Personal Computer World

A GUIDE TO BUSINESS SOFTWARE

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NOVEMBER 1979 50p

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The 2nd Personal Computer World show - preview issue

MicroCentre are the UK Cromemco experts

Sample catalogue prices:

*System Two computer	1995
*System Three computer	3293
*Z-2H computer	4998
Extra 64K memory	893
3101 visual display unit	1147
3355 daisywheel printer	2297
HDD 11-mbytes hard disc	4022
ANSI Cobol compiler	55
ANSI Fortran IV compiler	55
16K extended Basic	55
Word processing system	55
Database management	55
Macro relocating assembler	55

Prices exclude VAT and delivery

MicroCentre also supply peripherals, applications sofware, and multi-user timesharing systems; a PROM programmer; analogue-digital interface; and much more. On site maintenance can be arranged throughout the UK.
*Computer systems include fast 4MHz Z80A micro, S-100 bus (21 slots), 64K memory, dual floppy discs, peripheral interfaces, etc. CP/M compatible operating system CDOS free with software.

With our in-depth experience and total commitment to the reliable Cromemco range we are Cromemco's leading UK distributor. Rely on us, as many others do, for expert support with your routine or special micro-computer applications.

Photo features Cromemco System 3 computer, 3101 VDU, and 3355 daisywheel printer.

Micro Centre

Complete Micro Systems Ltd.
132 St. Stephen Street,
Edinburgh EH3 5AA.
Tel: 031-225 2022.

Look out for us at Compec '79, stand no. 756

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Because of the foregoing, it is necessary to add that the views expressed in articles we publish are not necessarily those of *Personal Computer World*. Overall, however, the magazine will try to represent a balanced, though independent viewpoint.

Finally, before submitting an article, please check it through thoroughly for legibility and accuracy.

Subscription rates: Britain £8.00 for 12 issues, USA $20 for 12 issues (surface mail), Continent and elsewhere £9.80 for 12 issues. All prices include postage and packing. Supplies to specialist shops can be arranged by negotiation direct with the publishers.

Dr. Chris' Evans, psychologist and computer scientist, died of cancer early in October following a period of indifferent health. Although having been at the forefront of computer science for many years, it's doubly tragic that this should have happened at a time when Chris' was due to attract far wider recognition with the television serialisation of his best-selling book, "The Mighty Micro". With his interests firmly centered around the man/machine interface, his flair and energy are sure to be greatly missed. The staff of Personal Computer World extend their sympathy and condolences to his family.

Rostronics present the Z-Plus Dual Floppy Microsystem

Price **£3750** plus VAT

Features:

Over One Megabyte Disk Storage

4 MHz Z-80 Processor 64k Memory

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An alphanumeric keyboard with 95 keys and numeric pad, character display (24 lines of 80 characters per line) on a 15 inch screen

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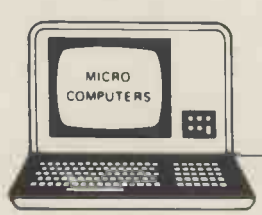

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DPS-1 MAINFRAME

Introducing the DPS-1 the full IEEE S100 bus computer system from Ithaca Intersystems — the S100 experts.

FOR EDUCATION, INDUSTRY, RESEARCH and all professional uses, including hardware and software development, low cost OEM systems, teaching applications etc.

A MINI COMPUTER using MICRO technology at a ridiculous MICRO Price!!! The front panel with a backplane and power supply accepts S100 bus boards from many manufacturers.

InterSystems

Just look at these professional features!

★ FRONT PANEL (we won't ask you to debug our hardware, but we will give you the tools to debug yours!) Has lights and switches to allow inspection and control of addresses and data. Other features include programmed input switches, and output lights. Examine. Examine next. deposit. deposit next. single or slow step (0.1 to 1000 IPS). hardware breakpoint on any data or address byte. repeat instruction and many other hardware diagnostic facilities.

★ 30 Amp. 8V power supply. 5 Amps on ± 16v rails (all rails are seperately fused)

★ 20 slot IEEE S100 Motherboard with active termination and shielding between bus lines

★ Guaranteed operation at 4MHz.

The DPS1 comes as a mainframe with front panel, Motherboard, power supply and 4MHz Z80A cpu board. The system is truly modular allowing the user to build up the system he requires in his own time.
S100 boards from a number of manufacturers will plug into the DPS1 IEEE S100 bus.
Just add S100 Memory Boards — S100 disk controller boards — S100 I/O boards — S100 video and/or graphics boards — S100 EPROM boards
All Ithaca Intersystems OEM products including K2 disk operating system and PASCAL/Z on 8" floppy drives will run in the DPS-1.

DPS-1 with S100 4MHZ Z80 cup board *Fully assembled and tested* **£695**

SOFTWARE
for your S100 system

PASCAL/Z The new language for Micros

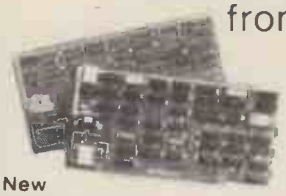
CP/M Version £165.00 (5¼" or 8")
K2 Version £131.25 (8")

Runs under K2 operating system.
★ Compiler that produces Z80 macro assembler code — NO NEED for slow run time P-code interpreter. ★ Comes complete with Macro assember. ★ Produces binary object modules — small and fast. ★ Modules are re-entrant and can be put into ROM. ★ IMBED. TRACE and ERROR debug facilities. ★ Recursion

K2 OPERATING SYSTEM £56.25

8" disk based operating system — distributed on Shugart compatible 8" floppy disk ★ TED — 52 command character orientated text editor with macros. ★ PIP — File and directory handler. ★ ASMBLE — full Z80 2 pass assembler. ★ HDT — Hex debug tool. ★ QCI — Utility overlay/command decoder. ★ SYSGEN — System builder. ★ COPY — disk to disk file copier. ★ DUP — disk duplicator.

OEM S100 boards
from the experts!



	Assembled and tested
8K Static RAM board (450ns)	£123.75
8K Static RAM board (250ns)	£146.25
16K Static RAM board (450ns)	£216.00
16K Static RAM board (250ns)	£234.00
64K Dynamic RAM board (250ns)	£540.00
Z80 cpu board (2MHz)	£131.25
Z80 cpu board (4MHz)	£153.75
2708/2716 EPROM board	£63.75
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New products from Ithaca audio!

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AVAILABLE SOON: ZBC-1 Single board computer for OEM market. Available in basic through to fully expanded. 4MHz Z80A. 64K RAM. memory mapped 4K screen buffer. composite video. up to 16K power on EPROM monitor. 4 parallel ports. 2 serial ports. 4 channel counter timer. 1 off £895 — please phone for a quote for your needs. (quantity discounts available).

ALL MANUALS AVAILABLE SEPERATELY £2.50 each

PASCAL MICRO DEVELOPMENT SYSTEM

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FOR RESEARCH and DEVELOPMENT LABORATORIES and TEACHING APPLICATIONS

The PASCAL System

- DPS1 Mainframe with hardware front panel.
- Z80A 4MHZ Microprocessor.
- 64K Static RAM.
- 8" Shugart or DRI Floppy Disc Drive, Power Supply and Controller.
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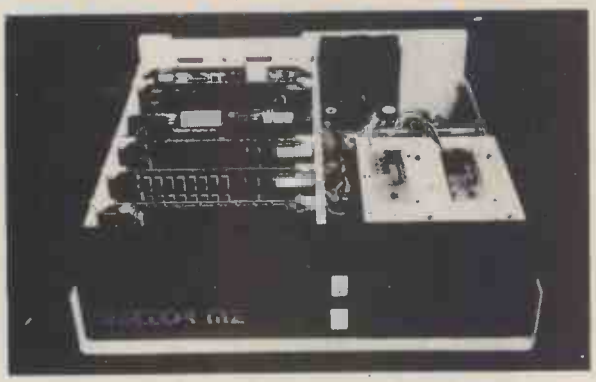

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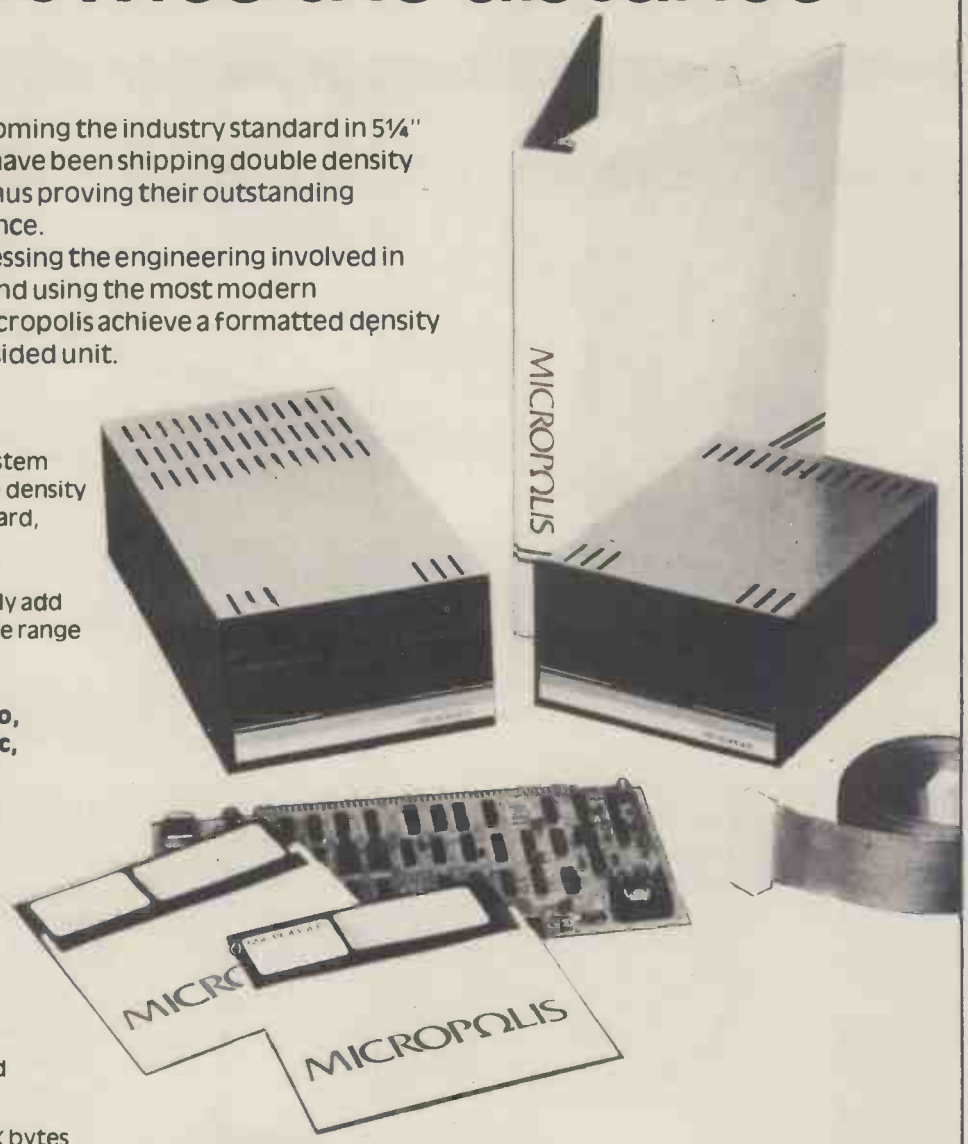

Starter system

The 1041/1 Macrofloppy system includes a 143K byte double density drive with S100 controller card, MDOS and BASIC with a comprehensive manual.

This unit will successfully add on-line disc storage to a wide range of S100 computers at an unbeatable price per byte.

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Fully assembled, tested and burnt-in unit
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PET
Z80/CPM
6800

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Approx 60 entries update require only 1-2 hours weekly and your entire business is under control.

OFFICIALLY APPROVED BY COMMODORE

*PROGRAMS ARE INTEGRATED

1 = ENTER NEW NAMES ADDRESSES IN LINE!
2 = *ENTER/PRINT INVOICES
3 = *ENTER PURCHASES
4 = *ENTER A/C RECEIVABLES
5 = *ENTER A/C PAYABLES
6 = ENTER/UPDATE STOCKS REC'D
7 = ENTER ORDERS REC'D
8 = EXAMINE/UPDATE BANK BALANCE
9 = EXAMINE SALES LEDGER
10 = EXAMINE PURCHASE LEDGER
11 = EXAMINE INCOMPLETE RECORDS
12 = EXAMINE PRODUCE SALES

WHICH ONE (ENTER 1 TO 24)

SELECT FUNCTION BY NUMBER

13 = PRINT CUSTOMER STATEMENTS
14 = PRINT SUPPLIER STATEMENTS
15 = PRINT AGENTS STATEMENTS
16 = PRINT QUARTERLEY TAX STATEMENTS
17 = PRINT WEEK/MONTH SALES
18 = PRINT WEEK/MONTH PURCHASE
19 = PRINT YEAR AUDIT
20 = PRINT PROFIT/LOSS ACCOUNT
21 = UPDATE ENDMONTH FILES
22 = PRINT CASHFLOW ANALYSIS
23 = ENTER PAYROLL

EACH PROGRAM GOES IN DEPTH TO FURTHER EXPRESS YOUR REQUIREMENTS.
FOR EXAMPLE (9) ALLOWS: a. list all sales; b. monitor sales by stock code; c. invoice search; d. amend ledger files; e. total all sales

BUSINESS PROGRAM VERSION £275
(VERBOSE SIMPLE LANGUAGE AND UNITARY FILE HANDLING)

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Dual Z-80A Vector Interrupt, 64 RAM pws 1K 2708 PROM Bootstrap, Two Double-Density 5in Floppy Disks £1,950

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For Business, Scientific and Educational Uses.

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There are dual integral Shugart minifloppy drives (capacity of about 360 KB on line, with an option for a further two drives), enabling easy and quick handling and copying of programs and data files.

And of course, there's the 12 slot S-100 bus which enables you to plug in many types of peripheral boards, including a hardware floating point board for increased "number crunching" performance.

PROFESSIONAL SOFTWARE

North Star Computers built their professional reputation around their powerful, but simple, Disc Operating System and Disc Extended BASIC Interpreter.

The latter contains, in addition to the usual BASIC commands, random and sequential access disc files, strings, string operators, multiple dimensioned arrays, formatted output, machine language CALL, memory EXAMine and FILL, line editor, program chaining and more.

The CP/M operating system is also available as an option and provides access to a Macro Assembler, C BASIC Compiler and FORTRAN-80 and COBOL-80 Compilers. A standard UCSD PASCAL has now been implemented.

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How will micro-computers help you? In thousands of ways–only a few can be mentioned here...

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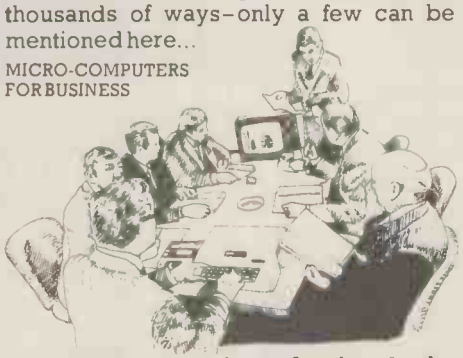

For business and professional, the versatility of compact micro-computers means that all the benefits of big computers are made available to all at low cost. The businessman can now computerise his accountancy, his stock control, his records and much more–cutting his overheads and improving his efficiency.

For the home, micro-computers have innumerable uses and considerable value too–sometimes in unexpected ways.

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components

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APPLE FEATURES
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APPLE II Plus is easily programmed in BASIC but now has available for the first time—PASCAL, probably the most exciting new computer language around.
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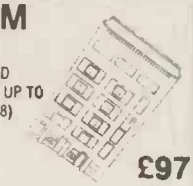

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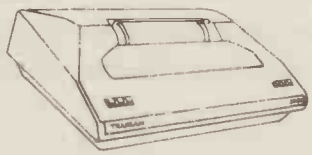

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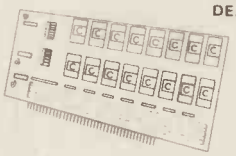

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EDITOR	BREAKPOINT
ASSEMBLER	SINGLE STEP
DISASSEMBLER	TRACE
SYMBOL TABLE	PROGRAMME LOAD
CREATE	MONITOR

SEE CATALOGUE FOR FURTHER DETAILS

COMPONENTS 74LSXX

SN74LS00N	18	SN74LS54N	21	SN74LS138N	75	SN74LS195AN	85	SN74LS325N	2 55
SN74LS01N	18	SN74LS55N	21	SN74LS139N	75	SN74LS196N	1 20	SN74LS326N	2 55
SN74LS02N	20	SN74LS63N	50	SN74LS145N	1 20	SN74LS197N	1 20	SN74LS327N	2 55
SN74LS03N	18	SN74LS73N	35	SN74LS148N	1 75	SN74LS221N	1 25	SN74LS352N	1 35
SN74LS04N	20	SN74LS74N	40	SN74LS151N	85	SN74LS240N	2 20	SN74LS353N	1 50
SN74LS05N	26	SN74LS75N	46	SN74LS153N	60	SN74LS241N	1 90	SN74LS365N	65
SN74LS08N	20	SN74LS76N	35	SN74LS154N	1 60	SN74LS242N	1 90	SN74LS366N	65
SN74LS09N	22	SN74LS78N	35	SN74LS155N	1 25	SN74LS243N	1 95	SN74LS367N	65
SN74LS10N	18	SN74LS83AN	1 15	SN74LS156N	1 25	SN74LS244N	2 10	SN74LS368N	65
SN74LS11N	26	SN74LS85N	1 10	SN74LS157N	60	SN74LS245N	2 60	SN74LS373N	1 75
SN74LS12N	25	SN74LS86N	40	SN74LS158N	99	SN74LS247N	1 25	SN74LS374N	1 70
SN74LS13N	55	SN74LS90N	65	SN74LS160N	1 15	SN74LS248N	1 95	SN74LS375N	72
SN74LS14N	89	SN74LS91N	99	SN74LS161N	1 15	SN74LS249N	1 30	SN74LS377N	1 75
SN74LS15N	25	SN74LS92N	90	SN74LS162N	1 15	SN74LS251N	1 45	SN74LS378N	1 32
SN74LS20N	20	SN74LS93BN	65	SN74LS163N	90	SN74LS253N	1 25	SN74LS379N	1 40
SN74LS21N	26	SN74LS95AN	1 20	SN74LS164N	1 50	SN74LS257N	1 40	SN74LS381N	3 65
SN74LS22N	26	SN74LS96N	1 75	SN74LS165N	1 70	SN74LS258N	95	SN74LS386N	57
SN74LS26N	29	SN74LS107N	39	SN74LS166N	1 75	SN74LS259N	1 45	SN74LS390N	1 98
SN74LS27N	35	SN74LS109N	39	SN74LS168N	1 95	SN74LS260N	39	SN74LS393N	1 50
SN74LS28N	35	SN74LS112N	39	SN74LS169N	1 95	SN74LS261N	3 50	SN74LS395N	1 80
SN74LS30N	25	SN74LS113N	44	SN74LS170N	2 50	SN74LS266N	39	SN74LS396N	1 70
SN74LS32N	27	SN74LS114N	44	SN74LS173N	2 20	SN74LS273N	1 85	SN74LS398N	2 75
SN74LS33N	39	SN74LS122N	79	SN74LS174N	1 15	SN74LS279N	79	SN74LS399N	1 60
SN74LS37N	29	SN74LS123N	90	SN74LS175N	1 05	SN74LS280N	1 75	SN74LS424N	4 50
SN74LS38N	29	SN74LS124N	1 50	SN74LS181N	2 75	SN74LS283N	1 80	SN74LS445N	1 25
SN74LS40N	25	SN74LS125N	65	SN74LS190N	1 75	SN74LS290N	1 80	SN74LS447N	1 25
SN74LS42N	79	SN74LS126N	65	SN74LS191N	1 75	SN74LS293N	1 80	SN74LS490N	1 95
SN74LS47N	95	SN74LS132N	75	SN74LS192N	1 45	SN74LS295AN	2 20	SN74LS668N	95
SN74LS48N	95	SN74LS133N	39	SN74LS193N	1 75	SN74LS298N	2 20	SN74LS669N	95
SN74LS49N	1 09	SN74LS136N	40	SN74LS194AN	1 89	SN74LS324N	1 80	SN74LS670N	2 70

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SUPPORT		RAMS		ROMS		LM747CH	1 19	7912K	1 50	1BM	2 90
8212	2 20	2101	2 32	745287	3 70	LM748CN-8	0 45	7915K	1 50	4BM	2 90
8216	2 20	2102L 4	1 20	745472	12 90	LM748CH	0 46	7924K	1 80	CMOS	
8224	2 80	2111	2 32	74570	8 00	LM1458H	0 72	OIL SKTS		CD4011	0 15
8226	2 20	2112	2 46	745473	12 48	LM1458N 8	0 48	8DIL	0 14	CD4040	0 79
8228	4 20	6810	4 08	745474	12 48	LM1488D	0 85	14DIL	0 15	+ full range	
8238	4 20	8154	8 18	1/0		LM1489D	0 85	16DIL	0 17	MISCLE	
8245	11 00	2114	5 50	2513	7 50	LM1489AD	1 25	18DIL	0 24	2513	7 50
8246	11 00	2102L-3	1 60	96364	10 95	LM1495N-14	0 99	20DIL	0 27	TMS6011	5 00
8251	5 00	74C920	11 00	1412	12 90	LM3302N	0 65	24DIL	0 30	MC14411	12 00
8253	11 00	74C921	11 00	LINEARS		LM3401N	0 65	28DIL	0 36	MC14412	12 90
8255	5 00	74C929	11 00	LM301AH	0 39	LM3403N	1 20	48DIL	0 50	96364	10.95
8257	11 00	4027	11 00	LM301AN 8		LM3900N	0 54	CRYSTALS		CPUs	
8259	12 50	4044	14 70	LM (MINI DIP)	0 30	TL080CP	1 49	100K	3.00	8080	6.33
8292	18 00	4045	9 15	LM308N	0 99	TL081CP	0 69	200K	3.70	6800	10.00
6820P	4 50	4060	7 00	LM309K		TL082CP	1 29	1MHZ	3 60	80	8 00
6821P	4 50	2107	7 80	LMT03	1 45	TL083CN	1 65	100BK	3 50	80A	15 00
6850P	4 60	4116	8 00	LM311H	1 29	TL084CN	1 69	184K	3 00	8085	12 95
6852P	5 50	4118	20.00	LM318H	2 25	VOLT REGS		2MHZ	1 50	6502	8 00
AY-5-2376	11.50	Z80P10	10 00	LM323K	6 00	7805	0 90	2457K	3 05	SCMP II	10.00
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M57109	12 43	Z80AP10	14 00	LM339N	0.54	7815	0 90	3MHZ	3 05	9900	30 00
M57160	10 00	Z80ACTC	14 00	LM555N	0.30	7824	0 90	4MHZ	2 10	W WRAP SKTS	
M57161	10 00	EPROMS		LM556N	0 75	7805K	1.50	4 43M	1 00		
TMS6011	5.00	1702	6.00	LM709CN	0 37	7812K	1 50	5MHZ	2 70	8DIL	0 20
81LS95	1 30	520K	8 00	LM723CH	0.58	7815K	1 50	6MHZ	2 70	14DIL	0 35
81LS96	1.30	2708	9.00	LM723CN	0 43	7824K	1 50	7MHZ	2 70	16DIL	0 42
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16x2114 only £79				LM741CN-14	0 33	7915	1.10	10MHZ	2 70	28DIL	0 74
8x4116 only £58				LM741CN-8	0 25	7924	1 10	10 7M	2 70	40DIL	0 95
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available separately as follows, prices include p & p

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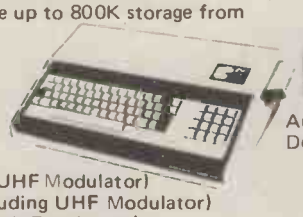

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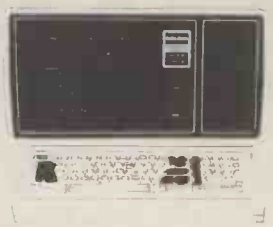

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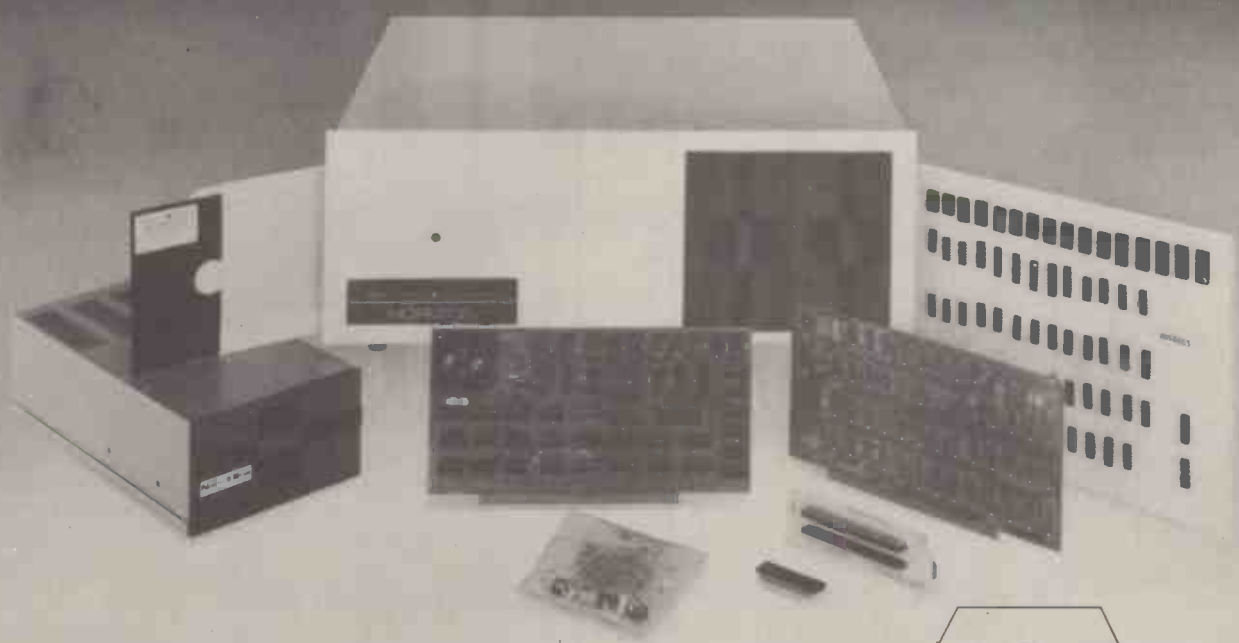

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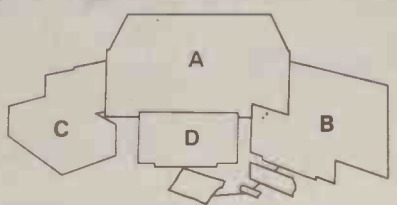

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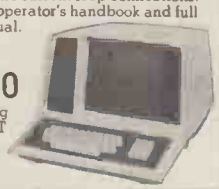

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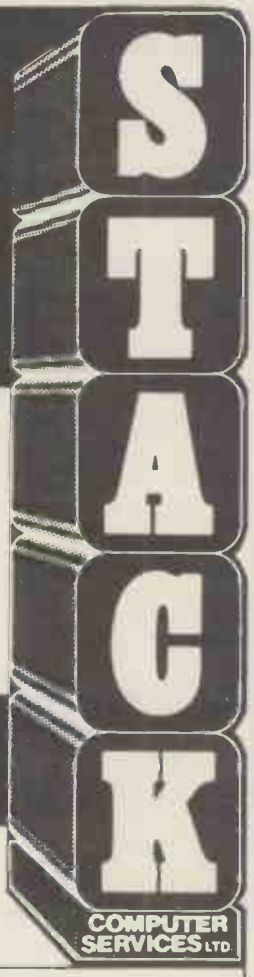

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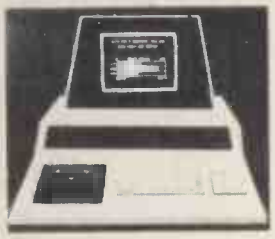

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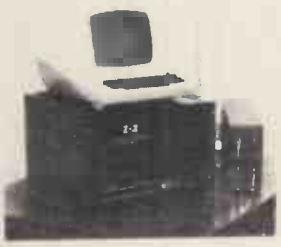

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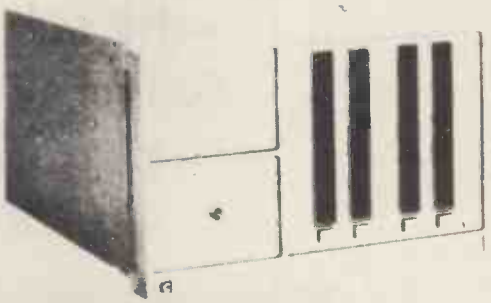

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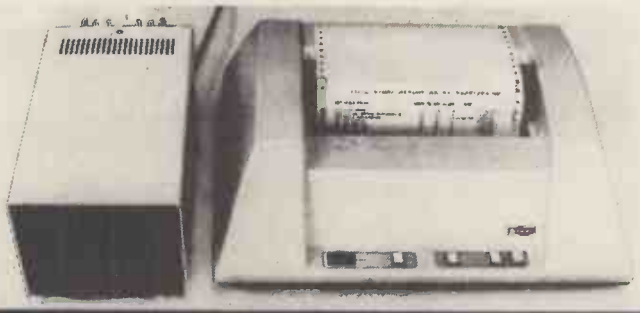

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NEWSPRINT

Newsprint (now incorporating What's New) is where Guy Kewney *reports the happenings of the micro world. Product news, rumours, gossip, prediction and speculation. . .read Newsprint and stay ahead of events.*

A quack one?

It sounds like one of those old-fashioned quack cure-alls that relieves constipation, removes tar from teeth, dissolves kidney stones *and* cleans your spectacles. It's a £200 kit that uses either the Zilog Z80, or the Texas 9980 micro, and you can pull out one chip and replace it with the other, whenever you like.

My attitude is if it's true, I want one. There are few enough opportunities to get a cheap computer based on the TI chip family; the least expensive I know of is a board made by a Birmingham firm Brandauer, based on the 9900, a chip which has a full 16-bit data and address bus. It's really meant for the system builder, not the amateur (by this I mean you need an expensive terminal to get anything into or out of it). At the same time, there are so few Texas users that I'd be nervous of buying a computer that used only that chip. . . where would I go for help when things got stuck? And so, the option of the much more common Z80 attracts me.

So much for attitude, but what is it we're talking about? According to the preliminary specification it's a big board, a "double double Eurocard", with the processor section on one side, and the TV scanning circuit and keyboard interface which together provide input and output, on the other. You can cut this side off, and put the processor side in a standard Eurocard slot, says the designer.

If you don't cut it off, this side provides a display on a standard TV, and reads from a standard typewriter qwerty keyboard. On the TV side, it gives 16 lines of 64 characters, with a modulator described as 'on-board channel 36 wide-band UHF'.

Data is stored on/or retrieved from an audio tape recorder. The designer has modified the Kansas City computer users' tape standard (CUTS) to transmit in 64 byte blocks, with error checking. This is very important, although it does kill the possibility of compatibility on software or data from other systems.

So much for the more interesting points of the boring detail. The designer also provides preliminary information on a similar level about software and memory mapping.

The really interesting bit is, how does he do it? From the fact that he recommends buying two forty-pin central processor sockets, both 'multiple insertion' types at £7.00 extra, you can safely deduce that he does not expect to plug the chips into the same socket. Just as well; it wouldn't work!

Yet, even allowing for the fact that the 9980 has a restricted data bus only 8 bits wide, rather than the full 16-bit bus of its big brother the 9900, there are fundamental differences between the Zilog and the Texas central processors.

For example, Texas provides an on-chip communications register unit which gives direct serial communications to outside teletype-writer devices. Can a system which is built round the Z80's need for universal asynchronous receiver/transmitters (UARTs) also accommodate a chip with a CRU output?

But hold it, you say: why are these questions appearing in print?. . .don't they know the answers?

No, not yet. The designer is one B.B. Leather of 1 Willow Way, Loudwater, High Wycombe, Bucks HP11 1JR. He has no traceable telephone, and our letter pleading for a chat had not reached him at press time.

By the time you read this, the mystery will have been resolved. Watch this space!

As you were

We described the Philips MDCR as a diskette in the September issue. It is, of course, a cassette – a mini-cassette, in fact, as Philips rep Vic Drayton has been quick to tell me. He also points out that the bare device includes only read-write and motion control circuitry; software is needed for search ability, and a bit of logic for phase encoding; It is now available from two distributors: Swift Sasco of Gatwick Road, Crawley, tel: Crawley 28700; and Tekdata Electronics of Federation Road, Burslem, Stoke-on-Trent, Tel: Stoke 813631. It will be visible at Compec, the Wembley show, in a Pelco displayed Aim 65 system. Thank you, Vic.

Sybex training system

From America, the publishing company Sybex has 'published' a computer. It costs $300, and from that you can safely deduce that in the UK it will cost quite a bit more than £150.

Making this computer, (which uses the 6502 microprocessor) different from any other 6502 micro, is the fact that it is sold as a self study training system. Packaged with the machine – it looks astonishingly like a Sym 1 – are two books and two cassette tapes. One book is Programming the 6502, published by Sybex, and my friend Robin Bradbeer of the North London Poly tells me it is a good book. The other is a 6502 Applications book, also published by Sybex. On one tape, there is software, and on the other, a voice (probably human) giving instructions on how to use the board.

I'm afraid, on the basis of this information, I can't tell you why you should buy this package, rather than getting hold of the books separately, and buying a £75 Acorn which can be built up into a Eurocard system. If I hear of reasons, I'll print them. Sybex is at 2020 Milvia Street, Berkeley, California 94704.

Memory aid

Intel's 2118S

A memory chip from Intel – just another 16K RAM, it would seem – is in fact being offered as a boon for the memory designer. The part is called the 2118, and it contains 16K bits, each addressable separately and singly. That means you need eight chips to make a useable memory for a machine with an 8-bit data bus, and you get a minimum of 16K bytes.

What makes it special, says Intel, is "It is the first 16K by 1 (ie singly selectable bits) RAM to operate with a single 5V power supply and to offer very low levels of power with 150 mW drawn in operation and 11 mW on standby". It is voltage and pin compatible with future 64K bit RAMs, so boards designed with this will carry four times the memory – that is, at least 64K bytes – when the 64s are out. But not this year. Intel also says that this chip is designed to work with its 8202 dynamic RAM controller, which makes it as easy to use as static RAM.

Sybex training system

Tandy trick

Cramming 117,740 bytes onto a Tandy diskette with capacity for 89,600 is a trick done by software from AJ Harding (Molimerx) by the simple expedient of deciding that all the information on a Tandy diskette is BASIC (and therefore is not truly eight-bit hexadecimal code, but upper case ASCII – which can all be stored in six bit codes, not eight). Together with this new product, a new word: "as with the regular system this buffer can be configurated as you wish". One can only offer sympathisement. Details from Bexhill (0424) 220391.

Floppy Power

Power supplies for floppy drives are not included in the average computer kit. You can make up one, or you can buy one, now, from HAL computers of Weybridge tel: Byfleet (09323) 45421.

Floppy PSUs

Owl's lisp

A new language? LISP is that, and costing £40 from Owl Computers it's probably a worthwhile experiment. Devotees claim that it's not so much a high level language as an assembly language for a high level machine, plus software to make your computer imitate that high level machine. Owl's version runs on the Apple II; it is supplied on disc or cassette, occupying 6K bytes of code, with a 44 page manual for a 16K byte or larger computer. Two demonstration programs are included.

It is aimed at "hobbyists who want hands on experience of the fundamental language of artificial intelligence research", amongst others. Owl is in Bishops Stortford, on 0279 52682.

Mass erase

You may never need to erase 104 programmable memory chips under ultra-violet – in fact statistics seem to show that most users of this form of read-only storage do just that – read only. Nonetheless, it may be worth your while knowing somebody who can cope with 104 at a time, because you may want to erase a u-v-e PROM that is soldered to a large board. That board will fit inside the big 100T PROM eraser now marketed by Microsystem Services. It's a fair bet that anybody who shells out the cost of a 100T will welcome the chance to recoup a bit by running an erasing service occasionally so if we hear of a sale – to a careless manufacturer of big EPROM systems who has to call back several thousand faulty boards, – we'll let you know. Meanwhile, back to the sun-ray lamp and guesswork timing. . .

Friends of Pascal

People take languages very seriously, and nobody likes to hear his mother tongue insulted. Not surprisingly, then, the language Pascal found itself amply provided with friends when a slightly negative comment was made by Abacus, about the package as supplied by the University of California at San Diego. (UCSD).

Oddly, Derek Rowe of Abacus was not attacking Pascal; he was announcing that it was available on a system he sells – the TEI system. Rowe's original comment was apparently designed to please Pascal freaks: he said that in the UK the demand for Pascal is very tentative, and that he found this reluctance rather disappointing.

He then blotted his copy book by warning the unwary that UCSD Pascal is not really suited for the amateur until it has been processed from its raw state into a purpose built package for a particular machine. Some exception has been taken! Those who 'speak Pascal' already, long to see others doing so too, and get very annoyed at anyone who seems to doubt their missionary zeal.

Yet the warning is worth repeating. What Rowe was trying to say was simple: if the inexperienced, BASIC-only programmer gets hold of the UCSD package, he won't have a clue how to select and tailor those portions that are dependant on the logical shape of your own computer.

"Most people who are looking to Pascal to give them a step up from BASIC are not systems programmers." Rowe said, "and if they were, they wouldn't be looking to Pascal, but to assembler. I think all serious programming should be done in assembler."

UCSD has now handed over the marketing of its Pascal to Softech, a US software corporation which is not required to be a non-profit outfit (UCSD was having tax problems over the success of Pascal, it seems). It remains to be seen what shape the product will take in their hands, given a stronger marketing drive. Meanwhile, Abacus is at 62 New Cavendish Street London W1M 7LD.

Off peak cheek?

The whole basis of the micro revolution has been the fact that you can have your own microcomputer for less money than the cost of a share in a large computer. So it takes a special kind of nerve for a London bureau to announce an 'off peak' time sharing service – for hobbyists. The bureau, Computer Time Sharing Services (CTSS), is prepared to let you use its machine for about a pound per hour. Quote from George Hertz, manager of CTSS:

"At these prices, many computer hobbyists will find time sharing more economical: all a user needs to get on to our system is a terminal with an RS-232C or V24 interface, a modem or acoustic coupler, plus his telephone. All this can be rented, or it can be purchased for less cost than most hobbyist computers. Yet it gives access to a system that is very much more sophisticated. No longer is data storage restricted by the limitations of cassettes or small floppy disks; the CTSS user can have many megabytes of online data storage for instant access."

All of which is very largely true. Exactly what it proves about the price of hobbyist systems in this country is probably unprintable. Until things change, CTSS is on 01-590 1155.

Switch to bits

A sub-miniature rotary encoder switch which will convert its ten positions into a four-bit binary code from 0 to 10 – or rather, from 0000 to 1010 – has been produced by Impectron. You could use it as a monitor select switch, or as the simplest form of direct input to a system. Alternatively you can set it so that when it points to 5, it gives out 1100 instead, and so introduces a whole new series of bugs! Details on 01-992 5388.

Solderless

Experimenters who do not rate their abilities as soldering operatives very highly will be pleased to see three 'solderless Breadboard units' from Lektrokit: two terminal strips, and one distribution strip. They have an adhesive on the back, or can be screwed down if you prefer. Details: Reading (0734) 669116.

Connections

Having brought Lektrokit's solderless breadboard, you can also buy a kit of wires to connect components together. Each kit has 350 wires, comes in a neat box, and has fourteen different lengths, insulated, bent over, and ready to push into the holes.

Photo-save

Your computer has just output a screen full of data onto a television. You know that if you write it down, you will acquire at least one error, and you can't afford any kind of printer. What do you do? Well it may seem obvious. . .

you take a camera and photograph the screen. A special Polaroid camera costs £128, and the supplier, John Davidson of GDS Ltd, will sell you a special hood to cut out reflections, for around £150 – or he will give you free designs and let you build your own hood. Phone Cambridge (0223) 51645 for details.

Star bores?

American software for Apple II computers is sold with a certain lack of style that makes it irresistible. Virginia company, Soft-One, has announced a two-volume package at $15 for each, with over a dozen programs on each volume.

But do we need things like 'Clock – turn your $1200 computer into a $5 clock with this program' and 'Story Teller tells simple stories; you supply the characters and the subject matter. Each one different' and 'Starwars – put the computer away Luke, and let the force be with you' and stuff? Yes? Somebody import it, then!

Coloured acorns

A colour computer for under £200 can now be put together from Acorn parts. Some may think it almost impudent of Acorn's Chris Curry to announce a colour video display board for his £65 kit (£75 built) and apologise for for the fact that it costs £88. Veterans of the hobby business may recall, somewhat wryly, that it was the PAL colour output board which Apple told us, here in Europe was responsible for its high price compared with the US price. (PAL is the system of colour television we have, and it is much better than the US system, which is NTSC – that's all you need to know to enjoy the fight).

Acorn is 'cheating' a little by using the Mullard teletext chip for colour characters and graphics, and there is a hidden extra: £12 for a UHF modulator board to provide a signal that the aerial socket will be able to tune in to. It's not a lot of money, though. Hidden extras are on the positive side too: the Acorn board can also give you a light pen facility.

Quest micropad

For computer users who can't type, a hand-writing reader in the form of an intelligent writing pad has been announced by Quest. Originally the Datapad was a large minicomputer hidden under the table, watching the position and direction of movement of a pen on a pad. It was good, but the minicomputer cost several thousand pounds, and it didn't do anything with the information; it just turned it into the sort of output you would normally get from a keyboard.

Not surprisingly, the original Datapad did not take the world by storm. Its little brother may do. It has a microprocessor built into the pressure sensitive pad – the micro is the Texas 9900. It's a lot cheaper, and, says the Quest subsidiary which makes it, every bit as good.

Micropad recognises the full English alphabet, with alpha, numeric and special characters 'allowing for a wide tolerance in style and shape'. You need not interpret this as implying that it will cope with a scrawl, because it won't; there is a little display to show you what it thinks you have written, and that display isn't there just for show. It makes the occasional mistake even then. The Micropad also recognises where on the form you are filling in, you have entered data: so if the computer is properly programmed, you can enter (say) '33' under Age, '38 Bloggs Drive' under address, and the machine will interpret this correctly.

Kits and bits

Kits and bits will be on show at the 'kits and bits' show, Breadboard '79 this Christmas. Last year, the first Breadboard attracted several microcomputer companies despite fears that it would prove to be the normal concoction of metal detectors and bad

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amplifiers, loved by electronics experimenters. This year the organisers, Trident Exhibitions, say over 90 exhibition stands will feature "microcomputer systems, analysers, logic test accessories, hi fi amplifier kits, modulators, etc, as well as a variety of exciting construction. . . ." (oh well, what do you expect. . .) "kits and TV games. . .visitors can construct their own lie detectors."

Trident, you should be warned, is a company with an uncanny knack of turning an exhibition into an astonishing success. The last one I know of was Compec (now owned by IPC).

At this stage, the alphabetical list shows Acorn, Commodore, Compshop, Crofton, Henry's Radio, Lektrokit, Lotus Sound, A Marshall, Microdigital, Newbear, Transam and Vero as the more obviously computing exhibitors. The dates are December 4 to 8, Tuesday to Saturday; and the location is Royal Horticultural Halls, Elverton Street, Westminster.

Better BASIC structure

An 'extremely advanced' version of the BASIC language, called Structured Basic, is available from the big S100 specialist distributor, Comart. The company introduced this new software tool as a way of allowing programmers to write structured (good) programs, rather than unstructured (bad) programs. Commands such as REPEAT, WHILE, IF...THEN...ELSE..., and PROCEDURE are believed to make clear program design easier: they do not make it inevitable, however, and you can write as badly structured a program as anybody – even using Structured Basic!

Pascal for Elf

An unusual microprocessor, the RCA Cosmac 1802, has acquired a Pascal system through the Bicester firm, Golden River, which specialises in this device.

The micro is extraordinary in many ways: chiefly there's its use of complementary metal oxide silicon technology. This takes very little current, and makes it possible to run quite large systems off a dry cell battery. It's also noteworthy for having an assembler language which makes Motorola and Intel assemblers look like voice recognition. The advantage of its fiddly assembler has always been that frighteningly efficient programs could be written, using only a little memory.

In the days when nobody could afford Cmos memory to go with the Cmos processor, that was an important advantage, and a Pascal system that needed 20K bytes of memory would have been meaningless for most amateurs. Now, however, Cmos is much cheaper, and even more important, standard dynamic memory chips are being sold that use as little power. All this is good news for users of the cheap Elf system, and eventually, the availability of Pascal will be reassuring to them. Golden River is on Bicester 44551.

Elf prices down

Most of the items in the Elf II range have now been reduced in price. The Giant Board is £37.80, the 4K Static RAM board is £75.60, the ASCII Keyboard, £54.63 and the Kluge Prototype Board, £13.82. A video graphics board will be available soon, as will text editor, assembler and disassembler on cassette. Enquiries to HL Audio Ltd., 138 Kingsland Road, London E2 8BY (01-739 1582).

DIY fibre optics

Do-it-yourself fibre optics for experimenters has been announced by Burr-Brown, the analogue to digital company in Watford. Two packages are available, each with sufficient parts to form a complete link with the addition of a power supply and TTL level signals. The difference between them is speed. Details on 0923 338337.

Look alike

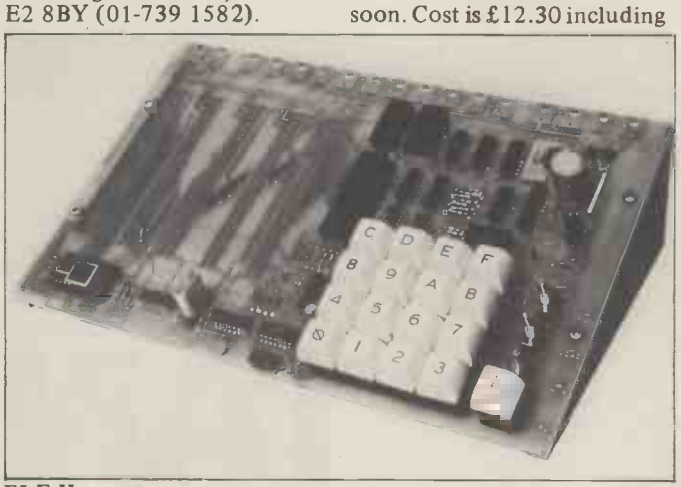
Could Japan have struck at the hardest nut of all, the TRS-80? Being the most common computer in the world, a Japanese imitation makes sense, and a Matlock based company, Lowe Electronics, may have found one. They call it Genie and expect to sell it for £500 without video monitor. Supposedly, it runs all TRS-80 software.

Danish soft

Denmark's personal computer industry has software for us. From a company called Lisco Micro Data in Kolding, comes a package of languages including Focal, Tiny BASIC, and some applications, aimed at users of the 6502 microprocessor.

Gunnar List claims that his Tiny BASIC will run in 4K byte systems on Kim-1 and Sym-1 from Commodore and Synertek, with a version for the Rockwell Aim 65 due out soon. Cost is £12.30 including tape and manuals.

Focal costs more – £13.20 for the standard language interpreter, £17.60 for the extended interpreter, £4.70 for a mini manual and £9.40 for a 'user manual'. My typewriter won't cope with the subtleties of the Danish spelling, but as near as I can manage is: Lisco, Aprilvaenget 6, 6000 Kolding. The phone number is (05) 56 86 82.



ELF II

From the Centre

A British system builder has joined the long list of American names offering systems based on the standard S100 layout. This is a £3,000 machine, so isn't for the user at home unless the user happens to have a generous employer.

The company, Computer Centre, is well known for the low prices it charges (especially on components such as memory boards) so it isn't surprising that boss Peter Norman has offered a 'basic kit form version for the scientific builder' at under £1,000.

The big machine is the OEM 2, with dual diskettes storing 2 million characters of data, a full 64K bytes of internal memory, and built-in software including the well respected CP/M operating system. This will allow the user to expand his external storage to 128 million characters without confusing the computer.

The basic kit version has only one diskette drive. Computer Centre is now in Swansea, at 9 De La Beche Street, Tel: 0792 460023.

Tape basic

Very probably, most people who move from tape cassettes to diskettes could manage quite well on tape, if only the data loaded into the computer or stored out onto tape, were less liable to be wrong.

Nascom software expert Tony Rundle, now with his own company, Starbase, has added an error checking system to the way that computer handles mag tape. It comes with the new version

of BASIC for the Nascom 1. . . . only the Nascom 2, when it is available, will have BASIC as standard on the board. Rundle says that he was virtually forced to design a checksum cassette handling system because there was no other way of loading an 8K byte program.

Tape Basic costs £30 from Nascom itself; Tony Rundle is prepared to help and advise from his address at Waxhouse Gate, 15 High Street, St. Albans, Herts AL3 4EH.

From Japan

Diskettes from Japan are to be marketed in this country by a new company: DRG Business Machines of Weston-super-Mare. Both five inch minifloppies and full 8-inch floppy drives are offered, data compatible on 8-inch with IBM drives. Details of these and a controller for the 8-inch, on 0934 415398.

Please help

Ian Litterick was astonished to find that when he was first infected with the desire to become a computer owner, there was nobody to ask about pros and cons of different systems. Ian, a consumerist by nature and by training, instantly wrote off to MPs and civil servants suggesting that here was a hole that needed to be plugged.

"If you want information on big computers," he noticed, "you go to the National Computing Centre and pay for it. But if you want information on a micro, the sort of money the NCC wants for giving help can be almost as much as the micro."

His idea is a national Microcomputing Centre; and by dint of being a lot more energetic than the rest of us, he has bullied the NCC into studying the idea, and providing money for the study. The Department of Industry provides half the cost.

Litterick is compiling the informed opinions of people with informed opinions. . .he has even asked me, for example. That can't be good enough. So, readers, please help with advice. What has been most lacking when you were making your purchase decision? Would it help if the NMCC existed and put out a 'preferred specification' against which you could match your requirements, and compare prices? Send your opinions to PCW, or, if what you have to say is too harsh for our ears, to the NCC, which is at Oxford Road, Manchester M1 7ED.

Pet sophistication

Pet owners usually go for the Pet in the first place because it has BASIC: after a while, they start wanting to do more sophisticated programming. The Pet Machine Language Guide, from Abacus Software in Michigan (not to be confused with Abacus Computers in the UK) is aimed at these ambitious people. Cost of the guide to us Britons is $8.95.

Included are sections on using the Pet's input and output routines, clocks and timers, floating point, fixed point, ASCII number conversion routines, and other complex arithmetic functions. Payments by Visa card is accepted; Abacus is at PO Box 7211, Grand Rapids, Mich 49510.

Cash in hand

It's competition time, and both Peterborough and the National Research Development Corporation have thousands of pounds ready to give away to those with bright micro ideas. Peterborough has a total of about £40,000 (that includes a free factory for a year in Peterborough). There are lots of details, musts and must-nots, all available from the organisers at Peterborough Council, and at the NCC respectively.

Superbrain 2xZ80

Causing some interest amongst enthusiasts with £3,000 to spare, is a computer that uses two Z80 micros. The Superbrain, as it is called, uses the second micro to control data coming in from the outside storage (two floppy disks) thereby speeding up the whole process.

The basic system is pretty big with a full quota of memory (64K bytes) and a wide variety of output methods. It will talk to standard computer terminals using the V24 protocol, and will drive an ordinary S100 bus from its S100 output port. Software includes the standard CP/M operating system, so the whole CP/M user library should be accessible to the user. The supplier, Computrade, is on Leatherhead (03723) 77374.

Superbrain – 2XZ80

Comma to you

Comma Computers is now officially the name of Computer Marketing, the company which got itself known as a terminal supplier, and moved into micros by selling American ICS micro courses. News of micros with the Comma label has been given in the past, and the company felt that to have the same name for computer and company would 'give a clearer, crisper image to the combined operation'. It all arises out of Computer Marketing's takeover of Micro Software systems in July; the Companies Registrar is blamed for the delay in changing names.

Comma managing director George Macfarlane has astounded his competitors in the terminal market with his willingness to stick his neck out; they speak of him in hushed tones because of his willingness to trust Decwriter's delivery promises; no doubt they will also shake their heads over his decision to sell the new Alpha Micro 16-bit system.

He says he plans to shift more than £7 million worth of micros and terminals in just over a year, "and we are celebrating the new name by announcing a novel microcomputer system called the Comma Copywriter". We look forward to seeing it, George, when can you bring it round?

Supermicros, but when?

The supermicros, computers that would give us 'all the power of a middle sized minicomputer like Digital's PDP-11/34, on one chip', are knocking on the door.

The most encouraging news is of Motorola's big chip, the 68000, now 'available' on an evaluation board costing £1400, The word 'available' is a wild exaggeration, of course, with around a dozen of these boards so far sold, and with the UK micro people proudly displaying chip number 1065. Obviously the machine is not yet available to just anybody, so when will it be?

The best bet, from the point of the private buyer, is that it will remain a rare beast for at least another year, maybe two. Again, from the private buyer's viewpoint, this doesn't matter a lot. The biggest restraint on any private system is not the power of the processor. It is a question of how much memory it can control – both internal, and external. The Motorola 68000 will be able to control some 24M bytes of semiconductor memory. . .that's more internal storage than most private systems have disc storage. Couple a machine of that power, with its full quota of memory – or even a quarter of it – to a big, 50M byte disc, and it will eat anything on the market for £30,000 today.

But the same could be said of the humble Intel 8080, if one were to spend a little time and ingenuity giving it memory management; with a 50M byte disc, and a virtual disc storage system, to give the appearance of having more than the maximum 64K bytes internal storage (a neat trick, and an old, well proven one), it too could eat most small business systems. The problem is not the speed at which the processor can process data, but the slowness

MSI 6800: At the root of every good system.

seed

Strumech Engineering Electronic Developments Limited
Portland House, Coppice Side, Brownhills, Walsall, West Midlands. Telephone (279) 4321

with which data gets into it. A big, fast disc makes many times the difference of a big, fast processor.

That said, the signs are that inside two years, Motorola, Zilog and Intel will be able to offer chips (and support chips) with 16-bit architectures that will be attractive to private users. Motorola's is agreed to be the biggest and best; many, however, have disagreed as to whether it was not over-ambitious, with its 68,000 transistors on an area of silicon measuring 246 by 281 mills. Is it just too small for today's semiconductor expertise?

The most convincing argument that says 'yes, it can be built' has just been produced by Rockwell. Rockwell had a design for a supermicro of its own; it was going to be a descendant of the 6502, and it was going to be called the Super 65. Rockwell has abandoned Super 65 in favour of taking on the 68000. In exchange for the design, it will give Motorola its bubble memory designs.

Rockwell's decision tells us two things. First, it is convinced that it can make the 68000, and so the prospect of Motorola making it itself becomes that much more tenable. (Ones and twos don't count; hundreds per day would barely be convincing.) Second, it tells us that Rockwell is equally sure that it has time to learn the recipe for the 68000 before Motorola has got it down to a fine art and can make them for $10 each.

Courses

A new micro consultancy which wishes itself to be known by personal computing enthusiasts is Microsystems Consultants. . .for the reason that they run courses based on the Rockwell Aim 65. The courses are approved by Rockwell agent, Pelco, in the UK.

Managing director Markus Moser says he would like to help companies "with little or no knowledge of microprocessor applications", to get them to take the plunge and develop ideas and projects. Moser says he is an engineer with a degree in communications, and has worked for large companies like SCM, IBM and Data General on mini and micro projects.

For details of the courses, ring Camberley 27417, and to take the plunge, contact Fleet 29627.

IBM on the move

"If there were any serious point to personal computing, then IBM would make a personal computer." Next time some computer industry know-all tries to put down personal computing as something for excessively open minded people – along with astrology and roulette systems – the comeback is a number: the 5105.

This machine will be announced by Christmas, and available at under £2,500 by Spring – in America at least. So says the California market research group Creative Strategies International (CSI) in a report costing some £500.

According to CSI, this will be the specification of the Entry Level System, or 5105 (assuming IBM doesn't change the name to prove them wrong): that's 500 nanosecond cycle time, BASIC and monitor in read only memory, a minimum of 16K bytes memory, built-in video with 960 or 1920 character screen, mag tape cartridge for bulk storage and slow printer built in.

Options will include a language called ACL in firmware, memory extensions to 64K bytes or possibly 96K bytes; diskette storage up to 2M bytes; add on matrix printers and software, including word processing. A later option may be a 5M byte hard disc – probably a mini Winchester.

For those who got lost somewhere in the middle of that, it would be a pick up and carry home system rather like the Pet, with a printer and a better quality tape drive, possibly a little more powerful, and certainly priced at the top end of the market for what it is. The add-on list would take the price to around £10,000, for a system that would apparently compete with others based on the hobbyist, S100 bus, although at something of a price disadvantage. Software packages could give it an edge, however, for those needing something more than the IBM badge.

Final goodie: it may have an S100 bus adaptor.

Sprint 5

Get it right!

Last issue I said that a British Company, A J Harding (Molimerx), was responsible for Tandy software addition, Infinite Basic. How wrong I was! Freddy Nichols of Optronics (who also handles the product) tells me that in fact it was written in the States by Ron Johnson.

At our show

Showing for the first time – and where else but at the 79 PCW Show? – are systems based on the Microstar 1.2 and 2.4 megabyte modules. Access Data are the appointed distributors and the two micro computer packages will have full software back-up for both word and data processing. For the stand demonstration, one will be showing the word processing capabilities of the 55cps Qume daisywheel printer, the other will be programmed for data processing using a Texas 820 dot matrix printer.

Access Data Communications are at 228 High Street. Uxbridge, Middlesex.

BENCH TEST

CHALLENGER C3 ~S1

At about the time that the 6502, 6800 and Z80 were emerging as the "big three" 8-bit microprocessors Ohio Scientific, Inc. began to advertise its solution to the problem of program portability. This was the Challenger CIII series — a range of systems centered on a novel MPU board which contained all those microprocessors and which could therefore utilize programs written to run on any one of the three. In designing this sytem, OSI have proved farsighted by predicting the decline in price of the actual processor chip relative to the accompanying hardware. To become really successful however, this scheme depends on the premise that people have a large number of assembly language programs which they need to transport from system to system. In the event, the arrival of BASIC (especially Microsoft's) and fairly widely implemented operating systems may have detracted from the original idea.

The Challenger III series offers a variety of memory sizes, peripherals and software configured around the basic board. Perhaps the most spectacular peripheral is the CD-74 74MB hard disc which comes with the top of the line system. Also catalogued are a voice I/O board, an A/D and D/A board, a multiplexing parallel board together with more standard serial and memory expansion boards. Also on offer are a variety of operating systems, starting with a simple DOS and graduating to a (not yet released) multi-user multiprogramming OS. CP/M is available, as are a Word Processing Package, Data Base Management System and a small business package.

The review machine, the S1 model, was a 56K RAM, twin floppy system with a Hazeltine 1410 terminal. Operating systems 65D, 65U, CP/M and application packages DMS (Data Base Management System) were provided on floppies together with most of the software documentation.

BY SUE EISENBACH

Hardware

The Challenger III model C3-S1 is housed in two cases, a light one containing the computer itself, and the other, heavier one, the disc drives. To open either box the cover has to be unscrewed. Both boxes are well ventilated. The computer has no fan and the operating instructions state that it should be run in an air-conditioned room with 6" clearance for ventilation. The fan in the floppy disc drive is small and noisy; attached to the box, for some reason it clatters when it is running.

The outstanding feature of any Ohio Scientific C3 computer is its CPU board. Called the model 510, it contains three microprocessors, the 6502A, the 6800 and the Z80. A software switching program is on the board so that choice of microprocessor is under program control. The PROM contains the 6502 and 6800 monitors as well as a floppy disc bootstrap. An RS-232 port, eight parallel lines and a clock (which supplies 4MHZ, 2MHZ and 1MHZ signals) are provided.

The memory comprises two to four OSI 520 16K static RAM cards. The fourth is only half populated, giving a maximum of 56K (as in the review machine).

The disc controller is an OSI

470 which can support 1 or 2 single or dual headed 8" floppy drives with soft sectored, single density recording format. Capacity varies from 230K Bytes to 290K Bytes depending on the operating system used. The disc drives are Siemans FDD 120-8.

There were problems arranging the test. The machine came from Computerland in Birmingham and travelled by train and van to reach me. It hadn't fared well during the journey. Inspection showed that not all of the PC boards were attached to the backplane of the computer. They could have been securely screwed down to the base of the box but this hadn't been done. After placing the loose boards back onto the bus and soldering up a few wires that had broken off in transit I turned my attention to the VDU. It failed to operate and investigation showed that a board was missing. Eventually, once equipped with a new VDU, the computer powered up successfully.

I experienced two hardware faults during testing. Firstly, the computer didn't always clear the memory when the reset button was pressed and secondly, when booting one of the CP/M discs, a few messages appeared on the screen and then the system crashed. This disc was however accessible (via the other CP/M disc) from the other drive.

My overall impression of the hardware was of a cleverly designed MPU board enclosed in a rather fragile mainframe.

System software

According to the sales literature, there are four operating systems for the Challenger III. The review machine was supplied with three:

OS-65D, OS-65U and OS-CP/M. OS-CP/M appeared to be a standard CP/M running on the Z80.

The other two operating systems were written by OSI and ran on the 6502. OSI do not provide an operating system to run on the 6800 as the fourth (a business/word processing system) also runs on the 6502.

65D is OSI's simplest operating system. It runs on any Ohio 6502 disc configuration (including those of the Challenger I and II) and is monitor type software. I was given two versions, one with BASIC and assembler, and one without. The disc without BASIC was designed for facilitating the execution of 6502, 6800 and Z80 machine code programs. It contains the operating system, a utilities package, I/O drivers and file handlers. The utility package provides software to use all three microprocessors. These include switches to the 6800 and 6502 monitors (in PROM on the MPU board), a Z80 monitor and Z80 and 6800 memory movers. For the 6800 there is also a MIKBUG simulator and 6800 LOAD and DUMP routines. MIKBUG itself cannot be executed on the C3 as it's not designed for such a large system. OSI explain how to alter MIKBUG programs for use under the OSI 6800 monitor and only provide the simulator for the execution of programs where there is no one available to do the alteration.

The utilities provided do not shield the user from the intricacies of data or processor transfers. To load 6800 or Z80 programs from disc the 65DOS must be entered, the utilities loaded, the program loaded and then the switch to the appropriate processor made. To save programs they must first be moved out of the way of the DOS, control switched back to the 6502, 65DOS booted in and finally the program saved. From

Disc drives unveiled. Notice the large opening in the back and small fan on the cover.

the documentation supplied, I could see no way of accessing disc files using the 6800. (The Z80 can access disc files under CP/M).

The second 65DOS disc supplied booted in BASIC along with the operating system. The BASIC utilities supplied are not provided with a 'LOAD and GO' facility and have to be explicitly executed — e.g. to see the disc directory one types RUN "DIR", to create a file RUN 'CREATE'. There are two ways of saving a BASIC program. The first is to exit from the BASIC system and then PUT the program onto a specifically named track (overwriting anything that might be there) and return to BASIC. The second method is to create a file before typing in any program. When creating the file its size must be declared and, unlike the previous method, the new file will be placed in free space. The user then types in a program and saves it in the usual manner. If the program is larger than the space allocated, nothing will be saved. In addition to the BASIC this 65DOS disc had an editor/assembler. Unfortunately no documentation was provided for these so I could not evaluate them.

The other OSI operating system provided, called OS-65U, is a BASIC only system. In most respects it felt like OS-65D with the BASIC booted in. The data file facilities under 65D are not as comprehensive as those under 65U. Both however have random and sequential files; in addition 65U has indexed sequential files and a FIND command.

The two operating systems are sufficiently similar that it is surprising that Ohio Scientific decided not to write one operating system with the features of both.

Basic

Each operating system came supplied with a BASIC — 65D and 65U BASIC occupy 9K. This includes 8K Microsoft BASIC and 1K of OSI add-ons (primarily file handling). The CP/M BASIC occupies 19K and is a slightly pared down version of 20K (Altair) Microsoft BASIC. Microsoft's BASICs are the industry standard and are upwardly compatible. Unfortunately OSI's file handling facilities are not the same as those written by Microsoft. The BASICs running under 65D and CP/M have comparable features (using different instructions) while 65U's are more sophisticated. The Data Base Management is written in 65U BASIC and utilizes its indexing instructions. For those readers with Pet experience 65D and 65U BASIC should seem familiar. In fact PET BASIC is easier to use with its screen editing.

65U BASIC contains a FLAG command which enables or disables a variety of system features, primarily error traps. Although there is no PRINT USING statement there is money mode output, which rounds to two decimal places with either left or right justification. File handling comprises: OPEN, CLOSE, PRINT%, INPUT%, INDEX and FIND. The INDEX is a pointer to a record in an open file which can be examined and altered. FIND searches from the current position of INDEX through the rest of the file for a given string (which can include 'don't care' characters). If found, INDEX points to the string; if not found it is set to 1,000,000,000.

TECHNICAL DATA

CPU(S):	6502A 2MHZ, 68B00 2MHZ, (Sic) Z80 4MHZ.
MEMORY:	32K - 56K STATIC RAM
KEYBOARD: SCREEN:	HAZELTINE 1410
CASSETTE:	N/A
DISC DRIVES:	2 DRIVES, 1 OR 2 HEADS PER DRIVE, 8" DISCS, SINGLE DENSITY.
PRINTER:	N/A
BUS:	OSI 48-LINE BUS
PORTS:	1 SERIAL, 1 PARALLEL, EXPANDABLE.
SYSTEM SOFTWARE:	OS-65D, OS-65U, OS-CP/M, WP-1B
LANGUAGES:	6502, 6800, Z80 ASSEMBLERS, BASIC, EXTENDED BASIC, FORTRAN, COBOL

The CP/M BASIC is a language you would expect to find on a machine in this price range. It has in line editing, PRINT USING statement, IF. . THEN. . ELSE, AUTO line number and RENUM.

I would have preferred more expansive error codes on all three BASICs ("OM IN LN 100"); fortunately the messages are the same. The tables with the BASICs reserved words should illustrate the differences between the languages. OSI claim that the 6502 is a superior microprocessor . . . after running the benchmark programs I don't see much between them.

Other software

Because CP/M runs on it, there is a large range of software available for the Challenger III. In particular, I was provided with two Microsoft compilers. . . one for 8080 Fortran IV and the second for Cobol-80. As these are completely standard (and good) software packages I will not describe them.

More interestingly, Ohio Scientific have written a comprehensive Data Base Management System designed to run under 65U O/S and aimed at the small business-man with no computer experience. OS-DMS boots in the DMS menu which is the first of several, the whole system being menu driven. The utilities, which can be altered by the programmer, are listed in the table below and show how comprehensive this system is. For security, passwords can be placed on any of the programs in the system. Unfortunately, the system might cause difficulties for a person without computer experience as most input is not checked for legality before being accepted. It is not difficult (contrary to statements in the documentation) to type in an answer that seems reasonable — only to get "SN IN LN 75" with no obvious way of getting back to the DMS system. Even when inputs are checked the user is just requested to type in another response — no range of acceptable data is offered. Before the non computer user would feel comfortable using this system, routines are necessary that buffer the operator from the programs and a rewrite of the documentation is needed.

CP/M BASIC with 65U & D marked U or D, B=Both

Commands:				
AUTO	CLEAR	CONT(B)	DELETE	EDIT
FILES	LIST(B)	LLIST	LOAD(B)	MERGE
NEW(B)	NULL(B)	RENUM	RESET	RUN(B)
SAVE	SYSTEM	TRON	TROFF	WIDTH
Program Statements:				
DEF(B)	DEFDBL	DEFINT	DEFSNG	DEFSTR
DIM(B)	END(B)	ERASE	ERROR	FOR(B)
GOSUB(B)	GOTO(B)	IF..THEN(ELSE)	LET	NEXT(B)
ON...ERROR	ON...GOSUB	ON...GOTO(B)	OUT	POKE(B)
REM(B)	RESUME	RETURN(B)	STOP(B)	SWAP
WAIT				PEEK(B)
Input/Output Statements:				
CLOSE(U)	DATA(B)	FIELD	GET	INPUT
KILL	LINEINPUT	LSET	NAME	OPEN(U)
PRINT(B)	PUT	READ(B)	RESTORE(B)	RSET
Arithmetic Functions:				
ABS(B)	ATN(B)	CDBL	CINT	COS(B)
CSNG	ERL	ERR	EXP(B)	FRE(B)
INP	INT(B)	LOG(B)	LPOS	
POS(B)	RND(B)	SGN(B)	SIN(B)	SPC(B)
SQR(B)	TAB(B)	USR(B)	VARPTR	
String Functions:				
ASC(B)	CHR$(B)	FRE(B)	HEX$	INSTR
LEFT$(B)	LEN	MID$(B)	OCT$	RIGHT$(B)
SPACE$	STRING$	STR$(B)	VAL(B)	
Input/Output Functions:				
			EOF	LOC
LOF	MKD$	MKI$	MKS$	

Extensions		
Both	**65U**	**65D**
IF...THEN	INDEX	EXIT
IF...GOTO	PRINT%	DISK!<STRING>
WAIT	INPUT%	DISK OPEN, <DEVICE>, <STRING>
	FIND	DISK CLOSE, <DEVICE>
	FLAG NN	DISK GET, <RECORD NUMBER>
	PRINT $R,X	DISK PUT
	PRINT $L,X	

DATA BASE MANAGEMENT SYSTEM PROGRAMS
Create New Master File
Create New Key File
Edit Master File
Load Key File From Master
Edit Key File
Dump Key File
Generate Mailing Labels From Master File
Master File Merge or Load
Diskette Copier
Multi-File Multi-Format Report Writer
Multi-Conditional Report Writer with Statistical Functions
Multi-Conditional Statistical Package
Sort a File
Master File Record Inserter
Master File Record Delete and Repack
Inventory
Order Entry
General Ledger
Personnel
Payroll
Accounts Receivable
Accounts Payable
Query

Benchmark

As well as running the Kilobaud benchmarks (see summary), I set up some disc tests.

These were run under OS-65U as Ohio Scientific state that this operating system provides the best file accessing facilities. All the files in these tests are 100 record files with 256 character records. Each record is composed of 8 fields (called A$ — H$). Tests 2 and 4 are designed to test the "randomness" of writing to and reading from files. If tests 2 and 4 take substantially longer to run than 1 and 3 then the operating system is probably using a sequential method for its random access.
Test 1. Fill A$ — H$ with 32 "A"s each. Open a datafile; using a FOR-NEXT loop write to records 0 to 99; close the file.
Test 2. As test 1 but writing the records to the file starting with the last record; that is the FOR-NEXT loop's step is -1.
Test 3. Open "Datafile" using a FOR-NEXT loop, read each

record out of the file, close the file.
Test 4. As test 3 but reading from the file starting with the last record.

Disc test 1	19.9
Disc test 2	21.9
Disc test 3	83.1
Disc test 4	83.1

Business potential

The Challenger III is designed for use both as an end user system for running application packages and as a development system. For either use probably its greatest selling point is its hard discs. No other personal computer system on the market offers the possibility of nearly 300M bytes of on line storage. With a Challenger III, software can be designed or purchased for a floppy disc system and then run with hard discs as capacity grows.

Business application

Looking at the Challenger III as an end user system, one ought to be able to run 6800, 6502 and Z80 packages on it. Unfortunately Ohio Scientific supply virtually no system software for running 6800 code. So either 6800 system software must be purchased first to run 6800 application programs or those packages purchased must be written in machine code. In either case, as standard 6800 MIKBUG code will not execute under the Ohio Scientific monitor, it is a safe bet that 6800 programs will not run without the attention of a system programmer.

Moving on to the 6502, Ohio Scientific have written three application packages. The review machine was only supplied with their Data Base Mangement System. It is a comprehensive package with the nice feature of optional passwords for reading and/or writing protection from unauthorized users. Unfortunately I had no difficulty in crashing (both accidentally and intentionally) DMS so any potential buyer should expect to experience some problems when it is first installed. The other two packages that Ohio Scientific supply are a Word Processor and a Small Business Package. Bearing in mind that Ohio Scientific's software is of variable quality, I cannot recommend software I haven't seen. In any case, I have serious doubts about the usefulness of the Small Business Package. It was designed in America, for an American market where business jargon is different and VAT is unheard of.

Inside the computer itself.

Benchmarks

	CP/M	65U
BM1	2.3	1.7
BM2	7.9	13.1
BM3	21	21.6
BM4	21	23.7
BM5	22.5	29.2
BM6	37.5	39.6
BM7	59.6	58.3
BM8	9.9	17.6

(processor timings in seconds)

Finally, turning to the Z80, the user should experience few problems. As CP/M runs on this microprocessor and most disc based British application packages run under CP/M, the situation is most satisfactory.

Development System

The Challenger III as a development system follows a similar pattern. Again the lack of systems software for the 6800 makes it difficult to use. On the other hand, the Z80 under CP/M gives access to a wide variety of system software. Translators for BASIC, FORTRAN, COBOL, PASCAL, Z80 Assembler and 8080 Assembler are on the market together with their corresponding debugging aids.

Looking at Ohio Scientific's own system software for the 6502 the kindest thing I can say is that it is of uneven quality. I have my doubts about the reliability of OS-65U. It crashed regularly throughout the period that I used it. Normally I would put this down to faulty hardware, but the system did not crash under CP/M and on the whole they use the same hardware. (I suppose there could have been something wrong with the 6502 chip itself). It has a few nice features such as a password system and good file handling facilities (including indexing) under OS-65U. On the whole Ohio Scientific's BASICs are less sophisticated than one would expect on a disc based system. It is also irritating to have three different BASICs each with its own advantages and disadvantages.

Summary

If a user either needs the large disc capacity or wants to run programs on more than one microprocessor, then the Challenger III has possibilities. If neither of these conditions apply, then the disadvantages inherent in the Challenger III probably outweigh its advantages. I cannot imagine the purchase of this machine for the developing or executing of 6800 programs. Ohio Scientific produce a less expensive range of computers, the Challenger II (6502 based only) for running their system software and Data Base Management System. There are a wide variety of other machines on the market that run under CP/M that are less expensive, more attractive and more robust.

Educational potential

I have my doubts whether the hardware is sufficiently rugged to withstand student users. Also the large number of cabinet vents might lead to objects, such as pencils, "falling into the computer". A rack mounted version would be more secure against such accidents.

I was told that it was a good machine for education because it allows students to use a variety of microprocessors. However, for the price of a C3 one can purchase a CP/M system, a PET and a single board 6800 computer. Although this collection doesn't provide identical facilities, it probably provides those features of the C3 that students would utilize, with scope for more "hands on" experience.

On the other hand, programming needs could well be met by the multi-user system with hard discs but again it is debatable, given the small BASIC, whether several stand alone computers would not provide a more reliable installation for the money.

Documentation

The documentation provided by Ohio Scientific Inc. was of variable quality. The OS-CP/M manuals (System, BASIC, FORTRAN, COBOL), written primarily by Microsoft Inc., are thorough, paginated, indexed and filled with examples.

The documentation that OSI

write themselves is more difficult to praise. Several of the manuals supplied were photocopies of preliminary versions, but even their final efforts are not impressive. Pages are only numbered within sections and there are no indices. The manuals are both repetitious and incomplete. There are very few programming examples and most of those are full-sized programs that are rather daunting to scan right through for a single question of syntax.

OSI seem to have difficulty in finding the appropriate level for each type of manual. For example in the documentation for OS-DMS (the Data Management System that is "immediately usable for the untrained small businessman") there is a glossary of terms with definitions such as: "Index — the index is the virtual field address of an entry field, record or file". In the midst of a technical discussion about the memory, the OSI technical writer, in an outburst of enthusiasm says, "520 memory is by far the finest semi-conductor memory available in computing, regardless of price, considering both its superb reliability and outstanding speed/power product".

On the whole, I feel a little tentative about reviewing a system whose characteristics risk being obscured by such documentation.

Expandability

Probably the largest personal computer system advertised is the Challenger III. A C3-S1 can be expanded to a full C3-B system with 768K bytes RAM, four 80M byte Winchester hard discs and 16 communication ports. Also announced is a multi-user version of 65U operating system.

Conclusion

When the Challenger III was designed, there was virtually no software on the market. At that time, people producing software had to program in machine code and so had a thorough knowledge of the operation of their microprocessor. It was a clever idea to place all the major microprocessors on one board, so that all available programs could be run. Unfortunately for the designers of the Challenger III system, software developments in the micro market have meant that programmers no longer need to learn machine code in order to use a personal computer. The overwhelming success of Microsoft BASIC, in which the majority of applications programs are coming to be written, means that the potential user who wants to fully exploit the C3 system will have to become more involved with the hardware than is necessary with other comparably priced systems.

My overall impression of the system was of a machine with some very clever ideas. However, I have the feeling that it was rushed into production, thus giving a rather ragged feel to the package. In particular neither the OS-65D and U system software nor the overall documentation are up to the standards currently available in systems priced upwards of £2000. The 74M byte hard disc system sounds promising but experience (with the Superboards) leads one to expect an element of delay between product announcement and eventual availability.

PCW would like to express its thanks to Computerland in Birmingham and the Byte shop in Ilford for the loan of equipment used in this test.

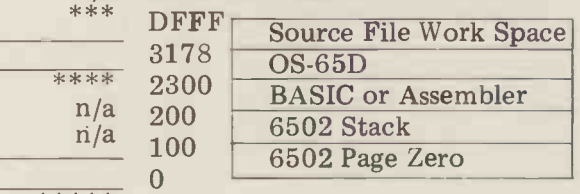
Prices

CS-S1	32K dual floppy in 2 cases with OS-65D	£2998
C3-OEM	32K dual floppies in 1 case	£2998
C3-A	48K dual floppies, 16 slot rack OS-65U	£4251
C3-B	C3-A with 74M byte hard disc	£9985
C3-C	C3-A with 29M byte hard disc	£7988
520	16K board	£ 385
	Centronics parallel interface board	£ 160
OS-65U	Single user	£ 200
OS-CP/M	With BASIC, FORTRAN and COBOL	£ 600
OS-DMS	Data Base Management System	£ 300
AMCAP	Small Business Package	£ 300
WP-2	Word Processing Software	£ 300

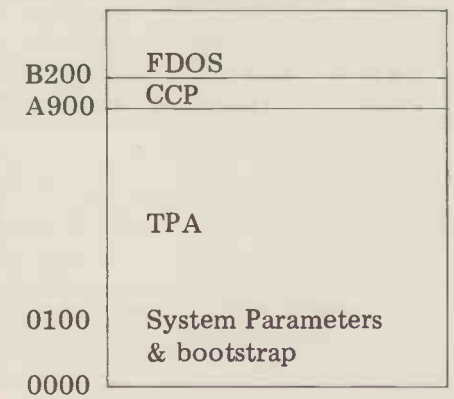
FIRST IMPRESSIONS	
Looks	**
Setting up	**
Ease of Use	***
HIGH LEVEL LANGUAGES	
BASIC (Ohio)	**
BASIC (CP/M)	****
COBOL	**
FORTRAN	****
PASCAL	n/a
System Software	***
PACKAGES	
Business	****
Education	n/a
Home	n/a
PERFORMANCE	
Processor	*****
Cassette	n/a
Disc	****
Peripherals	**
EXPANDABILITY	
Memory	****
Cassette	n/a
Discs	*****
Bus	***
COMPATIBILITY	
Hardware	**
Software	****
DOCUMENTATION	**
VALUE FOR MONEY	**

*****	excellent
****	very good
***	good
**	fair
*	poor

MEMORY MAP UNDER 65D



MEMORY MAP UNDER CP/M



EUROC

Simplicity is the watchword

EUROC is a new simple to use, fast, powerful micro-computer system for business. It's British, the program tried and tested.

EUROC is already being talked about by bankers, accountants and businessmen. See it on Stand 642 at the International Business Show at the National Exhibition Centre, Birmingham from 23rd October to November 1st, 1979.

EUROC hardware is manufactured exclusively for Euro-Calc Ltd., by Plessey Microsystems Ltd. **EUROC** will be on permanent display at Euro-Calc's branches at 55 High Holborn, London WC1 and at 224 Tottenham Court Road, London W1.

EUROC looks after your day books (Cash-Sales-Purchase & Nominal).
EUROC keeps your ledgers (Sales-Purchase & Nominal).
EUROC prints out your Statements and Remittance advices.
EUROC produces 8 vital REPORTS at your month end and to ensure you enjoy complete financial control. (I.E. Aged Debtors Report, Aged Creditors Report, Name and Address Report, Sales Analysis Report, VAT Report, Profit and Loss Report, Assets and Liabilities Report, Fund Report).

In addition optional Stock Control and Payroll programs will be available.

There are no hidden extras. EUROC's price of £7,995 ex. VAT includes-Hardware, Software, Initial Supply of Stationery and Binders - in fact everything you need to computerise your business including the 1st year's Maintenance Contract - nationwide service is undertaken by Plessey Microsystems Ltd.

EUROC

For further information and trade-distribution enquiries, talk to Peter Ingoldby, Managing Director, Euro-Calc Ltd., 55, High Holborn, London, W.C.1., telephone 01.405 3223 or Anthony Manton, Sales Director at Tottenham Court Road on 01-636 5560.

THE 2nd PERSONAL COMPUTER WORLD SHOW

1~3 November 1979 West Centre Hotel, Lillie Road, London SW6

Last year the vote was just about unanimous. . . The Ist Personal Computer World Show stood out above all others as Britain's major micro event of the year.

Now it's 1979 and although this time far bigger guns are being aimed at PCW's position of eminence, that in a way just makes us all the more determined to hold on to our first place. 'Bigger and Better' may be a hackneyed old phrase, but we are certain it will turn out to be an entirely apt description of The 2nd Personal Computer World Show.

We are happy to announce an over 50% increase in exhibitors this year — a sure sign of the continued growth of the micro industry. Indeed, so heavy has been the demand for site applications, the organisers have been forced to make special arrangements with the hotel to allow 'late-comers' to spill over into the foyer area.

Chess will again be a major highlight. Ever popular with the forces of the media, David Levy takes charge of the first European Microcomputer Chess Championship — and what an enthralling contest that promises to be. 'Chess-nut' or not, don't forget to come by for David's commentary of this titanic struggle between rival programs. By the way, the winning owner picks up a cheque for £1,500.

Of special interest, David Hebditch (who's also one of our Conference speakers) will be demonstrating communication between personal computers. The display will stand as the fruition of his 'On the Line' series in PCW in which, issue by issue, he has taught the rudiments of this exciting new activity. Will McLuhan's concept of a 'Global Village' be finally realised?. . . talk to David

Illustration by Hunt Emerson

and see what he thinks.

No PCW show could ever be complete without its accompanying 3-day Conference and this year's forum, with its carefully structured programme of subject matter, brings together some of the most skilled and knowledgeable speakers in their fields. Essentially the Conference breaks down into three main areas of interest. Day One caters for the businessman, Day Two for the industrialist and Day Three, the hobbyist.

Briefly, Day One looks at a businessman's decision to buy a micro, some possible uses for it, some first hand experience from a real user and, finally, an indication of the sort of return one might expect from the investment.

Next, the Conference switches tracks to look at the uses of microprocessors in the industrial environment. . . their place on the production line, their incorporation into the products themselves, the highly work-efficient world of the industrial robot and, to end, a session dealing with that thorny and emotive subject, the impact of micros on labour relations.

Day Three is 'hobby' day. First of all there'll be an overview of the current micro market, and that'll be followed by a look at the practicalities of dialling up other machines. The Conference then heads its way into the world of exotic peripherals and, to close, it strays across the Sci-Fi/Real Science border for a close-up investigation of the innards of fun robots.

Whatever else, The 2nd Personal Computer World Show is intended to be a family occasion. Usually that means, 'dad, bring along the kids and show them what it's all about'. . . in this case it probably means, 'kids, bring along your parents and show *them* what it's all about'!

There'll be machines on show, books and magazines for sale, packages being demonstrated, consultants consulting, advisers advising; in fact, you name it and — if it's anything to do with micros — it'll be there. If you've never ever attended an exhibition like this before, The 2nd Personal Computer World Show is the one you simply cannot afford to miss. . . SEE YOU THERE!

GENERAL INFORMATION
Venue:
West Centre Hotel, Lillie Road, London SW6
Hours:
10:00-19:00 Thursday 1st November
10:00-19:00 Friday 2nd November.
10:00-17:00 Saturday 3rd November
Admission (Show):
£1.00 (advance booking), £1.50 at the door.
Admission (Conference)
Thursday & Friday — £45 plus VAT
Saturday — £14, VAT inclusive.
(Both the above prices include entry to the show)
Access:
Underground to either Earls Court or West Brompton (Beware, the latter station is closed on the Saturday). Also buses — 30, 74 and 74b.

ACCESS DATA COMMUNICATIONS LTD & PRODUCTIVITY UNLIMITED — 47
228 High Street,
Uxbridge, Middx
0296 624887

A hardware supplier and a consultancy have teamed up to provide a complete service to the prospective micro buyer. The companies specialise in Microstar with Qume or Texas printers.

They offer business analysis advice, guidance and software packages which they will customise if necessary or they will write a bespoke system. They provide hardware and software support and are planning training courses.

ACT PETSOFT & PETSOFT SOFTWARE SUPERMARKET — 41 & 49
P.O. Box 9
Newbury, Berks
0635 201131

This company specialises in servicing the needs of PET users. They sell a wide variety of software packages including business, games and training. They also sell PET peripherals and add-ons such as disc drives, memory expansion and plug-in programmers tool kit.

On show will be a well-stocked PETSOFT software supermarket, demonstrations of their packages including a non-stop presentation of their PETACT business system. They will be showing their 800K PET disc drive and their new stock control system written for use with this drive.

APPLIED DATA EDUCATION SERVICES LIMITED — A9
Suite 304,
Albany House,
24 Regent Street,
London W1R 5AA
01-580 6361

This company specialises in educational packages designed for Apple, PET and Tandy machines.

On show will be their floppy disc based Little Genius self-instruction courses plus BASIC courses for the various machines.

B&B CONSULTANTS — A15
124 Newport Street,
Bolton, Lancs
0204 26644

This company sells hardware, software, support and training. They specialise in ITT 2020, Tandy, PET, Computhink and TECS equipment. They can hook up 2M Bytes disc storage to a PET if required. Their own packages include: Stock control, sales ledger, purchase ledger, nominal ledger and invoicing. A personalisation service is offered. Software is guaranteed and a hardware maintenance service can be provided.

At the show they will have their PET and TECS equipment running demonstration programs.

THE BYTE SHOP LTD 21 & 22
426/428 Cranbrook Rd
Ilford, Essex
01-518 1414

This company sells a range of hardware and software, both off the shelf and tailor made. They sell about 20 different machines. They also provide a software service through their sister company — Computer Aided Systems — which has been in the software business for 10 years.

On show will be a number of their more substantial systems aimed at the businessman. A range of financial and business packages will be demonstrated.

CS MICROCOMPUTERS A16
460 Cowbridge Road East,
Cardiff
0222 565012

This company provides hardware and software to your requirements. They cover England and Wales. Their speciality is in the North Star Horizon although they will provide other machines if required. They offer their own packages for collecting agencies, wages, stock control, sales statistics and word processing.

Meet them at the show, discuss your needs and see their hardware and software in action.

COMPELEC ELECTRONICS LTD 31,32, 33,35, 36
14/15 Berners Street,
London W1
01-636 1392

This company provides both hardware and software backed up by comprehensive support services. They sell both to end users and OEMs. The packages offered are designed so that the person totally without experience can customise them in a few days. Applications are: sales ledger, nominal ledger, purchase ledger, order processing and invoicing; stock control; payroll; personal records and fixed assets. These all include 3 days training. Special business applications covered are: estate agents, insurance portfolio management and mailing lists.

They will launch two new products at the show a 1MB,64K, VDU printer system and a word processing package which will also run their application software. They will also be showing Altair 300 systems — multiuser with 10 MB hard discs.

COMPSHOP LTD C3
14 Station Road,
New Barnet, Herts
441 2922

This company claims to be the largest discount microcomputer store in Europe. They stock Exidy, ITT, Compukit, TRS80 and PET products. They also sell software packages from PETSOFT, A.J. HARDING and APPLE. They have a service company called Compucare.

They will be demonstrating their basic range of machines and selling COMPUKIT UK 101. They will also be demonstrating colour add-on boards for this machine. The Video 100 and Hitachi monitors will be on display.

COMPUTER BOOKSHOP 3
Temple House,
43-48 New Street,
Birmingham B2 4LH
021-643 4577

A wholesaler of microbooks to the microcomputer industry, Computer Bookshop sells books from 8 or 9 publishers. They are the sole Sybex distributor for the UK.

A wide range will be on show including Sybex's books and cassette courses. They will also be bringing about 20 new books from Addison-Wesley.

3D DIGITAL DESIGN & DEVELOPMENT 8-9
43 Grafton Way,
London W1P 5LA
01-387 7388

3D are microprocessor interfacing specialists for industrial, medical and educational applications. They quote for custom interfacing packages which include both hardware and software.

On show will be their serial and parallel printer interfaces for the new Sharp MZ-80K, a wide range of industrial interfaces e.g. Analogue/Digital converters, Relay drivers and Numeric Control tape preparation packages for PET.

DATAC LIMITED A13
Tudor Rd, Altrincham,
Cheshire WA14 5TN
061 941 2361

Datac call themselves "The Printer People". Indeed, that is their speciality. They also sell floppy disc drives.

They will be showing most of their printer range and flexible disc drives. Printers on display will include: DB80 - an 80 column bi-directional sprocket feed matrix impact printer; 310 series, low cost 20 column printer which can be panel mounted or free-standing; and the 240/410 series of 16,20,32 and 40 column printers.

ELECTRONIC BROKERS LIMITED A5
49/53 Pancras Road,
London NW1 2QB
01-837 7781

This company specialises in the sale of secondhand computer equipment. The equipment is fully refurbished and offered with a warranty and full service backup.

They will be showing a range of low cost ASCII keyboards and accessories, floppy disc drives, monitors, papertape equipment and VDUs.

ENSIGN LTD 51 & 52
13-19 Milford Street,
Swindon, Wilts
0793 42615

Information not available at time of going to press.

EQUINOX COMPUTER SYSTEMS 45 & 46
Kleeman House,
16 Anning Street,
New Inn Yard,
London EC2A 3HB
01-739 2387

This company sells systems to scientific, business and educational users. The systems comprise hardware and system software and they offer a country-wide back-up service. They are well used to multi-user, multitasking systems incorporating hard discs.

On show will be their Horizon series 5000 and 8000, CP/M based with 5¼" and 8" floppies, printer and VDUs. Software will include BASIC, FORTRAN, COBOL, PASCAL, ALGOL, Assemblers, Text and Word Processing.

A.J. HARDING (MOLIMERX) 39
28 Collington Avenue
Bexhill-on-Sea
East Sussex
0424 220391

This company is one of the largest software suppliers for the TRS-80. Most of the packages are business and utility programs although they also sell some games. Their other activities include consultancy and custom design of systems.

They will be selling their more important programs at the show but, most of all, they will be there to meet their customers — both existing and prospective.

HEATH (GLOUCESTER) LIMITED 4
11B Bristol Road,
Gloucester GL2 6EE
0452 29451

Two years ago in the USA this company introduced 8-bit computer kits to hobbyists — this led to a lot of business interest so they moved on to ready-built business systems based on the 16 bit DEC 8/11.

Systems on show will be the WH89 — a 16K, 2 x Z80, integral disc plus VDU and the H8 — an 8080A based machine with an H19 intelligent VDU. A low-cost printer, the WH14 will also be on show.

ITHACA INTERSYSTEMS (UK) LTD 34
58 Crouch Hall Road,
London N8 8HG
01-341 2447

This company provides full technical and marketing support for Ithaca dealers throughout Europe. They sell a full range of IEEE S100 boards to OEM users.

They will be launching their DPS1 IEEE S100 mainframe computer, a PASCAL/Z compiler, a single board computer, a 16K static RAM board and an I/O board. In addition they will be showing a full range of S100 boards such as Z80 CPU, EPROM, video disc controller etc. . .

KATANNA MANAGEMENT SERVICES LTD. 54
22 Roughtons,
Galleywood,
Chelmsford,
Essex CM2 8PF
0245 76127

This company provides complete computer systems. They will install packages or tailor-made systems on any equipment although they do specialise in Tandy. They provide staff training and on-going post-sale support. They also sell a number of packages — both business and pleasure.

On show will be a range of software including the Apparat NEWDOS, their own packages and Tandy Business Systems. They will also have on the stand the Modata DSC-2 with 1.14M Bytes of floppy disc storage, a Hazeltine VDU and a choice of printers.

KEEN COMPUTERS APPLE DEALERS 13-18
c/o 5B The Poultry
Nottingham NG1 2HW
0602-583254

This is a network of companies comprising the Apple distributor and six dealers. They all specialise in Apple and its related hardware and software products.

They will have a 'hospitality area' at the show and will be presenting all normal Apple systems plus hard discs, speech recognition and synthesis, A/C controllers, supercolour for home TV, Business and games software and a hardware driven PASCAL.

L. P. ENTERPRISES C10 & C12
8-11 Cambridge House,
Cambridge Road,
Barking, Essex IG11 8NT
01-591 6511

This company distributes and retails books, magazines and microcomputer software. The software is supplied on cassette or floppy discs. Emphasis is on system software, applications and games packages.

On show will be a wide range of products. Specific items on show will be the Wordstar word-processing system and the new Cromemco Series Three operating system. This operating system is multi-user (up to 16), multitasking for any Z80 with 64K RAM and interrupt handling facilities.

LEXICON TRANSLATORS & ELECTRONICS (UK) LTD A10
Stewartson House,
691 Seven Sisters Road,
London N15
01-802 7970

This company markets the LK3000 — "your personal computer". This can be used as a computer or as a terminal. Different applications are contained on plug-in modules. There are 9 different language translators (with more to come), a calculator module, a computer terminal module, a user-programmable module and information modules.

At the show they will be exhibiting all the modules, including a Winter Olympics information module containing details of previous Olympic records. This also includes a stop watch facility.

LIFEBOAT ASSOCIATES A3
30-32 Neal Street
London WC2H 9PS

Information not available at time of going to press.

LONDON COMPUTER STORE 43
43 Grafton Way
London W1P 5LA
01-388 5721

This company specialises in microcomputer based systems for business users and software houses. They market and distribute the Pegasus — a Z80 based micro built by the National Multiplex Corporation.

On show will be a 10M Byte hard disc, a 2.4M Byte quad density 8" floppy disc drive and a low cost 80 column printer suitable for PET, Apple, TRS-80 etc. . .

LYNX COMPUTERS LTD A19
Rotherglen,
Gerrards Cross Road,
Stoke Poges,
Bucks SL2 4EJ
Fulmer 2572

This company serves "software cottages" around the country. They provide Apples to system writers who, in turn, produce systems to their clients requirements. These systems are then publicised and distributed to the other cottages by Lynx. Lynx themselves are also a consultancy.

On show will be 3 Apples. One with a daisy wheel printer attached for an embryo word processing system, another demonstrating standard commercial packages, the other demonstrating a stereo music synthesiser.

MBM (MICROCOMPUTER BUSINESS MACHINES) 38
4 Morgan Street
London E3 5AB 01-981 3993

This company is a wholesale distributor of the entire Ohio range. They offer engineering and back-up support. They also offer software — tape and disc based.

They will be showing the CI, CII and CIII. The CI will be cased and will include an extension board and a floppy disc drive. The CIII will come with a 29MB hard disc plus business and database software.

MEGAPALM LIMITED A12
"Downderry"
Halton Road
Nether Kellet,
Carnforth,
Lancs LA6 1EU
0524 73 3801

A small flexible software consultancy who cover the whole spectrum of pre- and post implementation activities. They do consultancy work, systems analysis, system design and program writing especially for the first-time user. They hold dealerships in Commodore and Computhink products and software packages. They run short residential courses in programming and allied topics.

They will be exhibiting a small business system at the show.

MICRO COMPUTER CENTRE 25
314 Upper Richmond West,
London SW14
01-876 6609

This firm offers PET based systems, either small applications for large businesses or large applications for small businesses. They offer a service from advice to designing and programming complete systems. They also sell standard packages which they are happy to customise. They supply PETs, Computhink products and any other PET peripherals.

On the stand they will be meeting clients, selling their range of hardware and software and demonstrating their business package.

MICRODIGITAL LTD A22-A24
25 Brunswick Street
Liverpool L2 0BJ
051-227 2535

From hobbyist kits to full scale business systems they supply hardware, software, support, books and publications. As well as selling packages they develop their own and are happy to custom-build to your requirements. They also offer a hire service — the cost of which is deducted from purchase price.

At the show will be books, a reed relay controller board for Nascom, some of their smaller systems and maybe even a surprise new computer???

MICROSOLVE COMPUTER SERVICES LTD 6
125-129 High Street
Edgware, Middx
01-951 0218

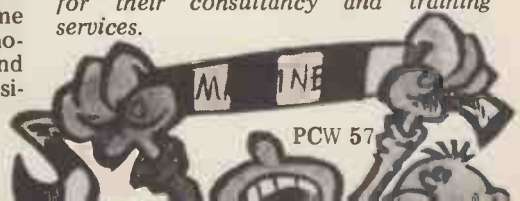
This company offers a complete service encompassing hardware and software sales. They will conduct business investigations, design systems and produce solutions. They specialise in 3 machine ranges — Apple, Microstar and Alpha Micro — plus, of course, the usual range of add-ons, VDUs, printers etc.

At the show they will be demonstrating some of their business packages.

MIKE ROSE MICROS 42
67 Nova Road,
Croydon,
Surrey CR0 2TN
01-688 6013

This company specialises in consultancy, training and programming services. They think that systems should be matched to a businessman's needs, and to this end they offer business analysis, hardware recommendations, system design, programming, an implementation service, training and full post implementation support. They will also arrange hardware support on behalf of their clients.

Meet them at the show. They will be happy to talk to prospective clients for their consultancy and training services.



NEWBEAR COMPUTING STORE LTD 11 & 12
40 Bartholomew Street,
Newbury, Berks RG14 5LL
0635 30505

They concentrate on the following machines: DPS1, Cromemco Series 3, Apple, North Star Horizon, printers, VDUs etc. Software is available for all these machines. The publication section boasts one of the biggest selections of books available. The components division sells chips, tools, kits, Jim-paks, UVEPROM erasing lamps etc.

They will exhibit all their machines, a selection of books and any tools, Vero boxes etc. that can be carried away by visitors.

NEWTONS LABORATORIES 19 & 24
123 Wandsworth High Street,
London SW18 4JB
01-870 4248

The computer division sells micros direct to end users and to OEMs. They sell their own software — order processing, invoicing, sales ledger, purchase ledger, nominal ledger and payroll. They offer full customer support.

They will be showing a 16 bit alpha micro with dual density dual sided 8" Shugart drives plus VDUs and a printer. They will also have 10MB and 90MB hard disc systems. They will be demonstrating their packages.

PERSONAL COMPUTERS LTD 30
194/200 Bishopsgate
London EC2M 4NR
01-283 3391
01-626 8121

This company is a long-established Apple distributor dealing in Apple and compatible products. These include Teksim, full size floppy disc drives, printers, analogue to digital converters and a wide range of software products.

They will have their full product range on show. Items of particular interest will be their Estate Agents software, their text processing package and the Milliken interactive medical education software.

PETALECT LTD 5
33-35 Portugal Road,
Woking, Surrey
048-62 69032

Last year they started selling PETS. They specialise in technical interfaces for the PET — electronic balances, spectrophotometers, light pens and so on. . . They produce the software and implementation service to back this up. In fact they are responsible for some very complex total systems.

See them on the stand where they will have weighing machines hooked up to PETs, lots of laboratory equipment, bar code readers, demonstration packages and a selection of Computhink products.

RAIR LIMITED 10
30-32 Neal Street
London WC2H 9PS
01-836 4663

Information not available at time of going to press.

RESEARCH MACHINES LIMITED 48
Chapel Street,
Oxford
0865 49792

A British microcomputer manufacturer, their product is the 380Z. The product is aimed at specialist markets such as research, education and the larger existing data processing user. They also supply system software. They offer systems and hardware support.

They will be showing 380Z based systems with a mixture of peripherals. On display will be a 1MB 8" floppy disc system, VDUs — both memory-mapped and standard, high resolution graphics with the possibility of a new colour board.

ROSTRONICS 7 & A18
118 Wandsworth High Street
London SW18
01-870 4805

They sell the Z Plus system, TRS80 and associated packages. They provide services from the initial investigation to programming plus training and full support.

On show will be their Z-Plus micro with its associated packages: Inventory, payroll, word processing, accounts receivable, and accounts payable. They will be showing the Paper Tiger printer, I/O boards, a double density, double sided disc controller and PASCAL-Z.

SOFTPRINT A8
The Vicarage, Kimpton
Nr. Hitchin, Herts
0438 832094

This company specialises in the production of tape-based magazines for the PET. They have just published issue 1 of their magazine "Lettercette".

On show they will have Softwriter — a new word processor for the PET, with full editing and format facilities.

THE SOFTWAREHOUSE A1 & A2
146 Oxford Streed
London W1
01-637 1587

They sell software, Apples and peripherals. They import, manufacture and distribute the software both wholesale and retail. They sell packages for almost every popular computer, covering a range of games and business applications.

They will be exhibiting "Be Wary" — a new game from the USA by Leo Christopherson. They will be showing other games, including the Creative Computing range. PET, TRS-80 and Apple machines will be on the stand.

STRUMECH ENGINEERING LIMITED 1 & 2
Portland House,
Coppice Side, Brownhills,
West Midlands
05433 4321

This company holds the UK agency for Midwest Scientific Instruments and are European Master Distributors for Smoke Signal Broadcasting and Micro-Term International Inc. They offer a wide range of machines for use in education, home computing and small businesses.

On show will be a new. multi-user BASIC interpreter and a graphic capability. Many microprocessors and peripheral devices based on the 6800 will be displayed.

TANDY CORPORATION (BRANCH) UK 26-29
Bilston Road,
Holyhead Road,
Wednesbury,
West Midlands
021-556 6101

Tandy are the manufacturers and suppliers of the TRS-80 computer. They also provide a wide range of perhipheral equipment. They will shortly open computer-only stores.

On show will be two new line printers, a voice synthesizer, a P2 Quick printer and the new TRS-80 Model II. Other items on the stand will be the TRS-80 model 1, expansion interface, printers, disc drives, system desk, software, voice synthesis peripheral and a range of books.

TRANSAM COMPONENTS LTD A6 & A7
12 Chapel Street,
London NW1
01-402 8137

Manufacturers and distributors of the British-designed TRITON system. They also sell firmware packages namely 7K Scientific BASIC and 8K TRAP — a system development package. . . They sell both wholesale and retail. Other products include components, books, connectors, cables, Ithaca products, Shugart drives and Compucolor.

3 levels of TRITON will be on show as well as Compucolor, Ithaca and Shugart drives. They will be running their home-grown software and firmware.

V & T ELECTRONICS 23
82 Chester Road
London N19 5DZ
01-263 2735

This company sells chips, cassette players and a relocatable assembler for Nascom. With its associated software the cassette can perform high speed, bi-directional, searching at data rates of around 5K baud.

On show will be a faster cassette mechanism (30K baud). They plan to have a cassette based BASIC which will provide the normal disc facilities but for cassette.

VERO ELECTRONICS LIMITED 40
Industrial Estate,
Chandlers Ford,
Hants
04215 69911

This company produces a range of useful electronic equipment. Products include: Universal prototyping boards; power supplies — including an S100 sub-rack; card housing systems; interconnection and wiring systems; instrument cases; small enclosures; racks and cabinets.

They will be displaying a wide range of their products.

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COMPUTER ANSWERS

Every month in PCW, Sheridan Williams assists readers with their hardware, software and systems difficulties. Some questions he deals with himself, other enquiries are directed towards members of his consultancy panel.

STOCK DISCS

I have been told that I should *not* look at cassette based micros for business purposes. I do not see why, as even a C60 cassette should in my estimation be capable of holding more than 50,000 characters. My application is for stock control, and I would be unlikely to have more than 1000 items on file at any one time.

There are many reasons for rejecting cassettes in favour of discs.
1 Even the 5¼ inch mini-floppy discs hold more on each side than the average cassette. I have seen figures from 70K to 350K quoted. This would save you having to change cassettes in order to swap between programs and files.
2 You can hold many (usually up to 40) programs and files on a single disc, and they will be instantly retrievable.
3 Cassettes can generally be read at between 30 and 300 characters per second. Discs can be read at around 10,000 ch/s upwards. To read a 50K file from cassette could take up to 20 minutes, and yet only around 10 seconds from disc.
4 Discs tend to be more reliable. . .this is because of the nature of the Philips cassette format and the cassette drives used. If digital cassettes with full logic control were used, this statement would not be true and also search times would be significantly improved.
5 Discs are a 'direct access' medium, whereas cassettes are 'serial access'. The advantage of direct access is that *any* record on a file is available for immediate use; in order to access the 1000th record from tape the previous 999 must be read and discarded. With disc the read/write head can be moved directly to the relevant track.

When discs are used, program packages may be written as a 'suite' of programs — one program calling the other when required. It is preferable to write many small programs rather than one large one as each can be worked on and developed separately.

Even if discs are used in a serial access mode (and there are many applications suited to serial access), they are considerably faster than cassettes.

I suggest that you follow this by reading more on the subject of files. I have only just brushed the surface on one absorbing aspect of programming.

Sheridan Williams

GIVE ME PROBLEMS

Is it possible for me to solve anything on my micro that no-one else has solved? I have found that I much prefer to program mathematical routines than ones related to data processing. Can you suggest any programs or ideas that I can look into?

You are obviously a person after my own heart. I agree that there is something very absorbing about manipulating numbers and expressions. However, I doubt whether you could do much with your micro as most of the pioneering work is carried out on machines that are a great deal faster. Don't let me put you off though; try and concentrate on finding better algorithms to solve common problems.

For example, to date I think that the highest known prime number is 2↑23209-1; it is known as the 26th Mersenne prime. It took 8 hours 40 minutes on a CDC Cyber 174 just to prove that it is prime! That's a good starting point. . .try to do it more quickly with a more efficient algorithm. Don't waste your time in BASIC, however, unless you have a BASIC *compiler*.

Look through past editions of PCW and find competitions set by myself. These will provide you with ideas on programs. In the meantime how about looking deeper into the Ackermann function. This can be stated very elegantly by the following recursive definition:—

A(0,n)=n+1
A(m,0)=A(m-1,1)
A(m,n)=A[m-1,A(m,n-1)]

Try building up a table for its values, and then try and find a formula for each row: ie. A(0,n)=n+1, A(1,n)=n+2, A(2,n)=2n+3. (You can do this one in BASIC.) Can you define a function recursively in your version of BASIC? In fact, better languages for this would be ALGOL or PASCAL.

You will uncover further reading on the above two problems in *Dr. Dobbs Journals* of June/July 1979 and August 1979. Good luck, and write back with your findings.

Sheridan Williams

RANDOM CONFUSION

What is the point of 'random access' files? If the files are random, how do you know where each record is stored?

I think the reason that you are confused is because of the word *random*. I prefer the term 'Direct access' to 'Random access'; the two terms are synonymous. I can only imagine that the term *random* access was coined because it does not matter in which order you access the records in the file. I much prefer to think of the file as a *direct* access file because you can access any record directly without first having to read all the previous records.

Your question about how do you find a record — this is answered fairly simply now. You only need a way of linking the 'key field' in the record to the disc address. This is known as the 'randomising algorithm' (there's that word again). The disc operating system usually takes care of the track and sector numbers, and all you have to do is work out the relative address (relative to the start of the file and record length). An example would be if you had a file of part numbers. For certain goods you could make your part numbers run from 0001 to 9999 say, and hence part number 1234 would be found at record number 1234.

Problems arise where the key field is a name. Where on a file of 26000 people would you place SMITH. Well, if the file is fairly well balanced, one idea is to start each letter of the alphabet at intervals of 1000 records, and each second letter in the name could start at 1000/26 intervals. Hence Smith would be placed at a record calculated by 19x1000+13x38=19494 (S=19th letter, M=13th). This is just one of many ideas, although obviously it can be wasteful of space.

Sheridan Williams

WHAT ARE THE PROSPECTS

I read your magazine regularly, and although I don't have my own system, I do intend to join the club one day. My immediate problem is my son. He is approaching 16 and will be leaving school next year with O levels (I hope). He expresses an interest in a computer career on the software side. What are his options as far as i) the course he should follow after school and ii) his choice of jobs within computing? And, as a matter of interest, how do the salaries compare?

Your son has a great deal to think about, and I would recommend that he talks to people, visits local colleges and libraries, and reads as much as possible.

As far as job choices are concerned, broadly the staff categories within a computer department are Systems Analyst, Programmer and Computer Operator. There are other categories and even subdivisions, but let us leave it at these three. Systems analyst is really only open to those with at least 5 years' experience and the approximate salary starts at £6500. Next comes a programmer; it's often from programming that people progress to systems analysis.

This is probably the best career to aim for; programmers' salaries start at £4500 for a trainee and can be as much as £250 per week for freelance contract work. A computer operator is the next category to aim for and it's worth saying too, that many companies give their operators time off from work to train as programmers. Computer operators often work shifts,

and as such get shift allowances, but in general their salaries start at £4000.

The question of courses must really be dependent on whether your son wishes to follow a career in scientific computing or data processing. If he desires the former then the best course of action is probably A level computing science followed by a degree. If he seeks the latter then this reduces to a further question . . .degree or not degree (pun intended). You can gain some very valuable experience by stopping at the stage of A level, City & Guilds 746/747, Royal Society of Arts Computers in Data processing, a Threshold scheme, or a British Computer Society award, and getting a job immediately; in the three years that you would have been studying for a degree you could have become very knowledgeable in a purely practical environment. Please seek further advice as there are many points that I have not covered. However, I hope that I have given you a starting point on which to base further questions.
Sheridan Williams

(We feel that we should mention the almost universal misuse of the term Systems Analyst. Sheridan is quite right when he says that this is often the next step for a programmer — it is, but it often comes as a disappointment. To illustrate why let's pretend that there is another progression for a programmer — to Systems Designer. This job would involve designing a computer system based on a statement of the business requirements of that system. This statement of requirements would be produced by someone who had studied the existing system in detail — usually by thoroughly interviewing users of that system and documenting the results. This would by followed by an analysis of the findings in order to establish the precise requirements of the system.

You can see that the skills required for the two jobs described are quite different, yet they are frequently given the same description — systems analysis. The first, I imagine, would be a very satisfying next step for a programmer. The second may be extremely successful but, as well as a logical and analytical mind, it would also require a number of interpersonal skills which are not a natural adjunct to programming. Ed.)

BIG AND BEAUTIFUL

My computer has BASIC and it makes a great programmable calculator, but when I try to write large programs I always get tangled and can't get the program to work the way I want. How can I learn to write big programs that work?

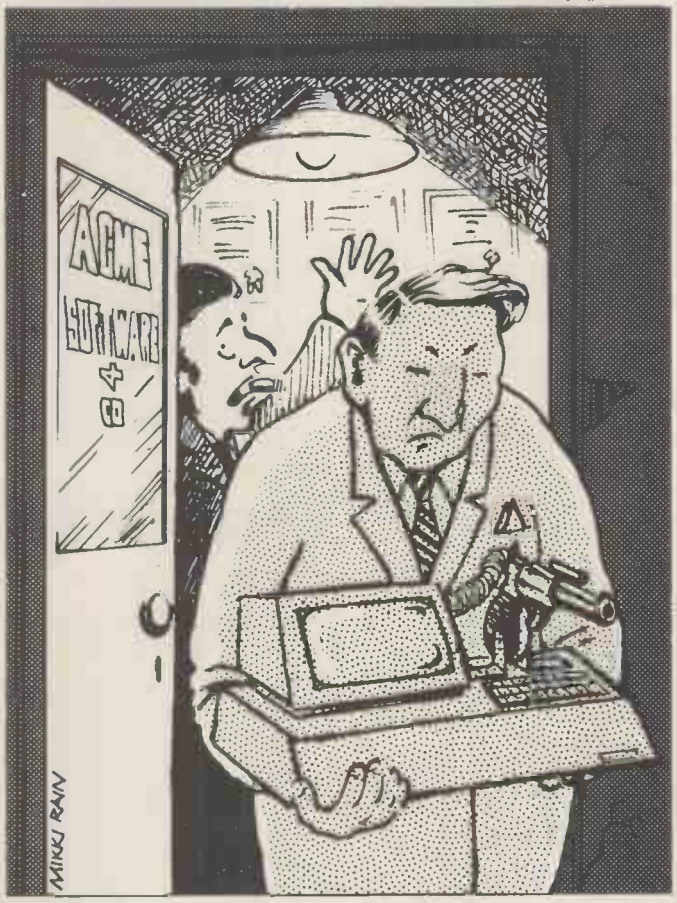
The mistake most beginners make is to jump straight into coding a program without designing it first. The problem with BASIC is that it makes coding very easy, but gives you no help at all in designing programs that are likely to do what was intended, or to be easy to test. Worse, beginners are usually taught flowcharting at the same time as BASIC, and though a well drawn flowchart is excellent for telling you which bit of the program is connected to which, it can still leave you clueless about the relationship between the program and the problem it was meant to solve. The art of programming is being able to go from a clear statement of the problem (a game, a calculation, handling a file), through several stages of refinement and definition, to a set of small, intelligible routines executed in the right order.

Many programmers use a structured programming technique to help them analyse a programming problem and record their stages of progress. There are several different forms. Some use pseudocode, a written problem definition language that looks like PL/1 or Pascal; some use a more pictorial technique such as a Warnier-Orr diagram, which brackets successive levels of the problem; some use structured flowcharts. All methods are based on the same theory — that correct programs have three components: a set of input data, a set of output data, and a process to convert one into the other. If the process is too complex to comprehend in one go, it can be decomposed into simpler processes by applying straight forward rules.

1 There are only three basic processes; sequence — input process output; decision — IF condition THEN sequence A ELSE sequence B; iteration — WHILE condition REPEAT sequence. 2 Any sequence block can be decomposed into two sequence blocks, or a decision block, or an iteration block. By using this technique the programmer is able to concentrate his efforts on one area of the program at a time (knowing the relationship with other parts) and push each area in turn towards more detailed definition, until he reaches a level from which he can code the final program. By this stage the design is complete and hopefully, most of the logic bugs have been discovered before a single statement is coded. The design stages have been recorded, so that the functions of the various sections of the program can be understood and tested, and there is a very good chance that the program will perform as intended as soon as the inevitable keying errors are eliminated. If it doesn't, then the design documentation enables you to backtrack and find out why.

There are two very good books for micro users:— *"Software Design for Microcomputers" by Ogdin (Prentice Hall, 1978);* this will help you define program inputs and outputs, and design appropriate control structure for your applications. *"Microprocessor Programming for Computer Hobbyists" by Graham (Tab, 1977);* this teaches pseudocode, plus a wealth of information on arithmetic, data structures, searching and sorting.

The American hobbyist magazines frequently have articles on program design and documentation:— FLOWCHART — *Ellis* "Use of flowcharts to communicate" *Kilobaud, Feb 1979* (for basic use of flowchart symbols). *Dunn* "Structural Decomposition" *Interface Age June 1979* for structured flowcharting (strongly recommended). WARNIER-ORR — *Higgins* various articles *BYTE Oct 77, Dec 77, Jan 78, Mar 79.* PROGRAM DESIGN — *Hearn* "Top-Down Modular Programming" *Byte July 1978. Weems* "Designing Structured Programs" *Byte Aug 1978 Schwartz* "Pascal Versus BASIC: An exercise" *Byte Aug 1978.*
And may all your bugs be little ones.
L.S. Warner



"Sorry. . . but we already have 27 Russian roulette programs."

RAM DECODE

I found Mike Dennis' article "Practising a Little Microcontrol" most enlightening but I am not sure how to decode RAM. Is is the same as for ROM?

In a nutshell, yes! Remember, *any* device connected to the data bus must only respond to either a specific individual address or a specific band of addresses. Address decoding achieves this and *any* device can be decoded to respond to any address. However, since the address bus doesn't always contain a valid address, it would be foolish to decode the device from the address bus alone. For this reason, the CPU provides suitably timed control signals that are present only when the address bus contains a valid address — $\overline{MREQ}$ (Z80) and VMA (6800); These control signals must be gated with each uniquely decoded address to provide the unique Chip Selection that each device needs. Some micros discriminate further with control signals for either I/O or memory operations ($\overline{IORQ}$ and $\overline{MREQ}$ in the Z80). Other micros (6800 and 6502) do not and so any I/O port is simply treated as a specific memory address — all the devices are said to be "memory-mapped". There is no reason why the Z80 cannot be used in this mode as well.
Mike Dennis

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SHAKESPEARE, BASIC AND THE CIA

Fingerprinting sentence structure

A few miles out of Washington, approaching Langley, Virginia, there is a sign over the highway. It reads 'C.I.A. Turn Right'. Shortly after making that turn a security barrier is encountered, and behind it a chain link fence. Identity documents are painstakingly checked against a list held by the guard, and your physical details verified with a computer housed in a large complex of buildings within the compound.
This is the first of a series of increasingly stringent checks that one meets on penetrating the heart of America's Intelligence machinery. And there, some six stories below ground, is a computer that plays with words. Exactly what this computer does, and indeed its very specification, remains a closely guarded secret. For at least part of the time, however, it is engaged in some fascinating literary detective work.
by Julian Allason.

Illustrations by Russell Mills

Literary detection is not a new science. Almost from the moment that Shakespeare was laid to rest, scholars have argued about the authenticity of various passages. In 1850 Spedding postulated that Shakespeare's disputed play, Henry VIII, was actually the result of a collaboration with Fletcher. This year Spedding's thesis was largely vindicated by Thomas Merriam — and a computer.

It was the Cold War, with its ceaseless propaganda battles, that generated the interest of the Intelligence community in computerised linguistics. Forgeries and plants abounded. They needed to know what was authentic — and what was not.

A celebrated case concerned the autobiography of Kim Philby, the Soviet double agent who had reached the top of the British Secret Intelligence Service. After his defection, a book entitled 'My Silent War' appeared, complete with foreword by Graham Greene. Philby claimed it was entirely his own work. SIS, knowing that it was a final attempt to smear them and damage Anglo-American relations, sent a copy to Langley. There, CIA specialists ran comparisons of 'My Silent War' with articles that Philby had written whilst operating as a Foreign Correspondent for the Observer. The tests showed that whole chapters had been written by others. The book is now regarded as highly suspect.

A similar thing hap-

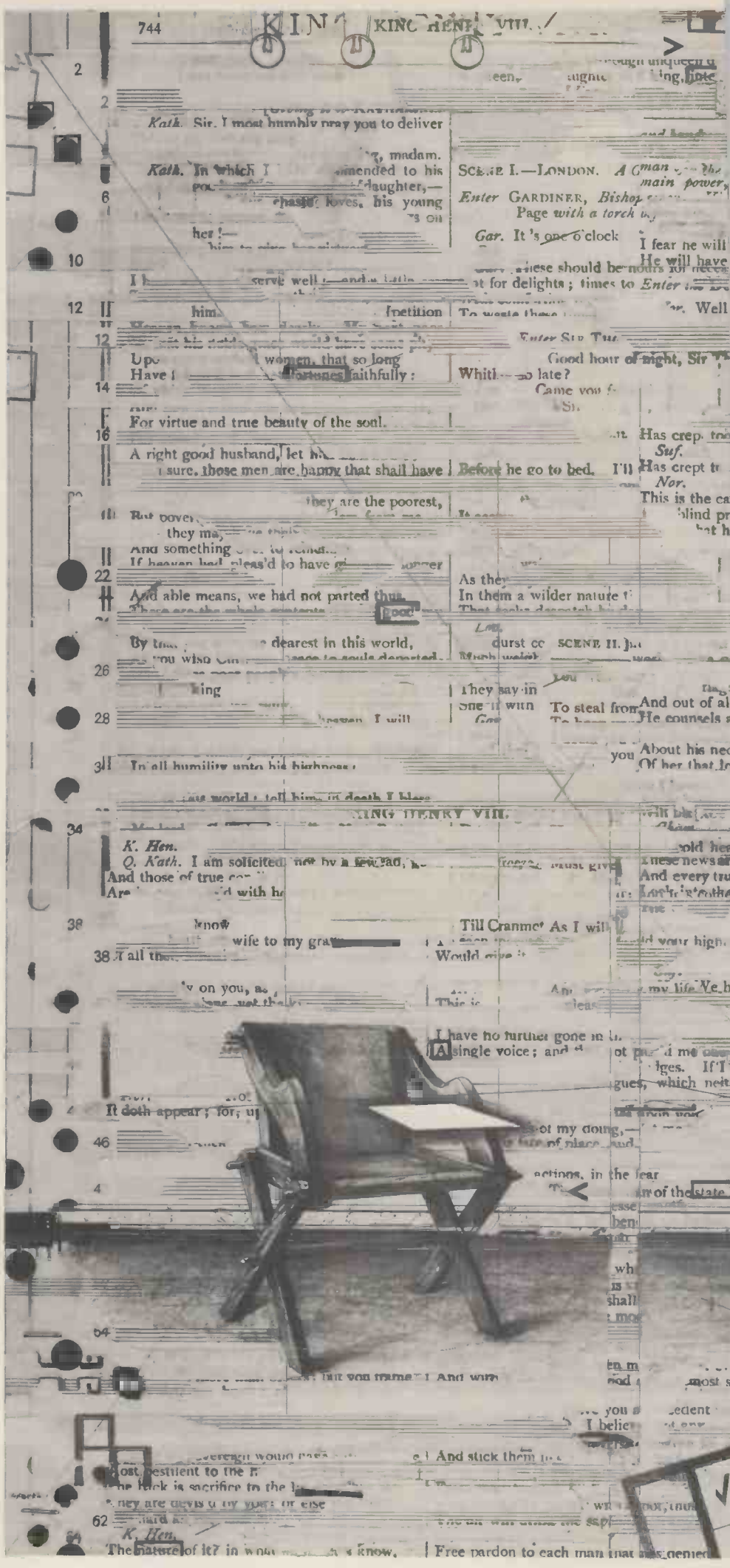
pened when the memoirs of the West's top Kremlin agent appeared. Using similar methods, Soviet specialists swiftly "proved" the "Penkovsky Papers" a forgery. Penkovsky was shot and his book remaindered.

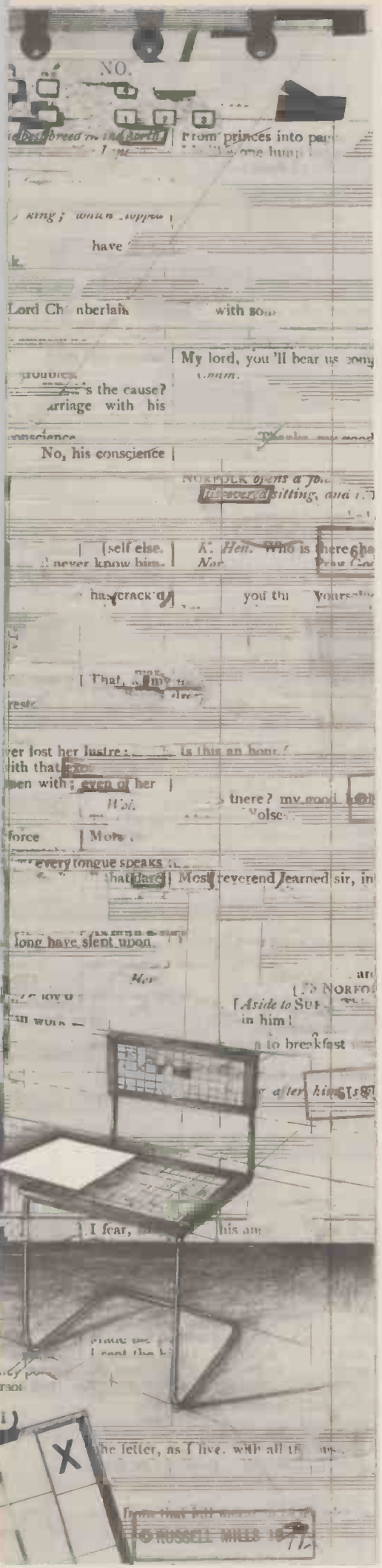
All methods of literary detection involve recognition techniques. The detective uses the computer to help establish an author's sub-conscious habits of speech or writing. Most Shakespearian scholars are capable of assembling a passable pastiche of the Bard's prose. To overcome vulnerability in this area, only very common "filler" words such as "and", or "it is" are tested. This is because use of these words is a matter of subconscious habit. Furthermore, they occur throughout written output whatever the mood or occasion. Position in the sentence is also held to be important.

Surprisingly, our syntactic habits are so ingrained that they show through even when an attempt is made to mimic the literary style of another. Usage of certain "filler" words remains fairly constant throughout a writer's work.

At the simplest level a literary detection program involves a series of string searches on text samples of established authorship. The incidence of certain strings, for example "such a", are noted. A profile of the author's literary style is then constructed. Similar tests are carried out on suspect text, and finally both profiles are compared. It should then be readily apparent whether or not all the samples were written by the same person.

Although fairly long samples of text are required for a definitive evaluation, it is possible to obtain reasonably accurate results from a short BASIC program. The routine I am working on for Petsoft uses less than 8K. The following simplified example illustrates a string search for the word "and".





```
100 DATA"HANDSOME ANDREW AND HIS WIFE"  : REM Text Sample
110 READ T$                             : REM Read Sample
120 FOR C=1 TO LEN(T$)                  : REM Set counter to no. of
                                          characters in string
130 IF MID$(T$,C,5)="  AND  " THEN S=S+1 : REM Tests next five characters
                                          (including spaces)
140 NEXT C                              : REM Increments Character Counter
150 PRINT " 'AND'APPEARED"S"TIMES"
160 PRINT"IN A STRING OF"LEN(T$)"CHARACTERS"
170 PRINT"ITS INCIDENCE WAS" S/(LEN(T$))*100 "%"
```

Note that five spaces are allowed for the string "AND" to avoid acceptance of "HANDSOME", "ANDREW" etc. An additional statement would be required to accept "AND" as the first word in a string.

In practice an expanded algorithm tests a much longer sample of text for the incidence and position of a number of such "filler" words and phrases.

At about the same time as the C.I.A. was trying to catch up on computerised literary detection they faced another problem. They needed English translations of all the scientific and technical information being published abroad. Their linguists could not keep up. Computers, it was argued, could provide the answer.

Early efforts at machine translation met with little success. The problem was the inadequacy of available syntactical analysis. Linguistics, the scientific study of language, was still in its infancy.

But in 1957, Professor Chomsky of the Massachussetts Institute of Technology, published a book called 'Syntactic Structures'. In it, he argued the existence of underlying or Deep Structures beneath the surface structure of the sentence. These defined and inter-related all the factors determining structural interpretation.

It is fair to say that not all linguisticians accept Chomsky's thesis. But it has given the machine translation and literary detection specialists a good deal to think about.

Computerised linguistics is now finding a much wider, and academically more respectable range of applications. In 1974 Dr. Andrew Morton created a legal precedent with his evidence that only 7 of 11 police statements submitted in a case had been written by the defendant. The result was an acquittal.

In a recent book *(Literary Detection, Bowker, £10.50)* Dr. Morton examined the difference between Jane Austin and The Other Lady, who in 1965 completed the novel which had lain unfinished since Jane's death. Although in literary terms the imitation is quite good. Morton demonstrated that the probability of Jane Austin having penned the 4,000 words that were written by The Other Lady to be more than one thousand million against (see chart).

With the continuing evolution of linguistics and the rapid pace of micro-processor development, it is reasonable to project not only considerably more accurate machine translation than my pocket Craig translator offers, but the prospect of an infallible literary detective. *Post script: Having run this article through my PET, the computer confirms that it is almost certainly not written by Shakespeare. . .*

A comparison of Jane Austen and The Other Lady

	Occurrences of the Habit in					
Habit	*Sense and Sensibility*	*Emma*	*Sandition* (Jane Austen)	*Sandition* (The Other Lady)	Chi squared (a)	(b)
an / *a + an*	25 / 172	26 / 212	11 / 112	29 / 112	1.40	12.85
a / P.B. *such*	147 / 14	186 / 16	101 / 8	83 / 2	0.20	3.92
and / F.B.*I.*	253 / 12	299 / 14	151 / 12	154 / 1	2.45	6.84
the / P.B. *on*	270 / 11	271 / 6	229 / 8	221 / 17	1.58	8.45
F.W.S.	22	26	19	8	0.43	6.34
this / *this + that*	32 / 126	39 / 144	15 / 52	15 / 37	0.25	3.64
with / *with + without*	59 / 77	74 / 84	28 / 38	43 / 47	5.02	3.71
very / P.B. *the*	37 / 4	68 / 2	26 / 3	27 / 7	—	12.7

Notes: 1. The samples are: *Sense and Sensibility* — Chapters 1, 3, *Emma* — Chapters 1,2,3. *Sandition*, Jane Austen — Chapters 1,6. *Sandition*, The Other Lady — Chapters 12,24.
2. The figures for chi squared are for the comparison of the three genuine samples, (a), and then for the comparison of these samples taken together for the comparison with The Other Lady, (b).

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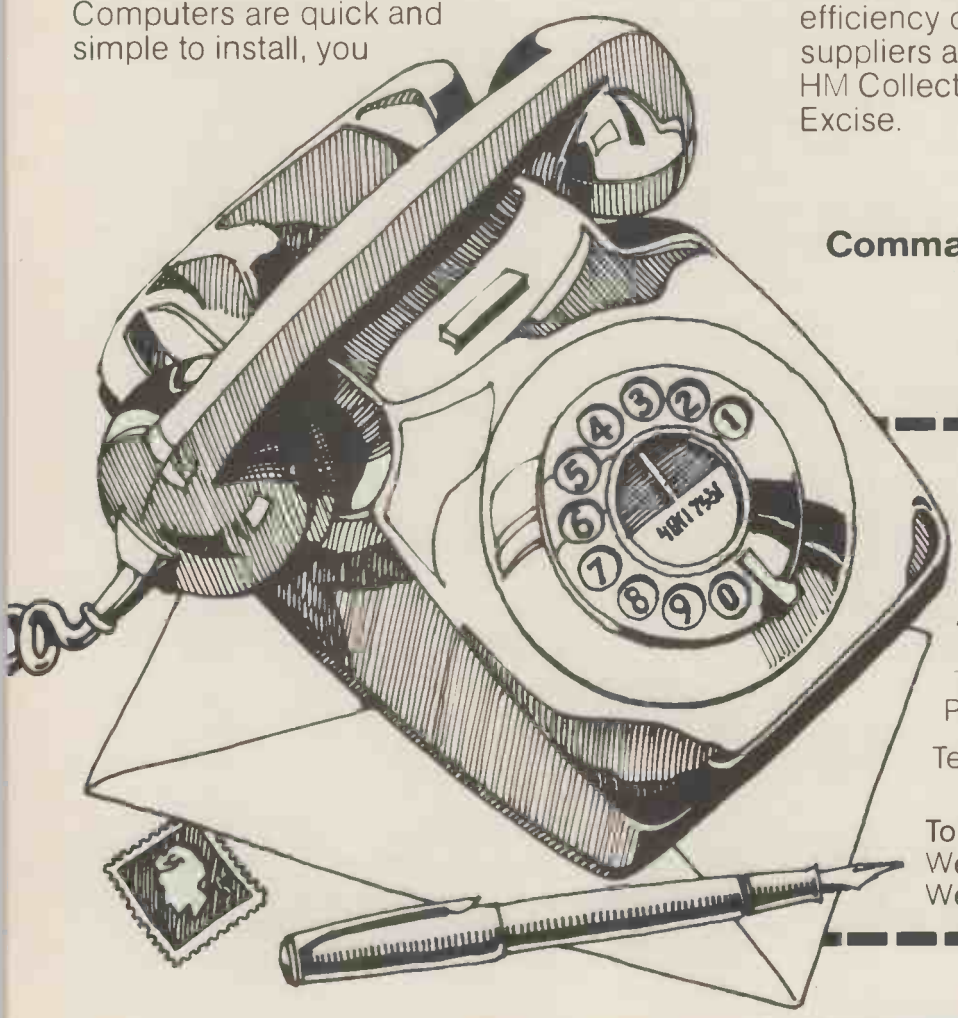

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Essex CM13 3XJ

Name _____

Position _____

Organisation _____

Address _____

_____

Postcode _____

Telephone _____

To: Comma Computers Ltd,
West Horndon Industrial Park,
West Horndon, Essex CM13 3XJ

READER SURVEY~AND WHAT A GIVEAWAY!

That's torn it — the secret's out. Our Star Prize in PCW's 1979 Reader's Survey is a 10k version of last month's "Mini Benchtest" machine:

THE SHARP MZ-80K

What a surprise for the sender of the first completed questionnaire drawn out of the bag! And that's not all — to each of the first *twenty-five names selected* goes a year's free subscription to Personal Computer World.

Where appropriate please either write in block capitals or tick relevent box. Please feel free to tick more than one box, if appropriate.

STAR PRIZE
THE SHARP MZ~80K

1. Age _____
2. Address _____

_____

3. Age _____
4. Occupation _____
5. Married or Single
6. Sex M ☐ F ☐
7. Do you?
   a) own your own home ☐
   b) rent your home ☐
   c) live with parents ☐
8. Do you go to the cinema?
   a) Once a week or more ☐
   b) More than once a month ☐
   c) Once a month ☐
   d) At least every 3 months ☐
   e) Once a year ☐
   f) Never ☐
9. Which ITV channel do you receive?
   a) London ☐
   b) Southern ☐
   c) East of England ☐
   d) South West ☐
   e) Wales & West ☐
   f) Midlands ☐
   g) Lancashire ☐
   h) Yorkshire ☐
   i) North Eastern ☐
   j) Scottish/Grampian ☐
10. Do you watch television on average?
    a) More than 3 hours per day ☐
    b) More than 1 hour per day ☐
    c) Less than 1 hour per day ☐
    d) At least 3 days per week ☐
    e) At least 1 day per week ☐
    f) Less than 1 day per week ☐
    g) Never ☐
11. Do you listen to radio on average?
    a) More than 3 hours per day ☐
    b) More than 1 hour per day ☐
    c) Less than 1 hour per day ☐
    d) At least 3 days per week ☐
    e) At least 1 day per week ☐
    f) Less than 1 day per week ☐
    g) Never ☐
12. Do you smoke cigarettes?
    a) Yes ☐
    b) No ☐

13. Which of the following newspapers do you read?

a)	Daily Telegraph	Every day	☐	3 times a week	☐	Once a week	☐	Sometimes	☐
b)	The Guardian	Every day	☐	3 times a week	☐	Once a week	☐	Sometimes	☐
c)	Financial Times	Every day	☐	3 times a week	☐	Once a week	☐	Sometimes	☐
d)	Daily Mail	Every day	☐	3 times a week	☐	Once a week	☐	Sometimes	☐
e)	Daily Express	Every day	☐	3 times a week	☐	Once a week	☐	Sometimes	☐
f)	The Star	Every day	☐	3 times a week	☐	Once a week	☐	Sometimes	☐
g)	The Sun	Every day	☐	3 times a week	☐	Once a week	☐	Sometimes	☐
h)	Daily Mirror	Every day	☐	3 times a week	☐	Once a week	☐	Sometimes	☐
i)	Local morning	Every day	☐	3 times a week	☐	Once a week	☐	Sometimes	☐
j)	Local evening	Every day	☐	3 times a week	☐	Once a week	☐	Sometimes	☐

14. Which of the following Sunday Newspapers do you read?

a)	The Observer	Every week	☐	3 times a month	☐	Once a month	☐	Sometimes	☐
b)	Sunday Telegraph	Every week	☐	3 times a month	☐	Once a month	☐	Sometimes	☐
c)	Sunday Express	Every week	☐	3 times a month	☐	Once a month	☐	Sometimes	☐
d)	Sunday Mirror	Every week	☐	3 times a month	☐	Once a month	☐	Sometimes	☐
e)	The People	Every week	☐	3 times a month	☐	Once a month	☐	Sometimes	☐
f)	News of the World	Every week	☐	3 times a month	☐	Once a month	☐	Sometimes	☐

15. Which of the following magazines do you read?

a)	Radio Times	Every week	☐	3 times a month	☐	Once a month	☐	Sometimes	☐
b)	TV Times	Every week	☐	3 times a month	☐	Once a month	☐	Sometimes	☐
c)	Melody Maker	Every week	☐	3 times a month	☐	Once a month	☐	Sometimes	☐
d)	Sounds	Every week	☐	3 times a month	☐	Once a month	☐	Sometimes	☐
e)	The Economist	Every week	☐	3 times a month	☐	Once a month	☐	Sometimes	☐
f)	Amateur Gardening	Every week	☐	3 times a month	☐	Once a month	☐	Sometimes	☐
g)	Country Life	Every week	☐	3 times a month	☐	Once a month	☐	Sometimes	☐
h)	The Listener	Every week	☐	3 times a month	☐	Once a month	☐	Sometimes	☐
i)	New Scientist	Every week	☐	3 times a month	☐	Once a month	☐	Sometimes	☐
j)	Punch	Every week	☐	3 times a month	☐	Once a month	☐	Sometimes	☐
k)	Titbits	Every week	☐	3 times a month	☐	Once a month	☐	Sometimes	☐
l)	Motor Cycle News	Every week	☐	3 times a month	☐	Once a month	☐	Sometimes	☐
m)	Weekend	Every week	☐	3 times a month	☐	Once a month	☐	Sometimes	☐
n)	Shoot	Every week	☐	3 times a month	☐	Once a month	☐	Sometimes	☐
o)	Computer Talk	Every week	☐	3 times a month	☐	Once a month	☐	Sometimes	☐
p)	Computer Weekly	Every week	☐	3 times a month	☐	Once a month	☐	Sometimes	☐
q)	Computing	Every week	☐	3 times a month	☐	Once a month	☐	Sometimes	☐
r)	Datalink	Every week	☐	3 times a month	☐	Once a month	☐	Sometimes	☐

16. Which of the following monthly magazines do you read?

a)	Car Mechanics	Every month	☐	9 times a year	☐	6 times a year	☐	3 times a year	☐
b)	Do It Yourself	Every month	☐	9 times a year	☐	6 times a year	☐	3 times a year	☐
c)	Family Circle	Every month	☐	9 times a year	☐	6 times a year	☐	3 times a year	☐
d)	House & Garden	Every month	☐	9 times a year	☐	6 times a year	☐	3 times a year	☐
e)	Ideal Home	Every month	☐	9 times a year	☐	6 times a year	☐	3 times a year	☐

f)	Mayfair	Every month ☐	9 times a year ☐	6 times a year ☐	3 times a year ☐
g)	Men Only	Every month ☐	9 times a year ☐	6 times a year ☐	3 times a year ☐
h)	Motor Cycle Mechanics	Every month ☐	9 times a year ☐	6 times a year ☐	3 times a year ☐
i)	Penthouse	Every month ☐	9 times a year ☐	6 times a year ☐	3 times a year ☐
j)	Practical Motorist	Every month ☐	9 times a year ☐	6 times a year ☐	3 times a year ☐
k)	Readers digest	Every month ☐	9 times a year ☐	6 times a year ☐	3 times a year ☐
l)	Electronics Today International	Every month ☐	9 times a year ☐	6 times a year ☐	3 times a year ☐
m)	Wireless World	Every month ☐	9 times a year ☐	6 times a year ☐	3 times a year ☐
n)	Director	Every month ☐	9 times a year ☐	6 times a year ☐	3 times a year ☐
o)	Investors Chronicle	Every month ☐	9 times a year ☐	6 times a year ☐	3 times a year ☐
p)	Microprocessors and Microsystems	Every month ☐	9 times a year ☐	6 times a year ☐	3 times a year ☐
q)	Which Computer	Every month ☐	9 times a year ☐	6 times a year ☐	3 times a year ☐
r)	Management Today	Every month ☐	9 times a year ☐	6 times a year ☐	3 times a year ☐
s)	Elektor	Every month ☐	9 times a year ☐	6 times a year ☐	3 times a year ☐
t)	Omni	Every month ☐	9 times a year ☐	6 times a year ☐	3 times a year ☐
u)	Video World	Every month ☐	9 times a year ☐	6 times a year ☐	3 times a year ☐
v)	TV & Home Video	Every month ☐	9 times a year ☐	6 times a year ☐	3 times a year ☐
w)	Practical Electronics	Every month ☐	9 times a year ☐	6 times a year ☐	3 times a year ☐

17. Which of the following computer magazines do you read?

a)	Personal Computer World	Every month ☐	9 times a year ☐	6 times a year ☐	3 times a year ☐
b)	Practical Computing	Every month ☐	9 times a year ☐	6 times a year ☐	3 times a year ☐
c)	Computing Today	Every month ☐	9 times a year ☐	6 times a year ☐	3 times a year ☐

18. Please specify the components of the system you own/have access to/are hoping to purchase. In the case of the Micro itself we are after the manufacturer and type, NOT the chip type or number.

	Owned	Have Access To	Hope to Buy Within 12 Months
Micro			
VDU			
Cassette Drive			
5¼" Floppy Discs			
8" Floppy Discs			
Hard discs			
Printer			
Other (Please Specify)			

19. Please indicate your usage of computer media

	1 per month	1-5 per month	5+ per month
Ordinary cassettes	☐	☐	☐
Special length cassettes	☐	☐	☐
Data cassettes	☐	☐	☐
Floppy discs (5¼")	☐	☐	☐
Floppy discs (8")	☐	☐	☐

20. Please indicate if you purchase the following

Continuous stationary	YES ☐	NO ☐
Special printed continuous stationary	YES ☐	NO ☐

21. Please indicate the sections of the magazine that interest you most and least

	Most	Least
Newsprint	☐	☐
Benchtests	☐	☐
Computer Answers	☐	☐
Transaction File	☐	☐
Interrupt	☐	☐
Calculator Corner	☐	☐
On the Line	☐	☐
Diary Data	☐	☐
Checkout	☐	☐
In Store	☐	☐
Bookfare	☐	☐
User Group Index	☐	☐
Programs	☐	☐
Leisure Lines	☐	☐
Business Case Studies	☐	☐
Hardware Features	☐	☐
Software Features	☐	☐
Advertisements	☐	☐

22. I am interested in the following types of program:-

BASIC	☐	Games	☐
Assembler	☐	Subroutines	☐
Machine Code	☐	Business	☐
Calculator	☐	Engineering	☐
Other (please specify)	☐	Education	☐
		Home Applications	☐
		Other (please specify)	☐

23. I am interested in the following software features:-

Language descriptions	☐	Programming efficiency techniques	☐
Systems design techniques	☐	Descriptions of software products available	☐
Others (please specify)	☐		

24. What other topics would you like to see included?

25. What topics would you like to see deleted?

26. What activities would you like to see PCW sponsor?

Exhibitions	☐
Conferences	☐
Courses	☐
Book publication	☐
Software publication	☐
Others (please specify)	☐

27. Are there any other comments you would like to make?

Please answer every question as accurately as you can, then post your completed Questionnaire to: PCW Reader Survey, 14 Rathbone Place, London W1P 1DE. The draw for the prizes will take place Monday 10th December, winners to be announced in PCW's February 1980 edition.

The staff of Personal Computer World would like to thank all readers who have taken the time to complete this questionnaire.

Even More!

Super software from the world's leading microsoftware supplier.

Software with Manual / Manual Alone

DIGITAL RESEARCH

- ☐ **CP/M* FDOS** — Diskette Operating System complete with Text Editor, Assembler, Debugger, File Manager and system utilities. Available for wide variety of disk systems including North Star, Helios II, Micropolis, iCOM (all systems) and Altair. Supports computers such as Sorcerer, Horizon, Sol System III, Versatile, Altair 8800, COMPAL-80, DYNABYTE DB8/2, and iCOM Attache. Specify desired configuration **£75/£15**
- ☐ **MAC** — 8080 Macro Assembler. Full Intel macro definitions. Pseudo Ops include RPC, IRP, REPT, TITLE, PAGE, and MACLIB. Z-80 library included. Produces Intel absolute hex output plus symbols file for use by SID (see below) **£55/£10**
- ☐ **SID** — 8080 symbolic debugger. Full trace, pass count and break-point program testing system with back-trace and histogram utilities. When used with MAC, provides full symbolic display of memory labels and equated values **£45/£10**
- ☐ **TEX** — Text formatter to create paginated, page-numbered and justified copy from source text files, directable to disk or printer **£45/£10**
- ☐ **DESPOOL** — Program to permit simultaneous printing of data from disk while user executes another program from the console **£30/£1**

MICROSOFT

- ☐ **Disk Extended BASIC** — Version 5, ANSI compatible with long variable names, WHILE/WEND, chaining, variable length file records **£155/£15**
- ☐ **BASIC Compiler** — Language compatible with Version 5 Microsoft interpreter and 3-10 times faster execution. Produces standard Microsoft relocatable binary output. Includes Macro-80. Also linkable to FORTRAN-80 or COBOL-80 code modules **£195/£15**
- ☐ **FORTRAN-80** — ANSI '66 (except for COMPLEX) plus many extensions. Includes relocatable object compiler, linking loader, library with manager. Also includes MACRO-80 (see below) **£205/£15**
- ☐ **COBOL-80** — ANSI '74 Relocatable object output. Format same as FORTRAN-80 and MACRO-80 modules. Complete ISAM, interactive ACCEPT/DISPLAY, COPY, EXTEND **£325/£15**
- ☐ **MACRO-80** — 8080/Z80 Macro Assembler. Intel and Zilog mnemonics supported. Relocatable linkable output. Loader, Library Manager and Cross Reference List utilities included **£75/£10**
- ☐ **EDIT-80** — Very fast random access text editor for text with or without line numbers. Global and intra-line commands supported. File compare utility included **£45/£10**

XITAN (software requires Z80** CPU)

- ☐ **Z-TEL** — Text editing language. Expression evaluation iteration and conditional branching ability. Registers available for text and commands. Macro command strings can be saved on disk for re-use **£40/£12**
- ☐ **ASM** Macro Assembler — Mnemonics per Intel with Z-80 extensions. Macro capabilities with absolute Intel hex or relocatable linkable output modules. New version 3 with added features **£40/£12**
- ☐ **LINKER** — Link-edits and loads ASM modules **£40/£12**
- ☐ **Z-BUG** debugger — Trace, break-point tester. Supports decimal, octal and hex modes. Dissassembler to ASM mnemonic set. Emulation technique permits full tracing and break-point support through ROM **£45/£12**
- ☐ **TOP** Text Output Processor — Creates page-numbered, justified documents from source text files **£40/£12**
- ☐ **A4 package** includes Z-TEL, ASM, LINKER, Z-BUG, TOP **£155/£30**

EIDOS SYSTEMS

- ☐ **KISS** — Keyed Index Sequential Search. Offers complete Multi-Keyed Index Sequential and Direct Access file management. Includes built-in utility functions for 16 or 32 bit arithmetic, string/integer conversion and string compare. Delivered as a relocatable linkable module in Microsoft format for use with FORTRAN-80 or COBOL-80, etc. **£275/£15**
- ☐ **K BASIC** — Microsoft Disk Extended BASIC with all KISS facilities, integrated by implementation of nine additional commands in language. Package includes KISS.REL as described above, and a sample mail list program **£495/£30**

MICROPRO

- ☐ **Super-Sort I** — Sort, merge, extract utility as absolute executable program or linkable module in Microsoft format. Sorts fixed or variable records with data in binary, BCD, Packed Decimal, EBCDIC, ASCII, floating, fixed point, exponential, field justified, etc. etc. Even variable number of fields per record! **£125/£15**
- ☐ **Super-Sort II** — Above available as absolute program only **£105/£15**
- ☐ **Super-Sort III** — As II without SELECT/EXCLUDE **£75/£15**

Software with Manual / Manual Alone

- ☐ **Word-Master** Text Editor — In one mode has super-set of CP/M's ED commands including global searching and replacing, forward and backwards in file. In video mode, provides full screen editor for users with serial addressable-cursor terminal **£75/£15**
- ☐ **Word-Star** — Menu driven visual word processing system for use with standard terminals. Text formatting performed on screen. Facilities for text paginate, page number, justify, center, underscore and, PRINT. Edit facilities include global search and replace, read/write to other text files, block move, etc. Requires CRT terminal with addressable cursor positioning. **£255/£15**

GRAFFCOM SYSTEMS

- ☐ **PAYROLL** — Designed in conjunction with the spec for PAYE routines by HMI Taxes. Processes up to 250 employees on weekly or monthly basis. Can handle cash, cheque or bank transfer payments plus total tracking of all year to date figures. Prints emp master, payroll log, payslips and bank giros. Requires CBASIC-2 **£475/£15**
- ☐ **COMPANY SALES** — Performs sales accounting function. Controls payments of invoices and prints sales ledger and aged debtors report. Suitable for any accounting period. Comprehensive VAT control and analysis of all sales invoices. Requires CBASIC-2. **£425/£15**
- ☐ **COMPANY PURCHASES** — Performs purchase accounting function. Controls invoices, credit & debit notes. Prints purchase ledger, aged creditors report and payment advices. Comprehensive VAT control and analysis of all purchases. Interfaces with the NAD system. Requires CBASIC-2. **£425/£15**
- ☐ **STOCK CONTROL** NEW
  Maintains stock records, monitors stock levels to ensure optimum stock holding. Details include stock desc., product code, unit, unit price, quantity on hand/on order/minimum. Stock analysis reports can be weekly, monthly, quarterly etc. Interfaces with Order Entry Invoicing system. Requires CBASIC-2 **£325/£15**
- ☐ **ORDER ENTRY & INVOICING** NEW
  Performs order entry and invoicing function. Handles invoices for services and consumable items, part orders and part quantities. Sales Analysis report shows sales movements and trends for user-defined period. Interfaces with Stock Control, NAD and Company Sales systems. Requires CBASIC-2 **£325/£15**
- ☐ **NAD** — Complete control of all your names & addresses including suppliers, clients, enquiries etc. Assign your own coding system and select all output via the report generator. Will print anything from mailing labels to directories. Requires CBASIC-2. **£225/£12**

SOFTWARE SYSTEMS

- ☐ **CBASIC-2** Disk Extended BASIC — Non-interactive BASIC with pseudo-code compiler and runtime interpreter. Supports full file control, chaining, integer and extended precision variables etc. **£75/£10**

STRUCTURED SYSTEMS GROUP

- ☐ **QSORT** — Fast sort/merge program for files with fixed-record length, variable field length information. Up to five ascending or descending keys. Full back-up of input files created. Parameter file created, optionally with interactive program which requires CBASIC. Parameter file may be generated with CP/M assembler utility **£50/£12**

GRAHAM-DORIAN SOFTWARE SYSTEMS

- ☐ **APARTMENT MANAGEMENT SYSTEM** — Financial management system for receipts and security deposits of apartment projects. Captures data on vacancies, revenues, etc. for annual trend analysis. Daily report shows late rents, vacancy notices, vacancies, income lost through vacancies, etc. Requires CBASIC. Supplied in source code. **£300/£25**
- ☐ **INVENTORY SYSTEM** — Captures stock levels, costs, sources, sales, ages, turnover, markup, etc. Transaction information may be entered for reporting by salesman, type of sale, date of sale, etc. Reports available both for accounting and decision making. Requires CBASIC. Supplied in source code. **£300/£25**
- ☐ **CASH REGISTER** — Maintains files on daily sales. Files data by sales person and item. Tracks sales, overrings, refunds, payouts and total net deposits. Requires CBASIC. Supplied in source code **£300/£25**

MICRO FOCUS

- ☐ **CIS COBOL** — Version 3 is ANSI 74 subset with extensions which offer powerful interactive screen formatting and built in cursor control. Version 4 additionally offers full level 1 ANSI for Nucleus. Table Handling, Sequential Relative and Indexed I/O. Inter-Program Communication and Library
  Version 3. **£295/£25**
  Version 4. **£395/£25**
- ☐ **FORMS** — Interactive utility to create CIS COBOL source code to perform CRT screen handling in application programs. Supports full prompt text, protected fields and input validation against data type and range expected **£65/£10**
  When purchased with CIS COBOL **£55/£10**

Software with Manual / Manual Alone

OTHER

- ☐ **tiny C** — Interactive Interpretive system for teaching structured programming techniques. Manual includes full source listings **£45/£30**
- ☐ **C Compiler** — Supports most major features of language, including Structures, Arrays, Pointers, recursive function evaluation, linkable with library to 8080 binary output. Lacks data initialization, long & float type and static & register class specifiers. Documentation includes "C" Programming Language book by Kernighan & Ritchie **£65/£10**
- ☐ **ALGOL 60 Compiler** — Powerful block-structured language featuring economical run time dynamic allocation of memory. Very compact (24K total RAM) system implementing almost all Algol 60 report features plus many powerful extensions including string handling, direct disk address I/O etc. Requires Z80 CPU. NEW **£110/£12**
- ☐ **Z80 Development Package** — Consists of: (1) disk file line editor, with global inter and intra-line facilities; (2) Z80 relocating assembler, Zilog/Mostek mnemonics, conditional assembly and cross reference table capabilities; (3) linking loader producing absolute Intel hex disk file for CP/M LOAD, DDT or SID facilities. **£50/£12**
- ☐ **Z80 Debugger**-Trace, break and examine registers with standard Zilog/Mostek mnemonic disassembly displays. Facilities similar to DDT £20 when ordered with Z80 Development Package. NEW **£30/£7**
- ☐ **DISTEL** — Disk based disassembler to Intel 8080 or TDL/Xitan Z80 source code, listing and cross reference files. Intel or TDL/Xitan pseudo ops optional. Runs on 8080. Standard CP/M and TRS-80 CP/M versions available **£35/£7**
- ☐ **DISILOG** — TEL to Zilog/Mostek mnemonic files. Runs on Z80 only. **£35/£7**
- ☐ **TEXTWRITER II** — Text formatter to justify and paginate letters and other documents. Special features include insertion of text during execution from other disk files or console, permitting recipe documents to be created from linked fragments on other files. Ideal for contracts, manuals, etc. **£45/£3**
- ☐ **WHATSIT?** — Interactive data-base system using associative tags to retrieve information by subject. Hashing and random access used for fast response. Requires CBASIC **£70/£15**
- ☐ **XYBASIC** Interactive Process Control BASIC — Full disk BASIC features plus unique commands to handle bytes, rotate and shift, and to test and set bits. Available in Integer, Extended and ROMable versions.
  Integer Disk or Integer ROMable **£165/£15**
  Extended Disk or Extended ROMable **£215/£15**
- ☐ **SMAL/80** Structured Macro Assembled Language — Package of powerful general purpose text macro processor and SMAL structured language compiler. SMAL is an assembler language with IF-THEN-ELSE, LOOP-REPEAT-WHILE, DO-END, BEGIN-END constructs **£40/£10**
- ☐ **Selector II** — Data Base Processor to create and maintain single Key data bases. Prints formatted, sorted reports with numerical summaries. Available for Microsoft and CBASIC (state which). Supplied in source code **£105/£12**
- ☐ **Selector III** — Multi (i.e., up to 24) Key version of Selector II. Comes with applications programs including Sales Activity, Inventory, Payables, Receivables, Check Register, Expenses, Appointments, and Client/Patient. Requires CBASIC Supplied in source code **£155/£12**
  Enhanced version for CBASIC-2 **£185/£12**
- ☐ **CPM/374X Utility Package** — has full range of functions to create or re-name an IBM 3741 volume, display directory information and edit the data set contents. Provides full file transfer facilities between 3741 volume data sets and CP/M files **£125/£7**
- ☐ **Flippy Disk Kit** — Template and instructions to modify single sided 5¼" diskettes for use of second side in singled sided drives **£6**

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Word Processing, Payroll, Accounts, on North Star Horizon with printer visual display unit and additional monitor.	5.500	137.50

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Adds Regent 25	645
Adds Regent 40	865
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Elbit 1920/30x	750
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Lear Siegler ADM 3A	595
Newbury Lab Range From	495
Pericom 6801	985
Pericom 6802	1085
Pericom 6803	1285

Printers

	From £
Anadex DP800	575
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OKI E T 5200	485
Teletype 43 KSR	840
Dec LA 34	895
Dec LA 36	905
Dec LA 120 KSR	1675
Diablo 1640 RO	2098
Diablo 1640 KSR	2292
Texas 743	1195
Texas 810	1450
Tally Range from	1895

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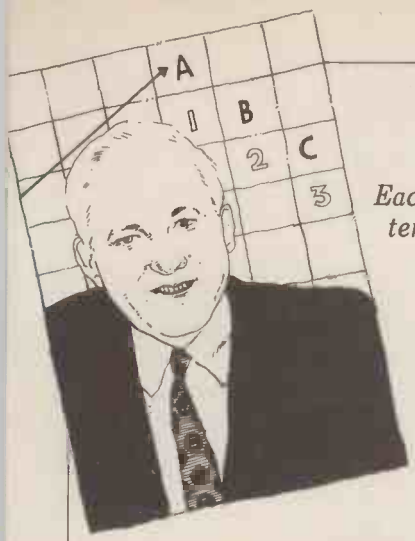

BUZZWORDS

Each month, Pete Reynolds takes us through the minefield of microcomputer terminology and jargon.

J

Jack Plug
A short rod-like connector whereby an electrical device (such as earphones) may be plugged into a jack.

JCL
Job Control Language — specifying (typically for some mainframe computer) the input/output devices and other environmental variables before a program or 'job' is run.

Jitter
Electrical instability, especially in the pattern of data displayed on a screen. Commonly due to inadequate voltage regulation.

Job
A set of data processing tasks, including running programs, for a specified application — for example, "weekly payroll".

Journal (tape)
A chronological listing, kept for backup, of all transactions and data entered to a computer system.

Joystick
A small control device whose knob may be moved in any direction within two dimensions in order, for example, to move a dot on a screen.

Jump
To depart from the normal sequence of program instructions. A jump instruction is often conditional. When a particular condition is satisfied (or not satisfied) the program instructions may be repeated in a loop, operating on each cycle on slightly modified data, until a predetermined count has been exhausted. The condition allowing the jump will then cease to obtain and program instructions will be followed sequentially.

Jumper
An electrical wire temporarily connecting two points on a circuit.

Justify (1)
To arrange printed (or typewritten) words so that the right-hand margin of each line forms a clear vertical line, as in most books and newspapers. There is usually no difficulty about achieving justification of the left-hand margin, where each line of type begins, but to achieve the same effect along the right-hand edge of every line requires that words and letters must, to some extent, be spaced out more than they need be; this calls for a count of the characters and spaces required in each line and a calculation of the number of extra spacing inserts required and where they can best be placed. This can be a minor computing problem in itself.

Justify (2)
To shift numeric characters to fill any spaces in the right-hand end of an accumulator or other area of computer storage, before an arithmetic operation.

K

Kilo (abbreviation)
Signifying 1000, as in kilometre or kilocycle. The internal storage of computers is commonly arranged by the manufacturer to hold a quantity of data which is some power of 2, for example, 4096 characters, bytes or words, which is 2^{12}. The convention is to refer to this number as 4K. 64K, sixteen times as great, actually amounts to 65536 (2^{16}). Note that the unit, bits, bytes or words is unstated. A '1K chip' probably holds 1K bits: to avoid ambiguity when referring to chips of greater capacity, the word size in bits may be shown after the K. Thus 1K8 means 1024 bytes, 16K1 means 16384 bits.

Kansas City Standard
A way of recording binary data on cassette tapes in which 1 is encoded as 8 cycles of 2400 hertz and 0 as 4 cycles of 1200 hertz.

Kb
1. Kilobytes, ie thousand bytes.
2. Kiloband, ie thousand cycles per second.
3. Kilobits, ie thousand bits.

K/c
Kilocycle (abbreviation). One thousand cycles per second; now known as KiloHertz (KHz).

KCS
Kansas City Standard.

Key
A pattern of digits used to identify an item or record.

Keyboard
The group of pushbuttons, as in a typewriter or calculator, whereby data or instructions may be input to a computer.

Key-to-disc/tape
A system for computer data entry on a commercial scale which was introduced to obviate the need for punched cards originally selected for data entry by companies already in the punched-card business. In a key-to-disc (or key-to-tape) system the data-entry operators write their data on the relevant magnetic media for subsequent processing in batch mode. A limited validation check may be made on the data at the time of entry.

Keyword
1. Same as key; a group of characters which identifies an item or record for data retrieval.
2. Same as password; a secret combination of characters which identifies an authorised user to a computer and may indicate which specific facilities are to be allowed or denied — eg to read data on the computer files but not to alter them in any way.

KHz
KiloHertz (abbreviation).

Kilo
Prefix signifying 1000 — but see entry under K.

KiloHertz.
A frequency of 1000 cycles per second.

KIPS
Kilo Instructions Per Second, describing the rate at which a processor can operate.

Kit
A set of parts for assembly by the user. It may not include case, power supply or connecting leads and may be more expensive than equivalent mass-manufactured systems (if such existing). But for those who enjoy assembly, a kit can be more instructive and satisfying and easier to modify to one's personal design.

Kludge
A local modification or patch in a computer program to overcome some error or design fault. Such patches make it difficult for others to follow the program or to deal with subsequent problems.

Knock-Off
A device for automatically inhibiting some machine activity in certain circumstances. For example, a paper knock-off will stop a printer when the paper supply is exhausted.

KSR
Keyboard Send Receive. Descriptive of a printing terminal, such as a teletype, having keyboard and printer but no other media (such as magnetic or paper tape) capable of sending or receiving messages without manual intervention (Automatic Send Receive, or ASR).

KVA
Kilo-Volt/Amps (abbreviation). A measure of electrical power, one KVA (or kilowatt) being equivalent, for example, to 4 amps at 250 volts or 5 amps at 200 volts. The consumption of one KVA for one hour (or 10 KVA for six minutes) is the familiar unit of the electricity bill.

L

L
1. Symbol for electrical inductance, eg of a coil, usually measured in Henries or Millihenries.
2. Low (state) in some bistable device.

Label
One or more characters used to identify the location of an instruction (when line numbers are not used) within a program. The process of compiling such a program will replace each label with an absolute address.

Lag
Delay between two successive events, such as reading a program instruction and completing its execution. The lag may be measured in clock cycles and knowledge of the interval used to advantage in advanced programming.

Land
An internal electrical connection, eg. between an LSI chip proper and one of the pins in the package inside which the chip is supported.

Language
Term used to describe a coding system by which instructions may be given, intelligible to a computer; for example, assembly language, BASIC, COBOL.

Large Scale Integration
The fabrication on a small silicon chip of a circuit embodying several hundreds of semiconductor devices (normally between 100 and 10,000)

10 PART PASCAL SERIES

THE COMPLETE PASCAL

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CHAPTER 3 CONTROL STRUCTURES: 1. LOOPS

In the last chapter, the procedure was presented as a means of performing the repetitive tasks so often required in computer programming. Thus program WALKING executed in "steps" LEFT and RIGHT alternately by successive calls *to the procedures of those names. Some programs however have to repeat their procedures a large number of times, the precise figure often depending on conditions arising within the data or during the calculation, and hence not known in advance. In order to deal with these requirements, a programming device known as the* loop *exists in almost all languages.*

The function of the loop is to cause the execution of certain lines of code (the *body)* a certain number of times. Different types of loop may be distinguished by the way in which they decide how many repetitions (or *iterations)* are required. The process of deciding whether to repeat the body of the loop one more time or to continue with the rest of the program is called a *test*. Every loop therefore consists of a body and a test and is known as a *control structure* because it causes the program control or "flow" to differ from the normal sequential execution of program statements.

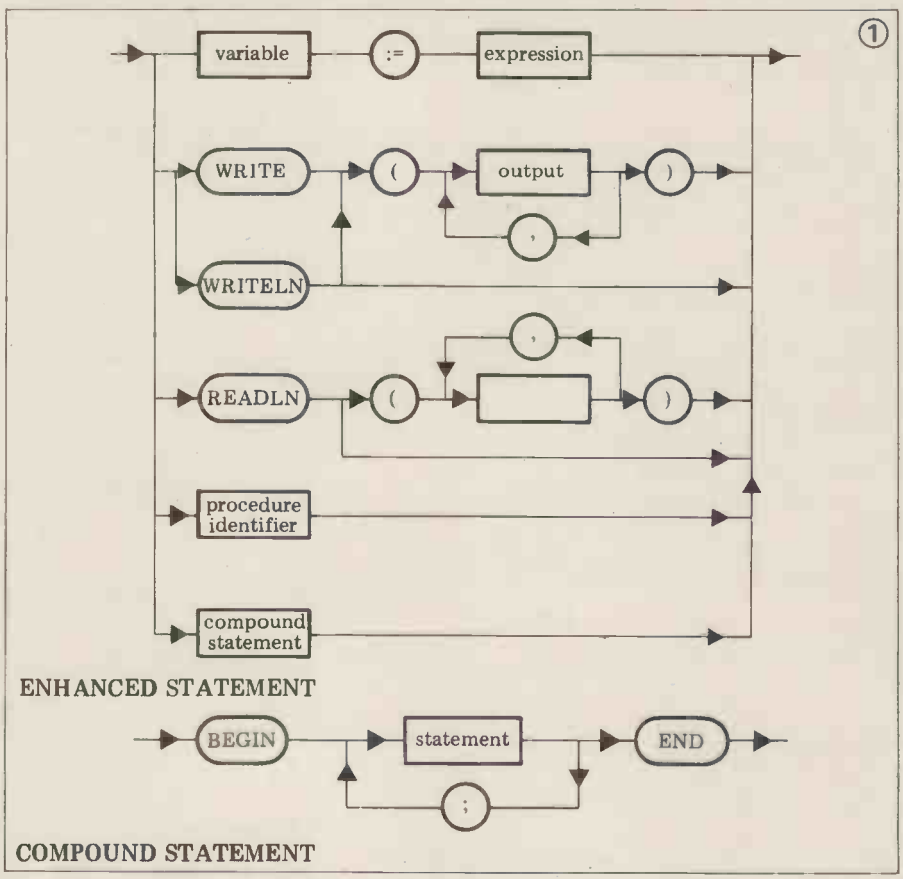
The most elementary type of loop is designed to execute the body a predefined number of times. This operation is controlled by an explicit *counter* variable and the test consists of comparing the value of the counter with the known finishing value. Depending on the outcome of the test, the counter is incremented (or sometimes decremented) and the body is repeated, or else program control passes to the code immediately beyond the loop.

In BASIC this structure is known as a FOR-NEXT loop and PASCAL has an equivalent called the FOR-DO loop. In addition, PASCAL has two loops for executing the body an unknown (or at least uncalculated) number of times. Here the test will depend on conditions arising within the body and a counter, if used at all, is not an explicit part of the loop. In the WHILE-DO loop, the test is made before the body is commenced whereas in the REPEAT-UNTIL loop, the test comes right at the end of the body. In the next few sections each of the above will be described, defined and exemplified in programs.

The body of a loop consists of either a single statement (now expanded to include the *compound statement*, as in the syntax diagram in Box 1) or in certain cases, a sequence of statements. When laying out a program it is normal to indent the code between every BEGIN-END pair. When the body of a loop does not contain a BEGIN-END pair, however, by convention it is indented anyway, to emphasize that it is controlled within a loop.

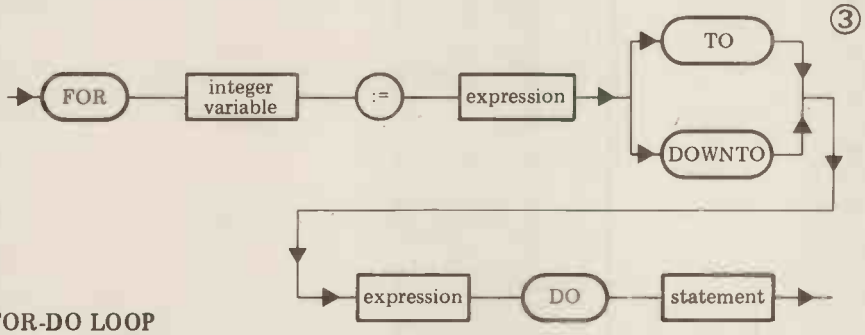
The FOR~DO Loop

Program ROLLOVER in Box 2 illustrates a FOR-DO loop in a fairly typical context. Procedure RESTOFVERSE contains the parts of the song which are repeated in each verse. The loop, set up in line 11, ensures that the part that changes (CROWDS) is correct for each verse. This requires the special DOWNTO reserved word to make the counter work backwards. Lines 13 and 14 actually produce each verse and line 15 sends the program control back to line 11 for the next verse — and so on. Line 16 finishes off the song. Lines 12



```
  1   PROGRAM ROLLOVER ;
  2   VAR CROWDS: INTEGER ;
  3   PROCEDURE RESTOFVERSE ;
  4   BEGIN
  5     WRITELN(' IN A BED AND THE LITTLE ONE SAID') ;
  6     WRITELN('''ROLLOVER, ROLLOVER''') ;
  7     WRITELN('SO THEY ALL ROLLED OVER AND ONE FELL OUT.') ;
  8     WRITELN
  9   END ; (*RESTOFVERSE*)
 10   BEGIN (*MAIN PROGRAM*)
 11     FOR CROWDS:=10 DOWNTO 2 DO
 12     BEGIN
 13       WRITE('THERE WERE ', CROWDS) ;
 14       RESTOFVERSE
 15     END ;
 16     WRITELN('THERE WAS 1 IN THE BED AND HE SAID ''GOODNIGHT''.')
 17   END
-------------------------------------------------------------------------
 18   THERE WERE 10 IN A BED AND THE LITTLE ONE SAID
 19   'ROLLOVER, ROLLOVER'
 20   SO THEY ALL ROLLED OVER AND ONE FELL OUT.
 21
 22   THERE WERE 9 IN A BED AND THE LITTLE ONE SAID
 23    ...
 ..    ...
 ..    ...
 54   THERE WAS ONE IN A BED AND HE SAID 'GOODNIGHT'.
```

② PROGRAM ROLLOVER



③ FOR-DO LOOP

to 15 provide an example of a compound statement. Finally, note PASCAL's solution to the problem of printing a ' mark. Since the quote (') is the text delimiter, the PASCAL compiler searches for pairs of quotes enclosing text. Two adjacent quotes will indicate that the text is not to be terminated but rather that a single quote is required for output.

The syntax diagram in Box 3 shows the precise structure of the FOR-DO loop. The different components appear as:

FOR (test) DO (body)

The counter is a variable (*not* a REAL) and must therefore, like any other variable, be declared explicitly in the declaration part. The starting and finishing expressions must be integer expressions. Because these expressions are evaluated before the loop commences, rather than during each iteration, there is no loss of efficiency in using quite complex expressions if required.

The counter increases or decreases (depending on whether TO or DOWNTO, respectively, is used) by 1 on each iteration. The restriction of the step size creates a loop-test requiring a minimal number of machine-code instructions. If a different step size is required, a "dummy" counter can be constructed within the body of the loop, but on no account should the value of the actual counter be changed inside the loop (for obvious reasons). The FOR-DO loop test will discontinue the loop when the value of the counter moves beyond the finishing value (in the indicated direction). This ensures not only that the body is executed the correct number of times, but also, if the counter is accidently set up to move away from the finishing value, the body of the loop will be skipped over entirely.

When the loop has finished the counter variable loses any value it had (i.e. it becomes *undefined*). This feature is included in PASCAL as a safety measure to guard against the tendency of some programmers to re-use a loop counter at a later stage of the program, without assigning a new value to it.

EXERCISE:
Write a program to print out the song "Ten Green Bottles".

The Generalized Loop

Circumstances can often arise in programming where the use of a fixed-limit FOR-DO loop is too restrictive to allow for a fluent program style. As an example consider the problem of entering a list of numbers from a keyboard into a program. If you don't want to count how many numbers there are before you start, you need to have a way of telling the program when the list has come to an end. This is usually done with a "rogue" value — a number which couldn't possible be a part of the list (eg. -9999). When the program detects the rogue value, this is an indication that the input list is complete and further processing can continue.

It would be nice to place the item-by-item reading of such a list in a loop, but if the length of the list is unknown, then the only way of doing this with a FOR-DO loop leads to awkward and error-prone code. Because circumstances such as this arise quite frequently, PASCAL has a more generalized loop form.

The distinguishing feature of the generalized loop lies in the nature of its test. Instead of a steady incrementation of a counter, the test checks the validity of some relationship which is (presumably) affected by the body of the loop. When the relationship holds, one course of action is taken and when events within the loop cause the relationship to change, a different course of action is embarked upon. Quite clearly, only two possibilities exist — the relationship holds or it doesn't (i.e. it is *true* or *false*). Such a relationship is called a *Boolean expression* after the English mathematician George Boole who first studied the algebra of such expressions.

The syntax diagram in Box 4 fully defines the Boolean expression. Note that <> stands for "is not equal to". Consider a Boolean expression like A=B. This expresses the relationship "A is equal to B" and the = is known as a *relational operator* as are all the other symbols shown in Box 4. Compare this with the *assignment statement* A:=B which reads "A *becomes* equal to B". Here := is an *assignment operator* and it is this distinction which enables one to write X:=X+1 in a program where it would make no sense as an equation.

PASCAL provides two versions of the generalized loop. In the first, the WHILE-DO loop, the test is made *before* the body is commenced, and iteration occurs as long as the Boolean expression is *true*. If the expression is false when the program first encounters the loop, the entire loop will be skipped. The syntax diagram in Box 5 defines a WHILE-DO loop. As with a FOR-DO loop, the body is a single statement, generally compound.

The program in Box 6 illustrates the use of a WHILE-DO loop, which runs from lines 10 to 15, line 10 containing the test and the rest comprising the body. While this is not a very practical sort of guessing game, it does show the unlimited nature of the loop which will go on asking for new guesses until the right number turns up. It also shows the major danger of the generalized loop — suppose the test never fails? The program will stay in the loop forever. For instance, suppose TARGET was 16 while CORRECT and GUESS were REAL instead of INTEGER, and CORRECT became 3.99999 (as often happens). Any integer value guessed could *never* pass the test. This can happen quite easily especially when dealing with the mathematical functions with which rounding errors are associated. Consequently, it is good programming practice to check explicitly for realisable loop tests.

Examples of mathematical functions appear in line 6. SQRT(A) is a REAL value representing $\sqrt{A}$ while TRUNC(B) is the largest integer less than B (when B is positive). In line 6 the above functions are *nested* so that CORRECT is the square-root of the largest perfect square less than TARGET. A list of all mathematical or *standard functions* available in PASCAL appears in the Look-Up Table at the end of this chapter.

The second generalized loop in PASCAL is the REPEAT-UNTIL loop defined in Box 7. The test comes at the *end* of the body and iteration occurs as long as the condition is *false*. PASCAL has two complementary loops to allow for a fluent programming style. Sometimes it will seem more natural to use a WHILE-DO loop and sometimes a REPEAT-UNTIL will suggest itself. In the latter case however, the body will be executed at least once, whatever state the Boolean expression is in, because the test comes after the body. Program ANOTHERGO in Box 8 illustrates the use of a REPEAT-UNTIL loop running from lines 22 to 26. Line 26 contains the test and the body lies above it.

The REPEAT-UNTIL loop has

reserved words which effectively bracket the body of the loop. This is not the case with the other two loops where the reserved word DO merely leads up to the beginning of the body. The PASCAL compiler needs to know where the loop body stops and the rest of the program begins. It is for this reason that the two DO loops restrict the programmer to a body consisting of a single statement (usually compound). Without the DO keyword possessed by the other loops, the REPEAT-UNTIL loop can contain more than one statement in its body (cf. syntax diagrams for the different loops). This means that one tends not to find BEGIN-END pairs following a REPEAT although the indentation convention is observed nonetheless.

The program from Box 6 has been converted into a procedure for ANOTHERGO. This is a sensible way to develop programs — writing a small, self-contained section as a separate program, testing it, and then incorporating it as a procedure in some larger program. This theme will be developed in more detail in the next section. Finally, line 2 introduces a new *data type*, the character type CHAR which consists of a single letter of the alphabet, digit or normal keyboard punctuation mark. The variable ANSWER can contain any one of these characters and can be compared with actual characters enclosed in 'quotes' as in line 26. Variables therefore can be declared as INTEGER, REAL or CHAR.

Each of the three control structures defined above is an extension of the definition of a statement, since it appears in the action part of a program. Consequently a complete syntax diagram for the statement must incorporate all of these, and this is shown in Box 9.

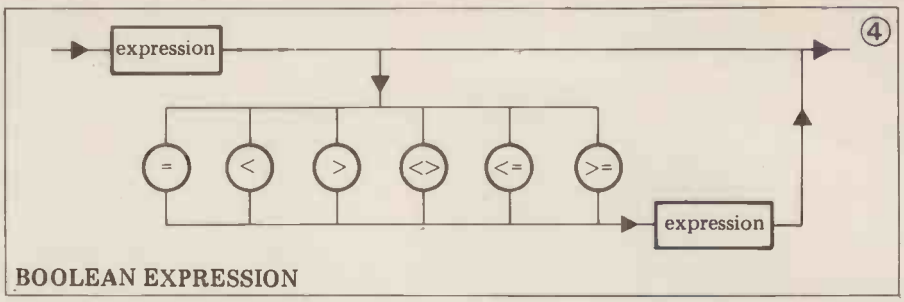
EXERCISE:
Computers (and calculators) are often tested for accuracy by computing a range of nested mutually inverse functions [eg. exp (ln[x]) = x].
Write a program to input a sequence of (positive) numbers (rogue values could be 0 or less), in each case calculating exp (ln[x]) and outputting this value, together with x and the difference between them before reading in the next one.

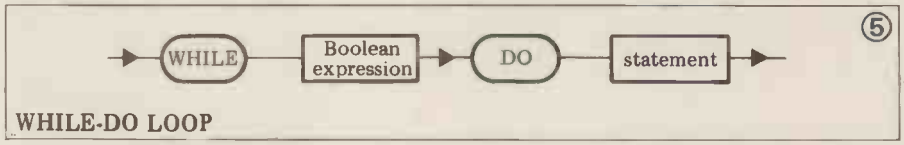
Using Loops

As an everyday application of the use of loops, consider the construction of a mortgage repayment table. These are normally constructed by actuaries from formulae which give the monthly payment incurred by a loan assuming a fixed interest rate and where repayment occurs over a fixed time period.

This reputedly boring occupation seems ideally suited for rendering into machine soluble form, releasing the actuary for more valuable tasks (like estimating the insurance risks on a personal computer). Instead of employing the actuarial formula, however, the problem will be used to illustrate a common programming technique which consists of taking a guess at the likely value, working out the implications, comparing the results with the required outcome, improving the guess, working out the implications again, and repeating this process until an acceptable answer is reached. Clearly, the loop provides a means of programming such an iterative solution — although it's unlikely to tempt any actuaries away from their formulae!

The approach we shall take in programming this problem is known as "Top-Down Design". The Top-Down designer begins by explicitly defining the problem, stating what results are expected from what initial information. The task is then coded by calling several procedures, each a distinct subtask or *module* which contributes to the solution of the total problem. Any consideration of the detail of these

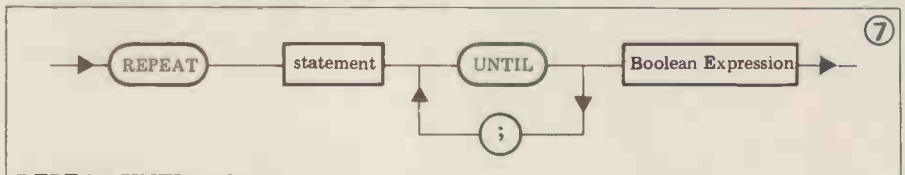




⑥

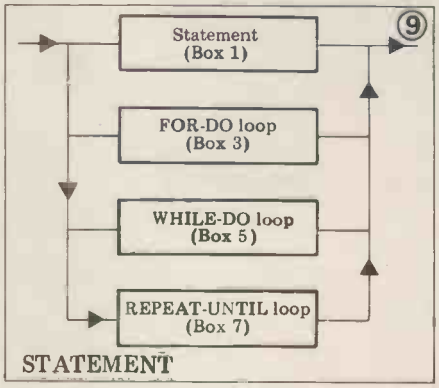
```
 1   PROGRAM PERFECTSQUARE ;
 2   VAR CORRECT, GUESS, TARGET: INTEGER ;
 3   BEGIN
 4     WRITE('TYPE IN YOUR TARGET NUMBER:-') ;
 5     READLN(TARGET) ;
 6     CORRECT:=TRUNC(SQRT(TARGET)) ;
 7     WRITE('NOW GUESS THE LARGEST INTEGER YOU THINK HAS A SQUARE ',
 8           'NOT LARGER THAN ', TARGET, ':-') ;
 9     READLN(GUESS) ;
10     WHILE GUESS<>CORRECT DO
11     BEGIN
12       WRITELN('NO THAT GIVES ', GUESS*GUESS) ;
13       WRITE('SO GUESS AGAIN:- ') ;
14       READLN(GUESS)
15     END ;
16     WRITELN('GOOD ', GUESS, ' HAS THE LARGEST PERFECT SQUARE ',
17             ' NOT LARGER THAN ', TARGET,'.')
18   END . (*PERFECTSQUARE*)
-------------------------------------------------------------------------
19   TYPE IN YOUR TARGET NUMBER:- 59
20   NOW GUESS THE LARGEST INTEGER YOU THINK HAS A SQUARE NOT LARGER THAN 59:- 6
21   NO THAT GIVES   36
22   SO GUESS AGAIN:- 7
23   GOOD   7 HAS THE LARGEST PERFECT SQUARE NOT LARGER THAN 59.
```

PROGRAM PERFECT SQUARE



PROGRAM ANOTHERGO ⑧

```
 1   PROGRAM ANOTHERGO ;
 2   VAR ANSWER: CHAR ;
 3   PROCEDURE PERFECTSQUARE ;
 4   VAR CORRECT, GUESS, TARGET: INTEGER ;
 5   BEGIN
 6     WRITE('TYPE IN YOUR TARGET NUMBER:-') ;
 7     READLN(TARGET) ;
 8     CORRECT:=TRUNC(SQRT(TARGET)) ;
 9     WRITE('NOW GUESS THE LARGEST INTEGER YOU THINK HAS A SQUARE ',
10           'NOT LARGER THAN ', TARGET, ':-') ;
11     READLN(GUESS) ;
12     WHILE GUESS<>CORRECT DO
13     BEGIN
14       WRITELN('NO THAT GIVES ', GUESS*GUESS) ;
15       WRITE('SO GUESS AGAIN:- ') ;
16       READLN(GUESS)
17     END ;
18     WRITELN('GOOD ', GUESS, ' HAS THE LARGEST PERFECT SQUARE ',
19             ' NOT LARGER THAN ', TARGET,'.')
20   END ; (*PERFECTSQUARE*)
21   BEGIN (*MAIN PROGRAM*)
22     REPEAT
23       PERFECTSQUARE ;
24       WRITE('DO YOU WANT TO TRY ANOTHER TARGET?  ') ;
25       READLN(ANSWER)
26     UNTIL ANSWER='N'
27   END.
-------------------------------------------------------------------------
28   TYPE IN YOUR TARGET NUMBER:- 44
29   NOW GUESS THE LARGEST INTEGER YOU THINK HAS A SQUARE NOT LARGER THAN 44:-
30   GOOD   6 HAS THE LARGEST PERFECT SQUARE NOT LARGER THAN  44.
31   DO YOU WANT TO TRY ANOTHER TARGET? N
```



```
1    PROGRAM REPAYMENTS ;
2    VAR MIN, MAX, LOAN, REPAY: INTEGER ;
3    PROCEDURE GETINPUTS ;
4              (*READ IN INTEREST RATE, NUMBER OF YEARS,
5                MINIMUM AND MAXIMUM LOANS*)
6    PROCEDURE PRINTHEADINGS ;
7              (*PRINT OUT INTEREST RATE, NUMBER OF YEARS
8                AND TABLE HEADINGS-I.E.LOAN & REPAYMENTS*)
9    PROCEDURE CALCULATEREPAY ;
10             (*WORK OUT MONTHLY REPAYMENTS*)
11   BEGIN (*MAIN PROGRAM*)
12     GETINPUTS ;
13     PRINTHEADING ;
14     LOAN:=MIN ;
15     WHILE LOAN<=MAX DO
16     BEGIN
17       CALCULATEREPAY ;
18       WRITELN(LOAN, '     ', REPAY) ;
19       LOAN:=LOAN + 1000
20     END
21   END. (*REPAYMENTS*)
```

⑩ PROGRAM REPAYMENTS — FIRST ATTEMPT

```
1  PROCEDURE CALCULATEREPAY ;
2  VAR TOTALMONTHS: INTEGER ;
3      MONTHLYINTERESTRATE, AMOUNTDUE: REAL ;
4  PROCEDURE TRYREPAY ;
5              (*WORK OUT THE ACTUAL AMOUNT A GIVEN REPAYMENT
6                WILL ACTUALLY PAY OFF*)
7  BEGIN
8    MONTHLYINTERESTRATE:=INTERESTRATE/12 ;
9    TOTALMONTHS:=12*YEARS ;
10   REPAY:=LOAN DIV TOTALMONTHS ;
11   REPEAT
12     AMOUNTDUE:=LOAN ;
13     REPAY:=REPAY + 1 ;
14     TRYREPAY
15   UNTIL AMOUNTDUE<=0
16 END ; (*CALCULATEREPAY*)
```

⑪ PROCEDURE CALCULATEREPAY

```
1  PROCEDURE TRYREPAY ;
2              (*WORK OUT THE ACTUAL AMOUNT A GIVEN REPAYMENT
3                WILL ACTUALLY PAY OFF*)
4  VAR MONTH:INTEGER ;
5  BEGIN (*CALCULATEREPAY*)
6    FOR MONTH:=1 TO TOTALMONTHS DO
7      AMOUNTDUE:=(AMOUNTDUE-REPAY)*(1 + MONTHLYINTERESTRATE)
8  END ; (*TRYREPAY*)
```

⑫ PROCEDURE TRYREPAY

```
1  PROCEDURE GETINPUTS ;
2  CONST IMIN=2 ; IMAX=50 ;
3        YMIN=5 ; YMAX=35 ;
4        LMIN=5 ; LMAX=200 ;
5  PROCEDURE GETINTEREST ;
6              (*READS IN INTEREST RATE BETWEEN IMIN AND IMAX AND
7                CONVERTS IT TO A DECIMAL*)
8  PROCEDURE GETYEARS ;
9              (*READS IN DURATION OF LOAN BETWEEN YMIN AND YMAX YEARS*)
10 PROCEDURE GETMIN ;
11             (*READS IN, IN THOUSANDS, THE MINIMUM LOAN VALUE BETWEEN
12               LMIN AND LMAX AND CONVERTS IT TO POUNDS*)
13 PROCEDURE GETMAX ;
14             (*LIKE GETMIN, BUT FOR THE MAXIMAL LOAN VALUE*)
15 63 BEGIN (*GETINPUTS*)
16 64   GETINTEREST ;
17 65   GETYEARS ;
18 66   GETMIN ;
19 67   GETMAX
20 68 END ; (*GETINPUTS*)
```

⑬ PROCEDURE GETINPUTS

```
1  PROCEDURE GETINTEREST ;
2              (*READS IN INTEREST RATE BETWEEN IMIN AND IMAX AND
3                CONVERTS IT TO A DECIMAL*)
4  BEGIN
5    WRITELN ('TYPE IN THE RATE OF INTEREST AS A PERCENTAGE.') ;
6    REPEAT
7      WRITE ('A NUMBER BETWEEN', IMIN, ' AND', IMAX, ':-' ) ;
8      READLN (INTERESTRATE)
9    UNTIL (INTERESTRATE>=IMIN) AND (INTERESTRATE<=IMAX) ;
10   INTERESTRATE := INTERESTRATE/100 ; (* % -> DECIMAL *)
11 END (*GETINTEREST*) ;
12 ------------------------------------------------------------
13 PROCEDURE GETYEARS ;
14             (*READS IN DURATION OF LOAN BETWEEN YMIN AND YMAX YEARS*)
15 BEGIN
16   WRITELN ('TYPE IN NUMBER OF YEARS FOR WHICH MORTGAGE WILL RUN.')
17   REPEAT
18     WRITE ('A NUMBER BETWEEN', YMIN, ' AND', YMAX, ':-') ;
19     READLN (YEARS)
20   UNTIL (YEARS>=YMIN) AND (YEARS<=YMAX)
21 END; (*GETYEARS*)
22 ------------------------------------------------------------
23 PROCEDURE GETMIN ;
24             (*READS IN, IN THOUSANDS, THE MINIMUM LOAN VALUE BETWEEN
25               LMIN AND LMAX AND CONVERTS IT TO POUNDS*)
26 VAR LOANMIN : INTEGER ;
27 BEGIN
28   WRITELN('TYPE IN THE SMALLEST MORTGAGE YOU ARE INTERESTED IN,',
29           'IN THOUSANDS.') ;
30   REPEAT
31     WRITE ('A NUMBER BETWEEN', LMIN, ' AND', LMAX, ':-') ;
32     READLN (LOANMIN)
33   UNTIL (LOANMIN>=LMIN) AND (LOANMIN<=LMAX);
34   MIN := LOANMIN*1000
35 END (*GETMIN*) ;
36 ------------------------------------------------------------
37 PROCEDURE GETMAX ;
38             (*LIKE GETMIN, BUT FOR THE MAXIMAL LOAN VALUE*)
39 VAR LOANMAX : INTEGER ;
40 BEGIN
41   WRITELN ('TYPE IN THE LARGEST MORTGAGE YOU ARE INTERESTED IN, ' ,
42            'IN THOUSANDS.') ;
43   REPEAT
44     WRITE ('A NUMBER BETWEEN', MIN DIV 1000, ' AND', LMAX, ':-') ;
45     READLN (LOANMAX)
46   UNTIL (LOANMAX>MIN DIV 1000) AND (LOANMAX<=LMAX) ;
47   MAX := LOANMAX*1000
48 END (*GETMAX*) ;
```

⑭ PROCEDURES GETINTEREST ETC.

modules is deferred to a later stage of the design. In due course, each module will undergo the same treatment and thus the problem devolves into a hierarchy of more-or-less independent sub-problems until a level is reached at which only elementary programming functions are required. At this point the final coding can be done quickly and accurately, and the result should be a well-structured program.

Returning to the mortgage table program, the problem definition could be:

Given the interest rate and a time period for repayment, create a table showing the monthly payment due over a given range of loans.
The input data required is therefore:
1. interest rate (% p.a.)
2. repayment period (years)
3. maximum and minimum loans required (thousands of pounds).

The output should be a list of loans from minimum to maximum in steps of £1000, showing monthly repayments. The interest rate and repayment period should also be displayed.
The next stage is to decide on the method of solution in order to code the main program. At this level the tasks that must be accomplished include reading in the user's parameters, printing out the appropriate headings and, for each loan from the minimum to the maximum requested, calculating and printing the repayment amount. At this stage, the means by which the calculations are to be performed do not concern us and neither are we interested in the details of getting the input data or printing out the heading. The calculations will have to be performed in a loop which will stop when the maximum loan value is reached. In Box 10, we have called procedures named GETINPUTS and PRINTHEADINGS to handle the initial part of the problem, and introduced a WHILE-DO loop (lines 15 - 20) to control the calculation and output of the table. Procedure CALCULATEREPAY will actually perform the calculations.

The declaration part of this first attempt includes all identifiers used in the main program. These include the integer variables MIN, MAX, LOAN and REPAY, together with the procedures GETINPUTS, PRINTHEADINGS and CALCULATEREPAY. Notice that these procedures have not been fully defined at this stage but merely contain a comment indicating what each will eventually do.

EXERCISE:
Try re-writing this first attempt with a FOR-DO loop instead of a WHILE-DO loop .

We have now completed the highest level of the program design and are ready to proceed to the next level. The three procedures will be tackled in the same way that the whole problem REPAYMENTS was approached. The question arises as to which of the three should be dealt with first. We prefer to start with the "Heart" of the problem — CALCULATEREPAY (Box 11). The problem definition of CALCULATEREPAY could be:

Work out the monthly repayment as follows — first guess an obviously low value and calculate how much that

would pay off over the given time period, taking into account the interest charges. If there is still a debt by the end, the repayment value was not enough, so increase it and try again. Continue until the repayment amount pays off the loan.
Input data
1. duration of loan
2. interest rate
3. amount of loan
Output data is the calculated monthly repayment amount.

In the declaration part, the variables required in the calculation will have to be declared only if they are local to the procedure, since the global variables will already have been declared. Thus a check should be made that the input and output variables, YEARS, INTERESTRATE, LOAN and REPAY appear in the variable declaration of the main program. Some of these may be missing in a "first attempt" version and so should be incorporated.

To start coding CALCULATEREPAY the first step is to generate the working data from the input data. The repayment period, for instance, is in years but is here required in months, as is the interest rate. Therefore two new (local) variables TOTALMONTHS and MONTHLYINTERESTRATE must be declared and calculated. Next, the initial estimate should be made, in order to start the whole process off. Since repayments will be *increased* to improve the "guess", it is important to start with an estimate *below* the likely value. A reasonable first estimate would be the amount one would pay back interest-free. This is simple enough to code at this stage as can be seen in line 10 of Box 11. (Note that DIV has been used since REPAY is an integer. This program could be changed to give pounds and pence if the user were willing to trade some speed for such accuracy). Since the initial estimate must be too low, the next step should be to add £1 to the repayment and test whether that will pay off the loan.

The process of incrementing the repayment amount and testing will be repeated until a figure is reached which actually *does* pay off the loan. This has been coded in the REPEAT-UNTIL loop, lines 11 to 15, Box 11, but, just as this calculation was put off in the main program, so the job of calculating how much a given value of REPAY would actually pay off over the time-period is deferred to procedure TRYREPAY, which is the next problem to be tackled (Box 12).

The problem definition of TRYREPAY could be:
Evaluate how much a given value of REPAY would pay off over the given duration of the mortgage using the given interest rate, assuming monthly payments and the compounding of interest.
Input data
1. monthly interest rate
2. duration of loan (months)
3. value of loan (£)
4. value of repayment (£ per month)
Output data — amount of debt remaining when time period has elapsed.

What is owing at the end of one month? Suppose AMOUNTDUE contains the amount due at the beginning of one month and an amount REPAY is paid back. At the end of that month, the amount due will be (AMOUNTDUE - REPAY) + interest accrued during the month. This figure will become the AMOUNTDUE for the next month; for N months, this calculation should pass through N iterations.

This is coded in the FOR-DO loop, Box 12, lines 6 and 7. The only variable needed that has not been previously declared is the loop counter, which is declared locally in line 4. This completes the definition of TRYREPAY which, in turn, completes the definition of procedure CALCULATEREPAY.

Having coded CALCULATEREPAY we now know exactly what information GETINPUTS must obtain. The problem definition could be:

Read in interest rate, duration of loan and maximum and minimum loans (in thousands of pounds). Convert interest rate to a decimal (instead of percentage) and loan values to pounds.
Output data
1. interest rate (decimal fraction)
2. duration of loan
3. minimum loan
4. maximum loan

An input procedure should usually check that the data it accepts is reasonable and unlikely to cause the program to crash. For instance, if the repayment period YEARS were zero, then TOTALMONTHS would also be zero. But we divide by TOTALMONTHS in CALCULATEREPAY, so that apart from zero being an unreasonable figure for years it will also crash the program.

Box 13 contains procedure GETINPUTS. In the action part the four procedures GETINTEREST, GETYEARS, GETMIN and GETMAX are called. The declaration part lays down limits within which the input data should fall (lines 2 - 4). If one of these should later on prove restricting, it will be easy to change the CONST declaration.

The four individual input procedures (Box 14) are so similar that only one, GETINTEREST, need be considered in detail. Its problem definition could be:

Output a message asking for the rate of interest. Check whether the response is within the range of reasonable values. Keep asking until an acceptable reply is received. Then convert this number from a percentage to a decimal fraction.
Input Data
IMIN and IMAX — limits of "reasonable" interest rates (as a percentage).
Output Data
INTERESTRATE — actual required interest rate as a decimal fraction.

A REPEAT-UNTIL loop (lines 6 to 9) is used to accept input. The program remains in the loop until an acceptable figure is entered.

The other three input procedures are developed in a similar fashion. Note that in procedure GETMAX, the minimum value for a loan is not LMIN but MIN DIV 1000 — the actual lower limit obtained from GETMIN (line 34).

Finally, PRINTHEADING is tackled (Box 15). Its problem definition could be:

Clear the screen, then print out a title followed by the required interest-rate and the duration of the loan. Skip several lines and print the headings MORTGAGE (for the loan) and MONTHLY REPAYMENTS.
Input Data
1. yearly interest rate (%)
2. duration of loan (years)
Output Data — none as this procedure simply produces the headings.

Cont. on Page 81

(15)

```
 1  PROCEDURE PRINTHEADINGS ;
 2            (*PRINT OUT INTEREST RATE, NUMBER OF YEARS AND
 3              TABLE HEADINGS-I.E. LOAN AND REPAYMENTS*)
 4  CONST SPACE='                    ' ;
 5  BEGIN
 6    WRITELN(SPACE, '**MONTHLY MORTGAGE REPAYMENTS**') ;
 7    WRITELN(SPACE, '---------- -------- ------------') ;
 8    WRITELN ;
 9    WRITELN('INTEREST RATE =', 100*INTERESTRATE, '% OVER ',
10          YEARS, 'YEARS') ;
11    WRITELN('    LOAN      REPAYMENTS') ;
12    WRITELN('    ----      ----------') ;
13    WRITELN
14  END ; (*PRINTHEADINGS*)
```

PROCEDURE PRINTHEADINGS

Look up table

PASCAL STANDARD FUNCTIONS

Arithmetic:		
ABS(X)	Ahsolute Value	Real or Integer
SIN (X)	Trig functions	Answer Real
COS (X)		
ARCTAN (X)		
EXP (X)	Exponential	Answer Real
LN (X)	Natural Logs	
SQR (X)	Square	Real or Integer
SQRT (X)	Square Root	Answer Real
Transfer:		
TRUNC(X)	Truncate	X real, Answer is integer part
ROUND(X)	Round to closest integer	

[ROUND(X) = TRUNC(X + 0.5) when X is positive]

COMPUTING JARGON

Control Structure
Counter
Compound Statement
Rogue Value
Boolean Expression
Relational Operator
Module
Iteration

PASCAL RESERVED WORDS

FOR
DO
TO
DOWNTO
WHILE
REPEAT
UNTIL
CHAR

UCSD Exceptions

ATAN(X) instead of ARCTAN(X)
Also LOG(X) is log to base 10.

EXERCISE SUMMARY

1. Ten Green Bottles
2. Accuracy Test
3. Mortgage Table

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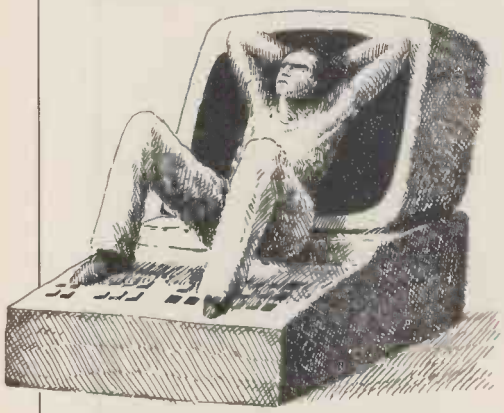
INTERRUPT

Interrupt is the place in PCW where readers can unburden their grievances and air controversial views. New subjects are always welcome; the 'right of reply' shall be wielded at the discretion of the Editor. Please hold all contributions to within 800 words.

Future-What future?



I am beginning to have strong suspicions that our leaders and the media are actively conspiring to keep the real implications of information technology from the general public. Having always held BBC documentaries in high regard, I was disturbed to see the recent three part production "The Right To Work?" brilliantly obscuring the most important issues.

There was the predictable argument regarding the amount of unemployment which may occur, and how best to minimise it, and a tantalising, albeit superficial, glance at the role of leisure in utilising the spare man hours. Unfortunately, however, any good intentions there may have been collapsed into a familiar political squabble between Sir Keith Joseph and two TUC representatives. The problem was one of approach. "The Right To Work?" provided an excellent example of that little known but highly pervasive phenomenon, best described as 'temporal chauvinism'. This is manifest in the inability of members of a society to envisage any future society without imposing their own contemporary political and economic structures upon it. The best, latter-day example, would be the persistent attitude of unions and government alike towards unemployment; they see it as a social evil to be avoided at all costs.

The real question posed by the present technological revolution was summed up by Peter Large of the *Guardian*; "Do we want to work anyway, if our jobs are unsatisfying or unpleasant, if we are there just for the money? Can we rethink the work ethic and find another way, by whatever political means, of distributing wealth?"

In the present social climate, however, resistance to such ideas is very powerful (A Nation of Scroungers? reads the headline). Even aside from the indignant abhorrence of the average man in the street towards 'living off welfare', there are many respectable academics who would argue that, for the individual, unemployment causes depression and psychological instability. The latter is, of course, bound to be true in a society where a person's education and culture, together with the media and the inadequacy of many welfare payments, conspire to make the experience as miserable as possible.

Those of you familiar with the work of Ivan Illich will know that education can logically be considered as preparation for failure. The fact is that in national terms, educational institutions are designed to feed the needs of society. Thus, in a society where intellectual activities are accorded more status than manual, but where manual jobs greatly outnumber those requiring intellect, it is necessary to ensure that only a small minority of people finish their education feeling intellectually adequate. In order to achieve this end, examinations with a minority pass rate are held, and those who do not fall within the top twenty per cent or so are stamped 'failures'. Put simply, education is a subtle and apparently benign means of inducing people to accept their position within society.

"...it is necessary to ensure that only a small minority of people finish their education feeling intellectually adequate."

Many young adults thus enter both manual and clerical jobs accepting that they are unlikely to be satisfying in any real sense, but nevertheless with an intense fear of the ultimate failure — unemployment. The middle class college student, with some sense of intellectual adequacy and personal confidence, will find long periods of unemployment much more acceptable than the individual whose dignity relies heavily upon being able to run a car and buy a round in the pub. Thus we are brought up to think of our status in society almost entirely in terms of the job we do.

This is even reflected in linguistics; when asked "what do you do?" the words "for a living" are immediately implied, and one describes a job. If you were jobless you might say "I'm unemployed at present but. . . "; you would be unlikely to say "I look for a job one day a week, play basketball, read science fiction books and newspapers, go for walks and make love to my wife". Thus although many people are presently unable to accept unemployment — in the conventional sense — this is clearly a result of learning rather than any innate predisposition towards "employment" as such. It should therefore be possible, through changes in education and parental attitudes, to produce a situation where members of society are capable of achieving a high degree of personal satisfaction, regardless of their source of income.

But what about the profit motive, I hear you scream. Is not man really driven by greed, his career being merely an expression of an overwhelming desire to own more than his neighbour? How can we distribute wealth in a way which will satisfy this inner need without some kind of capitalist employment structure? Isn't the alternative a totalitarian state where nobody is really satisfied? True, one doesn't have to look far for confirmation of the intrinsic nastiness of human nature, and it would be foolish to suggest that this could change overnight, if at all.

Nevertheless, I cannot accept that mankind is incapable of achieving a higher degree of social awareness, or of maintaining a more egalitarian and humanistic social structure. Social evolution, which has long since superseded biological evolution as the major instrument of change in man, is difficult enough to understand — let alone control. The so called 'profit motive' is just one aspect of the complex relationship between the individual and his society which must be understood if we are to survive the hazardous future ahead of us.

I am not alone in the belief that we are entering a period of social change as dramatic and pervasive as the industrial revolution. This change will affect us all whether we choose to have any control over it or not. As individuals we can avoid the issue (and the headaches) by taking the view of Ron Condon (Editor of *Data Link)* that: ". . . as for the future, well, let it look after itself as it is so unpredictable anyway. . ."

I am sure, however, that many of you, feeling as I do, both excited and terrified by the social implications of information technology, will agree that we must at least attempt to direct the course of events if we are to avoid a catastrophic outcome. I am convinced that if we ignore the problems we will face inevitable social collapse and/or totalitarianism.

I have covered only a few of the most obvious points, and clearly there is much ground to be explored before any realistic plans can be made. Those of us already involved will have to carry the discussion across to the general public. Social change can only come from the people, since controlling bodies are, by their very nature, concerned only with social maintenance. Do you want your future to remain in their hands?

Dick Granby, Fitzrovia, London

Grow your own

From the way microcomputer hardware is sold these days you'd think that

round every corner there were large forests of software trees tended by 'green fingered' programmers. In fact there's more likely to be giant sized briar patches tended by Weed Killer manufacturers.

"If we could only find skilled workers we could double our growth rate over the next four years".

"We've been looking for skilled workers for the past two years with no success".

These two comments were made by two exporters during recent television programs on the Malaise of British Industry.

It is, I suppose, a small comfort to see that the computer industry makes the same mistakes as the rest of British Industry. If you read the computer press, almost weekly you will see an article or letter bemoaning the 'lack of experienced programmers'. In fact, if you look at the job advertisements you see more and more companies offering larger and larger salaries to proportionally fewer and fewer programmers. On the other hand, one noticeable omission from the job advertisements is vacancies for trainee programmers. On those rare occasions when they do appear the response is normally overwhelming (one company reported 700 replies to one such advertisement).

As you can see our 'big' brothers in the mainframe business have already got a serious staff shortfall, (by the end of 1980 it is predicted that this shortfall will have reached 70% of the total requirements).

What are the prospects in micros?

One noticable omission from the job advertisements is vacancies for trainee programmers. On the rare occasions when they do appear, the response is normally overwhelming.

Let's look at the numbers first: in 1978 the average monthly sales volume of microcomputers was larger than the total worldwide number of all computers installed before that year. This fact alone seems to indicate that microcomputers are already in a disaster situation. So what can be done about it.

Solutions to the software problem, available now, are to either use standard packages or to custom build.

The package approach is the one which seems to have been adopted as 'standard'. Every month we see in the microcomputer press ever increasing numbers of software houses advertising ever increasing numbers of 'standard' packages. The problems associated with this are:

1. It gets increasingly difficult for small companies to evaluate these products. Many of the products on offer are poorly documented and little indication is given of their scope.
2. No joint standards have been agreed between software houses. So even if you get a package which meets your functional requirements it will need *customising* to interface with products from other software houses.
3. The products on offer are all *generalised* and in most cases, therefore, demand that you change your business to meet the requirements of the software rather than changing the software to meet your business needs.

The custom build approach would seem to be ideal since you will get exactly what you ask for. The problems associated with this approach are:

1. The obvious problem of the small number of programmers available.
2. The high cost of programmers. They usually cost between £5 and £10 per hour, so a customised system could turn out as much as 6 or 8 times the cost of the hardware.
3. Programmers know a lot about programming but they don't necessarily know about your business.

In my view the only satisfactory answer to the growing software problem is to combine both of these approaches. What is needed is industry specialisation. You, the businessman, bring your knowledge of your industry and its problems; the programmer brings his knowledge of computers. Together you provide an ideal combination which will lead to a standard package approach, but, since the package is specific to one industry, it is likely to meet the requirements of most companies in that industry. Obviously no two companies are exactly the same so some customisation is always going to be needed, although, only to a small degree. In addition, the cost of producing an industry standard package is offset by the higher likely demand for that product in that particular industry.

This all sounds ideal, but some of you will have noticed the slight flaw in my argument. I started by saying that we have a major shortfall in programming resource; how can this be overcome?

Well, the answer is in your own hands. It takes two years to develop a good programmer but programmers can be productive after six months. The answer then is to train your 'industry' knowledgeable staff to be programmers. The better software houses usually run training schemes (e.g. 'BASIC' programming courses) usually lasting 3-5 days and costing approximately £50 per day (a lot of this 'expense' can be recouped from your own industry training board). These courses will enable you to provide your own programming, although they will need some direction. Once again, the better software houses should offer consultancy services so that the initial system design and program specification can be done by computer professionals with the bulk of the programming being done by your own staff. In addition, the same software house would probably undertake the marketing of the finished 'industry package' for you.

Illustrations by Ingram Pinn

In conclusion, one thing is certain — if you just sit there and do nothing the problem will not go away, it will just get bigger.

Mike Rose, Croydon

Micro-mania revisited

I would like to challenge Mr Smith's view of personal computing in PCW volume 2 Issue 5, Interrupt column.

Mr Smith — I think you missed the whole point of the hobby. I would like you to show us the magazine or newspaper in which such fantastic claims were made for it. Or did you make them up for rhetorical effect? Because there is no hobby which can truthfully profess to fulfil any of your 'claims'.

Are you addicted, bored, dehumanised? Moreover, are you unable to justify . . . etc? Surely you had some reason for buying yours in the first place, some motivation? Or did you get it because it was the latest executive toy? Anyone who buys anything for such a reason deserves to be bored out of his/her tiny mind.

I am one of the genuinely poor people who cannot afford even the meanest computer kit. But already I have tens, even hundreds of ideas for my dream machine. None of them involves commercial equipment or software. The only reason I haven't tried to contribute to PCW is that I have not had the equipment to debug my ideas, and I doubt that the editor would enjoy reading any bug-riddled script, however valuable the core material.

As for your intro, we don't think of personal computers as liberating us in any sense. However the microprocessor *will* liberate a large proportion of the population, for a large proportion of their week, from the drudgery of work — whether in the typing pool or on a production line. Thus liberated there will have to be a cultural and educa-

INTERRUPT

tional renaissance, in which personal computers could play a great part.

The pocket computer you describe will follow the development of the plasma screen or else the ultra miniaturisation of existing LED/LCD screens. Whether Woolworths will sell them is a matter of speculation.

The only requirement for the 'mental annihilation' you talk about is a weak, even sick mind. No such mind could insinuate its owner into any position of responsibility. I must agree that computer art is boring. The reason is similar to the reason why musicians disdain 'disco' music, as being more or less speeded up Musak with heavy drums/bass overlaid. Computer art is constrained by:

Display and definition and colouring.
Computer speed and memory capacity.
Display medium; most have just a VDU and/or printer
Character graphics.

Could you produce a piece of art on a 25x40 grid with PET graphics which is not either totally random (sorry — pseudorandom) or documentatively symbolic? If so — you're a genius! In any case, judgement of art on any basis other than technical exactness has to be subjective. Similarly 'disco' music is constrained to a dominant beat surrounded in time by audible-but-not-too-distractingly-brilliant music.

Lastly to your question about defence spending. The only way this could be stopped is by multilateral agreement, which would in turn be followed by multilateral distrust, and by a surge in spending on surveillance techniques, and secretion techniques. In any case, suppose some goodly invention does come from defence research; that is, an invention which, had it been sought from any other point on the 'knowledge map', would have had minimal chance of being found without a huge amount of extra expenditure? The ultimate aim of a scientific explorer is not as significant as the route taken and what he finds on the way. Example: The whole 'space race' was sparked off by military interest. Why don't you send for a catalogue of the valuable spinoffs *that* produced?

If you ever decide to drop your machine from your window, inform me beforehand. I'll be there with a butterfly net, and I promise to decapitate the first new enthusiast I see who even nearly imitates your attitude.
T. Magee, Bradford.

SYSTEMS

PCW already has the most authoritative and comprehensive guides in the UK for hardware — namely our Benchtest and In Store contributions. Now, building on this success, we are pleased to introduce Systems. The brief for this new, monthly feature will be to take a different business application each issue and to report on some of the software packages available around it. PCW's David Tebbutt *and* Mike Knight *of* Mike Rose Micros *take up the explanation.*

Perhaps before looking at the fine detail of our approach for the future we should examine the reasons for introducing Systems.

You've probably seen or heard business packages described in glowing terms. They are said to be complete, comprehensive or total. Sometimes they are not described in any terms at all; sometimes they are described in terms which only the writer understands. Somehow the prospective buyer must decide from this morass of inadequate information, which packages to consider buying.

Nor do the problems end there. Having selected a few possible packages, the potential buyer needs to know quite a lot more before making any final decision.

Is it well documented, for example? We can barely believe some of the apologies produced in the name of documentation. It can be inadequate in a number of ways. First of all it may simply not exist. . .not even instructions for operating the machine! Secondly, yes, it may exist, but in such a form as to be totally unintelligible to mere mortals — not to mention the prospective buyer/user. Thirdly, it may exist, but only in parts. The missing sections are usually the ones you need when you're burning the midnight oil and all the 'experts' are fast asleep in bed.

An exaggeration? In many cases we think not, although we have to point out that some companies do produce quite excellent documentation.

And here's something else to think about — bugs. What are bugs? .. .well, in common parlance, they are errors existing in the application package which cause it to go wrong from time to time. Of course, ideally, one would like any problems resolved on the spot — time, after all, can be expensive. Here the difficulty may be that the firm from which you bought the package no longer exists. Perhaps (more likely) they aren't too interested, or don't have the staff to tackle any bugs. Again we don't want to paint an unduly miserable and pessimistic picture, but these are very serious matters and they need to be considered before any money is exchanged for software. For the businessman it could mean his business crashing down alongside the programs.

Okay, enough of the horror stories, time now to take a look at some constructive action.

Each month when we report on a particular application area, the feature will be divided into the following sections:

Objectives
Tasks and volumes
Evaluations
Comparisons
New products

Let's look at each of these in turn.

Objectives

In this section we shall define the objectives of the application. We shall also describe the application and explain any relationship with other applications. Failure to be very clear about objectives will lead any investigation to likely failure.

Taking 'payroll' as an example, we might describe the overall objective as 'to pay employees the amount due *on time* and to meet statutory requirements'. Then we might describe the application as follows:

1 Capturing information upon which payment will be based.
2 Using this information to calculate net payment.
3 Maintaining records of payments to each employee.
4 Producing appropriate documentation for company, employee and government records.

Finally, we might define the relationship with other applications as: 'information gathering — possibly the product of production hours recording. The payroll application will almost certainly create "transactions" for the accounting function'.

Tasks and volumes

In this section we shall select, say, three packages and match them against the tasks to be performed. Staying with our payroll example, we might say something like this:

"Not only will this give a guide to three particular packages, it will also offer a framework against

Tasks:	Package	A	B	C
Create employee records		●	●	●
Delete (suspend) leavers			●	
Maintain existing records		●	●	●
Build up to gross		●		
Gross to nett			●	●
Print payslips		●	●	●
payroll		●	●	●
cash analysis			●	
cheques or credit transfers		●		
bank reconciliation		●		
NI stamp analysis		●	●	●
Update employee records		●	●	●
Prepare P60s				●
Produce accounting transactions		●		
etc.				
Maximum Volume/sizes:				
Employee records		400	250	600
Record size		180ch	360ch	200ch

which to measure other packages of your choosing."

Evaluations

In this section we shall again focus attention on the selected packages. This part of the feature will be written as a structured narrative, describing each package in turn. The main elements are as follows.

Availability
Documentation
System content
System maintenance
Costs
Hardware required
Support and training
User comments

Availability covers number of suppliers, their distribution and whether the product is available 'off the shelf'.

Documentation describes the scope, content and quality of the manuals and guides supplied.

System content will describe the programs involved in the package, their functions and certain aspects of their operation. For example, it may be that each program, on conclusion, automatically loads the next in sequence. On the other hand, there may be a need for a lot of disc or tape changing during the operation. We will try to give a picture of what will be involved in the day to day running of the system.

System maintenance. We shall be interested in whether the system has been designed to be changed easily. Examples which spring to mind are tax rates and discount terms. We shall also see if customisation is easy. Some packages are written with 'hooks' to enable customised routines to be added fairly simply. The language used is also important here. Finally, we shall check out who you have to go to to have these changes made.

Costs need little explanation. We shall give the costs for various versions of the package and, if applicable, the cost of any maintenance agreements.

Hardware required. We shall describe the different hardware configurations and relate these to the volumes which can be handled by each. We shall also give a guide to the hardware costs.

Support and training. If either of these areas are neglected, it's likely that you'll end up very disappointed with your new system. Training should, at the very least, teach you how to operate the system. Support is the on-going advice and guidance you will get from the supplier. It also covers their response to any problem you may encounter — a hardware fault, a software fault or perhaps an accident such as over-writing some important files. We shall assess the services offered.

User comments. We shall contact users of each system and summarise their opinions and experience of the package.

Comparisons

This section comprises a straightforward comparison chart showing all the packages notified to PCW, for the application in question. Each will be evaluated against the criteria discussed in this article. Because we cannot do an in-depth analysis of every package, this information will be based on that made available by the suppliers. If the publicity documentation fails to mention something, we shall not make assumptions and the column shall be marked N/A — not applicable.

New products

Finally, and quite separately to the above, we shall provide information on any packages newly notified, for application areas already covered.

We're sure that this structured approach to package evaluation will help readers in the selection of their business software. There are a lot of good and reliable suppliers of these products in the field, all of whom will give sound advice. But this series of articles, as much as anything, should help clarify your own thoughts on what can be a rather tricky subject.

From time to time, PCW publishes business case studies. This involves spending a few hours with a user of a computer and chatting through their experiences. Last month, you will recall, we featured a betting shop system. If you would like to tell the world about your system, be it a standard package or custom-built, then please get in touch — other people's successes (and failures) may offer invaluable information to businessmen working in similar areas.

PASCAL. . . continued from P.76

The coding for this procedure appears in Box 15. The entire program can now be gathered together, incorporating the extra global variables (INTERESTRATE and YEARS) into the declaration part of the first attempt (Box 10) and filling out the details of the different procedures as they have subsequently been designed.

EXERCISE:
Adapt REPAYMENTS to produce a table showing the 15 year, 20 year, 25 year and 30 year monthly repayment figures for a given range of loans. The input should be the interest rate and range of loans (and *not* the loan period) and the output should be a table with 5 columns — one for the amount of the loan and one each for each repayment period.

Conclusion

Loops control the repetition of a set of statements within a program. Every language needs a loop — PASCAL has three, which enriches the language and makes it versatile. Loops can be distinguished by the type and position of the loop test relative to the loop body.

Just as a program can be built up from basic blocks into an ordered structure, so can the data on which the program operates be organised into efficient and powerful *data structures*. The next chapter will serve as an introduction to these.

BUGGING THE 6800

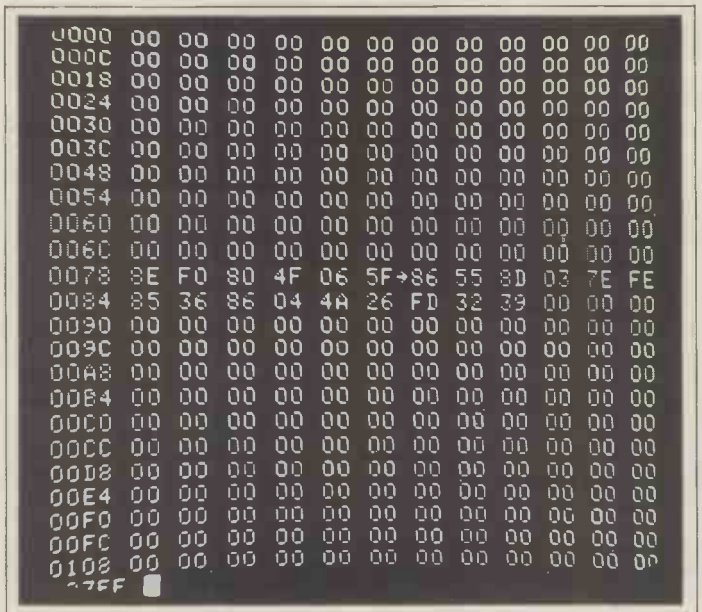
This article presents a monitor program developed by John Moore for the 77-68 system (described in PCW vol. 1 issue 1). This is a very flexible computer system sponsored by the Amateur Computer Club and designed for home construction. It uses the Motorola MC6800 processor for which there is a wealth of readily available cheap and sometimes free software of good quality. The 77-68 hardware is usually configured with an interrupt driven parallel keyboard, and a memory mapped VDU with a Teletext compatible 24x40 format of upper and lower case characters. Users of other 6800 systems may also find ideas in this program that could be of use to them

For those unfamiliar with machine code programming and debugging, or the function of monitors, a little explanation may be in order. A monitor serves three main purposes:

1. It includes routines to give the computer access to the outside world through input/output devices such as keyboards, VDUs and printers.
2. It is used as the executive or operating system to allow the user to run his own applications programs. For example it might support a BASIC interpreter which in turn runs user programs written in the BASIC language. Some monitors can support more than one user program simultaneously.
3. Used for machine code program development, it allows the operator to examine and alter memory contents one by one, to run sample programs, and generally to get them into working order.

Usually monitors are held in ROM so that they are available and running as soon as the computer is started. This particular one is unusual in that after switch on it has to be loaded from tape into a hardware determined 1K byte block of memory (address FC00 - FFFF).

Although this is inconvenient it only takes 5 seconds at 2400 Baud, and it does allow for easy program modification to meet changing requirements. The 1K byte limitation meant there had to be some compromise between the three requirements outlined above so, if anything, the emphasis was in favour of program development capabilities. In particular MIKBUG, the original standard Motorola 512 byte monitor, and similar related variations do not support modern I/O systems and have only slow and limited debugging facilities.



1. Example of the display while using the Edit function. The simple program shown is as follows:

```
0078   8E   F080          LDS £$F080
007B   4F                 CLRA
007C   06                 TAP
007D   5F                 CLRB
007E   86   55            LDAA ££55
0080   8D   03            BSR DELAY
0082   7E   FE85          JMP CONTROL
0085   36          DELAY  PSHA
0086   86   04            LDAA £04
0088   4A          $1     DECA
0089   26   FD            BNE $1
008B   32                 PULA
008C   39                 RTS
```

The pointer is at location 007E.

MIKBUG™ Compatibility

The monitor described here retains a good number of MIKBUG compatible subroutines and although their coding and locations are different they do achieve the same end results. The following are included:

1. CONTROL, the normal re-entry point.
2. Output to VDU: OUT2H, OUTHL, OUTHR, OUT4HS, OUT2HS, OUTS, and OUTEEE. (Note that PDATA could not be squeezed in, but commercially available software usually has it built in).
3. Input: BADDR, BYTE, INHEX, INEEE. All these operate from keyboard or tape, so that a MIKBUG format tape can be loaded, if necessary, by use of a short routine relying heavily on the monitor.

Input/Output

Looking at the program

listing, the section from FEF8 to FFDD is the VDU driver. As most of it has been described before in the ACC news it will not be covered again in detail. The reason for it being so long (230 bytes) is that the 24x40 format is not simply divisible by binary numbers, and therefore some calculation is necessary. The HOME routine can be used at any time, even when a user program is running, because it is called by a keyboard interrupt (see FEDO) and and it is transparent, i.e. it saves and restores all registers that it uses so as not to disturb the user program.

The selections from FEB9 to FEBD and FEF4 to FEF7 handle the keyboard input. Its simplicity shows one of the advantages of using an interrupt driven keyboard. FEC8 to FEF3 handles the non-maskable interrupt itself, having been called by the vector at FFFC. The ability to break into a user program and escape from it (e.g. if stuck in a loop) is the other advantage of an interrupt driven system. The rather fiddly bit from FED9 to FEEB (19 bytes) is necessary to cater for the situation where a user program has stopped at a WAI instruction, to await a keyboard input. Press the Home key; after homing the screen, it re-establishes the WAI condition, (without that the user program would press on regardless).

Commands

To use the monitor for program development, commands are entered at the keyboard and decoded by FE8F to FEA5. In this case, the use of a keyed jump table is more efficient than successive comparison with a list of characters. It also allows easy modification and expansion; in fact, space has been left at FFF3 to FFF6 for the inclusion of your own defined command. This could even be a prefix to a whole group of commands, contained in another area of memory. The following are available in this monitor:

G XXXX Go to user program at address XXXX. The user program runs in a stack whose pointer is extracted from TGTSTK (F0FA in the scratchpad RAM). After a system reset the stack will be from F0E0 down to F0DA, but after escaping from a user program this value could be indeterminate. It is thus good practice to make sure that your own programs set their stack pointer at an early stage.
Continue from an escaped point in a program. This will only work properly if the target stack has been initialised to some area not used by the monitor (try LDS £$F080 for example).

L XXXX Loads a binary tape into memory from address XXXX. In this mode the test of the data register switches at FEB9 is bypassed and their position is immaterial. When the tape has finished it is necessary to use the Escape key to return to CONTROL.

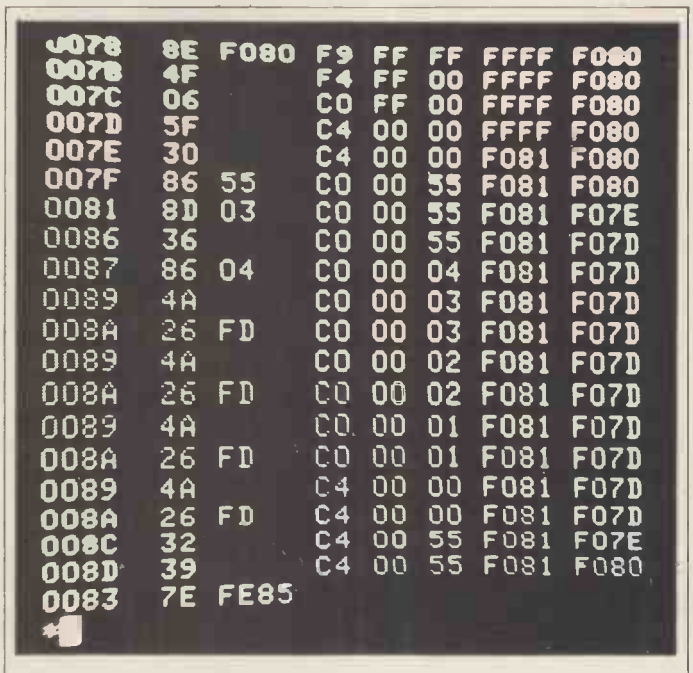
D XXXX YYYY Dump a binary tape from address XXXX to address YYYY. This routine can be used to dump any area of memory including the monitor itself. The program starts at FE13 by calling INADDS, a useful subroutine to get a pair of addresses from the keyboard. When the dump is finished it returns to CONTROL.

E XXXX YYYY Edit a block of memory from XXXX to YYYY. This routine is one of the central features of the monitor. It displays on the screen the first 276 bytes of memory contents starting from XXXX. The format is 23 lines and each contains the address at the start of line and 12 bytes of memory. A cursor, which is initialised to the first byte in the top left hand corner, points to one of the locations and may be moved left, right, up or down by the keys ←, →, ↑, and C/R. The byte pointed to may be overwritten simply by typing the new value. Bytes can be removed by typing "R" or inserted by typing "I" followed by the new value.

In both cases, the succeeding memory contents close up or move out as necessary up to the end address (initially YYYY). The new end address is displayed for reference at the bottom of the screen. This system allows fast and easy interactive editing of machine code in small or large chunks. In the process it does away with the need for a number of separate commands to manipulate memory contents. The edit routine runs from FC5B to FCE1; it uses the MEMPRINT subroutine at FC20 to FC5A to print the display. It should be exited by typing a non-hex character, such as a space.

M XXXX YYYY ZZZZ Block move of memory from XXXX to YYYY to a new area starting at ZZZZ. It is not necessary for the user to calculate the length of the block in advance. If desired, the effect of the move can be checked afterwards, with the Edit command. This routine (FDEA-FE04) is short and fast because it uses the stack pointer as a data counter in the absence of a second index register on the MC6800. You cannot, of course, move a block forwards to a new area which overlaps the old one. . . it will overwrite itself. In this case you have to move it first to a spare area and then to its destination.

T WWWW XXXX YYYY ZZZZ This is a software single step and trace routine that provides a powerful debugging tool. It traces a target program WWWW to XXXX, starting at instruction address ZZZZ. It needs a spare block of memory which you define to start at



2. An extra byte (30=TSX) has been inserted at 007E and then the program run in the single step and trace mode. The order of the columns is: address, opcode, operand if any, condition codes register (CCR), B,A,X,SP. Note the movement of the stack pointer on entering and leaving the subroutine and the further movement when pushing and pulling data onto the stack; also how the Z (=Zero) bit 2 of the CCR is set at 0089 when A has been finally decremented to zero. Details like these of the internal workings of the processor are clearly demonstrated by this sort of display.

YYYY and must be of the same length as the target. Any areas of data must be excluded from both and left intact as they are used by both the target program and the trace routine (or "host" program).

To understand how this routine works you should know that manual debugging of a user program uses the software interrupt (SWI, opcode 3F) as a breakpoint. The SWI is placed at a strategic point in the target so that, when the program gets to it, it responds to the artificial interrupt by dumping the processor registers on the stack and jumping to the address contained at FFFA. It is then possible manually to examine the stack to see what was happening at this point. There are some problems with this approach:

1. The program may never get to the SWI. You can counter this by placing several SWIs in different likely places in the hope of hitting one of them.
2. The process of substituting bytes of target with SWIs, remembering them, and replacing them afterwards is tedious and prone to error.
3. The whole business takes a long time and a lot of mental effort.

The solution adopted here is to extend this method to its logical conclusion by filling the whole of the target program, except for the instruction being executed, with SWIs. Whatever the instruction does it should now hit an SWI next. If it should jump right out of the target program this will be obvious from the display, so you will at least have located the problem instruction.

The trace, starting at FD0F, sets its own SP at F0CF, and the target's at F0B8 (to allow the target to run in an independent stack right from the start, and both target and host to be independent of the monitor stack). As soon as (or if) the target sets its own SP, this is used from then on. At FD32 the host calls the Transfer routine to save a copy of the target in the area from YYYY, and to fill the original with SWIs. At FD37 it starts a line by line print by displaying the first instruction address. From FD48 to FD74 it measures the length of the instruction (1, 2 or 3 bytes), then displays it. At FDA7 the program waits for the single step command from the keyboard (→) and at FDB2 it executes the one instruction. Usually an SWI will be encountered next which will vector to FDB9 and fill the rest of the display line with the resulting register contents for your information. At FDE1 Transfer again prepares the target area and the program then loops round to the start again and waits for the next single step command.

The result is a line by line trace of the program flow that shows exactly what happens at each step. Apart from its diagnostic use this is a first rate educational tool for showing the internal workings of the microprocessor.

If the target gets into a long loop (e.g. a timing loop) you can skip to the end as follows:

1. Press the Escape key once. Do not press it again while you are temporarily out of the trace routine.
2. Knowing from the display where the target SP is, use the Edit command to examine the 7 bytes below it. These correspond to the CCR, B, A, X, and PC registers. You can then modify the CCR, B, A, and X registers (but not the PC) as necessary to shorten the loop. Press the space bar to leave Edit.
3. Alternatively you can modify areas of data in memory in the same way.
4. Press the continue key (←) to return to the Trace routine.

The only types of program that cannot be handled by the Trace are those with self modifying code or those with areas of data and program intermingled.

When you have finished, it is necessary to use the Move command to shift the program copy from YYYY back to WWWW.

Conclusion

This monitor has been in use for about six months now and has made it possible to tackle programs like 8K BASIC, study them and modify them to run on the 77-68 without too much difficulty. If you have more than 1K available for your monitor I suggest the following inclusions:

1. Automatic return of a traced program to its original location when finished.
2. Automatic decoding and display of the individual CCR flags during Trace.
3. Addition of the MIKBUG PDATA routine.
4. Inclusion of more sophisticated tape dump and load formats with file names and error checking *before* transfer from a buffer to storage, unlike MIKBUG which loads each block first and then checks the address and data to see if it got it right!
5. An even bigger Edit display if you have a bigger VDU format.
6. Software vectoring of interrupts to allow more than one interrupt driven peripheral at a time, and also multi-programming.

Finally, may I add that suggestions for improvement of the existing monitor will always be welcome.

Copies of the monitor are available on 2708 EPROM at £14.10 + VAT. Contact John at 1 The Spinney, Fleet, Hants. Telephone: 02514 29553.

Program

```
FC00  A6 00     OUT2H   LDAA X
FC02  8D 05             BSR OUTHL
FC04  A6 00             LDAA X
FC06  08                INX
FC07  20 04             BRA OUTHR
FC09  44 44     OUTHL   LSRA x 2
FC0B  44 44             LSRA x 2
FC0D  84 0F     OUTHR   ANDA #$00001111
FC0F  BB 90             ADDA #$90       Allison's algorithm - saves 2 bytes &
FC11  19                DAA             average of 2¼ cycles per character
FC12  89 40             ADCA #$40
FC14  19                DAA
FC15  7E FE F8  OUTCH   JMP OUTEEE
FC18  8D E6     OUT4HS  BSR OUT2H
FC1A  8D E4     OUT2HS  BSR OUT2H
FC1C  86 20     OUTS    LDAA #'space
FC1E  20 F5             BRA OUTCH
FC20  BD FF 1C  MEMPRINT JSR HOME
FC23  FE F0 F1          LDX STARTING
FC26  FF F0 F6          STX TEMPX
FC29  C6 17             LDAB #$17       page length
FC2B  37        NEWLINE PSHB
FC2C  CE F0 F6          LDX #TEMPX
FC2F  C6 0C             LDAB #$0C       line length
FC31  8D CD             BSR OUT2H
FC33  BD CB             BSR OUT2H       Print address
FC35  FE F0 F6          LDX TEMPX
FC38  BC F0 EF  NEWBYTE CPX MEMLOC
FC3B  26 06             BNE MEM1
FC3D  86 5D             LDAA #'→        Print pointer against the byte
FC3F  8D D4             BSR OUTCH
FC41  20 02             BRA MEM2
FC43  8D D7     MEM1    BSR OUTS
FC45  8D B9     MEM2    BSR OUT2H
FC47  5A                DEC B
FC48  26 EE             BNE NEWBYTE
FC4A  FF F0 F6          STX TEMPX
FC4D  33                PULB
FC4E  5A                DEC B
FC4F  26 DA             BNE NEWLINE
FC51  86 3C             LDAA #'>
FC53  8D C0             BSR OUTCH
FC55  CE F0 F3          LDX #ENDING
FC58  8D BE             BSR OUT4HS      Print end address
FC5A  39                RTS             End of MEMPRINT
FC5B  BD FE 05  EDIT    JSR INADDS
FC5E  8D C0     ED6     BSR MEMPRINT
FC60  3E                WAI             Get keyboard command
FC61  B6 F0 FE          LDAA KBUFF2
FC64  FE F0 EF          LDX MEMLOC
FC67  81 5D             CMPA #'→        Cursor right?
FC69  26 03             BNE ED1
FC6B  08                INX
FC6C  20 2D             BRA ED2
FC6E  81 5B     ED1     CMPA #'←        Cursor left?
FC70  26 03             BNE ED3
FC72  09                DEX
FC73  20 26             BRA ED2
FC75  81 0D     ED3     CMPA #'↓        Cursor down?
FC77  26 0F             BNE ED4
FC79  B6 F0 F0          LDAA MEMLOC LOW
FC7C  8B 0C             ADDA #$0C
FC7E  B7 F0 F0          STAA MEMLOC LOW
FC81  24 03             BCC ED5
FC83  7C FD EF          INC MEMLOC HIGH
FC86  20 D6     ED5     BRA ED6
FC88  81 5E     ED4     CMPA #'↑        Cursor up?
FC8A  26 14             BNE ED7
FC8C  B6 F0 F0          LDAA MEMLOC LOW
FC8F  80 0C             SUBA #$0C
FC91  B7 F0 F0          STAA MEMLOC LOW
FC94  24 03             BCC ED8
FC96  7A F0 EF          DEC MEMLOC HIGH
FC99  20 C3     ED8     BRA ED6
FC9B  FF F0 EF  ED2     STX MEMLOC
FC9E  20 BE             BRA ED6
FCA0  81 49     ED7     CMPA #'I        Insert?
FCA2  26 19             BNE ED9
FCA4  BD FE 55          JSR BYTE
FCA7  FE F0 F3          LDX ENDING
FCAA  08                INX
FCAB  FF F0 F3          STX ENDING
FCAE  09        ED10    DEX
```

```
FCAF  E6 00              LOAB X
FCB1  E7 01              STAB 1,X
FCB3  BC F0 EF           CPX MEMLOC
FCB6  26 F6              BNE EO10
FCB8  A7 00              STAA X
FCBA  08                 INX
FCBB  20 DE              BRA ED2
FCBD  81 52     EO9      CMPA £'R        Remove?
FCBF  26 13              BNE ED11
FCC1  FE F0 EF           LDX MEMLOC
FCC4  E6 01     ED12     LOAB 1,X
FCC6  E7 00              STAB X
FCC8  08                 INX
FCC9  BC F0 F3           CPX ENDING
FCCC  26 F6              BNE ED12
FCCE  09                 DEX
FCCF  FF F0 F3           STX ENDING
FCD2  20 BA              BRA EO6
FCD4  BD FE 69  ED11     JSR INHEX1
FCD7  BD FE 57           JSR BYTE1
FCDA  A7 00              STAA X
FCDC  08                 INX
FCDD  FF F0 EF           STX MEMLOC
FCE0  20 FD              BRA ED6         End of Edit routine
FCE2  FE F0 E2  TRANSFER LDX TGT START
FCE5  BE F0 EC           LDS M.S.A.
FCE8  C6 3F              LDAB £$3F
FCEA  B6 F0 F0  TRAN4    LDAA VDULOW     Used as a flag
FCED  84 0F              ANDA £%00001111
FCEF  26 04              BNE TRAN1
FCF1  A6 00              LDAA X
FCF3  36                 PSHA            Included if flag = 0
FCF4  31                 INS
FCF5  E7 00     TRAN1    STABx
FCF7  BC F0 EA           CPX I.A.
FCFA  26 03              BNE TRAN2
FCFC  BF F0 E8           STS M.I.A.      Sets Mirror Instruction Address
FCFF  BC F0 E4  TRAN2    CPX TGT END
FD02  27 04              BEQ TRAN3
FD04  08                 INX
FD05  31                 INS
FD06  20 E2              BRA TRAN4
FD08  8E F0 CD  TRAN3    LDS £HOSTSTK-2  To enable correct RTS
FD0B  39                 RTS
FD0C  7E FE 44  BAD1     JMP BADDR
FD0F  8E F0 CF  TRACE    LDS £HOSTSTK    Beginning of single step & trace routine
FD12  CE F0 B8           LDX £TGTSTK     Trace target stack
FD15  FF F0 E6           STX TEMPSTK     To allow Continue command
FD18  8D F2              BSR BAD1
FD1A  FF F0 E2           STX TGT START   Start of target program area
FD1D  8D ED              BSR BAD1
FD1F  FF F0 E4           STX TGT END     End of target program area
FD22  8D E8              BSR BAD1
FD24  FF F0 EC           STX M.S.A.      Mirror program start address
FD27  8D E3              BSR BAD1
FD29  FF F0 EA           STX I.A.        Instruction address
FD2C  FF F0 BE           STX P.C.        Sets P.C. in target stack
FD2F  B0 FF 1C           JSR HOME        Clear screen
FD32  8D AE              BSR TRANSFER
FD34  CE F0 EA  TRACE1   LDX £I.A.
FD37  BD FC 18           JSR OUT4HS      Print Instruction Address
FD3A  80 77              BSR OUTS1
FD3C  FE F0 E8           LDX M.I.A.
FD3F  A6 00              LOAA X
FD41  81 3F              CMPA £$3F       Is it a SWI?
FD43  26 03              BNE TRACE2
FD45  7E FE 82           JMP ESCAPE      If so
FD48  81 8C     TRACE2   CMPA £$8C       Start disassembly of Opcode
FD4A  27 22              BEQ THREE
FD4C  81 8E              CMPA £$8E
FD4E  27 1E              BEQ THREE
FD50  81 CE              CMPA £$CE
FD52  27 1A              BEQ THREE
FD54  84 F0              ANDA £%11110000
FD56  81 50              CMPA £$50
FD58  22 0C              BHI MORE
FD5A  81 20              CMPA £$2D
FD5C  26 04              BNE ONE
FD5E  C6 02     TWO      LDAB £2
FD60  20 0E              BRA TRACE3
FD62  C6 01     ONE      LDAB £1
FD64  20 0A              BRA TRACE3
FD66  85 10     MORE     BITA £$10
FD68  27 F4              BEQ TWO
FD6A  85 20              BITA £$20
FD6C  27 F0              BEQ TWO
FD6E  C6 03     THREE    LDAB £3
FD70  86 03     TRACE3   LDAA £3          Instruction length now in 8
FD72  B7 F0 F5           STAA CKSM       Length of opcode + operand
FD75  80 3F              BSR OUT2HS1     Print first by[illegible] opcode
FD77  09        PREP1    DEX
FD78  A6 00              LOAA X          Get instruction[illegible]
FD7A  FE F0 EA           LDX I.A.
FD7D  A7 00              STAA X
FD7F  7A F0 F5           DEC CKSM
FD82  5A                 DECB
FD83  27 10              BEQ PREP2
FD85  08                 INX
FD86  FF F0 EA           STX I.A.
FD89  FE F0 E8           LDX M.I.A.
FD8C  08                 INX
FD8D  FF F0 E8           STX M.I.A.
FD90  BD FC 00           JSR OUT2H       Print operand
FD93  20 E2              BRA PREP1
FD95  7D F0 F5  PREP2    TST CKSM
FD98  27 0B              BEQ PREP3
FD9A  8D 17              BSR OUTS1
FD9C  8D 15              BSR OUTS1
FD9E  7A F0 F5           DEC CKSM
FDA1  20 F2              BRA PREP2
FDA3  8D 0E     PREP3    BSR OUTS1
FDA5  8D 0C              BSR OUTS1
FDA7  3E        PREP4    WAI             Get command from keyboard
FDA8  B6 F0 FE           LDAA KBUFF2
FDAB  81 50              CMPA £'P        Wait for single step command
FDAD  26 FB              BNE PREP4
FDAF  BE F0 E6           LDS TEMPSTK
FDB2  3B                 RTI             Run next instruction
FDB3  7E FC 1C  OUTS1    JMP OUTS
FDB6  7E FC 1A  OUT2HS1  JMP OUT2HS
FDB9  BF F0 E6  SWINT    STS TEMPSTK     Start of SWI service routine
FDBC  8E F0 CF           LDS £HOSTSTK
FDBF  FE F0 E6           LDX TEMPSTK
FDC2  08                 INX
FDC3  8D F1              BSR OUT2HS1     Print CCR
FDC5  8D EF              BSR OUT2HS1     Print B
FDC7  8D ED              BSR OUT2HS1     Print A
FDC9  B0 FC 18           JSR OUT4HS      Print X
FDCC  AE D0              LDS, X          Get P.C.+1
FDCE  34                 DES             Correct it
FDCF  BF F0 EA           STS I.A.        Update Instruction Address,
FDD2  AF 00              STS  X          and P.C. on target stack.
FDD4  8E F0 CF           LDS £HOSTSTK
FDD7  08                 INX             Correct S.P.
FDD8  FF F0 F6           STX TEMPX
FDDB  CE F0 F6           LDX £TEMPX
FDDE  BD FC 18           JSR OUT4HS      Print corrected S.P.
FDE1  BD FC E2           JSR TRANSFER    Refill with SWIs & update M.I.A.
FDE4  BD FE FC           JSR OUTC/R
FDE7  7E FD 34           JMP TRACE1      and round again
FDEA  8D 19     MOVE     BSR INADDS      Block Move routine
FDEC  08                 INX
FDED  FF F0 F3           STX ENDING+1
FDF0  8D 52              BSR BADDR
FDF2  35                 TXS
FDF3  31                 INS
FDF4  FE F0 F1           LOX STARTING
FDF7  A6 00     MOVE1    LOAA X
FDF9  08                 INX
FDFA  36                 PSHA
FDFB  31 31              INS x 2
FDFD  BC F0 F3           CPX ENDING+1
FE00  26 F5              BNE MOVE1
FE02  7E FE 85  CONT     JMP CONTROL
FE05  8D 3D     INADDS   BSR BADDR       Get start & end addresses
FE07  FF F0 F1           STX STARTING
FE0A  FF F0 EF           STX MEMLOC      For MEMPRINT routine
FE0D  8D 35              BSR BADDR
FE0F  FF F0 F3           STX ENDING
FE12  39                 RTS
FE13  8D F0     DUMP     BSR INADDS      To tape in binary format
FE15  FE F0 F1           LOX STARTING
FE18  80 14              BSR INITZE
FE1A  B6 F4 01  DUMP1    LDAA ACIA S
FE1D  85 02              BITA £%00000010 Tx busy?
FE1F  27 F9              BEQ DUMP1
FE21  A6 00              LDAA X
FE23  B7 F4 00           STAA ACIA D     Dump a byte
FE26  BC F0 F3           CPX ENDING
FE29  27 5A              BEQ CONTROL
FE2B  08                 INX
FE2C  20 EC              BRA DUMP1
FE2E  86 23     INITZE   LDAA £$23       Subroutine to prepare ACIA
FE30  B7 F4 01           STAA ACIA C
FE33  47                 ASRA
FE34  B7 F4 01           STAA ACIA C     No parity, 2 stop bits
FE37  39                 RTS
FE38  80 0A     LOAD     BSR BADDR       Load a binary tape until stopped
FE3A  80 F2              BSR INITZE
FE3C  BD FE BE  LOAD1    JSR STATUS      Get a byte
FE3F  A7 00              STAA X
FE41  08                 INX
FE42  20 F8              BRA LOAD1       round again
FE44  BD FC 1C  BADDR    JSR OUTS        Mikbug routine, from keyboard or tape.
FE47  80 0C              BSR BYTE
FE49  B7 F0 F6           STAA TEMPX HI
FE4C  80 07              BSR BYTE
FE4E  B7 F0 F7           STAA TEMPX LO
FE51  FE F0 F6           LDX TEMPX
FE54  39                 RTS
FE55  8D 10     BYTE     BSR INHEX
FE57  48 48              ASLA x 2
FE59  48 48              ASLA x 2
FE5B  16                 TAB
FE5C  8D 09              BSR INHEX
FE5E  1B                 ABA
FE5F  16                 TAB
FE60  FB F0 F5           ADDB CKSM
FE63  F7 F0 F5           STAB CKSM       Update Checksum
FE66  39                 RTS
FE67  80 5D     INHEX    BSR INEEE
FE69  80 30     INHEX1   SUBA £$30
FE6B  2B 18              BMI CONTROL
FE6D  81 09              CMPA £$09
FE6F  2F 0A              BLE INTHG
FE71  81 11              CMPA £$11
FE73  2B 10              BMI CONTROL
FE75  81 16              CMPA £$16
FE77  2E 0C              BGT CONTROL
FE79  80 07              SUBA £$07
FE7B  39        INTHG    RTS
FE7C  8E F0 DA  RESET    LDS £CTRLSTK-7  Initialises target stack if required
FE7F  BD FF 1C           JSR HOME        Clears screen
FE82  BF F0 FA  ESCAPE   STS TGTSTK
FE85  8E F0 E1  CONTROL  LDS ICTRLSTK
FE88  B0 FE FC           JSR OUTC/R      Carriage return
FE8B  86 2A              LDAA £'*
FE8D  80 69              BSR OUTEEE
FE8F  80 28              BSR INEEE       Get keyboard command
FE91  CE FF DE           LOX £JTABLE     Point at keyed jump table
FE94  E6 00     CONT1    LOAB X          Get key
FE96  C1 00              CMPB £00        End of table?
FE98  27 EB              BEQ CONTROL     If character not recognised
FE9A  11                 CBA
FE9B  27 05              BEQ FOUNDIT
FE9D  08 08 08           INX x 3         Point to next key
FEA0  20 F2              BRA CONT1
FEA2  EE 01     FOUNDIT  LOX 1,X
FEA4  6E 00              JMP X           Jump to required routine
FEA6  80 9C     GO       BSR BADDR
FEA8  FE F0 FA           LDX TGTSTK
FEAB  B6 F0 F6           LDAA TEMPX HI
FEAE  A7 06              STAA 6,X
FEB0  B6 F0 F7           LOAA TEMPX LO
FEB3  A7 07              STAA 7,X        Target P.C. prepared
FEB5  BE F0 FA  CONTINUE LDS TGTSTK      Target S.P. prepared
FEB8  3B                 RTI             and go
FEB9  B6 F0 FF  INEEE    LDAA SWITCHES   Mikbug compatible routine.
FEBC  27 36              BEQ KBD         If parallel input required (sws.=0)
FEBE  B6 F4 01  STATUS   LOAA ACIA S     If serial input required.
FEC1  44                 LSRA            Rx ready?
FEC2  24 FA              BCC STATUS
FEC4  B6 F4 00           LDAA ACIA D
FEC7  39                 RTS
FEC8  B6 FB FF  NMI      LDAA KBUFF      NMI handler
FECB  81 03              CMPA £$03       Escape?
FECD  27 B3              BEQ ESCAPE
FECF  36                 PSHA
FED0  81 04              CMPA £$04       Home?
FED2  26 1B              BNE NMI1
FED4  FF F0 FB           STX TEMPX2
FED7  80 43              BSR HOME
FED9  30                 TSX
FEDA  EE 06              LDX 6,X
FEDC  09                 DEX             Get last byte before NMI occurred.
FEDD  A6 00              LDAA X
FEDF  81 3E              CMPA £$3E       Was it WAI?
FEE1  26 09              BNE NMI2
FEE3  30                 TSX
FEE4  6D 07              TST 7,X
FEE6  26 02              BNE NMI3
FEE8  6A 06              DEC 6,X
FEEA  6A 07     NMI3     DEC 7,X         Re-establish WAI after RTI
FEEC  FE F0 FB  NMI2     LDX TEMPX2
FEEF  32        NMI1     PULA
FEF0  B7 F0 FE           STAA KBUFF2
FEF3  3B                 RTI
FEF4  3E        KBD      WAI             Get keyboard input
FEF5  B6 F0 FE           LDAA KBUFF2
FEF8  81 0D     OUTEEE   CMPA £'C/R      Mikbug compatible, echoes INEEE
FEFA  26 39              BNE PUTVDU
FEFC  37        OUTC/R   PSHB            Entry to print carriage return
FEFD  36                 PSHA
FEFE  86 20              LOAA £'space
FF00  F6 F0 FC  OUT1     LOAB VDU HI
FF03  C1 FB              CMPB i$FB
FF05  27 04              BEQ OUT2
FF07  8D 2C              BSR PUTVDU      Print space
FF09  20 F5              BRA OUT1
FF0B  F6 F0 FD  OUT2     LOAB VDU LO
FF0E  53                 COMB
FF0F  C5 07              BITB I07        End of line?
FF11  27 04              BEQ ENDOUT
FF13  8D 20              BSR PUTVDU      Print space
```

Dick Pountain *analyses and reports on the micro-associated world of programmable calculators.*

GETTING IT TAPED

IN My glowing review of the Casio FX501/502P last month ("This one will run and run . . ."), I promised a follow up on the FA-1 adaptor. Here it is.

Tempus of Cambridge kindly supplied the adaptor and also exchanged the 501 for a 502 (which, as I suspected, is just like the 501, but more so).

The FA-1 is a small cradle into which the calculator slips, connecting via a gold plated, 7-pin socket. The cradle has a lead ending in two mini jack plugs which fit into the microphone and earphone sockets of a standard cassette recorder. Cassette radios, mono and stereo cassette decks and even mini cassette dictation machines will work. Some hi-fi cassette decks will require a 5-pin DIN plug to be substituted for the mini jacks.

Saving and loading are performed in the same manner as on a micro computer. The instruction SAVE is followed by a three digit file number, and is executed from the keyboard with the recorder running. Loading is by LOAD and the same file number. The calculator searches for the named file and displays, say, FP005 when a program file is found or F005 when a data file is found.

For speed, it is best to first roughly locate the file using tape counter readings, but if necessary, the calculator will search a whole tape – displaying each file name as it passes, but loading only the designated one.

The maximum time for a LOAD is about 15 seconds. . . correspondingly shorter for smaller programs. Therefore a C-60 cassette can hold over 200 programs.

As alluded to earlier, program and data are stored in separate files, unlike most magnetic card calculators which store the whole program and data register contents on one card. The separate way is of much more use as the same program can be used with any number of different data sets. Also, execution of a program may be halted partway through and a fresh data file loaded (manually, of course) which greatly increases the data handling facilities of the 502. In addition, the load instruction will fill all or any of the ten program registers. Therefore several different programs may be loaded into the machine simultaneously (size permitting), or parts of a large program may be loaded independently, or subroutines may be stored on tape and added to existing programs in the machine.

I have used the adaptor with three different recorders including an 'electronic memo-pad' (which provides great portability) and found loading and saving very easy and reliable on all of them – provided the output volume is set as high as possible.

The FA-1 is also necessary for the music synthesizing function of the calculator, about which the less said the better. The world didn't need Rolf Harris and the Stylophone; it needs a robot Rolf Harris even less.

To summarise then, the Casio FX502P with the FA-1 and a mini cassette recorder provides a pocketable computing system which is in some ways unrivalled, even by the £150 plus Hewlett Packard and Texas machines, particularly in regard of ease of learning.

As a footnote, I must clarify a wrong impression my review last month may have given. I said that the 501/502 have only ten labels available for use in programs. Of course, since there are ten independant program registers, all ten labels may be used ten time over, if the program is broken down into modules (which is a habit the machine rapidly encourages). This gives a potential of 100 labels, which is quite sufficient.

Master pack

Following on from the above, I have been informed by Premier Publications that they are launching the Master Pack, a software package for the Casios. It takes the form of a cassette containing over 160 programs and a 60 page manual which includes an introduction to programming, advanced programming, plus full program documentation. At press time I hadn't seen the whole package, though extracts I have looked at from the manual suggest that it will be far superior to Casio's own User Manual. The programs include all of Casio's own library programs ready to load, plus a variety of educational, games and personal finance routines and general purpose subroutines for advanced programmers.

The pre-production sample contained some quite sophisticated games with ingenious use of the Casio's display formats, including one which scrolls a 10 by 10 field, line by line over the display. Another routine provides, via data packing techniques, the equivalent of 100 independent memories – each to store a single digit variable.

The Master Pack will be available from dealers after the middle of October and I shall report more fully when a production sample is available.

Look sharp

A new pocket calculator from Sharp, the EL-5100, has reached me; although it won't interest PCW readers particularly, since it is not truly programmable, nevertheless it has some clever features which may give pointers to the future.

Immaculately presented in the inimitable Sharp fashion, it's distinguished from an ordinary scientific calculator by its unusually large LCD display. This display is alphanumeric (though only a part alphabet is provided).

When you enter a simple arithmetic calculation problem, the whole calculation is displayed, e.g. 5.7 + 3.8 x 6.4. On pressing = the answer is displayed. But more intriguing is the Algebraic Expression Mode. In this mode, algebraic expressions of any complexity may be written in stan-

Cont. on Page 93

Four of a kind!

The most advanced VDU interface available at £88

Acorn Computers announce with pride the fourth module in the series — a VDU interface on a Eurocard. This unit uses two very powerful devices, the MC 6845 and the SAA5050. The 6845 programmable controller provides all the signals to drive a 625 line 50 frames per second VDU together with read addresses for the character RAM, the SAA5050 character generator then produces the necessary dot patterns to refresh the VDU. The SAA5050 produces standard teletext characters and graphics and has Red, Green and Blue outputs. This means that the Acorn system will be compatible with CEEFAX, ORACLE and PRESTEL transmissions.

The Acorn VDU module in kit form is complete with sockets and is supplied with listings for programs which set up the 6845, a miniature dissassembler which displays 25 hex instructions (double or treble byte) and graphics programs. All these may be loaded and run using the Acorn system 1 monitor.

Options include:- VHF modulator for B.W. domestic T.V. and PAL colour encoder for domestic colour T.V.

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- Teletext graphics font
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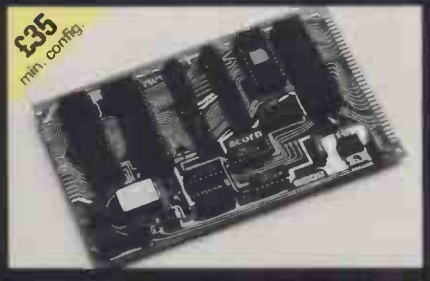

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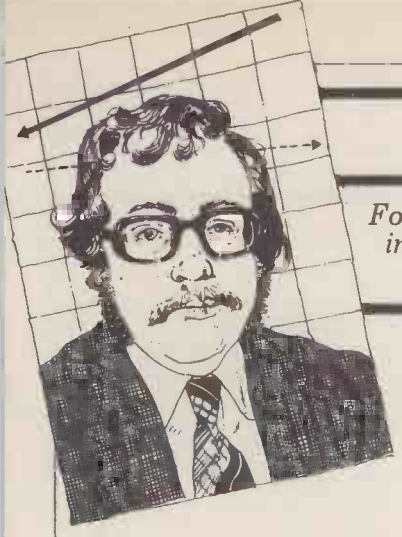

ON THE LINE

For almost a year now, David Hebditch in his 'On the Line' series has been expounding the basic concepts of using your personal computer to communicate with other systems over the public telephone network.

HIGH-LEVEL PROTOCOLS

By the way of review, we have now explored the basic hardware and software mechanisms for interfacing personal computers to the public telephone network and for moving blocks of data between processors with a minimal level of error control.

This may well be adequate for most users to be able to establish simple point-to-point 'conversations'. However, in order to determine what to do with this capability it may be useful to return to base and consider our original ideas for the practical application of personal computer networking.

Let's forget (for the time being) the medium-term possibilities of using Prestel, Teletext and teleconferencing etc. The most practical (and useful) applications in the short-term are listed below.

1. **Conversations:** Simply sending messages between systems. The benefits of this are:
   - a fast (and relatively cheap) way of sending someone a message — electronic mail?
   - an effective way of using the telephone for deaf people.
   - a means of setting-up calls for other purposes (see below)
   - given the correct data link control, a basis for emulating a terminal for linking to another, larger computer (eg. a time-sharing service or database provider).
2. Program Transfer
   - a means of swapping programs with another user.
   - a means of sending the fixes to make the previous version of the program work.

It is technically feasible for software companies to use this as a method of distributing programs. Of course, the number of prospective customers with a communications capability needs to be big enough to make the investment on their part worthwhile and it may be some time before this is achieved.

3. **File Transfer** is functionally very similar to program transfer but involves the shifting of *data* from one processor to another. This is more likely to be of use in a business system than in a domestic environment. For example, details of goods received at a warehouse could be transmitted to the order-processing computer for addition to the stock-on-hand file. The major difference between program transfer and file transfer is one of data format and this will be discussed later in the article.

I did consider including a category for interactive game-playing. The protocol required is, however, a function of the type of game involved. In the case of video games very little information needs to be sent (eg. the eight-bit value of a game-control) but it must be sent quickly (to avoid missing the ball!) In view of this and the relatively unimportant nature of the application, the use of a data link control with error handling would probably be too cumbersome. Other games like

ANNOUNCING...THE PERSONAL COMPUTER NETWORK

The number of users with some form of communications capability has now reached a high enough level to justify the introduction of the 'Personal Computer Network'. The network will comprise a directory published in Personal Computer World (and periodically updated). The directory will include an entry for each reader who is interested in linking up to other enthusiasts and will list his name, telephone number, type of system, times available and applications. If you wish to participate, please complete the form below and send it to Personal Computer World.

During the Personal Computer World show, David Hebditch will be demonstrating data communications on a number of popular systems, including the Apple II, Pet and Nascom I. He will be available to provide assistance and answer any questions you may have about networking in general and the Personal Computer Network in particular.

Please register me as being interested in Personal Computer Networking.

Name: _____

Address: _____

_____

_____

Telephone No: _____

Computer System: _____

_____

I do not yet have a communications interface, but would like to be kept informed of developments: Tick ☐

I have the following type of communications interface: Tick

I can transmit at the following speeds 110 bit/s ☐
300 bit/s ☐
1200 bit/s ☐

I have a Post Office modem: ☐
I use an acoustic coupler: ☐
I can act as an originating station: ☐
a receiving station: ☐
both: ☐

Other comments: _____

_____

_____

Date: _____

Signature: _____

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chess and simulations could be handled using the conversational mode. To cut a long story short, I don't think that any special protocol is needed for game-playing.

A major problem with the three modes identified above is that of transparency. This is caused by the transmission of characters in the text of a message which could be mistakenly identified at the receiving end as a data-link control character. For example if you sent ASCII ETX (3) in a message the receiver will treat this as the last character in the transmission and lose all the subsequent characters. The same thing could happen with EOT (4).

"Well", you might ask, "why do such a silly thing?" But it may be difficult to avoid. For example, in conversational mode, the user may inadvertently type a control-shift key which generates a protocol character. The solution here is relatively straight-forward; impose a rule which says that only displayable characters may be included in messages. This means that your dialogue control program must 'filter out' any illegal characters.

But what if you have to transmit the equivalent of a control character in a message? This could happen during the transmission of a program in object form, or of a data file containing integer values, or of a program in source form with 'funny' characters between the quotes in a PRINT statement.

The standard way of solving this problem is to employ some form of 'escape logic'. This involves the prefixing of each dubious character with ASCII ESC (27). This has to be inserted by the transmitting program and tells the receiving software that the next character is not really ETX (or whatever). The receiver will delete the ESC.

Now the smart guys amongst you are already asking, "What happens if you want to send 'ESC'?" Clearly a spurious ESC immediately prior to the real ETX will cause the ETX to be ignored. More problems. In this case, a further ESC prefix is also required and will cause the following ESC to be treated as a regular data character.

Phew! That's enough of escape logic. Now let's move on to the high level protocols (HLP) needed for the three application modes.

Byte No.	Name	Comments ①
0	Type	H: Handshake message D: Dialogue P: Program Transfer F: File Transfer etc.
1 - 3	Transmission Number	Sequential message number (incremented automatically by transmitting program)
4	Action code (Command/ Response)	I: Initial transmission block S: Subsequent transmission block F: Final transmission block etc.
5 - 9	SPARE	(And anything else we can think of).

First of all, I have to make a disclaimer; there are no internationally agreed standards for HLP. Indeed there are no national standards, either. Whilst writing this article, I have a three-foot molehill on my desk of working papers from the various standards organizations (BSI, ISO, ECMA, CCITT, ANSI et al) as well as the manuals for many proprietary networking standards (IBM's SNA, Digital Equipment's DECNet and so on). I even have articles from BYTE and INTERFACE AGE describing the procedures used in the various US personal computer networks. And I plan to ignore them all.

The reasons are as follows:

1. They are too complicated.
2. Although we are talking about the establishment of a Personal Computer *Network* the network we are employing is the plain old telephone system rather than any sophisticated multi node grid, permanently interconnecting a large number of users. Only two processors will be connected at any one time.
3. Implementation of the HLP should be possible by the average home user.
4. Costs must be kept to a minimum.
5. Speed and reliability concerns are not so serious.
6. Which proposed 'standard' do we choose anyway?

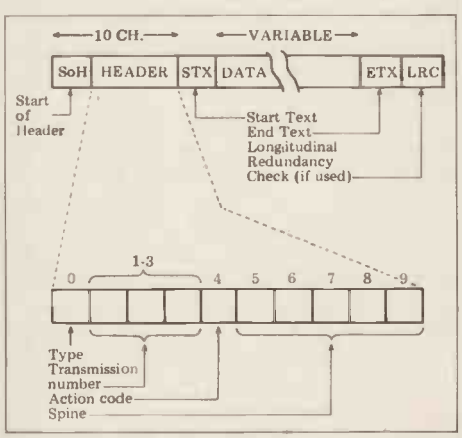
Now having said all that, I would need an ego of enormous proportions to even consider that I might be able to come up with the definitive HLP for all future requirements. But as my ego is only of moderately large proportions (he says modestly) I am only going to *suggest* a possible protocol and then throw the floor open for discussion. In other words, we need a simple, minimal, easy to implement protocol with which we can play and experiment and develop. HLP's are all based upon the use of a 'header' in each message which will contain all the necessary control information. A possible format is shown in Figure 1. The header occurs in every message of the exchange and comprises the following items: (Box 1). It is now necessary to consider how this header might be used for each mode. For example, I would suggest that the first message sent by each processor be a handshake message (Type 'H'). The action code would be set to 'I' and the transmission number to '001'. The data area might consist of:

— User name (20 bytes)
— Telephone number (15 bytes)
— System type
(e.g. APPLE II 24 K) (20 bytes)

A handshake message must be received before any further communications can take place. At a later stage, a password might be incorporated in the message.

Immediately handshakes have been exchanged the system can enter dialogue mode to facilitate a conversation between the users. Subsequently, file or program transfer can be initiated.

We will look at these in more detail in another article. In the meantime, please send me your ideas and comments c/o The Editor, Personal Computer World.



HARD TIMES

Winchester discs~secure or not?

Comart Ltd. have just announced the Cromemco Z2H microcomputer system, incorporating a Winchester disc drive. David A. Broad, Managing Director and Chairman of Comart, gives a description of the device and presents some solutions to the data security problems imposed by it.

The emergence of high capacity low-cost disc storage units housed in the physical space previously occupied by first generation floppy disc drives has opened up a whole new spectrum of applications for the small computer and intelligent controller. The technology of "Winchester" drives was first pioneered by IBM with their Piccolo fixed drive systems; they were designed to incorporate high reliability with high capacity. The essence of the concept is a disc pack fixed and spinning inside a sealed enclosure. Air within this enclosure is internally filtered by convection through a micro filter, with the effect that the disc drive has its own environment.

Another aspect of the Winchester concept is that the disc heads and carriage are of very low mass and inertia, allowing them to come within a very close proximity of the spinning disc surfaces. This results in a high sensitivity to flux changes which, in turn, enables a high storage capacity. Electronics are normally mounted outside the enclosure itself, to minimise dissipation and the necessity for access into it.

The concept of the fixed disc is particularly relevant to the microcomputer market. This is a market where the owner, operator and programmer of a computer system is often one and the same person and the environment that the system is intended to work in is that of a normal office, workshop or laboratory. Exchangeable disc systems should ideally only be operated in environments which are controlled in terms of the dust and temperature.

The second important benefit relates to one of the prime aspects of all microcomputer devices. . . . . their very low cost. Systems are being brought to the marketplace now which enclose 11M bytes of hard disc storage, 64K bytes of main memory processors, and interfaces for a VDU and printer – all for less than £5,000; it's the price that the micro user wants to pay.

The other aspect is the very small size of the Winchester disc drives. They can be inserted in physical replacement of standard floppy drives and with very similar power supply requirements. Indeed their ability to work from DC supplies makes them not only very suitable for microcomputer applications, but also ideal for international use where there may be variations in mains frequencies and voltage. Of course the drives will find applications in the minicomputer industry and other types of small computer where low cost and compactness are desirable. But application areas will also open up in communications controllers, word processors and in other dedicated but intelligent devices where high capacity is required.

Security aspects

One of the regular comments made on the fixed disc Winchester drives relates to their use in business applications. Here, the necessity exists for protecting and backing up the data in the event of a catastrophic failure and, indeed, advice is often sought from the suppliers on the best way for a customer to approach this problem.

"..the necessity exists for protecting and backing up the data in the event of a catastrophic failure.."

Let us first, however, consider the nature of the problem in relation to the design of the drives. Firstly, because of the light head mechanism and loading techniques, consideration of 'head crashes' is of lesser concern. The media itself is lubricated and in certain circumstances the heads will come in contact with the media (for example during powering up or powering down of the disc drive). Secondly, because of the enclosed environment, the ingress of dust and other foreign bodies is almost totally restricted and build-ups of material on the head is eliminated.

Electronic controller design also allows individual surfaces to be write protected and operating system design further allows faulty tracks to be interchanged in the event of corruption. So the problem of disc failures is greatly reduced. Write circuitry in the controllers is also normally designed for fail safe operation so that the incorrect combination of conditioned signals will result in no current passing through the disc head.

But of course failures can occur and the MTBF of the drives are commonly quoted at 10 thousand hours or so. To back up these disc drives several methods are often proposed by the manufacturers. Firstly, individual files or transaction records can be backed up to floppy discs. Careful systems design can enable the history of changes to the 10M byte data base to be recorded in concise form in transaction records. It is not necessary therefore for the entire disc to be saved in a back up procedure – the latest transactions are merely re-run to a different disc file.

Secondly, many suppliers propose the attachment of an auxiliary cartridge tape system. These systems often use high speed slewing of the tape across the head in order to record a very large amount of data in the shortest possible time. These devices, however, would still take some 15 minutes or so to back up a drive, and current deliverable versions of cartridge units average in the order or 4-5 M bytes total capacity. Also, the data rates proposed often exceed the design specifications of the cartridge media.

The conclusion on tape cartridge back-up media may therefore be

that, because of these limitations, it is not the best method of protecting valuable data. Indeed, it is the very occasion when you need to recover using back up media that the best possible reliability is required.

A third method of data protection is perhaps more practicable and certainly most reliable. That is the provision of a second disc drive which can often be run from the same controller in a daisy chain fashion and which may well have write protect key lock switches for operator protection. With the very high data rates that these drives possess, it is often possible to do a complete back up of data in a minute or so.

It's not surprising that back up procedures are often only followed where the operation is quick and easy. Most will be content to wait a minute or two to undertake a back up, whereas 15 to 30 minutes is unpopular and hence often avoided.

Conclusions

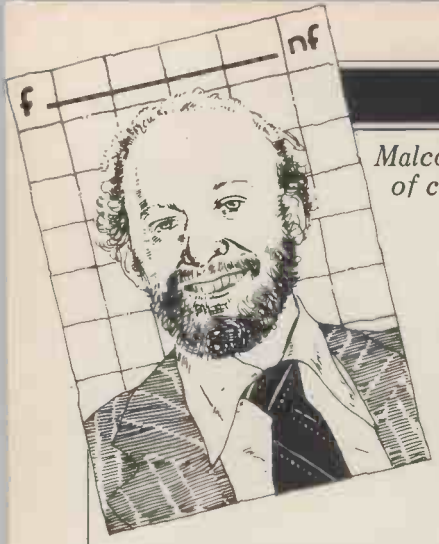
Winchester technology has brought a new impetus to the microcomputer revolution. Few people would have envisaged with the introduction of the floppy disc drive that it would become an essential part of the standard microcomputer system of today. Now, many anticipate that the microcomputer system of tomorrow will include a Winchester drive as a standard feature. There is no doubt that whole new ranges of applications can be brought within the capabilities of the microcomputer and that many who up to now have been using a mini, on an OEM basis, are starting to consider the micro as an alternative tool.

Calculated Corner
Cont. from P. 86

dard algebraic form, e.g. $A^2 + B^2 + SIN\ C^2$ ..... up to 88 characters. On returning to the Computation Mode, the calculator asks you for the variable values (A = ?) and evaluates the expression! Editing is via a flashing cursor, and expressions longer than the display scroll off to the left. The eleven memories are non-volatile and a full set of scientific and statistics functions are provided.

The sophistication of this display is such that, surely soon, once large scale LCD displays are available, we will have a hand held micro which is programmed in BASIC!

For a user who needs to evaluate many algebraic functions and doesn't want to trouble to learn a calculator "language" for programmed solutions, this calculator will be useful; anyway, it's certainly a status symbol. But the impossibility of any sort of recursive operation limits its flexibility drastically and at a price of £69.90, it cannot compare well with various programmables in this cost range. Perhaps worse is that it takes away all the fun of playing computers!



Malcolm Peltu has made his name writing and lecturing about the nature and impact of computer-related technologies.

In the grip of the systems monster

Why is it that a personal computing "amateur" can produce a multiprogramming operating system, compiler and utilities in a couple of years part-time work, whereas "professional" software suppliers can invest decades of man years to less avail?

"Perhaps it was because I didn't know that some problems existed, so I never encountered them", was the answer given to me by Tom Aschenbrenner who won the 1977 Personal Computer Fair competition at the US National Computing Conference (he had developed a message switching system for fellow radio hams in the Dallas area). As, another reason he added, "I did it because I enjoyed it — not because I had to, in order to earn a living." Aschenbrenner's comments would fit very pertinently into *Systemantics* by *John Gall* which tries humourously to analyse the behaviour of a beast which seems to run amok through so many aspects of modern life — The System. Written in a sometimes irritating, too-clever-by-half style, *Systemantics* offers a number of "laws" relating to systems behaviour, often paying homage to folk-lorish inventions like Murphy's Law that "If anything can go wrong, it will go wrong."

The Fundamental Theorem of *Systemantics* is that "New systems create new problems". According to Gall, one starts with a problem, like getting rid of rubbish. Then a system is set up to organise garbage collection and the main objective of that organisation is to *manage the system* rather than to solve the original garbage problem. In fact, Gall says, "for the practising systems-manager, the greatest pitfall lies in the realm of problems and problem-solving. Systems can do many things, but one thing they emphatically cannot do is to solve problems. This is because problem-solving is not a systems-function, and there is no satisfactory systems-approximation to the solution of a problem. A system represents someone's solution to a problem but does not *solve* a problem.

"Solutions," he continues, "usually come from people who see in the problem only an interesting puzzle and whose qualifications would never satisfy a select committee." There could be no better proof of Gall's pudding than in the exciting tang of the home-brewing personal computer world. Aschenbrenner's remark about not being aware of the problems was true because many of the problems of software development are concerned with the complexities of managing large projects. A programmer in a Data Processing department or large software development team is likely to be less productive and less creative than a hobbyist.

Gall's most biting comments are lashed out at the dangers of trying to control complex systems. "Any large system is going to be operating most of the time in failure mode," he says, putting the boot in further with the Fundamental Failure Theorem that "a system can fail in an infinite number of ways" and that "the mode of failure of a complex system cannot ordinarily be predicted from its structure."

For programmers he has two special axioms: programs never run the first time, and complex programs never run. In a more general context, these axioms are summarised by his belief that complex systems designed from scratch never work; the only complex systems that do work are those which have evolved from successful simple systems.

I believe that computers are ideal models of Gall's system world. Operating systems which hog machine resources in order to sort out machine rather than user problems are perfect examples of how complex systems fail to tackle the problems for which they were initially created. The way in which the personal computing market has focused on the development of more human interfaces, such as colour graphics, has also shown that the computer industry as a whole proves another Gallism, "To those within a system, the outside reality tends to pale and disappear."

At the last National Computing Conference in New York, the hundreds of stands from the traditional computer industry paid lip-service to "user needs" but were still essentially displaying evolutions from the grey elephants which form

Illustrations from The Cyberiad

their "user base". The personal computing show at the same event was filled with colour graphics, voice synthesisers and other devices that offer a human window to the computer. And the reason is that the personal computer user is also a systems developer who focuses attention to the main goal of using the system.

For larger, established computer companies, the System has other goals, like growing and extending its administrative machine, its sales targets and all those other factors that have little to do with the user.

Systemantics is a book with a serious message and you'll find it if you scratch beneath its glossy, over-jokey veneer. Anyone working a bureaucracy whose purpose is to deal with people in need should, for example, spread the message "The dossier is not the person" which is Gall's extension of a sign he saw in a smallish hospital which said "The chart is not the patient".

The underlying strength of Gall's book is that it is based on a good appreciation of General Systems Theory and cybernetics. With tongue in cheek, Gall does in fact admit that the science of General Systemantics is a spoof of General Systems Theory, an idea inspired by one Ludwig von Bertalanffy (who coined the phrase *system* to describe the entity concerned with the organisation of a function rather than the function itself).

In *An Approach to Cybernetics* by *Professor Gordon Pask*, von Bertalanffy's work is cited as one of the sources that lead to the study of cybernetics. Where Gall provides some glib but perceptive insights into the complexities of Systems thinking, Pask, who is a professor of cybernetics at Brunel University, takes a more scientific and mathematical approach in trying to explain the background and scope of one of the major Systems "sciences".

For example, Gall and Pask both quote Le Chatelier's Principle, derived from chemistry, which states that any natural process tends to set up conditions opposing the further operation of that process; thus equilibrium can be maintained when various forces, such as chemical reactants, are mixed in certain concentrations in a closed vessel.

Gall turns this Principle into a corner stone of General Systemantics, that "Systems get in the way and Systems tend to oppose their own proper functions". He clarifies this by the example of a research worker who is asked to define his aims and objectives to satisfy various organisational Systems needs — like touting for research money. So he makes up objectives that look good to the System, such as writing x papers in a year, even though his real objectives are different. But he then has to waste time meeting his Systems-inspired objectives. The System has therefore got in the way of real objectives.

For Pask, Le Chatelier provides a simplified analysis of what he regards as the crux of organisational Systems study — stability. "That which is stable can be described, either as the organisation itself or some characteristic which the organisation preserves intact". He writes "The trouble with cybernetics is that the very substance of its study is an entity as amorphous and generalised as the words 'organisation' and 'systems'."

Pask, however, makes a brave attempt at trying to explain in relatively simple terms the unique characteristics of a science which, as he says, "cuts across the entrenched departments of natural science; the sky, the earth, the animals, and the plants." The book is well worth reading as a first step towards a deeper understanding and involvement in a subject which both fascinates and confuses by its general applicability to anything — from running a company to developing a computer to studying the brain.

A mad and magnificent book which puts the whole Systems and cybernetics approach into an imaginative galactic context is *Stanislaw Lem's The Cyberiad*. A combination of science fantasy, political satire and mathematical impishness, *The Cyberiad* consists of a number of short fables, most of them loosely linked by the journeys of the 'constructors' Trurl and Klapaucius.

The starting point of each fable is often a superbly illogical logical idea like a machine that can create anything that begins with n, then causes havoc when asked to create Nothing. Or the stupidest eight storey thinking machine in the world which terrorises the constructors because they challenge its belief that 2+2=7.

My favourite is Trurl's Electronic Bard, the poetry machine. In Lem's words "Whenever Trurl felt he just couldn't take another chart or equation, he would switch over to verse, and vice versa. After a while it became clear to him that the construction of the poetry machine itself was child's play in comparison with writing the program. The program found in the head of an average poet, after all, was written by the poet's civilisation, and that civilisation was in turn programmed by the civilisation that preceded it and so on to the very Dawn of Time. Hence, in order to program a poetry machine, one would first have to repeat the entire Universe from the beginning. . ." and that is what Trurl does to Universe-shattering effect.

A trip on Lem's Cyberiad machine gives a whole new perspective to the real world of machines, people and organisations and helps to point to the farcical pimples on the bum of the Systems beast.

Learning the lingo

One day Grace Hopper, one of the founders of the Cobol programming language, found herself lost in Tokio. And she managed to get back to her hotel merely by speaking Cobol words such as MOVE and GOTO because, she says, Cobol uses such basic universal commands.

It would be nice if a stranger lost in computerland could rely on a similar simple language. (In parentheses it is worth noting that Grace Hopper is said to have originated that descriptive computer jargon word 'bug', meaning an error. According to the story, one of the early computers with which she was working was giving a lot of trouble, until one day she opened a processor cabinet and a moth flew out. Hence the 'bug' came into being).

Meanwhile, back with the stranger in computerland, it is necessary to provide him/her with two forms of route finding assistance — firstly some guidance through the jargon used to describe the technology, and then help with learning the programming languages that get the machines doing something useful.

The problem with introductory books in computing is that they tend to be either too general, and therefore of little use in finding out about one system, or else they are far too specific to give a good perspective on the intrinsic points of the technology.

Introduction to Microprocessors by G. L. Simons offers a general overview of the hardware and software technology together with sufficient detail of some popular processors, languages and microcomputers to give the stranger some confidence and sense of direction; however it can in no way be taken as a training or reference book.

In addition to the systems, Simons provides a useful overview of design needs and the range of applications for micros, as well as a summary of some contemporary views on the social consequences of microcomputing.

When it comes to learning a computer language, one's choice is usually limited to those available on the machine at hand. With microcomputers, the most widely available language is, of course, BASIC.

The trouble is each machine has its own restrictions and dialects for any given language. And this is the major drawback with the otherwise excellent *The BASIC Handbook by David A Lien*

The Handbook is aptly described by its subtitle as being an "encyclopedia". It clearly admits in the introduction, however, that it is not intended to replace the manufacturer's handbook which describes the language facilities for that machine. Instead it concentrates on simple, clear descriptions of the fundamental core words that are common to most machines using BASIC.

The aim is to provide some help to those who wish to adapt programs in a magazine like Personal Computer World into suitable forms to run on particular machines. Each BASIC word discussed starts at the top of page. They are listed alphabetically and an indication is clearly given whether the word is part of the American National Standards Institute (ANSI) BASIC standard.

Then there is a standard list of topics dealt with for each word, such as its word category, general description and variations that might be encountered. Test programs for the word and sample runs are also given as well as some very useful hints, including what to do if your computer does not have a particular word. Used as an encyclopedia, the Handbook will be exceedingly helpful in a variety of ways.

But, as Lien says, "like the expanding universe theory, BASIC keeps expanding; we can only chase it — but never catch it all."

So, although the BASIC Handbook will shine a guiding light through some unknown territory, it will still be necessary to get a more detailed and updated A to Z of any real system you want to use.

Books discussed in this month's Bookfare have been:
Systemantics by John Gall (Fontana, 85p)
An Approach to Cybernetics by Professor Gordon Pask (Hutchinson's Radius Books, £1.00)
The Cyberiad by Stanislaw Lem (Secker & Warburg, £3.90)
Introduction to Microprocessors by G. L. Simons (National Computing Centre, £6.50)
The BASIC Handbook by David Lien (Compusoft, available through Rostronics, 118 Wandsworth High Street, London SW18 — £11.00)

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Britain's most up-to-date and comprehensive guide to the selection of microcomputer equipment, compiled for PCW by Richard Olney *of Heuristic Consultants.*

Machine (Price from)	Main Distributor/s (No. of dealers)	Hardware	Software	Documentation	Miscellaneous
ALPHA MICRO (£5,700)	Alpha Micro Systems UK Ltd: 01-930 1991 (TBA)	64K-16M RAM: W/L 16 bits: Dual 8" F/D (1.2MB): 6 S/P: modular	multi-user O/S: BASIC: M/A: PASCAL: T/E: U: *B/P*	E	Expands to 1200 MB, 32 terminal system: average 10MB H/D system — £1,100
APPLE II (£810)	Microsense: 0442 63561 (80+)	16-48K RAM: 6502: 8 I/O slots: 15"x18"x5": options — single 5¼" F/D (116K), £425; C, £33; RS232 int, £110; 16K RAM, £110	O/S: BASIC: *PASCAL: games*	S	280x192 high resolution graphics: integer BASIC in 6K ROM
ATTACHE (£4,381)	Moncoland: 01-839 3661 (5)	48-64K RAM: 8080: dual 8" F/D (616K): 1 S/P, 1 P/P: two units: option — 9", 16x 64 b&w VDU, £250	ExBASIC: *FORTRAN*	S	Interfaces to Centronics 702 printer
CHALLENGER (£350)	Mutek: 0225 743289 Byte Shop: 01-518 1414. CTS: 0706 79332 (5)	4-8K RAM: 6502: RS232 port: 15"x16"x4": option — dual 5¼" F/D (160K), £550	O/S: BASIC: games: *Ex-BASIC: Data Man: B/P (limited)*	S	D/A conv: colour capability: 8K microsoft BASIC in ROM
CHALLENGER C3 (£2,450)	As above	32-56K RAM: 6502, 6800, Z80: dual 8" F/D (1.15MB): 2-16 S/P: 17"x22"x12"	OS65U O/S: *CP/M BASIC: COBOL: FORTRAN: Data Man: B/P*	S&H	Also C3B & C3P H/D modules: 74MB for about £10,000
COMMA VO3 (£4,200)	Comma: 0277 811131 (n/a)	32K RAM: LSI 11: dual 8" F/D (512K): 4 serial DLU11S ports: modular	*RP11 O/S (£750): BASIC: COBOL: FORTRAN: B/P (limited)*	H	Many configs possible: max 20 MB, H/D — about £27,000
COMPELEC SERIES (£2,400)	Compelec: 01-636 1392 (n/a)	64K RAM: Z80: dual 8" F/D (512K): 2 RS232 ports, 1 P/P	CP/M: A: CBASIC: COBOL: FORTRAN: PASCAL: *W/P: B/P*	S	Also with double density F/D, 1MB, £2,900; 1K EPROM
COMPUCORP 625 (£6,000)	Compucorp: 01-952 7860 (15)	60K RAM: Z80: dual 5¼" F/D (700K): 9", 16x80 b&w VDU: 40cps printer 1 RS232 port: 20"x28"x10"	A: BASIC: U: *W/P: B/P*	B	Also available, 655 model with 315K F/D capability & 12", 20x80 VDU — £3,750
COMP WORKSHOP SYSTEM 1 (£1,600)	Comp Workshop: 01-491 7507 (n/a)	32K RAM: dual 5¼" F/D (170K): 9", 16x64 b&w VDU: modular	A: BASIC: FORTRAN: FLEX: PASCAL: PILOT: *B/P*	E	These systems are example configs from a fully compatible modular range
COMP WORKSHOP SYSTEM 2 (£11,000)	As above	128K RAM: 6809: dual 8" F/D (1.2MB): 3 intelligent 20x80 terminals; 80 col, 125cps printer: daisy wheel Sprint 3 printer	A: BASIC: FORTRAN: FLEX: PASCAL; PILOT: *B/P*	E	As above
COMP WORKSHOP SYSTEM 3 (£36,000)	As above	768K RAM: 6809: dual 8" F/D (1.2MB): 64MB H/D: 10 intelligent 20x80 terminals: 2 132 col, 120cps printers: 2 80 col, 125cps printers: 2 daisy wheel Sprint 3 printers: max 16 ports.	A: BASIC: FORTRAN: FLEX: PASCAL: PILOT: *B/P*	E	As above
COMPUCOLOUR II (£1,058)	Abacus: 01-580 8841 (6)	8-32K RAM: 8089: 13", 32x64 8-colour VDU: single 5¼" F/D (51K): RS232 port: 18"x15"x13"	ExBASIC (ROM): *A: personal data base: games*	I	16K module, £1,134; 34K, £1,137; maintenance & programming manual available.
CROMEMCO SYSTEM 2 (£1,995)	Comart: 0480-215005. Datron: 0742-585490. Microcentre: 031-225 2022 (20)	64K RAM: Z80: dual 5¼" F/D (180K): options — dual 8" F/D (512K), £1370; 11MB H/D, £3495; 22MB H/D, £5999	CDOS: *BASIC: COBOL: FORTRAN (£55): multi-user BASIC*	E	Expandable to multi-user system (2-7 users), £3,455-£6,400
CROMEMCO SYSTEM 3 (£2,995) (64K, £3,293	As above	32-64K RAM: Z80: dual 8" F/D (512K): options as above: extra dual F/D, £1,200	CDOS: *BASIC: COBOL: FORTRAN; multi-user BASIC*	E	As above

List of Abbreviations

A Assembler
B BASIC
B/P Business package
C Cassette
C/P Commercial package
E Extensive
F/D Floppy disc
G/C Graphics card
H Hardware
H/D Hard disc
I Introductory
int Interface
I/S Indexed sequential
M/A Macro assembler
N/P Numeric pad
O/S Operating system
P/P Parallel port
S Software
S/P Serial port
TBA To be announced
T/E Text editor
T/P Text processor
U Utility
W/L Word length
W/P Word processor

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are *exclusive* of VAT

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Machine (Price from)	Main Distributor/s (No. of dealers)	Hardware	Software	Documentation	Miscellaneous
DIGITAL MICROSYSTEM DSC-2 (£5,395)	Modata: 0892 39591 (TBA)	64K RAM: Z80: dual 8" F/D (2.28MB): 4 RS232 ports: EIA port: 17"x21"x7"	CP/M: BASIC-E: *CBASIC: COBOL: FORTRAN: PASCAL: CAP B/P*	H	Up to 6 additional F/D units possible
DURANGO (£7,750)	Comp Ancillaries: 07843 6455 (12)	48K RAM: 8085x3: dual 5¼" F/D (1MB): 9", 16x64 green VDU: 132 col 165cps printer: N/P: options — add F/D £1,753; aux VDU £875	O/S: *DBASIC: B/P*	S	Takes up to 4 workstations: fully integrated system 15"x30"x24"
DYNABYTE DB8/1 (£1,500)	Dynabyte UK/Europe Ltd: 0723 65559 (6)	32-64K RAM: Z80: S100 bus; 2 RS232 ports: 1 P/P: 20"x18"x7": option — dual 8" F/D (1MB), £2,000	CP/M: *BASIC: COBOL: FORTRAN: PASCAL: W/P: B/P*	H	Expands to multi-user system: also DB8/2 with dual 5¼" F/D (400K), £3,000
EQUINOX 300 (£11,750)	Equinox: 01-739 2387 (n/a)	64-256K RAM: W/L 16 bits: 2MB H/D: 15", 24x80 b&w VDU: 150cps printer: 6 S/P	O/S: BASIC: COBOL: M/A: PASCAL: T/P: multi-user: *B/P*	S	Up to 1200MB of storage possible (4x300MB, Calcomp Tridents)
EUROC (£7,995)	Eurocalc Ltd: 01-405 3113 (TBA)	64K RAM: 8080A: dual 8" F/D (1MB): 15", 25x80 b&w VDU: 132 col, 140cps printer	CP/M: CBASIC: A: account system: U: *B/P*	S	A year's maintenance and stationary supply inc.
EXIDY SORCERER (£650) (16K, £760; 32K £859)	Factor One: 0736 66565 (10)	8-32K RAM: Z80: RS232: 1 P/P: S100 connector: 30x64 VDU I/O: options — dual 5¼" F/D (630K), £1,200; 12", 30x64 green VDU, £240; S100 chassis, £210	O/S: ExBASIC (ROM): *W/P: Editor: A: games*	I	High resolution graphics capability.
IMS 5000 (48K desk top £5,100)	Equinox: 01-739 2387 (20)	32-256K RAM: Z80: dual 5¼" F/D (320K): 15", 24x80 b&w VDU: 150cps printer: 2 S/P; 1 P/P: 18"x24"x3"	CP/M: BASIC: COBOL: FORTRAN: *PASCAL: W/P: CAP B/P*	S&H	Also available: IMS 8000 (dual 8" F/D); IMB desk top or stand alone models, £6,500
IMSAI VDP 42 (£3,900)	Computermart: 0603 615089. Corner Comp: 03727 41101 (2)	32-64K RAM: 8085: dual 5¼" F/D (400K): 9", 24x80 b&w VDU: 1 S/P: 1 P/P: 18"x27"x12"	IMDOS (CP/M comp): A: ExBASIC: U: *CBASIC: COBOL: FORTRAN*	H	Can support 8 additional F/D drives; also available, VDP 44 with F/D (780K), £4,400
IMSAUI VDP 80 (£6,200)	As above	32-64K RAM: 8085: dual 8" F/D (1.2MB): 12", 24x80 b&w VDU: 1 S/P: 1 P/P: 25"x15"x25"	IMDOS: A: ExBASIC: U: *CBASIC: COBOL: FORTRAN: CAP B/P*	H	
ITT 2020 (£867) (32K, £916; 48K, £995)	ITT: 0268 3040 (15)	16-48K RAM: 2020: 15"x18"x4": options — single 5¼" F/D (116K), £425, C, £33; 60cps printer, £825; 16K RAM, £110; RS232 port, £110	Monitor: A: BASIC: Dis-A: *games*	B	High resolution graphics capability: Integer BASIC in 6K ROM
LUXOR ABC 80 (£790)	CCS Microsales: 01-444 7739 (TBA)	16-40K RAM: Z80A: C: 12", 16x40 b&w VDU: 4680 bus: IEEE 488: RS232 port: option — dual 5¼" F/D (160K, own DOS), £895	DOS: BASIC: games: *W/P: Database: Engineering & construction prog*	S	Graphics loudspeaker with 128 effects: Viewdata compatible.
MEGAMICRO (£6,080)	Bytronics: 0252 726814 (5)	256K: 8080A: dual 8" F/D (1MB): 12", 20x80 b&w VDU: 120cps printer: 2 S/P: 2 P/P: option — printer stand, £100	CP/M: U: *B/P*	H&B	
MICROENGINE (£2,080)	Pronto: 01-599 3041 (TBA)	64K RAM: MCP 1600: 2 RS232 ports: 2 P/P: 16"x13"x5": options — dual 5¼" F/D (1MB), £1,500; dual 8" F/D (2MB), £1,200	BASIC: PASCAL: File Manager: U	H&S	CPU has user written word set: PASCAL uses integral P code: available as board, £1,400
MICRONOVA (£12,000)	Digitus: 01-636 0101 (3)	64-1128K RAM: N601: 10MB H/D (5 fix, 5 rem): 12", 24x80 VDU: 132 col 60cps printer: 4 S/P: 1 P/P	DOS: M/A: U: T/E: I/S: debug: FORTRAN IV: *BASIC: PASCAL: W/P: B/P*	E	Larger configs usual: bus system for multi-user; smaller system possible with F/D
MICROSTAR 45 PLUS (£4,950)	Data Efficiency: 0442 57137 (TBA)	64K RAM: 8085: dual 8" F/D (1.2MB): 3 S/P: RS232 port: 17"x26"x8"	STARDOS: CP/M: BASIC: COBOL: FORTRAN: UPDATE (database): *B/P*	E	

IN STORE

DIRECT ACCESS

Machine (Price from)	Main Distributor/s (No. of dealers)	Hardware	Software	Documentation	Miscellaneous
MSI 6800 (£1,203)	Strumech: 05433 4321 (5)	16K RAM: 6800: C: (9", 16x64 b&w VDU: 1 S/P: option — PROM prog	BASIC: mini A T/E: U	H&S	Up to 8 serial or parallel interfaces possible.
MSI 6800 SYSTEM 1 (£2,175)	As above	32K RAM: 6800: dual 5¼" F/D (160K): 9", 16x24 b&w VDU: 1 RS232 port: option — dual 8" F/D (624K), £1,640	DOS, BASIC: U: *A: FORTRAN: T/E*	H&S	As above
MSI 6800 SYSTEM 2 (£7,500)	As above	56K RAM: 6800: Single 8" F/D (312K): 10MB H/D: 1 RS232 port: 9", 16x64 b&w VDU: options — dual 8" FYD (624K), £1,640 10MB H/D £4,250	DOS: BASIC: multi-user BASIC: A: *B/P*	H&S	Rack mounted
NORTH STAR HORIZON (£4,650 for 48K)	Comart: 0480 215005. Comma: 0277 811131. Equinox: 01-739 2387 (20)	24-56K RAM: Z80A: dual 5¼" F/D (360K): 15", 24x80 b&w VDU: 150cps printer: 2 S/P: 1 P/P	DOS: BASIC: *CP/M: COBOL: FORTRAN: PASCAL: B/P*	E	
PET 2001-8 (£550)	Commodore: 01-388 5702 (150)	8K RAM: 6502: C: 9", 25x40 VDU: IEEE488 (non standard) port: options — dual 5¼" F/D (353K), £795; 80 col 93cps printer, £645; expand to 32K RAM, £249	O/S: BASIC: A: *FORTH: PILOT: games*	I	Graphics facility: BASIC in 8K ROM: also available, dual 5¼" F/D (800K), £995 + £30 for operating ROM
PET 2001 - 16/32 (£675) (32K, £795)	As above	16-32K RAM: 6502: C: 9", 25x40 green VDU: IEEE488 (non standard) port: options — dual 5¼" F/D (353K), £795; 80 col 93cps printer, £645	O/S: BASIC: A: *FORTH: PILOT: games*	I	As above but disc operating ROM included.
POWER-HOUSE II (£1,650)	Powerhouse Micros: 0442 48422 (TBA)	16-32K RAM: Z80A: 5", 27x96 b&w VDU: 1 S/P: 1 P/P: 17"x11"x7": options — IEEE488 int, £95; C, £150; G/C, £250	FDOS: BOS: BASIC: *games: C/P: ExBASIC (14K EPROM), £350*	I	
RAIR BLACK BOX (£2,300)	Rair: 01-836 4663 (n/a)	32-64K RAM: 8085: dual 5¼" F/D (160K): 2 RS232 port: 20"x16"x 5": option — dual 5¼" F/D (520K), £1,000	CP/M: BASIC: COBOL: FORTRAN: M/A: T/E: *B/P*	H	16K RAM expansion, £250.
RESEARCH MACHINES 380 - Z (£1,048) (56K, £1,654)	Research Machines: 0865 49791 (n/a)	16-56K RAM: Z80A: C: RS232 port: 19"x16"x6": options — dual 5¼" F/D (168K), £895; dual 8" F/D (1MB), £1,695 (fitted in machine)	Tiny BASIC: games: graphics: *A: ExBASIC: CBASIC: COBOL: FORTRAN: ALGOL: CP/M: U*	S	Designed for education: high resolution graphics being developed
SDS 100 (£4,290)	Airamco: 0294 57755 (11)	64K RAM: Z80: dual 8" F/D (1MB): 12", 24x80 VDU: S100 bus: RS232 port: N/P: 1 P/P	CP/M: A: ExBASIC: *COBOL: FORTRAN: CAP B/P*	E	Facility for 8K PROM
SEMEL 1 (£2,900)	Strutt Electrical: 0822 5439 (n/a)	16-64K RAM: Z80: single 8" F/D (250K): 12", 24x80 b&w VDU: RS232 port: options — single 8" F/D (250K), £500; light pen	BASIC: *COBOL: FORTRAN: B/P*	I	Supports up to 8 drives
SHARP MZ-80K (£520-£740)	Sharp UK: 01-571 2157 (TBA)	6-34K RAM; Z80: C: 10", 24x40 b&w VDU	BASIC: A: *games*	B	Graphics: loudspeaker: BASIC in 14K RAM
SMOKE SIGNAL CHIEFTAIN 1 (£3,050)	Winrush Micro Designs: 069-24 5189 (TBA)	32-64K RAM: 6800: dual 5¼" F/D (160K): 12", 24x80 VDU: 112cps printer: RS232C port: option — 16K RAM expansion, £500	DOS: BASIC: *DBASIC: RBASIC: A: FORTRAN: U: T/E: B/P*	E	Also available, Chieftain 3 with dual 8" F/D (1MB), £3,950.

List of Abbreviations

A Assembler
B BASIC
B/P Business package
C Cassette
C/P Commercial package
E Extensive
F/D Floppy disc
G/C Graphics card
H Hardware
H/D Hard disc
I Introductory
int Interface
I/S Indexed sequential
M/A Macro assembler
N/P Numeric pad
O/S Operating system
P/P Parallel port
S Software
S/P Serial port
TBA To be announced
T/E Text editor
T/P Text processor
U Utility
W/L Word length
W/P Word processor

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are *exclusive* of VAT

DIRECT ACCESS

IN STORE

Machine (Price from)	Main Distributor/s (No. of dealers)	Hardware	Software	Documentation	Miscellaneous
SOLITAIRE/ WP (£6,750)	Solitaire/KPG: 04252 71448 (TBA)	64K RAM: 8085: dual 5¼" F/D (700K): 14" VDU (with own CPU): 45cps printer: CPU	DOS: W/P: *BASIC*	S	All Solitaire systems are compatible: graphics on 11x13 dot matrix
SOLITAIRE/ BS200 (£7,950)	As above	64K RAM: 8085: dual 8" F/D (960K): 14" VDU (with own CPU): 45cps printer: CPU port	DOS: BASIC: W/P: *specialised B/P*	S	As above
SOLITAIRE/ HBS100 (£9,500)	As above	64K RAM: 8085: 10MB Fix H/D: 14" VDU (with own CPU): 200cps printer: CPU port: option — up to 40MB H/D	DOS: BASIC: W/P: *specialised B/P*	S	Up to 8 interface terminals can be used: also available, HBS200 with 20-80MB H/D.
SORD M100 ACE (£2,650)	Dectrade: 0602 861774 (TBA)	48K RAM: Z80: single 5¼" F/D (143K): 12", 24x64 colour VDU: RS232 port: option — single 5¼" F/D, £300	O/S: BASIC	I	With colour graphics: 8K ROM
SORD M223 (£3,500)	As above	64K RAM: Z80: single 5¼" F/D (350K): 12", 24x80 b&w VDU: S100 bus: RS232 port: option — extra F/D, £450	O/S: BASIC: *CAP B/P*	I	Other configs possible.
SUPER-BRAIN (£1,995)	Icarus: 0632 29593 (TBA)	64K RAM: 2xZ80: dual 5¼" F/D (320K): 12", 25x80 b&w VDU: S100 bus: RS232: TRS80 port: 21"x23" x14": options — dual 5¼" F/D (320K); dual 8" F/D (2.4MB); 8-120MB H/D	CP/M: A: *BASIC: COBOL: FORTRAN: APL: B/P*	H&S	Limited graphics: mainframe interface available
TAND-BERG EC10 (£5,000)	Tandberg: 0532 35111 (n/a)	50K RAM: 8080A: single 8" F/D (250K): 12", 25x80 b&w VDU: RS232 port	ExBASIC (24K): multi-user BASIC: A: U: *COBOL*	H&S	Pascal available next year
TANDY TRS 80 LEVEL 1 (£380)	Tandy: 021 556 6101 (200)	4-16K RAM: Z80: C: 12", 16x64 b&w VDU	BASIC: games: A	I	BASIC in 4K ROM: upgradable to level 2
TANDY TRS 80 LEVEL 2 (£515-£1,005)	As above	4-48K RAM: Z80: C: 12", 16x64 b&w VDU: RS232 int: 1 P/P: option — single 5¼" F/D (78K), £478 (max of 4)	BASIC: games: *M/A: FORTRAN: B/P*	I	16K machines include N/P: 4-16K upgrade, £120; without pad, £85
TECS (£1,600)	Technalogics: 051 724 2695 (TBA)	16-56K RAM: 6800: 8K PROM: RS232 port: C int: option — dual 5¼" F/D (320K), £800	BASIC	H	256 char graphics: Prestel compatible: plugs into standard TV
TEI 208 (£4,400)	Abacus: 01-580 8841 (5)	32-60K RAM: 8080/8085: dual 5¼" F/D 320K: 9", 24x80 green VDU: 3 S/P: 3 P/P: 17"x18"10": option — 150cps printer, £1,250	CP/M: *BASIC: COBOL: FORTRAN: PASCAL: ALGOL: B/P*	H&S	
TEI 212 (£5,067)	As above	32-60K RAM: 8080/8085: dual 8" F/D (1MB): 15", 24x80 green VDU: 3 S/P: 3 P/P: 17"x20"x17": option — 150cps printer, £1,250	CP/M: *BASIC: COBOL: FORTRAN: PASCAL: ALGOL: B/P*	H&S	
VECTOR GRAPHICS MZ (£2,300)	Almarc: 0602 248565 Sintrom Microshop 0734 84322 (5)	48K RAM: Z80: dual 5¼" F/D (630K): 1 S/P: 2 P/P: 20"x17"x8"	DOS: BASIC: A: *CP/M: CBASIC: COBOL: FORTRAN: PASCAL:*	E	4K PROM
VECTOR GRAPHICS SYSTEM B (£2,850)	As above	48K RAM: Z80: dual 5¼" F/D (630K): 12", 24x80 b&w VDU: 1 S/P: 2 P/P: 20"x17"x8"	DOS: BASIC A: *CP/M: CBASIC: COBOL: FORTRAN: PASCAL*	E	With graphics and N/P
ZENTEC (£5,700)	Zigal Dynamics: 0753 71049 (1)	32-64K RAM: 2x8080: dual 5¼" F/D (280K); 15", 25x80 b&w VDU: RS232 port: options — dual 5¼" F/D (280K, £600; dual 8" F/D (1MB), £2,100 RS422 port, £105	O/S: A: U: *BASIC: micro COBOL: W/P*	S	User programmable character set

List of Abbreviations

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E Extensive
F/D Floppy disc
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H Hardware
H/D Hard disc
I Introductory
int Interface
I/S Indexed sequential
M/A Macro assembler
N/P Numeric pad
O/S Operating system
P/P Parallel port
S Software
S/P Serial port
TBA To be announced
T/E Text editor
T/P Text processor
U Utility
W/L Word length
W/P Word processor

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are *exclusive* of VAT

IN STORE

DIRECT ACCESS

Machine (Price from)	Main Distributor/s (No. of dealers)	Hardware	Software	Documentation	Miscellaneous
ZILOG MCZ1/05 (£4,200 - portable)	Micropower: 0256 54121. Memec: 084421 5471 (n/a)	64K RAM: Z80: dual 8" F/D (600K): RS232 port	Rio O/S: M/A: U: T/E: *BASIC: COBOL: FORTRAN: PASCAL: B/P*	H&S	Debug in 3K PROM: also available as desk top unit or R/M model, both £4,800.
ZILOG MCZ1/35 (£1,200)	As above	64K RAM: Z80: 10MB H/D (5 fix, 5 rem): RS232 port	Rio O/S: M/A: U: T/E: *BASIC: COBOL: FORTRAN: PASCAL: B/P*	H&S	Internal disc control with own Z80
Z-PLUS (£4,000)	Rostronics: 01-874 3665 (TBA)	32-64K RAM: Z80: dual 8" F/D (1MB): 2 S/P: 2 P/P: 10"x29"x11"	CP/M: A: U: *BASIC: COBOL: FORTRAN: PASCAL: Database: B/P*	H&S	

In response to reader demand PCW will soon be extending In Store to include single board computers.

USER GROUPS INDEX

User Group Index is Britain's major, up-to-date listing of clubs, user groups and societies. The details published here were correct at the time of going to press; if YOUR group hasn't been included, then please let us have all relevant information. Send it to: PCW, 14 Rathbone Place, London W1P 1DE. Updates on changes would also be appreciated.

AVON

Bristol Computing Club. £3.00 p.a. Meetings 3rd Wednesday, monthly. Contact: Leo Wallis, 6 Kilbirnie Rd., Bridge Farm Estate, Bristol, BS14 0HY. Tel: Bristol 832453.

Brunel Technical College Computing Club. The club divides into two sections . . .the "skilled" and the "not skilled". They share alternate Wednesdays at the College. Contact S.W. Rabona at 18 Castle Road, Worle, Weston-Super-Mare, Avon, BS22 9JW (0934 513068).

BEDFORDSHIRE

UK Intel MDS Users Group. Contact: Lewis Hard, 29 Chaucer Rd., Bedford.

Cosmac Users Club (proposed) For People using the RCA 1802, Cosmac ELF, ELFII, Super Elf etc. Those interested contact James Cunningham at 7 Harrowden Court, Harrowden Road, Luton LU2 0SR (enclose sae, please).

The 6502 Users Club. Hoping soon to hold regional and national meetings, they offer "support, encouragement and fellowship". Contact: Walter Wallenborn, 21 Argyll Ave., Luton, Beds LU3 1EG.

BERKSHIRE

77/68 User Group. Quarterly Newsletter. Free membership for 1st year if you buy the 77/68 instruction manual, £1.50 thereafter. Contact: Newbear Computing Store, 40 Bartholomew St., Newbury, Berkshire.

The Thames Valley Amateur Computer Club. Meetings are on the first Thursday of every month and from November on, that will be at "The Southcote", Southcote Lane, off the Bath Road, Reading, Berks. Starting time, 7.00pm. Contact Brian Quarm (Camberley 22186) OR Brian Steer (Slough 20034).

BUCKINGHAMSHIRE

TRS-80 Users Group. Contact: Brian Pain, 40a High St., Stony Stratford, Bucks.

CHESHIRE

Anyone interested in starting a Chester club please contact: Mr. W. Collins, 37 Garden Lane, Chester, Cheshire.

DERBYSHIRE

The Independant PET Users Group. IPUG. Secretary is Mike Lake of 9 Littleover Lane, Derby (Derby 23127).

DEVONSHIRE

Exeter and District Amateur Computer Club. General meetings 2nd Tuesday monthly, specialist meetings 3rd or 4th Tuesday. £5.00 p.a. Contact: Doug Bates, 3 Station Road, Pinhoe, Exeter, Devon.

DURHAM

Northeast PETS. Contact: Jim Cocallis, 20 Worcester Road, Newton Hall Estate, Durham. The group meets on the 3rd Monday of each month (at 7.30 pm.) in: Room A102, Ellison Bldgs, Newcastle Polytechnic, Newcastle-upon-Tyne.

ESSEX

TRS80 User Club (Chelmsford). Now part of the National TRS80 User Club. Contact Michael Dean, 22 Roughtons, Galleywood, Chelmsford, Essex.

Amateur Computer Club. Membership now costs £3.50. Contact D. Ellis (the Membership Secretary), c/o 118 Cambridge Avenue, Gidea Park, Romford, Essex RM2 6RA.

The Colchester Microprocessor Group. Meetings held at the University of Essex on the second and fourth Wednesdays of each month — 7.30pm start. Membership is open to all, on payment of £5 annual sub £1 for full-time students). Contact the Information Centre at the University on the evening of the meeting.

GLOUCESTERSHIRE

Cheltenham Amateur Computer Club. Meetings, 4th Wednesday monthly, 7.30pm start. Microprocessor workshop starting October 2nd. Contact: Mr. M. Pullin, 45 Merestones Drive, The Park, Cheltenham, GL50 2SU (Cheltenham 25617).

9900 Users Group, TI

9900 Users Group, TIMUG Contact: Chris Cadogan, 21 Thistle Downs, Northway Farm, Tewkesbury, Glos.

HAMPSHIRE

Southampton Amateur Computer Club. Meetings 1st Wednesday monthly (not July, Aug. or Sept.). Contact: Paul Dorey, Department of Physiology, University of Southampton, Southampton, SO2 3SU or Tel: Paul Maddison on Winchester 4433 Ext. 6955.

HERTFORDSHIRE

'11s Users Group. A sort of help service only. No meetings no newsletter. Contact: Pete Harris, 119 Carpenter Way, Potters Bar, Herts., EN6 5QB. Tel: 0707 52091 or 01-248 8000 Ext. 7065.

Harpenden Microprocessor Group. They hold meetings every fortnight, cover a wide range of interests and attract members from the area around Luton, St. Albans and Welwyn. Contact: David James, 5 Ox Lane, Harpenden, Herts AL5 4HH (05827 5366).

KENT

Medway Amateur Computer and Robotics Organisation. Contact: Tony Aylward, 194 Balmoral Rd., Gillingham, Kent. Tel: Medway 56830.

North Kent Amateur Computer Club. Meetings, the second Tuesday of each month — usually at the Charles Darwin School, Jail Lane, Biggin Hill, Kent. The sub is £2.50 per annum (£1 for students). More members are needed . . .contact: Barry Biddles at 3 Acer Road, Biggin Hill, Kent (09594 71742).

LANCASHIRE

Merseyside Microcomputer Group. Several sub-groups . . .Contact: J.S. Stout, Department of Architecture, Liverpool Polytechnic, 53 Victoria St., Liverpool L1 6EY or Tel: 051 236 0598 or STEM Ltd., 19/23 Abercrombie Sq., PO Box 147, Liverpool University, Liverpool L69 3BX.

LEICESTERSHIRE

The Leicestershire Personal Computer Club. Meetings held the 2nd Monday in each month, at Leicester University and Loughborough University alternately. They start 7pm. Membership is £2 per annum (£1 for under 16s). Contact Miss Jill Olorenshaw (Club Secretary) c/o Arden Data Processing, Municipal Buildings, Charles Street. Leicester (0533 22255) OR Mr Dick Foden (Club Chairman) at 11 Gaddesby Lane, Rearsby, Leicester.

LINCOLNSHIRE

Lincolnshire Microprocessor Society. Various meeting-places. For up-to-date information, contact the Hon. Sec., Mr Eric Booth, Senior Common Room, Bishop Grosseteste College, Newport Lincoln.

LONDON

MK14 Club. Bi-monthly magazine called "Complement and Add". Contact: Geoff Phillips, 8 Podsford Rd., London NW9 6HP.

Southgate Computer Club. Meetings 1st Wednesday and 3rd Thursday monthly during term time. Newsletter. Contact: Paul Woolley,

USER GROUPS INDEX

Southgate Technical College, High Street, London N14 6BS. Tel: 01-888 6521.

UK Pet Users Club. Contact: Commodore Systems Division, 360 Euston Road, London, NW1 3BL.

East London Amateur Computer Club. Meetings 3rd Tuesday monthly. £2.50 p.a. (½ price to school students). Contact: Jim Turner, 63 Millais Rd., London E11.

The North London Hobby Computer Club. General meetings held on a Wednesday evening, once a month — specialised topics on three evenings each week. Location: The Polytechnic of North London. Contact: Robin Bradbeer (Chairman) at the Dept, of Electronic and Communications Engineering, Polytechnic of N. London, Holloway, N7 8DB (01-607 2789).

MIDDLESEX

Harrow Computer Group. Meetings (term time) at the Harrow College of Higher Education and (other time) the "Traveller's Rest" Public House, in Kenton, Middlesex — on alternate Wednesdays at 7pm. Contact: Bazyle Butcher, 16 St. Peter's Close, Bushey Heath, Watford (01-950 7068) or P. Lecker, 23 Moss Lane, Pinner, Middx.

NOTTINGHAMSHIRE

UK Apple Users Group, Contact: Andy Witterick (Keen Computers), 5 The Poultry, Nottingham. Tel: 0602 583254/5/6.

OXFORDSHIRE

Research Machines Ltd. National User Group. Inaugural meeting 5th October. Contact: M.D. Fischer, PO Box 75, Oxford, OX4 1EY, for a registration form.

Oxfordshire Microcomputer Club. £5.00 p.a. Contact: S. C. Bird, 139 The Moors, Kidlington, Oxford OX5 2AF Tel: Kidlington (08675) 6703

Microsoc, the Oxford University micro group holds shared meetings with the Oxford Microcomputer Club. Contact: M Bourla, St. John's College, Oxford.

STAFFORDSHIRE

Central Program Exchange. Full membership £25 Europe, £40 overseas), provides 30 free programs p.a. Small User Serivce £10 Europe, £20 overseas) provides 10 free programs p.a. Contact: Mrs Judith Brown, The Polytechnic, Wilfruma St., Wolverhampton, WV1 1LY.

SURREY

Exidy Sorcerer Users Group. Newly formed, and a division of the U.S. User Group. Fee is £5 p.a. Write, stating what hardware you own, to: Andy Marshall (Micro44), 44 Arthurs Bridge Road, Woking GU21 4NT (04862 66084).

Richmond Computer Club. Held the second Monday of each month at the Richmond Community Centre (20p per meeting), members have the use of a good range of equipment. Contact: Robert Forster, 18a The Barons, St. Margarets, Twickenham, Middx (01-892 1873).

SUSSEX

Independent PET Users Group — South. Free membership — meetings the first Wednesday of every month. £1.50 to receive monthly newsletter. Contact: John C Nuttall, 56 West Street, Shoreham-by-Sea, Sussex BN4 5WG.

WARWICKSHIRE

ACC (Midland) Group. They meet every 3rd Saturday in room P109 at Lanchester College, Coventry. . .no sub, no magazine. Contact: Roy Diamond (Chairman), 27 Loweswater Road, Coventry, Warks (0203 454061).

WEST MIDLANDS

West Midlands Amateur Computer Club. Newsletter . . . meetings 2nd Tuesday monthly. £2 p.a., or £1 if under 18, or a full time student. Contact: John Tracey, 100 Booth Close, Crestwood Park, Kingswinford, West Mids DY6 8SP. Phone Brierley Hill 70097.

YORKSHIRE

South Yorkshire Personal Computing Group. (Please note, another publication has listed, incorrectly, a South Yorkshire Amateur Computer Club. It does not exist). For details of the SYPCG, contact Tony Rycroft, 88 Spinneyfield, Moorgate, Rotherham, S. Yorks, (Tel: Rotherham 74889, eve).

IRELAND

Computer Education Society of Ireland. A voluntary organisation that consists of a national body and an expanding number of local branches. Their brief is to monitor computer education in Ireland. *National CESI* (£3 p.a.) — Diarmuid McCarthy, 7 St. Kevin's Park, Kilmacud, Blackrock, Co. Dublin. *Cork branch* (£1 extra) — Michael Moynihan, Colaiste an Spioraid Naomh, Bishopstown, Cork. *Dublin branch* (£1.50 extra) — Jim Walsh, C.B.S. Naas, Co. Kildare. *Limerick branch* (£1 extra) — Sr. Lourda Keane, Convent F.C.J., Laurel Hill, Limerick. *Waterford branch* (£1 extra) — Mr. Hugh Dobbs, Newtown School, Waterford. *Kilkenny branch* (£1 extra) — Sr. Helen Lenehan, Presentation Secondary School, Kilkenny.

SCOTLAND

Ithaca Audio S100 bus UK User Group. Contact Dave Weaver, 16 Etive Place, Cumbernauld, Glasgow G67 4JE. Phone 02367 36570.

WALES

Gwent Amateur Computer Club. Covering the Gwent and Cardiff areas, the club has its own computer room and technical library. Meetings held once a week, Wednesdays, starting 7.30pm, at Room 149, Civic Centre, Newport. Contact: Peter Hesketh on Shirenewton 596.

FAX

PCW introduces the first of a series of reference sheets with, this month, the 8080 instruction set. We plan to give you similar charts with the op-codes for all the common processors. Other areas we shall cover are standard codes — ASCII, EBCDIC, BAUDOT etc, hardware interface standards and protocols and anything else which lends itself to this format.

THE 8080 MNEMONICS ARRANGED BY OP CODE

Compiled by John A. Coll.

MSB / LSB	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
0	NOP				MOV B,B	MOV D,B	MOV H,B	MOV M,B	ADD B	SUB B	ANA B	ORA B	RNZ	RNC	RPO	RP	0
1	LXI B	LXI D	LXI H	LXI SP	MOV B,C	MOV D,C	MOV H,C	MOV M,C	ADD C	SUB C	ANA C	ORA C	POP B	POP D	POP H	POP PSW	1
2	STAX B	STAX D	SHLD	STA	MOV B,D	MOV D,D	MOV H,D	MOV M,D	ADD D	SUB D	ANA D	ORA D	JZ	JNC	JPO	JP	2
3	INX B	INX D	INX H	INX SP	MOV B,E	MOV D,E	MOV H,E	MOV M,E	ADD E	SUB E	ANA E	ORA E	JMP	OUT	XTHL	DI	3
4	INR B	INR D	INR H	INR M	MOV B,H	MOV D,H	MOV H,H	MOV M,H	ADD H	SUB H	ANA H	ORA H	CNZ	CNC	CPO	CP	4
5	DCR B	DCR D	DCR H	DCR M	MOV B,L	MOV D,L	MOV H,L	MOV M,L	ADD L	SUB L	ANA L	ORA L	PUSH B	PUSH D	PUSH H	PUSH PSW	5
6	MVI B	MVI D	MVI H	MVI M	MOV B,M	MOV D,M	MOV H,M	HALT	ADD M	SUB M	ANA M	ORA M	ADI	SUI	ANI	ORI	6
7	RLC	RAL	DAA	STC	MOV B,A	MOV D,A	MOV H,A	MOV M,A	ADD A	SUB A	ANA A	ORA A	RST 0	RST 10H	RST 20H	RST 30H	7
8					MOV C,B	MOV D,B	MOV H,B	MOV A,B	ADC B	SBB B	XRA B	CMP B	RZ	RC	RPE	RM	8
9	DAD B	DAD D	DAD H	DAD SP	MOV C,C	MOV D,C	MOV H,C	MOV A,C	ADC C	SBB C	XRA C	CMP C	RET		PCHL	SPHL	9
A	LDAX B	LDAX D	LHLD	LDA	MOV C,D	MOV D,D	MOV H,D	MOV A,D	ADC D	SBB D	XRA D	CMP D	JZ	JC	JPE	JM	A
B	DCX B	DCX D	DCX H	DCX SP	MOV C,E	MOV D,E	MOV H,E	MOV A,E	ADC E	SBB E	XRA E	CMP E		IN	XCHG	EI	B
C	INR C	INR E	INR L	INR A	MOV C,H	MOV D,H	MOV H,H	MOV A,H	ADC H	SBB H	XRA H	CMP H	CZ	CC	CPE	CM	C
D	DCR C	DCR E	DCR L	DCR A	MOV C,L	MOV D,L	MOV H,L	MOV A,L	ADC L	SBB L	XRA L	CMP L	CALL				D
E	MVI C	MVI E	MVI L	MVI A	MOV C,M	MOV D,M	MOV H,M	MOV A,M	ADC M	SBB M	XRA M	CMP M	ACI	SBI	XRI	CPI	E
F	RRC	RAR	CMA	CMC	MOV C,A	MOV D,A	MOV H,A	MOV A,A	ADC A	SBB A	XRA A	CMP A	RST 8	RST 18H	RST 28H	RST 38H	F
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	

TRANSACTION FILE

The "Transaction File" is available for the free use of PCW readers (please, no companies). Buying, selling, exchanging, searching. . .whatever, just post your advertisement to: PCW Transaction File, 14 Rathbone Place, London W1P 1DE. We'd appreciate a maximum of around 50 words per insert.

For Sale

77:68 CPU board. . .all complete — £20.
77:68 MON 1 Board. . .all socketed and complete — £20.
77:68 VDU board. . .all socketed and complete — £25.
Apply Mr J K Newman, 2 Carlton Drive, Benfleet, Essex. Phone 0702 556891.

Applesoft floating point BASIC card. . . £80. Phone A Gleeson on Southampton (0703) 557538.

Cromemco Z2. . .computer system, 48K memory, 5" floppy (90K) drive, 16K extended BASIC and macro assembler included — £2200. Plus Hazeltine intelligent VDU 1510 — £800. Contact Paul Clarke, 32 Upper Mall, London W6 9TA. Phone 01-748 1176.

Triton micro. . .full on board RAM, with cassette recorder — £280.

Nascom 1. . .with T2 & B-Bug Monitors, complete in case with PSU — £150. Both units fully operational. Phone Ken on Shrewsbury (0743) 56698 (between 3 & 5 pm).

Motorola 6800. . 12K words, cassette interface, ASCII keyboard for TV set, manuals. Offers — phone Ron James on 01-388 1827 (office hours).

Verbatim Soft Sector Discs. . .5¼", unopened box of ten — £20. Ten used very briefly — £1.90 each. Contact D. Briers, 53a Newlands, Pershore, Worcs.

Nascom 1. . .PSU, B-Bug Monitor, graphics board, all neatly boxed in Vero case, fully tested and working, all documentation, 3 months old — £220. Phone 01-722 2039 or 01-249 6764.

IBM "Golfball" Typewriter. . .with punch and reader, box of spares & accessories & literature, metal case with tape holder. Z80 program for linking IBM printer to Exidy Sorcerer included (will require adaptation for this machine). Works, but needs overhaul to remove small faults. As is £290. Phone Porthtowan 890688.

Pet 2001. . . 8K plus twenty or so programs (Petsoft etc). — £400 and free delivery in the London area. Contact Mr Forrester, 24 Connaught Avenue, Plymouth. Phone 0752 29638.

Texas T158. . .with PC100A printer, includes Master & Leisure libraries, electrical program "Pakette", programs & paper. £200 or S100 boards (RAM I/O A/D etc) in exchange. Phone Garelochhead (0436) 810605 evenings/weekends.

Pet 2001-8. . .nearly new, plus many games and programming aids. Only used in home — £500 o.n.o. Contact Mr Hounsell after 7pm on 031 332 8913.

MK.14. . .new keyboard, revised monitor, cassette interface, single step facility, instruction manual & amendments — £50. Phone K. Hones on Sandown (0983) 405256.

TRS-80 Level II 16K. . .with lower case, shift lock and control keys (Electric Pencil use), levels 1/2 and technical manuals, keyboard cover, video monitor, CTR-41 recorder with audible CLOAD/CSAVE and AUTO/MANUAL switch for rewind etc., "Electric Pencil" tape, "Tandy Personal Finance Package", output only RS232 interface, various other tapes — £600. Phone Dave Holloway on Asthall Leish (093 387) 241 (evenings/weekends).

Mikbug 6830 L-7 ROM. . .£8 o.n.o. Also, anybody interested in implementing Pilot or Forth on 6502? — swap ideas, etc. Contact Mr Dunnicliffe, 19a Hitchin Road, Henlow Camp, Beds.

Texas TI58. . . programmable calculator. Little used, too good for me, 240 and 110 volt adaptors — £45. Contact A. Park, Laburnum Cottage, Broomhall, Nantwich, Cheshire. Phone Crewe (0270) 780608.

Pet 8K. . .new in March 79. Inc soundbox, software, manuals, etc — £500. Phone Peter on 01-883 1560.

System 68 VDU. . .cards A&B, socketed & wired, never used: teleprinter type 28 KSR, 115V: Bunker-Ramo type 103A1 VDU, needs new main transformer: high speed Opto. paper tape reader, 8 or 5 holes. Will sell or swop for interesting/useful bits. Contact Chris Warwick G8DSO, 44 Wellington Road, Birmingham B20 2SB.

VDU. . .need a VDU? Come and see mine and make me an offer I can't refuse. Phone 01-794 8419.

16 Dynamic RAM chips. . .4027, 250nS — £48. Phone 01-907 9065 any time.

TI59. . . noughts & crosses program on mag card — £1.35. Contact M. Lancaster, 14 Barley Cote Road, Riddlesden, Keighley, W. Yorks.

PDP8-L. . .4K mini-computer with TTY interface and full set diagnostics software. Ideal for emulation of Harris HM6100 12-bit micro. Seen working — £400. Additional 4K memory for above fitted and working in BA08 peripheral expander unit — £150. Phone Cobb on Portsmouth (0705) 385589.

Printer Mechanism. . .80-col. impact, unused, no logic — £65.
Star devices. . .touch keyboard — £30.
MK.14 computer. . .extra RAM. manuals, new keyboard — £30.
Phone David Pearce on Biggin Hill 73585.

TRS-80 Level II 16K. . . plus extra 16K chips, sound adapter and software, auto/manual tape control. Also software: Startrek III, X-Wing Fighter, T-Bug, and others — £500. Phone 0480 624286.

Flexowriter. . . electric typewriter with integral 7-hole paper tape punch and reader. All solenoid operated, requires 110 volt transformer, includes handbook and cct diagram — £40.
Card Reader. . .Burroughs, reads 200 80-col cards per minute, circuits and maintenance manuals included — £100. Maintenance manual. . .for IBM Selectric I/O typewriter — £8. Phone 01-449 1690, evenings.

PET 2001-32N. . . complete with cassette drive, dustcover and TIS workbooks 1-6. Commodore 2040 dual disc drive, just add printer for complete business system. Plenty of software included, both still under warranty. Cost over £1700 — open to offers. Anadex printer. . . DP-8000 80-col printer, RS232C and parallel interfaces, complete with CMC Pet interface for immediate use with any Pet. Cost over £700 — open to offers. Phone P. Wright on Blythburgh (050270) 252.

77:68 4K RAM boards. . .three, fully working — £50 each. Phone Leeds 771681 between 9 and 5.30 or write to David Thatcher, 2 Halfpenny Lane, Featherstone, Yorks.

Olivetti printer/terminal. . . 10cps with papertape punch/reader (similar to ASR 33), recently reconditioned — £250 o.n.o. Phone 01-455 3888, evenings.

Nascom 1. . . complete, fully socketed and working, with buffer board, cased keyboard, Cannon connectors — £180 o.n.o. PSU available if required. Phone Jon on 021 743 3442 (Solihull) evenings/weekends.

TRS-80 Level 1 4K. . . complete with monitor and cassette unit, plus program library — £300 o.n.o.

Olivetti TE 500. . . printer with tape punch/reader, believed good working order, but no documentation — hence £40 o.n.o.

Video writer. . . Practical Wireless design 7-bit ASCII in video /UHF out — £20 o.n.o. Phone Chelmsford 84732.

Pet 2001-8K. . .6 months old, plus assorted games software and BASIC manuals — £475 o.n.o. Phone 01-572 4215, evenings.

Texas SR-56 calculator. . .programmable, 100 step, with operating manual and various sample programs — £25. Contact F. R. Applewhite, 252c Porchester Road, Nottingham NG3 6HE.

Apple II (ITT 2020). . . 32K RAM, cassette recorder, 30 various programs, as new with box and packing — £950 or take good Pet in part exchange. Phone Warrington (0925) 811191, after 6pm.

Sorcerer 32K. . . as new and complete with all cables, manuals etc. Also tape deck and technical manual. Save £150 plus by buying mine at £650. Phone Charles Thompson on 0438 832737 or 0438 032321 (Herts).

Sorcerer 16K. . . in excellent condition with all accessories — £615. Also available, TV monitor, cassette recorder, D/A and A/D converter, library of programs and cassettes, technical manual — £130. Together — £715. Phone Southport 65787/64809.

7/8" paper tape. . . to clear, £1.50 per 8" reel (includes p&p). Contact C. E. Brough, 21 Ashdene Gardens, Stourbridge, W. Mids DY8 5JQ.

Printer/terminal. . . ASR33 teletype (Westrex) with paper tape punch/reader, RS232 & SWTP MP-S interface — £300 o.n.o. Phone 01-764 5999.

Nascom 1. . . built and working, plus modulator, without PSU — £120. Phone Pete Overall on 0626 68975.

Nascom 1. . . built and tested, including PSU, mounted in stylish wooden cabinet, all manuals and programs supplied — £200 o.n.o. Contact T. D. Botterill, 48 Yardley Drive, Northampton. Phone N'ton 844338.

Kilobaud and Byte. . . exchange your unwanted copies — SAE list. Contact Geoff Smith, 84 Edenfield Gardens, Worcester Park, Surrey KT4 7DY.

Superboard II. . . with 8K RAM, fully operational, mounted in custom built and professionally finished metal cabinet. Supplied with all interface cables, diagrams and manuals and program tapes. Also UHF modulator. Needs 5V PSU — £280. Phone Mr A. D. Sellers on 0582 38581, 9am - 6pm.

Comp 80. . . fully built and working Powertran W. W. Comp 80 — £300.

TRANSACTION FILE

Phone 0632 650653 and ask for Geoff.

Superboard II. . . with 8K RAM, complete with 5V 5A PSU and UHF modulator — £220 o.n.o. Phone Rod on Watford (0923) 20310, evenings.

Ohio Disc System. . . C2-4P with TV monitor, as illustrated in the American Data adverts, complete with many business and games discs — £950 o.n.o. Phone Lichfield (Staffs) 54515.

SC/MP II. . . in superb Vero case, 1K byte memory mapped VDU including cursor control, 2½K byte memory expandable to 64K, 5V PSU, 10 digit 7-seg LED O/P, cassette I/P & O/P interface, 16-bit I/O port with handshake mode, light touch keyboard, programs and all documentation — £125. Contact U. Yoltay, 1 Grosvenor Gardens, London N10 (top flat).

Triton. . . includes full on board RAM (4K) and the new BASIC and monitor in (4K) of ROM; has sprayed front and rear panels, also includes cassette recorder — £400. Phone 01-805 1878, after 6pm.

Colour graphics kit. . . William Stuart Systems, for Nascom 1, complete with instructions, colour modulator and software — £38. Phone 0602 266748, weekends only.

Pet. . . new ROM set for 8K Pet. Update your machine for £25, or offer. Phone Sandwich (03046) 7209, evenings.

TRS-80 Level 2. . . numeric keypad, 32K interface — £750 plus VAT. Micropolis Dual Drive. . . 394K — £950 plus VAT. Only a few months old. Phone Henfield (Sussex) 3101.

Wanted

Mite printer. . . any condition, any price considered. Contact Mr P. Spooner, 6 Ebor Close, West Parley, Dorset BH22 8LZ.

Software. . . copies of CP/M library programs on 5¼", 16 sector Micropolis quad density. Also programs for the Sorcerer: IN BASIC, machine language, on disc or cassette, or on CP/M format disc. Phone Garelochhead (0436) 810605, evenings/weekends.

DIARY DATA

Moscow, Russia	Electronic Devices Production & Control Exhibition, 'Expocentre', 1a Sokolnichesky Val, 107113 Moscow, U.S.S.R.	Oct 11 - Oct 21
Budapest, Hungary	MIPEL — International Exhibition of Industrial Electronics. Hungarian Foreign Trade for Fairs & Publicity, Electronics, P.O. Box 44, H-1441, Budapest.	Oct 23 - Oct 28
Birmingham, England	International Business Show. BETA 109, Kingsway, London WC2B 6PU. Tel: 01-405 6233	Oct 23 - Nov 1
Harrogate, England	Management Services & Equipment Exhibition. Peter Mirrington Exhibitions, 1 The Coppice, School Rd., Kelvedon Hatch, Brentwood, Essex. CM15 6DL Tel: 0277 74290	Oct 25 - Oct 26
Frankfurt, W. Germany	Office Equipment Exhibition. Collins & Endress, 36 Sackville St., London W1X 1DB. Tel: 01-734 0543	Oct 30 - Nov 2
London, England	2nd Personal Computer World Show. Montbuild Exhibitions Ltd., 11 Manchester Sq., London W1M 5AB. Tel: 01-486 1951	Nov 1 - Nov 3
Cardiff, Wales	BEX — Business Equipment Exhibition. Douglas Temple Studios Ltd., 104B Old Christchurch Rd., Bournemouth, BH1 1LR, Hants Tel: 0202 20533	Nov 5 - Nov 6
London, England	COMPEC — Computer Peripheral & Small Computer Systems. Iliffe Promotions Ltd., Dorset House, Stamford St., London SE1 9LU. Tel: 01-261 8000	Nov 6 - Nov 8
Dublin, Ireland	ITRON — Irish Electronics Exhibition. SDL Exhibitions Ltd., 68 Fitwilliam Sq., Dublin 2, Ireland. Tel: Dublin 763871	Nov 6 - Nov 8
Helsinki, Finland	FINNTEC 79/ELKOM 79 — Electrical Technology & Professional Electronics Fair. ECL Ltd, 11 Manchester Sq., London W1M 5AB. Tel: 01-486 1951	Nov 6 - Nov 10
Munich, W. Germany	PRODUCTRONICA — International Exhibition for Electronics Production, ECL Ltd, 11 Manchester Square, London W1M 5AB. Tel: 01-486 1951	Nov 6 - Nov 10
Dunstable, England	The All Business Show. Luton and District Chamber of Commerce and Industry, George Street West, Luton LU1 2BT. Tel: 0582 23456	Nov 13 - Nov 15
Hamburg, W. Germany	Office Equipment Exhibition. Hamburg Fairs & Congress Co., 238 High St., Poole, Dorset BH15 1DY. Tel: 02013 4450	Nov 13 - Nov 17
Madrid, Spain	SIMO — International Office Equipment & Computers Exhibition. CITEMA, Plaza de Conde de Valle Suchil 8, Madrid 15, Spain	Nov 15 - Nov 23
Manchester, England	Minicomputers, Word Processors & Copying Machines Exhibition. Groundrule Exhibition Co. 7 Market St., Altrincham, Cheshire, WA14 2QW Tel: 061 928 2227	Nov 20 - Nov 21
London, England	Electronics '79 Show. Industrial & Trade Fairs Ltd., Radcliffe House Blenheim Court, Solihull B91 2BG. Tel: 021 705 6707	Nov 20 - Nov 23
Brussels, Belgium	International Electronics Exhibition. Brussels International Trade Fair, Palais du Centenaire, Parc des Expositions, B 1020 Brussels, Belgium	Nov 26 - Dec 1
Tokyo, Japan	Semicon Japan. Golden Gate Enterprises Inc., De Anza Office Center, 1307, So. Mary Ave., Suite 210, Sunnyvale, CA 94087 U.S.A.	Nov 28 - Nov 30
Bucharest, Romania	SYSTEMTECHNIK — International Electronics Exhibition & Trade Fair. Glahe. International GmbH & Co., Herler Strasse, 91-109, P.O. Box 800349, D-500 Cologne 80. W. Germany	Dec 3 - Dec 8
London, England	Breadboard Exhibition (Home Electronics). Trident International Exhibitions Ltd., 23a Plymouth Rd., Tavistock, Devon, PL19 8AU. Tel: 0822 4671	Dec 4 - Dec 8
Paris, France	International Electrical Equipment Exhibition. French Trade Exhibitions, 54 Conduit St., London W1. Tel: 01-439 3964	Dec 10 - Dec 15
Birmingham, England	TV MEX. Montbuild Ltd., 11 Manchester Sq., London W1M 5AB. Tel: 01-486 1951	Jan 15 - Jan 17
Wembley, England	Microsystems '80 Exhibition & Conference. Iliffe Promotions Ltd., Dorset House, Stamford St., London SE1 9LU. Tel: 01-261 8000.	Jan 30 - Feb 1
Leeds, England	BEX — Business Equipment Exhibition. Douglas Temple Studios Ltd., 104b Old Christchurch Rd., Bournemouth, Dorset. Tel: 0202 20533	Feb 6 - Feb 7
Milan, Italy	INTEL — International Electrical & Electronic Technology Exhibition. Intel, Via Luciano Manara 1, 20122 Milan, Italy	Feb 9 - Feb 13
Solihull, England	Mini Computers, Word Processors & Copying Machines Exhibition. Groundrule Exhibition Company, 7 Market Street, Altrincham, Cheshire WA14 2QW. Tel: 061 928 2227	Feb 12 - Feb 13

DIARY DATA

London, England	Business Computing, Word Processing & Information Mgt., Exhibition & Conference. BED Exhibitions Ltd., Bridge House, Restmor Way, Wallington, Surrey. SM6 7BZ. Tel: 01-647 1001	Feb 12 - Feb 15
Wembley, England	INFO EUROPE — European Information Management Exhibition & Conference. Clapp & Poliak Europe Ltd., 232 Acton Lane, London W4 5DL. Tel: 01-995 4806	Feb 18 - Feb 21
Bournemouth, England	BEX — Business Equipment Exhibition. Douglas Temple Studios Ltd., 104b Old Christchurch Rd., Bournemouth, Dorset, Tel: 0202 20533	Feb 20 - Feb 21
Swansea, Wales	OFFEX — Office Equipment Exhibition. Phoenix Exhibitions Ltd., 1st Floor, Burrows Crambers, East Burrows Rd., Swansea. Tel: 0792 460364	Feb 20 - Feb 22
Dortmund, W, Germany	HOBBYTRONIC — Electronic Hobby Exhibition. Westfalenhalle GmbH, Postfach 1130, Reinlanddamm 200, 4600, Dortmund, W. Germany	Feb 20 - Feb 24
Birmingham, England	IEA — International Instruments, Electronics & Automation Exhibition. Industrial & Trade Fairs Ltd., Radcliffe House, Blenheim Court, Solihull, West Midlands, B91 2BD. Tel: 021 705 6707	Feb 25 - Feb 29
Copenhagen, Denmark	TECHEX — World Fair of Technology Exchange. Dr Dvorkovitz & Associates, P.O. Box 1748, Ormond Beach, Florida 32074 U.S.A.	Feb 26 - Feb 29
Birmingham, England	Computermarket '80, Couchmead Ltd, 42 Great Windmill Street, London W1V 7PA. Tel: 01-437 4187	Mar 4 - Mar 6
Liverpool, England	Merseyside Business Efficiency & Office Equipment Exhibition. Gwen Shillaber Design, 81 Whiteladies Rd., Clifton, Bristol BS8 2NT. Tel: 0272 312850	Mar 4 - Mar 7
London England	Microforum Europe. Business Equipment Trade Association, 109 Kingsway, London WC2B 6PU. Tel: 01-405 6233	Mar 11 - Mar 13
Sheffield, England	Business Efficiency & Office Equipment Exhibition. Gwen Shillabar Design, 81 Whiteladies Rd., Clifton, Bristol BS8 2NT. Tel: 0272 312850	Mar 11 - Mar 13
Manchester, England	Computermarket '80. Couchmead Ltd., 42 Great Windmill St., London W1V 7PA. Tel: 01-437 4187	Mar 11 - Mar 13
Bahrain, UAE	Middle East Business Equipment Show. Arabian Exhibition Management 11 Manchester Sq., London W1M 5AB. Tel: 01-486 1951	Mar 16 - Mar 20
Glasgow, Scotland	Computermarket '80. Couchmead Ltd., 42 Great Windmill St., London W1V 7PA. Tel: 01-437 4187	Mar 18 - Mar 20
London, England	Computermarket '80. Couchmead Ltd., 42 Great Windmill St., London W1V 7PA. Tel: 01-437 4187	Mar 25 - Mar 27
London, England	Viewdata '80. Online Conferences Ltd., Cleveland Road, Uxbridge, Middx UB8 2DD. Tel: 0895 39262	March 26 - March 28
Paris France	International Exhibition of Electronic Components. French Trade Exhibitions, 54 Conduit Street, London W1R 9SD. Tel: 01-439 3694	Mar 27 - Apr 2

COMPETITIONS ROUND-UP

One of the less appreciated inheritances for the new team at PCW was a collection of hitherto unresolved competitions. We believe, after some hours of research, that five (and possibly six) sets of results are outstanding (!) — please let us know if you spot others — and of those, at least two still require their instigators to pass judgement. They are: "Puzzle Dazzle 2", set in the February '79 issue; "Alphametics" set in the May '79 issue. Others, which we can deal with now, are: "Magic Squares", set by Sheridan Williams in the June '79 issue: "Knight's Tour", again set by Sheridan Williams, this time in the January '79 issue; finally, "Witbit 1" set by David Parkinson and Graham Trott in the June '79 issue.

It's obviously most unfair that the winners be kept waiting any longer. However, it'll come as no surprise to everyone to learn that the outlining of all these reports would take up far more space than any one PCW issue could possibly donate (not to mention the possibility of our readers going down with a nasty bout of 'competition overkill').

Therefore, this month we are restricting ourselves to little more than a round-up of results although, through later issues, we hope eventually to publish a much fuller analysis.

KNIGHT'S TOUR

The problem was to find a complete tour of the chessboard for a knight, so that the piece visits, in turn, every square on the board once, and once only.

Sheridan had purposely set a difficult competition. . . and yet the entries still came flooding in. Joint winners (£10 each) are Philip Crane of Romford in Essex and Brian Legg of Bishops Stortford in Hertfordshire. The run times of the two programs were 3.87 seconds and 2.36 seconds, respectively.

MAGIC SQUARES

The problem here was to find a magic square that satisfies the following conditions: (1) It comprises of 2-digit numbers (zeroes not allowed) (2) It's a 3x3 square (3) When the digits are reversed, another magic square is produced with none of the original numbers reappearing (4) The sum of the *two* magic constants is less than 200.

A prize was offered for the first correct entry supported by BASIC program. The solution was as follows:

13	34	25		31	43	52
36	24	12	reversed	63	42	21
23	14	35		32	41	53
MC=72				MC=126		

The winner is: Mr O. M. Dixon of Alverstoke in Hampshire, who receives £10. A consolation prize of £5 goes to Mr C. Palmer of Bradford, Yorkshire who, although not first out of the 'hat', submitted the best entry.

WITBIT

The problem set was to write a short subroutine for an editor to execute a "Find string" command.

Solutions were accepted in Z80 and 6800 code, prizes to be awarded to the winners of each section. Z80. First prize (£10) goes to Mr J. Robertson of East Kilbride, Scotland for his neat solution which uses the minimum of temporary storage. Second prize (£5) goes to David Medland-Slater of Farnborough in Hampshire. 6800. Only four entries received in this section! Winner (£10) is Martin Bond of Didsbury, Lancashire and runner-up (£5), John Phillips of Saltash, Cornwall.

Cryptic clue

Re September Issue 1979, Spaceship FX201-P . I have an entry for your diversions and puzzles page.

With reference to the above article:-

A Try and figure out how the list of step numbers applies to the program.

B Make a list of incorrect function signs.

C Fill in the missing line which would give answer 4 — your new radial distance.

I would be most grateful if you could send me the same copy that Dick Pountain wrote his review from.

E. Fernie, Enfield, Middx

Okay, pax. . . Corrections to Spaceship FX201-P in Blunders at the end of our Programs section.

Faith healing

Further to my letter of 1st June, 1979, concerning difficulties I have experienced in obtaining a MPS 6550 memory chip for my Commodore PET. I now have the greatest pleasure to inform you of the remedy. . . a small shop in the town of Luton, Bedfordshire, called Isher-Woods. I rang them and explained my problem and was told that they had the devices in stock. I was invited to take my PET over to them where they could test the device in situ.

Once at the shop I was received by their Wizard, John Rees, who operates in a well-organised (you should see mine) workshop with an air of calm confidence and rather like a slow-motion Magnus Pyke. That he knows what he is doing is evident from the constant flow of people seeking his advice and leaving satisfied. I was invited to participate in the operation (painless) but the best part was enjoying the interesting chat seeded with snippets of valuable information.

The Wizard introduced me to the Vizier, Ian Wade who is their Divisional Controller and obviously knows a lot more about the aspects of hard and software than he is telling! If you wish to discuss the purchase of either he is in an ideal position to give you the "low down" on it. I wonder how many persons in his position can say the same.

Throughout my visit I was impressed with the atmosphere of friendly co-operation and enthusiasm and I strongly urge anyone in the vicinity, to drop in and say hello. This really is an unsolicited testimonial; unless Isher-Woods reads your worthy publication they will never know about it.

S.R. Somers, Aylesbury

Well earned "plugs" we never mind repeating — Ed.

Punter postscript 1

I read with interest "The Programmed Punter" by Dr. M.R.J. Morgan in the July issue of PCW. I was surprised at the low limits on the value of the permutations he could calculate until I realised that he calculated them from three factorials.

This is a very long winded and restricting method as many terms in the fraction always cancel out. To take his example:

$$\frac{8!}{3!x5!}$$

$$= \frac{8x7x6x5x4x3x2x1}{(3x2x1)x(5x4x3x2x1)}$$

$$= \frac{8x7x6}{3x2x1}$$

The subroutine at line 1000 in the program below calculates the permutations this way cancelling the larger factorial on the bottom into the top.

```
10 REM *** BINOMIAL CO-EFFICIENTS ***
20 INPUT "M, N"; M, N
30 IF M=0 THEN END
40 GOSUB 1000
50 PRINT C
60 GOTO 20
1000 REM $1$ BIN CO $1$
1010 IF M-N>=N GOTO 1030
1020 N=M-N
1030 C=M
1040 IF N=1 GOTO 1090
1050 M1=M+1
1060 FOR I=2 TO N
1070 C=C*(M1-I)/I
1080 NEXT I
1090 RETURN
```

This program will allow your readers to see how large they can get M and N on their systems. With M=122 I can do all values of N although my RML380Z overflows at about 10^{38}.

Hugh Williams (Past Chairman MUSE) West Bridgeford, Nottingham

Punter postscript 2

In Dr Morgan's short article "The Programmed Punter" (July PCW) he used the formula M!/N! (M-N)! which gives the number of combinations of N objects that can be chosen from M unlike objects. ABC and ACB are different permutations of the same combination of letters.

An alternative way of calculating the number of possible combinations, other than evaluating the three factorials as that program does, uses the fact that the coefficients of the binomial expansion $(x+y)^M$, are the number of combinations of 0,1,2,...,M objects from M objects. For example, the coefficients of the terms of $(x+y)^7$ are 1,7,21,35,35,21,7,1 so there are 21 possible combinations of 2 objects from 7 objects.

Successive coefficients are related by:

$$^mC_n / {}^mC_{n-1}$$

$$= m!/n!(m-n)! \times (n-1)!(m-n+1)!/m!$$

$$= (m-n+1)/n$$

$$^7C_3 / {}^7C_2 = 35/21 = 5/3 = (7-3+1)/3$$

so $^mC_n = {}^mC_{n-1} \times (m-n+1)/n$

As $^mC_0 = 1$, the number of combinations can be evaluated by successively multiplying by (M-I+1)/I where I=1,2, ...,N. A program, assuming that the data is always correct being:

```
10 INPUT M,N
20 C = 1
30 FOR I=1 TO N
40 C= C*(M-I+1)/I
50 NEXT I
60 PRINT C
```

As $^mC_n = {}^mC_{m-n}$ another line could be added to increase the efficiency of the program

```
15 IF M-N <N THEN N= M-N
```

Using this algorithm, our RM 380Z, using DBAS12, can evaluate the number of combinations of N objects from 123 objects to an accuracy of 10 significant figures. Some results for values of M greater than this can be obtained, but the greater M is, the smaller N has to be. When M= 300,N can only be 26 or less. Using the formula for the number of combinations directly, the greatest value of M is 33.

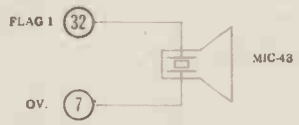
The formula for the number of permutations of N objects chosen from M unlike objects is M!/(M-N)! and a similar method of evaluation can be used that does not involve working out factorials.

As the order in which multiplication and division are executed does not matter, it is worth investigating to see if the equivalent statement C=C/I*(N-I+1) will enable greater values of M to be evaluated.

Peter Butt, Chadwell Heath, Essex.

MK14 sound out

In musical or noise generating applications of the Science of Cambridge SC/MP based Mk.14 microcomputer, a crystal microphone insert may be used as a high impedance loudspeaker, driven directly by the logic levels at the flag outputs of SC/MP. The prototype used an ACOS type MIC-43 connected as shown below.



The brief program listed here may be used to generate a sound to test the set up. It operates by incrementing a store, loading the result to the Status (flag) Register, and also using the result as a parameter for a variable delay before jumping back to the start. The program is written in locations 0F20 to 0F26 inclusive with 0F1F as a store but it is relocatable to any eight contiguous locations in RAM. The type of output sound may be varied by altering the delay base number in location 0F24.

```
0F1F  00      Store:
0F20  A8FE    Start:  ILD  Store
0F22  07              CAS
0F23  8F00            DLY
0F25  90F9            JMP  Start
      0000            .END
```

See the Mk.14 User Manual Music section for more ambitious programs using this circuit.

T. J. Spriggs, Havant

Dodgy delays

The SC/MP micro-processor has a DELAY instruction (opcode 8F) which provides a pause, corresponding to a specified number of micro-cycles, with very simple software. (In the 6800 MPU, we have to write a short subroutine to achieve the same effect).

In the manual for the Mk.14 (which uses the SC/MP chip) there are programs (on Pages 65 and 66)

for Serial Data Input and Serial Data Output. These programs use the DELAY instruction. In a program I wrote, similar to the Serial Input program, I found that the constants for the DELAY operation suggested in the Mk. 14 programs, were not correct. My program worked correctly when the constants were changed to values which were found after some experiments guided by theory.

Page 64 of the manual gives a table for delay constants based on a frequency of 4 MHz. These constants are used in the Mk. 14 program for Serial Data Input. But the Mk. 14 works in association with a crystal which has a frequency of 4.433618 MHz (this is the value stamped on the casing of the crystal). It would therefore seem to be wrong to use the constants in the table.

In my project, I was working at 300 baud, the "bit time" is 3.333 milliseconds. For this condition, the table suggests

"C4 5E
8F 03"

This means "Load 5E into the accumulator and set the displacement in the DELAY instruction to 06".

This leads to a delay of n microcycles, where n is given by 13 + 2 x (accumulator) + 2 x displacement + 2^9 x displacement; i.e.

13 + 2 x 5E + 2 x 6 + 512 x 6.

This statement is somewhat confusing in that decimal numbers are mixed with hexadecimal. "5E" in hex means "94" in decimal. Thus n =

13 + 188 + 12 + 3072
= 3285 microcycles.

At a frequency of 4 MHz, one microcycle lasts 1 microsecond. The delay is thus 3.285 milliseconds.

We require 3.333 milliseconds. This leaves 48 microcycles for the SC/MP instructions — a reasonable figure.

However, when SC/MP is working at 4.433618 MHz, the delay corresponding to 3285 microcycles is

$$3285 \times \frac{4}{4.433618} \text{ microsecs}$$

i.e. 2.9637 milliseconds.

For my project, I found that the program would work with

"C4 22
8F 07"

The constants were chosen by taking the mean of the upper and lower limits of the delays found to be satisfactory.

Because of the synchronising action of the START and STOP bits in the program, there is a certain range within which operation is satisfactory. With "8F 07" the program would work with values stored in the accumulator varying from 00 to 44 (in hex).

In addition to changing the constants for "bit time", I changed those required for "half bit time". To save space, those changes will not be mentioned here. The purpose of this letter is to suggest that values in a table intended for a frequency of 4 MHz should not be applied to an MPU working at 4.433618 MHz.

Tom Palmer, Kew

We rang Science of Cambridge who confirm your observations. They did point out, however, that since January they have incorporated a genuine 4MHz crystal. They also mentioned that their manual page numbers have changed following a recent update so you may find Tom's references different to your own. One last thing — they also told us that because the input and output routines use the same byte in memory, spurious data can find its way onto the output line as it is displaced by incoming data. You can work out your own solution to this by either dealing with the content of this byte before a read or by 'gate'-ing the output. — Ed.

Pascal possibilities

Alex Cawley's letter in your September Issue gives incorrect information concerning the availability of PASCAL Compiler RAM requirements.

Our company has a 3 Pass PASCAL Compiler designed for the RCA 1802 Microprocessor which runs in a 20K RAM System with Floppy Discs. This Compiler, whilst designed for the 1802 family, can be adapted to other microprocessors by alteration of the 2K run time kernel to suit the required instruction set.

The 2K interpreter makes application programs as small as 3K a practical possibility; the package is designed to appeal to the professional and industrial user looking for minimum read only memory costs.

M. J. Dalgleish, Golden River Company, Bicester

Routine business

I read an aritcle in PCW recently describing Dr. Roger Quy's 380Z system at the National Hospital's Institute of Neurology. In it, Dr. Quy was quoted as saying that he had found PCW to be a useful source of assembler multiplication and division routines. As a fairly recent convert to PCW and a new user of a 380Z, I should like to track down these routines. I wonder if you can quote me chapter and verse? I'd be very grateful.

Mrs A M Guenault, Lancaster

We rang Dr. Quy and, with his help, tracked down an article by Neil Harrison in volume 1 number 2. It's called 'Four Easy Pieces' and in it, among other things, he describes a multiplication routine. He thinks that his division routines came out of a hardware manual — Ed.

Was ist das?

I would be grateful if you could kindly inform me of any computer that translates German into English, it would also be a great help if you could supply the companies' names and addresses.

PS I do take your magazine.

H. Thomas, Shirehampton, Bristol.

Nice to hear from another discerning reader! The company distributing translators in the UK is Lexicon. Their head office is in Parliament Street, London (Tel: 01-930 3030). They supply to shops all over the country — the nearest one to you is probably Communications Imports in Cheltenham. The phone number there is 0242 41173. It is probably worth noting that the translator has a repertoire of some 1500 words and translates word for word in the present tense, first person singular. Therefore, although it's no replacement for a human interpreter, it does provide a very useful means of communication. One last thing — price; a Lexicon 3000 with one language module of your choice costs £148 + 15% VAT. Each additional module costs £32.95 + 15% VAT. Each module plugs in and allows translation in either direction.

Stop Press: Lexicon have just announced that they are selling 'personal program' modules — you can store recipes, 'phone numbers jokes etc. — Ed.

Sorcerer tips

Despite claims to the contrary, there is no GET statement in Sorcerer BASIC. It is, however, possible to simulate a GET statement using a machine code routine that is POKE'd in from BASIC.

The statements are as follows:

firstly,

```
FOR X = 1 to 14
READ W
POKE 223 + X, W
NEXT X
DATA 62, 0, 50, 240, 0, 205,
9, 224, 200, 50, 240, 0, 201,
0.
```

then,

```
POKE 260, 224
POKE 261, 0
```

To use this routine:

V = USR (0) : A = PEEK (240)

A now has the value of the ASC11 code of the last key to be pressed.

If no key is pressed then A = 0.

An example is shown below:

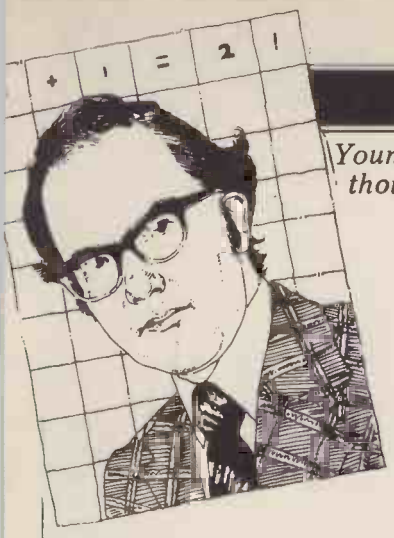
```
10  PRINT "DO YOU WANT TO CONTINUE"
20  V = USR (0) : A = PEEK (240)
30  IF A = 0 THEN 20
40  IF A = ASC ("Y") THEN 80
50  IF A = ASC ("N") THEN 100
60  PRINT "RESPONSE INVALID"
70  GO TO 20
80  REM Do something
90  GO TO 10
100 END
```

To control a printer from BASIC, rather than from the monitor, USE the output vectors:

7FD0 H 32720 D
and 7FD1 H 32721 D

The contents of these locations will change depending on the output option selected. To turn on the line printer (Centronics) POKE 32720, 147 and to switch it off again POKE 32720, 240. (A word of warning, we've found that if we mess about in the monitor before executing POKE 32720, 147 we lose our program entirely — some caution is needed).

Rob Beynon, Liverpool University.



YOUNG COMPUTER WORLD

Young Computer World is the place where, each month, John Coll highlights the thoughts, ideas and contributions of PCW's younger readers.

Reactions

I can see that the major problem about this page is going to be finding space to print all the good stuff that comes in. We have given some thought to this problem and perhaps there is a place for publishing a whole selection of programs in book form in addition to the regular page in PCW. Anyway that remains to be seen. Also, of course, we are able to "overflow" into the Programs section.

However, I have only had one reply to my request for an idiot proof input subroutine, but I guess that may be because of the misprints which made the idea a little difficult to follow! I will leave that topic open for a while in the hope that others will try.

Calculator programmes

I've been surprised at the number of calculator programs sent in. S.P Tait (17) is an apprentice with Marconi Communications Systems in Chelmsford and he has submitted five programs for the T157. One uses Kirchoff's and Ohm's laws, one plays pontoon. The other three deal with Matrix Multiplication, Number Base Conversion and a version of Mastermind. One of his programs is printed below.

Number base conversion

```
STO 2          32 2
R/S            81
STO 0          32 0
R/S            81
STO 5          32 5
RCL 2          33 2
LBL 1          86 1
STO 2          32 2
1              01
STO 3          32 3
LBL 6          86 6
RCL 5          33 5
INV PROD 2     -39 2
X              55
RCL 2          33 2
INV INT        -49
INV SUM 2      -34 2
X              55
RCL 3          33 3
=              85
SUM 1          34 1
RCL 0          33 0
PROD 3         39 0
RCL 2          33 2
X=T            -66
GOTO 6         51 6
RCL T          33 1
INV SUM 1      -34 1
R/S            81
RST            71
```

The program converts any integer in any base 1 to 10 to decimal or any decimal integer to any base 1 to 10
To use the program enter the number then R/S. Enter the base of the first number then R/S, then enter the base of the result followed by R/S.

CESIL

Undoubtedly the most interesting letter this month came from Richard Clyne (15) of London SW11. He has written a CESIL interpreter in BASIC. CESIL is a language which makes the computer behave like a very simple machine and illustrates how an assembler works. Space does not permit a detailed explanation of how to work the program but it's fairly obvious. It was not the length of the program that was impressive but rather the fact that it was so clearly set out and easy to use. Richard's program was written to run on the ILEA RSTS Systime 6000 but it will be easy to alter the file handling for other systems. A fine piece of work.

See you at the show and in the meantime keep sending me useful bits and pieces. My address is Laxton House, Oundle, Peterborough PE8 4AQ. Thanks.

Program listing

```
CESIL    13:37            13-SEP-79
10 RANDOMIZE
20 PRINT " MODES AVAILABLE :"
30 PRINT TAB(10),"  (1) INPUTING A PROGRAM"
40 PRINT TAB(10),"  (2) LISTING A PROGRAM"
50 PRINT TAB(10),"  (3) EDITING A PROGRAM"
60 PRINT TAB(10),"  (4) RUNNING A PROGRAM"
70 PRINT TAB(10),"  (5) RECALLS A SAVED PROGRAM"
80 PRINT TAB(10),"  (6) INDEX OF ALL SAVED PROGRAMS"
90 PRINT TAB(10),"  (7) SAVE A PROGRAM"
100 PRINT TAB(10),"  (8) LIST OF VARIABLES"
110 PRINT TAB(10),"  (9) LIST OF LABELS"
120 PRINT TAB(10),"  (10) DELETING A PROGRAM"
130 DIM C$[3,200],L[200],L$[200],V$[200],V[200],P$[100]
131 DIM D[100]
140 PRINT:INPUT "MODE";M
150 IF M>10 GOTO 20
160 M= INT (M)
170 IF A9>A6 THEN A6=A9
180 IF M>7 GOTO 1940
190 ON M GOTO 200,310,410,530,1530,1610,1710,1950
200 OPEN 'KB:'FOR INPUT AS FILE 9%
210 A9=1
220 INPUT #9,"L<";C$(1,A9)
230 IF C$(1,A9)="END"GOTO 290
240 INPUT #9,"Ç<";C$(2,A9)
245 IF C$(2,A9)="DATA" GOTO 301
250 INPUT #9,"A<";C$(3,A9)
260 PRINT
270 A9=A9+1
280 GOTO 220
290 CLOSE #9
300 GOTO 140
301  INPUT "HOW MANY DATA ITEMS";D:FOR D1=1 TO D:INPUT #9,D(D1):NEXT D1
302 D2=D
303 GOTO 140
310 !          LISTING PROGRAM (CESIL)
320 PRINT:PRINT
330 PRINT "CARD NUMBER",
340 PRINT "LABEL","COMMAND","LABEL/VARIABLE"
350 A9 =1
360 IF C$(1,A9)="END" GOTO 140
375 IF C$(2,A9)="DATA" GOTO 401
377 PRINT A9,
380 PRINT C$(1,A9),C$(2,A9),C$(3,A9)
390 A9=A9+1
400 GOTO 360
401 PRINT "DATA",:PRINT D(D); FOR D= 1 TO D2
402 GOTO 140
410 ! ************************************************************
420 A9=1
430 IF C$(1,A9)="END" GOTO 440 ELSE GOTO 460
440 INPUT "ADD MORE";Y$
450 IF LEFT(Y$,1)="Y" GOTO 220 ELSE GOTO 140
460 PRINT C$(1,A9),C$(2,A9),C$(3,A9)
470 INPUT "KEEP" ; E$
480 IF E$="E" GOTO 140
490 IF E$="C" GOTO 500 ELSE A9=A9 +1:GOTO430
500 INPUT C$(1,A9),C$(2,A9),C$(3,A9)
510 A9=A9+1
520 GOTO 430
```

PROGRAMS

```
530 L=1:D=1
540 FOR A8=1 TO A6-1
550 IF C$(1,A8)=""GOTO570
560 L$(L)=C$(1,A8):L(L)=A8:L=L+1
570 NEXT A8
580 L(0)=L
590 V=1
600 FOR A8=1 TO A6-1
610 V9$ =C$(2,A8)
620 IF V9$="STORE" GOTO 650
630 NEXTA8
640 GOTO 680
650 V9$=LEFT(C$(3,A8),1)
660 IF V9$="+" OR V9$="-" GOTO 630
670  V$(V)=C$(3,A8):V=V+1:GOTO 630
680 V(0)=V
690 P=1
700 A=INT(A)
710 X$=C$(2,P)
720 IF X$="IN" GOTO 890
730 IF X$="OUT" GOTO 920
740 IF X$="HALT" GOTO 950
750 IF X$="LOAD" GOTO 980
760 IF X$="JIZERO" GOTO 1090
770 IF X$="JINEG" GOTO 1120
780 IF X$="JUMP" GOTO 1140
790 IF X$="STORE" GOTO 1210
800 IF X$="PRINT" GOTO 1270
810 IF X$="LINE" GOTO 1290
820 IF X$="ADD" GOTO 1310
830 IF X$="SUBTRACT" GOTO 1340
840 IF X$="MULTIPLY" GOTO 1370
850 IF X$="DIVIDE" GOTO.1400
860 IF C$(2,P)="" GOTO140
870 PRINT C$(2,P);" IS NOT A LEGAL COMAND
880 PRINT"EDIT IT OUT!":GOTO140
890 A=D(D): D=D+1
900 P=P+1
910 GOTO 700
920 PRINT A;
930 P=P+1
940 GOTO 700
950 GOTO 130
960 P=P+1
970 GOTO 700
980 J$=C$(3,P)
990 IF LEFT (J$,1)="+" OR LEFT(J$,1)="-" GOTO1060
1000 FOR A9=1 TO V(0)
1010 IF C$(3,P)=V$(A9) GOTO 1040
1020 NEXT A9:P=P+1
1030 GOTO 700(NEVER REACHED
1040 A=V(A9)
1050 P=P+1:GOTO 700
1060 A= VAL(RIGHT(J$,LEN(J$)-1))
1070 IF LEFT(J$,1)="-" THEN A=-(A)
1080 P=P+1:GOTO 700
1090 IF A=0 GOTO 1140
1100 P=P+1
1110 GOTO 700
1120 IF A<0 GOTO 1140
1130 P=P+1:GOTO 700
1140  FOR  A8=1 TO L(0)
1150 IF C$(3,P)=L$(A8) GOTO 1190
1160 NEXT A8
1170 PRINT"LABEL ERROR CARD";P
1180 GOTO 140
1190 P=L(A8)
1200 GOTO 700
1210 FOR A7= 1 TO V(0)
1220 IF V$(A7)=C$(3,P) GOTO 1260
1230 NEXT A7
1240 PRINT "VARIABLE ERROR! CARD";P
1250 GOTO 140
1260  V(A7)=A:P=P+1:GOTO700
1270 PRINT C$(3,P);
1280 P=P+1 :GOTO 700
1290 PRINT
1300 P=P+1:GOTO 700
1310 GOSUB 1430
1320 A=A+T
1330 P=P+1:GOTO 700
1340 GOSUB 1430
1350 A=A-T
1360 P=P+1:GOTO 700
1370 GOSUB 1430
1380 A=A*T
1390 P=P+1:GOTO 700
1400 GOSUB 1430
1410 A=INT(A/T)
1420 P=P+1:GOTO 700
1430 J$=C$(3,P)
1440 IF LEFT (J$,1)="+" OR LEFT (J$,1)="-" GOTO 1500
1450 FOR A7= 1 TO V(0)
1460 IF V$(A7)=J$ GOTO 1490
1470 NEXT A7
1480 PRINT" VARIABLE ERROR!!!(MATH FUNCTION) CARD";P:GOTO140
1490T=V(A7):RETURN
1500 T=VAL(RIGHT(J$,LEN(J$)-1))
1510 IF LEFT (J$,1)="-" THEN T=-(T)
1520 RETURN
1530 INPUT "PROGRAM NAME";P$
1540 OPEN P$ FOR INPUT AS FILE 1%
1550 V=1
1560 INPUT #1,C$(1,V)
1570 IF C$(1,V)="END" GOTO 1590
1580 INPUT#1,C$(2,V):INPUT #1, C$(3,V):V=V+1:GOTO 1560
1590 CLOSE#1
```

PROGRAMS

```
1600 GOTO130
1610 OPEN 'INDEX' FOR INPUT AS FILE 1%
1620 A=INT (RND*6)+7
1630 PRINT TAB(A),"CESIL PROGRAMS"
1640INPUT #1,J
1650 FOR O5 = 1 TO J
1660 INPUT #1,P$
1670 PRINT P$
1680 NEXT O5
1690 CLOSE #1
1700 GOTO 130
1710 INPUT"PROGRAM NAME";P$
1720 OPEN P$ FOR OUTPUT AS FILE 1%
1730 FOR A7=1 TO A6
1740 PRINT #1,C$(1,A7)
1750 PRINT #1,C$(2,A7)
1760 PRINT #1,C$(3,A7)
1770 NEXT A7
1780 PRINT #1,"END"
1790 CLOSE #1
1800 OPEN'INDEX' FOR INPUT AS FILE 1%
1810 INPUT #1,J
1820 FOR A=1 TO J
1830 INPUT #1,P$(A)
1840 NEXT A
1850 CLOSE #1
1860 P$(J+1)=P$
1870 OPEN 'INDEX' FOR OUTPUT AS FILE 1%
1880 PRINT #1,J+1
1890 FOR A=1 TO J+1
1900 PRINT #1,P$(A)
1910 NEXT A
1920 CLOSE #1
1930 GOTO 130
1940 ON M-7 GOTO 1950 ,2070,2110
1950 ! LIST OF VARIABLES
1960 Z=1
1970 FOR X=1 TO V(0)
1980 FOR Y = 1 TO X-1
1990 IF V$(X)=V9$(X) GOTO 2030
2000 NEXT Y
2010 V9$(Z)=V$(X):V9(Z)=V(X)
2020 Z=Z+1
2030 NEXT X
2040 PRINT "VARIABLE","CONTENTS"
2050 PRINT V9$(X),V9(X) FOR X= 1 TO Z-1
2060 GOTO 130
2070 ! LIST OF LABELS
2080 PRINT"CARD","LABEL"
2090 PRINT L(Z),L$(Z)FOR Z=1 TO L(0)-1
2100 GOTO 130
2110    !DELETEING A FILE
2120 INPUT"PROGRAM TO DELETE";P$
2130 OPEN'INDEX'FOR OUTPUT  AS FILE 1%
2140  INPUT #1,J
2150 FOR X=1 TO J
2160 INPUT #1,P$(X)
2170 IF  P$=P$(X) THEN 2210
2180 NEXT X
2190 PRINT"NO SUCH PROGRAM"
2200 GOTO 130
2210 INPUT #1,P$(X)
2220 FOR Y=X+1 TO J
2230 INPUT #1,P$(Y)
2240 NEXT Y
2250 CLOSE #1
2260 KILL P$
2270 OPEN'INDEX'FOR OUTPUT AS FILE1%
2280 PRINT #1,J-1
2290 FOR X=1 TO J-1
2300 PRINT #1,P$(X)
2310 NEXT X
2320 CLOSE #1
2330 GOTO 130
32627 END
```

BELLS & WHISTLES

Recently PCW has received several cassette handling programs and subroutines. Here are two which should prove particularly useful.

READ/WRITE ROUTINES

Thomas Turnbull, PETSOFT consultant presents a method for reading and writing PET data files without error.

This method gives close to 100% reliability. It involves two subroutines to increase the gap between data blocks written to tape, thus allowing the machine to read back all the data without dropping a single block. Remember, if a block that is lost contains an EOT or EOF the computer will crash with hardly any hope of recovery.

My subroutine starts at line 5000 for tape 1 and line 6000 for tape 2. These subroutines need only be used on PRINT files (not READ files). Before opening a print file to CASSETTE 1 have the following POKE commands:

10 POKE 244,2:POKE 243,122:open 1,1,1

This is the POKE command for CASSETTE 2:

20 POKE 244,3:POKE 243, 58:OPEN 3,2,1

PROGRAMS

These POKE commands tell the PET which buffer it is to use and make sure that a proper tape header is written. If this is not done you will be unable to open that file for read operations. These POKE commands need only be put before the open statements and nowhere else in the print file used.

To use these subroutines you must GOSUB 5000 for tape 1 or GOSUB 6000 for tape 2 after every print to the file.

Here is an example:

```
40 PRINT*1,A$:GOSUB5000:REM THIS IS FOR TAPE 1

      TAPE 1
5000  IF PEEK(625)<180 THEN RETURN:REM LOCATION
      625 IS THE TAPE 1 BUFFER COUNTER
5010  POKE59411,53:T=TI:REM POKEING LOCATION
      59411 WITH 53 STARTS TAPE 1 MOTOR RUNNING
5020  IF TI-T<6 THEN 5020:REM THIS SETS TAPE
      RUNNING FOR 1/10TH SECOND INCREASING GAP
5030  POKE59411,61:RETURN:REM THIS POKE COMMAND
      SWITCHES CASSETTE 1 OFF

      TAPE 2
6000  IF PEEK(626)<180 THEN RETURN:REM LOCATION
      626 IS BUFFER FOR TAPE 2
6010  POKE 59456,207:T=TI:REM THIS STARTS CASSETTE
      2 MOTOR
6030  IF TI-T<6 THEN 6030
6040  POKE 59456,223:RETURN
```

All PETSOFT programs that use files have this subroutine included and they are very reliable in use.

The reason that the buffer is made to check the number 180, and not 191 as you would expect, is because this keeps the motor running in small starts until the buffer is finally emptied. Once empty, there is no need for the tape recorder to build up to writing speed as it will already be at the right speed and the data will be written at the correct rate.

GLITCH FREE LOADING

by J. Luxford

This is written for NASCOM 1 users but the principles described may be easily applied to other micros.

Problem:

You have a cassette written on another recorder which (due to incompatible head alignment, speed differences or poor tape quality) will not give error free program loading. You do not have listings in order to make manual corrections and, anyway, even if you did there may be too many. What to do?

Solution:

1. Load the corrector program in a disused location.
2. Clean the tape recorder heads.
3. Load as normal, (keep a note of errors). We will call the memory block just loaded block 1.
4. Copy block 1 to a free memory area. Call this area block 2.
5. Re-run the tape, reloading block 1 to free memory area. Call this block 3.
6. Re-run the tape, reloading block 1
7. Execute the corrector program. If there are any remaining errors the faulty locations will be listed. If none are listed the program is loaded.
8. If errors still exist copy block 1 to block 2, reload block 1. Execute correc-

PROGRAM: Data error corrector for Nascom 1 (Z.80)

```
CP   Machine Code  Label  Mn    Op1  Op2       Comments
0D00 21000E        START  LD    HL   #0E00     ] Initialise pointers
  03 DD210016             LD    1X   #1600     ] to start of mem.
  07 FD21001E             LD    1Y   #1E00     ] blocks 1,2&3.
  0B 7E              NEXT LD    A    (HL)      ] Get the bytes
  0C DD5600               LD    D    (1X+d)    ] for comparison
  0F FD5E00               LD    E    (1Y+d)    ]
  12 BA                   CP    D              Are blocks 1,2 same ?
  13 2812                 JR    Z    GOOD      If so, good
  15 BB                   CP    E              Else compare blocks 1,3
  16 280F                 JR    Z    GOOD      If 1,3 same good
  18 7A                   LD    A    D         ] Else compare
  19 BB                   CP    E              ] blocks 2 & 3
  1A 77                   LD    (HL) A         Upgrade block 1
  1B 280A                 JR    Z    GOOD
  1D E5D5                 PUSH  HL   DE        ] If data bad
  1F CD3202               CALL  TBCD3          ] print bad addr.
  22 CD4002               CALL  CRLF           ] and scroll
  25 D1E1                 POP   DE   HL        ]
  27 23              GOOD INC   HL             ] Set pointers
  28 DD23                 INC   1X             ] to next byte
  2A FD23                 INC   1Y             ]
  2C 010016               LD    BC   (=END     ] Check to see
  2F B7                   OR    A    BLK1+1)   ] if finished
  30 ED42                 SBC   HL   BC        ]
  32 09                   ADD   HL   BC
  33 CA8602               JP    Z    PARSE     Exit to monitor
  36 1BD3                 JR    NEXT           Else get next byte
```

tor program.
9 If errors are still listed repeat step 8.
Note: If insufficient memory is available to load the whole program in one go, split the program into segments. When each segment is cleaned up, DUMP on to scratch tapes, then assemble the individual good tapes to re-form the complete program.

Example:
1 The corrector is loaded at 0D00 — 0D37. (This may be relocated as only relative jumps are used). Our program to be loaded resides in 0E00 to 15FF so we define block 1 as 0E00 to 15FF, block 2 as 1600 to 1DFF and block 3 to 1E00 to 25FF.
Note: corrector lines 0D00, 0D03 and 0D07 are set to point at the start of these blocks and line 0D2C is a terminator set at [(END OF BLOCK 1) + 1].
Notice Z80 practice of putting Lo order byte first.
2 Load block 1. Copy to block 2.
>CE00 1600 7FF NL
3. Reload block 1. Copy to block 3.
>CE00 1E00 7FF NL
4. Reload block 1
5. Execute corrector program, but because block 1 overlaps page 0 — 1 first modify R.SP. to 0C33 to prevent corruption of block 1. (see PCW March 1979 letters).
>M0C3D NL 33 0C. NL
>E0D00 NL
The monitor will now list any remaining errors. If none, the monitor will return a prompt (>) and the program is loaded.
Final note: This represents a very simple process of choosing any two from three, more sophisticated combinations may be used but it is doubtful if more complex and hence longer programs are justified on this application.

APPLE WORMS

by Ray West, freelance programmer

TAPEWORMS: A KEYBOARD VIDEO GAME FOR THE APPLE

'Tapeworms' is a game for two players which uses the keyboard interactively. Each player has four allocated keys, which are identified by the keyboard PEEK function. Two shape tables are loaded by the program, and these give each 'worm' a different appearance. To improve the appearance of the display, the rotation feature of the shape table is used so that the direction of movement of the worm is matched by the rotation of the shape. A game ends either when a player crosses the rectangular border of the playing area, or collides with a previously plotted shape; the collision counter provides a way of checking for this event. For a detailed explanation of the listing, now read on. . .

Lines 510-640 are the main program control. There are essentially six subroutines which are called.

SUB 20000. This sets up a shape table of two shapes. Line 20000 sets up pointers in locations 232 and 233, the low and high bytes respectively. Since 117*256+48=30000, the Apple expects the shapes to start at 30000. This works for a 48K or 32K machine. Line 20001 tells the machine there are two shapes in the table, and lines 20005 and 20010 give their addresses, offset from 30000. So shape 1 begins at 30000+256*0+159=30159, for example. The two shapes are 'A' and 'V', and were used because they happened to be available. If you don't like them, try adjusting the table!

SUB 10000. This prints the title page onto the screen, enabling one of three playing speeds to be selected. In addition, variables are stored just after the program; line 10010 ensures that the coordinates and directions of each 'worm' are stored where retrieval time is minimised. Random start points and directions are generated for each player; in line 10220 they are checked to avoid starting too close to each other. Directions 1 to 4 are converted into the relevant keystroke equivalent for each player.

SUB 1000 & SUB 1400. This symmetrical pair of routines reads the keyboard. The point of the last statements of lines 1000 and 1400 is that the Apple seems sometimes to admit a low ASCII value. If on A's turn his part of the keyboard registers an input, its ASCII value is saved; and similarly on B's turn. In a fast game, only one peek at the keyboard is allowed.

SUB 2110 & SUB 2510. The x or y coordinate is incremented/decremented as required, and the direction indicator AD or BD set to correspond. Lines 2145 and 2545 test the new plot. If it is an acceptable move, the other person's score is increased by 1 and exit to the end-of-game routine occurs. The POP instruction removes the subroutine's return address from the stack: were this instruction omitted, after about 24 games the stack would fill up and an OUT OF MEMORY message appear. The formulae for ROT need to introduce multiples of 16, for which the values differ for the shapes plotted, so that lines 2147 and 2547 use different calculations. The direction is coded as 1 for north, 2 for east, and so on.

SUB 25000. This is entered only in a slow or medium speed game. It uses simple delay loops, which, however, have diminishing effect as the game proceeds. So the tempo accelerates towards the end.

SUB 26000. This routine displays the aggregate scores to date, the player sitting on the left having his score shown at the left of the screen and vice versa. The set of games can be terminated in order to change speed, or start afresh, by entering 'N'. Since some characters may remain in the buffer, line 26040 checks for the presence of an 'N' within it. If the set of games continues, line 26040 loops back to reset new starting positions and directions, before returning to the program's main control.

PROGRAMS

```
0  REM 'TAPEWORMS' GAME (C) RAY WEST MARCH 79
11  GOSUB 20000: GOSUB 10000
510  GOSUB 1000: REM  SEE IF A WANTS TO MOVE,
520  GOSUB 2110: REM    PLOT A'S NEW POSITION
530  IF  PEEK (234) (  ) 2 THEN SB% = SB% + 1: GOTO 26000: REM END OF A GAME INDICATED BY COLL
     ISION COUNTER
540  IF R (  ) 1 THEN  GOSUB 25000
610  GOSUB 1400: REM   SEE IF B WANTS TO MOVE
620  GOSUB 2510: REM    PLOT B'S NEXT SEGMENT
630  IF  PEEK (234) (  ) 0 THEN SA% = SA% + 1: GOTO 26000: REM  END OF A GAME
632  IF R = 1 THEN 510
635  GOSUB 25000
640  GOTO 510
1000 Z =  PEEK ( - 16384): POKE  - 16368,0: IF Z ( CT% THEN Z = Z + CT%
1002  IF Z = WK% OR Z = SK% OR Z = ZK% OR Z = AK% THEN AD% = Z: RETURN
1004  IF R = 1 THEN  RETURN
1006 Z =  PEEK ( - 16384): POKE  - 16368,0: IF Z ( CT% THEN Z = Z + CT%
1008  IF Z = WK% OR Z = SK% OR Z = ZK% OR Z = AK% THEN AD% = Z: RETURN
1020  RETURN
1400 Z =  PEEK ( - 16384): POKE  - 16368,0: IF Z ( CT% THEN Z = Z + CT%
1402  IF Z = DK% OR Z = LK% OR Z = CK% OR Z = KK% THEN BD% = Z: RETURN
1404  IF R = 1 THEN  RETURN
1406 Z =  PEEK ( - 16384): POKE  - 16368,0: IF Z ( CT% THEN Z = Z + CT%
1408  IF Z = DK% OR Z = LK% OR Z = CK% OR Z = KK% THEN BD% = Z: RETURN
1510  RETURN
2110  IF AD% = WK% THEN AY% = AY% - C7%: AD = C1%
2120  IF AD% = SK% THEN AX% = AX% + C7%: AD = C2%
2130  IF AD% = ZK% THEN AY% = AY% + C7%: AD = C3%
2140  IF AD% = AK% THEN AX% = AX% - C7%: AD = C4%
2145  IF AX% ( 2 OR AX% ) 277 OR AY% ( 3 OR AY% ) 152 THEN  POP :SB% = SB% + 1: GOTO 26000
2147  RDT= CS% * (AD - C1%)
2150  DRAW 1 AT AX%,AY%: RETURN
2510  IF BD% = DK% THEN BY% = BY% - C7%: BD = C1%
2520  IF BD% = LK% THEN BX% = BX% + C7%: BD = C2%
2530  IF BD% = CK% THEN BY% = BY% + C7%: BD = C3%
2540  IF BD% = KK% THEN BX% = BX% - C7%: BD = C4%
2545  IF BX% ( 2 OR BX% ) 277 OR BY% ( 3 OR BY% ) 152 THEN  POP :SA% = SA% + 1: GOTO 26000
2547  RDT= CS% * (C1% + BD)
2550  DRAW 2 AT BX%,BY%: RETURN
10000  TEXT : HOME : FLASH : PRINT "****              TAPEWORMS          ****": NORMAL
10010 AX% = 0: AY% = 0: BX% = 0: BY% = 0: AD% = 0: BD% = 0
10015 WK% = 215: SK% = 211: ZK% = 218: AK% = 193: DK% = 207: LK% = 204: CK% = 172: REM
10016 KK% = 203: REM  K=KEY, STORED AT START OF VARIABLE SPACE
10017 C1% = 1: C2% = 2: C3% = 3: C4% = 4: C7% = 7: CS% = 16: CT% = 128
10030  PRINT : PRINT : PRINT "A GAME FOR 2 PLAYERS": PRINT : PRINT "PREFERABLY ONE LEFTHANDER!
     ": PRINT : PRINT : PRINT "FIRST PLAYER'S WORM CONTROLLED": PRINT "WITH KEYS W,S,Z,A."
10040  PRINT : PRINT "SECOND PLAYER USES O,L,COMMA,K."
10045  PRINT : PRINT : PRINT "A RAY WEST SUPERIOR": PRINT "PROGRAM PRODUCT": PRINT
10046  INPUT "SLOW, MEDIUM, OR FAST GAME?";K$
10047  IF  LEFT$ (K$,1) = "F" THEN R = 1: S = 1: T = 1: GOTO 10050
10048  IF  LEFT$ (K$,1) = "M" THEN R = 100: S = 50: GOTO 10050
10049 R = 200: S = 150: T = 150
10050  PRINT : PRINT "HIT RETURN TO PLAY": GET K$
10200 AX% = 7 *  INT (( RND (1) * 34 + 3)): AY% = 7 *  INT (( RND (1) * 17 + 3)): AD =  INT (1 +
     4 *  RND (1))
10201  IF AD = 1 THEN AD% = 215
10202  IF AD = 2 THEN AD% = 211
10203  IF AD = 3 THEN AD% = 218
10204  IF AD = 4 THEN AD% = 193
10210 BX% = 7 *  INT (( RND (1) * 34 + 3)): BY% = 7 *  INT (( RND (1) * 17 + 3)): BD =  INT (1 +
     4 *  RND (1))
10211  IF BD = 1 THEN BD% = 207
10212  IF BD = 2 THEN BD% = 204
10213  IF BD = 3 THEN BD% = 172
10214  IF BD = 4 THEN BD% = 203
10220  IF  ABS (AX% - BX%) ( 20 AND  ABS (AY% - BY%) ( 20 THEN 10200
10300  HCOLOR= 3: SCALE= 1: HGR
10305 SP = 0
10310  HPLOT 3,3 TO 277,3 TO 277,152 TO 3,152 TO 3,3
10320  RETURN
20000  POKE 232,48: POKE 233,117
20001  POKE 30000,2: POKE 30001,0
20005  POKE 30002,159: POKE 30003,0
20010  POKE 30004,21: POKE 30005,3: REM  V
20015  POKE 30159,146: POKE 30160,27
20020  POKE 30161,4: POKE 30162,36
20025  POKE 30163,36: POKE 30164,33
20030  POKE 30165,49: POKE 30166,49
20035  POKE 30167,49: POKE 30168,54
20040  POKE 30169,6: POKE 30170,36
20045  POKE 30171,63: POKE 30172,63
20047  POKE 30173,0
20050  POKE 30789,146: POKE 30790,36
20055  POKE 30791,39: POKE 30792,60
20060  POKE 30793,36: POKE 30794,140
20065  POKE 30795,73: POKE 30796,54
20070  POKE 30797,55: POKE 30798,62
20075  POKE 30799,0
20080  RETURN
25000 SP = SP + 1: IF SP ) 80 THEN 25040
25010  IF SP ) 40 THEN 25030
25020  FOR I = 1 TO R: NEXT
25030  FOR I = 1 TO S: NEXT
25040  FOR I = 1 TO T: NEXT
25050  RETURN
26000  HOME : FOR I = 1 TO 7: PRINT  CHR$ (7);: NEXT : VTAB 23: PRINT  SPC( 11);: INVERSE : PRINT
     "****  SCORE  ****": NORMAL : PRINT SA%; TAB( 41 -  LEN ( STR$ (SB%))); SB%
26010  INPUT "HIT RETURN FOR NEXT GAME OR N TO EXIT";K$
26020  VTAB 22: CALL  - 956
26030  IF K$ = "" THEN  GOSUB 10200: GOTO 510
26040 L =  LEN (K$): FOR I = 1 TO L: IF  MID$ (K$,L,1) (  ) "N" THEN  GOSUB 10200: GOTO 510
26050  NEXT I
26060  END
```

Here, by popular demand, is the continuation of David Parkinson's Revas.
We apologise for the delay — it disappeared during the recent move.

```
FC24  CD 16 FC          0680          CALL  ST1         ;"A"
FC27  CD 31 F9          0681          CALL ¬(*.¬¬¬¬¬H'¬¬¬¬1¬(¬¬¬¬¬1                    0682
FC2B  FE 22             0683 LD1:     CP    $22         ;REGPR OR EXTENDED?
                                                                          FC2D  EB
FC2E  36 28             0685          LD    (HL),'('
FC30  23                0686          INC   HL
FC31  EB                0687          EX    DE,HL
FC32  3F                0688          CCF               ;REVERSE RESULT OF COMPARE
FC33  D4 7E F9          0689          CALL  NC,REGPR    ;(RETURNS WITH NC)
FC36  DC 57 F9          0690          CALL  C,LD16A     ;EXTENDED ADDRESS
FC39  C3 04 FA          0691          JP    NOTIXY      ;CLOSE BRACKETS
FC3C                    0692 ;
FC3C                    0693 ; 16-BIT INDIRECT STORE  LD (NNNN),PP
FC3C                    0694 ;
FC3C  CD 2B FC          0695 ST16I:   CALL  LD1         ;DO INDIRECT BIT
FC3F  CD 11 F9          0696          CALL  COMMA       ;","
FC42  C3 7D F9          0697          JP    REGPR-1     ;GET OP & PR. REG PAIR
FC45                    0698 ;
FC45                    0699 ; 16-BIT INDIRECT LOAD  LD PP,(NNNN)
FC45                    0700 ;
FC45  F1                0701 LD16I:   POP   AF          ;GET OPCODE
FC46  CD 7E F9          0702          CALL  REGPR       ;PRINT REG PR.
```

PROGRAMS

```
FC49  CD 11 F9          0703          CALL  COMMA       ;","
FC4C  A7                0704          AND   A           ;CLEAR CARRY
FC4D  18 DE             0705          JR    LD1+2       ;DO INDIRECT BIT
FC4F                    0706 ;
FC4F                    0707 ; ROTATE/SHIFT/BIT/SET/RESET
FC4F                    0708 ;  NB. IF INDEXED THEN OFFSET PRECEDES OPCODE
FC4F                    0709 ;
FC4F  3A 0B 10          0710 CB:      LD    A,(HXYFLG)
FC52  A7                0711          AND   A           ;INDEXED?
FC53  F5                0712          PUSH  AF          ;SAVE FLAG
FC54  28 0B             0713          JR    Z,NOTXY     ;NO,SKIP
FC56  11 34 10          0714          LD    DE,BUFFER+34;YES,WRITE..
FC59  3E 06             0715          LD    A,6         ;...REG. FIRST.
FC5B  CD C4 F9          0716          CALL  SREG
FC5E  11 2D 10          0717          LD    DE,BUFFER+27;RESET POINTER FOR MNEMONIC.
FC61  CD DB F8          0718 NOTXY:   CALL  BYTE        ;GET OPCODE
FC64  F5                0719          PUSH  AF          ;SAVE IT
FC65  FE 40             0720          CP    $40         ;<$40?
FC67  38 27             0721          JR    C,ROTATE    ;YES,JUMP
FC69  21 A8 FC          0722          LD    HL,BRSTAB-3;LOAD POINTER
FC6C  07                0723          RLCA              ;SHIFT OPCODE DOWN
FC6D  07                0724          RLCA
FC6E  E6 03             0725          AND   3           ;ISOLATE ID
FC70  47                0726          LD    B,A         ;MAKE  3,6,OR 9
FC71  07                0727          RLCA
FC72  80                0728          ADD   B
FC73  CD 2A F9          0729          CALL  FTADR       ;FORM ADDRESS
FC76  CD 23 F9          0730          CALL  COPY3       ;WRITE MNEMONIC
FC79  13                0731          INC   DE          ;SPACE
FC7A  13                0732          INC   DE
FC7B  F1                0733          POP   AF          ;GET OPCODE
FC7C  F5                0734          PUSH  AF          ;SAVE AGAIN
FC7D  0F                0735          RRCA              ;PRINT BIT NUMBER
FC7E  0F                0736          RRCA
FC7F  0F                0737          RRCA
FC80  E6 07             0738          AND   7           ;ISOLATE BIT ID
FC82  F6 30             0739          OR    $30         ;MAKE ASCII
FC84  12                0740          LD    (DE),A      ;WRITE IT
FC85  13                0741          INC   DE
FC86  CD 11 F9          0742          CALL  COMMA       ;","
FC89  C1                0743 TESTXY:  POP   BC          ;RECOVER OPCODE
FC8A  F1                0744          POP   AF          ;RECOVER HXY FLAG
FC8B  78                0745          LD    A,B         ;LOAD OPCODE
FC8C  C0                0746          RET   NZ          ;YES,RETURN
FC8D  C3 C4 F9          0747          JP    SREG        ;NO,GO WRITE.
FC90  0F                0748 ROTATE:  RRCA              ;SHIFT DOWN
FC91  0F                0749          RRCA
FC92  C6 02             0750          ADD   2           ;ROLL CODING ROUND
FC94  E6 0E             0751          AND   $E          ;ISOLATE ID
FC96  FE 0E             0752          CP    $E          ;IS IT 0E?
FC98  CA D6 FD          0753          JP    Z,NTVL      ;YES,INVALID CODE
FC9B  47                0754          LD    B,A         ;DO ID*3 AGAIN
FC9C  0F                0755          RRCA
FC9D  80                0756          ADD   B
FC9E  21 B4 FC          0757          LD    HL,ROTTAB ;LOAD BASE ADDRESS
FCA1  CD 2A F9          0758          CALL  FTADR       ;FORM ADDRESS
FCA4  CD 23 F9          0759          CALL  COPY3       ;WRITE MNEMONIC
FCA7  13                0760          INC   DE
FCA8  13                0761          INC   DE
FCA9  18 DE             0762          JR    TESTXY      ;EXIT WRITING REGISTER
FCAB                    0763 ;
FCAB  42 49 54 52       0764 BRSTAB:  DB    'BITRESSET'
      45 53 53 45
      54
FCB4  53 52 4C 52       0765 ROTTAB:  DB    'SRLRLCRRCRL RR SLASRA'
      4C 43 52 52
      43 52 4C 20
      52 52 20 53
      4C 41 53 52
      41
FCC9                    0766 ;
FCC9                    0767 ; AUTO CP LD IN OUT
FCC9                    0768 ;
FCC9  CB 57             0769 AUTO:    BIT   2,A         ;TEST FOR VALIDITY
FCCB  C2 D6 FD          0770          JP    NZ,NOTVAL   ;JUMP IF NOT
FCCE  F5                0771          PUSH  AF          ;SAVE OPCODE
FCCF  E6 03             0772          AND   3           ;ISOLATE OP ID
FCD1  07                0773          RLCA              ;*2
FCD2  21 E9 FC          0774          LD    HL,OPTAB    ;LOAD BASE ADDRESS
FCD5  CD 2A F9          0775          CALL  FTADR       ;FORM ADDRESS
FCD8  CD 25 F9          0776          CALL  COPY2       ;WRITE PART OF MNEMONIC
FCDB  F1                0777          POP   AF          ;RECOVER OPCODE
FCDC  21 F1 FC          0778          LD    HL,OPTAB+8;LOAD BASE ADDRESS
```

To be continued

BLUDNERS

Basic Problem
You all spotted the $s coming out as Ss in Bench Test and ESP didn't you? If not, why not!

Puzzle
We've decided that Pythagoras was right after all — the area of a right-angled triangle is (once again) ½B x H.

Spaceship
We think that we've had phone calls from every Fx 201-P owner! Just in case we haven't, ÷ came out as –in the following steps: 40,59,74, and 86 (the second one). Step 98 reads 4 = 7 ÷ K2 + 9 + 4:.

STOP PRESS

...44 NEW PROGRAMS for the PET in the latest PETSOFT CATALOGUE including . . .

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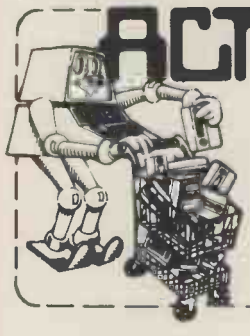

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I have a new/old ROM PET I have NO PET

PUZZLES

LEISURE LINES

With J. J. Clessa

Most of you spotted the deliberate (?) mistake in our first Leisure Lines – gulp!

Puzzle 1A involves some logical reasoning, and should not have proved much of an obstacle to our readers. The solution is that the pilot's name is SMITH.

Puzzle 1B was a bit tougher, and although it can be solved analytically, by anyone who's familiar with Diophantine analysis, it's a much simpler task to write a small program for desk calculator or microcomputer.

Since we made the error in defining the area of a triangle we decided we would accept either of the two possible solutions – many entries included both anyway.

Using our formula for triangle area (area - axb), the smallest solution possible is a triangle with sides 36,48 and 60 units, which has a perimeter of 12^2 and an area (?) of 12^3.

However, using the correct formula for area (axb/2), the smallest solution is a triangle with sides 144,192,240, with a perimeter of 12^2 and an area of 24^3.

Since there was no outright winner, we made a draw and the two lucky readers are: Puzzle 1A: D. E. Arnett of Grimsby. Puzzle 1B: Paul Durrant of Norwich.

Congratulations to both and stand by for a shower of chocolate bars (not to mention the subsequent visit to the dentist).

Just one puzzle for this month, but it's really a rather interesting one. Three friends, Alan, Bert and Colin each possess vehicles. Alan owns a big foreign car, Bert a small English car and Colin, a moped.

One day while discussing mileages, Alan reports that his mileometer, which gives 6-figure mileage readings, is currently showing a palindromic reading of 006600 miles (for those that know not, a palindromic number is one which reads the same from right to left as it does from left to right).

"What a coincidence", explains Bert, "So is mine. The 5-figure reading at the moment is 18981 miles".

"Well I never", says Colin, "although the mileometer on my moped only shows 4-figures, it's reading 5335 miles, which is also palindromic".

"I wonder if we're ever likely to get such a coincidence again," says Alan.

Well, of course, since each vehicle does a different weekly mileage from the others, there's no way that the question could be answered. But, supposing all three mileometers were connected to just one vehicle, and also supposing that they were equally accurate, then what is the least number of miles that would elapse before a) Alan's and Bert's mileometers are both showing palindromic readings again? b) Alan's and Colin's mileometers are both showing palindromic readings again? c) Bert's and Colin's mileometers are both showing palindromic readings again? and d) all three mileometers are mutually palindromic?

Answers please on a postcard *to Puzzle No. 3, Personal Computer World, 14 Rathbone Place. London W1P 1DE. Entries must reach our offices by November 30th.*

PRIZES FOR THIS MONTH

This month's prize is really cunning. In order to make sure the winner continues to send in entries to Leisure Lines, we intend presenting him/her with a hundred 10p stamps.

NRDC and NCC announce the

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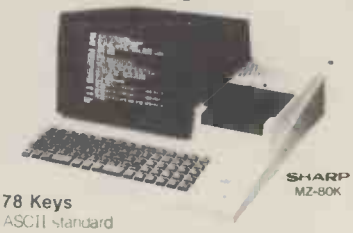

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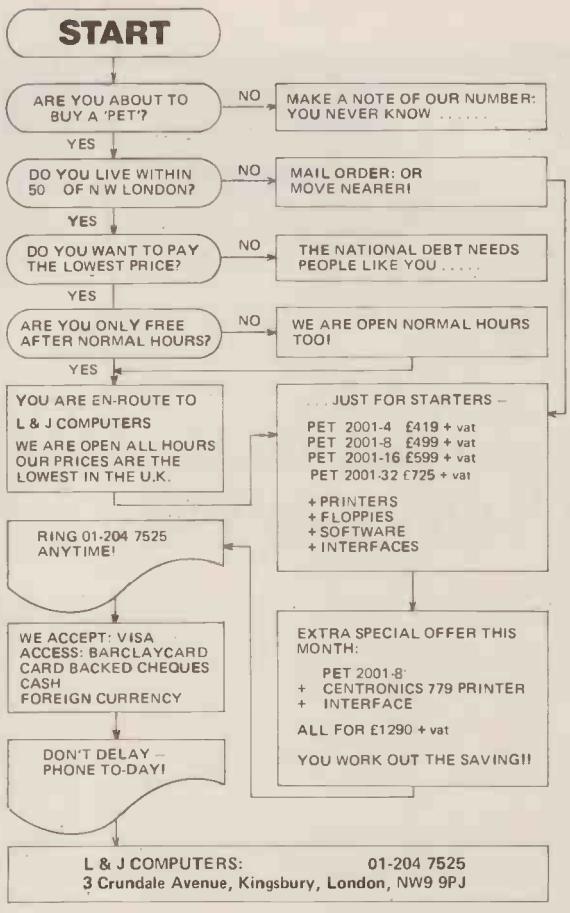

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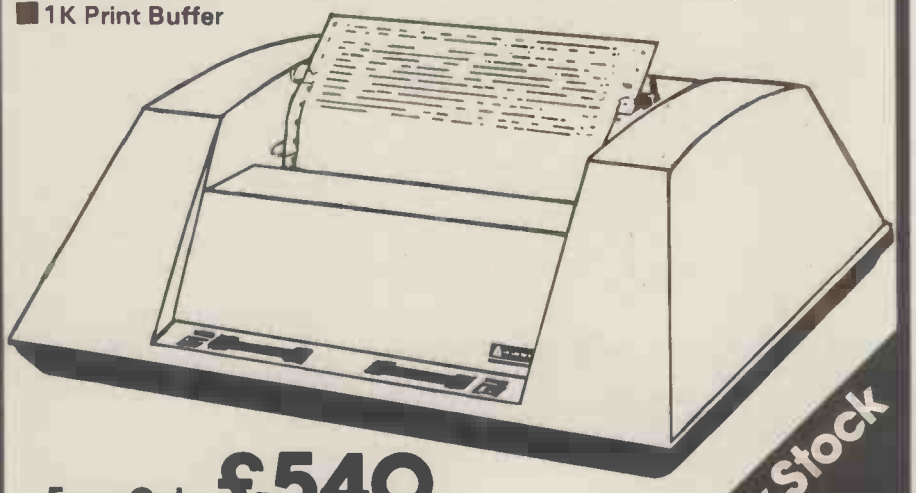

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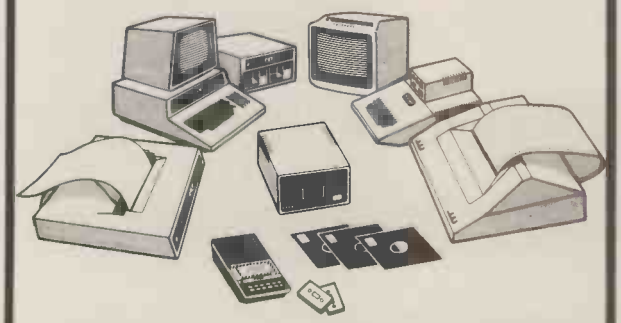

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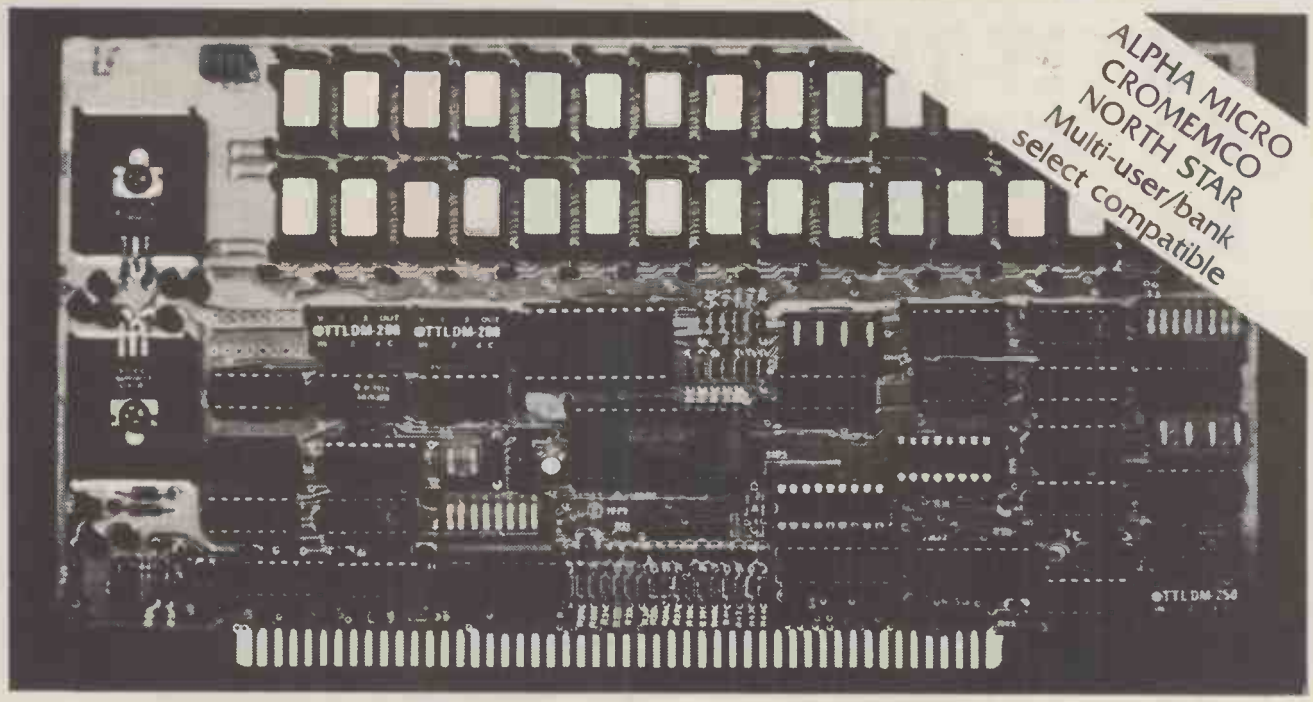

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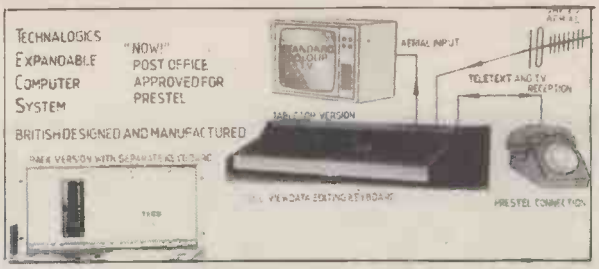

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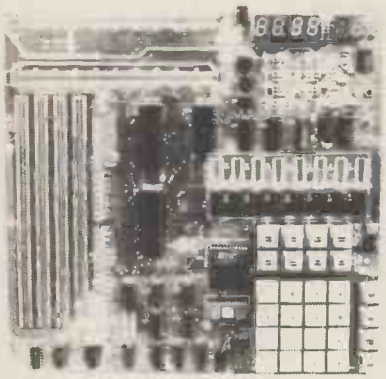

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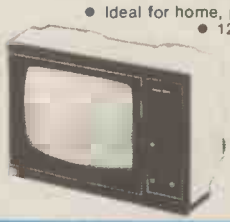

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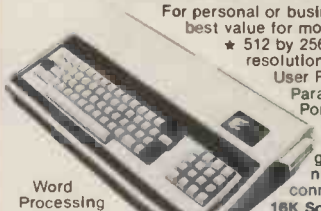

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CONT	LIST	NEW	NULL	RUN

STATEMENTS

CLEAR	DATA	DEF	DIM	END	FOR
GOTO	GOSUB	IF..GOTO	IF..THEN	INPUT	LET
NEXT	ON..GOTO	ON..GOSUB	POKE	PRINT	READ
REM	RESTORE	RETURN	STOP		

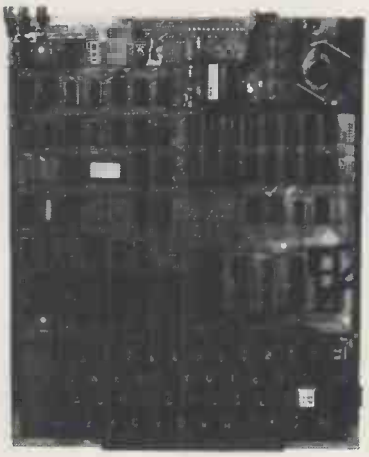
EXPRESSIONS

OPERATORS

+ - * / ↑ NOT.AND.OR. > < <> > = < = RANGE 10^{-32} to 10^{+32}

VARIABLES

A.B.C. ....Z and two letter variables
The above can all be subscripted when used in an array. String variables use above names plus $,e.g.A$



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@ Erases line being typed, then provides carriage return, line feed.
Erases last character typed.
CR Carriage Return — must be at the end of each line.
: Separates statements on a line.
CONTROL/C Execution or printing of a list is interrupted at the end of a line.
"BREAK IN LINE XXXX" is printed, indicating line number of next statement to be executed or printed.
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SPC(I)	SQR(X)	TAB(I)	TAN(X)
FRE(X)	INT(X)		
SGN(X)	SIN(X)		
USR(I)			

STRING FUNCTIONS

ASC(X$)	CHR$S(I)	FRE(X$)	LEFT$(XS.I)
RIGHT$(X$.I)		STR$(X)	
LEN(X$)	MID$(X$.I.J)		
VAL(X$)			

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2) Any documentation that you have for the program (source listing not necessary)
3) This coupon signed by you accepting the rules and conditions of the competition.

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1) Entries, including documentation, must be printed by computer or typed double spaced, with your name on every page.
2) Send or bring your entries to the address shown below.
3) Entries must be received by midnight on 29/2/80, any received after this time are void.
Winners will be notified by post before 31/3/80.
4) You warrant by your signature that all programs and documentation material included is entirely your own creation, and that no rights to it have been given or sold to any other party, and you agree to allow **COMPUKIT LTD.** to use, publish, distribute, modify, and edit it as it sees fit.
5) All entries become the property of **COMPUKIT LTD.** No entries will be returned nor any questions answered regarding individual entries.
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