):E(END):L=
  (FIRST LINE):I=
  (INCREMENT) :B$=
  CHR$(20)
FORJ=STOESTEP8:?L"DA"
  ;:FORK=0T07:?MID$(STR$
  (PEEK (J+K)),2)",";:
  NEXT:?B$:L=L+I: NEXT
```

In the second line DA represents D followed by shifted A to get the DATA token, and you will have to tokenise just a couple of the other words to get it all in: F + shifted 0 for FOR and N+shifted E for NEXT should do the trick. When you have a screenful of data statements, home the cursor (being careful not to clear the screen) and progressively press RETURN to incorporate the data into the program. I found that, with a little bit of practice, I can have a screenful of data statements within 45 seconds.

If your code is longer than about 180 bytes it may scroll off the top of the screen, in which case you need to break it into two (or more) manageable portions. It is obviously better to keep line numbers small (less than 1000) to prevent overflow onto a second line which wastes space. Good luck with either version!

Mike Hart

```
1 REM  ***     AUTODATA-C64     ***
2 REM
3 REM    **       MIKE HART      **
4 REM
5 :
6 S=53000:REM START OF CODE
7 :
8 FOR J=S TO S+159:READ X:T=T+X:POKE J,X:NEXT J
9 IF T<>20822 THEN PRINT "DATA ERROR!":END
10 :
11 L=S+147:REM 'SYS STRING' START
12 POKE S+117,L/256:POKE S+119,L-PEEK(S+117)*256
13 :
14 REM SYNTAX IS :-
15 REM SYS(LOC'N)START,END,FIRST,INCREMENT
16 :
100 DATA 32,158,173,32,247,183,133,252
101 DATA 132,251,32,253,174,32,158,173
102 DATA 32,247,183,133,254,132,253,32
103 DATA 253,174,32,235,183,134,2,165
104 DATA 20,133,38,165,21,133,39,165
105 DATA 254,197,252,208,8,56,165,253
106 DATA 229,251,176,1,96,144,253,169
107 DATA 147,32,210,255,32,215,170,32
108 DATA 215,170,166,38,165,39,32,205
109 DATA 189,134,87,169,68,32,210,255
110 DATA 169,193,32,210,255,32,63,171
111 DATA 160,0,177,251,170,152,32,205
112 DATA 189,230,251,208,2,230,252,169
113 DATA 44,32,210,255,230,87,165,87
114 DATA 201,8,208,228,160,207,169,155
115 DATA 32,30,171,24,165,2,101,38
116 DATA 133,38,144,2,230,39,169,13
117 DATA 141,119,2,141,120,2,169,2
118 DATA 133,198,96,20,13,83,89,83
119 DATA 53,51,48,51,57,19,0,0
121 :
122 REM FOR CASSETTE BUFFER THEN:
123 :
124 REM MAKE S=828 IN LINE 6
125 :
126 REM MAKE LINE 119:-
127 REM DATA 56,54,55,32,19,0,0,63
128 :
READY.
```

VARIABLE SPEED LISTING

The list command in the QL's SuperBasic requires a certain amount of dexterity, with the CTRL and f5 keys used to pause and restart the listing as it scrolls past at high speed.

Vlist_proc is designed to be incorporated into a utility program and has the following facilities.

While in operation the commands available are displayed at the bottom of the screen.

The speed of the listing can be changed by pressing f1 to f5. f1 is full speed, and f5 scrolls the listing at a speed which allows the listing to be read easily.
+ key jumps forward.
− key jumps backward.
1 to 9 sets the number of lines to be jumped by the + and −

keys. 1 jumps 10 lines and 9 jumps 90 lines.
ENTER allows a new start line number to be set.
ESC returns to QDOS.

To work effectively the program needs to be numbered with an interval of 10 between each line. This is the reason for the RENUM statement in line 170. I found the CLEAR statement to be essential on my JM version QL, otherwise the program stopped with a 'not implemented' error message.

The program renumbers to 29999, as I used above 30000 for programming utilities.

Enter the program as listed and, before saving, renumber to any number above 30000 so it will not clash with any other utilities you may be using: for example, RENUM ;31000,2. Then save as vlist_proc.

Merge the procedure with any program you are developing and type vlist (ENTER) to use.

Peter Edwards

```
100 REMark vlist_proc
110 REMark Peter Edwards / 1985
120 :
130 DEFine PROCedure vlist
140  LOCal lin,lin$,speed,j,skip,key
150  CLS:PRINT "Program renumbered in 10's"
160  CLEAR:RENUM TO 29999;
170  OPEN#0,con_448x40a32x216
180  CSIZE#0,2,0
190  REPeat outer
200   CLS#0:INPUT#0,"Start at line no."\"
     (ENTER for start)"!lin$
210   IF lin$="" THEN lin$="100"
220   lin=lin$-10:speed=2:skip=100
230   CLS#0
240   PRINT#0,"F1/F5:Set Speed   SPACE:Toggle Hold"
250   PRINT#0,"      1/9:Set Skip Value (*100)"
260   PRINT#0,"+:Skip Forwards     -:Skip Backwards"
270   PRINT#0,"    ENTER:New Start   ESC:Quit"
280   REPeat inner
290    lin=lin+10
300    key=CODE(INKEY$)
310    SELect ON key
320     =10:CLS:EXIT inner
330     =27:CLS#0:STOP
340     =32:PAUSE-1
350     =43,61:CLS:lin=lin+skip
360     =45:CLS:lin=lin-skip
370     =49 TO 57:skip=100*(key-48)
380     =232,236,240,244,248:speed=(key-232)/4
390    END SELect
400    FOR j=0 TO speed*100:NEXT j
410    IF lin<100:lin=100
420    IF lin>29990:lin=29990
430    LIST lin
440   END REPeat inner
450  END REPeat outer
460 END DEFine vlist
```

BBC TIMER

The program sets the f0 function key to draw a clockface displaying the correct time. The program is run once and can then be deleted, leaving the user with the option of seeing the time just by pressing the f0 key.

If the program is run and no specific time is entered, then the clock acts as a timing device which allows the user to see how long the computer has been switched on. If you merely wish the f0 key to perform this task, there is no need to run the program at all. You merely save the soft-key buffer which contains the f-key by typing
*SAVE"FKEY"BOO BFF

The f0 key (along with any other key definitions) can now be reloaded at any time by
*LOAD"FKEY"

The only major drawback with the program is the fact that it leaves very little room for other f-key definitions.

Dr David Unsworth

```
 10 REM TIMEKEEPER
 20 REM Dr.D.R.Unsworth
 30
 40 CLS
 50
 60 INPUT"Hour = ";H%
 70 INPUT"Minute = ";M%
 80 INPUT"Second = ";S%
 90 TIME=100*S%+6000*M%+360000*H%
100
110 *KEYOMO.1
  : V.29,1000;900;
  : FORA=0TO2*PI S.PI/6
  : MOVE100*COSA,100*SINA
  : DR.90*COSA,90*SINA
  : N.
  : h=(TI. DIV360000) MOD12
  : H=h/6*PI
  : m=(TI. DIV6000) MOD60
  : M=m/30*PI
  : MOV.0,0
  : DR.60*SINH,60*COSH
  : MOV.0,0
  : DR.75*SINM,75*COSM
  : P.TAB(30,8);h";";m!M
120
130 PRINT''"Clock set"'"Press KEY0 to display clock"
140 PRINT''"You may delete the program."
```

CARBON PAPER RIBBON

Carbon printer ribbon is not so very different from good quality, lightweight carbon paper. By carefully placing a good smooth new sheet on top of my cut bond paper, I found I was producing copy virtually as good as the printer cartridge had produced and far better than the quality obtainable, other than with a really new fabric ribbon on a dot matrix printer.

Obviously the principle is impractical for a tractor-fed platen, but there should be no reason why it could not be employed with a friction-drive dot matrix printer.

George J Zitterstein

ORIC LOADER

The following brief routines will allow you to CLOAD a program and a machine code routine without the need (as is sometimes suggested) to PRINT DEEK (#9C), note the address and POKE it back later.

If you have a Basic program and a section of machine code, follow these steps to save them to tape. When you CLOAD it back, it will all RUN automatically. It involves just a one-line loader program and 13 bytes of machine code.

1) Type in the loader program
10 DOKE#400,
DEEK(#9C):CLOAD'program'
and then CSAVE 'program', AUTO
2) Add this to the start of your machine code routine:
AE,00,04,86,9C,AE,01,04,86, 9D,4C,65,C7 (all in HEX)
3) CSAVE'program',Astart address, Eend address, AUTO
4) Type in or CLOAD your Basic program and then save it to tape with
CSAVE'program', AUTO

To load the complete program from tape just CLOAD''. The loader program will load in the machine code, which will RUN automatically to reset the original top of program as stored in #400 and will then re-RUN the loader. This will then load in the Basic program which will overwrite the loader and set its own top-of-program location.

To protect your program secrets from prying eyes, you could add POKE 555,64:DOKE 27,62509 to the loader program.

Martin Bolter

BBC PROGRAM PROTECTION

Here are some relatively simple methods of protecting your basic programs so that no-one can list or edit them:
*FX 200,n disables the 'ESCAPE' key;
*FX 220,n resets the 'ESCAPE' key,
'n' being the ASCII code of the key you want to have the effect of 'ESCAPE'. For example: *FX220.0 makes CTRL @ 'ESCAPE'. *FX 200,2 clears the machine's memory when BREAK is pressed so no one can OLD and LIST your program.

Pete Sweatman

BBC SPEEDUP

I have some small changes that can be made to Acornsoft's Snapper and Defender to produce some interesting effects.

In the program before the main program, press ESCAPE and write in an extra line before the CALL statement. (In Snapper I think it is line 355.)

355 ?&10CD=&A2 — Super Speed Snapper
?&12EA=&A9 — Invincibility Snapper
?&E98=&A9 — Super Speed Defender
?&1221=&FF — Wierd Humanoids ! Defender.

Pete Sweatman END

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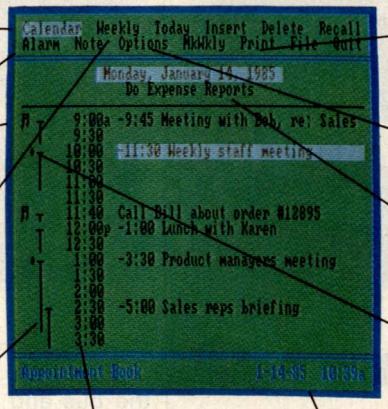

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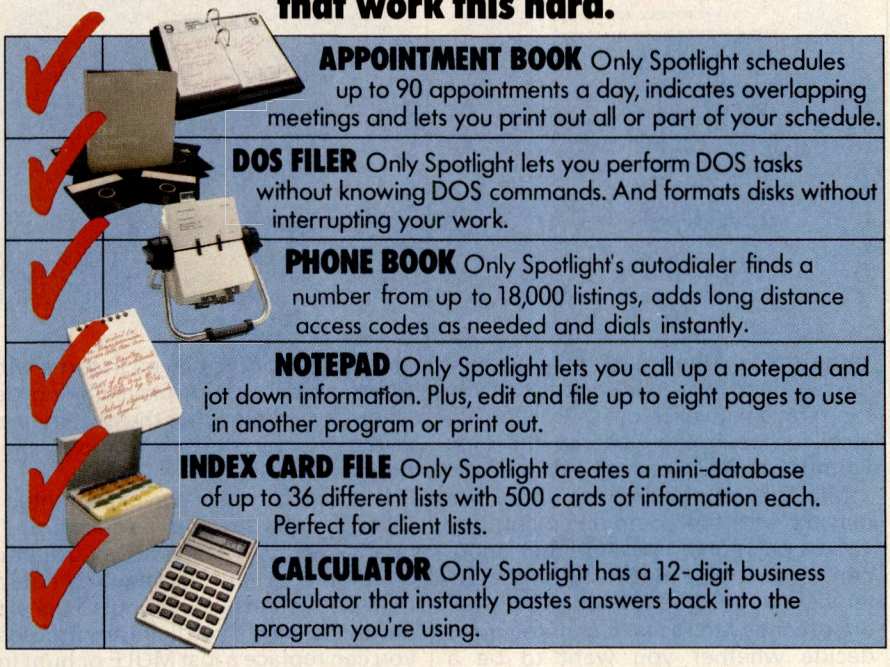

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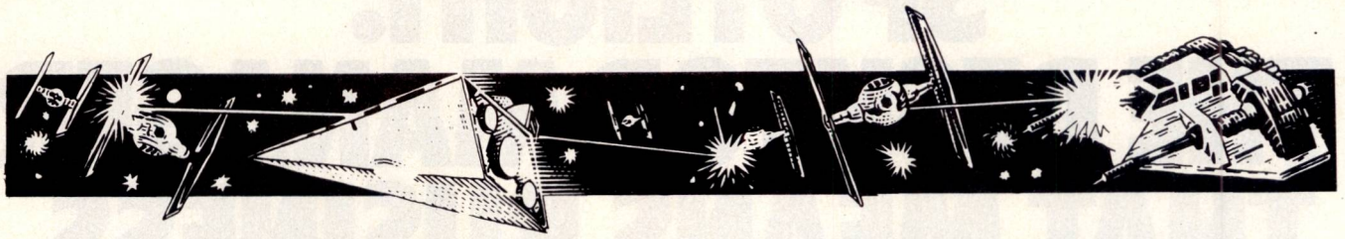
SCREENPLAY



When you've installed a MULE, fought the gods, escaped the Asylum and shot the rapids, you've had a good time. Tony Hetherington looks at this month's best games for the Commodore 64, Spectrum and Atari.





It's a mad, mad world

Title: Asylum
Computer: Atari, Commodore 64
Supplier: Screenplay (via Softsel)
Format: Disk, cassette
Price: £25.90

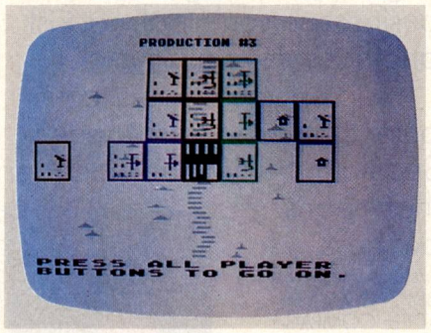
You have been committed to the Asylum, because you are part of a wave of people who have been wandering around town saying things like: 'Take the bus and pay the conductor.' The cure for such a bad case of adventure madness is to escape from the Asylum.

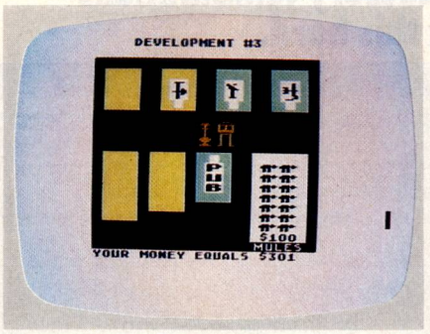
So starts an adventure with a very novel setting. It's also a good graphical adventure, as it's littered with high-resolution pictures of the rooms and characters that you'll meet in the Asylum. Some of these inmates will help you, others will hinder you, but most will drive you mad. For example, one inmate that you can meet is wearing a hat with the words 'Look up' on it. If you do, a piano that may or may not be there falls on you and the game is over. Madness, yes, but you are in an asylum.

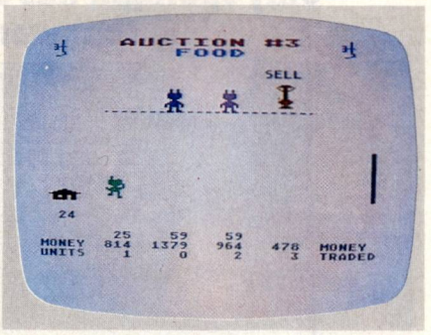
You might even meet the author of the game on your travels—then maybe you'll understand!

Asylum is a hybrid graphics adventure and 3D maze; the result is a challenging game set in a maze which is almost impossible to map. It includes some useful features to help you, including a list of permissable commands (enough to fill four screens) and a help, or clue, facility.

It's worth noting that you are supplied with a tape and a disk, both containing the Atari and Commodore 64 versions. A number of American software houses are adopting this approach as it reduces costs.







It's a hard life

Title: MULE
Computer: Commodore 64
+ 1/2 joysticks
Supplier: Ariolasoft
Format: Disk, cassette
Price: £11.95, £9.95

A MULE is an electronic mule that is ideally suited for planet settlement because it can farm, mine, and produce energy plants. Unfortunately, it's as stubborn and unreliable as its animal counterpart and will run away at the slightest provocation, but unfortunately it's all you've got.

You are one of four life forms trying to settle on a planet; each of you must develop land to produce goods that you then trade with each other. But you are also competing to become the First Founder of the colony.

MULE can be played by up to four players with the computer filling any vacant positions. The computer opponent tends to play the Mechtron character, but you are free to choose between the other seven races. It's up to you to decide whether you want to be a Humanoid, Leggite or Flapper, or go totally alien in the form of a Bonzoid, Spheroid, Packer or Gollumer. Each race has its own characteristics, but life is hardest for the poor old Humanoid.

The game, previously only available as a US import, is played in turns with the most successful player being declared the winner after the twelfth turn. If the colony doesn't survive, then nobody wins.

In a typical turn, a player is granted a plot of land to develop. To do this you'll need a MULE, which you buy from the corral and fit with the required equipment. You then lead him out to the plot and install him. If you have any time left, you can replace a lost MULE or hunt for the Wampus in the hills, but you should always end your turn gambling in the pub.

The time that you have to perform these activities is represented by a gradually-diminishing time bar, the

length of which is affected by the amount of food you have (food is just one of the commodities that are traded at the end of each turn). In order to trade you'll have to produce goods, but this depends on the land and the type of goods. For example, food grows best in the river valley whereas energy production is greatest on flat land, and the mountains are best for mining smithore.

Before the auction can begin, the computer adjusts your stock totals to account for usage, spoilage and production. It then calculates required food and energy levels, and decides whether you are a buyer or a seller. Then the fun begins.

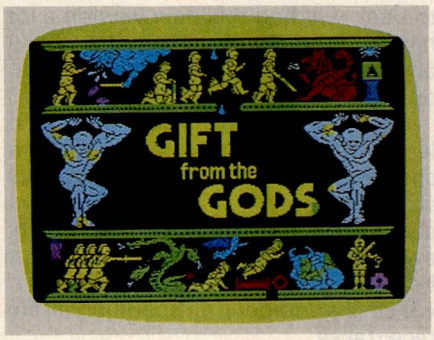
Each player is represented on an auction screen with the buyers at the bottom and the sellers at the top; they move up and down the screen until they meet and a sale is agreed. Again there's a time limit, and there's often a bargain to be had or a high profit to be made from opponents who are desperate for money or goods. Trading in goods doesn't just yield profits—it can also be used as a weapon against your opponents. Indeed, it may be better not to sell your excess food to the others (even though it will decay) as keeping them hungry will prevent their growth and improve your position in the game.

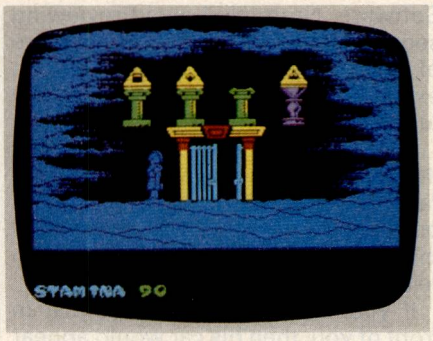
Similarly, a shortage of energy restricts the production of all plots, and a shortage of smithore will ensure that MULEs are scarce since they are made from this metal.

Obviously you could be on the wrong side of such heavy-handed tactics, in which case you should don your diplomatic hat and try some speedy negotiating. This is difficult with digital opponents but with fellow humans it's a must: in fact, MULE is at its best when played between four human players.

At the end of the twelfth turn, the players' assets are totalled, but the winner will only be awarded First Founder status if the colony is big enough to survive. For example, one victory was grimly rewarded with the message that the colony would only just survive and that we would be living in tents far from the busy galactic trade routes.

MULE is one of the flood of US games that started life as Atari programs and which are now being converted for other machines. (It's ironic that UK Atari owners will still have to pay about £30 for an imported version.)





A family affair

Title: Gift from the Gods
Computer: 48k Spectrum
Supplier: Ocean
Format: Cassette
Price: £9.95

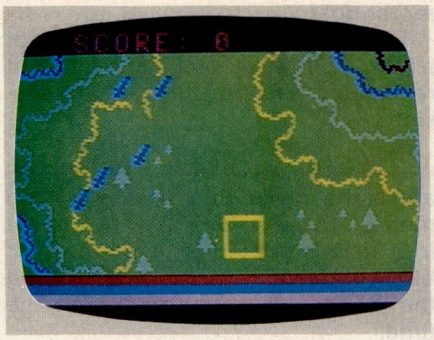
Even the Greek myths hold no fear for games programmers. The gods Apollo and Zeus have given you, Orestes a magic sword to help you in your quest through the labyrinth under the palace of Mycenea. If you succeed, you will gain the throne that is rightfully yours.

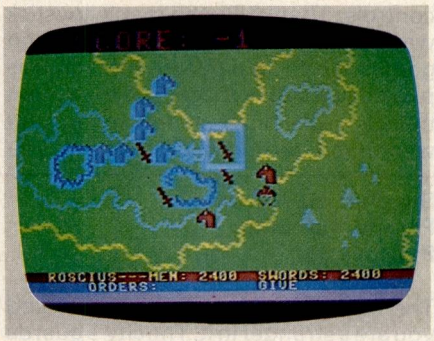
To survive and complete this quest, you must gather the six Euclidian shapes and arrange them correctly in the guardian's chamber. Your sister, Electra, knows the location of shapes but unfortunately she is held captive somewhere in the labyrinth. Life is further complicated by numerous demi-gods who inhabit the labyrinth and project images of these shapes to confuse you. They will also project images of monsters that will sap your strength but which can be killed with the sword the gods gave you.

Your main enemy is your mother, who killed your stepfather, the king, and is aiming to complete the hat-trick by dispatching you and your sister and so claim the throne for herself.

All this is represented by animated characters, with Orestes being controlled by you via a joystick or the keyboard. The game uses an 'intelligent joystick' — a push of the joystick can be interpreted in various ways, depending on what the program thinks you are trying to do. In one instance it may make you fly forwards, in another cause you to thrust with your sword.

As the booklet accompanying the game indicates, Orestes is human. Any action you perform will weaken you. An excellent way of quickly reducing your stamina from 100 to 0 is to fall through the floor to a lower level; you'll slowly rise to your feet and painfully rub your head. You can fly over such gaps but this is very tiring. Your main chance of success is to quickly find the guardian's chamber, which has recuperative powers — you can recover your stamina before returning to your quest.





Roman allsorts

Title: Legionnaire
Computer: Commodore 64
Supplier: Eclipse
Format: Cassette
Price: £7.95

Like MULE, Legionnaire has also taken a long time to cross the Atlantic. Legionnaire is a representation of Caesar's battles as he attempts to conquer Gaul. It was written by Chris Crawford, the man behind Eastern Front, consequently there are many similarities between this and his earlier classic war game.

The scrolling background is of a simpler design: it isn't a map, but more a representation of the terrain on which the battles are fought. Neither are there any set battle orders — you simply choose the number of legions you wish to command and which barbarians you want to fight. The infantry units are displayed on screen as sword symbols, the cavalry as horse's heads.

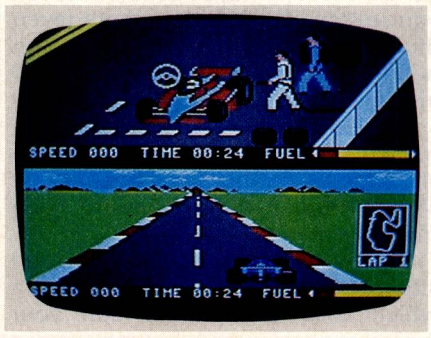
This simplistic approach hides the fact that this is a complex and challenging game to play. Much of its depth lies in the choice of legions and barbarians, as they all have their own strengths and weaknesses. Not all of your Legions are as good and as strong as Caesar's own Tenth Legion. Indeed, the Sabinus Legion is accurately described in the instruction book as 'a disaster which is so weak and slow that it must be kept out of harm's way.'

Each unit has a unit strength and sword strength. The unit strength confirms the number of men in a unit, but the sword strength is an indication of how many of those men are currently fit to fight. This strength drops if they tire after a long march, particularly when it is uphill and after a battle. The Tenth Legion recovers quickly, but the

likes of the Sabinus will be out for the count. The tops of hills are an extremely good place to meet the barbarian hordes—they'll be worn out by the time they meet your swords.

The barbarian infantry and cavalry are as much a collection of allsorts as are your own legions. They range from the feared Helvetii and Tencteri to the pitiful Auscii and Aedui, who are included as clay pigeons for the beginner to practice with.





Advanced driving

Title: Pitstop II
Computer: Commodore 64 + 1/2 joysticks
Supplier: CBS Software
Format: Disk, cassette
Price: £13.95, £10.95

Pitstop II is the sequel to the car racing game Pitstop, which I reviewed in December. Both are written by Epyx and imported into the UK by CBS Software. Normally I avoid reviewing sequels since they tend to be just more of the same, but Pitstop II is an exception. It is best described as a finely tuned version of the original.

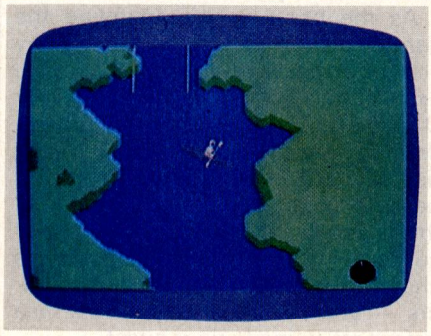
The most significant difference is that the game is played by two players who race together. This is represented onscreen by two displays, which show the position of each player's car in relation to the other's.

If your opponent's car was just in front of you, then his car would appear on your display but you wouldn't appear on his, as the display shows only the player's car and the view in front of it.

More aggressive players will see this as an opportunity to ram the other car and force it off the track, but you'll probably do more damage to your own tyres. These, as in the original game, change colour as they are worn down, but can be replaced in the pits.

Seasoned Pitstop players who always engineered it so that they raced second in order to know what they had to beat, will find this new version a lot harder, particularly in the pits. You'll always have to keep one eye on the opposition.

Again there is a selection of tracks, laps and skill levels to keep the players challenged, but the scoring system has changed; now it's in the form of a championship decided by the points awarded during the races. This works better when you play the Grand Circuit, which is a competition spanning all six race tracks.



Paddle your own canoe

Title: Shoot the Rapids
Computer: Commodore 64
Supplier: New Generation
Format: Cassette
Price: £7.95

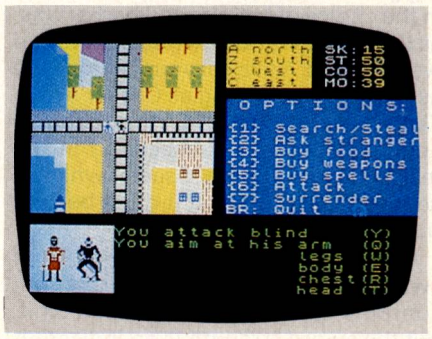
Shoot the Rapids is a canoe slalom simulation in which you steer your canoe through gates to the finishing line within a qualifying time. The time is indicated by a breakfast TV-style clock at the bottom of the screen, and you'll incur time penalties if you miss a gate.

You control your canoe by either gently rocking your joystick from side to side, or via user-defined keyboard controls. Thankfully the manic joystick waggling necessary in decathlon games isn't required as this game is played at a slower pace. The important thing is to develop a steady rhythm and well-timed turns which will get you through the course unscathed.

You only have one chance, or life, which can be lost either by running out of time or sinking your canoe on the sharp rocks which line the river. To add to your problems, the river flows at different speeds along its length as well as running faster in the middle.

Completing the first course within the two minute time limit qualifies you for the second course, completing that the third, and so on. Things are made more difficult in later courses by the addition of more rocks, beavers and even a motor boat.

This isn't one of the classic games of all time, but it will provide some light relief between monster-bashing sessions.



No place for strangers

Title: City of Death
Computer: ZX Spectrum
Supplier: Red Shift
Format: Cassette
Price: £9.95

The City of Death is aptly named and you are a stranger in it. The city's guards have a policy for strangers—hunt them down and either kill or jail them,

However, you're known as Swordsbane and you're on a quest to find the wizard Bellatrix, but you'll have to use your sword to locate him. To survive in the city you'll have to rob houses for food and money with which you can buy spells. Don't be too rough on the citizens though, as they know where the wizard lives.

The screen display is split into several areas: the top left quarter is a scrolling map of the city with the movement instructions printed on the right of it; below the map is a picture of you and the opponent that you're fighting at the time.

The alternative to fighting is to surrender and be jailed for 30 days, but if you fight then you must choose where you will aim your blows: the head is harder to hit than the body, but a good hit on the head will do more damage.

As you are hit your strength will decrease, and if it falls below zero you'll die. Your strength and stamina levels, as well as the amount of money you've plundered, is displayed alongside the city map. END

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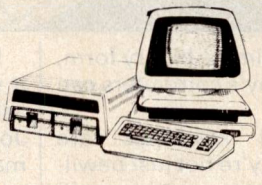

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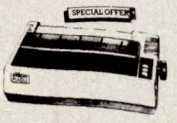

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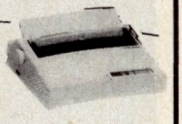

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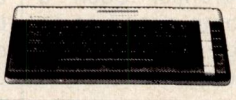

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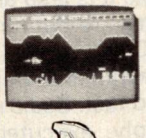
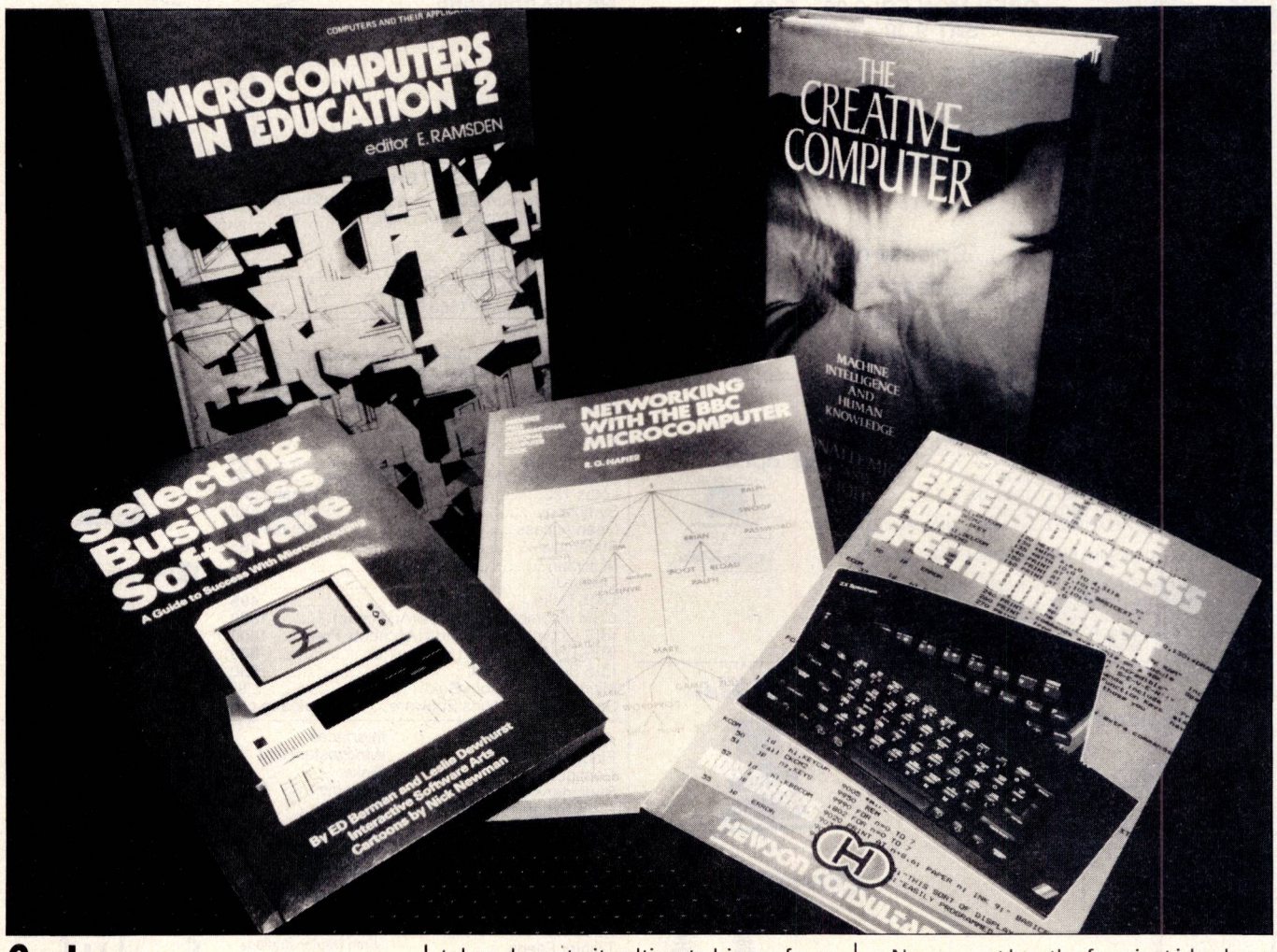




BIBLIOFILE

Two differing views of fifth generation computing are among this month's book selection — David Taylor reads about the 'thinking' and the educational micro.



Garbage

Title: The Creative Computer: Machine Intelligence and Human Knowledge
Authors: Donald Michie and Rory Johnston
Publisher: Viking
Price: £12.95

The Japanese, noted for their technical perspicacity, take the view that the next (fifth) generation of computers won't so much process *information* as *knowledge*. It's a formidable engineering task. It is also an awesome conceptual jump: re-defining what computers do.

Current (fourth generation) machines manipulate data logically — and fast. Basic mathematical methods apply, executed at such speed as to become seemingly unrelated skills. Word processing, for example, might not appear to involve crunching numbers electronically and yet that, at root, is *all* that it involves. It is *information*, taken down to its ultimate binary form, which is all that today's computers can handle.

Knowledge-based machines are something else. They're not just bewilderingly quick, but unimaginably rapid calculation is involved: exploiting mathematical principles so mind-bendingly complex as to seem surreal. The potential upshot is a computer able to mix logic and *inference*. Such a machine would become expert at its tasks, able to leap-frog mere procedure. Such a machine would, to all intents and purposes, *think*.

The Japanese insist that this sci-fi device is imminent, and the British (and Americans) believe they might be right. Now the race is on to develop the 'enabling technologies' — Very Large-Scale Integration chippery, software of unprecedented sophistication, man-to-machine interfaces based upon voice recognition, knowledge-based systems which stretch the present limits of artificial intelligence.

No-one yet has the foggiest idea how it will all turn out. Except, we're now asked to believe, Messrs Michie and Johnston. The former is a professor in machine intelligence, the latter a science writer of what I would call the corblimey or ooh-er school. Together in *The Creative Computer* they indulge an extravagantly unabashed tone. The world is in a fine old mess, they say, as if this were a revelation. But smart-thinking computers will soon sort it all out, they continue, as if this were a certain fact. 'Could inanimate creatures of technology possibly produce solutions to the problems (technology) has spawned and to myriad others that afflict humanity?' the daring duo ask us. 'The message of this book is that in principle they can and that in the world of tomorrow they will... We can foresee the day when poverty, hunger, disease and political strife have been tamed through the use of new knowledge, the product of computers acting as our servants, not as our slaves.'

Stirring stuff, you'll agree, and amazing to think that, even today, far-sighted men like Michie and Johnston already possess the capability to turn out this bilge by the yard. There's lots more. There's Socrates and Jimmy Carter, Montaigne and Mitsubishi. There's Galileo and the day Three Mile Island went bang. We're told how the NORAID bells went off by mistake and the whole world went bang — or jolly nearly did, or might easily have done. We see life among remote Pacific islanders and among eighth-century Bulgars. We think about making a robot cricketer. We're shown heuristic tables of when to open an umbrella.

Coo. This is of course meant to be an expansionist, thought-provoking, frontier-stretching, wherever-will-it-end vision of tomorrow's undoubtedly faster, cleverer computers. There's potential for a fascinating book in that, but here, unfortunately, the garbage in-garbage out principle prevails.

Switched on

Title: Networking with the BBC Microcomputer
Author: R G Napier
Publisher: Prentice Hall International
Price: £8.98

The Cambridge Ring is neither something left round the bath, nor a new Wagnerian cycle, but the local area networking of monster computer systems in and around 'Silicon Fen'. It is the most dramatic local hook-up in which Messrs Acorn have taken a hand.

Possibly the least dramatic, but nevertheless a useful and fun-to-use system, is that which Acorn devised for its BBC Micro — Econet.

Econet began, rather shambolically, a handful of years ago, as a means of directly connecting BBCs in order that they might share data and resources like disks and printers. Note that it is direct connection (as opposed to squirting into remote computers via modem-linked phone lines), and therefore LANs are usually as local as one building or perhaps neighbours linked by a dedicated line. Schools use it a lot.

Official documentation on how to use Econet, of course, took years to surface. This book steps in to fill gaps and enlarge on general principles, plus pass on direct experience.

It's extremely well done: detailed yet lucid and authoritative, free of any irritating waffle. After a brief overview of what's what on an LAN, Napier plunges straight into Econet's most powerful feature, the file server, which stashes for several users on a central disk drive but can keep the files separated. You get a go on the printer server, too, are shown how to set up station-to-station comms, and led through processing star commands and error messages.

All good stuff and very handy, but only if you have lots of BBC-using mates.

The choice is yours

Title: Selecting Business Software
Authors: ED Berman and Leslie Dewhurst
Publisher: Frances Pinter (Covent Garden)
Price: £7.95

There are reckoned to be about 20,000 software packages currently on the market and, it sometimes seems to me, there must by now be roughly as many well-meaning little handbooks to help you choose which to buy.

This book is *terribly* well-meaning. It is also little. It tries hard to set out the fundamentals which ought to determine a sensible choice for a small commercial set-up, and tries too hard not to bore the pants off non-specialist readers in the process.

You're supposed to be Confused of Staines, or at any rate a small businessman flummoxed by the wonder and confusion of it all. In 160-odd less-than-jam-packed pages you are scooted through picking your word processing/spreadsheet/database needs, and hectically briefed on best-selling business computers, printers, modems, operating systems — the lot. It is breathless, chatty, superficial. It drives you up the wall with fatuous analogies such as buying a computer is like buying a suit — 'beyond anything else it has to fit you.' Hardware (despite the book's title) gets a dozen pages. Framework and Symphony get just over two between them. Only four word processing packages are mentioned and the summary disarmingly declares: 'Which of the many packages on the market you finally select is largely a matter of personal taste.'

Yes, and failing that, I suppose, you could always toss a coin.

Building on a strong foundation

Title: Machine Code Extensions for Spectrum Basic
Author: Rob Banks
Publisher: Hewson Consultants
Price: £6.95

For millions of micro users, Basic doesn't come much more, well, basic, than Sinclair Basic *à la* Spectrum. When you get good, it's frustratingly slow, for instance, and it lacks structure.

What's to be done? You could save up for a QL. Or, *pro tem*, you could add these machine code extensions to provide, for example, procedures, IF/ELSE routines to get round GOTO, or screen tidying commands.

It's ingenious — using error-intercepting routines within Spectrum's ROM, only asking for under 4k of user RAM — and in principle it's open house for you to persevere along similar lines towards customised commands of your own or (for suckers for punishment only) programming languages.

It's also hard work for any but determined hackers. A good assembler would help, or you can rely on the book's hex loader and then try to borrow an electron microscope to follow the (Basic) lines as written here, possibly by trained ants.

The book assumes you will want to do your own keying-in, grasping the way the extensions work as you tap. Spoilsports who only want results rather than sleepless nights can opt for a cassette version. Either way it's all a bit of a lash-up, this performing tricks with extensions. It's undeniably cheaper than a QL or BBC, mind, and even as it comes out of the box the recently price-cut Spectrum is still a good place for hobbyists to start microcomputing.

The sober view

Title: Microcomputers in Education 2
Editor: Elizabeth Ramsden
Publisher: Ellis Horwood (John Wiley & Sons)
Price: £18.50

What's afoot at our Alvey Directorate and elsewhere on the road to fifth generation computing again features here, in a collection of academic papers intended to brief budding teachers. For them, it's certainly useful. It's also refreshing to find factual analysis having the upper hand over speculative rambling.

For a general reader, chunks of this book will prove too specialised (a pilot Logo course for 16/18-year-old students, teaching pupils to do statistics using a Pet) and other chunks incomprehensible (demonstration of learning programs in nuclear physics on the Commodore 64).

On the other hand, there's an interestingly informative (and topical) essay on ITECs (Information Technology Centres, which aim to train young unemployed people and boost their chances of finding work within IT in its broadest sense). It's written by the Principal at one of the first ITECs to be set up (in Bradford) and is a very encouraging report. Almost 90 per cent of its intake find jobs, we learn, and the national average (some 150 ITECs are being set up) is around 70 per cent.

Other papers included here are sober asides on the use of computers in secondary schools and higher education, plus a look at some of the latest and most fashionable micro languages like Prolog.

Unlikely, I'd think, that anyone except a professional educationalist (or conscientious reviewer!) is going to read this book cover-to-cover, though at £18.50 you might well feel that you'd better. Selective dips are nevertheless recommended. END

Up and running

Peter Toothill relays details of the cost involved in setting up a bulletin board system, and describes the workings of a TBBS

A newsletter for bulletin board system (BBS) operators in the US has done some research into the costs (in time and money) of running a bulletin board. It found that on average, system operators (sysops) spent 50 hours a month maintaining the message base, dealing with user queries, updating the system, and so on. Monthly expenses, including electricity, telephone charges, supplies and legal advice(!) averaged $50. Startup costs were around $3000.

It would be interesting to see if British sysops spend the same; I would think that the time is probably very similar. The costs are much more difficult to assess, as most sysops use their systems for other things and it could be difficult to know just how to allocate expenses. Startup costs can also be considerably reduced by buying second-hand equipment. A BBS could be put online for around £1000 if you shop around — much less if you have some of the equipment already available.

There's no such thing as a typical BBS: each sysop has his own ideas about how things should fit together. Different systems have different features and facilities.

I'll start with TBBSs. Fig 1 is a map of a 'typical' TBBS. Fig 2 is a map of Liverpool Mailbox, which I've included so that you will have some idea of the way that systems from the same 'family' can vary. The main difference is that Liverpool Mailbox doesn't have a 'message area' menu; this is because all the main message area functions are controlled from the main system menu.

The menus that are shaded are ones that you will not normally see unless you are given special access to them. Many BBSs have areas that are hidden from public view. Sometimes you need to register with a system to be able to use some of the features such as private mail, or downloading. Other features may be open to a particular class of caller. The TBBS sysops menu is an example of the latter; it's an area where those operating TBBS systems can

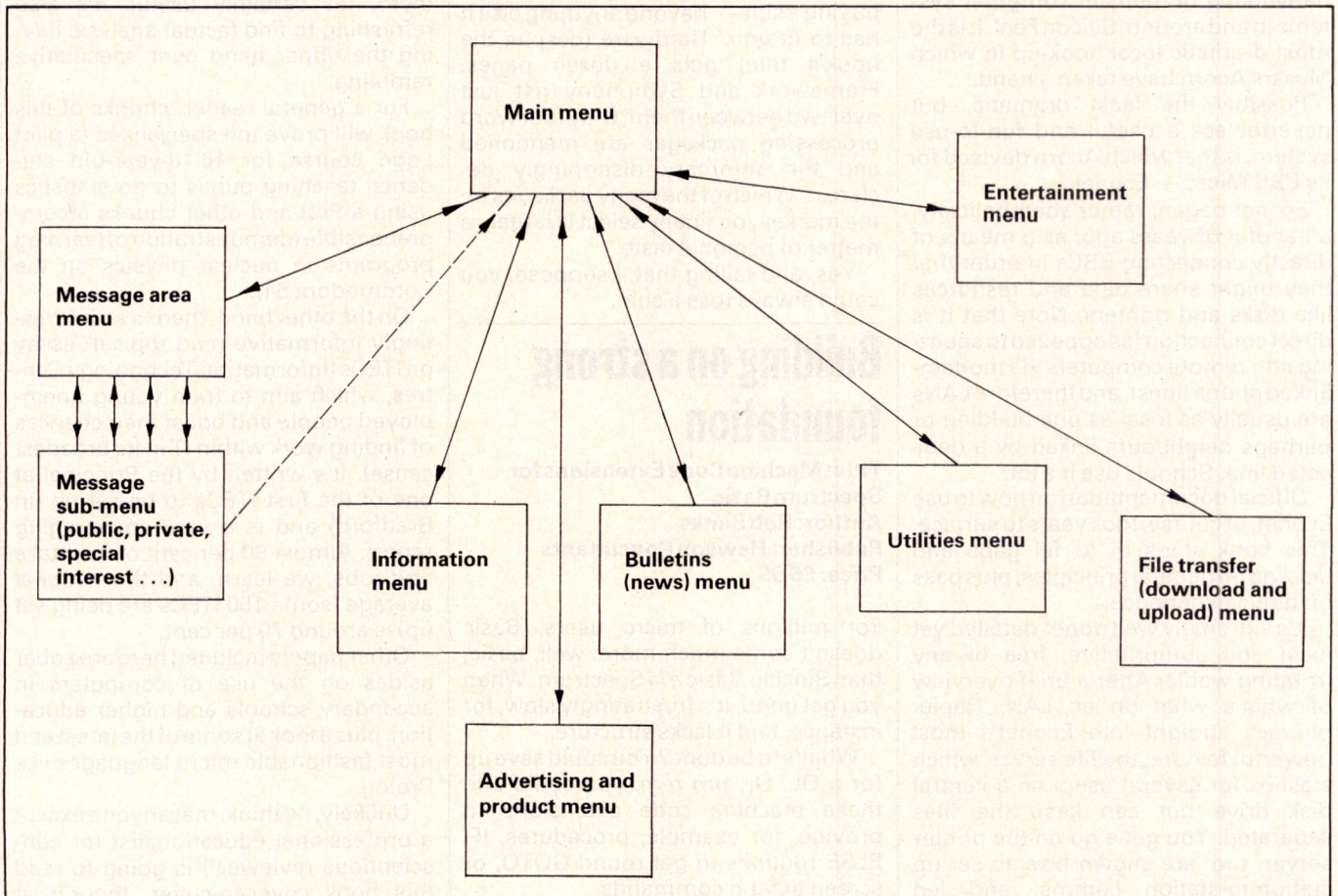


Fig 1 Typical TBBS map

UK subscriber commercial/business systems

Bulletin board	Phone number	Notes
Comet	(0527) 28515	Message-handling system: facilities for leaving and retrieving messages; £30 per month; access to telex network for extra £10. Details from Istel Ltd, Grosvenor House, Prospect Hill, Redditch, Worcs
Micronet 800	(01) 278 3143	Prestel database information for micro users. Service details as Prestel. £50-£75 joining fee (covers acoustic coupler and software) and £8 per quarter on top of normal Prestel charges. Details from Micronet 800, 8 Herbal Hill, London EC1R 5EJ
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Telecom Gold	(01) 403 6777	All information from Sales Admin, 60-68 St Thomas Street, London SE1 3QU

communicate with each other and read the latest news about TBBS software.

Most of the menu titles are self-explanatory: utilities usually include such things as redefining terminal parameters (screen width, linefeeds, and so on); set or change your password; and set expert modes (cuts down length of menu text). Entertainments will include a selection of online games and diversions.

Many menu selections will lead to a sub-menu of options. For example, selecting 'R' for read messages will lead to the following list of options:

<F>orward or <R>everse Multiple
<N>ew Messages
<M>arked Messages
<S>elective Retrieval
<I>ndividual Message(s)
<A>bort Retrieve

```
You have the following waiting:
Msg£:10611 *E-MAIL*
Subj: BULLETIN BOARDS
01/06/85 21:40:18
From: SYSOP
To: PETER TOOTILL

These message(s) are marked for
retrieval
```

Fig 3 Typical bulletin board message

Which one?

Individual message retrieval is best avoided on a TBBS system unless you know exactly where the message is. A

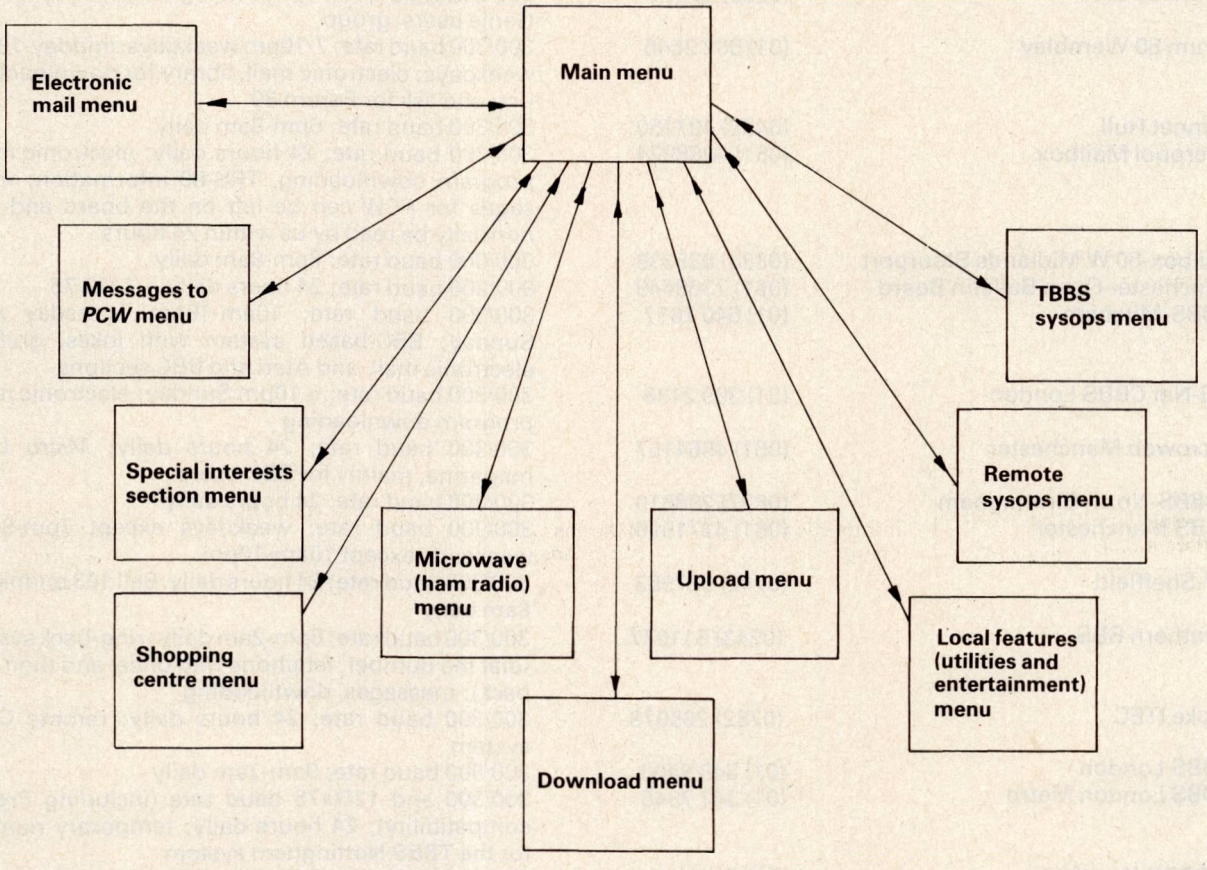

Fig 2 Map of Liverpool Mailbox

TBBS stores all messages in one file and allocates them to the various message areas (public, private, special interest, and so on). So, for example, if you select the number of a private message when you are in the public message area, you won't find it even though it does exist.

Another hint to help you in retrieving messages: as you logon, a TBBS system tells you if there are any personal messages waiting for you. Many people don't realise that it also tells you where to look for them (Fig 3); the name of the appropriate message area is between the asterisks. In this case it is 'E-mail' which means 'electronic mail' — the private message area. You can read this message by selecting the menu entry for electronic mail and then using the marked message retrieval option. END

UK free networks

Bulletin Board	Phone Number	Notes
BABBS-Bath	(0225) 23276	300/300 baud rate; 9pm-8am weekdays, 9am-noon weekends; Atari-based system, ring-back system
BABBS-Felixstowe	(0394) 276306	300/300 baud rate; 24 hours daily; Apple users' group
BABBS TWO-Basildon	(0268) 778956	300/300 baud rate; 24 hours daily; Apple users' group with special area for queries to Apple UK
Bettisfield	(094875) 378	300/300 baud rate; 9pm-9am daily; remote CP/M system
Blandford Board	(0258) 54494	300/300 baud rate; 24 hours daily
CABB	(01) 631 3076	300/300 baud rate; 24 hours daily + 1200/75
CBBS SW	(0392) 53116	300/300 baud rate; 24 hours daily
CBBS Surrey (Woking)	(04862) 25174	1200/75 and 300/300 baud rates; 24 hours daily; jokes, jobs, reviews, news
CNOL Lancaster	(0524) 60399	300/300 baud rate; 24 hours daily; Clinical Notes Online service, mainly for medical users; works in conjuction with a database on the Datastar network
Computers Incorporated Newcastle	(0207) 543555	300/300 baud rate; 24 hours daily; primarily business-oriented
Forum 80 Hull	(0482) 859169	300/300 baud rate; 5-11.30pm weekdays, noon-11.30pm weekdays; Bell 103 standard, midnight-8am daily; international electronic mail, library for up/downloading
Forum 80 SPA	(0926) 39871	300/300 baud rate; 11pm-midnight daily; TRS-80 and Genie users' group
Forum 80 Wembley	(01) 902 2546	300/300 baud rate; 7-10pm weekdays, midday-10pm weekdays; electronic mail, library for downloading; ring and ask for Forum 80
Hamnet Hull	(0482) 497150	300/300 baud rate; 6pm-8am daily
Liverpool Mailbox	(051) 4288924	300/300 baud rate; 24 hours daily; electronic mail, program downloading, TRS-80 information; messages for *PCW* can be left on the board and will normally be read by us within 24 hours
Mailbox-80 W Midlands Stourport	(0384) 635336	300/300 baud rate; 6pm-8am daily
Manchester Open Bulletin Board	(061) 7368449	300/300 baud rate; 24 hours daily + 1200/75
MBBS-Mitcham	(01) 640 2617	300/300 baud rate; 10am-10pm Thursday and Sunday; BBC-based system with jokes, graffiti, electronic mail, and Atari and BBC sections
MG-Net CBBS London	(01) 399 2136	300/300 baud rate; 5-10pm Sunday; electronic mail, program downloading
Microweb Manchester	(061) 4564157	300/300 baud rate; 24 hours daily; *Micro User* magazine, mainly for BBC users
NBBBS-North Birmingham	(0827) 288810	300/300 baud rate; 24 hours daily
OBBS Manchester	(061) 4271596	300/300 baud rate; weekdays except 7pm-9pm, weekends except 10am-10pm
PIP-Sheffield	(0742) 667983	300/300 baud rate; 24 hours daily. Bell 103 midnight-8am daily
Southern BBS	(0243) 511077	300/300 baud rate; 8pm-2am daily; ring-back system (dial the number, let phone ring once, and then ring back); messages, downloading
Stoke ITEC	(0782) 265078	300/300 baud rate; 24 hours daily; remote CP/M system
TBBS London	(01) 348 9400	300/300 baud rate; 9am-7am daily
TBBS London Metro	(01) 341 7840	300/300 and 1200/75 baud rate (including Prestel compatibility); 24 hours daily; temporary number for the TBBS Nottingham system
WABBS-Worthing	(0903) 42013	300/300 baud rate; 24 hours daily; ring-back system (dial the number, let phone ring once, and then ring back); Atari-based

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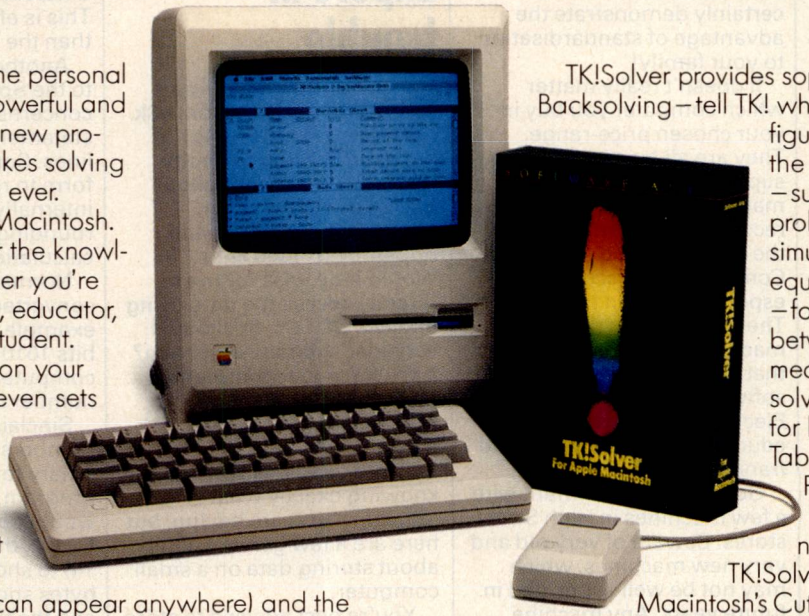

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It's not what you've got . . .

I am considering buying my family a 'basic' computer costing about £200. My wife has recently undertaken an evening course which consists of micro processing in its initial stages, and she will achieve a standard where she is able to write a straightforward program.

My eldest son, aged 9, has used models such as the Commodore 64, and a machine could be useful to him for the future. The school he attends has a BBC Micro, and consequently my wife suggests an Acorn Electron. I have other, younger children and would like to think that the item purchased would be able to be expanded to cope for the next three to five years.

With so many machines on the market and the pressurised selling and advertising they are being given, I feel that expert help in making the right choice is essential.
M J Moore, Luton, Beds

This letter is typical of many I receive.

Home computers are much of a muchness. The difference between having a computer and *not* having one is much greater than that between models, even between those which differ wildly in price. Much of the 'pressurised advertising' you refer to appears for exactly this reason — if the manufacturers didn't shout loudly about the quirks and special features of their own machines, first-time buyers might catch on and realise that there's not much real difference between models.

The advertising is really aimed at second-time buyers, who are more selective than beginners. Home computing is still a fashion, and surveys which estimate that the market is saturated ignore the fact that most enthusiasts are collectors — as the price and power of machines change, they buy a new model and keep the old one because its resale value would be small. Fashions change, although the real power and attraction of computing may not. Computers are also like puzzles, in the sense that people buy them, learn all about them, and then buy another to analyse in the same way.

To make the point by analogy, there's more variety among modern four-cylinder, four-wheel cars than there is in 8-bit home computers (a set which includes all the home machines up to a price of about £400). As with cars, you get roughly what you pay for. When you buy your first car, the need to get from A to B — regardless of style — is paramount; later you take an interest in turbochargers, auto-reverse cassette players, nodding dogs and furry dice.

The Acorn Electron has the same Basic as the BBC Micro, but this is a superficial advantage of the machine. You should bear in mind that the vast majority of computers use differing versions of Basic; your family will have to learn how to cope with a variety of 'dialects' sooner or later, so precise compatibility with the language used at school may not be important. Micro Basics have a lot in common, and the move from one to another is educational rather than traumatic — it will certainly demonstrate the advantage of standardisation to your family!

It doesn't really matter which computer you buy in your chosen price-range. They are all reasonably well supported by books, magazines, add-ons and recorded software, although the Spectrum and Commodore 64 score especially high in this respect. The link between the Acorn machines and schools means that plenty of educational software is available for the Electron, but much educational software is, quite frankly, rubbish.

Go out and experiment with a few machines in High Street stores. Beware of very old and very new machines, which may not be well supported in future years. Any machine that has been extensively advertised in the past is likely to have a reasonable long-term following.

It's a good idea to choose a machine that you can easily return if it breaks down. This happens to a large proportion of home computers in their first six months of use, but if a computer survives this period it is likely to go on working for a long time — computer components are very reliable once you've sifted out any which were defective in manufacture.

You should consider buying a second-hand computer unless you're desperate to keep up with the Jones's. An older computer will have gone through the 'burn in' period safely and will be sold at a bargain price, often with a 'redundant' collection of books, magazines and programs at no extra charge.

To find out more, go along to your local computer club and talk to people there. They will be helpful, eager to demonstrate their machines and let you experiment with them. They will also be ridiculously partisan — remember the motoring analogy. Enrol on your wife's evening course. Buy your computer from someone who seems to understand the machine, whether a shop assistant or an enthusiast. And don't worry — it's almost impossible to make a bad choice.

Expert in trouble

I am writing a small expert system on my Spectrum 48k. I have written the logic but am experiencing difficulty with the data. I have about 250 lines of data so far, although this will expand, hopefully to 1000 lines. Would it be wise for me to directly access the data using endless GOTOs, or should I consider a database system? If so, can you recommend a package?
M D Gibbons, Rise Park, Nottingham

It's hard to advise you without knowing exactly what 'difficulty' you are having, but here are a few general points about storing data on a small computer.

You're best advised to store all the data in a string or string array, and load it into your program from tape or micro-drive. This avoids all the 'overheads' — memory which would be used to store line numbers, LET or DATA statements, and so on, at the expense of the room available for your data.

DATA statements are definitely to be avoided since they can be very wasteful. If you read data from program lines into an array you are, effectively, creating two copies in memory — the version in the program, and a copy in the variables area. Some computers take special care to minimise the wastage of memory when strings are assigned from DATA, but in general the technique is very wasteful (remember that READ and LET take a copy of the data and associate that copy with the variable being assigned).

The snag with using tape files and string arrays is that Spectrum arrays use 'fixed length' strings. Every string is padded out with spaces to a fixed length, it can however be very wasteful if the strings vary a great deal. They will all be padded out to the length of the longest one, leaving large amounts of memory containing nothing but spaces. This is not a problem in Microsoft Basic (on the Dragon, IBM PC, Oric, Commodore 64, and so on). Those machines use so-called 'dynamic string arrays'; each string in an array can be a different length to the others. This is efficient, but slower than the Sinclair system.

Another problem confined to the Spectrum and ZX81 concerns numbers in DATA statements and program lines. Computers use a binary form to represent numbers internally (leading to strange rounding errors in some calculations).

Normally every number is converted from decimal (for example, 42) into binary (the bits 101010) whenever the computer encounters the number in a program.

Sinclair computers store all numbers in text *and* a hidden binary form within the program. Thus the value 42 would be stored as the digit 4, then 2, then a marker (CHR$ 14) to show that the next five bytes should not be listed, and the five-byte binary form of the number. Five bytes are used so that large numbers or small numbers can be represented in the same way.

This means that the computer doesn't have to keep converting values from text to binary whenever it finds them. Therefore, the computer runs programs a

little more quickly (and saves Sinclair the hassle of having to write a fast routine to convert text to binary) but it wastes large amounts of memory. The value 1, for example, takes up seven bytes rather than one (one for the text, plus a marker and five binary bytes) and the value −255 takes up 10 bytes (four from the text, a marker, and five, once again, for the value).

The way to stop this largesse is to store the numbers in such a way that they can't be converted to binary as you enter them. The Spectrum only converts numbers (sequences of digits). It can't cope with expressions like SQR(PI) and works those out as it goes along.

Consequently it's more economical to type INT PI (two bytes) rather than 3 (seven bytes — one for the text, a marker and five for the binary) in a DATA statement. You can use NOT PI instead of zero, PI/PI to replace one, −INT PI for minus three, and so on, saving four or five bytes each time. The program will go a little more slowly (about 30-40 per cent in my experience) but the data will occupy less memory.

In general you will save three bytes on every number if you type VAL 'number', rather than 'number'. Three bytes are used up by VAL and the two string quotes, but six bytes are saved since the number is seen as a string and consequently not stored as binary as well as text. Remember, this is only true of the ZX81 and Spectrum.

It is often a good idea to store your data as a code block, PEEKing and POKEing values. If many of your numbers are integers between 0 and 255, it's best to store those in single bytes rather than use five-byte floating point numbers.

You can store numbers in their text form using a word processor such as Tasword. Put an 'enter' character between lines of data, and commas or spaces between the numbers. Use a relatively small numeric array to contain the address of each line (you'll need a loop to initialise this array by PEEKing the code). Tasword produces a code file containing text data which can be loaded at any address.

PEEK and POKE are the most efficient ways to store data, especially numbers, but they may be rather slow since you have to PEEK characters one by one whenever you need them.

It's a good idea to divide your program into two parts — one to set up the data and another to process it. This minimises the space taken up by program lines at any point, but it can be unwieldy on a cassette system.

There's an excellent book on simple expert systems. *Build Your Own Expert System* by Chris Naylor contains example Basic programs (for the Apple and Spectrum) which use GOTOs to implement a database.

BBC disk dilemma

I have owned a BBC Model B since it was first launched onto the market, but I must confess to being what is commonly referred to as 'computer illiterate'.

I want to upgrade my computer with disk drives, a sideways ROM expansion board, and perhaps at a later date a second 6502 processor.

I am undecided about which disk interface to buy. Will I also need to buy a disk filing system when I buy a disk interface? Is there any difference between the two? After reading several reports on double-density disk interfaces, I would like to purchase one of these interfaces as it appears to be a sensible upgrade. However, which double-density interface is compatible with the tube and the ROM board? Does Acorn intend to launch a double-density disk interface, and if so, will it be worth waiting for?
S Rawal, London N3

A disk system consists of three components. Firstly, you need the drive, to spin the disk around and detect the data recorded on it. Drives are made by a number of manufacturers to a standard design developed by an American firm, Shugart.

Then you need a controller, to tell the disk when to start and stop, and to act as an electronic link between the drive and the computer. The controller determines the precise way data is recorded on a disk: the number of bytes a disk can store on a given track, for example.

Finally, you need some software to tell the controller what to do — obviously the software will vary depending upon the type of controller you've chosen. This software is called the disk filing system (or DFS); it keeps track of the bytes on the disk so that you can load and save files without having to worry about exactly where on the disk they are recorded.

Disk drives are fairly standard, although the precise mechanical design and speed may vary between models. There are basically two types of disk controller. With a single-density system, each bit of information is stored as an ON signal, followed by an OFF. Double-density systems store each bit as a change — from ON to OFF, or *vice versa*. This gives tighter packing, but it's harder to control. The timing of bits determines whether the value recorded is a '1' or a '0'.

When Acorn designed the BBC Micro it made a point of using 'proven' technology, although the design itself was quite advanced. In 1982 the standard component used to control disk interfaces was called (in the usual unimaginative fashion) the 8271. Even then there were a number of newer, more sophisticated devices available, but Acorn opted for the tried-and-tested 8271: a single-density component.

After a while the 8271 became obsolescent, expensive and hard to obtain, as more modern devices became the market leaders. Acorn persisted in using the component, which lead to a shortage of disk interfaces and a relatively high price.

Other manufacturers stepped into the breach with interfaces using newer, cheaper chips; some of these could use double-density recording to pack extra data onto a disk. The new devices can generally read and write using the old single-density system if required.

As far as I know, Acorn has no plans to produce a double-density system, but it isn't a good idea to wait for Acorn to produce anything — in the past it has not been particularly punctual in its supply of new products.

In performance terms a double-density disk interface is a good buy, especially if you write you own programs. You'll need a special DFS which will be available from the supplier of the interface — a controller is fairly useless without an appropriate filing system. But problems may appear if you use a double-density system to try to load commercial software which has been 'protected' against copying.

In principle, protected software is recorded in a non-standard way so that parts of it can only be read from within the program — not by the DFS or a disk copier routine. Since protection involves using techniques unavailable to the DFS, it can only be achieved if the software communicates directly with the disk controller. But the exact workings of a controller will vary from one model to the next, so different software (normally the DFS) is needed to use each model.

Commodore mixing

I am a Commodore 64 user and have been exploring the machine's graphics. I can handle sprites and hi-res, but I have struck a problem — I don't know how to mix graphics and text. I have many books and not one of them explains how this can be done.
P Feely, Houston, Renfrew

There are two popular ways of designing a computer display. In each case an area of memory is reserved so that it contains a representation of the screen display; this area is commonly called video memory.

In the first case, character mapping, every time you change one of the values stored in the video memory a character on the display changes — from a space to an



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```
10 MEMORY HIMEM-10
20 start=HIMEM+1
30 |ASSEMBLE,start
40 'get start
50 'limit &FFFF
60 'ORG start
70 'CP 10:SCF:RET Z
80 'RST 1,& 87F2
90 'ORG &BD2B
100'JP start
110'END
```

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asterisk, for example, or from one letter to another, depending on the value concerned.

In the other case, a change in video memory causes a much smaller change on the screen: a dot on the display may change colour, or a few dots in a row may be altered. This system is called pixel mapping (a dot on the screen is technically known as a picture element, or pixel) or hi-res — the term 'high resolution' implies that small changes can be shown or resolved.

The Commodore 64 can use either character or hi-res mapping. Character mapping is used for listings and simple business programs; it has the advantage of speed (since one change in video memory changes a whole character, not just a few dots) but it's not very flexible since, generally, you are restricted to a maximum of 256 different character shapes on the screen at a time.

It's hard to produce attractive moving graphics with character mapping, since it doesn't allow you to move a character smoothly from one position to the next: a symbol can be in one position or the other, but not midway between the two. You can get around this limitation to some extent by defining a pair of characters, each containing one side of the symbol you want to move, but you reach the limit of 256 distinct characters quite quickly.

When you switch to pixel mapping things become much easier. Each bit (or small group of bits, depending on the computer you're using) in the video memory controls one dot. To move a dot from one place onscreen to another you just change (and restore) successive bits in the video memory. If you want to move a line, you change and restore the value of a group of bits, once again moving steadily through memory.

A character is nothing more than a group of dots on the display, whether it is produced using character or pixel mapping. In character mapping the computer just assembles the group for you, using some electronics and a table of dot values called a font.

For example, the = sign might be displayed using eight lines of the display. In the font there would be an entry for each line: the first three lines would be represented by OFF values, then would come a line of ON values, then a line of OFF (for the gap between the two horizontal bars in an = sign), then another line of ON values and two OFF lines. The exact number of lines in the font for each character will vary from one computer to the next, depending upon the level of detail with which characters are displayed.

To print text on the hi-res screen you must explicitly set each dot of every character you wish to display. This is a chore — you'll need to make a table of values for each row in a character, and then set the dots one by one. The display circuit in the Acorn Electron can only use pixel mapping so characters must always be printed by setting groups of dots, yet the machine will LIST and PRINT very quickly.

Financial routines

In the December 1984 issue of *PCW* there was a financial program by J McCartney. This is the kind of program I have been searching for. Unfortunately I am only conversant with Sinclair Basic, and hard as I try I cannot translate the program.

Could you supply the formulae that have been used in all 12 calculations?
W Wallis, Taylor Hill, Huddersfield

Jim McCartney's program was written for the ACT Sirius; it's a shame that it used so many idiosyncratic commands, especially in connection with display handling. It isn't worth translating such a program line by line — you just get bogged down trying to convert parts of the program which aren't important. The key routines are between lines 30,000 and 41,000 — you'll obviously need to alter the line numbers to fit the program into your Sinclair computer.

The routines should work in Sinclair Basic if a few small changes are made. Many of the variable names are followed by £ signs. These tell the Sirius to use double-precision arithmetic and should be omitted on a Sinclair computer, which always uses a level of precision mid-way between that of single- and double-precision on the Sirius. The circumflex signs in line 30,040 and elsewhere should be typed as upward arrows on the Spectrum: press SYMBOL SHIFT and H. Type 100 in place of C%.

The rest of the program is rather verbose, and is mainly concerned with keyboard and display handling. In essence, the only subroutines you need are those at line 1000 (to read input values into the array IN$), line 600 (to print the value of the answer, A) and line 800 (to process inflating withdrawals). You'll also need to set up FN I, which is defined in line 20,050; again, type 100 in place of C%.

Once you've got these routines working, you should add your own 'bells and whistles' to make the program user-friendly.

Age of Aquarius?

Are there any books available on the Aquarius computer system as books and software for this machine seem to be about as common as ZX-81's with colour.

Is it possible to use the games paddles in your own programs, or are they only for use in cartridge games?
S Forster, Derby

The only book about the Aquarius that I can trace is *The Aquarius and how to get the most from it* by the ubiquitous Ian Sinclair. It's published by Granada Publishing — (01) 493 7070 — and costs about £6. Hopefully information about the paddle controls will be in the book, since they are not mentioned in the computer's manual.

If you're still stuck after reading the book, try printing the value read with the IN function, using parameters between 0 and 255. Look for a parameter value that gives a changing result as the paddles are manipulated. The paddles are almost certainly port-mapped, which means that they will be connected in such a way as to alter the value at a given port as they are adjusted.

Expanding Apricot

I have an Apricot Xi with 10Mbyte hard disk and 256k of RAM. I want to expand the Apricot to increase the RAM, and I would also like to get an internal modem board. Unfortunately the hard disk takes up one of the two expansion slots on my machine.

Although I could use an external modem, I sometimes take my Apricot home, and in any event a built-in modem is more attractive with its smaller footprint, and so on. Is there any way in which I could expand the RAM without using up an expansion slot?

My father has an Apricot with 256k of RAM, two single-sided floppy disks, a 512k RAM expansion board, and a built-in modem. He now wants to add an external hard disk. Is there any way that he can do so? His RAM expansion board and the built-in modem board are using up his two expansion slots.

Is there a product that could increase the number of slots available for expansion?
J Elman, London W11

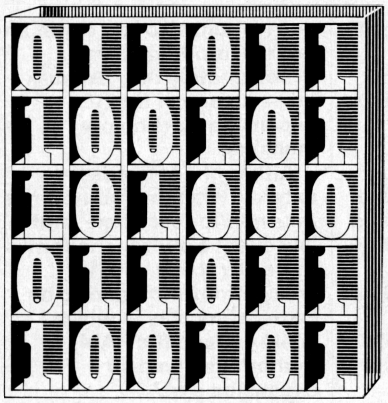
It sounds as if you're both engaged in some kind of technological race! ACT, the maker of the Apricot, has produced an expansion box which is designed to provide extra slots for the new F1 system. It should work with your father's floppy-based system but — according to ACT technical staff — it is not compatible with hard disks, and there are no plans to remedy this problem. It seems that you have reached the practical limits of expansion for an Apricot system, unless you get out a soldering iron and re-design the machine.

If you want to take that approach, your best bet is to add extra memory to the main processor board, in addition to the 256k already there. This is not, in design terms, a very difficult task, but you'll invalidate your warranty and you could run into problems providing sufficient power to keep everything going at once.

Unless you're very skilled, or know someone who is, I'd recommend that you opt for an external modem and use your two expansion slots for the hard disk and extra memory. This may be less aesthetically pleasing, but it's more likely to work. END

Unfortunately we can't answer questions on an individual basis, so please don't send a SAE with your query.

SUBSET



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 Sub Set, PCW, 62 Oxford Street, London W1A 2HG.

UNTRAPPABLE DIVISION

DIV32S (Datasheet 1) and DIV32U (Datasheet 2) by TA Browning of Wells are the response to the challenge made in *PCW*, November 1984, for 68000 divisions that don't run the risk of ending up in system mode for exception processing.

The M68000 series processor does have 32-bit by 16-bit division instructions but gives only 16-bit quotients and remainders. Overflow, or division by zero, is trapped and dealt with in supervisor mode — not particularly useful if the system limits you to user mode.

DIV32S and DIV32U are full 32-bit operations giving 32-bit quotient and remainder. They both exit immediately with the overflow flag (V) set on input of a zero divisor. The 32-bit results cannot overflow the 32-bit result registers and so error trapping ought not to occur. The problem of a zero divisor can be dealt with by your own error routine in user mode.

DATASHEET 1

```
;=============================================================
:= DIV32S   32-bit signed division (non-trappable).
;=============================================================
:JOB        To divide one signed (2's complement) number by
:           another, returning signed quotient and remainder, or
:           division by zero flag.
:ACTION     IF divisor = 0:
:           THEN [ Set division by zero flag. ]
:           ELSE [ Clear division by zero flag.
:                  Calculate quotient sign.
:                  Make arguments absolute.
:                  Call unsigned division subroutine.
:                  IF quotient sign negative:
:                  [ Negate quotient and remainder. ] ]
;-------------------------------------------------------------
:CPU        M68000 series.
:HARDWARE   None.
:SOFTWARE   DIV32U - 32-bit unsigned division (non-trappable).
:           (Assembled within an 8-bit offset range of DIV32S.)
;-------------------------------------------------------------
:INPUT      D0 = signed dividend. D1 = signed divisor.
:OUTPUT     V = 1: division by zero, arguments unchanged.
:           V = 0: division completed.
:                  D0 = signed quotient.
:                  D1 = remainder (negative if D0 is negative).
:ERRORS     None.
:REG USE    CCR D0 D1 (A7)
:STACK USE  (USP) 18 (including call to DIV32U).
:RAM USE    None.
:LENGTH     46
:CYCLES     Not given.
;-------------------------------------------------------------
:CLASS 1     *discreet      *interruptable      *promable
:******      *reentrant     *relocatable        *robust
;=============================================================
:
DIV32S MOVE    SR,-(A7)     :Save Condition Codes and set    40E7
       BSET    #1,(A7)      :stacked overflow flag V for     08D7
                            :if divisor is zero.             0001
       TST.L   D1           :Test divisor, if zero exit      4A81
       BEQ     DIVS0        :immediately with V = 1.         6722
       BCLR    #1(A7)       :Else clear stacked V flag to    0897
                            :show division valid.            0001
       MOVE.W  #1,-(A7)     :Put a positive "sign-word" on   3F3C
                            :stack for sign calculation.     0001
       TST.L   D0           :Test sign of dividend, skip     4A80
       BPL     DIVSA        :if positive as okay,            6A04
       NEG.W   (A7)         :else change sign-word and get   4457
       NEG.L   D0           :absolute dividend value.        4480
:
DIVSA  TST.L   D1           :Repeat process to get absolute  4A81
       BPL     DIVSB        :value of divisor in D1 and      6A04
       NEG.W   (A7)         :stacked sign-word positive only 4457
       NEG.L   D1           :if arguments had same sign.     4481
:
DIVSB  BSR     DIV32U       :Go divide absolute values.      61dd
       TST.W   (A7)+        :Test sign-word while clearing   4A5F
       BPL     DIVSC        :it off stack, skip if positive, 6A04
       NEG.L   D0           :else negative so negate         4480
       NEG.L   D1           :quotient and remainder.         4481
:
DIVSC  :Label for positive result skipping negation.
DIVS0  :Early exit label for division by zero.
:
       RTR                  :Exit, restoring CCR.            4E77
;=============================================================
```

DATASHEET 2

```
;=============================================================
:= DIV32U   32-bit unsigned division (non-trappable).
;=============================================================
:JOB        To divide one unsigned (absolute) number by another,
:           returning unsigned quotient and remainder, or
:           division by zero flag.
:ACTION     IF divisor = 0:
:           THEN [ Set division by zero flag. ]
:           ELSE [ Clear division by zero flag.
:                  Clear remainder accumulator.
:                  FOR 32-bit count:
:                  [ Shift dividend left 1-bit into remainder.
:                    Clear dividend lowest bit as quotient bit.
:                    IF divisor < remainder:
:                    [ Remainder = remainder - divisor.
:                      Set quotient bit. ] ] ]
;-------------------------------------------------------------
:CPU        M68000 series.
:HARDWARE   None.
:SOFTWARE   None.
;-------------------------------------------------------------
:INPUT      D0 = unsigned dividend. D1 = unsigned divisor.
:OUTPUT     V = 1: division by zero, arguments unchanged.
:           V = 0: division completed.
:                  D0 = unsigned quotient.
:                  D1 = absolute remainder.
:ERRORS     None.
:REG USE    CCR D0 D1 (A7)
:STACK USE  (USP) 10.
:RAM USE    None.
:LENGTH     46
:CYCLES     Not given.
;-------------------------------------------------------------
:CLASS 1     *discreet      *interruptable      *promable
:******      *reentrant     *relocatable        *robust
;=============================================================
:
DIV32U MOVE    SR,-(A7)     :Save Condition Codes and set    40E7
       BSET    #1,(A7)      :stacked overflow flag V for     08D7
                            :if divisor is zero.             0001
       TST.L   D1           :Test divisor, if zero exit      4A81
       BEQ     DIVU0        :immediately with V = 1.         6722
       BCLR    #1(A7)       :Else clear stacked V flag to    0897
                            :show division valid.            0001
       MOVEM.L D2/D3,-(A7)  :Save working registers D2 & D3  48E7
                            :on user stack.                  3000
       MOVE.L  D1,D2        :Move divisor to D2 and clear    2401
       CLR.L   D1           :D1 for remainder register.      4281
       MOVEQ   #31,D3       :Set count for 32 bit division.  761F
:
DIVULP ASL.L   #1.D0        :Loop, shifting next dividend    E380
       ROXL.L  #1,D1        :bit to remainder and clearing   E391
                            :quotient bit (bit 0,D0).
       CMP.L   D2,D1        :Test if divisor will subtract,  B282
       BCS     DIVUA        :skipping if not.                6504
       ADDQ.B  #1,D0        :Else set quotient bit in D0     5200
       SUB.L   D2,D1        :take divisor from remainder.    9282
DIVUA  DBF     D3,DIVULP    :Always decrement counter, loop  51CB
                            :until D3 = -1 (32 times).       FFF2
       MOVEM.L (A7)+,D2/D3  :Restore working registers       4CDF
                            :D2 and D3 from user stack.      000C
DIVU0  :Early exit label for division by zero.
:
       RTR                  :Exit, restoring CCR.            4E77
;=============================================================
```

Z80 BANK SWITCHING

I wrote in January that the Z80 block repeat instructions, LDIR and LDDR, could not be used for moving data between parallel banks of RAM/ROM. Since then I have been overwhelmed by letters from programmers whose machines do switch data from ROM to a RAM bank occupying identical addresses — I think I've got the message!

Keith Bremer of Chorlton utilises such a facility on his old NASCOM II which allows memory banks to be independently set for 'read' or 'write'.

With one of two parallel blocks read-disabled (write-enabled) and the other write-disabled (read-enabled), LDDR or LDIR is used with the source pointer HL having the same value as the destination pointer DE to copy data.

FRAMED

Keith Bremer is also due an apology. I didn't mention the most obvious use of his routines ENTRY and EXIT in my introduction to them in February.

Although I stressed the possibilities of using the routines to set up and index stack frames, Keith submitted them primarily as a solution to the perennial problem of assembler programming — pushing more than you pop. The Z80 stack is the most obvious place for temporary workspace, but is also very dangerous. All stack used within the routine must be tidied up before exit. If not, the most likely result will be an irrecoverable attempt to execute data in video RAM as the PC is loaded with the high order word of your square root, or whatever. Keith's routines ensure against this possibility by saving the top-of-stack address (that is, the location of the return address) in IX at the start of a routine and reloading the stack pointer from it on exit from the routine.

PASCAL'S TRIANGLE

PASCAL, from Robert Gardner-Medwin of Heddon-on-the-Wall, is a routine to calculate the value in any indexed cell of the well known Pascal's Triangle.

The triangle is constructed by adding two adjacent values to form the value that lies between them on the next row.

This is shown (skewed into an orthogonal grid) in Fig 1.

	Columns (X):	0	1	2	4	5	6	7	8	9
Rows (Y):	0	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	2	1	2	1	1	1	1	1	1	1
	3	1	3	3	1	1	1	1	1	1
	4	1	4	6	4	1	1	1	1	1
	5	1	5	10	10	5	1	1	1	1
	6	1	6	15	20	15	6	1	1	1
	7	1	7	21	35	35	21	7	1	1
	8	1	8	28	56	70	56	28	8	1

Fig 1 Pascal's triangle

Gamblers will recognise the triangle as a tabulation of the probabilities for (X) heads uppermost among (Y) tossed coins. A-level students will also recognise the values as the coefficients of binomial expansions for $(b+a)^Y$ and calculated by the formula $C(x,y) = y! / (x!(y-x)!)$.

The '!' is a factorial sign denoting that all integers from x or y down to unity be multiplied together. Using the coefficient formula can be complex, very slow, and can produce intermediate values of astronomical proportions. Robert's algorithm uses only simple three-byte addition and single-byte comparisons to achieve the same result.

PASCAL is recursive: since each cell value is the sum of the two values above it in the triangle, the method simply decrements Y and X in turn and calls itself to calculate the new (X,Y). Recursion ends when X= 0, or when X = Y and the cell value is 1. Each return but the last is to the next higher level where the 1s are accumulated. The routine does not recurse when X = 0 or X = Y on input, but returns the correct value of 1 (if input X is greater than Y the routine still returns a default value of 1, although logically these values should be 0 — the probability of five heads showing among four coins is zero). Recursive routines are very heavy users of stack and not particularly well suited to the small 256-byte stacking facility of the 6502.

USEFUL TRICKS

Alastair Macdonald of King's Lynn would like to see more space given over in Subset to the unspecified instructions that seem to come with every processor, and all those natty programming tricks that aren't quite so obvious. As an example, he notes that the CLR instruction cannot be used to zero a 68000 address register, but the instruction 'SUBA An,An' will do the job without affecting the condition codes.

Subset has pointed out quite a few wrinkles in the past. Check them up in the Subset index (February 1983 and January 1985). If you do discover any new ways to ease the programmer's task, send them in and let everyone know.

DATASHEET 3

```
;=============================================================
:= PASCAL   Calculate Pascal triangle cell value.
;=============================================================
:JOB        To calculate the value of a single cell in the
;           Pascal triangle (or coefficient of a binomial
;           expansion) by recursively calculating preceeding
;           cell values and adding.
:ACTION     (To calculate the Pascal number P(x,y) where x is
;           the column value and y is the row value, x and y are
;           repeatedly reduced until x=0 or x=y where P(x,y)=1.
;           The number of reductions gives the required value.)
;           IF x=0 OR x>=y:
;           THEN: [ P(x,y) = 1. ]
;           ELSE: [ y = y - 1. Call PASCAL, compute P(x,y-1).
;                   Push current result.
;                   x = x - 1. Call PASCAL, compute P(x-1,y-1).
;                   Result = current result + stacked result.
;                   y = y + 1. x = x + 1. ]
;-------------------------------------------------------------
:CPU        6502
:HARDWARE   None.
:SOFTWARE   None.
;-------------------------------------------------------------
:INPUT      X = Pascal triangle cell column.
;           Y = Pascal triangle cell row.
:OUTPUT     The cell value, P(X,Y), is in M1,2,3.
;           P(X,Y) = Y! / (X! * (Y-X)!).
;           (If X=0 or X>=Y then result = 1.)
;           M0, P and A are changed.
;           X and Y are unchanged.
:ERRORS     Large input X or Y values could cause the Stack
;           Pointer to wraparound the 256-byte stack or an
;           overflow of the 3-byte result variable.
:REG USE    P A X Y
:STACK USE  3X + 2Y - 2
:RAM USE    M0 M1 M2 M3
:LENGTH     56
:CYCLES     IF X=0: 27.   IF 0<X>=Y: 32.
;           IF 0<X<Y:   (27 * (Y-1)!) / (X! ((Y-1)-X)!)
;                     + (32 * (Y-1)!) / ((X-1)! (Y-X)!)
;                     + (88 * (Y!-1)) / (X! (Y-X)!).
;-------------------------------------------------------------
:CLASS 2    -discreet      *interruptable      *promable
:-***--     *reentrant     -relocatable        -robust
;=============================================================
;
PASCAL STY  M0          :Save y value for comparison.     84 M0
       TXA              :First test x value for zero,     8A
       BEQ  EQUAL       :if so, P(x,y) = 1.               F0 28
       CPX  M0          :Else test if x>=y,               E4 M0
       BCS  EQUAL       :if so, P(x,y) = 1.               B0 24
;
       DEY              :Else compute P(x,y-1) by a       88
       JSR  PASCAL      :recursive call to PASCAL.        20 lo hi
;
       LDA  M3          :M1,2,3 (M3 hi-byte) contains     A5 M3
       PHA              :value of preceeding cell at      48
       LDA  M2          :(x,y-1) so save it on stack      A5 M2
       PHA              :before computing other cell      48
       LDA  M1          :which adds to it to give value   A5 M1
       PHA              :at (x,y).                        48
;
       DEX              :Compute value at cell (x-1,y-1)  CA
       JSR  PASCAL      :by recursive call to PASCAL.     20 lo hi
;
       CLC              :M1,2,3 now contains value of     18
       PLA              :cell at (x-1,y-1), so add the    68
       ADC  M1          :top 3-bytes of stack, value at   65 M1
       STA  M1          :cell (x,y-1), to form value      85 M1
       PLA              :of cell at (x,y), storing        68
       ADC  M2          :result in M1,2,3.                65 M2
;
       STA  M2          :  The recursive algorithm used   85 M2
       PLA              :repeatedly reduces x and y until 68
       ADC  M3          :either x=0 or x=y ... in either  65 M3
       STA  M3          :case giving a cell value of 1.   85 M3
;
       INY              :Set x and y to index current     C8
       INX              :cell and exit either to compute  E8
       RTS              :next cell or exit routine.       60
;
EQUAL  LDA  #1          :Either x=0 or x>=y. In both      A9 01
       STA  M1          :cases P(x,y) = 1 so set result   85 M1
       LDA  #0          :in M1,2,3 to 1. Then exit this   A9 00
       STA  M2          :level to compute cell value at   85 M2
       STA  M3          :next level, or exit routine if   85 M3
       RTS              :required cell value computed.    60
;=============================================================
```

END ZONE

TRANSACTION FILE

Your chance to buy, sell or swap equipment.

TANDY Hi Res graphics unit Model 1. 380x192 res user definable characters. Demonstration s/w, enhaned Basic, also gives lower case. Cost £170, accept £80. Can install. Tel: Fairfeat 823126

● ACORN ELECTRON plus one interface. Acorn cassette recorder, many Acornsoft and Micropower titles. Books & joystick, worth £450+, fully guaranteed, £300 ono. Tel: Ipswich (0473) 73203.

● BBC B. DFS, Opus 200k drive, Epson RX80, cassette deck, joystick, software Elite on disk. Cost £1,200, £750 for quick sale. Tel: Bristol 49674 after 6pm.

● BBC B with two Omega compucorders, manual, software etc. Unpacked but never used. £370 ono. Optional compatible Fisher 14in flatscreen CTV, still boxed, plus aerial, £230. Tel: 01-935 9676.

● SINCLAIR QL. Including all leads, user guide and microdrive cassettes. Also joystick adapter and books £330 ono. Quick sale. Tel: Philip Bennett, Ormskirk (0695) 72255.

● IBM-PC 320k memory. One 360k drive plus new Davong 5 megabyte high speed Winchester. Back-up disks plus business software recently checked by approved service engineers. Tel: 01-789 5162 eve, £2,000 ono.

● ICL PC model 31 128k. 5mg hard disk plus Wordstar mailmerge, £1,800. Tel: Mr. Addison, (0444) 412823.

● SHARP MZ80K (48k). New CRT. Lots of software including 5 Basics, Forth, Fortran, Pascal, mach/code, Zen, assembler. Full documentation plus many games etc. £250 ono. Tel: Dave, 0268 743087 (Essex).

● TRS80 Model I Level II 48k. Twindisk drives, high resolution graphics, RS232, green monitor + sound board, Eprom programmer software; LDos, NewDos80, Superscript, Edtasm; plus many more programs. £400. Tel: Phil, 01-521 4448.

● ACT SIRIUS I. 10Mb hard disk, boxed, DBaseII, Supercalc 2, Wordstar +40 floppy disks and communications software. £2,400 ono. Call Mike on 01-485 0209, eve or 01-837 0384 day.

● APPLE II CP/M software; Wordstar, DBaseII, Pascal, Cobol, Calcstar and Datastar, £30 each. Tel: Daryl (0724) 720250, 7-9pm.

● Z80 COMPUTER. S100, problem solver systems. Pertec 8in DD + extensive s/ware. Diablo 630 printer, Televideo Iv1-920B. RS232 I/O tester (break-out) box. Offers together or separate. Tel: 01-906 3209 eve/weekends.

● LYNX 48k micro computer. All leads, psu, manual, and two user magazines. Also two books on Lynx Basic and over £30 worth of software. £95. Tel: Manchester (061) 766 9247.

● BBC Model B. Fitted Watford DFS, Ultracalc Cumana disk drive. All un-boxed, un-wanted present. Tel: Dennis, 01-452 1736 after 7 pm or weekends.

● PERSONAL COMPUTER WORLD and Practical Computing magazines from 1978/9 onwards. Some years in binders. Sell in year sets only. Offers Jebb, 72 West Street, Dunstable, Beds LU6 1NX. Tel: (0582) 607690.

● PROGRAM SET: Perfect Writer, Speller, Calc, Filer for IBM-PC. Unused, value over £750, £400 ono. Latest IBM-PC version Flight Simulator (duplicated present). Cost £55. £35 no offers. Tel: Sid 0438 736030.

● COMPLETE SYSTEM: APPLE II + 48k. Two Apple II disk-drives (one with control), 11in Hitachi VDU. Epson RX80FT printer (6 mths old). All recently serviced, report available. £980 ono. Tel: 0392 76089.

● EPSON RX80FT printer. Hardly used, boxed as new. £220 please. Tel: 01-556 5164 (Leytonstone).

● PET 3016, updated to 4032, with disk unit 2031 and cassette recorder. Excellent condition, manuals etc, £275 ono. Tel: Fareham (0329) 235117 eve.

● ATARI 800 48k. 810 disk drive, cassette recorder, joystick, many books + £500 worth of software; including Microsoft Basic, £500 ono. Tel: Cardiff (0222) 778421.

● TANDY Model 1 48kL2, TRSDos, 2 drives, monitor, assorted games, £300. Ashford, Middlesex. Tel: 07842 41019.

● HP41C CALCULATOR. As new, boxed, all manuals etc, with one memory module. £100. Tel: John (0276) 63311 ext 3064 daytime, weekdays or (0276) 685108 eve.

● APPLE II+. 64k, disk drives, colour monitor, Pascal, Logo, printer interface AD/DA interface, clock, Eprom programmer, all with manuals. Extra books and software galore, £850 ono. Tel: Wrexham (0978) 840629.

● SHARP MZ-80K (48k RAM). With integral monitor and cassette deck. Also included: Basic, Pascal, manuals, two extra books, dust-cover and several games, £175. Tel: Broxton 450. (after 5.30pm weekdays).

● VIDEO GENIE 16k with integral cassette recorder, sound box, vu meter and some software. All leads, boxed as new, £120 ono. Write RM202, Taylor House, Oxstalls Lane, Gloucester, GL2 9JR. Mr. Caddick.

● NEC PC800 with 64k and two 160k disk drives. With Wordstar, and Silver Reed daisy wheel printer, colour vdu, £800 ono. Tel: 06845 2651 (eves).

● SHARP MZ80K 48k. vgc plus hi-res graphics option. Basics, Forth, assemblers and many games. Includes books, manuals and user notes. Must sell. Best offer £120+ secures. Tel: 01-889 1090 (eve).

● EPSON HX20, expansion unit, charger, no cassette drive, good condition. Offers over £220. Contact Leon on 01-881 3435.

● IBM PC compatible Corona PC. 256k RAM, twin disks, RGB card, monitor, centronics, extensive software. £1,100. Tel: Coventry 419769 after 6pm.

● APPLE II Europlus with Apple monitor II, Apple disc drive + interface, 16k language card, Silentype printer, games paddles, Applewriter II word processor. With all manuals. Virtually unused, £595. Tel: Bourne End (06285) 25895, eves-w/ends.

● APPLE III computer. Monitor and additional drive, software including Visicalc, Applewriter, Mail List Manager, system software with Apple II emulator, £995. Apple III disk drive £140. Tel: Bourne End (06285) 25895, eves-w/ends.

● SIRIUS software. Control-C CC86 compiler under CP/M-86 complete with reference manual £95. Tel: Bordon (04203) 7194.

● OK1 MICROLINE 80. Supports all Tandy Model I graphics, £90 ono. Tel: 01-579 3808, Simpson, 1 Northcroft Rd, Ealing, London W13 9SR.

● TURBO PASCAL for IBM PC, Sanyo 550 series etc, £40 or W.H.Y. for Sanyo. Also can convert IBM Basic programs to ASCII format. Tel: 0491 39497.

● SIRIUS I, 128k, 1.2Mb, MS-Dos, CP/M-86, MsBasic, CBasic, database, spreadsheet, word processor, Basic compiler, one year old, very good condition, £1,300. Tel: 021 384 6064.

● WANTED: 8080A based micro system with RAM, ROM, etc built on cards using S100 Bus. Need not be working, S100 cards only will do. Tel: 041 429 4844 eve. Keep cheap.

● NEWBRAIN accessories wanted: Books, software and especially hardware, disk drive(s) and controller, ROM and I/O information too. Anything considered! Tel: Canterbury (0227) 463564, Andrew, weekends.

● NEWBRAIN Model A, Sanyo monitor DM2112, software, technical manual, Newbrain dissected, Getting More From Your Newbrain, magazine listings, NBug magazines, Chess, Othello, assemblers, Quick sale, £225 ono. 6.30pm-9.30pm weekdays. Tel: 021 476 2430.

● IBM PC. Colour, 312k ROM 2x320k drives, graphics printer, PC Dos2, concurrent CP/M-86, CBasic-86, UCSD P-system Pascal, Multiplan, Microplan, Nultimate, Wordstar, Palantir, Friday, Copy II PC, Sideways, Sidekick, Diagnostics, Flight Simulator, etc, £3,250. Tel: 01-731 4192.

● COMMODORE 700. 256k RAM. Little used. See review in PCW Jan '84. Low price for quick sale £450. Logabax LX180RO serial printer 175Cps needs attn, £175 ono. Tel: 0933 675188.

● APPLE II compatible disk drives (two) plus interface card, grappler + printer card and cable, Z80 card. Hardly used £250 or split. Tel: Barry Bond, home: 0949 20556 or work: 0533 545123.

● BBC MODEL B. Bought Dec '84. Hardly used, with DDFS, View, and Pascal ROMS, 13 ROM board, CLS 400k. DSDD disk drive, Microvitec 1451 colour monitor, manuals, magazines, £1,050 inc VAT. Tel: Sammy, London, 01-352 3700.

● KAYPRO 2 twin disk, monitor, extra software, £900 ono or swap for IBM PC type machine with cash adjustment. Machine has hardly been used. Tel: 01-478 5936 eves or weekends.

● 80Bus Nascom Gemini boards, Gemini GM812 IVC £75. Nascom I/O board with three Z80 PIO's and one Z80 CTC £50. Sidcup, Kent, 01-303 7852 eves and weekends.

● CBM32k wanted. Also printer, disk-drives, modems, software. Contact Ray Calverley, 061 368 9216 day, or 061 427 7765 eve.

● APPLE software half price. Defender, Zaxxon, Decathlon, Flight Simulator, Graphics Magician, Bag Of Tricks, GPLE Data Capture, many more. All originals with full documentation. Tel: Guildford (0483) 69975 eve.

● HEWLETT PACKARD 75C handheld computer 24k. Original wrapping, manuals. Textformatter 150 magnetic strips. HP.GP-I/O interface for a parallel printer. Mint condition £600 ono. Tel: (0932) 46579 Weybridge, Surrey.

● OCTET interface for Olivetti 121 £195. ITT 2020 Apple system plus two Apple drives with The Last One £400 or £300 without The Last One. Tel: Chelmsford 263811 after 5pm.

● BBC Hitachi disk drives with all leads and instructions, £120 pair. Wanted: Apple IIC. Tel: 0379 870633.

● CBM64 disk system; includes Superbase64, Vizawrite, Practicalc, utilities, Simons Basic, Payroll, plus many games, manuals, books, etc. Bargain £475 ono. May split, for details. Tel: Caterham 47320 eve.

● BBC R.H. electronics lightpen, 8k Forth ROM. 0·90 DFS ROM. Leo Brodie, Starting Forth Book. Any reasonable offer considered. Tel: 061 430 2060. Dave.

● TANDY TRS80 model II. Twin disk with TRS 80 printer including software £850 ono. John Robinson, 061-728 2438.

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Any accompanying program listings should be supplied on disk or cassette, ideally with a printout as well.

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Bear in mind that it's worth taking a look at the Back Issues advertisement to see what sort of things we have already published — after all there's no point in reinventing the wheel. And please be sure to tell us if you've contacted another magazine (perish the thought): it would be very awkward if the same article appeared elsewhere. Frankly, we're more likely to accept something which has been offered exclusively to us.

Finally, we do pay for published work — the rate is £65 per 1000 words, and payment usually follows about four-six weeks after publication.

Readers are strongly advised to check details with exhibition organisers before making arrangements, in order to avoid wasted journeys due to cancellations, printer's errors, and so on.

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US	(Atlanta), Comdex/Spring. Contact: as above.	6-9 May

LEISURE LINES

Brain-teasers from J J Clessa

Quickie

No answers, no prizes.

Farmer Brown told his wife: 'I went to the stable this morning and there were the same number of heads and arms in there, as there were legs and tails.'

What is the least number of horses and riders that there must have been in the stable?

Prize Puzzle

Probably the most well-known triangular number these days is 15 — the number of red balls used in snooker to give an equilateral triangle of balls with five balls in each side. On smaller snooker tables 10 balls are used, to give a triangle with four balls in each side.

Can you find the smallest three consecutive triangular numbers whose product is a perfect square greater than 1000? Answers, please,

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LEISURE LINES

on postcards only (letters are automatically disqualified) to *PCW* Prize Puzzle, April 85 Leisure Lines, 62 Oxford Street, London W1. Entries to arrive not later than 31 May 1985.

January Prize Puzzle

Cries of 'Easy', 'I didn't need a micro for it', and 'When are you going to give us a really difficult problem' greeted the puzzle about the missing pages in my book. Funnily enough, although there was a good response — over 230 entries — about 15 per cent contained incorrect answers.

Anyway, the answer required was 59-92. One other possible answer was the two pages 1283-1284, but we did say that a whole section was missing. Finally, the answer 143-159 is not valid since page 143 could not be missing unless 142 was also; the same with pages 159 and 160. Try it and see. And as for those who said page 2567 on its own — well, really!

The winner drawn from the prize-hungry mob at random was Mr Anthony Hiorns of Aberystwyth. Congratulations Mr Hiorns, your prize is on its way.

Meanwhile, many thanks to those of you who have sent in ideas for puzzles. Two or three came with this month's batch of puzzle entries and we're looking closely at them for future use.

NUMBERS

A simple problem on sums of powers from Mike Mudge.

In 1851 E Poulet noticed that the integers 1,2,3, . . . 27 could be separated into three sets, each having the same sum and sum of squares. Thus (1,6,8,12,14,16,20,22,27); (2,4,9,10,15,17,21,23,25); (3,5,7,11,13,18,19,24,26) where the sum of the numbers in each set is 126 and the sum of their squares is 2310.

In 1911 E N Barisien separated the integers 1,2,3, . . . 32 into four sets having the same properties. Thus (1,8,10,15,20,21,27,30); (4,5,11,14,17,24,26,31); (2,7,9,16,19,22,28,29); (3,6,12,13,18,23,25,32) with sum 132 and sum of squares 2860 in each set.

In 1913 G Terry quoted (1,12,21,43,52,63) and (3,7,28,36,57,61) as having the same sum, sum of squares, of cubes, of fourth powers and of fifth powers.

Theorem (G Terry 1912) The first 2^n $(2a + 1)$ integers can be separated into two sets, each having the same number of elements and the same sum of tth powers for $t = 1,2 \ldots n$. For example: $a = 1$, $n = 3$, (1,3,7,8,9,11,14,16,17,18,22,24) and (2,4,5,6,10,12,13,15,19,20,21,23) each have sum of 150 sum of squares equal to 2450 and sum of cubes equal to 45000.

Problem Write a computer program to input n and a, and to output the two sets together with their sums of tth powers for $t = 1 \ldots n \ldots$ then investigate the possible generalisation of each of the following:

(1,5,10,16,27,28,38,39) $\underline{6}$ (2,3,13,14,25, 31,36,40)

(1,5,10,24,28,42,47,51) $\underline{7}$ (2,3,12,21,31, 40,49,50)

where $\underline{n}$ denotes that the sets have equal sums of the kth powers for $k = 1,2, \ldots n$.

Readers are invited to submit their program listings, output and hardware details to Mike Mudge, 'Square Acre', Stourbridge Road, Penn, Nr Wolverhampton, Staffordshire WV4 5NF. Tel: (0902) 892141.

A suitable prize will be awarded to the best entry received by 1 July 1985.

Please note that submissions can only be returned if a suitable stamped addressed envelope is provided. Expanded reviews of previous Numbers problems together with, subject to the approval of the contributor, copies of detailed programs from prize winning entries may also be requested.

Binomial Coefficients, October 1984

This problem attracted a small response, due probably to the amount of algebra in its formalism. However, these notes and results may encourage readers to return to it.

(i) $k = 7$ has associated n values 21, 30 and 54; no others are known.

(ii) For a full discussion of this problem see P Erdös and G Szekeres, *Some Number Theoretic Problems on Binomial Coefficients,* Australian Mathematical Society Gazette Vol 5 (1978) pp97-99.

(iii) There was a misprint: $\binom{14}{9}$ should read $\binom{14}{4}$.

(iv) The sequence of n values is 1,10,756,757,3160,3186,3187,3250, 7560,7561,7651,20007,59548377 and 59548401; other much larger values are known. For further discussion see P Erdös *et al* on the prime factors of $\binom{2n}{n}$, *Mathematics of Computation* Vol 29 (1975) pp83-92.

This month's prize winner is AS Tickner of Pinner, Middlesex, using Basic on a ZX81 extending (i) to include $k = 13, n = 33,36,56$; $k = 17, n = 36$. In (ii) the primes were studied up to 599. Further studies by Mr Tickner used an HP 85 together with some algebraic insight into binomial coefficients.

If k is greater than or equal to 9, is it true that three is a factor of

$$\binom{2^k + 1}{2^k}$$

Albebra can be intimidating, but a little research and commitment works wonders!

MICROCHESS

Kevin O'Connell looks at Elite X's winning moves at the Fourth World Microcomputer Chess Championship

White: Elite X. Black: Psion. Sicilian Defence. Notes by Kevin O'Connell.

It's no good having a won game unless your technique is good enough to convert that position into the full point, as testified by the following game from the Fourth World Microcomputer Chess Championship played in Glasgow last September.

1	e2–e4	c7–c5
2	Ng1–f3	Nb8–c6
3	Bf1–b5	e7–e6
4	0–0	Ng8–e7
5	c2–c3	a7–a6
6	Bb5×c6	Ne7×c6
7	d2–d4	c5×d4
8	c3×d4	d7–d5
9	e4–e5	

(This assures White of a lot of extra space; it also fixes the backward pawn on d4 as a permanent weakness and long-term target for Black.)

9	. . .	Bf8–e7
10	Nb1–c3	0–0
11	Bc1–f4	Bc8–d7
12	Qd1–d2	Qd8-b6
13	Rf1–c1	Rf8–c8

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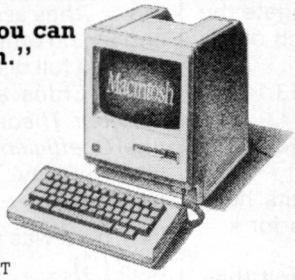

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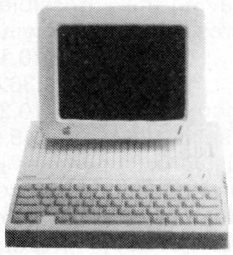

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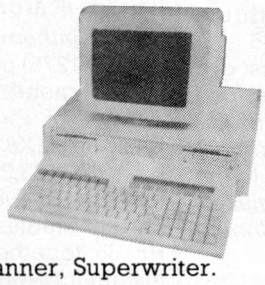

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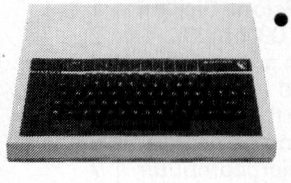

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MICROCHESS

14	Nc3–a4	Qb6–b5
15	Na4–c5	Bd7–e8
16	Rc1–c3	

(Threatening 17 Rc3–b3.)

16	. . .	Nc6–a5
17	a2–a4	

(This is positionally weakening — eventually White will probably have to play b2–b3 leaving a second weakened, attackable, backward pawn.)

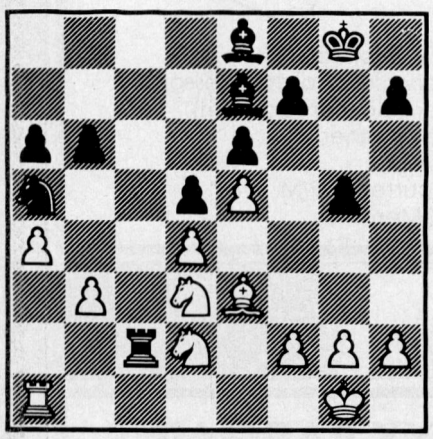
17	. . .	Qb5–b4
18	Rc3–c1	

(White really is tied up and it is difficult to find any reasonable move. If 18 Ra1–c1 Na5–c4 19 Qd2–e1 Black wins material and keeps the better game after 19 . . . Qb4xb2 20 Rc3–b3 Qb2–a2.)

18	. . .	Qb4xd2
19	Nf3xd2	b7–b6
20	Nc5–d3	Rc8xc1+
21	Nd3xc1	

(Otherwise the weak a-pawn falls off the board.)

21	. . .	Ra8–c8
22	Nc1–d3	Rc8–c2
23	b2–b3	g7–g5
24	Bf4–e3	



Position after Bf4–e3

(Black stands better but this may be only temporary, for White now plans Kg1–f1–e1–d1 and then Ra1–c1. However, there is one line which is promising . . .)

24	. . .	Rc2xd2
25	Be3xd2	Na5xb3
26	Ra1–a2	Nb3xd2
27	Ra2xd2	Be8xa4
28	f2–f4	f7–f5

(Black starts a process of fixing all the king-side pawns, but it is not relevant to the one plan with winning chances — Ba4–b5–c4 followed by b6–b5–b4–b3 and then running with the a–pawn.)

29	g2–g3	g5–g4
30	Kg1–f2	Kg8–f7
31	Rd2–b2	Ba4–b5
32	Kf2–e3	h7–h5
33	Ke3–d2	h5–h4
34	Rb2–b3	h4–h3

(Black has completed the fixation of those pawns, but only at the cost of permitting the centralisation of White's king.)

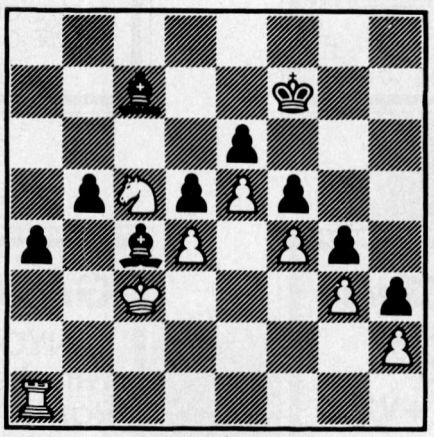
35	Nd3–f2	Be7–d8
36	Rb3–b1	Bb5–c4
37	Nf2–d3	b6–b5?

(Now this gives White the opportunity to put his knight on the excellent c5 square with gain of tempo. 37 . . . a6–a5 should have been tried.)

38	Nd3–c5	a6–a5
39	Nc5–b7	Bd8–c7
40	Kd2–e3	a5–a4
41	Rb1–a1	Kf7–e7
42	Ke3–d2	Ke7–e8
43	Kd2–c2	Bc7–b6
44	Nb7–c5	Ke8–e7
45	Kc2–b2	Bb6–a5

(Black must keep the white king out of his position.)

46	Kb2–c2	Ke7–f7
47	Nc5–b7	Ba5–c7
48	Ra1–a3	Bc7–b6
49	Nb7–c5	Bb6–a5
50	Ra3–a1	Ba5–c7
51	Kc2–c3	



Black's winning chances are gone

51	. . .	Bc7–b6?

(A big mistake. 51 . . . Bc7–a5+ was better. All Black's winning chances are gone and now he must even be very careful if he is to retain equality.)

52	Kc3–b4	Bb6–d8
53	Nc5–b7	Bd8–e7+
54	Nb7–d6+	Be7xd6+

(Otherwise Kb4–c5–c6 wins the b-pawn (or the a-pawn if Black pushes the b-pawn) or the game if Black then captures on d6).

55	e5xd6	Kf7–e8
56	Kb4–c5	Ke8–d7
57	Ra1–a3	Bc4–e2
58	Ra3–c3	Be2–d1
59	Rc3–c1	Bd1–b3
60	Rc1–c3	b5–b4?

(Another error. Black just needs to keep his bishop on the c4–f1 diagonal in order to draw.)

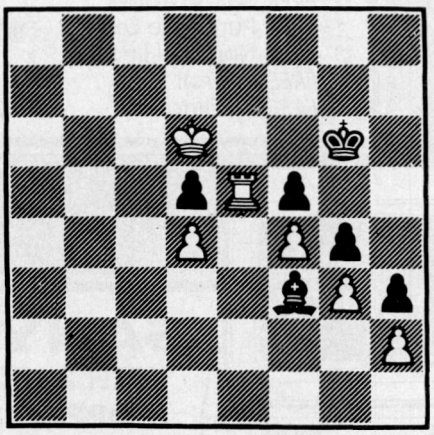
61	Rc3–c1!	Bb3–c4
62	Kc5xb4	Kd7xd6

(The only chance of prolonging resistance was with Bc4–b3. Now White's task is very easy.)

63	Kb4xa4	Bc4–d3
64	Ka4–a5	

(White commences the winning procedure which is played to perfection.)

64	. . .	Bd3–e2
65	Ka5–b6	Be2–c4
66	Rc1–c3!	Bc4–e2
67	Rc3–c6+	Kd6–d7
68	Kb6–c5	Be2–d3
69	Rc6–b6	Kd7–e7
70	Rb6–b7+	Ke7–f6
71	Kc5–d6	Bd3–e2
72	Rb7–e7	Be2–f3
73	Re7xe6+	Kf6–f7
74	Re6–e5	Kf7–g6



The perfect winning procedure

75	Re5xd5!	

(Finding this move was the only remaining hurdle.)

75	. . .	Bf3xd5
76	Kd6xd5	Kg6–f6
77	Kd5–d6	Kf6–f7
78	d4–d5	Kf7–f6
79	Kd6–c7	Kf6–e7

(and Black resigns (1–0).)

ACC NEWS

Rupert Steele keeps you up-to-date on computer clubs.

First up this month is news from the ComputerTowns (CTUK!). These are a very informal type of local computer club where there are no members as such. Instead the organiser sets out a number of home computer systems in a local library or similar venue, often on a Saturday, and waits for hordes of young enthusiasts to come and play.

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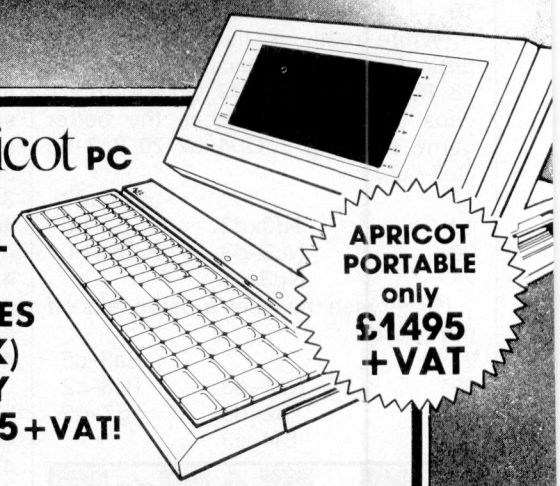

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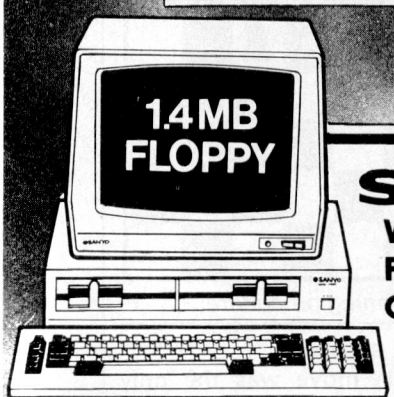

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Now that computers are cheaper and Junior may well have a machine of his own, the need for these has declined somewhat, but many are still thriving.

Ted Ryan of 15 Queens Square, Eastwood, Nottingham NG16 3BJ is now running Eastwood CTUK!, which meets once a month. Last year it ran a May fund-raising event, and split the proceeds 50/50 with a charity.

From Kent comes a letter from BR & C Tayler of 22 Millbrook, Leybourne, Maidstone ME19 5QJ. They are running two ComputerTowns; the first is CTUK! Tonbridge, which runs on alternate Saturday mornings, 9.30am to 1pm, in Tonbridge Central Library, Avebury Avenue, Tonbridge; the second is CTUK! West Malling, which runs on alternate Friday evenings, 5.30pm to 7.30pm, in West Malling Library, High Street, West Malling. Both ComputerTowns run Tandy equipment and a Spectrum. They are also linked to a local computer club, the Tonbridge Regional Area Computer Enthusiasts, which runs on the second and fourth Thursday of the month, 7.30pm to 10pm, in the Wier View Scout Hut, Avebury Avenue, Tonbridge.

Ted Ellerton of 25 Beechdale, London N21, writes to say that CTUK! Palmers Green is now meeting less frequently, concentrating on occasional special events. Last year it ran a kind of mini-exhibition at Palmers Green library, where some 200-300 people were able to learn something about computers.

Martin Hough writes from Hayes Library, Golden Cresent, Hayes, Middlesex, to remind me that CTUK! Hayes is meeting monthly as part of the Hayes Computer Club, with members bringing and demonstrating their own equipment.

If either of these interest you, why not drop them a line?

ComputerTown North East (CTNE!) is run by ACC Treasurer and general hobby computing guru, John Bone. CTNE! has two branches, both of which meet every week and have close connections with the voluntary sector in Tyne and Wear. The Newcastle branch (which also calls itself CTNE!) meets every Saturday in the Science Museum, Blandford Street, Newcastle-upon-Tyne. Admission is free (thanks to Grant-in-Aid from Tyne & Wear County Council) and there are usually around 15 machines present from 10am to 4pm. BBC, Spectrum and Commodore are the main machines, but others often appear.

The South Shields branch (called CTSH!) meets weekly in the YMCA building, off Fawcett Street, South Shields, 10am to 3pm; admission is 20p. CTNE! and CTSH! are both members of their local Councils for Voluntary Service. For more information, go along or contact John Bone at 2 Claremont Place, Gateshead, Tyne & Wear NE8 1TL, or call (0632) 770036.

Other clubs

I have been bombarded with literature about how I can Go Well with Shell (Lensbury) Computer Club. Otherwise known as the Shell Micro Users' Club it boasts 250 members. It meets at Staff Lounge C, Shell Centre, and the secretary, Jan Watterson, can be contacted on SM 3049 or at the Shell/Lensbury Micro Users' Club, 21 Corringham Road, Wembley, Middlesex HA9 9PX. The club has a keen interest in robots as well as a sub-group on Artificial Intelligence. There have also been lunchtime Basic seminars (with homework!).

I think it's for Shell employees only, but it may accept guests. Also from Shell, I had a letter from Ken Riley, of the Shell Wythenshawe Sports & Social Club, who runs a personal computer section. The address of Shell Wythenshawe is Rowlandsway, Manchester M22 5SB.

Roy Street, whose address is Church Farmhouse, Themelthorpe, Dereham, Norfolk NR20 5PS, tel: Foulsham 579, runs the Norwich and District BBC Micro User Group.

I have had a letter from Anthony Scatt, secretary of the Commodore Users' Group (Peterborough). If you are interested in his club, write to him at 18 Coventry Close, Werrington, Peterborough PE4 6NN, or call him on (0733) 74819.

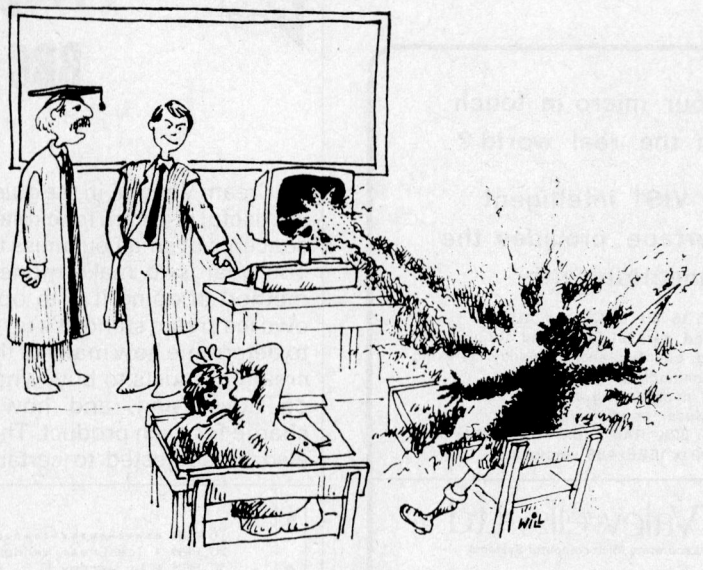
For military personnel, Richard A Hanson of 7 Portal Close, RAF Feltwell, Norfolk IP26 4HP, has started the Gateway Computer Club for USAF members serving at RAF Mildenhall. The club also has British members, and seeks to provide a chance for prospective purchasers to see various systems in operation before buying.

Anthony Hurden writes from 14 Plovers Way, Bury St Edmunds, Suffolk IP33 2NJ, to tell me of the West Suffolk BBC Micro Users' Club. Now almost two years old, the club has nearly 40 members, most of whom have BBC Micros but there are some Electron owners. The club meets on the second Monday of each month, but has run various courses on other nights. Membership is £5 a year, £2 for junior members. The meeting details are sometimes publicised on the local radio station (Saxon Radio), and you can find out more by writing to Antony or calling Bury St Edmunds 5946.

I have had a note from Gerald Wilcockson, the secretary of BAUG, the Bottisham Acorn User Group. His address is 19 Gallows Hill, Saffron Walden, Essex CB11 4DA, tel: Saffron Walden 23793. An alternative contact is the chairman, Peter Rank, on Cambridge 812080. Bottisham is about six miles east of Cambridge.

In London, there's two new clubs. The first is the Central London Micro Club, based at the Mary Ward Centre, 42 Queen Square, London WC1, tel: (01) 831 7711. Meetings for enrolment are held on the first Wednesday of each month from 6.30pm to 8.30pm. The other is the Kensington and Chelsea Computer Society (KCCS), which aims to cover parts of Fulham as well as the Borough of Kensington & Chelsea itself. The contact for that is myself, via the address and telephone number below.

To get a mention for your club, to find the address of your local club, or if you would like to know how the Association of Computer Clubs (ACC) can help your club, contact me, Rupert Steele, 17 Lawrie Park Cresent, London SE26 6HH, or call (01) 370 0601.



'In my day, Mr Hobson, we used to throw chalk at them!'

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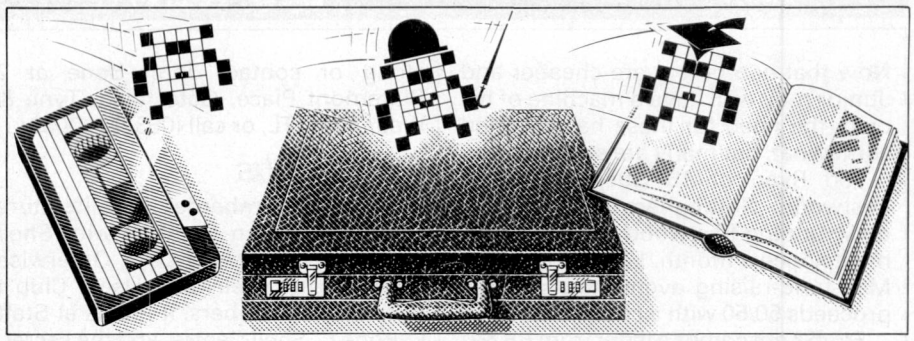

Nick Walker selects the best of readers' programs — for details on submitting your own, see the end of this section.

When I first looked at the Program of the Month I was tempted to dismiss it as a rather inconsequential game. However, I then remembered a particularly popular American educational program called Lemonade. This was a simulation of a lemonade sales stand, and was widely acclaimed as a good introduction to small business operation for children.

Ice Cream Vendor for the BBC Model B bears a strong resemblance to Lemonade except that you are managing an ice cream stand on a beach. As the program was very well implemented I sent it to a primary school teacher friend to see what she thought: her reaction was an emphatic 'yes'. She particularly recommended it for the six to 10 age range, and suggested that it should be used for groups of five children playing competitively.

There's always a gap between a micro coming on sale and some decent software becoming available for it; this is true of both commercial and user programs. For two machines, the QL and the Amstrad, this is the first issue in which I've been able to publish substantial programs.

See PC for the Amstrad is a disassembler that will allow you to delve deeper into this machine's well-written operating system, as well as aid in machine code subroutine design.

For the QL there's a version of the strategy game Connect Four. I've always considered this game to be a cut above the average Hangman or Noughts and Crosses (program contributors take note!) and this is the first program I've seen that makes use of some of the QL's potential.

Other programs this month include a word search puzzle generator for the Commodore 64 with an example puzzle at the end of the listing, and a user-defined keys program for the 16k Vic-20.

Games
Scientific/mathematic
Business
Toolkit/utilities
Educational/Computer Aided Learning

Program of the Month
BBC Ice Cream Vendor
by JES Phoenix

Ice Cream Vendor, in the guise of game, is a useful program for explaining a few concepts of small business to children. The goal is to make money, and the method of doing it is to operate your own ice cream stand. It's up to the child to determine how many of the three ice cream products to buy, what to spend on advertising, and how much to charge for each product. The child will also be subjected to certain random, uncontrollable factors, such as heatwaves, that will affect sales.

The program is very nicely implemented with graphic displays of the seaside and weather forecast, and suitable sound effects.

A maximum of five people can play over a total trading time of one to 49 weeks. It's a good program to bring out the capitalist in your child at an early age!

```
V.2
>L.
   10 REM ************************
   20 REM * Ice Cream Vendors     *
   30 REM * by Jeremy E.S. Phoenix *
   40 REM *      Aug 1984         *
   50 REM ************************
   60 MODE7
```

PROGRAM FILE

```
  70 *FX229,1
  80 *FX4,1
  90 ON ERROR PROCerror
 100 PROCoff:CLS
 110 PROCoption:CLS
 120 CLS:PROCname
 130 IF S%=0 THEN 150
 140 PROCmusic
 150 REPEAT
 160 REPEAT:A$=GET$:UNTILA$="Y"ORA$="y"ORA$="n"ORA$="N"
 170 IFA$="Y"ORA$="y"THENPROCinstructions
 180 UNTILA$="N"ORA$="n"
 190 PROCsetup
 200 REM Main Loop
 210 DAY=DAY+1:DAY%=DAY%+1
 220 W=INT(RND(1)*7)+1:CLS
 230 PROCday:CLS
 240 IF O1=1 THEN PROCbank:CLS
 250 PROCweather:CLS
 260 PROCprices:CLS
 270 PROCtable:CLS
 280 PROCsum:CLS
 290 IF DAY%<>LO THEN 210
 300 REM End of Loop
 310 CLEAR
 320 GOTO50
 330 END
 340
 350
 360 REM * * * * * * * * * *
 370 DEFPROCname
 380 VDU31,1,0,145,232:PRINTSTRING$(36,CHR$172);CHR$180;
 390 FORI=1TO2:VDU31,0,I,141,145,234,133:PRINT"******";CHR$131;"ICE CREAM VENDO
RS";CHR$133;"*******";CHR$145;"  5":NEXT
 400 VDU31,1,3,145,234:PRINTSTRING$(36,CHR$240);CHR$181
 410 VDU31,1,4,145,234,32,32,32,32,32,32,234
 420 VDU31,1,5,145,234,130:PRINT"CHOC";:VDU145,234
 430 VDU31,1,6,145,234,133:PRINT" 12p";:VDU145,234
 440 VDU31,1,7,145,234,32,32,32,32,32,32,234
 450 VDU31,1,8,145,234,129:PRINT"LOLL";:VDU145,234
 460 VDU31,1,9,145,234,135:PRINT" 7p ";:VDU145,234
 470 VDU31,1,10,145,234,32,32,32,32,32,32,234
 480 VDU31,1,11,145,234,132:PRINT"ICES";:VDU145,234
 490 VDU31,1,12,145,234,134:PRINT" 13p";:VDU145,234
 500 VDU31,1,13,145,234,240,240,240,240,240,240,250:PRINTSTRING$(29,"p")
 510 FORI=14TO21:VDU31,1,I,132,157:NEXT
 520 PROCman(6,6,149)
 530 VDU31,0,22,131,157
 540 VDU31,12,6,150,240:PRINTSTRING$(4,CHR$255);:VDU240:VDU31,13,7,150,181,32,3
2,234
 550 VDU31,13,8,150,245,176,224,250,31,13,9,150,32,181,234
 560 VDU31,11,10,150,183,163,163,161,162,163,163,181
 570 VDU31,11,11,150,181,32,32,32,32,32,32,243,243,243,243,251
 580 FORI=1TO2:VDU31,11,11+I,150,181,32,32,32,32,32,32,181,145:NEXTI
 590 PRINTTAB(12,4);CHR$135;"By Jeremy Phoenix 1984"
 600 PRINTTAB(0,23)CHR$129;CHR$157;CHR$135;"Do you need instructions (Y/N)?"
 610 ENDPROC
 620
 630
 640 REM * * * * * * * * * *
 650 DEFPROCsetup
 660 DIMRS(10),RC(10),RH(10),RL(10)
 670 DIMGA(10),GD(10),GE(10),LO(10)
 680 DIMA(10),C(10),N$(5)
 690 DIMD(10),S(10),E(10),L(10),CA(10),PA1(10)
 700 DIMPA(10),PB(10),PE(10),PD(10)
 710 DIMX(10),CH(10),SS(10),SL(10),SC(10),SH(10)
 720 CLS:FORI=1TO2:PRINTCHR$132;CHR$157;CHR$133;CHR$141;"]]]]]]]]]":CHR$131;"E
NTER PLAYERS";CHR$133;"[[[[[[[[[[":NEXTI
 730 PRINTTAB(0,7);CHR$130;"How many players would you like (1-5)?";
 740 REPEAT:B$=GET$:UNTILB$>"0"AND B$<"6":P=VAL(B$)
 750 PRINTTAB(0,7);STRING$(39," ");
 760 PRINTTAB(0,4);CHR$129;"You chose";CHR$131;P;CHR$129;"players."
 770 IF P=1 THEN PRINTTAB(19,4);". "
 780 PRINTTAB(0,6);CHR$134;"Enter Player's names":PRINTTAB(0,7);CHR$134;"(Max.1
0 letters)"
 790 IF P=1 THEN PRINTTAB(20,6);" "
 800 FORI=1TOP
 810 PRINTTAB(2,8+I);CHR$132;CHR$157;CHR$131;"Player";CHR$133;I;"?";CHR$130;:N$
="":REPEAT Z1$=GET$
 820 IF Z1$=CHR$127 N$(I)=LEFT$(N$(I),LEN(N$(I))-1):GOTO840
 830 IF Z1$>=" "AND LEN(N$(I))<10 N$(I)=N$(I)+Z1$
 840 PRINTTAB(15,8+I)N$(I)"    "
 850 UNTIL Z1$=CHR$13
 860 N$(I)=N$(I)+"    ":N$(I)=LEFT$(N$(I),10)
 870 NEXTI
 880 PROCon:PRINT
 890 PRINTTAB(4,15);CHR$131;CHR$157;CHR$132;"How many days trading do you";TAB
(4);CHR$131;CHR$157;CHR$132;"want to play (1-49)";CHR$129;
 892 PRINTSTRING$(10," ");:INPUTTAB(27,16)" ",LO:IF LO<1 OR LO>49 THEN 890
 900 PRINTTAB(0,15);STRING$(39," ");TAB(0,16);STRING$(39," ");:PRINTTAB(0,15);C
HR$129;"You chose";CHR$131;LO;CHR$129;"days trading."
 910 IF LO=1 THEN PRINTTAB(16,15);" "
 920 PROCoff:PRINT:PRINTTAB(0,23);CHR$129;CHR$157;CHR$135;"Do you wish to chang
e anything (Y/N)?";
 930 REPEAT A$=GET$:UNTIL A$="Y" OR A$="y" OR A$="N" OR A$="n"
 940 IF A$="Y" OR A$="y" THEN FORI=1TO5:N$(I)="":NEXTI:GOTO 720
 950 DAY=0:DAY%=0:FORN=1TO10:SS(N)=0:SC(N)=0:SL(N)=0:SH(N)=0:X(N)=200:NEXTN
 960 WEEK=1
 970 PROCspace
 980 ENDPROC
 990
1000
1010 REM * * * * * * * * * *
1020 DEFPROCspace
1030 *FX15,0
1040 VDU31,0,23,129,157,135:PRINT"Press SPACE to continue ...";SPC(10);:REPEATA
$=GET$:UNTILA$=" "
1050 ENDPROC
1060
1070
1080 REM * * * * * * * * * *
1090 DEFPROCprices
1100 PLA=1
1110 PROCpost:CLS
1120 IF X(PLA)<=0 THEN PROCbroke
1130 CLS:PROCon:PRINT
1140 MON=X(PLA)
1150 FORI=1TO2:VDU132,157,141,133:PRINT"]]]]]]]]]]]]";CHR$131;"PRICES";CHR$133
;"[[[[[[[[[[[[":NEXTI
1160 PRINTCHR$129;"Player";CHR$130;PLA;")";CHR$134;"..";N$(PLA);SPC(5);CHR$129;
"Week:";CHR$134;WEEK;CHR$129;"Weather:";CHR$134;WET$;CHR$129;"Day:";CHR$134;DA$;
VDU148:PRINTSTRING$(38,",")
1170 VDU 28,0,12,39,7
1180 CLS
```


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PROGRAM FILE

```
1190 PRINTCHR$134;"Leftovers from";CHR$131;"YESTERDAY:";CHR$129;RS(PLA)
1200 PROCbalance
1210 PRINTCHR$130;"How many";CHR$131;"CONTAINERS OF ICE-CREAM";CHR$130;"do"'CHR
$130;"you wish to buy at £7 each?"'CHR$129;"(1 container provides 100 portions)"
1220 REPEAT INPUTS(PLA):IF S(PLA)*7>X(PLA)THEN PROCover:GOTO1180
1230 UNTIL S(PLA)*7<=X(PLA):X(PLA)=X(PLA)-S(PLA)*7
1240 PROCmoney
1250 CLS:PRINTCHR$129;"You bought";CHR$131;S(PLA);CHR$129;"containers of ice-cr
eam."
1260 VDU 28,0,15,39,9
1270 CLS
1280 PRINTCHR$134;"Stock left from";CHR$131;"YESTERDAY:";CHR$129;RC(PLA)
1290 PROCbalance
1300 PRINTCHR$130;"How many";CHR$131;"CONES";CHR$130;"do you wish to buy at"'CH
R$130;"3p each";
1310 REPEAT INPUTC(PLA):IF C(PLA)*.03>X(PLA)THEN PROCover:GOTO1270
1320 UNTIL C(PLA)*.03<=X(PLA):X(PLA)=X(PLA)-C(PLA)*.03
1330 PROCmoney
1340 CLS:PRINTCHR$129;"You bought";CHR$131;C(PLA);CHR$129;"cones."
1350 VDU 28,0,17,39,11
1360 CLS
1370 PRINTCHR$134;"Stock left from";CHR$131;"YESTERDAY:";CHR$129;RH(PLA)
1380 PROCbalance
1390 PRINTCHR$130;"How many";CHR$131;"CHOC-ICES";CHR$130;"do you wish to buy"'C
HR$130;"at 10p each";
1400 REPEAT INPUTCH(PLA):IF CH(PLA)*.1>X(PLA)THEN PROCover:GOTO1340
1410 UNTIL CH(PLA)*.1<=X(PLA):X(PLA)=X(PLA)-CH(PLA)*.1
1420 PROCmoney
1430 CLS:PRINTCHR$129;"You bought";CHR$131;CH(PLA);CHR$129;"choc-ices."
1440 VDU 28,0,19,39,13
1450 CLS
1460 PRINTCHR$134;"Stock left from";CHR$131;"YESTERDAY:";CHR$129;RL(PLA)
1470 PROCbalance
1480 PRINTCHR$130;"How many";CHR$131;"LOLLIES";CHR$130;"do you wish to buy"'CHR
$130;"at 5p each";
1490 REPEAT INPUTL(PLA):IF L(PLA)*.05>X(PLA)THEN PROCover:GOTO1440
1500 UNTIL L(PLA)*.05<=X(PLA):X(PLA)=X(PLA)-L(PLA)*.05:PROCmoney
1510 CLS:PRINTCHR$129;"You bought";CHR$131;L(PLA);CHR$129;"lollies."
1520 PROCoff:PRINT'':PROCbalance
1530 VDU26:PRINTTAB(0,23);CHR$129;CHR$157;CHR$135;"Do you wish to change anythi
ng (Y/N)?";:REPEATA$=GET$:UNTILA$="Y"ORA$="N"
1540 IF A$="Y" THEN X(PLA)=MON:CLS:GOTO1130
1550 PROCspace:PROCon:PRINT
1560 VDU 28,0,23,39,7
1570 CLS
1580 SS(PLA)=SS(PLA)+S(PLA)*100
1590 SC(PLA)=SC(PLA)+C(PLA):SH(PLA)=SH(PLA)+CH(PLA)
1600 SL(PLA)=SL(PLA)+L(PLA):PROCon:PRINT
1610 VDU 28,0,12,39,7
1620 PRINTCHR$130;"What is your selling price for an"'CHR$131;"ICE-CREAM";CHR$1
30;"cone (costs you 10p)";:INPUT A(PLA)
1630 CLS:PRINTCHR$129;"Your price for a cone is";CHR$131;A(PLA);"p"
1640 VDU 28,0,15,39,9
1650 CLS:PRINTCHR$130;"What is your selling price for a"'CHR$131;"CHOC-ICE";CHR
$131;"(costs you 10p)";:INPUT D(PLA)
1660 CLS:PRINTCHR$129;"Your price for a choc-ice is";CHR$131;D(PLA);"p"
1670 VDU 28,0,17,39,11
1680 CLS:PRINTCHR$130;"What is your selling price for a"'CHR$131;"LOLLY";CHR$13
0;"(costs you 5p)";:INPUT E(PLA)
1690 CLS:PRINTCHR$129;"Your price for a lolly is";CHR$131;E(PLA);"p"
1700 VDU 28,0,19,39,13
1710 CLS:PROCbalance:PROCoff:PRINT
1720 VDU26:PRINTTAB(0,23);CHR$129;CHR$157;CHR$135;"Do you wish to change anythi
ng (Y/N)?";:REPEATA$=GET$:UNTILA$="Y"ORA$="N"
1730 IF A$="Y"THEN VDU28,0,23,39,7:CLS:GOTO1610
1740 PROCspace
1750 PROCcash:PROCcash1:PROCcash2
1760 GA(PLA)=PA(PLA)*MKT:IF GA(PLA)>SS(PLA)THEN GA(PLA)=SS(PLA)
1770 IF GA(PLA)>SC(PLA)AND SS(PLA)>SC(PLA) THEN GA(PLA)=SC(PLA)
1780 GE(PLA)=PE(PLA)*MKT:IF GE(PLA)>SL(PLA)THEN GE(PLA)=SL(PLA)
1790 GD(PLA)=PD(PLA)*MKT:IF GD(PLA)>SH(PLA)THEN GD(PLA)=SH(PLA)
1800 RS(PLA)=SS(PLA)-GA(PLA):RC(PLA)=SC(PLA)-GA(PLA)
1810 RH(PLA)=SH(PLA)-GD(PLA)
1820 RL(PLA)=SL(PLA)-GE(PLA)
1830 X(PLA)=X(PLA)+(GA(PLA)*A(PLA)+GD(PLA)*D(PLA)+GE(PLA)*E(PLA))/100
1840 PROCmoney
1850 VDU26:PROCoff:PRINT
1860 PLA=PLA+1:IF PLA<=P GOTO 1110
1870 ENDPROC
1880
1890
1900 REM * * * * * * * * * *
1910 DEFPROCtable
1920 FOR V=1TOP
1930 VDU26:CLS
1940 PRINTCHR$129;"Player";CHR$130;V;")";CHR$134;"..";N$(V);SPC(4);CHR$129;"Wee
k:";CHR$134;WEEK'CHR$129;"Weather:";CHR$134:WET$'CHR$129;"Day:";CHR$134;DA$:VDU1
48:PRINTSTRING$(38,",")
1950 PRINTCHR$132;"Trading position at the end of the day:"
1960 VDU31,10,6,130:PRINT"STOCK";TAB(10);"STOCK";TAB(21);"STOCK"
1970 VDU31,11,7,131:PRINT"A.M.";TAB(10);"SOLD";TAB(21);"LEFT"
1980 VDU145:PRINTSTRING$(38,",")
1990 VDU31,0,9,133:PRINT"ICE"'CHR$133;"CREAM";CHR$136;">";CHR$137;TAB(11);CHR$1
35;SS(V);TAB(22);GA(V);TAB(32);RS(V)'CHR$133;"PORTIONS"
2000 VDU145:PRINTSTRING$(38,",")
2010 FORI=1TO3000:NEXTI:PRINTTAB(6,10);CHR$137
2020 VDU31,0,13,134:PRINT"CONES";CHR$136;">";CHR$137;TAB(10);CHR$135;SC(V);TAB(
21);GA(V);TAB(31);RC(V)
2030 VDU145:PRINTSTRING$(38,",")
2040 FORI=1TO3000:NEXTI:PRINTTAB(6,13);CHR$137
2050 IF S%=1 PROCmusic2
2060 VDU31,0,15,132:PRINT"CHOC"'CHR$132;"ICES";CHR$136;">";CHR$137;TAB(11);CHR$
135;SH(V);TAB(22);GD(V);TAB(32);RH(V)
2070 VDU145:PRINTSTRING$(38,",")
2080 FORI=1TO3000:NEXTI:PRINTTAB(5,16);CHR$137
2090 VDU31,0,18,130:PRINT"LOLLIES";CHR$136;">";CHR$137;TAB(10);CHR$135;SL(V);TA
B(21);GE(V);TAB(31);RL(V)
2100 VDU145:PRINTSTRING$(38,",")
2110 FORI=1TO3000:NEXTI:PRINTTAB(8,18);CHR$137
2120 PRINT'CHR$130;"You have £";X(V)
2130 PRINTCHR$130;"You have lost/made";CHR$131;"";INT(X(V)*100)/100-200;CHR$13
0;"so far."
2140 SS(V)=RS(V)
2150 SC(V)=RC(V)
2160 SH(V)=RH(V)
2170 SL(V)=RL(V)
2180 PROCspace
2190 NEXT V
2200 ENDPROC
2210
2220
2230 REM * * * * * * * * * *
2240 DEFPROCweather
2250 FORJ=0TO1:VDU31,0,J,132,157,141,134:PRINT" MICROVILLE'S WEATHER REPORT:"
2260 NEXTJ
```

PROGRAM FILE

```
2270 ON W GOTO2280,2290,2300,2310,2320,2330,2340
2280 WET$="Sunny & Hot Temp 96F":MKT=3000:GOTO2350
2290 WET$="Sunny Temp 86F":MKT=2000:GOTO2350
2300 WET$="Sunny Temp 78F":MKT=1400:GOTO2350
2310 WET$="Cloudy & Dry Temp 72F":MKT=1000:GOTO2350
2320 WET$="Showery Temp 63F":MKT=600:GOTO2350
2330 WET$="Thundery Temp 56F":MKT=400:GOTO2350
2340 WET$="Rain Temp 49F":MKT=200:GOTO2350
2350 IFDAY=6 OR DAY=7 MKT=MKT*2
2360 IF O1=1 MKT=MKT*4
2370 IF W=1 OR W=2 OR W=3 PROCsun
2380 IF W=4 PROCcloud
2390 IF W=5 OR W=6 OR W=7 PROCrain:PROCcloud
2400 VDU31,0,2,132,157,131:PRINTWET$;":";DA$
2410 VDU31,0,3,132,157,145:PRINT"/5"
2420 VDU31,0,4,132,157,150:PRINT"~";CHR$255;"}"
2430 FORJ=5TO10:VDU31,0,J,132,157,150:PRINT"=";CHR$255;"n"
2440 NEXTJ
2450 VDU31,0,11,132,157,145:PRINTSTRING$(6,CHR$255);" 7```k 7```k 7``````````
`k"
2460 VDU31,21,10,132,157,145:PRINT"j";CHR$133;"Amusements";CHR$145;"5"
2470 VDU31,13,10,132,157,130:PRINT"SHOPS"
2480 VDU31,0,12,131,157,132:PRINTTAB(2);"O";CHR$133;"ICE CREAMS ";CHR$132;"O"
2490 VDU31,0,13,131,157,148:PRINTTAB(2);"j";STRING$(13,"`");"5"
2500 FORI=1TO3:VDU31,0,13+I,131,157,148:PRINTTAB(2);"j              5"
2510 NEXTI
2520 VDU31,0,16,131,157,148:PRINTTAB(2);"j";CHR$146;"  ! ! !";CHR$148;"    5"
2530 VDU31,0,17,131,157,148:PRINTTAB(2);"j";CHR$145;"  j j j";CHR$148;"    5"
2540 FORJ=18TO22:VDU31,0,J,131,157,132:VDU31,4,J,132,157,132:VDU31,19,J,131,157
,132
2550 NEXTJ
2560 PROCmain(0,12,148)
2570 IF S%=0 THEN 2590
2580 PROCsounds
2590 VDU31,0,23,129,157,135:PRINT"Press SPACE to continue";SPC(14);:REPEATA$=GE
T$:UNTILA$=" "
2600 ENDPROC
2610
2620
2630 REM * * * * * * * * * *
2640 DEFPROCday
2650 IF DAY>7 THEN WEEK=WEEK+1:DAY=1
2660 IF DAY=1 AND INT(RND(2))=1 THEN DA$="BANK HOLIDAY":O1=1:ELSE DA$="MONDAY":
O1=0
2670 IF DAY=2THEN DA$="TUESDAY"
2680 IF DAY=3THEN DA$="WEDNESDAY"
2690 IF DAY=4THEN DA$="THURSDAY"
2700 IF DAY=5THEN DA$="FRIDAY"
2710 IF DAY=6THEN DA$="SATURDAY"
2720 IF DAY=7THEN DA$="SUNDAY"
2730 ENDPROC
2740
2750
2760 REM * * * * * * * * * *
2770 DEFPROCmoney
2780 X(PLA)=INT(X(PLA)*100)/100
2790 ENDPROC
2800
2810
2820 REM * * * * * * * * * *
2830 DEFPROCcash
2840 FORI=1TOP:IFA(I)-10<1THEN PA(I)=1:GOTO2890
2850 IF A(I)-10<3 THEN PA(I)=.7:GOTO2890
2860 IF A(I)-10<6 THEN PA(I)=.5:GOTO2890
2870 IF A(I)-10<10 THEN PA(I)=.25:GOTO2890
2880 PA(I)=0
2890 NEXTI
2900 ENDPROC
2910
2920
2930 REM * * * * * * * * * *
2940 DEFPROCcash1
2950 FORI=1TOP:IFD(I)-10<1THEN PE(I)=1:GOTO3000
2960 IFD(I)-10<3THEN PD(I)=.7:GOTO3000
2970 IFD(I)-10<6THEN PD(I)=.5:GOTO3000
2980 IFD(I)-10<10THEN PD(I)=.25:GOTO3000
2990 PD(I)=0
3000 NEXTI
3010 ENDPROC
3020
3030
3040 REM * * * * * * * * * *
3050 DEFPROCcash2
3060 FORI=1TOP:IFE(I)-5<1THEN PE(I)=1:GOTO3110.
3070 IFE(I)-5<3THEN PE(I)=.7:GOTO3110
3080 IFE(I)-5<6THEN PE(I)=.5:GOTO3110
3090 IFE(I)-5<10THEN PE(I)=.25:GOTO3110
3100 PE(I)=0
3110 NEXTI
3120 ENDPROC
3130
3140
3150 REM * * * * * * * * * *
3160 DEFPROCover
3170 CLS:PROCoff:PRINT:FORI=1TO2:PRINTCHR$129;CHR$136;CHR$141;"You have OVERSPE
NT!!"
3180 IF S%=1 THEN SOUND1,-15,1,10
3190 NEXTI:FORI=1TO3000:NEXTI:PROCon:PRINT
3200 CLS
3210 ENDPROC
3220
3230
3240 REM * * * * * * * * * *
3250 DEFPROCsounds
3260 TIME=0
3270 ENVELOPE1,5,0,0,0,5,2,3,10,-3,0,-1,126,70
3280 ENVELOPE2,3,0,-2,-1,2,2,30,50,-1,-12,-2,126,126
3290 REPEAT
3300 S1%=RND(2)
3310 SOUND0,1,S1%+3,20
3320 G%=RND(20)+40
3330 SOUND&1000,0,0,G%
3340 IF RND(2)=2 THEN PROCtweet
3350 UNTIL TIME>200
3360 ENDPROC
3370
3380
3390 REM * * * * * * * * * *
3400 DEFPROCtweet
3410 F%=RND(3)
3420 FOR GU%=1 TO F%
3430 SOUND1,2,220,20
3440 IF F%>1 THEN SOUND2,2,200,25
3450 IF F%>2 THEN SOUND3,2,240,10
3460 NEXT
```


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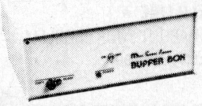

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PROGRAM FILE

```
3470 ENDPROC
3480
3490
3500 REM * * * * * * * * * * *
3510 DEFPROCinstructions
3520 CLS:FORI=1TO2:PRINTCHR$132;CHR$157;CHR$133;CHR$141;"]]]]]]]]]";CHR$131;"IN
STRUCTIONS";CHR$133;"[[[[[[[[[[":NEXTI
3530 PRINT'CHR$130;"You are the owner of an";CHR$131;"ICE-CREAM";CHR$130;"van"'
CHR$130;"trading on the sea front at";CHR$131;"MICROVILLE"'CHR$130;"by the sea
"
3540 PRINT'CHR$130;"Each morning you buy your stock at the"'CHR$130;"depot,est
imating your likely sales,"'CHR$130;"which depend on the weather and the"'CHR$
130;"day."
3550 PRINT'CHR$130;"At the beginning of the game, each"'CHR$130;"player starts
off with";CHR$131;"`200";CHR$130;"and has"';CHR$130;"to try and earn the great
est profit."
3560 PROCspace
3570 CLS:FORI=1TO2:PRINTCHR$132;CHR$157;CHR$133;CHR$141;"]]]]]]]]]";CHR$131;"IN
STRUCTIONS";CHR$133;"[[[[[[[[[[":NEXTI
3580 PRINT'CHR$134;"You sell 3 different products:-"'CHR$130;"1."CHR$131"CONES
"CHR$130"with soft ice-cream filling."'CHR$130;"(The cones cost you 3 pence and
the ice"CHR$130"cream 7 pence per portion)"
3590 VDU14B:PRINTSTRING$(38,",")
3600 PRINT'CHR$129;"2."CHR$131"CHOC-ICES"'CHR$130;"(Which cost you 10 pence eac
h)"
3610 VDU14B:PRINTSTRING$(38,",")
3620 PRINT''CHR$129;"3."CHR$131"LOLLIES"'CHR$130"(Which cost you 5 pence each)"
3630 VDU14B:PRINTSTRING$(38,",")
3640 PRINT'CHR$130;"If you do not manage to sell all your"''CHR$131;"produce";C
HR$130;"it is kept for the next day."
3650 PRINT'CHR$129;CHR$157;CHR$135;"Do you want instructions again?(Y/N)"
3660 ENDPROC
3670
3680
3690 REM * * * * * * * * * *
3700 DEFPROCsum
3710 CLS
3720 IF DAY%=LO FORI=1TO2:PRINTTAB(10,I);CHR$131;CHR$157;CHR$132;CHR$141;"SUMMA
RY  ";CHR$156:NEXT:PRINTTAB(9,3);CHR$149;STRING$(14,"`"):GOTO3740
3730 FORI=1TO2:PRINTTAB(5,I);CHR$134;CHR$141;"LATEST STATE OF PLAY":NEXTI:PRINT
TAB(5,3);CHR$145;STRING$(22,"s")
3740 PRINT'''TAB(2);"PLACING";TAB(15);"CASH";TAB(28);"PROFIT"
3750 PRINTTAB(1);CHR$145;"````````";TAB(15);"`````";TAB(28);"``````"
3760 FOR PLA=1TOP:IF DAY%=LO THEN X(PLA)=X(PLA)-LO(PLA):NEXTPLA
3770 FORI=1TOP:CA(I)=X(I):NEXTI
3780 FORI=1TOP:HS=CA(1):ND=1:W=2
3790 IF CA(W)>HS THEN HS=CA(W):ND=W
3800 IF W<P THEN W=W+1:GOTO3790
3810 PA1(I)=ND:CA(ND)=-1000
3820 NEXTI
3830 Z8=0
3840 FOR PLA=1 TO P
3850 PRINTTAB(1,8+PLA*2)CHR$(128+RND(6));PLA;".";N$(PA1(PLA));
3860 PRINTTAB(14,8+PLA*2);CHR$(128+RND(6));"£";X(PA1(PLA));
3870 PRINTTAB(27,8+PLA*2);CHR$(128+RND(6));"£";INT(X(PA1(PLA))*100)/100-200
3880 NEXTPLA
3890 IF DAY%<LO THEN GOTO 3960
3900 Z8=Z8+1
3910 IF Z8<=25 THEN IF S%=1 SOUND1,-15,INT(RND(200)),1:GOTO3840
3920 FORI=1TO2:PRINTTAB(0,3+I);CHR$134;CHR$141;"  T H E  W I N N E R  I S  :":N
EXTI
3930 PRINTTAB(0,10);CHR$136
3940 IF S%=0 GOTO 3960
3950 PROCmusic3
3960 PROCspace
3970 ENDPROC
3980
3990
4000 REM * * * * * * * * * *
4010 DEFPROCmusic
4020 FORI=1TO43
4030 READ A%,B%
4040 SOUND 1,-15,A%,B%
4050 SOUND 2,-15,A%+1,B%
4060 SOUND 3,-15,A%+2,B%
4070 NEXTI
4080 ENDPROC
4090
4100
4110 REM * * * * * * * * * *
4120 DATA 81,6,85,4,89,8,81,6,69,4,61,6,53,4,49,6,53,4,81,7.2,0,2.4,81,15.2,0,2
.4,81,6,85,4,89,8,81,6,69,4,61,6,53,4,49,6,53,4,89,24,89,6,93,4,97,8,89,6,73,4,6
9,6,61,4,57,6,61,4,89,8,81,8,73,8,69,2.4,61,2.4,65,3.2,69,8
4130 DATA61,8,49,8,33,8,53,24
4140
4150
4160 REM * * * * * * * * * *
4170 DEFPROCon
4180 VDU23,0,11,255,0,0,0,0,0
4190 ENDPROC
4200
4210
4220 REM * * * * * * * * * *
4230 DEFPROCoff
4240 VDU23,0,11,0,0,0,0,0,0
4250 ENDPROC
4260
4270
4280 REM * * * * * * * * * *
4290 DEFPROCsun
4300 VDU31,25,4,132,157,147:PRINT"¦";STRING$(2,CHR$255);"¦"
4310 VDU31,25,5,132,157,147:PRINTSTRING$(4,CHR$255)
4320 VDU31,25,6,132,157,147:PRINT"/";STRING$(2,CHR$255)"/"
4330 VDU31,24,3,132,157,147:PRINT" )  &"
4340 VDU31,24,7,132,157,147:PRINT"&    )"
4350 VDU31,23,5,132,157,147:PRINT"`"
4360 VDU31,32,5,147:PRINT"`"
4370 ENDPROC
4380
4390
4400 REM * * * * * * * * * *
4410 DEFPROCcloud
4420 VDU31,18,4,132,157,151:PRINTSTRING$(4,CHR$255)
4430 VDU31,15,5,132,157,151:PRINTSTRING$(8,CHR$255)
4440 VDU31,16,6,132,157,151:PRINTSTRING$(5,CHR$255)
4450 VDU31,17,7,132,157,151:PRINTSTRING$(3,CHR$255)
4460 VDU31,28,5,132,157,151:PRINTSTRING$(4,CHR$255)
4470 VDU31,26,6,132,157,151:PRINTSTRING$(7,CHR$255)
4480 VDU31,27,7,132,157,151:PRINTSTRING$(8,CHR$255)
4490 VDU31,28,8,132,157,151:PRINTSTRING$(4,CHR$255)
4500 VDU31,8,5,132,157,151:PRINTSTRING$(4,CHR$255)
4510 VDU31,6,6,132,157,151:PRINTSTRING$(7,CHR$255)
4520 VDU31,7,7,132,157,151:PRINTSTRING$(7,CHR$255)
4530 VDU31,8,8,132,157,151:PRINTSTRING$(4,CHR$255);CHR$134
4540 ENDPROC
```

PROGRAM FILE

```
 4550
 4560
 4570 REM * * * * * * * * * *
 4580 DEFPROCrain
 4590 VDU31,7,9,134:PRINT"/  /  /  /  /  /  /  /  /  /  /"
 4600 VDU31,16,8,134:PRINT"/  /  /  /"
 4610 ENDPROC
 4620
 4630
 4640 REM * * * * * * * * * *
 4650 DEFPROCerror
 4660 IF ERR=17 THEN CLEAR:RUN
 4670 PROCon:PRINT
 4680 VDU26,12
 4690 REPORT:PRINT" at line ";ERL
 4700 *FX4
 4710 END
 4720
 4730
 4740 REM * * * * * * * * * *
 4750 DEFPROCbroke
 4760 VDU26,12:FORI=1TO2:PRINTTAB(0,I);CHR$132;CHR$157;CHR$133;CHR$141;"]]]]]]]
]]]]";CHR$131;"BROKE";CHR$133;"[[[[[[[[[[[[":NEXTI
 4770 PRINT''CHR$131;N$(PLA);CHR$130;"you are broke but luck is"''CHR$130"on yo
ur side. You see a bank and"
 4780 PRINT''CHR$130"borough £50 but you will have to pay"''CHR$130"'75 back ("
;CHR$131;"MISER BANKS";CHR$130;")"
 4790 LO(PLA)=LO(PLA)+75
 4800 IF X(PLA)<0 THEN X(PLA)=0
 4810 X(PLA)=X(PLA)+50
 4820 PROCspace
 4830 ENDPROC
 4840
 4850
 4860 REM * * * * * * * * * *
 4870 DEFPROCoption
 4880 CLS:*FX15
 4890 FORI=1TO2
 4900 PRINTTAB(0,I);CHR$132;CHR$157;CHR$133;CHR$141;"]]]]]]]]]]";CHR$131;"SOUND
OPTION";CHR$133;"[[[[[[[[[[":
 4910 NEXTI
 4920 PRINTTAB(0,7);CHR$134;"Do you want";CHR$133;CHR$157;CHR$135;"SOUND  ";CHR$
156;CHR$134;"?"
 4930 PRINT'''
 4940 FORI=1TO2
 4950 PRINTCHR$129;CHR$141;"Press";CHR$131;"'Y' or 'N'";CHR$147
 4960 NEXTI
 4970 PROCman(3,8,147)
 4980 REPEAT A$=GET$:IF A$="Y" OR A$="y" S%=1 ELSE S%=0:UNTIL A$="Y" OR A$="y" O
R A$="N" OR A$="n"
 4990 IF A$="Y" OR A$="y" THEN PRINTTAB(0,16);CHR$129;"You chose";CHR$131;"Yes";
CHR$129;"for sound.":ELSE PRINTTAB(0,17);CHR$129;"You chose";CHR$131;"No";CHR$12
9;"for sound."
 5000 PRINTTAB(0,23);CHR$129;CHR$157;CHR$135;"Do you wish to change anything (Y/
N)?";
 5010 REPEAT A$=GET$:UNTIL A$="Y" OR A$="y" OR A$="N" OR A$="n"
 5020 IF A$="Y" OR A$="y" THEN GOTO 4880
 5030 PROCspace
 5040 ENDPROC
 5050
 5060
 5070 REM * * * * * * * * * *
 5080 DEFPROCbalance
 5090 PRINTCHR$135;"You have £";X(PLA)
 5100 ENDPROC
 5110
 5120
 5130 REM * * * * * * * * * *
 5140 DEFPROCpost
 5150 *FX15,0
 5160 VDU26,12:FORI=1TO2:PRINTCHR$132;CHR$157;CHR$133;CHR$141;"]]]]]]]]]]]]";CH
R$131;"POST";CHR$133;"[[[[[[[[[[[[":NEXTI
 5170 PRINTCHR$129;"Player";CHR$130;PLA;")";CHR$134;"..";N$(PLA);SPC(4);CHR$129;
"Week:";CHR$134;WEEK'CHR$129;"Weather:";CHR$134;WET$'CHR$129;"Day:";CHR$134;DA$:
VDU148:PRINTSTRING$(39,",")
 5180 PRINTCHR$134;"  This mornings post is:"'
 5190 RESTORE 5500
 5200 L=INT(RND(1)*9+1)
 5210 FORI=1TOL
 5220 READ XX$,YY$,ZZ$,C1,C2
 5230 NEXTI
 5240 FORI=1TO2:PRINTCHR$130;CHR$141;XX$;CHR$131;YY$;CHR$129;ZZ$;CHR$136;"  ";C1
 5250 NEXTI
 5260 IF C2=0 IF S%=1 SOUND1,-15,1,10
 5270 IF C2=1 IF S%=1 SOUND1,-15,200,10
 5280 PROCbalance
 5290 PROCman(3,10,147)
 5300 FORI=1TO1000:NEXTI
 5310 VDU31,13,16,145:PRINT"5";SPC(7);"j";STRING$(5,"'");CHR$146:VDU31,13,17,145
:PRINT"upppppppz"
 5320 IF C2=0 THEN GOTO 5390
 5330 FORI=1TO4:VDU31,15,12+I-1,145,32,32,32,32,32,146:VDU31,15,12+I,131:PRINT"'
";CHR$129;C1;CHR$145
 5340 IF S%=1 SOUND1,-15,100+I*2,10:SOUND2,-15,50+I*3,10
 5350 FORW=1TO1000:NEXTW
 5360 NEXTI
 5370 VDU31,15,16,131:PRINT"$$$$$":VDU145:IF S%=1 SOUND1,-15,150,10:SOUND2,-15,
110,10
 5380 X(PLA)=X(PLA)+C1:VDU31,0,11:PROCbalance
 5390 IF C2=1 THEN GOTO 5460
 5400 FORI=1TO6:VDU31,15,15+I-1,145,32,32,32,32,32,145:VDU31,15,15+1,131:PRINT"'
";CHR$129;C1;CHR$145
 5410 IF S%=1 SOUND1,-15,100-I*2,10:SOUND2,-15,50-I*3,10
 5420 FORW=1TO1000:NEXTW
 5430 NEXTI
 5440 VDU31,15,21,148:PRINT"9f 9f":IF S%=1 SOUND0,-15,100,10
 5450 X(PLA)=X(PLA)-C1:VDU31,0,11:PROCbalance
 5460 FORI=1TO500:NEXTI:PROCspace
 5470 ENDPROC
 5480
 5490
 5500 REM * * * * * * * * * *
 5510 DATA "VAN","REPAIR","PAY",50,0
 5520 DATA "UNCLE'S","LEGACY","COLLECT",100,1
 5530 DATA "POOLS","WIN","COLLECT",100,1
 5540 DATA "ICE CREAM","MELTED","PAY",25,0
 5550 DATA "WINDFALL","","COLLECT",75,1
 5560 DATA "LOTTERY","PRIZE","COLLECT",50,1
 5570 DATA "ELECTRICITY","BILL","PAY",75,0
 5580 DATA "FIRE IN","VAN","PAY",50,0
 5590 DATA "CASINO","WIN","COLLECT",125,1
 5600 DATA "BEACH","RENT","PAY",75,0
 5610
 5620
 5630 REM * * * * * * * * * *
```


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PROGRAM FILE

```
5640 DEFPROCman(Z1,Z2,COL)
5650 VDU31,30,Z2,137,150:PRINT "p";STRING$(4,CHR$255):VDU31,32,Z2+1,146:PRINT"5
 j"
5660 VDU31,32,Z2+2,146:PRINT"u0_z":VDU31,32,Z2+3,146:PRINT" 5j"
5670 VDU31,30,Z2+4,146:PRINT"7``!""``k":VDU31,30,Z2+5,146:PRINT"5       j"
5680 VDU31,27,Z2+6,146:PRINT"jssssss    j":VDU31,30,Z2+7,146:PRINT"5       j"
5690 VDU31,30,Z2+8,146:PRINT"upp  ppz":FORI=1TOZ1:VDU31,30,Z2+8+I,146:PRINT"   j
 5":NEXTI
5700 VDU31,30,Z2+8+I,COL:PRINTSTRING$(5,CHR$255);"5"
5710 ENDPROC
5720
5730
5740 REM * * * * * * * * * *
5750 DEFPROCmusic2
5760 FORI=1TO3
5770 FORL=50TO100
5780 SOUND17,-15,L+INT(RND(30)),1
5790 SOUND17,-15,L,1
5800 NEXT
5810 NEXT
5820 ENDPROC
5830
5840
5850 REM * * * * * * * * * *
5860 DEFPROCmusic3
5870 FORI=1TO10
5880 FORP%=50TO100
5890 SOUND17,-15,P%,2
5900 SOUND17,-15,P%,2
5910 NEXT
5920 FORP%=100TO50STEP-1
5930 SOUND17,-15,P%,2
5940 SOUND17,-15,P%,2
5950 NEXT
5960 NEXT
5970 ENDPROC
5980
5990
6000 REM * * * * * * * * * *
6010 DEFPROCbank
6020 Z9=0
6030 CLS:FORI=1TO2:PRINTTAB(0,I);CHR$132;CHR$157;CHR$133;CHR$141;"JJJJJJJJJJ";C
HR$131;"BANK HOLIDAY";CHR$133;"LLLLLLLLLL":NEXTI
6040 PRINT''CHR$130;"Today is";CHR$129;"BANK HOLIDAY MONDAY"
6050 PRINT'CHR$134;"And so your market will be increased."'
6060 PROCman(3,10,147)
6070 FORI=1TO7
6080 PRINTTAB(0,8+I*2);CHR$(128+RND(6));"It's";CHR$(128+RND(6));"Bank";CHR$(128
+RND(6));"Holiday";
6090 IF SX=1 SOUND1,-15,I*INT(RND(5)),1
6100 NEXTI
6110 Z9=Z9+1
6120 IF Z9<=20 THEN GOTO 6060
6130 IF SX=1 PROCmusic3
6140 PROCspace
6150 ENDPROC
6160
6170
6180 REM * * * * * * * * * *
>
```

QL Connect Four

by RB Perkins

It's been a long time coming, but this is the first good, lengthy program I've received for the Sinclair QL. Although Connect Four is not the most original game to be devised for a micro, it's a challenging game and this is a nice implementation.

The program runs in TV mode so it can be used by all QL owners.

The idea is to get four of your counters in a row either horizontally, vertically or diagonally. Counters are 'dropped' into seven columns alternatively with your opponent (in this case, the QL).

The only input that you have to respond with is the column you want your counter dropped in (one to seven).

```
100 REMark ***********************************
110 REMark ***      QL Connect 4             ***
120 REMark ***      ============             ***
130 REMark ***       Version 2.0             ***
140 REMark *** Written by A W H Perkins      ***
150 REMark ***      Loughborough.            ***
160 REMark ***      Runs in TV Mode          ***
170 REMark ***********************************
180 DIM pos(7,6),col(7),pla$(2,10),pla$(2,64)
190 MODE 8:PAPER 0:PAPER#2,0:CLS:CLS#2
200 get_names:MODE 4:PAPER 0:CLS
210 LINE 10,2TO 150,2
220 FOR kk=10TO 150STEP 20:LINE kk,2TO kk,84
230 FOR fg=9TO 63STEP 9:AT 2.5,fg-4:PRINT fg/9
240 player=1:play=3:INK 3
250 FOR sv=1TO 7
260 FOR vs=1TO 6
270 pos(sv,vs)=0
280 NEXT vs:col(sv)=6:NEXT sv
290 UNDER 1:CSIZE 3,0:AT 0,1:INK 7:PRINT "Connect 4":UNDER 0:CSIZE 0,0:INK
3
300 IF pla$(player)="COMPUTER"
310 AT 1,4:PRINT "COMPUTER THINKING"
320 CGO:GO TO 380
330 END IF
340 AT 1,0:PRINT "You're move, ";pla$(player);:INPUT " please ? ";bb$
350 IF LEN(bb$)<>1 :GO TO 430
360 IF CODE(bb$)<49 OR CODE(bb$)>55 :GO TO 430
370 cn=bb$:IF col(cn)=0 :GO TO 430
380 play=player+2:draw_piece
390 check
400 IF player=1 :player=2:GO TO 420
```

PROGRAM FILE

```
410 player=1
420 play=player+2
430 AT 1,0:PRINT FILL$(" ",40)
440 INK play
450 GO TO 300
460 DEFine PROCedure draw_piece
470 IF col(cn)=1 :GO TO 570
480 FOR kk=6 TO (7-(col(cn))) STEP -1
490 INK play:CIRCLE cn*20,(kk*14)-7,7,.5,.5*PI
500 PAUSE 2
510 IF kk=7-(col(cn)) :GO TO 530
520 INK 0:CIRCLE cn*20,(kk*14)-7,7,.5,.5*PI
530 END FOR kk
540 pos(cn,7-(col(cn)))=player
550 col(cn)=col(cn)-1
560 GO TO 600
570 INK play:CIRCLE cn*20,77,7,.5,.5*PI
580 pos(cn,6)=player
590 col(cn)=0
600 BEEP 20,1:END DEFine
610 DEFine PROCedure get_names
620 INK 7:LINE 50,65 TO 111,65 TO 111,85 TO 50,85 TO 50,65
630 CSIZE 3,1:AT 2,9:PRINT "Connect 4":CSIZE 0,0
640 AT 11,0:INK 2:INPUT "Name of Player 1 ? ";pla1$
650 AT 13,0:INK 4:INPUT "Name of Player 2 ? ";pla2$
660 IF LEN(pla1$)>10 OR LEN(pla2$)>10 :CLS:GO TO 630
670 pla$(1)=pla1$:pla$(2)=pla2$
680 INK 7
690 PAUSE 70
700 END DEFine
710 DEFine PROCedure check
720 FOR SW=1 TO 6
730 FOR GH=1 TO 4
740 IF pos(GH,SW)=1 AND pos(GH+1,SW)=1 AND pos(GH+2,SW)=1 AND pos(GH+3,SW)=
1 :xxx=GH:yyy=SW:jjj=1:one_win
750 IF pos(GH,SW)=2 AND pos(GH+1,SW)=2 AND pos(GH+2,SW)=2 AND pos(GH+3,SW)=
2 :xxx=GH:yyy=SW:jjj=1:two_win
760 NEXT GH:NEXT SW
770 FOR GH=1 TO 7
780 FOR SW=1 TO 3
790 IF pos(GH,SW)=1 AND pos(GH,SW+1)=1 AND pos(GH,SW+2)=1 AND pos(GH,SW+3)=
1 :xxx=GH:yyy=SW:jjj=2:one_win
800 IF pos(GH,SW)=2 AND pos(GH,SW+1)=2 AND pos(GH,SW+2)=2 AND pos(GH,SW+3)=
2 :xxx=GH:yyy=SW:jjj=2:two_win
810 NEXT SW:NEXT GH
820 FOR SW=1 TO 3
830 FOR GH=1 TO 4
840 IF pos(GH,SW)=1 AND pos(GH+1,SW+1)=1 AND pos(GH+2,SW+2)=1 AND pos(GH+3,
SW+3)=1 :xxx=GH:yyy=SW:jjj=3:one_win
850 IF pos(GH,SW)=2 AND pos(GH+1,SW+1)=2 AND pos(GH+2,SW+2)=2 AND pos(GH+3,
SW+3)=2 :xxx=GH:yyy=SW:jjj=3:two_win
860 NEXT GH:NEXT SW
870 FOR GH=1 TO 4
880 FOR SW=4 TO 6 STEP 1
890 IF pos(GH,SW)=1 AND pos(GH+1,SW-1)=1 AND pos(GH+2,SW-2)=1 AND pos(GH+3,
SW-3)=1 :xxx=GH:yyy=SW:jjj=4:one_win
900 IF pos(GH,SW)=2 AND pos(GH+1,SW-1)=2 AND pos(GH+2,SW-2)=2 AND pos(GH+3,
SW-3)=2 :xxx=GH:yyy=SW:jjj=4:two_win
910 NEXT SW:NEXT GH
920 FOR Vk=1 TO 7
930 FOR VJ=1 TO 6
940 IF pos(Vk,VJ)=0 :END DEFine
950 NEXT VJ:NEXT Vk
960 game_drawn
970 DEFine PROCedure one_win
980 INK 3:FILL 1
990 ON jjj GO TO 1000,1020,1040,1060
1000 FOR ii=0 TO 3:FILL 1:CIRCLE (xxx+ii)*20,(yyy*14)-7,7,.5,.5*PI:FILL 0:N
EXT ii
1010 GO TO 1070
1020 FOR zz=0 TO 3:FILL 1:CIRCLE xxx*20,((yyy+zz)*14)-7,7,.5,.5*PI:FILL 0:N
EXT zz
1030 GO TO 1070
1040 FOR qq=0 TO 3:FILL 1:CIRCLE (xxx+qq)*20,((yyy+qq)*14)-7,7,.5,.5*PI:FIL
L 0:NEXT qq
1050 GO TO 1070
1060 FOR tt=0 TO 3:FILL 1:CIRCLE (xxx+tt)*20,((yyy-tt)*14)-7,7,.5,.5*PI:FIL
L 0:NEXT tt
1070 FOR ll=1 TO 3000:NEXT ll
1080 PAPER 0:CLS:INK 7
1090 IF pla1$="COMPUTER"
1100 CSIZE 1,1:AT 1,1:INK 3:PRINT "The Computer won that game!":GO TO 1150
1110 END IF
1120 CSIZE 1,1:AT 1,1:PRINT "Well done ";
1130 INK 3:PRINT pla1$;
1140 INK 7:PRINT ", you won that game!"
1150 ANOTHER:STOP
1160 END DEFine one_win
1170 DEFine PROCedure ANOTHER
1180 FOR ff=1 TO 10:PAN ff*2
1190 FOR ff=1 TO 10:PAN -ff*2
1200 CSIZE 1,0
1210 AT 10,0:INPUT "Fancy another game ? (Y/N) ";yn$
1220 IF yn$<>"N" AND yn$<>"Y" :cline:GO TO 1210
1230 IF yn$="Y" :RUN
1240 CSIZE 0,0:CLS
1250 END DEFine ANOTHER
1260 DEFine PROCedure two_win
1270 INK 4:FILL 1
1280 ON jjj GO TO 1290,1310,1330,1350
1290 FOR ii=0 TO 3:FILL 1:CIRCLE (xxx+ii)*20,(yyy*14)-7,7,.5,.5*PI:FILL 0:N
EXT ii
1300 GO TO 1360
1310 FOR zz=0 TO 3:FILL 1:CIRCLE xxx*20,((yyy+zz)*14)-7,7,.5,.5*PI:FILL 0:N
EXT zz
1320 GO TO 1360
1330 FOR qq=0 TO 3:FILL 1:CIRCLE (xxx+qq)*20,((yyy+qq)*14)-7,7,.5,.5*PI:FIL
L 0:NEXT qq
1340 GO TO 1360
1350 FOR tt=0 TO 3:FILL 1:CIRCLE (xxx+tt)*20,((yyy-tt)*14)-7,7,.5,.5*PI:FIL
L 0:NEXT tt
1360 FOR nn=1 TO 3000:NEXT nn
1370 PAPER 0:CLS:INK 7
1380 IF pla2$="COMPUTER"
1390 CSIZE 1,1:AT 1,1:INK 4:PRINT "The Computer won that game!":GO TO 1430
```


MICROMART

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WD Utilities (3rd ed) **(base £5.50)**
view 60-file DIRectory on one screen, one-key LOAD, COPY or print 60 files with one key (allows for namesakes). Multiple FORMATting to prevent corruption by stretching of tape. TOOLKit to give dated, numbered modules in program development. PRUNE old files to release space (one key DELETEs a file). Full instructions in QUILL file. Use up to 6 EXTRA MICRODRIVES (add on your Spectrum ones)!

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PROGRAM FILE

```
1400 END IF
1410 CSIZE 1,1:AT 1,1:PRINT "Well done ";
1420 INK 4:PRINT pla2$;:INK 7:PRINT ", you won that game!"
1430 ANOTHER:STOP
1440 END DEFine two_win
1450 DEFine PROCedure cline
1460 AT 10,0:PRINT FILL$(" ",55)
1470 END DEFine
1480 DEFine PROCedure game_drawn
1490 PAPER 0:CLS
1500 CSIZE 1,1:AT 2,1:PRINT "How boring, a draw!"
1510 ANOTHER:STOP
1520 END DEFine game_drawn
1530 DEFine PROCedure CGO
1540 v=player
1550 FOR s=1TO 6
1560 FOR g=1TO 4
1570 IF pos(g,s)=v AND pos(g+1,s)=v AND pos(g+2,s)=v AND pos(g+3,s)=0:IF s=
1:cn=g+3:END DEFine :ELSE IF pos(g+3,s-1)<>0:cn=g+3:END DEFine
1580 IF pos(g,s)=v AND pos(g+1,s)=v AND pos(g+2,s)=0AND pos(g+3,s)=v:IF s=1
:cn=g+2:END DEFine :ELSE IF pos(g+2,s-1)<>0:cn=g+2:END DEFine
1590 IF pos(g,s)=v AND pos(g+1,s)=0AND pos(g+2,s)=v AND pos(g+3,s)=v:IF s=1
:cn=g+1:END DEFine :ELSE IF pos(g+1,s-1)<>0:cn=g+1:END DEFine
1600 IF pos(g,s)=0AND pos(g+1,s)=v AND pos(g+2,s)=v AND pos(g+3,s)=v:IF s=1
:cn=g:END DEFine :ELSE IF pos(g,s-1)<>0:cn=g:END DEFine
1610 NEXT g:NEXT s
1620 FOR g=1TO 7
1630 FOR s=1TO 3
1640 IF pos(g,s)=v AND pos(g,s+1)=v AND pos(g,s+2)=v AND pos(g,s+3)=0:cn=gg
:END DEFine
1650 NEXT s:NEXT g
1660 FOR s=1TO 3
1670 FOR g=1TO 4
1680 IF pos(g,s)=v AND pos(g+1,s+1)=v AND pos(g+2,s+2)=v AND pos(g+3,s+3)=0
 AND pos(g+3,s+2)<>0:cn=g+3:END DEFine
1690 IF pos(g,s)=v AND pos(g+1,s+1)=v AND pos(g+2,s+2)=0AND pos(g+3,s+3)=v
AND pos(g+2,s+1)<>0:cn=g+2:END DEFine
1700 IF pos(g,s)=v AND pos(g+1,s+1)=0AND pos(g+2,s+2)=v AND pos(g+3,s+3)=v
AND pos(g+1,s)<>0:cn=g+1:END DEFine
1710 IF pos(g,s)=0AND pos(g+1,s+1)=v AND pos(g+2,s+2)=v AND pos(g+3,s+3)=v:
IF s=1:cn=g:END DEFine :ELSE IF pos(g,s-1)<>0:cn=g:END DEFine
1720 NEXT g:NEXT s
1730 FOR g=1TO 4
1740 FOR s=4TO 6STEP 1
1750 IF pos(g,s)=v AND pos(g+1,s-1)=v AND pos(g+2,s-2)=v AND pos(g+3,s-3)=0
:IF s-3=1:cn=g+3:END DEFine :ELSE IF pos(g+3,s-4)<>0:cn=g+3:END DEFine
1760 IF pos(g,s)=v AND pos(g+1,s-1)=v AND pos(g+2,s-2)=0AND pos(g+3,s-3)=v
AND pos(g+2,s-3)<>0:cn=g+2:END DEFine
1770 IF pos(g,s)=v AND pos(g+1,s-1)=0AND pos(g+2,s-2)=v AND pos(g+3,s-3)=v
AND pos(g+1,s-2)<>0:cn=g+1:END DEFine
1780 IF pos(g,s)=0AND pos(g+1,s-1)=v AND pos(g+2,s-2)=v AND pos(g+3,s-3)=v
AND pos(g,s-1)<>0:cn=g:END DEFine
1790 NEXT s:NEXT g
1800 v=NOT(player-1)
1810 FOR s=1TO 6
1820 FOR g=1TO 4
1830 IF pos(g,s)=v+1AND pos(g+1,s)=v+1AND pos(g+2,s)=v+1AND pos(g+3,s)=0:IF
 s=1:cn=g+3:END DEFine :ELSE IF pos(g+3,s-1)<>0:cn=g+3:END DEFine
1840 IF pos(g,s)=v+1AND pos(g+1,s)=v+1AND pos(g+2,s)=0AND pos(g+3,s)=v+1:IF
 s=1:cn=g+2:END DEFine :ELSE IF pos(g+2,s-1)<>0:cn=g+2:END DEFine
1850 IF pos(g,s)=v+1AND pos(g+1,s)=0AND pos(g+2,s)=v+1AND pos(g+3,s)=v+1:IF
 s=1:cn=g+1:END DEFine :ELSE IF pos(g+1,s-1)<>0:cn=g+1:END DEFine
1860 IF pos(g,s)=0AND pos(g+1,s)=v+1AND pos(g+2,s)=v+1AND pos(g+3,s)=v+1:IF
 s=1:cn=g:END DEFine :ELSE IF pos(g,s-1)<>0:cn=g:END DEFine
1870 NEXT g:NEXT s
1880 FOR g=1TO 7
1890 FOR s=1TO 3
1900 IF pos(g,s)=v+1AND pos(g,s+1)=v+1AND pos(g,s+2)=v+1AND pos(g,s+3)=0:cn
=g:END DEFine
1910 NEXT s:NEXT g
1920 FOR s=1TO 3
1930 FOR g=1TO 4
1940 IF pos(g,s)=v+1AND pos(g+1,s+1)=v+1AND pos(g+2,s+2)=v+1AND pos(g+3,s+3
)=0AND pos(g+3,s+2)<>0:cn=g+3:END DEFine
1950 IF pos(g,s)=v+1AND pos(g+1,s+1)=v+1AND pos(g+2,s+2)=0AND pos(g+3,s+3)=
v+1AND pos(g+2,s+1)<>0:cn=g+2:END DEFine
1960 IF pos(g,s)=v+1AND pos(g+1,s+1)=0AND pos(g+2,s+2)=v+1AND pos(g+3,s+3)=
v+1AND pos(g+1,s)<>0:cn=g+1:END DEFine
1970 IF pos(g,s)=0AND pos(g+1,s+1)=v+1AND pos(g+2,s+2)=v+1AND pos(g+3,s+3)=
v+1:IF s=1:cn=g:END DEFine :ELSE IF pos(g,s-1)<>0:cn=g:END DEFine
1980 NEXT s:NEXT g
1990 FOR g=1TO 4
2000 FOR s=4TO 6STEP 1
2010 IF pos(g,s)=v+1AND pos(g+1,s-1)=v+1AND pos(g+2,s-2)=v+1AND pos(g+3,s-3
)=0:IF s-3=1:cn=g+3:END DEFine :ELSE IF pos(g+3,s-4)<>0:cn=g+3:END DEFine
2020 IF pos(g,s)=v+1AND pos(g+1,s-1)=v+1AND pos(g+2,s-2)=0AND pos(g+3,s-3)=
v+1AND pos(g+2,s-3)<>0:cn=g+2:END DEFine
2030 IF pos(g,s)=v+1AND pos(g+1,s-1)=0AND pos(g+2,s-2)=v+1AND pos(g+3,s-3)=
v+1AND pos(g+1,s-2)<>0:cn=g+1:END DEFine
2040 IF pos(g,s)=0AND pos(g+1,s-1)=v+1AND pos(g+2,s-2)=v+1AND pos(g+3,s-3)=
v+1 AND pos(g,s-1)<>0:cn=g:END DEFine
2050 NEXT s:NEXT g
2060 v=player
2070 FOR s=1TO 6
2080 FOR g=1TO 4
2090 IF pos(g,s)=0AND pos(g+1,s)=0AND pos(g+2,s)=v AND pos(g+3,s)=v:IF s=1:
cn=g:END DEFine :ELSE IF pos(g,s-1)<>0:cn=g:END DEFine
2100 IF pos(g,s)=v AND pos(g+1,s)=0AND pos(g+2,s)=0AND pos(g+3,s)=v:IF s=1:
cn=(RND(1TO 2)+g):END DEFine :ELSE IF pos(g+2,s-1)<>0:cn=g+2:END DEFine
2110 IF pos(g,s)=v AND pos(g+1,s)=v AND pos(g+2,s)=0AND pos(g+3,s)=0:IF s=1
:cn=g+3:END DEFine :ELSE IF pos(g+3,s-1)<>0:cn=g+3:END DEFine
2120 IF pos(g,s)=0AND pos(g+1,s)=v AND pos(g+2,s)=0AND pos(g+3,s)=v:IF s=1:
cn=g:END DEFine :ELSE IF pos(g,s-1)<>0:cn=g:END DEFine
2130 NEXT g:NEXT s
2140 FOR s=1TO 3
2150 FOR g=1TO 4
2160 IF pos(g,s)=v AND pos(g+1,s+1)=v AND pos(g+2,s+2)=0AND pos(g+3,s+3)=0:
IF pos(g+3,s+2)<>0:cn=g+3:END DEFine :ELSE IF pos(g+2,s+1)<>0:cn=g+2:END DE
Fine
2170 IF pos(g,s)=0AND pos(g+1,s+1)=v AND pos(g+2,s+2)=v AND pos(g+3,s+3)=0:
IF pos(g+3,s+2)<>0:cn=g+3:END DEFine :ELSE IF s=1:cn=g:END DEFine :ELSE IF
pos(g,s-1)<>0:cn=g:END DEFine
2180 IF pos(g,s)=v AND pos(g+1,s+1)=0AND pos(g+2,s+2)=0AND pos(g+3,s+3)=v:I
F pos(g+2,s+1)<>0:cn=g+2:END DEFine :ELSE IF pos(g+1,s)<>0:cn=g+1:END DEFin
e
2190 NEXT g:NEXT s
```

```
2200 FOR g=1TO 4
2210 FOR s=4TO 6STEP 1
2220 IF pos(g,s)=0AND pos(g+1,s-1)=0AND pos(g+2,s-2)=v AND pos(g+3,s-3)=v:I
F pos(g,s-1)<>0:cn=g+3:END DEFine :ELSE IF pos(g+1,s-2)<>0:cn=g+1:END DEFin
e
2230 IF pos(g,s)=v AND pos(g+1,s-1)=0AND pos(g+2,s-2)=0AND pos(g+3,s-3)=v:I
F pos(g+1,s-2)<>0:cn=g+1:END DEFine :ELSE IF pos(g+2,s-3)<>0:cn=g+2:END DEF
ine
2240 IF pos(g,s)=0AND pos(g+1,s-1)=v AND pos(g+2,s-2)=v AND pos(g+3,s-3)=0:
IF pos(g,s-1)<>0:cn=g:END DEFine :ELSE IF s-3=1:cn=g+3:END DEFine :ELSE IF
pos(g+3,s-4)<>0:cn=g+3:END DEFine
2250 NEXT s:NEXT g
2260 IF pos(4,1)=0:cn=4:END DEFine
2270 cn=RND(1TO 7):IF col(cn)=0:GO TO 2270
2280 END DEFine CGO
```

Amstrad See PC

by John Coyne

See PC for the Amstrad CPC464 enables the user to examine and disassemble all 96k of internal memory, both ROM and RAM. Output consists of either disassembled machine code or a hex dump, both accompanied by a character representation of memory contents. The program uses two 40-column windows side by side, so one window can be used for the main routine and the other to display called subroutines.

Upon running, the program is driven by the following commands:

S: start address in hex followed by the number of lines to be displayed (a high number gives continuous scrolling)
X: switches windows
D or H: disassembly or hex dump
A or O: RAM or ROM (defaults to RAM at &4000 and &BFFF)
C: to view next address, can be held to scroll
W: to wipe current screen
Q: to quit

Continuous scrolling can be paused by [ESC] or terminated by [ESC][ESC] without exiting the program.

The program wasn't printed on an Amstrad printer so the hash sign appears as a pound sign. Other than that, it's all correct.

```
10 ' ** SEE-PC **
20 ' AMSTRAD CPC464 ROM/RAM DISASSEMBLER
30 ' COPYRIGHT J. COYNE 1985
40 SYMBOL AFTER 256:MEMORY &ABBF:SYMBOL AFTER 248:MODE 2
50 ON BREAK GOSUB 80
60 ON ERROR GOTO 90
70 GOTO 41000
80 L=0:RETURN
90 PRINT CHR$(7):RESUME 51000
1000 ' SUNDRY SUBROUTINES
1200 CLS £0:WINDOW SWAP 0,1:WINDOW SWAP 2,3:WINDOW SWAP 4,5
1230 F=S(S,0):R=S(S,1):A=S(S,4)
1250 CLS £2:PRINT £2,CHR$(10);"FUNCTION: ";F$(R);F$(F)
1255 T1=S(0,F):T2=S(1,F):RETURN
1300 CALL &ABC0,R,@B,@A:PRINT £4,HEX$(B,2);:C$=C$+CHR$(1)+CHR$(B):RETURN
1700 IF Y<4 AND Y<>2 THEN T$=T$+"A,"
1710 RETURN
1800 IF Y=6 THEN F$="F" ELSE F$=R$(Y)
1810 S$="(C)":RETURN
1900 O$=""
1905 GOSUB 1300:O$="&"+HEX$(B,2)+O$:RETURN
1910 GOSUB 1300:O$=HEX$(B,2):GOTO 1905
1920 GOSUB 1900
1925 O$="("+O$+")":RETURN
1930 GOSUB 1910:GOTO1925
9997 '
9998 ' NOT CB/ED PREFIXED
9999 '
10000 ON X GOTO 11000,12000,13000
10010 ON Z GOTO 10100,10200,10300,10400,10500,10600,10700
10020 IF B=0 THEN T$="NOP":RETURN
10030 IF B=8 THEN T$="EX  AF,AF'":RETURN
10040 IF B=16 THEN T$="DJNZ ":GOTO 10070
10050 IF B=24 THEN T$="JR  ":GOTO 10070
10060 T$="JR  "+C$(Y-4)+","
10070 GOSUB 1300:IF B>127 THEN B=B-256
10080 B=B+A:T$=T$+"&"+HEX$(B,4):RETURN
10100 IF Y AND 1 THEN T$="ADD "+I$+","+W$(V):RETURN
10110 GOSUB 1910:T$="LD  "+W$(V)+","+O$:RETURN
10200 T$="LD  "
10210 IF V=0 THEN F$="(BC)":S$="A"
10220 IF V=1 THEN F$="(DE)":S$="A"
10230 IF V=2 THEN GOSUB 1930:F$=O$:S$=I$
10240 IF V=3 THEN GOSUB 1930:F$=O$:S$="A"
10250 IF Y AND 1 THEN T$=T$+S$+","+F$ ELSE T$=T$+F$+","+S$
10260 RETURN
10300 IF Y AND 1 THEN T$="DEC "+W$(V) ELSE T$="INC "+W$(V)
10310 RETURN
10400 T$="INC "+R$(Y):RETURN
10500 T$="DEC "+R$(Y):RETURN
10600 GOSUB 1900:T$="LD  "+R$(Y)+","+O$:RETURN
```


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PROGRAM FILE

```
10700 T$=M$(4,Y):RETURN
11000 IF B=118 THEN T$="HALT":RETURN
11010 T$="LD   "+R$(Y)+","+R$(Z):RETURN
12000 T$=M$(0,Y):GOSUB 1700:T$=T$+R$(Z):RETURN
13000 ON Z GOTO 13100,13200,13300,13400,13500,13600,13700
13010 T$="RET "+C$(Y):RETURN
13100 IF Y AND 1 THEN 13300
13110 T$="POP  "+W$(V+4):RETURN
13200 GOSUB 1910:T$="JP   "+C$(Y)+","+O$:RETURN
13300 K=-1
13310 K=K+1:IF K=12 THEN 40000
13320 IF B<>B(0,K) THEN 13310
13340 ON K GOTO 13351,13352,13353,13354,13355,13356,13357,13358,13359,13360,13361
13350 GOSUB 1910:T$="JP   "+O$:RETURN
13351 GOSUB 1920:T$="OUT  "+O$+",A":RETURN
13352 T$="EX   (SP),"+I$:RETURN
13353 T$="DI":RETURN
13354 T$="RET":RETURN
13355 T$="EXX":RETURN
13356 T$="JP   "+R$(6):RETURN
13357 T$="LD   SP,"+I$:RETURN
13358 GOSUB 1920:T$="IN   A,"+O$:RETURN
13359 T$="EX   DE,HL":RETURN
13360 T$="EI":RETURN
13361 GOSUB 1910:T$="CALL "+O$:RETURN
13400 GOSUB 1910:T$="CALL "+C$(Y)+","+O$:RETURN
13500 IF Y AND 1 THEN 13300
13510 T$="PUSH "+W$(V+4):RETURN
13600 T$=M$(0,Y):GOSUB 1700:GOSUB 1900:T$=T$+O$:RETURN
13700 T$="RST"+STR$(8*Y):RETURN
19997 '
19998 ' CB PREFIXED
19999 '
20000 IF X THEN 20100
20010 T$=M$(1,Y)+R$(Z):RETURN
20100 IF X=1 THEN T$="BIT"
20110 IF X=2 THEN T$="RES"
20120 IF X=3 THEN T$="SET"
20200 T$=T$+STR$(Y)+","+R$(Z):RETURN
29997 '
29998 ' ED PREFIXED
29999 '
30000 ON X GOTO 31000,32000,40000
30010 GOTO 40000
31000 ON Z GOTO 31100,31200,31300,31400,31400,31400,31400
31010 GOSUB 1800:T$="IN   "+F$+","+S$:RETURN
31100 IF B=113 THEN 40000
31110 GOSUB 1800:T$="OUT  "+S$+","+F$:RETURN
31200 IF Y AND 1 THEN T$="ADC " ELSE T$="SBC "
31210 T$=T$+"HL,"+W$(V):RETURN
31300 GOSUB 1930:IF Y AND 1 THEN T$="LD   "+W$(V)+","+O$:RETURN
31310 T$="LD   "+O$+","+W$(V):RETURN
31400 K=-1
31410 K=K+1:IF K=12 THEN 40000
31420 IF B=B(1,K) THEN T$=B$(K):RETURN
31430 GOTO 31410
32000 IF Y<4 OR Z>3 THEN 40000
32010 K=Z+4*(Y AND 1):T$=M$(V,K):RETURN
40000 T$="INVALID OPCODE":RETURN
40997 '
40998 ' INITIALISE VARIABLES
40999 '
41000 DEFINT A,B,R,F,S,V,X,Y,Z,I,K,L,P,T
41010 T$="":C$="":O$="":F$="":S$="":I$=""
41020 DIM S(1,4),F$(3)
41025 S(0,0)=2:S(0,1)=0:S(0,2)=21:S(0,3)=32:S(0,4)=0
41030 S(1,0)=2:S(1,1)=0:S(1,2)=36:S(1,3)=32:S(1,4)=0
41035 F$(0)="RAM ":F$(1)="ROM ":F$(2)="DISASSEMBLY":F$(3)="HEX DUMP"
41040 DIM M$(4,7),R$(7),W$(7),C$(7)
41050 DIM B(1,11),B$(11)
41100 FOR K=0 TO 7
41110 FOR L=0 TO 4:READ M$(L,K):NEXT
41120 READ R$(K),W$(K),C$(K):NEXT
41140 FOR K=0 TO 11:READ B(0,K),B(1,K),B$(K):NEXT
42000 DATA "ADD ","RLC ",LDI,LDIR,RLCA,B,BC,NZ
42010 DATA "ADC ","RRC ",CPI,CPIR,RRCA,C,DE,Z
42020 DATA "SUB ","RL  ",INI,INIR,RLA,D,HL,NC
42030 DATA "SBC ","RR  ",OUTI,OTIR,RRA,E,SP,C
42040 DATA "AND ","SLA ",LDD,LDDR,DAA,H,BC,PO
42050 DATA "XOR ","SRA ",CPD,CPDR,CPL,L,DE,PE
42060 DATA "OR  ","ERRR",IND,INDR,SCF,(HL),HL,P
42070 DATA "CP  ","SRL ",OUTD,OTDR,CCF,A,AF,M
43000 DATA 195,68,NEG,211,69,RETN
43020 DATA 227,70,"IM  0",243,71,"LD  I,A"
43040 DATA 201,77,RETI,217,79,"LD  R,A"
43060 DATA 233,86,"IM  1",249,87,"LD  A,I"
43080 DATA 219,94,"IM  2",235,95,"LD  A,R"
43100 DATA 251,103,RRD,205,111,RLD
44997 '
44998 ' LINE 1300 ENABLES ROM IF NEC.:="B=PEEK(A):A=A+1"
44999 '
45000 A!=43968:FOR K=0 TO 57:READ T$:POKE A!+K,VAL("&"+T$):NEXT
45100 DATA DD,6E,00,DD,66,01,4E,23
45110 DATA 46,DD,7E,04,B7,28,19,78
45120 DATA 2F,E6,C0,E2,E8,AB,07,07
45130 DATA 07,32,DD,AB,CD,00,B9,F5
```


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PROGRAM FILE

```
45140 DATA 0A,5F,F1,CD,0C,B9,18,02
45150 DATA 0A,5F,03,70,2B,71,16,00
45160 DATA DD,6E,02,DD,66,03,73,23
45170 DATA 72,C9
46997 '
46998 ' PROMPTS MENU
46999 '
47000 C$=CHR$(13)+CHR$(10):T$=STRING$(27,CHR$(9)):PRINT TAB(33)"AMSTRAD CPC464"
47005 PRINT TAB(30)"ROM/RAM DISASSEMBLER";C$;C$;TAB(20)"PRESS:"
47010 PRINT T$;"X TO CHANGE CURRENT SIDE";C$;T$;
      "D FOR DISASSEMBLY";C$;T$;"H FOR HEX DUMP"
47020 PRINT T$;"A TO READ RAM";C$;T$;"O TO READ ROM";C$;T$;
      "S TO ENTER START ADDRESS";C$;T$;"C TO PRINT NEXT INSTRUCTION"
47030 PRINT T$;"W TO WIPE CLEAN CURRENT WINDOW";C$;T$;"Q TO QUIT";C$;C$;T$;
      "ANY KEY TO CONTINUE"
47040 T$=INKEY$:IF T$="" THEN 47040
47050 CLS
48997 '
48998 ' OPEN WINDOWS, INITIALISE SCREEN
48999 '
49000 WINDOW £6,1,80,1,2:WINDOW £4,1,40,3,22:WINDOW £5,41,80,3,22
49010 WINDOW £2,1,40,23,24:WINDOW £3,41,80,23,24
49020 WINDOW £0,1,40,25,25:WINDOW £1,41,80,25,25
49500 PRINT £6,"ADDRESS:    CODE:     ASSEMBLER:      CHAR ";
49505 PRINT £6,"ADDRESS:    CODE:     ASSEMBLER:      CHAR "
50000 S=0:B=0:GOSUB 1230:GOTO 53000
50997 '
50998 ' MAIN LOOP 51000-53080
50999 '
51000 LINE INPUT £0;"START ADDR.:&";T$:T$="&"+T$:A=UNT(VAL(T$))
51010 INPUT £0;"NO. OF LINES";L
51020 CLS £0
51997 '
51998 ' LOOP FOR EACH LINE DISASSEMBLED/DUMPED 52000-52900
51999 '
52000 WHILE L<>0
52010 L=L-1
52020 A!=A:IF A!<0 THEN A!=A!+65536
52030 PRINT £4,MID$(STR$(A!),2);:PRINT £4,TAB(7);HEX$(A,4);" ";
52040 T$="":C$="":IF F=2 THEN 52100
52049 ' HEX DUMP
52050 FOR K=1 TO 4:GOSUB 1300:GOSUB 1300:PRINT £4," ";:NEXT:GOTO 52700
52099 ' DISASSEMBLER
52100 I=0:P=0:I$="HL":GOSUB 1300
52110 IF B=237 THEN P=2:GOSUB 1300:GOTO 52150
52120 IF B=221 THEN I=1:I$="IX":GOSUB 1300:GOTO 52140
52130 IF B=253 THEN I=2:I$="IY":GOSUB 1300
52140 IF B=203 THEN P=1:GOSUB 1300:IF I THEN K=B:GOSUB 1300
52150 W$(2)=I$:W$(6)=I$
52200 X=(B AND 192)/64
52210 Y=(B AND 56)/8
52220 Z=(B AND 7)
52230 V=(B AND 48)/16
52299 ' DEAL WITH IX,IY OFFSET
52300 IF I=0 THEN 52400
52310 IF NOT(Y=6 OR Z=6) THEN 52400
52320 IF P=1 THEN B=K:GOTO 52350
52330 GOSUB 1300
52350 K=1:IF B>127 THEN K=-1:B=ABS(B-256)
52360 I$=I$+CHR$(44-K)+MID$(STR$(B),2)
52400 R$(6)="("+I$+")"
52499 ' DECODING SUBROUTINES
52500 ON P+1 GOSUB 10000,20000,30000
52600 IF I THEN K=INSTR(5,T$,I$):IF K=0 THEN T$="INVALID PREFIX"
52699 ' PRINT OUTPUT
52700 PRINT £4,TAB(T1);T$;TAB(T2);
52705 FOR K=1 TO LEN(C$):PRINT £4,MID$(C$,K,1);:NEXT:PRINT £4
52800 IF NOT (INKEY(62)) THEN 52020
52900 WEND
52999 ' GET KEY
53000 CALL &BB1B:PRINT £0,"ENTER X - D/H - A/O - S - C - W -Q"
53010 T$=UPPER$(INKEY$):IF T$="" THEN 53010
53020 IF T$="C" THEN CLS £0:L=1:GOTO 52000
53030 IF T$="S" THEN 51000
53040 IF T$="A" THEN R=0:S(5,1)=R:GOSUB 1250
53045 IF T$="O" THEN R=1:S(5,1)=R:GOSUB 1250
53050 IF T$="D" THEN F=2:S(5,0)=F:GOSUB 1250
53055 IF T$="H" THEN F=3:S(5,0)=F:GOSUB 1250
53060 IF T$="X" THEN S(5,4)=A:S=ABS(S=0):GOSUB 1200
53070 IF T$="W" THEN CLS £4
53080 IF T$<>"Q" THEN 53000
55000 FOR K=0 TO 6:WINDOW £K,1,80,1,25:NEXT:END
READY.
MACHINE CODE ROUTINE CALLED IN LINE 1300:
EQUIVALENT TO 'B=PEEK(A):A=A+1'


 100 CALL &ABC0,R,@B,@A
 105 ********************
 110 ABC0 DD6E00 START: LD  L,(IX+0)
 120 ABC3 DD6601        LD  H,(IX+1)
 130 ABC6 4E            LD  C,(HL)
 140 ABC7 23            INC HL          ;BC<-"A"
 150 ABC8 46            LD  B,(HL)
```


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PROGRAM FILE

```
 160 ABC9 DD7E04        LD  A,(IX+4)     ;ACC←"R"
 170 ABCC B7            OR  A
 180 ABCD 2819          JR  Z,GETRAM
 190 ABCF 78            LD  A,B
 200 ABD0 2F            CPL             ;IF "A">=&C000, THEN ACC←&00
 210 ABD1 E6C0          AND &C0         ;IF "A"<=&3FFF, THEN ACC←&C0
 220 ABD3 E2E8AB        JP  PO,GETRAM   ;ELSE PO, SO GETRAM
 230 ABD6 07            RLCA
 240 ABD7 07            RLCA
 250 ABD8 07            RLCA            ;ACC←&00 OR &06
 260 ABD9 32DDAB        LD  (ENABLE+1),A;&B900 FOR UPPER ROM
 270 ABDC CD**B9 ENABLE:CALL &B9**      ;&B906 FOR LOWER ROM
 280 ABDF F5            PUSH AF
 290 ABE0 0A     ROMGET:LD  A,(BC)
 300 ABE1 5F            LD  E,A
 310 ABE2 F1            POP AF
 320 ABE3 CD0CB9        CALL &B90C      ;RESTORE PRIOR ROM STATE
 330 ABE6 1802          JR  POKRAM
 340 ABE8 0A     GETRAM:LD  A,(BC)
 350 ABE9 5F            LD  E,A
 360 ABEA 03     POKRAM:INC BC           ;("A=A+1")
 370 ABEB 70            LD  (HL),B
 380 ABEC 2B            DEC HL          ;"A"←BC
 390 ABED 71            LD  (HL),C
 400 ABEE 1600          LD  D,&00
 410 ABF0 DD6E02        LD  L,(IX+2)
 420 ABF3 DD6603        LD  H,(IX+3)
 430 ABF6 73            LD  (HL),E
 440 ABF7 23            INC HL          ;"B"←DE
 450 ABF8 72            LD  (HL),D
 460 ABF9 C9            RET
READY.
```

Commodore 64 Word Search

by D Talbot

Word Search for the Commodore 64 presents a fun way to create the word search-type puzzles commonly found in puzzle magazines. These are grids of miscellaneous letters which contain hidden words either horizontally, vertically or diagonally. Additionally, the words may be written forwards or backwards. At the end of the listing is an example puzzle printed by the program, with the names of 50 computer companies hidden in it.

Upon running, the program prompts you to insert words into a puzzle to be created. If the puzzle is to be displayed onscreen it's maximum size is 20 words; if it's to be printed, it's 50. The puzzles look more professional if the words entered all adhere to a theme, such as makes of motor cars or types of vegetable. Having entered the words, the computer will then generate a puzzle to be solved and an average time for solution. If the puzzle is on the screen, a joystick is needed to mark the ends of the words.

As it stands at the moment, the program generates very good puzzles. However, the words are not completely interlocking—there are no letters in the puzzle that are used by more than one word. Those printed in magazines have two, three and even four words that use common letters.

If any reader can improve the program to incorporate this, I would be very interested in seeing the improvements.

```
  1 REM ********************************
  2 REM ****       WORDSEARCH 64       ****
  3 REM ****     (C) D.TALBOT 1984     ****
  4 REM ********************************
  5 N=1:Z=0:I=Z:W=Z:D1=Z:D2=Z:P1=Z:P2=Z:P3=Z:P4=Z:K=256
  6 DIMW$(51),R(15),D(51,N),T$(2),C$(N)
  9 JY=56320:SID=54272
 10 FORI=ZTO24:POKESID+I,Z:NEXT
 11 POKESID+24,15:POKESID+5,9
 12 POKESID+18,128:POKESID+15,255:R=SID+27:REM SET RANDOM NUMBER GENERATOR
 15 FORI=ZTO15:READU:R(I)=U:NEXT:I=N
 16 DATA-1,-1,-1,0,-1,1,0,-1,0,1,1,-1,1,0,1,1
 20 E1$="[YELLOW][DOWN]WORD TOO LONG[DOWN][PURPLE]":E2$="[YELLOW][DOWN]WORD TOO S
HORT[DOWN][PURPLE]"
 25 T$(Z)="┌──────────────┐"
 30 T$(N)="│WORD SEARCH 64│"
 35 T$(2)="└──────────────┘"
 40 C$(Z)=CHR$(129)+"[RVS] ┬┌╱│ _▲│ ∧L▲│↘┌╱● ":REM CONGRATULATIONS
 45 C$(N)="[PURPLE][RVS] ┬┌╲↘●┬_▲│↘┌╱● ":REM COMMISERATIONS
 50 PRINTCHR$(14):REM SWITCH TO LOWER CASE
 55 GOSUB13000:REM TITLE
 56 PRINTCHR$(129):REM ORANGE
 57 :
 58 REM **** INSTRUCTIONS ****
 59 :
 60 PRINT"[DOWN][DOWN]THE PUZZLE CAN EITHER BE PLAYED ON THE  SCREEN OR PRINTED O
UT FOR";
 65 PRINT" LATER USE.":PRINT"OITH THE SCREEN VERSION YOU ARE LIMITED"
 70 PRINT"TO A MAXIMUM OF TWENTY WORDS PER PUZZLE.";
 75 PRINT"TN THE PRINTER YOU ARE ALLOWED UP TO    FIFTY WORDS."
 80 INPUT"[DOWN][DOWN]TUTPUT TO (●)CREEN OR (┐)RINTER ";DEV$:DEV$=LEFT$(DEV$,1)
 85 IF DEV$<>"P" AND DEV$<>"S" THEN RUN
 90 IF DEV$<>"P" THEN 105
100 INPUT"[DOWN]┐O YOU WANT AN ANSWER SHEET (Y/┘) ";ANS$:ANS$=LEFT$(ANS$,1)
105 GOSUB13000:PRINT"[CYAN]":IFDEV$<>"P"THEN115
```


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PROGRAM FILE

```
110 PRINT"[DOWN][DOWN][DOWN][DOWN] IOU MAY ENTER BETWEEN 1 AND 50 WORDS.":GOTO 12
0
115 PRINT"[DOWN][DOWN][DOWN][DOWN] IOU MAY ENTER BETWEEN 1 AND 20 WORDS."
120 PRINT"[DOWN] ACH WORD MAY BE BETWEEN 2 AND 10       LETTERS IN LENGTH."
130 PRINT"[DOWN]I YPE '←' TO DELETE THE LAST WORD       ENTERED."
140 PRINT"[DOWN]I YPE '●' TO FINISH."
150 PRINT TAB(9)"[DOWN][DOWN][DOWN][DOWN][DOWN][RVS][YELLOW] RESS ● -  TO STAR
T "
160 K$=" ":GOSUB16000:REM GET KEY
169 :
170 REM **** ENTER WORDS ****
171 :
180 PRINTCHR$(142):REM SWITCH TO UPPER CASE
190 PRINT"[CLR][DOWN][GREEN][RVS]         PLEASE ENTER WORDS NOW.         [DOWN][
DOWN][PURPLE]"
195 W=N
200 PRINT"ENTER WORD NO."W;:INPUTU$
210 IFU$="Q"THEN300
220 IFU$="←"THENW=W-N:GOTO200
230 IFLEN(U$)<2THENPRINTE2$:GOTO200
240 IFLEN(U$)>10THENPRINTE1$:GOTO200
243 FORI=ZTOW-N:IFU$=W$(I)THENGOSUB12000:I=98
250 NEXT:IFI=99THEN210
255 D1=D1+LEN(U$)
256 FORI=NTOW-N:IFLEN(U$)=>LEN(W$(I))THEND2=I:I=99
257 NEXT
258 FORU=WTOD2STEP-N:W$(U+N)=W$(U):NEXT
259 W$(D2)=U$
260 W=W+N:IFW>20ANDDEV$="S"THEN300
270 IFW<=50THEN200
300 GOSUB14000:REM WAIT
310 NO=W-N
399 :
400 REM **** FILL GRID ****
401 :
410 F=FRE(0):REM FORCE GARBAGE COLLECT
420 DIM ANS(NO,N,N),FO(NO)
440 X=INT(SQR(D1*2)):Y=INT((D1*2)/X)
450 IFLEN(W$(N))>XORLEN(W$(N))>YTHEND1=D1+N:GOTO440
470 IFDEV$="S"ANDY>17THENY=17:X=20
480 DIMG$(X,Y)
490 FORW=NTONO:POKESID+N,W*5:GOSUB18000:U$=W$(W):LN=LEN(U$)-N
500 PRINTTAB(24)"[RVS][UP]   [LEFT][LEFT][LEFT]"STR$(NO-W+1)
510 P3=INT(PEEK(R)/K*Y)+N:P4=INT(PEEK(R)/K*X)+N
520 D=INT(PEEK(R)/32)*2:D1=R(D):D2=R(D+1):A=Z:U=Z:P1=P4+D1*LN:P2=P3+D2*LN
540 IFP2<NORP1<NORP1>XORP2>YTHEN510
550 B$=G$(P4+D1*U,P3+D2*U):IFB$=MID$(U$,U+N,N)THENA=A+U:GOTO570
560 IFB$<>""THEN510
570 U=U+N:IFU<=LNTHEN550
580 IFA=LN+NTHEN510
590 ANS(W,Z,Z)=P4:ANS(W,N,Z)=P3:ANS(W,Z,N)=P1:ANS(W,N,N)=P2:D(W,Z)=D1:D(W,N)=D2
620 FORI=ZTOLN:G$(P4+D1*I,P3+D2*I)=MID$(U$,I+N,N):NEXT:NEXT
690 GOSUB17000:REM TARGET TIME
700 GOSUB10000:REM ALPHBETICAL SORT
710 POKESID+N,90:GOSUB18000:REM SOUND
720 IFDEV$="S"THEN5000
797 :
798 REM **** PRINTER ****
799 :
800 PRINT"[HOME][DOWN][DOWN][RVS][PURPLE]"TAB(10)" PRESS 'P' TO PRINT "
810 K$="P":GOSUB16000
820 PRINT"[CLR][DOWN][DOWN][RVS][YELLOW]"TAB(13)" PRINTING "
830 SO$=CHR$(14):BS$=CHR$(8):TS=12:SP=(80-(X*2+4))/4:ANS=Z
870 OPEN1,4:GOSUB11000:PRINT#1
910 FORI=NTONO:W$(I)=LEFT$(W$(I)+"                ",10):NEXT:I=Z
920 FORW=NTO7
930 I=I+N:IFI>NO THENU$="":GOTO960
940 U$=W$(I)
960 PRINT#1,U$;:IFI<NOANDW<7THENPRINT#1," ";
970 NEXT:PRINT#1:IFI<NO THEN920
980 PRINT#1,CHR$(13)SPC(27);:FORI=NTO28:PRINT#1,"-";:NEXT:PRINT#1
1060 PRINT#1,SPC(27)" CAN YOU FIND"STR$(NO)" WORDS"
1160 PRINT#1,SPC(27)" TARGET TIME=";TT$
1170 PRINT#1,SPC(27):FORI=NTO28:PRINT#1,"-";:NEXT
1175 IF ANS$="Y"THENANS=N:PRINT#1,CHR$(10):GOSUB 11030
1180 PRINT#1:CLOSE1:PRINT"[CLR]"CHR$(14):GOTO5430
4997 :
4998 REM **** SCREEN ****
4999 :
5000 PRINTCHR$(14):GOSUB 13000
5002 PRINT"[DOWN][GREEN] SE THE CURSOR KEYS OR A JOYSTICK IN    PORT 2 TO MOVE T
HE ";
5010 PRINT"CURSOR ABOUT THE":PRINT"GRID. [_1],[_3],[_5] AND THE HOME KEY"
5011 PRINT"WILL POSITION THE CURSOR IN THE CORNERS OF THE GRID." PRINT"  OHEN";
5013 PRINT" YOU FIND A WORD, POSITION THE":PRINT"CURSOR ON THE FIRST LETTER ";
5015 PRINT"OF THE WORD  AND PRESS EITHER [_7] OR FIRE." PRINT"  THEN ";
5016 PRINT"REPOSITION THE CURSOR ON THE LASTLETTER OF THE WORD AND AGAIN PRESS"
5019 PRINT"EITHER [_7] OR FIRE. IF YOU HAVE"
5020 PRINT"IDENTIFIED THE WORD CORRECTLY, THE WORD"
5022 PRINT"WILL BE HIGHLIGHTED IN YELLOW ON THE"
5023 PRINT"GRID AND DELETED FROM THE WORD LIST."
5025 PRINT"   RESS '●' TO GIVE IN AND SEE THE      ANSWERS."
5028 PRINTTAB(9)"[DOWN][DOWN][RVS][PURPLE] RESS ● -  TO START "
5029 K$=" ":GOSUB16000:REM GET KEY
5035 SO$=CHR$(0):B$=CHR$(0):TS=4:SP=INT((24-(X+2))/2):ANS=Z:A=Z:SC=Z
5040 GOSUB15000:REM PRINT SCREEN
5045 TI$="000000"
5050 PRINT"[HOME][DOWN][DOWN][DOWN][DOWN][DOWN][DOWN]"SPC(SP+N);
5090 DEL=Z:RV=128
5100 U=PEEK(211)+PEEK(209)+PEEK(210)*256
5110 POKEU,PEEK(U)+RV
5120 J=PEEK(JY):GETK$:IFK$<>""ORJ-127THEN5200
5130 DEL=DEL+N:IFDEL=10THENRV=-RV:DEL=Z:GOTO5110
5140 GOTO5120
5200 POKEU,PEEK(U)AND127:YP=INT((U-1024)/40):XP=U-(1024+40*YP)
5202 P1=N-(JANDN):P2=2-(JAND2):P3=4-(JAND4):P4=8-(JAND8)
5205 IF(K$="[LEFT]"ORP3)ANDXP>SP+NTHENPRINT"[LEFT]";
5210 IF(K$="[RIGHT]"ORP4)ANDXP<SP+XTHENPRINT"[RIGHT]";
5220 IF(K$="[DOWN]"ORP2)ANDYP<5+YTHENPRINT"[DOWN]";
5230 IF(K$="[UP]"ORP1)ANDYP>6THENPRINT"[UP]";
5231 IFK$=CHR$(133)THENPRINT"[HOME][DOWN][DOWN][DOWN][DOWN][DOWN][DOWN]"SPC(SP+X
);
5232 IFK$=CHR$(134)THENPRINT"[HOME][DOWN][DOWN][DOWN][DOWN][DOWN]";:FORI=NTOY:PR
INT"[DOWN]";:NEXT:PRINTSPC(SP+N);
5233 IFK$=CHR$(135)THENPRINT"[HOME][DOWN][DOWN][DOWN][DOWN][DOWN]";:FORI=NTOY:PR
INT"[DOWN]";:NEXT:PRINTSPC(SP+X);
5240 IFK$="[HOME]"THEN5050
5250 IFK$="A"THENANS=N:GOSUB15000:PRINT"[BLACK][UP]":END
5255 IFK$<>CHR$(136)ANDJ<>111THEN5090
5260 IFA=NTHEN5290
5270 D1=U+54272:POKED1,7:D2=XP-SP:SY=YP-5:A=N:GOTO5090
5290 FORI=NTONO
5300 IFANS(I,Z,Z)<>D2THEN5320
5310 IFANS(I,N,Z)=SYANDANS(I,Z,N)=XP-SPANDANS(I,N,N)=YP-5THENANS=I
5320 NEXT
5330 A=Z:IFANS=ZORFO(ANS)THENPOKED1,2:GOTO5050
```


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PROGRAM FILE

```
5340 FORI=NTOLEN(W$(ANS))-N:D1=D1+(40*D(ANS,1)):D1=D1+D(ANS,0)
5345 POKE SID+1,I*10:GOSUB 18000:POKE D1,7:NEXT I
5350 PRINT"[HOME][WHITE]";:FORI=NTOANS+N:PRINT"[DOWN]";:NEXT
5355 PRINTSPC(25);:FORI=NTOLEN(W$(ANS)):PRINT"*";:NEXT
5360 FO(ANS)=N:SC=SC+N:IFSC<>NO THEN5050
5362 T$=TI$:IFVAL(T$)>(VAL(S$)+100*VAL(M$))THEN5364
5363 C=Z:FORI=ZTO255STEP4:POKESID+N,I:GOSUB18000:NEXT:GOTO5365
5364 C=N:FORI=64TOZSTEP-N:POKESID+N,I:GOSUB18000:NEXT
5365 M$=MID$(T$,3,2)+"M ":S$=RIGHT$(T$,2)+" SECONDS":SP$=""
5366 IFVAL(M$)<NTHENM$="":SP$="     "
5370 PRINTCHR$(14):GOSUB13000
5380 PRINT"[GREEN][DOWN][DOWN]♠ GOOD TIME WOULD HAVE BEEN":PRINT "[LEFT]"TT$
5390 PRINT"[DOWN] YOU TOOK "M$S$" TO COMPLETE THE "SP$"PUZZLE.[DOWN][DOWN][DOWN][DOWN]"
5400 IFC=ZTHEN5415
5415 PRINTTAB(11)LEFT$(C$(C),2);:FOR I=NTOLEN(C$(C))-2:PRINT" ";:NEXT
5420 PRINT:PRINTTAB(11)C$(C)
5425 PRINTTAB(11)LEFT$(C$(C),2);:FORI=NTOLEN(C$(C))-2:PRINT" ";:NEXT
5430 PRINT:PRINTTAB(8)"[DOWN][DOWN][DOWN][YELLOW][RVS] ♠♙♖ ♗♘ ♖♙♦♦♞ ♔♕♙ ?[RVSOFF]";:REM ANOTHER PUZZLE?
5435 POKE19,N:INPUTK$:POKE19,Z
5440 IFK$<>"N"THENRUN
5450 PRINT"[CLR]"CHR$(142):END
9997 :
9998 REM **** SHELL METZNER SORT ****
9999 :
10000 IFNO=NTHENRETURN
10010 D1=2↑(INT(LOG(NO-N)/LOG(2))+N)
10020 D1=D1/2
10030 P3=NO-D1:P2=Z:IFD1<NTHENRETURN
10040 P1=P2
10050 P4=P1+D1
10055 IFW$(P1)>W$(P4)THEN10080
10060 P2=P2+N:IFP2>P3THEN10020
10070 GOTO10040
10080 U$=W$(P1):W$(P1)=W$(P4):W$(P4)=U$
10090 FORI=ZTO N:FORW=ZTON
10100 U=ANS(P1,I,W):ANS(P1,I,W)=ANS(P4,I,W):ANS(P4,I,W)=U:NEXT
10110 U=D(P1,I):D(P1,I)=D(P4,I):D(P4,I)=U:NEXT
10120 P1=P1-D1:IFP1<ZTHEN10060
10130 GOTO10050
10997 :
10998 REM **** PRINT SQUARE ****
10999 :
11000 PRINT#1,SO$SPC(TS)T$(0)BS$
11010 PRINT#1,SO$SPC(TS)T$(1)BS$
11020 PRINT#1,SO$SPC(TS)T$(2)
11030 PRINT#1,CHR$(13)SO$SPC(SP):FORI=NTOX+2:PRINT#1,"♦";:NEXT:PRINT#1
11040 FORI=NTOY:PRINT#1,SPC(SP)"♦";
11050 FORW=NTOX:PRINT#1,"[RED]";
11060 IFG$(W,I)=""ANDANS=ZTHENPRINT#1,CHR$(64+INT(PEEK(R)/K*26+1)):GOTO11090
11070 IFG$(W,I)=""ANDANS=NTHENPRINT#1," ";:GOTO11090
11080 PRINT#1,G$(W,I);
11090 NEXT:PRINT#1,"[YELLOW]♦":NEXT
11100 PRINT#1,SPC(SP):FORI=NTOX+2:PRINT#1,"♦";
11110 NEXT:PRINT#1,CHR$(15):I=Z
11120 RETURN
11989 :
11990 REM **** SAME WORD ****
11991 :
12000 PRINT"[DOWN][YELLOW]YOU HAVE ENTERED THE WORD "U$" PRINT MORE THAN ONCE.
12010 INPUT"[DOWN][GREEN]PLEASE ENTER A DIFFERENT WORD ";U$
12020 PRINT"[PURPLE]":RETURN
12997 :
12998 REM **** TITLE ****
12999 :
13000 PRINT"[CLR]":POKE 53281,Z:POKE 53280,11
13010 PRINTTAB(11)"[YELLOW][RVS]                "
13020 PRINTTAB(11)"[RVS] ♂♙♖ ♦♞♗♙♖ 64 ":REM WORD SEARCH 64
13030 PRINTTAB(11)"[RVS]                "
13040 RETURN
14000 PRINT"[CLR][DOWN][DOWN][RVS]";CHR$(154);TAB(11)" PLEASE WAIT ":RETURN
14097 :
14098 REM **** PRINT SCREEN ****
14099 :
15000 PRINT"[CLR][DOWN][YELLOW]"CHR$(142);:POKE53280,2:POKE53281,10
15010 FORI=ZTO2:PRINTSPC(TS)"[RVS]"T$(I)"[RVSOFF]":NEXT
15020 OPEN1,3:GOSUB11030:CLOSE1
```

WORD SEARCH 64

```
♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦
♦XGLOYNASWPFGHIHHCETOMEMV♦
♦BEYQETOCIRPAPUAISHKMUJRN♦
♦MFNJANVISYRUBLBDIDDLBEQBW♦
♦HOXFLPRAKJDKCXORDECUSEYC♦
♦KHHIAAMUBTSAGEABMKUFIYGR♦
♦ALSSSBUOOXMXRGHMGCEERLEO♦
♦YAOJHUTLCBWOOTYRYHIPPKEM♦
♦PFMWAKDFYSSNCZSGONEERHDE♦
♦RVTGRDUKHEDOQSLMSCAYEWLH♦
♦ORAJPOBEZFSLVEATAPAATMTC♦
♦YNIARBREPUSRULENFPSBNEAO♦
♦DIILEAEVXPWLJIHSQSNZEUNO♦
♦IYYDXCTNRQAANYOLIVETTIDX♦
♦NNGWLQOAUFRDTXYFIRHJIXYW♦
♦AHERRKBJRTNEVOPSAAOPSOSQ♦
♦USNZCETGDIRIXAMOIIWRUNUM♦
♦JOIGIBNLWJHOAQNBANJRIURB♦
♦DTEJVIQUSWGRFRGCUBVHRCUM♦
♦BNDQBERODOMMOCBKEODEIRHS♦
♦ZIJMPERQPVWWVPLWXWTJSCAT♦
♦FCZLTHIJZZBULLETEUGPRXOA♦
♦HAVOZSZRETIPUJBBCNKOEDTZ♦
♦MMSPECTRUMNORTCELETTWTLV♦
♦GRIALCNISNVJOTVIYHELPPAS♦
♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦
```

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CAN YOU FIND 50 WORDS
TARGET TIME= 25M 48 SECONDS.

```
15030 PRINT"[HOME]"SPC(24)"[RVS][RED]     WORDS       ";
15040 PRINTSPC(24)"[RVS][RED]                         ";
15050 FORI=NTONO:PRINTSPC(24)"[RVS] [RVSOFF]"LEFT$(STR$(I)+". ",4)W$(I):NEXT
15060 PRINTSPC(24)"[RVS][RED]                         "
15070 RETURN
15097 :
15098 REM **** GET KEY ****
15099 :
16000 POKE198,Z
16010 GETKEY$:IFKEY$<>K$THEN16010
16020 POKE198,Z:RETURN
16997 :
16998 REM **** TARGET TIME ****
16999 :
17000 TT=(NO+3)*1.85
17010 M=INT(TT/60):S=INT(TT-(M*60))
17020 M$=STR$(M)+"M":S$=STR$(S)+" SECONDS.":IFVAL(M$)<1THENM$=""
17030 TT$=M$+S$
17040 RETURN
17997 :
17998 REM **** SOUND ****
17999 :
18000 POKESID+4,16:POKESID+4,17:RETURN
```

Vic-20 Programmable Keys

by Robert Grieder

This program for the Vic-20 with 16k RAM expansion gives the user single-key entry of Basic keywords or other commonly-used text. Single-key entry is obtained by using the control (CTRL) key in conjunction with an alpha-numeric or function key. Up to 16 words can be defined to the function keys when combined with the Commodore and SHIFT keys, making a total of up to 56 words.

First, type POKE 644,88:SYS 64824 to lower the RAMTOP pointers; this protects the machine code from being overwritten by Basic variables. Then type in program one; this loads the key definitions into the correct area of RAM for use by the machine code routine. The key definitions are held in data statements at the end of the listing and are best illustrated by an example:

To define CTRL P as PRINT, the data statement would be

2010 DATA K,P,PRINT,]

The first data statement K indicates a key is being defined (for a function it would be F). The next character P indicates that the P key is being defined; this is followed by the word to be defined, PRINT, and finally a] indicates that more data follows ([indicates the last key definition). An asterisk on the word to be defined indicates a carriage return, which is useful for automatic RUN and LIST functions.

After typing listing one and adding the data statements of your choice, run the program. Errors in the data statements will generate one of three error statements:

?BAD LENGTH: the message was zero or greater than 20 characters long

?NO K/F: the first character in the data statement is not a K or an F

?BAD KEY CODE: no key exists for this character

When you are satisfied that the program is working correctly, save it and then run it. Now type NEW and enter program two, but as this contains machine code check it very thoroughly. Save before running. When everything is correct, run the Basic loader and type SYS 22689. When pressing the CTRL key in conjunction with another, you should get the messages defined in program one.

A convention similar to the Commodore 64 Brackets program has been used for control characters within print statements, [CLS] meaning clear screen (CLS key) and [DWN] meaning down cursor key.

```
100 PRINT "[CLS]DEFINING KEYS"
110 FOR C=22794 TO 22794+(16*20)+(10*65)
120 POKE C,0
130 NEXT
140 READ M$
150 IF M$="K" THEN 500
160 IF M$="F" THEN 600
170 GOTO 1000
180 READ ME$
190 L=LEN(ME$)
200 IF L=0 OR L>MX THEN 1010
210 FOR S=1 TO L
220 N=ASC(MID$(ME$,S,1))
230 IF MID$(ME$,S,1)="*" THEN N=13
240 POKE AD+S-1,N
250 NEXT
260 POKE S,0
270 READ A$
280 IF A$="[" THEN PRINT "[DWN]OK":END
290 GOTO 140
500 READ A$
510 A=ASC(A$)
```

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PROGRAM FILE

```
520 FOR C=0 TO 65
530 IF A=PEEK(C+60510) THEN 560
540 NEXT
550 GOTO 1020
560 MX=10
570 AD=C*MX+22794
580 GOTO 180
600 READ C
610 IF C<0 OR C>15 THEN 1020
620 MX=20
630 AD=C*MX+22794
640 GOTO 180
1000 PRINT "[DWN]?NO K/F":GOTO 1030
1010 PRINT "[DWN]?BAD LENGTH":GOTO 1030
1020 PRINT "[DWN]?BAD KEY-CODE"
1030 PRINT " ERROR IN";PEEK(63)+256*PEEK(64);
1040 END
2000 REM EXAMPLE DATA FOR KEYS
2010 DATA K,E,END,]
2020 DATA K,T,THEN,]
2030 DATA K,I,INPUT,]
2040 DATA K,P,PRINT,]
2050 DATA K,D,DATA,]
2060 DATA K,N,NEXT,]
2070 DATA K,F,FOR,]
2080 DATA F,0,RUN*,]
2090 DATA F,4,LIST*,[
```

Listing 1. Define keys.

```
100 L=22528
110 READ A$
120 C=LEN(A$)
130 IF A$="*" THEN 230
140 IF C<>2 THEN 220
150 A=ASC(A$)-48
160 B=ASC(RIGHT$(A$,1))-48
170 N=B+7*(B>9)-(C=2)*(16*(A+7*(A>9)))
180 IF N<0 OR N>255 THEN 220
190 POKE L,N
200 L=L+1
210 GOTO 110
220 PRINT"[";A$;"] IN ";PEEK(63)+256*PEEK(64);"????"
230 END
1000 DATA AD,A2,02,D0,6D,A5,C5,A2,00,C9,27,D0,02,A2,01
,C9,2F,D0,02,A2,05
1010 DATA C9,37,D0,02,A2,09,C9,3F,D0,02,A2,0D,E0,00,F0
,4A,8E,A1,02,AD,8D
1020 DATA 02,8D,A3,02,AD,A3,02,C9,04,D0,03,CE,A3,02,AD
,A1,02,18,6D,A3,02
1030 DATA 8D,A1,02,A9,01,8D,A2,02,A9,00,8D,A4,02,CE,A1
,02,A9,0A,85,57,A9
1040 DATA 59,85,58,A0,00,C0,14,F0,12,A5,57,18,6D,A1,02
,85,57,A5,58,69,00
1050 DATA 85,58,C8,4C,59,58,4C,C1,58,AC,A4,02,B1,57,F0
,1B,A6,C6,E0,0A,B0
1060 DATA 0B,EA,9D,77,02,8E,89,02,E8,86,C6,C8,C0,14,F0
,06,8C,A4,02,4C,BF
1070 DATA EA,A9,00,8D,A2,02,A9,0A,8D,89,02,4C,BF,EA,78
,A9,00,8D,A2,02,8D
1080 DATA A4,02,8D,14,03,A9,58,8D,15,03,58,60,78,A9,BF
,8D,14,03,A9,EA,8D
1090 DATA 15,03,58,60,AD,8D,02,C9,04,F0,03,4C,BF,EA,A5
,C5,CD,AA,02,F0,F6
1100 DATA 8D,AA,02,A9,4A,85,57,A9,5A,85,58,A2,00,E0,0A
,F0,11,A5,57,18,65
1110 DATA C5,85,57,A5,58,69,00,85,58,E8,4C,DF,58,A0,00
,C0,0A,F0,0B,B1,57
1120 DATA F0,07,99,77,02,C8,4C,F6,58,84,C6,4C,BF,EA,*
```

Listing 2. Machine code handler.

BBC Errutil

by M Elliot

This BBC Model B program provides an improvement on the current error reporting facilities. Normally when an error occurs in Basic the line at which the error occurred is stated; with this program, the exact point within the line

where the error occurred is highlighted. This is a real boon when designing compact multi-statement Basic program lines.

To use the program, incorporate lines 1 and 2 and line 1000 into your program and use it as normal. It may be useful to SPOOL these lines and to EXEC them when they are needed.

```
    1 PROCASSEMBLE
     :ON ERROR GOTO 10000
    2 ?oldv=?&202
     :?(oldv+1)=?&203
     :?&203=0
     :?&202=&75
    3 A=1
     :LET B=2
     :C=""
     :LET D$="G"
     :FOR I%=1 TO 12
     :NEXT
     :D$=2
     :FOR M=1 TO 2
     :NEXT
     :PRINT"THIS IS A TEST"
    4 END
10000 ON ERROR OFF
     :MODE7
     :REPORT
     :PRINT" IN LINE ";ERL
10010 E$="L."+STR$(ERL)+CHR$&0D
10020 FOR I%=1 TO LEN(E$)
10030 A%=8A
     :Y%=ASC(MID$(E$,I%,1))
     :X%=0
10040 CALL &FFF4
10050 NEXT
10060 P%=?&71*&100+?&70-2+?&2
10070 FOR I%=P% TO 0 STEP -1
     :IF ?(I%)=&0D THEN J%=I%
     :I%=-2
10080 NEXT
10090 P%=P%-J%-3
     :C%=0
10100 L%=?(J%+1)*&100+?(J%+2)
     :PRINT;L%;
10110 J%=J%+4
     :REPEAT
     :A%=?(J%+C%)
     :CALL&B53A
     :IF P%=C% THEN PRINTCHR$129;
10120 C%=C%+1
     :UNTIL A%=&0D
     :PRINT''
10125 ?&202=?oldv
     :?&203=?(oldv+1)
10130 END
10140 DEF PROCASSEMBLE
10150 P%=&73
10160 [OPT 2
10165.oldv BRK
     :BRK
10170 TYA
     : STA &72
10180 LDA &38
     : STA &71
10190 LDA &37
     : STA &70
10200 JMP (oldv)
10210 RTS
10220 ]
10230 ENDPROC
```

dBasell Preprocessor

by David Hart

Although dBasell was not intended to be used as a programming language, it is frequently utilised in this way by writing and running files containing dBase commands. These commands are then carried out by the dBase command interpreter.

One problem with this is that as commands are executed interpretively, syntax checking is carried out at a run time. Errors in the command file can therefore only be detected by running applications.

The program listed here carries out a partial syntax analysis of dBasell command files without running an application. The program was written in Pascal and has been compiled by several CP/M and MS-DOS compilers without fault. It requires a version of Pascal which supports string handling.

The following commands are checked:
IF/ELSE/ENDIF
DO WHILE/ENDDO
DO CASE/CASE/OTHERWISE/

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PROGRAM FILE

ENDCASE
DO command-file

These commands control the structure of a dBase application and are the most difficult errors to find. In fact, dBase will often completely fail to detect missing or extra occurrences of them.

The program displays the commands onscreen, with their line numbers. The commands are indented to reflect the structure of the command file, and extra or missing commands are displayed at the appropriate points. In this way the overall structure of the command file can be seen, and any errors in the structure can be precisely located.

When the program is run it requests the name of the command file to be checked; the name must be given in full, complete with any extensions. The command file is then checked and the structure, and any errors, are displayed onscreen.

The program repeats until a null filename is entered; this enables several command files to be checked in one run.

```
program dSTRUCT;

(* dBASEII Command File Structure Checker *)

const
  contchar = ';';
  tabval   = 9;

  ifsym          = 'IF';
  elsesym        = 'ELSE';
  endifsym       = 'ENDIF';
  dowhilesym     = 'DO WHILE';
  enddosym       = 'ENDDO';
  docasesym      = 'DO CASE';
  casesym        = 'CASE';
  othercasesym   = 'OTHERWISE';
  endcasesym     = 'ENDCASE';
  dosym          = 'DO';
  eofsym         = '*EOF*';

type
  longline = string[255];
  wordtype = string[10];

var
  dfile     : text;
  dfilename : string[80];
  dline     : longline;
  word,
  symbol    : wordtype;
  linecount : integer;

function terminator : boolean;

(* returns true if symbol is a valid terminator *)

  begin
  terminator:=(symbol=elsesym)      or (symbol=endifsym)   or
              (symbol=enddosym)     or (symbol=casesym)    or
              (symbol=othercasesym) or (symbol=endcasesym) or
              (symbol=eofsym)

  end; (* terminator *)

procedure indent(depth:integer;word:wordtype);

(* print line number and command word correctly indented *)

  var
    count : integer;

  begin
  writeln(linecount:5,' ':depth*3,word)

  end; (* indent *)

procedure ucase(var word:wordtype);

(* convert word to uppercase *)

  var
    count : integer;

  begin
  for count:=1 to length(word) do
    if word[count] in ['a'..'z'] then
      word[count]:=chr(ord(word[count])-32)

  end; (* ucase *)

procedure readline(var line:longline);

(* read next input line *)

  begin
  linecount:=linecount+1;
  if not eof(dfile) then
    readln(dfile,line)
  else
    line:=eofsym

  end; (* readline *)

procedure getline;

(* get next input line handling possible continuation *)

  var
    line : longline;

  begin
  repeat
    readline(dline)
  until dline<>'';

  while dline[length(dline)]=contchar do
```

```
      begin
      delete(dline,length(dline),1);
      readline(line);
      dline:=concat(dline,line)
      end;

    dline:=concat(dline,' *EOL*')

    end; (* getline *)

  procedure getword;

  (* get next word from current line *)

    begin
    while (dline[1]=' ') or (dline[1]=chr(tabval)) do
      delete(dline,1,1);

    word:=copy(dline,1,pos(' ',dline)-1);
    delete(dline,1,length(word));
    ucase(word)

    end; (* getword *)

  procedure getcommand;

  (* get command from current line *)

    begin
    getline;
    getword;
    symbol:=word;

    if symbol=dosym then
      begin
      getword;
      if word='WHILE' then
        symbol:=dowhilesym
      else
      if word='CASE' then
        symbol:=docasesym
      else
        begin
        symbol:=dosym;
        word:=concat(dosym,' ',word)
        end
      end

    end; (* getcommand *)

  procedure analysecommand(depth:integer); forward;

  procedure ifcommand(depth:integer);

  (* analyse IF/ELSE/ENDIF command *)

    begin
    indent(depth,symbol);
    getcommand;
    repeat
      analysecommand(depth)
    until terminator;

    if symbol = elsesym then
      begin
      indent(depth,symbol);
      getcommand;
      repeat
        analysecommand(depth)
      until terminator
      end;

    if symbol = endifsym then
      begin
      indent(depth,symbol);
      getcommand
      end
    else
      writeln('      Missing ',endifsym)

    end; (* ifcommand *)

  procedure dowhilecommand(depth:integer);

  (* analyse DO WHILE/ENDDO command *)

    begin
    indent(depth,symbol);
    getcommand;
    repeat
      analysecommand(depth)
    until terminator;

    if symbol = enddosym then
      begin
      indent(depth,symbol);
      getcommand
      end
    else
      writeln('      Missing ',enddosym)

    end; (* dowhilecommand *)

  procedure docasecommand(depth:integer);

  (* analyse DO CASE/CASE/OTHERWISE/ENDCASE command *)

    begin
    indent(depth,symbol);
    getcommand;
    repeat
      analysecommand(depth)
    until terminator;

    repeat
      if symbol = casesym then
        begin
        indent(depth,symbol);
        getcommand;
        repeat
```

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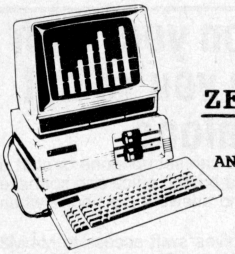

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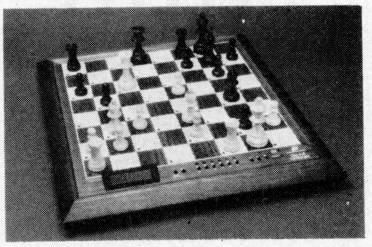

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PROGRAM FILE

```
          analysecommand(depth)
        until terminator
        end

  until (symbol=elsesym)      or (symbol=endifsym)   or (symbol=enddosym) or
        (symbol=othercasesym) or (symbol=endcasesym) or (symbol=eofsym);

  if symbol = othercasesym then
    begin
    indent(depth,symbol);
    getcommand;
    repeat
      analysecommand(depth)
    until terminator
    end;

  if symbol = endcasesym then
    begin
    indent(depth,symbol);
    getcommand
    end
  else
    writeln('      Missing ',endcasesym)

  end; (* docasecommand *)

procedure docommand(depth:integer);

(* analyse DO command *)

  begin
  indent(depth,word);
  getcommand

  end; (* docommand *)

procedure analysecommand(*depth:integer*);

(* analyse current command *)

  begin
  if symbol=ifsym then
    ifcommand(depth+1)
  else
  if symbol=dowhilesym then
    dowhilecommand(depth+1)
  else
  if symbol=docasesym then
    docasecommand(depth+1)
  else
  if symbol=dosym then
    docommand(depth+1)
  else
  if not terminator then
    getcommand

  end; (* analysecommand *)

procedure checkfile;

(* check the structure of the file *)

  begin
  assign(dfile,dfilename);
  reset(dfile);
  linecount:=0;
  writeln(' Line   Command');
  writeln;
  getcommand;
  while not eof(dfile) do
    begin
    analysecommand(0);

    if (symbol=elsesym) or (symbol=endifsym)     or (symbol=enddosym) or
       (symbol=casesym) or (symbol=othercasesym) or (symbol=endcasesym) then
      writeln(linecount:5,' Extra ',symbol);

    if (symbol<>ifsym) and (symbol<>dowhilesym) and (symbol<>docasesym) and
       (symbol<>dosym) and (symbol<>eofsym) then
      getcommand

    end;

  writeln('End of File');
  writeln;
  close(dfile)

  end; (* checkfile *)

begin (* main program *)
writeln('dBASEII Command File Structure Checker');
writeln;

repeat
  write('Name of Command File to Check or RETURN to Finish ');
  readln(dfilename);
  if dfilename<>'' then
    checkfile
until dfilename = ''
end.

A>
```



Dragon Darts
by Keith Theobald

Darts is not a game I'd immediately think of simulating on a computer, but this program for the Dragon 32 works rather well. The game is for two players who, upon running the program, are prompted to enter their initials. After this you can then select whether you want a double start, a double finish, computer scoring, the initial starting score, and skill level (1 = hard, 20 = easy).

When you have configured your game you can start it by pressing S; the display will change to a dartboard.

PROGRAM FILE

```
0 CLS0:PRINT@75,"K.THEOBALD";:PRINT@175,"IS";:PRINT@268,"PROUD"CHR$(128)"TO";
1 PRINT@364,"PRESENT";
9 PCLEAR6:PMODE1,5:PCLS:GOSUB400:GOSUB11000
10 PMODE4,1:PCLS:POKE65495,0:CLS
11 PSET(1,0):PSET(2,0)
12 PSET(2,1):PSET(3,1)
13 FORX=1TO9:PSET(X,2):NEXT
14 PSET(2,3):PSET(3,3):FORX=6TO8:PSET(X,3):PSET(X,1):NEXT
15 PSET(1,4):PSET(2,4)
20 DIM S(20),B0(916),SX(20,3),DX(20,3),TX(20,3),B(10),TY(20,3),DY(20,3),SY(20,3)
,DA(10)
21 GET(1,0)-(9,5),DA,G:PCLS
30 CIRCLE(96,96),78:CIRCLE(96,96),86:CIRCLE(96,96),55:CIRCLE(96,96),47
40 PAINT(96,2),3,4
50 SI=1.5:PI=3.141592654:C=PI/30:FR=50
60 A=SI*C
70 SX=96+85*SIN(A):SY=96-85*COS(A)
80 LINE(96,96)-(SX,SY),PSET
90 SI=SI+3:IF SI<=58.5 THEN 60
100 COLORO:FORD=0TO15:CIRCLE(96,96),D:NEXT:COLOR5:CIRCLE(96,96),15:COLOR5:CIRCLE
(96,96),7:CIRCLE(96,96),15:PAINT(96,96),5,5:PSET(87,100,0):PSET(100,87,0)
110 DATA 96,23,111,26,133,34,150,50,160,67,167,87,166,109,157,133,143,150,123,16
2,103,166,80,167,59,155,41,138,31,124,27,103,27,81,37,60,52,40,69,30
120 C=0:FORI=1TO20:READ X,Y:PAINT(X,Y),C,5
130 IF C=5 THENC=0:GOTO150
140 IF C=0 THENC=5
150 NEXT
170 DATA 96,14,117,18,141,29,159,44,170,63,177,86,175,116,161,144,147,159,118,17
6,97,176,78,176,48,161,33,146,21,124,16,100,16,78,35,42,53,27,67,21
180 C=5:FORI=1TO20:READ X,Y:PAINT(X,Y),C,5
190 IFC=5 THENC=0:GOTO210
200 IFC=0 THENC=5
210 NEXT
220 DATA 96,48,81,50,65,58,54,70,48,85,48,92,50,110,57,123,67,134,80,141,95,144,
110,143,123,136,136,124,141,114,145,92,141,76,134,64,123,55,110,50
230 C=5:FORI=1TO20:READX,Y:PAINT(X,Y),C,5
240 IFC=5THENC=0:GOTO260
250 IFC=0THENC=5
260 NEXT
270 DATA 96,55,108,58,116,67,116,81,116,90,116,96,116,103,116,111,109,111,103,11
5,95,115,91,115,81,115,81,108,78,101,78,96,78,90,78,83,78,73,88,73
280 C=0:FORI=1TO20:READX,Y:PAINT(X,Y),C,5
290 IFC=5 THENC=0:GOTO310
300 IFC=0 THENC=5
310 NEXT
320 COLOR5:LINE(194,0)-(255,180),PSEI,B
330 LINE(194,8)-(255,8),PSET
340 LINE(225,8)-(225,180),PSET
350 GOTO830
400 DIMA$(90)
410 DRAW"BM0,0"
420 A$(65)="U4E1R2F1D1NL4D3"
430 A$(45)="BM+0,-3;R3"
440 A$(66)="U5R3F1G1NL3F1D1G1L3"
450 A$(43)="BM+2,-3NU2ND2NR2NL2"
460 A$(67)="BM+3,+0NE1L2H1U3E1R2F1"
470 A$(44)="BM+3,-1;DG"
480 A$(68)="U5R3F1D3G1L3"
490 A$(69)="NR4U3NR3U2R4"
500 A$(70)="U3NR3U2R4"
510 A$(71)="BM+3,+0E1U1L2R2D1G1L2H1U3E1R2F1"
520 A$(72)="U5D2R4U2D5"
530 A$(73)="R4L2U5L2R4"
540 A$(74)="BM+0,-1F1R1E1U4L2R4"
550 A$(75)="U5D3R1NE3U1F3"
560 A$(76)="NR4U5"
570 A$(77)="U5F2E2D5"
580 A$(78)="U5F4D1U5"
590 A$(79)="BM+0,-1U3E1R2F1D3G1L2H1"
600 A$(80)="U5R3F1D1G1L3"
610 A$(81)="BM+0,-1U3E1R2F1D3NF1NH1G1L2H1"
620 A$(82)="U5R3FDGNL3FD"
630 A$(83)="BM+0,-1;F1R2E1U1H1L2H1U0E1R2F1"
640 A$(84)="BM+2,+0;U5L2R4"
650 A$(85)="BM+0,-1NU4F1R2E1U4"
660 A$(86)="BM+0,-5;D3F2E2U3"
670 A$(87)="BM+0,-5D4F1E1U1D1F1E1U4"
680 A$(88)="U1E4BM-4,-0F4D1"
690 A$(89)="BM+2,+0U3NE2H2"
700 A$(90)="R4L4U1E4L4"
710 A$(49)="R4L2U5L1G1"
720 A$(50)="NR4U1E1R2E1U1H1L2G1"
730 A$(51)="BM+0,-1;F1R2E1U1H1L1R1E1H1L2G1"
740 A$(52)="BM+3,+0U5BL3D3R4"
750 A$(53)="BM+0,-1;F1R2E1U1H1L3U2R4"
760 A$(54)="BM+0,-1F1R2E1H1L2G1U3E1R2F1"
770 A$(55)="U1E4L4"
780 A$(56)="BM+0,-1FR2E1U1H1L2G1D1U1EH1E1R2F1G1"
790 A$(57)="BM+0,-1F1R2E1U3H1L2G1F1R2E1"
800 A$(46)="BM+3,+0U1"
810 A$(48)="BM+0,-1F1R2E1U3H1L2G1D3"
820 A$(32)="BR6"
821 RETURN
830 K$="BSDSTSOS":X=200:Y=190:GOSUB840:GOTO860GOTO860
840 FORU=1TOLEN(K$):A=ASC(MID$(K$,U,1)):DRAW"BM"+STR$(X)+","+STR$(Y)+A$(A):X=X+7
841 IF X>255 THEN X=0:Y=Y+7
850 NEXTU:RETURN
860 K$="20":X=90:Y=8:GOSUB840
870 K$="1":X=120:Y=13:GOSUB840
880 K$="18":X=142:Y=23:GOSUB840
890 K$="SCORE":X=200:Y=7:GOSUB840
900 K$="4":X=167:Y=46:GOSUB840
910 K$="13":X=178:Y=64:GOSUB840
920 K$="6":X=185:Y=99:GOSUB840:K$="10":X=179:Y=134:GOSUB840
930 K$="15":X=166:Y=156:GOSUB840:K$="2":X=144:Y=172:GOSUB840
940 K$="17":X=117:Y=186:GOSUB840:X=92:Y=189:K$="3":GOSUB840
950 K$="19":X=63:Y=186:GOSUB840:K$="7":X=41:Y=171:GOSUB840
960 K$="16":X=11:Y=148:GOSUB840:K$="8":X=9:Y=128:GOSUB840
970 K$="1":X=0:Y=100:GOSUB840:X=5:GOSUB840
980 K$="14":X=1:Y=74:GOSUB840:K$="9":X=16:Y=52:GOSUB840:K$="12":X=28:Y=30:GOSUB8
40
990 K$="5":X=60:Y=16:GOSUB840
1000 CLS:FORY=172 TO 184STEP 6:PUT(162,Y)-(170,Y+5),DA,PSET:NEXT
1001 GET(0,0)-(190,192),B0,G
1010 PRINT@11,"d a r t s":PRINT@64,"ENTER INITIALS.(NO MORE THEN 3)":PRINT:INPUT
```


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PROGRAM FILE

```
"PLAYER1";P$(1):PRINT:IF LEN(P$(1))>3 OR P$(1)="" THEN1010
1020 INPUT"PLAYER2";P$(2):IF LEN(P$(2))>3 OR P$(2)="" THEN1020
1030 K$=P$(1):X=200:Y=16:GOSUB840:K$=P$(2):X=228:Y=16:GOSUB840
1040 LL=15:SC(1)=501:CLS:GOSUB1500:SC(2)=SC(1):K$=RIGHT$(STR$(SC(1)),LEN(STR$(SC
(1)))-1):X=200:Y=24:GOSUB840:X=228:Y=24:GOSUB840:SP(1)=31:SP(2)=31:SC=0
1050 SCREEN1,1:PL=2:DD=1
1060 DATA 25,20,1,18,4,13,6,10,15,2,17,3,19,7,16,8,11,14,9,12,5
1070 IF S(0)>0 THEN1300 ELSEFORI=0TO20:READ S(I):NEXT:GOSUB10070:GOTO1300
1075 GOSUB10000:LINE(0,0)-(40,14),PRESET,BF:IF I$="@" THENRUN ELSEIF I$="D" THEN
1295
1080 SI=SI/3
1090 X=200:Y=190
1100 GET(X,Y)-(X+6,Y-6),B,G
1105 PUT(X,Y)-(X+6,Y-6),B,PRESET
1106 FORD=1TO LL*5:NEXT
1120 PUT(X,Y)-(X+6,Y-6),B,PSET
1125 IF INKEY$>""THEN1150
1130 X=X+7:IF X>255 THENX=200
1140 GOTO1100
1150 V=1:IF X=200 THENSI=0:V=2
1160 IF X=214 THEN V=2
1170 IF X=228 THEN V=3
1180 IF X=242 THENSI=0
1181 IF CG(3)=1 THEN1220ELSEIF DO(PL)=0 THEN 1182 ELSEIF V=1 OR V=3 THENV=0:SC=0
 ELSE DO(PL)=0
1182 SC=SC+(S(SI)*V):IF CG(2)=0THENIF SC(PL)-SC=0 AND V<>2 THENSC=SC-(S(SI)*V):G
OTO1260
1190 K$=STR$(SC):X=0:Y=14:GOSUB840
1200 K$=STR$(SC(PL)-SC)
1210 X=0:Y=7:GOSUB840
1220 IF V=1THEN X=SX(SI,DD):Y=SY(SI,DD)ELSEIFV=2 THENX=DX(SI,DD):Y=DY(SI,DD)ELSE
X=TX(SI,DD):Y=TY(SI,DD)
1230 P=PPOINT(X,Y):IFP=5 THENDRAW"CO"ELSEDRAW"C5"
1235 DRAW"BM"+STR$(X)+","+STR$(Y)+"NU4ND4NR4NL4"
1236 IF PPOINT(SX,SY)=5 THEN P=0 ELSE P=5
1237 IF CG(3)=0 THENIF SC(PL)-SC=0 THEN1260
1238 IF CG(3)=0 THENIF SC(PL)-SC<2-CG(2)  THEN SC=SC-(S(SI)*V):GOTO1260
1239 LINE(162,(166+(6*DD)))-(170,(165+(6*(DD+1)))),PRESET,BF
1240 IF TT=1 THEN RETURNELSEPSET(SX,SY,P):DD=DD+1:IF DD<=3 THEN1075
1260 IF CG(3)=1 THEN1290 ELSESC(PL)=SC(PL)-SC:IF PL=1 THENX=200 ELSEX=228
1270 DRAW"BM"+STR$(X)+","+STR$(SP(PL)-7)+"C5M+17,-5"
1280 Y=SP(PL):SP(PL)=SP(PL)+7:K$=RIGHT$(STR$(SC(PL)),LEN(STR$(SC(PL)))-1):GOSUB8
40:IF SP(PL)>179 THENSP(PL)=24:IF PL=1 THEN LINE(200,17)-(220,179),PRESET,BF:X=X
-21:GOTO 1280 ELSESP(PL)=24:LINE(228,17)-(250,179),PRESET,BF:X=X-21:GOTO1280
1290 FORD=1TO2000:NEXT
1295 PUT(0,0)-(190,192),BO,PSET
1300 IF SC(PL)=0 THEN 1340 ELSEIF PL=1 THENPL=2:GOTO1320
1310 IFPL=2 THENPL=1
1320 K$=P$(PL)+" TURN":X=130:Y=10:GOSUB840
1330 SC=0:DD=1:GOTO1075
1339 ' PLAYER PL HAS WON
1340 CLS:PRINTP$(PL)" HAS WON"
1345 LINE(200,9)-(253,179),PRESET,BF:LINE(225,8)-(225,180),PSET
1350 A$="DO YOU WANT ANOTHER GAME (Y/N)?"
1360 PRINT@64,A$:B$="do you want another game (y/n)?"
1370 FOR I=1TO LEN(B$)
1380 PRINT@63+I,MID$(B$,I,1);
1390 I$=INKEY$:IFI$>"" THEN1440 ELSE NEXT
1400 FORI=1TOLEN(B$)
1410 PRINT@63+I,MID$(A$,I,1);
1420 I$=INKEY$:IFI$>"" THEN1440 ELSENEXT
1430 GOTO1370
1440 IF I$="Y" THENCLS:GOTO 1010
1450 IF I$="N" THENPOKE65494,0:END
1460 GOTO1370
1469 ' CHOOSE GAME
1500 CLS:N$(0)="off":N$(1)="on":PRINT@11,"d a r t s":PRINT@67,"WRITTEN BY KEITH
THEOBALD":PRINT@110,"(C) COPYRIGHT 1985":PRINT@160,"1-DOUBLE START "N$(CG(1))
1510 PRINT"2-STRAIGHT OFF "N$(CG(2))
1520 PRINT"3-YOU SCORE(THIS IS GOOD IF YOU WISH TO PLAY ANOTHER GAME E.G. AROUND
 THE CLOCK) "N$(CG(3))
1530 PRINT"4-WHERE YOU WISH TO START. E.G. 501. THIS IS ON"SC(1)
1535 PRINT"L-CHANGE LEVEL. THIS IS @N"LL
1540 PRINT"S-START GAME"
1550 K$=INKEY$
1560 IF K$="1" AND CG(1)=0 THEN CG(1)=1:DO(1)=1:DO(2)=1:GOTO1500 ELSE IFK$="1" T
HENCG(1)=0:DO(1)=0:DO(2)=0:GOTO1500
1570 IF K$="2" AND CG(2)=0 THEN CG(2)=1:GOTO1500 ELSEIFK$="2"THENCG(2)=0:GOTO150
0
1580 IF K$="3" AND CG(3)=0 THEN CG(3)=1:GOTO1500 ELSE IFK$="3"THEN CG(3)=0:GOTO1
500
1590 IF K$="4" THEN PRINT@448,"HOW MANY";:INPUTSC(1):IFSC(1)>999 OR SC(1)<1 THEN
1590 ELSE1500
1595 IF K$="L" THENPRINT@448,"CHANGE LEVEL ENTER 1-20";:INPUTLL:IF LL<1 OR LL>20
 THEN1595 ELSE1500
1600 IF K$="S" AND SC(1)>1 THENRETURN
1610 GOTO1550
9999 SCREEN1,1:GOTO9999
10000 C=PI/30:SI=RND(19)*3:A=SI*C:GOTO10020
10010 A=SI*C
10015 LINE(X2,Y2)-(SX,SY),PRESET
10020 SX=96+43*SIN(A):SY=96-43*COS(A)
10030 X2=96+17*SIN(A):Y2=96-17*COS(A)
10040 SI=SI+3
10044 P=PPOINT(SX,SY):IF P=5 THEN COLOR0,5 ELSE COLOR5,0
10045 I$=INKEY$:IF I$>"" THENPSET(SX,SY):COLOR5,0:RETURN
10046 LINE(X2,Y2)-(SX,SY),PSET
10050 IFSI=60 THENSI=0
10060 GOTO10010
10070 DATA 94,85,84,93,90,104,90,24,97,34,102,24,112,26,113,37,121,31,132,35,128
,44,139,42,142,56,150,51,150,62,161,69,152,73,160,79,155,91,166,90,161,99,155,11
1,163,114,157,121,157,131,146,129,150,140,134,144,131,152,141,150,118,154,111,15
9,121,163,90
10080 DATA 165,100,165,96,157,77,152,78,163,69,159,61,144,57,154,52,148,49,131,4
2,140,38,131,28,113,30,122,39,115,37,93,28,100,24,90,26,78,30,69,36,76,35,59,41,
51,47,60,49,41,58,36,58,48,66,29,77,28,74,38
10100 DATA93,93,99,95,94,100,88,15,98,15,105,15,113,17,119,19,126,21,135,25,141,
28,147,33,156,41,161,47,165,54,170,62,172,69,175,77,176,87,177,96,176,103,174,11
2,172,120,169,128,166,138,162,143,158,149,151,157,147,161,140,165,128,171,122,17
4,113
10110 DATA177,97,177,104,176,88,176,78,176,69,174,62,171,54,166,48,161,41,157,34
,149,30,145,27,139,21,128,18,121,15,113,15,103,14,96,15,88,15,79,18,72,21,64,27,
55,31,49,35,42,42,35,46,31,53,26,63,21,70,19,76,17
10130 DATA91,45,97,43,100,46,106,49,112,48,115,50,121,52,125,55,128,58,133,62,13
6,65,139,69,142,76,145,79,143,84,146,91,145,95,147,101,143,107,145,112,141,115,1
39,122,136,125,133,129,129,135,125,138,121,140,116,141,113,144,107,144,100,144,9
6,148,91
```

PROGRAM FILE

```
10140 DATA146,85,146,81,144,76,142,70,139,66,135,62,133,58,128,54,124,51,121,49,
116,46,110,49,107,45,100,43,95,47,91,45,85,48,81,51,77,53,70,56,67,59,64,61,58,6
5,56,70,53,76,50,80,49,84,47
10150 DATA94,85,84,93,90,104,93,93,99,95,94,100
10160 FORI=0TO20:FORJ=1TO3:READ X,Y
10170 SX(I,J)=X:SY(I,J)=Y
10180 NEXTJ,I
10190 FORI=0TO20:FORJ=1TO3:READX,Y
10200 DX(I,J)=X:DY(I,J)=Y
10210 NEXTJ,I
10220 FORI=1TO20:FORJ=1TO3:READX,Y
10230 TX(I,J)=X:TY(I,J)=Y
10240 NEXTJ,I:RETURN
11000 K$="D":X=13:Y=56:DRAW"S40":GOSUB840
11010 K$="A":X=X+40:Y=56:GOSUB840
11020 K$="R":X=X+40:Y=56:GOSUB840
11030 K$="T":X=X+40:Y=56:GOSUB840
11040 K$="S":X=X+40:Y=56:GOSUB840
11050 CIRCLE(128,192),130,,1,.5,0
11060 CIRCLE(128,192),110,,1,.5,0
11070 CIRCLE(128,192),100,,1,.5,0
11080 CIRCLE(128,192),60,,.9,.5,0
11090 CIRCLE(128,192),50,,.9,.5,0
11100 SI=2.8:PI=3.141592654:C=PI/30
11110 A=SI*C
11120 SX=128+110*SIN(A):SY=192-110*COS(A)
11121 SI=128+40*SIN(A)
11125 IF SX>255 OR SX<0 OR SY>192 OR SY<0 THEN11140
11130 LINE(SI,192)-(SX,SY),PSET
11140 SI=SI+4.2:IF SI<=58.5 THEN11110
11150 PAINT(45,192),4,4:PAINT(128,192),2,4:PAINT(84,190),4,4:PAINT(125,108),2,4:
PAINT(63,140),2,4:PAINT(88,125),4,4:PAINT(102,178),4,4:PAINT(148,178),4,4:PAINT(
167,137),4,4:PAINT(196,180),4,4:PAINT(172,189),4,4:PAINT(88,178),2,4:PAINT(167,1
78),2,4
11155 PAINT(196,137),2,4
11156 GOTO11250
11250 PAINT(199,92),3,4:PAINT(220,140),4,4:PAINT(127,87),4,4:PAINT(54,118),4,4:P
AINT(230,169),2,4:PAINT(176,99),2,4:PAINT(91,93),2,4:PAINT(28,162),2,4:PAINT(178
,174),4,4:PAINT(128,143),4,4:PAINT(82,167),4,4:PAINT(183,185),2,4:PAINT(165,157)
,2,4
11260 PAINT(103,149),2,4:PAINT(77,186),2,4
11270 K$="2":X=113:Y=76:DRAW"C2S10":GOSUB840:K$="0":X=130:Y=76:GOSUB840
11280 K$="1":X=181:Y=93:GOSUB840
11290 K$="1":X=213:Y=116:GOSUB840:K$="8":X=228:Y=135:GOSUB840
11300 K$="4":X=240:Y=183:GOSUB840
11310 K$="5":X=60:Y=95:GOSUB840
11320 K$="1":X=16:Y=141:GOSUB840:K$="2":X=31:Y=121:GOSUB840
11330 K$="9":X=6:Y=186:GOSUB840
11340 COLOR1:LINE(116,145)-(81,175),PSET:LINE(128,145)-(128,175),PSET:LINE(142,1
45)-(180,175),PSET
11350 LINE(124,150)-(132,150),PSET:LINE(124,150)-(128,175),PSET:LINE(132,150)-(1
28,175),PSET:PSET(126,153):PSET(130,153):PSET(126,155):PSET(130,155)
11360 COLOR3:LINE(128,169)-(123,172),PSET:LINE(128,169)-(134,172),PSET:LINE(123,
172)-(123,186),PSET:LINE(134,172)-(134,186),PSET:LINE-(129,182),PSET:LINE-(123,1
86),PSET:PAINT(129,178),3,3:COLOR1:LINE(128,169)-(128,182),PSET
11370 LINE(105,146)-(113,154),PSET
11380 LINE(105,146)-(81,174),PSET:LINE-(113,154),PSET:COLOR3:LINE(93,164)-(107,1
52),PSET:COLOR1:PAINT(103,154),1,1:PSET(89,166,1)
11390 LINE(87,168)-(67,178),PSET:LINE-(71,184),PSET:LINE-(75,190),PSET:LINE-(87,
168),PSET:PAINT(75,180),3,1:LINE(87,168)-(71,184),PSET
11400 LINE(147,154)-(155,146),PSET:LINE-(180,175),PSET:LINE-(147,154),PSET
11410 COLOR3:LINE(153,152)-(165,162),PSET:PAINT(163,160),1,1:PSET(167,164,1):COL
OR1
11420 LINE(175,170)-(183,190),PSET:LINE-(197,178),PSET:LINE-(175,170),PSET:PAINT
(185,180),3,1:LINE(175,170)-(189,184),PSET
11430 DRAW"S4C4":SCREEN1,0:RETURN
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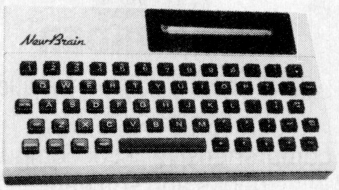

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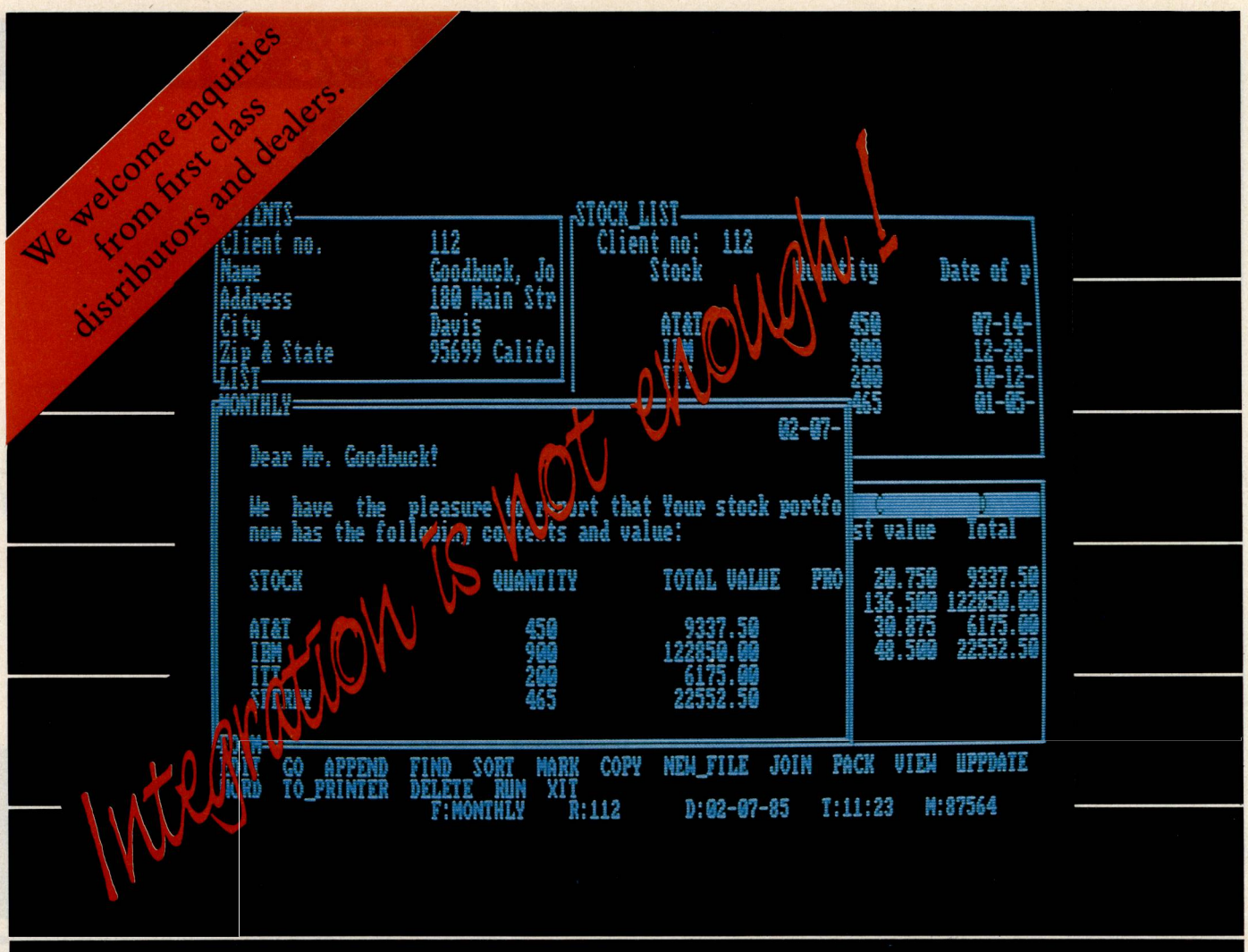

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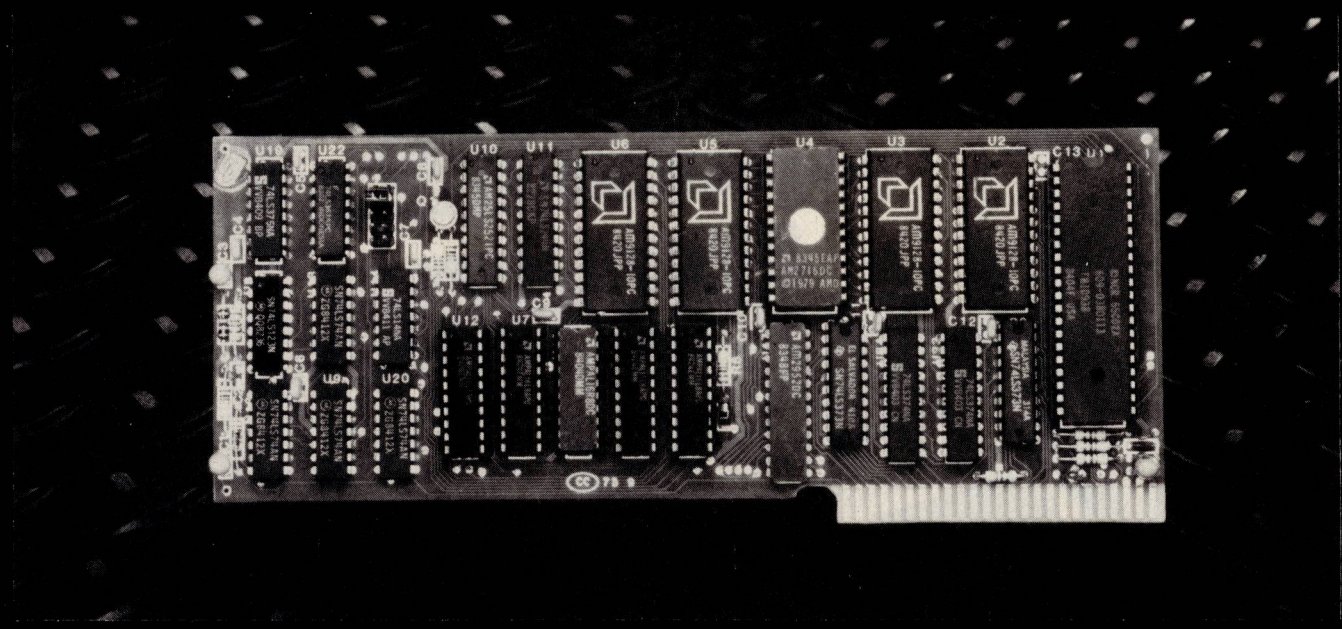

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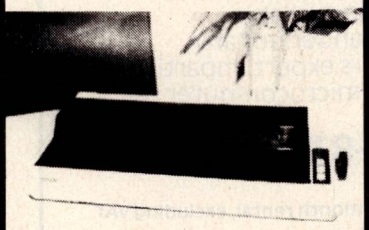

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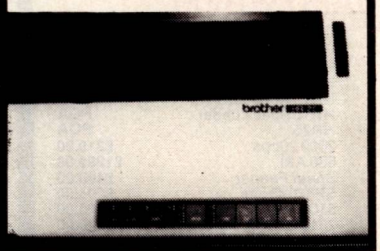

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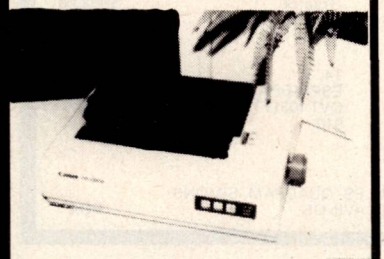

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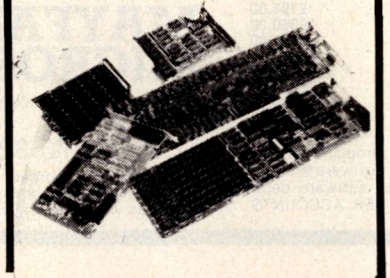

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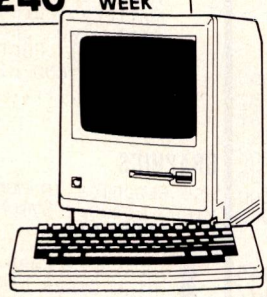

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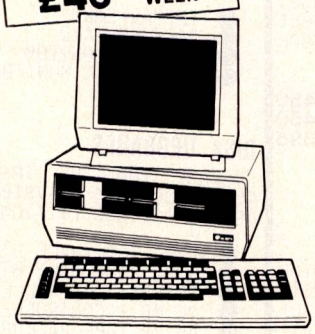

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BROTHER	M1009 50cps	£159.00
CANON	PW1080A 160cps (NLQ)	£299.00
CANON	PW1156A 160cps (NLQ)	£379.00
EPSON	RX 80T 100cps	POA
EPSON	RX 80F/T 100cps	POA
EPSON	FX 80 160cps	POA
EPSON	FX 100F/T 160cps	POA
EPSON	LQ 1500 200cps (NLQ)	POA
HONEYWELL	From	£375.00
MANNESMANN	MT80 80cps	£177.00
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BROTHER	HR15	POA
BROTHER	HR15 Keyboard	POA
BROTHER	HR15 Sheetfeeder	POA
BROTHER	HR25	POA
DAISYSTEP	2000 20cps	£219.00
DIABLO	630 API	£1295.00
DIABLO	Sheet Feeder	£490.00
FUJITSU	SP320 48cps	£795.00
JUKI	6100 18cps	£325.00
NEC	2010 Serial 20cps	£545.00
NEC	2030 Parallel 20cps	£545.00
NEC	3510 Serial 35cps	£1049.00
NEC	3530 Parallel 35cps	£1049.00
NEC	7710 Serial 55cps	£1440.00
NEC	7730 Parallel 55cps	£1440.00
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QUME	LETTERPRO 12/20	£475.00
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RICOH	RP1600S FLOWRITER 8k	£1249.00
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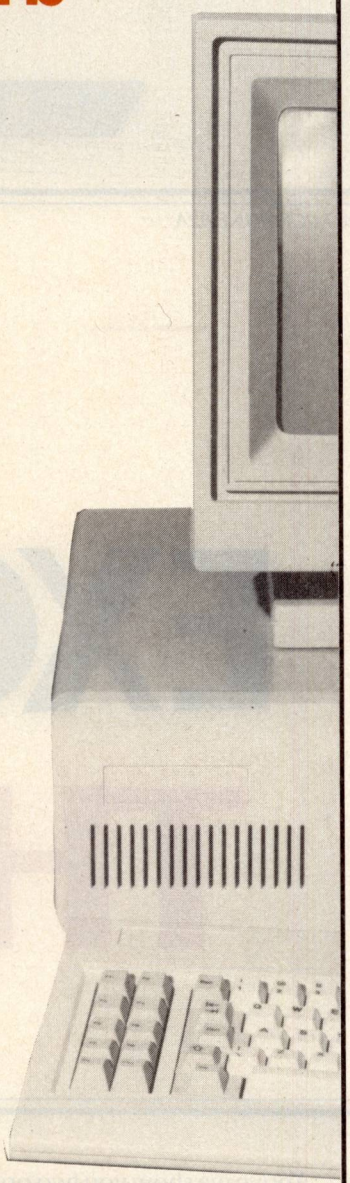

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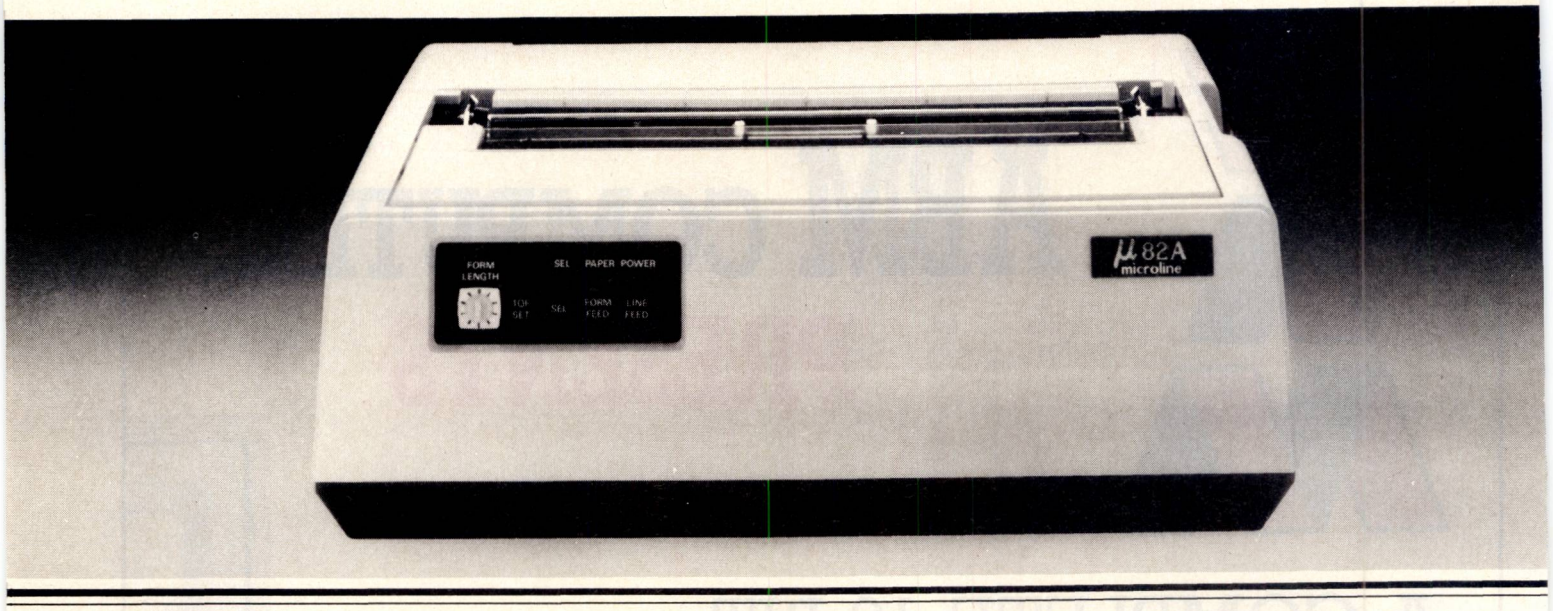


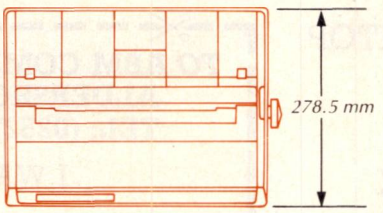
The MICROLINE 82A

FROM EXCELLENCE

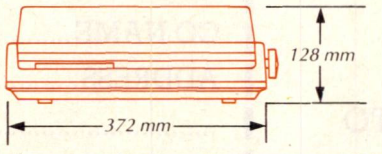
THE NEW OKI

Above we show you two printers (to the same scale). On the left is the OKI MICROLINE 82A - one of the most successful standard dot matrix printers ever manufactured. On the right is the printer that will become the NEW standard for dot matrix printers - the new MICROLINE 182 - from OKI.

In the past OKI have always achieved excellence in their printer products - now we believe they've reached perfection! OKI's revolutionary design concept for the new Microlines sets hitherto unparalled standards of performance, styling - and price.

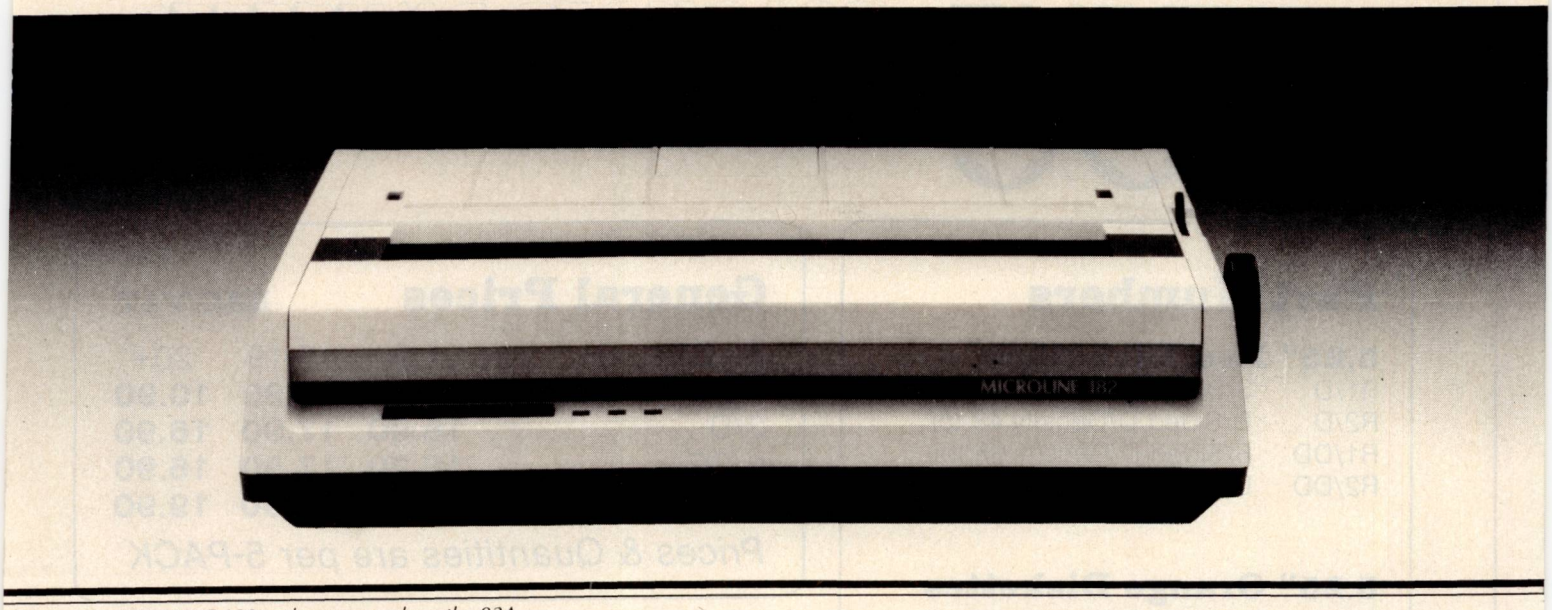


182 and 192



The dimensions of the larger Microline 193 are, length 524 mm, width 278.5 mm and height 128 mm. These dimensions do not include the platen and tractor unit.

The new MICROLINE 182 is the first of a whole new range of printers from OKI which fulfil all the requirements of today's printing needs. With operating noise level reduced to an almost unbelievable 58dB. and a print speed of 120 characters/second, listings, invoices and many other applications are all handled quietly, with upmost speed and efficiency. If your requirement is for high resolution computer graphics, the MICROLINE 182 will reproduce your screen images with a degree of accuracy never before seen from a matrix printer. True underlining, superscript and subscript are



The new MICROLINE 182 to the same scale as the 82A

TO PERFECTION MICROLINES

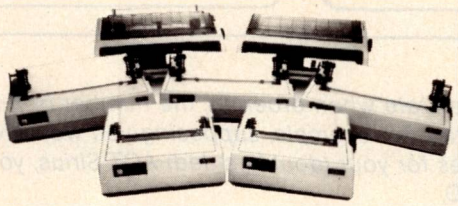
OKI IS O.K.

also incorporated as standard. In addition a new concept in ribbon design, allows a single action 'clean hands' operation.

But that's not all - complementing the new styling and incorporating even more features are the MICROLINE 192 and 193. Both have the same incredibly high specification as the 182 - PLUS

- Even faster throughput (160 cps)
- Correspondence quality printing
- Down line loadable character font memory - with battery back-up
- Operator selectable default settings.

OKI



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The reputation of OKI MICROLINE printers was built on excellence of quality and reliability. The new Microlines are no exception - even higher quality, greater reliability and performance bring the new generation of OKI MICROLINE printers - to near perfection.

Contact your local dealer for more details of the new generation from OKI or contact us directly at the address below. Insist on perfection.... insist on OKI.

PCW249

DISKING COLOURED DISKETTES

Part Numbers

5.25" Red Diskettes

R1/D	S/Sided D/Density 48 tpi
R2/D	D/Sided D/Density 48 tpi
R1/DD	S/Sided D/Density 96 tpi
R2/DD	D/Sided D/Density 96 tpi

5.25" Orange Diskettes

O1/D	S/Sided D/Density 48 tpi
O2/D	D/Sided D/Density 48 tpi
O1/DD	S/Sided D/Density 96 tpi
O2/DD	D/Sided D/Density 96 tpi

5.25" Yellow Diskettes

Y1/D	S/Sided D/Density 48 tpi
Y2/D	D/Sided D/Density 48 tpi
Y1/DD	S/Sided D/Density 96 tpi
Y2/DD	D/Sided D/Density 96 tpi

5.25" Green Diskettes

G1/D	S/Sided D/Density 48 tpi
G2/D	D/Sided D/Density 48 tpi
G1/DD	S/Sided D/Density 96 tpi
G2/DD	D/Sided D/Density 96 tpi

5.25" Pale Blue Diskettes

P1/D	S/Sided D/Density 48 tpi
P2/D	D/Sided D/Density 48 tpi
P1/DD	S/Sided D/Density 96 tpi
P2/DD	D/Sided D/Density 96 tpi

5.25" Blue Diskettes

B1/D	S/Sided D/Density 48 tpi
B2/D	D/Sided D/Density 48 tpi
B1/DD	S/Sided D/Density 96 tpi
B2/DD	D/Sided D/Density 96 tpi

General Prices EXC VAT

All Colours	1-9	10-19	20+
1/D	**12-90**	**11.90**	**10.90**
2/D	**18.90**	**17.90**	**16.90**
1/DD	**18.90**	**17.90**	**16.90**
2/DD	**21.90**	**20.90**	**19.90**

Prices & Quantities are per 5-PACK

Post Packing & Ins.

All Colours		EXC VAT
1-3	5-PACKS	**50p per pack**
4-9	5-PACKS	**30p per pack**
10+	5-PACKS	POST FREE

Quality Promise

Like All diskettes from DISKING, these Coloured Diskettes are individually certified, and are from a leading world manufacturer. We offer our usual no-quibble money-back warranty.

What you get

All Coloured diskettes are supplied in packs of five (5) of ONE colour. They come in a FREE plastic library box, and with colour coder pens. You will also be entitled to any other applicable promotions at the time of ordering.

Please state when ordering, the number of 5-PACKS you require, and the type number of the diskettes. For example, supposing you want five red diskettes for your IBM PC, and five green diskettes for your (double sided) ACT Sirius, you would order One pack of R2/D & one pack of G2/DD.

DISKING International, Liphook, Hampshire, GU30 7EJ. Telephone (0428) 722563

VISA Welcome

DISKING COLOURED DISKETTES

FOR PRICES SEE OPPOSITE

"I'll use the orange ones for my IBM, the blue ones for my Sirius, and the green ones for my Apple"



"No! We'll use the red ones for Masters, the pale blue for bought ledger and the yellow for word processing"



FREE Plastic Library Box with every 'One-Colour' 5-Pack.
Choose from six RED, ORANGE, YELLOW, GREEN, PALE BLUE or BLUE.
Or Treat yourself to six 5-Packs, one of each colour!

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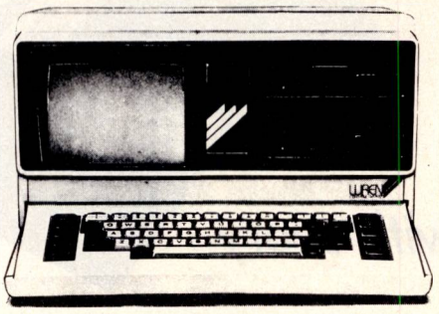

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DISKING NEWS

THE DISKING PROMISE. If you don't find us the slickest diskette supplier in the world, or if you have ANY reason to be unhappy with our products OR services in ANY way — we want to know. After all we are here to serve you, and if you're not happy — we're not happy. We continuously strive for perfection, and everything you see here is IN STOCK and ready to be shipped within four hours (YES, HOURS!). A full refund if dissatisfied goes without saying.

NEW FROM DISKING. To brighten up your office desk, just pick up the 'phone and order your very own SUPERB Colour Coded diskettes. We have *RED, ORANGE, YELLOW, GREEN, PALE BLUE* and BLUE. They are packed in fives of one colour, and come with a *FREE* SEE 10 Library Box, and pack of Colour Coders. So before you erase the wrong disk or accidentally leave the master disk out in the dusty environment — *COLOUR CODE THEM!.*

THE DISKING BD (British Disease) AWARD. *Our BD award this week for another useless company, goes to Corralls (Powell Duffryn Fuels Ltd), who, when asked for an urgent delivery of heating oil that we required, answered "We cannot give you a delivery time, and we cannot give you a price, I'm only here to take orders". If any of you out there understand that, we'd love to hear from you?*

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Prices and quantities relate to ***Ten-Packs***

Prices exc VAT	1-4	5-9	10+
MD1-D S/S 48 tpi	23.90	22.90	21.90
MD2-D D/S 48 tpi	34.90	33.90	32.90
MD1-DD S/S 96 tpi	34.90	33.90	32.90
MD2-DD D/S 96 tpi	42.90	41.90	40.90

Certified for single OR double density. 48 tpi suitable for 35 or 40 track operation. 96 tpi suitable for 77 or 80 track operation.

8" Diskettes

Prices and quantities relate to ***Ten-Packs***

Prices exc VAT	1-4	5-9	10+
FD1-XD S/S D/Dens	32.90	31.90	30.90
FD2-XD D/S D/Dens	40.90	39.90	38.90

32 hard sector available at the same prices.

3½" Microdisks

Prices and quantities relate to ***Ten-Packs***

Prices exc VAT	1-4	5-9	10+
MF2-DD D/Sided 1.0Mb	59.90	58.90	57.90

3" Microdisks

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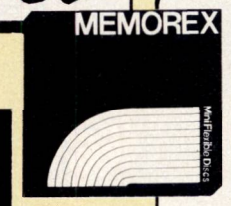
CF2 Compact D/S Floppy	39.90	38.90	37.90



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3491 D/S 48 tpi	29.90	28.90	27.90
3504 S/S 96 tpi	28.90	27.90	26.90
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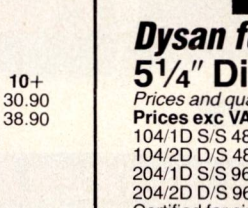
Prices and quantities relate to ***Ten-Packs***

Prices exc VAT	1-4	5-9	10+
6100 S/Sided 0.5Mb	42.90	41.90	40.90



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5¼" Diskettes

Prices and quantities relate to ***Ten-Packs***

Prices exc VAT	1-4	5-9	10+
104/1D S/S 48 tpi	23.90	22.90	21.90
104/2D D/S 48 tpi	34.90	33.90	32.90
204/1D S/S 96 tpi	34.90	33.90	32.90
204/2D D/S 96 tpi	42.90	41.90	40.90

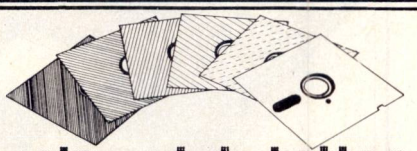
Certified for single OR double density. 48 tpi suitable for 35 or 40 track operation. 96 tpi suitable for 77 or 80 track operation.

8" Diskettes

Prices and quantities relate to ***Ten-Packs***

Prices exc VAT	1-4	5-9	10+
3740/1D S/S D/Dens	32.90	31.90	30.90
3740/2D D/S D/Dens	40.90	39.90	38.90

32 hard sector available at the same prices



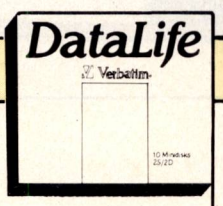
coloured diskettes

5¼" Supplied in *Five-Packs* of one colour

Prices and quantities relate to ***Five-Packs***

Prices exc VAT	1-9	10-19	20+
1D S/S 48 tpi	12.90	11.90	10.90
2D D/S 48 tpi	18.90	17.90	16.90
1DD S/S tpi	18.90	17.90	16.90
2DD D/S 96 tpi	21.90	20.90	19.90

To order the colour of your choice, just precede the type number with the appropriate letter, (R) RED, (O) ORANGE, (Y) YELLOW, (G) GREEN, (B) BLUE & (P) PALE BLUE. For the actual colours, please see our full colour advertisement back a couple of pages, or call and ask for our full colour brochure.





Verbatim Datalife = Best!

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Prices exc VAT	1-4	5-9	10+
MD 525-01 S/S 48 tpi	22.90	21.90	20.90
MD 550-01 D/S 48 tpi	29.90	28.90	27.90
MD 577-01 S/S 96 tpi	28.90	27.90	26.90
MD 557-01 D/S 96 tpi	36.90	35.90	34.90

Certified for single OR double density. 48 tpi suitable for 35 or 40 track operation. 96 tpi suitable for 77 or 80 track operation.

8" Diskettes

Prices and quantities relate to ***Ten-Packs***

Prices exc VAT	1-4	5-9	10+
FD 34-9000 S/S S/D	31.90	30.90	29.90
FD 34-8000 S/S D/D	31.90	30.90	29.90
DD34-4001 D/S D/D	36.90	35.90	34.90

32 Hard Sector available at same price.

3½" Microdisks

Prices and quantities relate to ***Ten-Packs***

Prices exc VAT	1-4	5-9	10+
MF350 S/Sided 0.5Mb	42.90	41.90	40.90

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5¼" Diskettes

Prices and quantities relate to ***Ten-Packs***

Prices exc VAT	1-4	5-9	10+
MD200-01 S/S 48 tpi	19.90	18.90	17.90
MD250-01 D/S 48 tpi	23.90	22.90	21.90

48 tpi suitable for 35 or 40 track operation.

8" Diskettes

Prices and quantities relate to ***Ten-Packs***

Prices exc VAT	1-4	5-9	10+
FD34-1500 S/S S/D	22.90	21.90	20.90
DD34-1501 D/S D/D	29.90	28.90	27.90

32 Hard Sector available at same price.

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worth 8.95



with EVERY 20 Diskettes ordered at these prices

When you buy twenty diskettes (any size, make or type) at these prices, you will receive, completely FREE of charge, this superb calendar clock with a large easy to read 24mm LCD display. Buy forty diskettes and you will receive two clocks and so on.

Offer ends 30th April, 1985

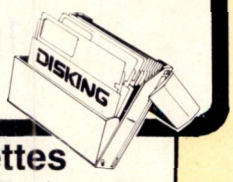
PLUS

FREE with every Ten-pack of diskettes from DISKING (or Five-Packs if coloured disks). The Superb SEE 10 Library Box. Also available individually for £2.50 exc VAT, either for 5¼" Disks (SEE 10), or 3½" Disks (SEE 10-3). Now also available for 8" Disks (SEE 10-8) at £3.00 exc VAT.

PLUS

FREE DISKING Colour Coders

A multicoloured pack of ten fibre tipped pens for colour coding your diskette labels. Available individually at 49p exc VAT.



BARGAIN CORNER

Bargain Corner Diskettes 5¼" Diskettes

Complete with a FREE SEE 10 library box and Colour coders, these disks are certified and are from one of the manufacturers in this ad.

Prices and quantities relate to ***Ten-Packs***

Exc VAT (No hub ring)	1-4	5-9	10+
UL1D S/S 48 tpi	13.90	12.90	11.90
UL2D D/S 48 tpi	20.90	19.90	18.90
UL1DD S/S 96 tpi	20.90	19.90	18.90
UL2DD D/S 96 tpi	24.90	23.90	22.90

Suitable for single OR double density.

Exc VAT (With hub ring)	1-4	5-9	10+
UL1DHR S/S 48 tpi	14.90	13.90	12.90
UL2DHR D/R 48 tpi	21.90	20.90	19 90
UL1DDHR S/S 96 tpi	21.90	20.90	19.90
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30 Minidisk capacity in smart beige brown complete with five coloured dividers.

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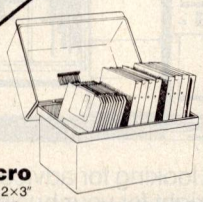

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30 Microdisk capacity (or 12×3" disks). Smart two-tone beige brown.

Part No	Description	Price exc VAT
BM	30 Microdisk capacity	6.90

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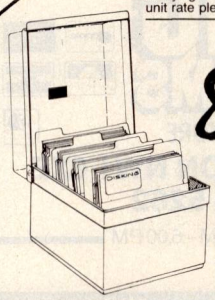
6·90



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POPULAR



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18·90



17·90

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60 Minidisk capacity, complete with keys, dividers, tags and even built in carrying handles.

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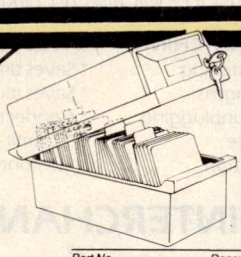

19·90

Executive Range
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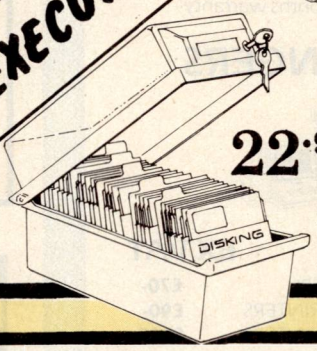

22·90

Executive Mini 100
100 5.25" minidisk capacity complete with removable lid, dividers, tabs, lock and 2 keys.

Part No	Description	Price exc VAT
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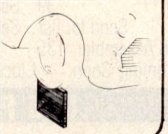

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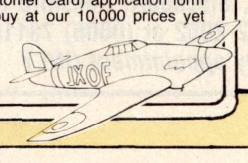

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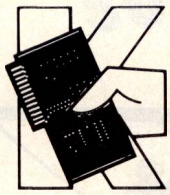
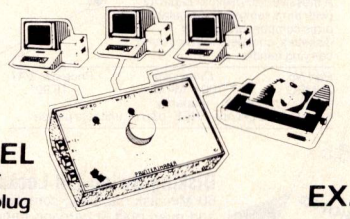


SOLID STATE DESK TOP
SWITCHING DEVICES

THE PRINTERSHARERS



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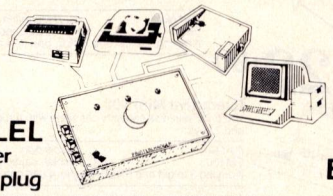

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THE PRINTERCROSSOVERS

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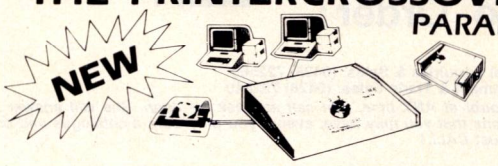

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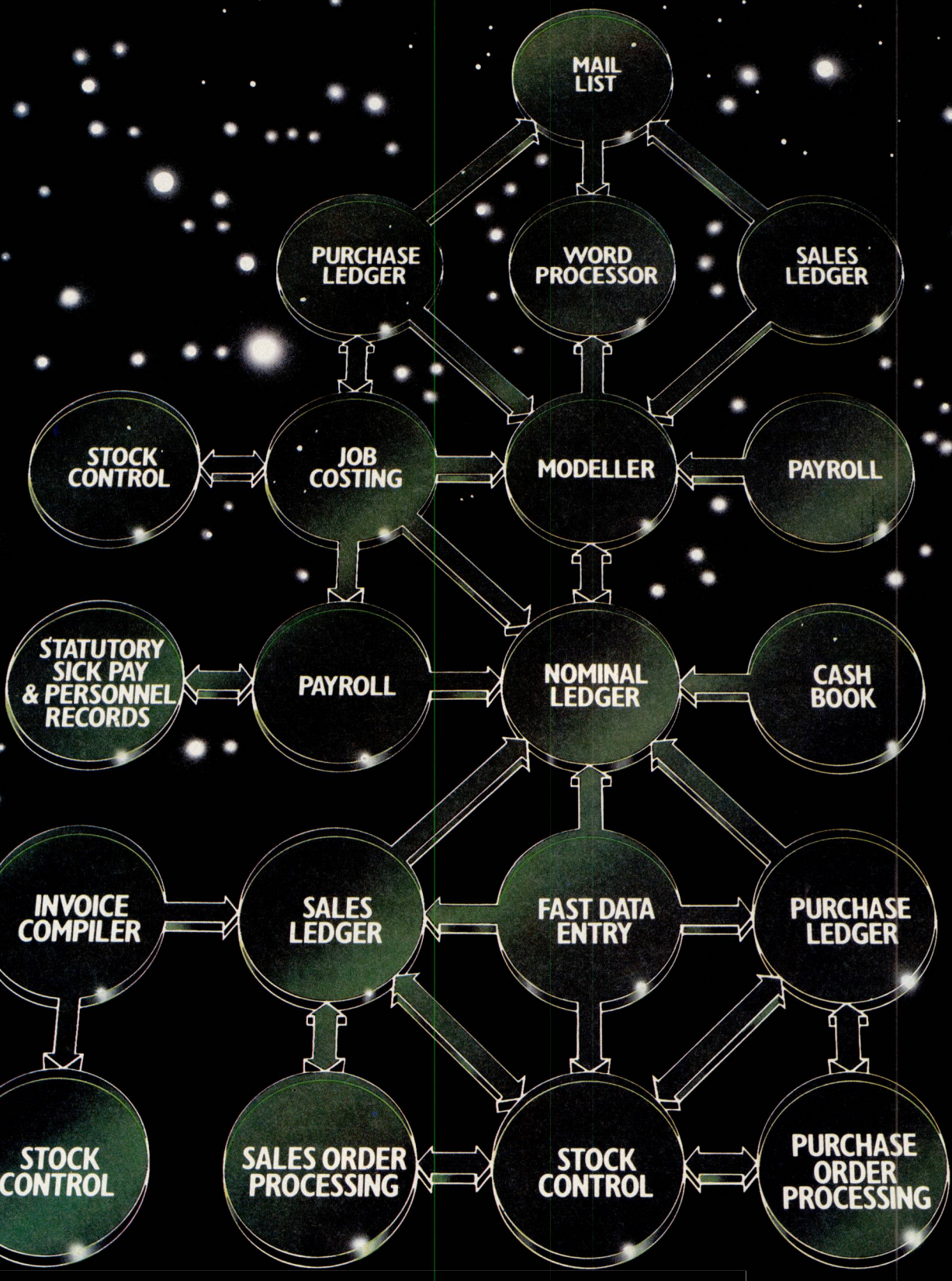

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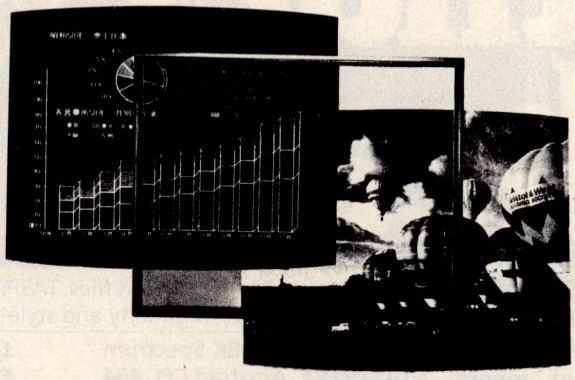

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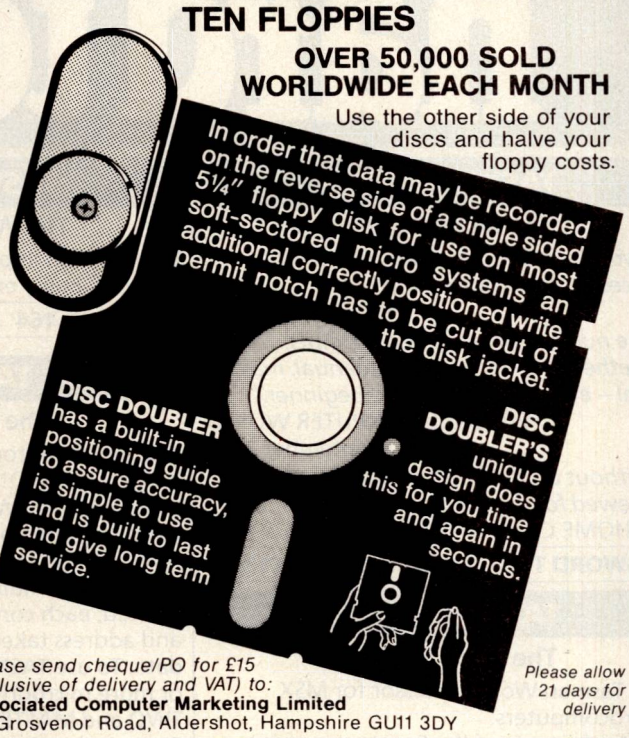

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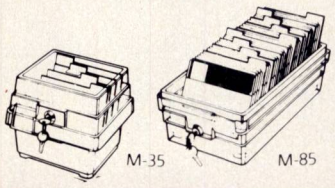

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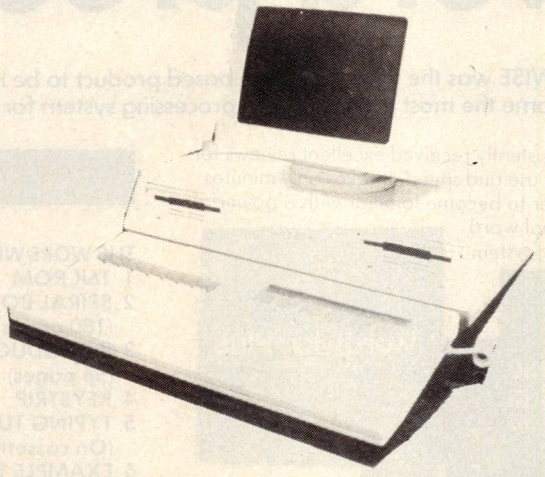

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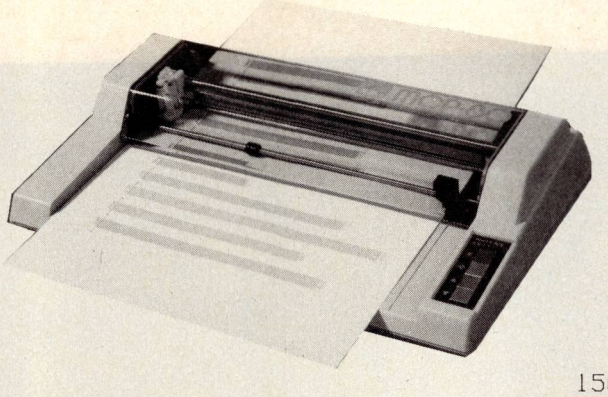

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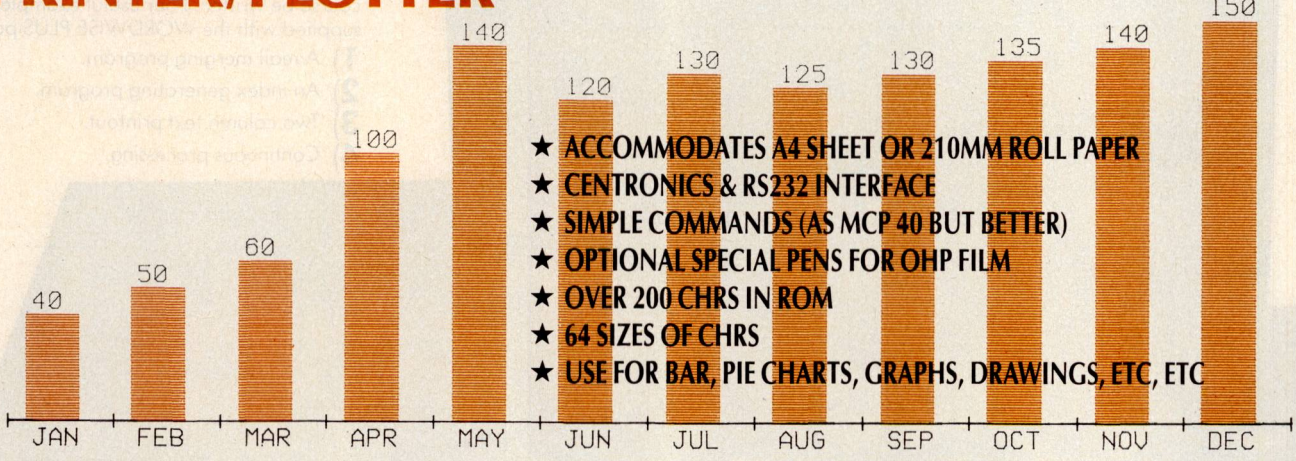

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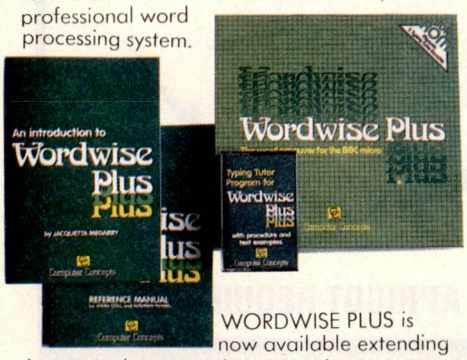

WORDWISE PLUS is now available extending the original program in many unique directions. Not only is the program now twice the size but the package includes two completely new manuals—an introductory manual that gently introduces the newcomer to word processing with WORDWISE, and a reference manual listing all the commands.

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WORDWISE PLUS is completely compatible with all older versions and is able to use existing WORDWISE files without modification.

WORDWISE PLUS FEATURES

Over the last couple of years we have received countless suggestions for ways of extending or adding new facilities to WORDWISE. It soon became obvious that we would not be able to implement every single suggestion. Indeed, each person uses a word processor in a different way—each individual has differing requirements—a feature that one person may think essential another may have no need for.

We have overcome this problem in two ways. Firstly we have included the most commonly requested additions and improvements. A number of new editing features and a few more embedded commands have been added.

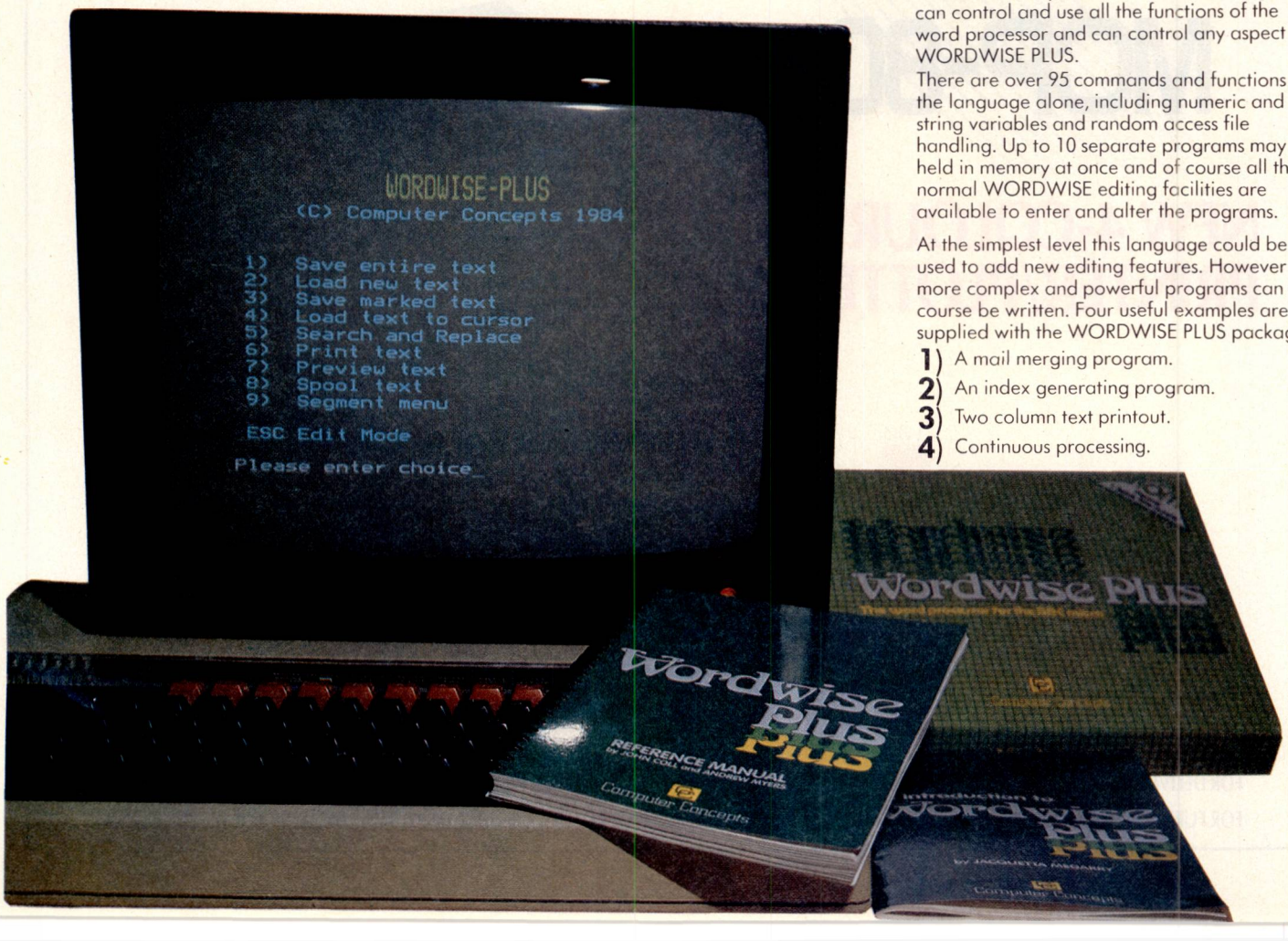
Secondly a unique BASIC-like programming language has been incorporated. This facility enables the capabilities of this word processor to be extended in an infinite number of ways.

The language itself has been designed, like WORDWISE, to be simple to use and understand. Many of the commands look and act like BASIC commands and so will be familiar to many users. However the language can control and use all the functions of the word processor and can control any aspect of WORDWISE PLUS.

There are over 95 commands and functions in the language alone, including numeric and string variables and random access file handling. Up to 10 separate programs may be held in memory at once and of course all the normal WORDWISE editing facilities are available to enter and alter the programs.

At the simplest level this language could be used to add new editing features. However more complex and powerful programs can of course be written. Four useful examples are supplied with the WORDWISE PLUS package.

1) A mail merging program.
2) An index generating program.
3) Two column text printout.
4) Continuous processing.



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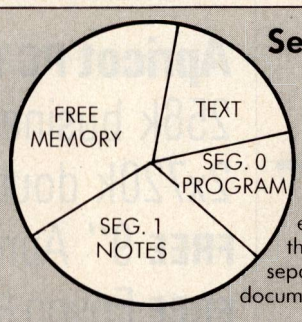
Word Processing with Wordwise Plus

WORDWISE PLUS still has WORDWISE as its core therefore it is still very user friendly and retains all the features that made WORDWISE the most popular word processor. It now has many new additions making this the most flexible word processor yet.

WORDWISE will continue to be sold alongside WORDWISE PLUS. For those more specialised users who require the added flexibility here are a few of the new features.

Segments



When using WORDWISE PLUS, the BBC's memory is divided between your text and up to 10 'segments'. Each segment may contain either a program or just normal text. It is therefore possible to store and edit up to 11 separate documents in memory, or 1 document and 10 programs, or any mixture.

Often when writing letter or articles it is useful to keep a notepad, outlining what you intend to write. In WORDWISE PLUS one of the segments could be reserved for an electronic notepad. It would be a simple matter to switch your 'notepad' and your main document with just a single key press.

Some of the New Editing, Embedded Commands and Wordwise Extensions

WORDWISE PLUS works with the 6502 2nd processor. This allows more text to be stored in memory and 80 column previewing no matter how full memory is.

New embedded command FI will fully indent text against the right margin.

New commands for underlining and bold printing. The bold and underline effects are shown on screen—and it is a simple matter to configure these features for any printer.

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There is now a working filename—i.e. WORDWISE remembers the name of the current document being worked on.

New command deletes markers automatically.

It is now possible to print or preview a file directly from disc without having to load it first.

New embedded command 'PS' allows strings to be inserted into the text when it is printed.

New embedded command 'PF' will read a document from file when printing and interpret any embedded command in that file.

Improved search and replace facilities now include wild-cards.

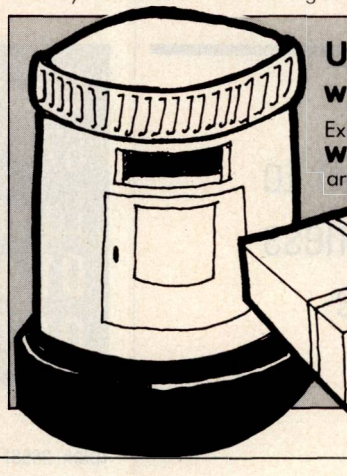
Example Programs Supplied With Wordwise Plus

1) A mail merging program that allows names and addresses to be added to a standard letter. This is a relatively easy job with this language.

2) An index generating program. This finds keywords and generates a separate index listing the word and the page numbers where the keywords occurred.

3) Two column printout. This program will print your text in two columns across the page.

4) Continuous processing. This enables the disc user to process and edit extremely large documents spread over several files as if it were one continuous document in memory.



Upgrades

WORDWISE PLUS for only **£21+VAT**

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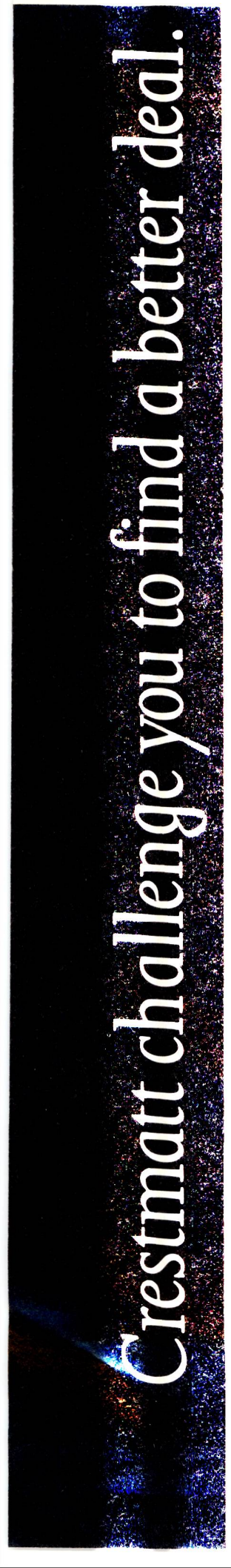

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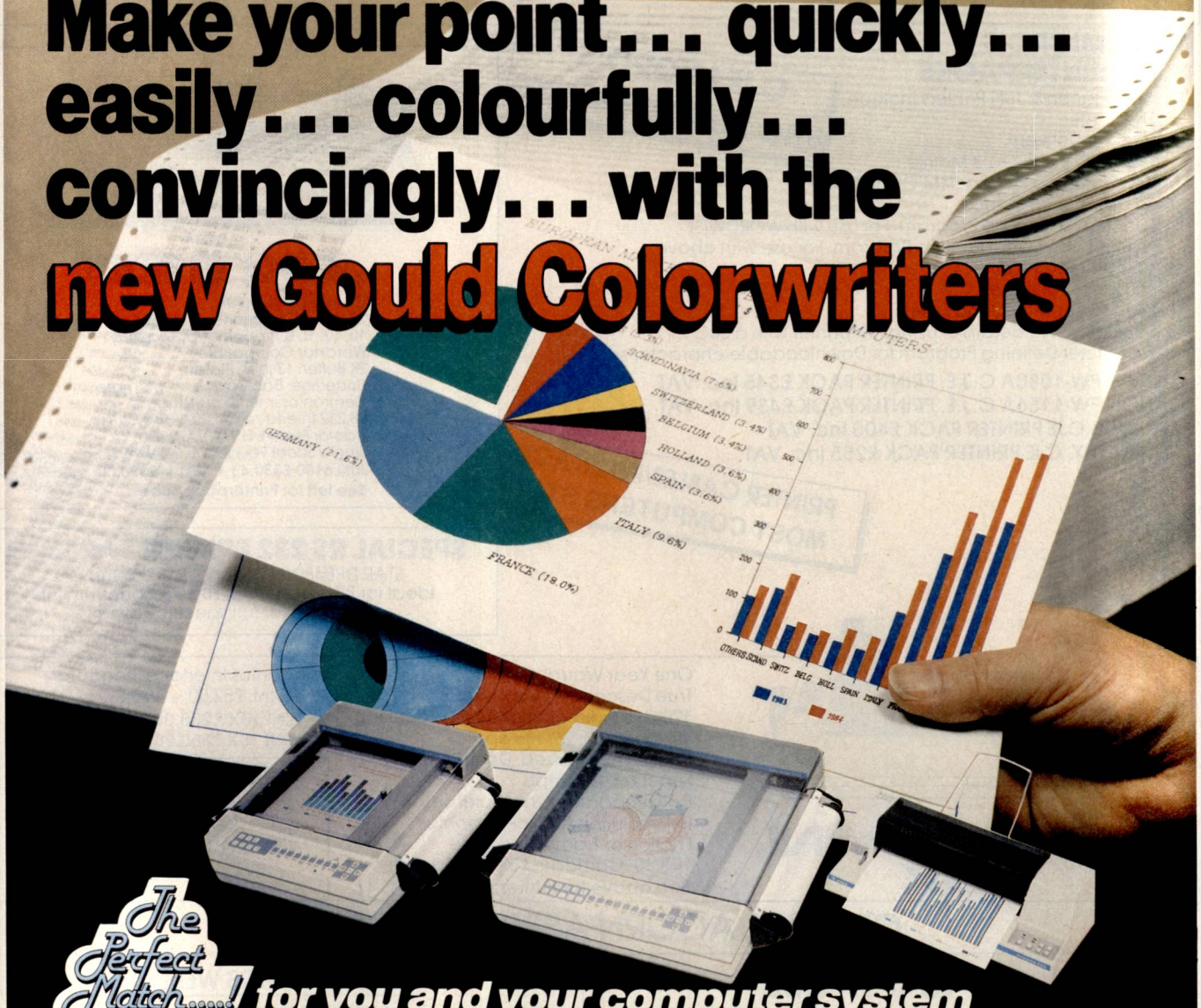

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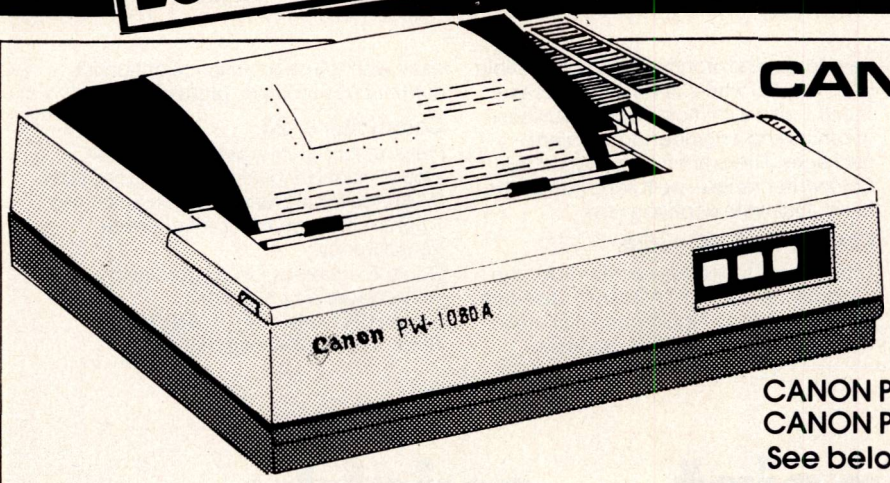

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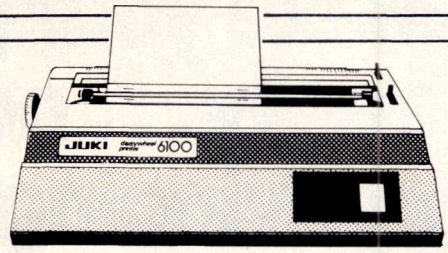

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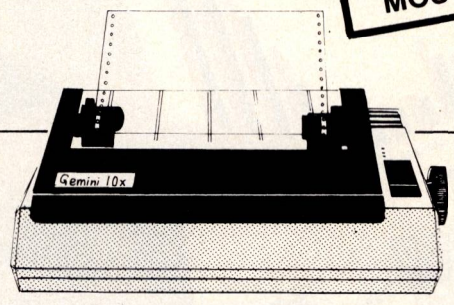

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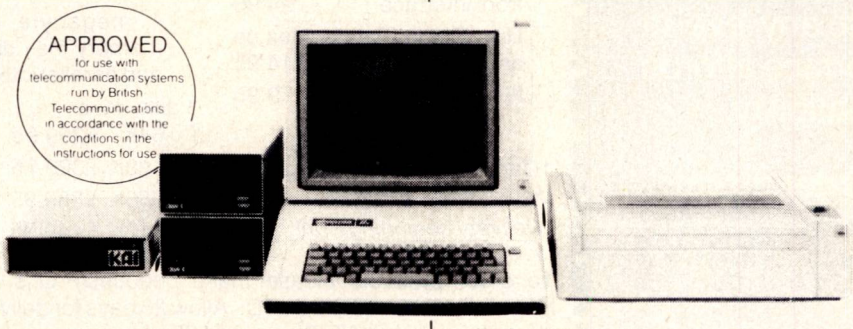

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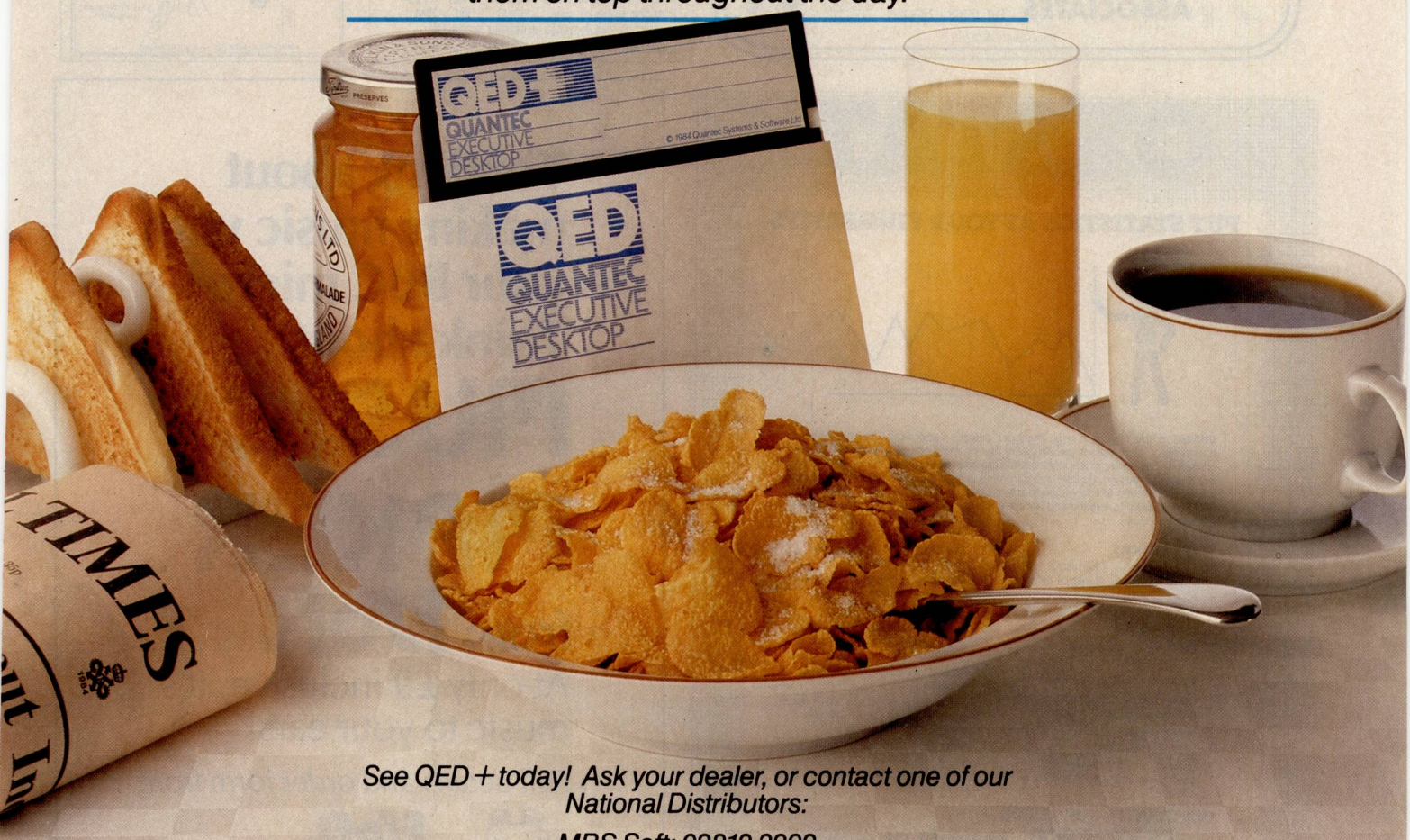

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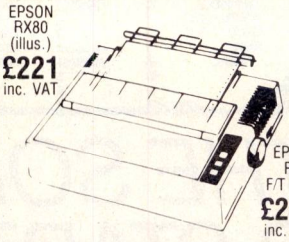

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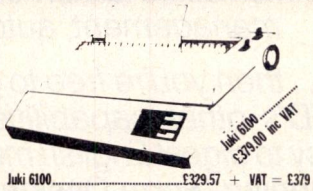

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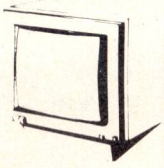

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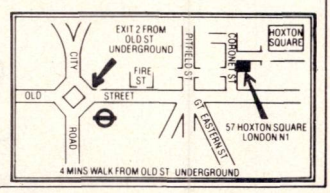

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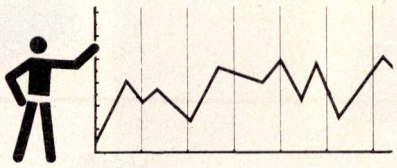

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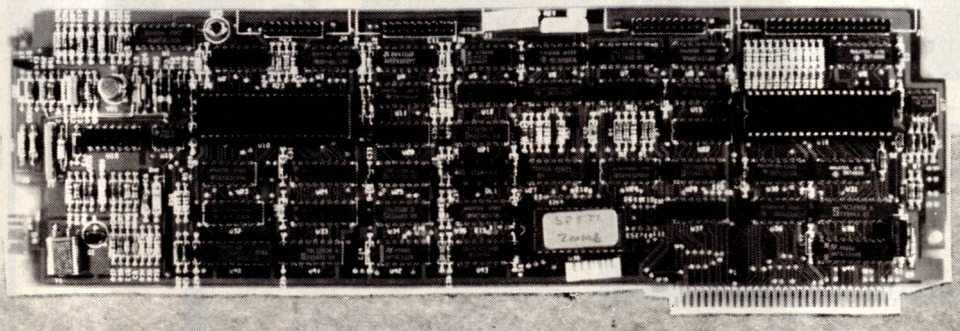

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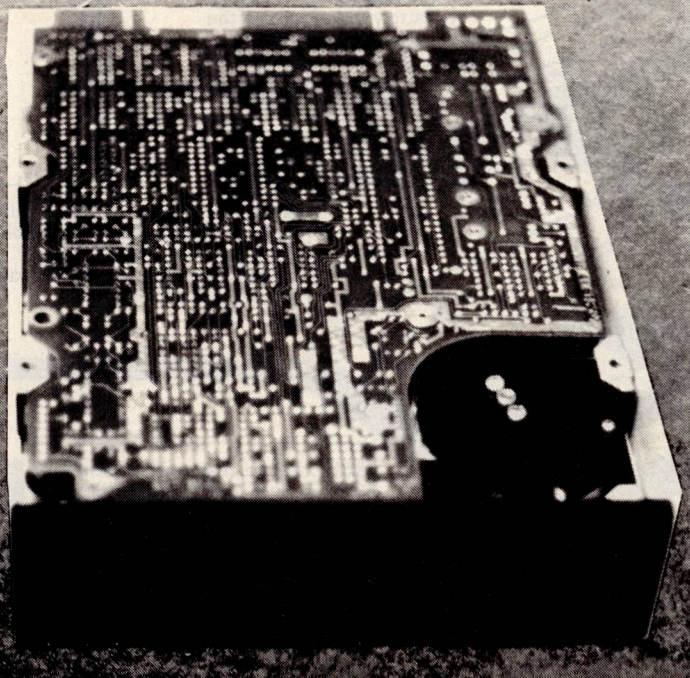

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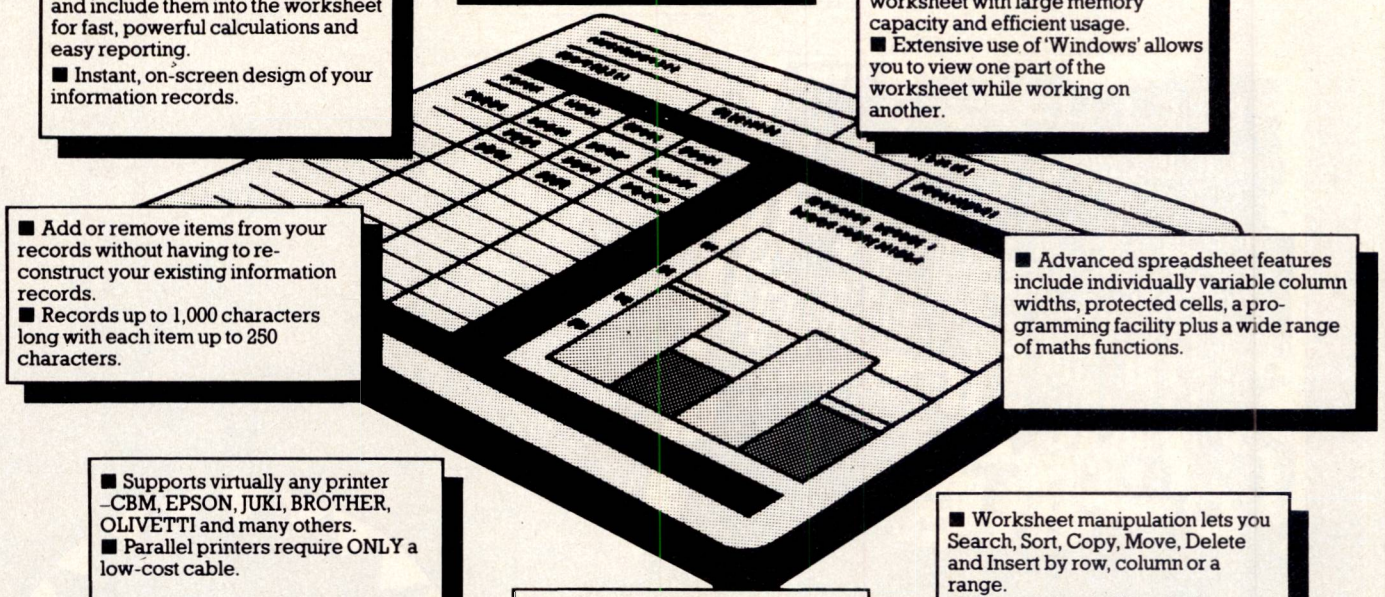

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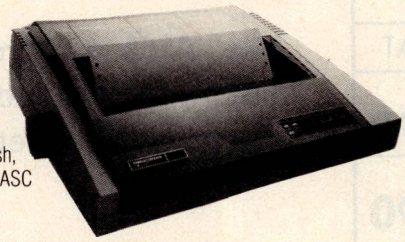

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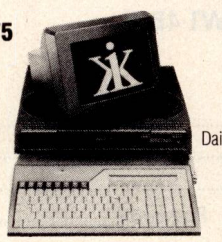

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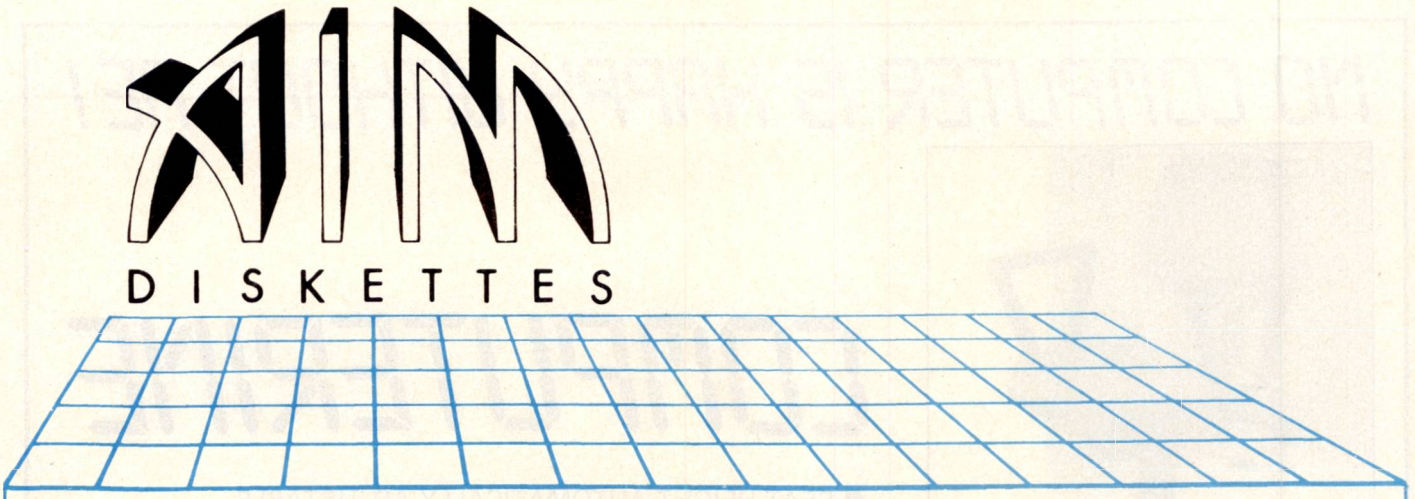

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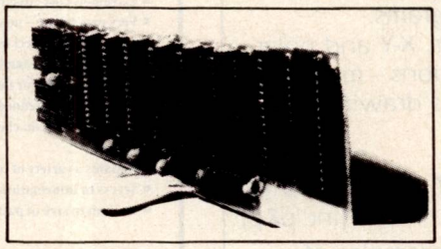

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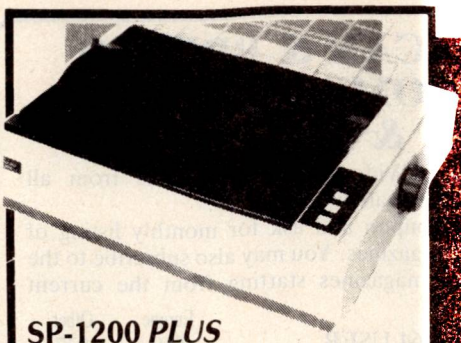

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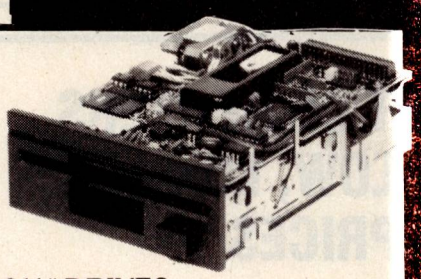

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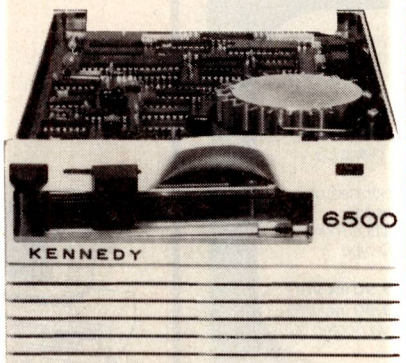

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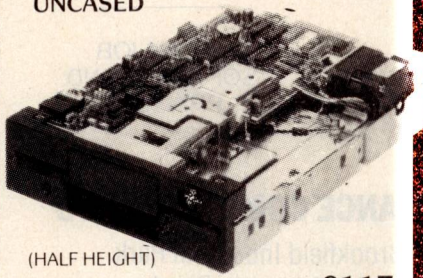

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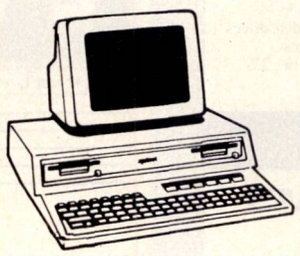

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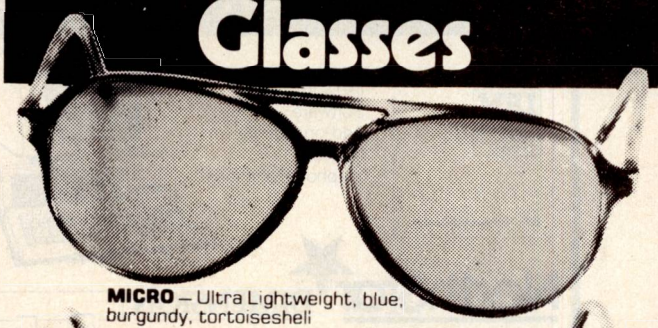

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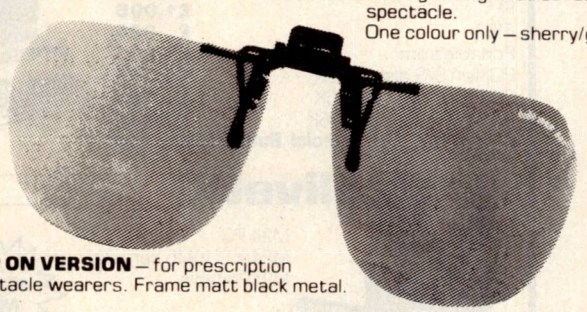

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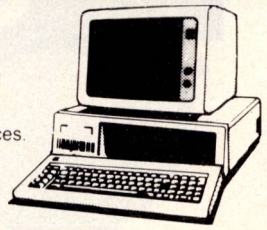

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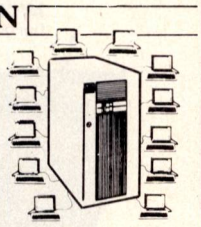

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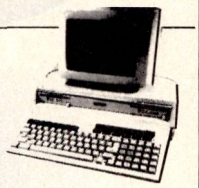

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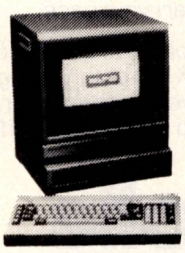

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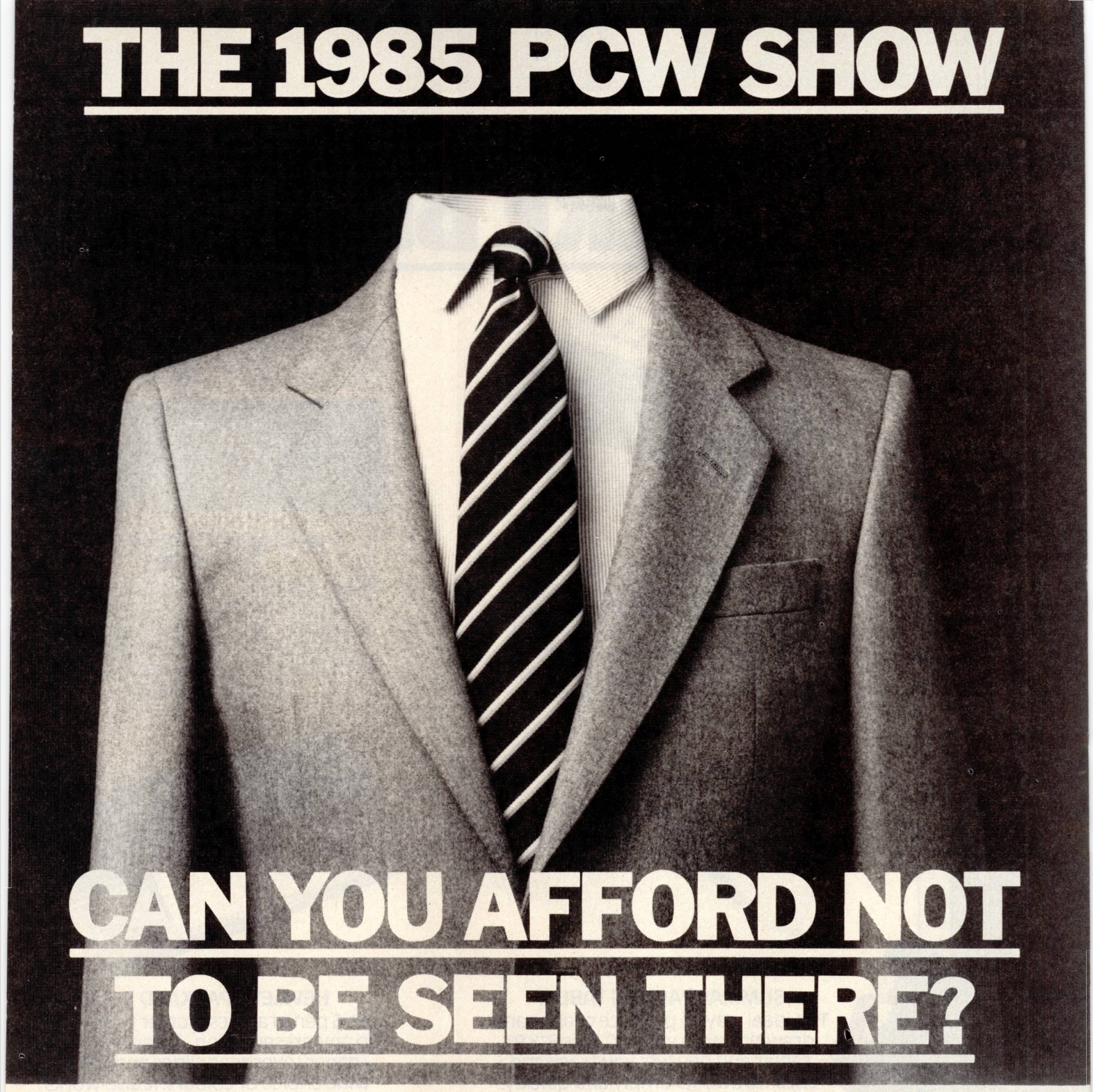

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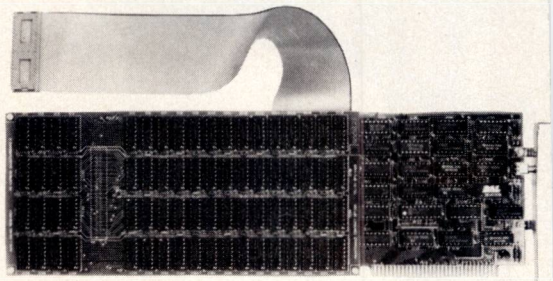

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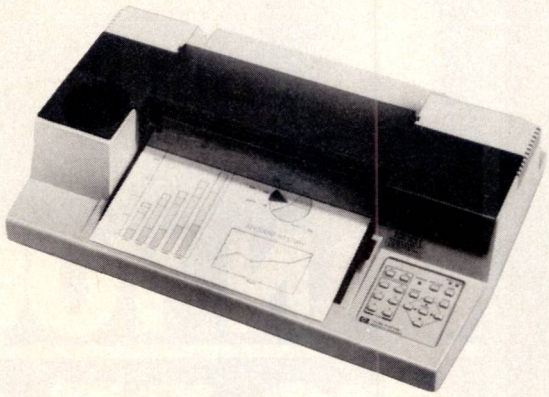

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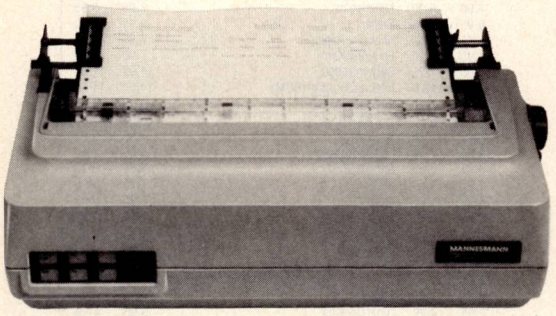

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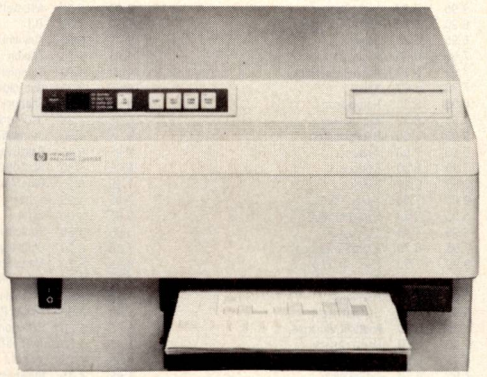

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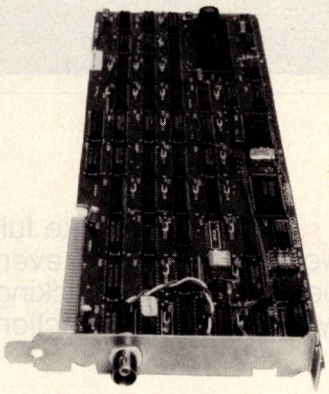

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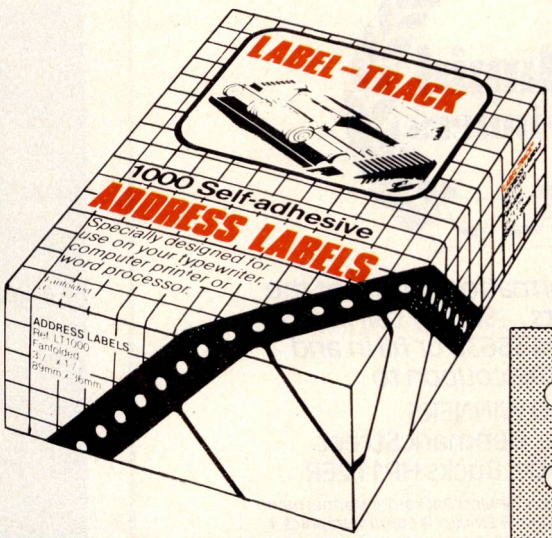

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Telephone _____

CHIP CHAT

Sorry, I'll mail that again: who else but IBM would have the nerve to send its dealers details of prices undermining their own? The company sent out the information relating to discount offers at its own shops to a range of past and potential PC purchasers, as well as to the afore-mentioned dealers. One trade paper says IBM blames 'a hiccup with the mailing list'. A hiccup resulting, perhaps, from the company being drunk on its own power?

And I'll mail this again too: mailing lists are a boon to companies eager to contact the right kind of customer. They're also expensive, so it does help if they're accurate. One mailing firm sent details of its lists to Datasoft in Essex with an invitation to buy some of them. There's just one snag — Datasoft's now based in Somerset.

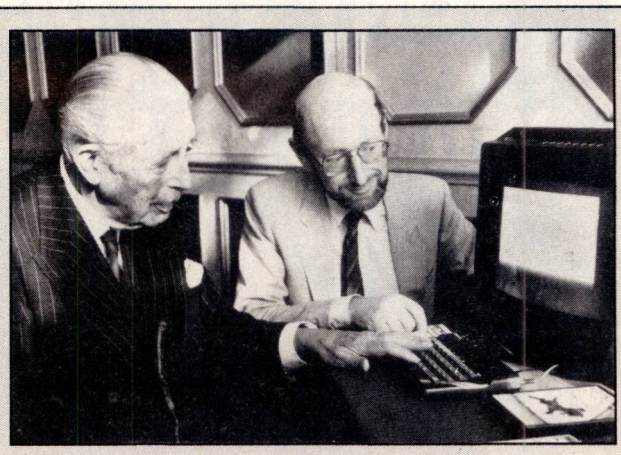
Atari acronyms: the forthcoming ST from Atari isn't named after leader Jack Tramiel's son Sam — it stands for 16-bit. The XE acronym is even more clever — X is for compatibility with the XL range and E is for 8-bit.

A great one for rubbing salt in wounds is Mr Tramiel Snr — having left Commodore last year under circumstances neither side will discuss in detail, he now intends to make Commodore-compatible peripherals. Disk drives are among his plans, although we also hear that Commodore may have some 3½in drives up its sleeve. Where Atari is getting the money to do all this is, of course, another question.

SOS: help was at hand to interpret the message left on Douglas Nunn's computer and published in our January issue. The key to the message is A=1, B=2, C=3, D=4, E=5, F=6, G=7, H=0, I=+, J==, K=−, L=×, M=/, N=↑, O=., P=<, Q=>, R=~, S=π, T=OR, U=AND, V=EOR, W=!, and X=√. D F Gibbs of Bristol used the symbols to work out that the message comes from an eight-fingered Martian with an interest in maths, music and the arts (and also, we have to admit, with a habit of making the occasional typographical error). Mr Gibbs wins the prize of a Hewlett Packard 12C calculator for his deductions. A less conventional explanation came from Russel Hutson of St Leonards: 'The message is an unpublished page of Sinclair syntax rules found during an excavation of an Ancient Greek comprehensive school in Athens. The page was to be included in the ZX-80 manual but the modern machine, which was constructed in the 80s, was found to have fewer functions than the original used by its inventor, Uncle Archimedes.'

Teacher's pet: Apple is promoting sales of its micros to schools with its customary fervour. Managing director David Hancock says: 'I think it is tragic that the education of our children has for years been adversely affected because schools have not been given a chance to use the one personal computer, with 2000 proven educational software packages worldwide, that can do the job the government requires. This is of grave concern to teachers and parents alike — and I include myself as a father of four.' Not that we doubt your sincerity, David — but introducing school children to Apple won't be too tragic for your company's profits in the long-run either.

Avon calling: an anguished telephone message from Bristol-based Micro Planning Software. The company wanted to know why we hadn't mentioned Micro Planner's part in the latest Mac test-drive campaign.



Who said computing was a young person's hobby? Obviously not Sir Clive, pictured here with the venerable Lord Stockton playing the screen version of Walking the Dog. Perhaps Sinclair is enquiring about the possibility of a peerage, or His Lordship is booking his order of Sinclair shares early, or perhaps . . . well, that's up to you. Send your suggestions on the back of a postcard to ChipChat, PCW, 62 Oxford Street, London W1, to reach us by the end of April. Remember to include your name and address so we can send you the prize if your entry is the wittiest.

After all, Micro Planner, a project management package, had gained this honour alongside some pretty hefty American names. Well, we explained, our editorial criteria are very demanding, competition is keen, and so on, and in addition we missed the announcement. So, Micro Planner, take a bow.

'Pick your guru carefully, like a horse': this is the advice of Mike Banahan and Andy Rutter in *Unix — the book*. They continue: 'Occasionally you may come across the Unix *expert*. Too old and weary for anything of use, these creatures are put out to grass, where they immediately elect themselves to committees and start writing books. If you have one of these, be kind to it, buy it drinks and treat it with respect. On no account ask it for advice, for its language is no longer the same as yours.' The authors themselves finished writing their book — and they are worth turning to for advice.

Cosmopolitan corner: a certainty for the *Guinness Book of Records* is the London Festival of Computing — running, as it does, for more than a week. If your stamina will take it you can start on Tuesday 9 April with a robotics exhibition in Covent Garden. Community computing follows on the Wednesday and communications on the Friday — both in Covent Garden. On the Saturday Camden Town takes a look at Logo while County Hall helps you choose and use a micro. More events are scheduled for the week after, culminating in the London Computer Fair at Westminster's Central Hall from 18-20 April. On Sunday you can take a well-earned rest. And that's just the edited highlights. For more information call the Covent Garden Information Technology Centre on (01) 240 8206 — or look at Prestel, page number 81018.

Trivial Fact No 437: according to a leading paper manufacturer which makes floppy disk sleeves, if you were to repeatedly remove and insert a disk from one of its sleeves a 100 times, the total build up of static charge would be less than 0.6 pico farads. You did want to know that, didn't you?

Disk in time: Tolkien addicts with access only to an IBM PC have Hobbit sustenance at hand. Disk versions of this high-selling home computer game are on their way for a range of machines, including the PC, and with extras such as enhanced graphics. At least that means when you're stuck in the Goblin's Dungeon, the surroundings should be prettier.

Flight fatalities: Torch is setting up a network of machines at the Biggin Hill pilot aptitude testing centre. Aside from a range of made-to-measure applications packages, Biggin Hill has also ordered a full set of games, including Elite. END

'The year ahead looks very exciting for Sinclair' according to top man Nigel Searle. There's flat-screen pocket TVs, wristwatch/radios, portable micros and all sorts of other goodies to look forward to. Well, thanks for writing to us, Nigel — though we've one suggestion to make. What about developing a signature-writing machine with a built-in spelling checker?

Yours sincerely

Nigel Searle

NIGEL SEARLE

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