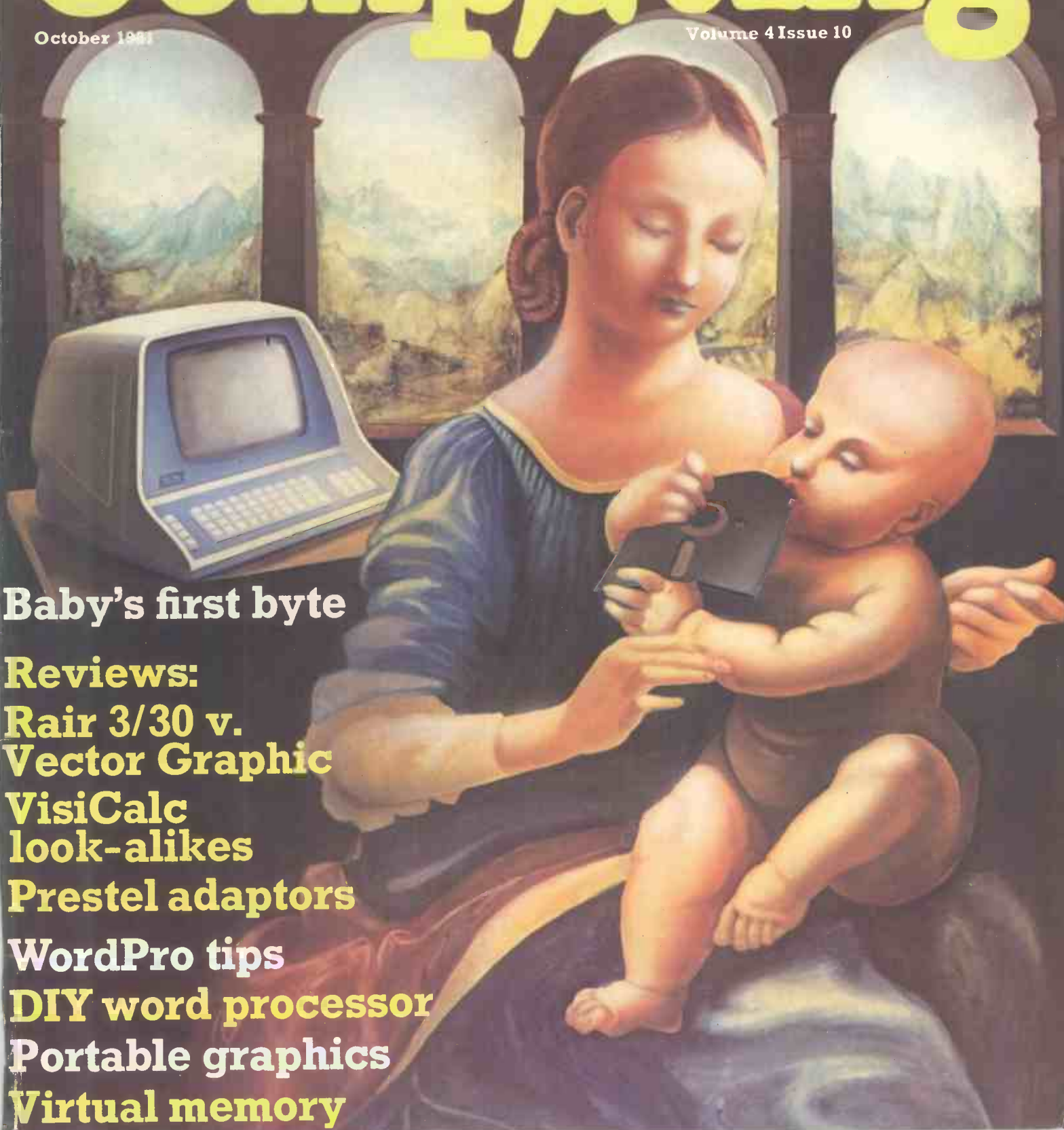


Practical Computing

October 1981

Volume 4 Issue 10



Baby's first byte

Reviews:

**Rair 3/30 v.
Vector Graphic**

**VisiCalc
look-alikes**

Prestel adaptors

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Practical Computing



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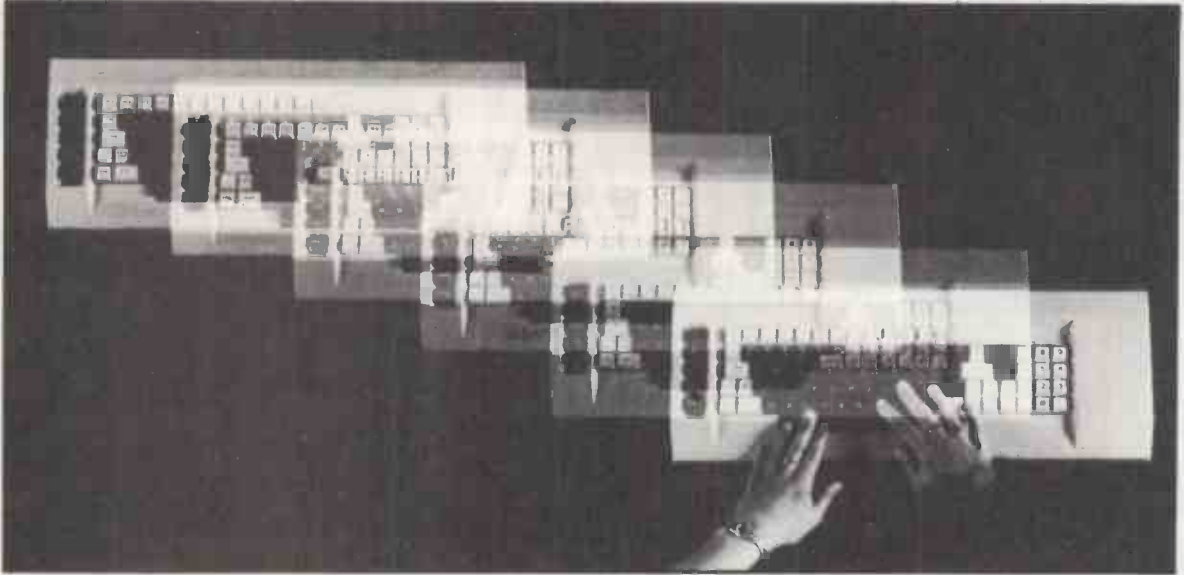
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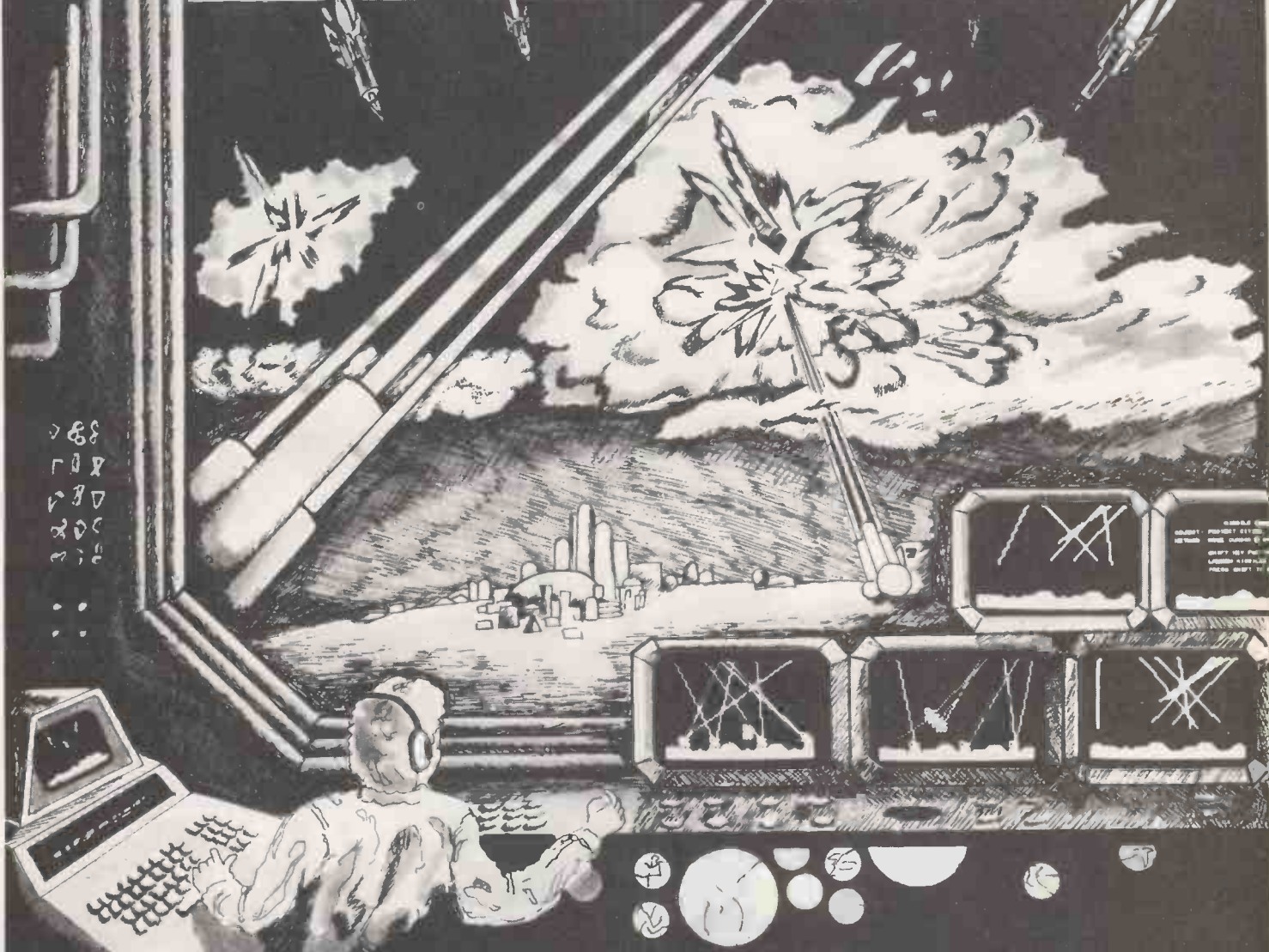
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SpellStar whizzes through your text at thousands of words per minute, comparing what you've written with its 20,000-word dictionary-on-a-disc. It flags every word not in its dictionary, giving you three choices. Change the word. Leave it as is. Or leave it and add it to the dictionary, and it won't get flagged again. You can put it in the main dictionary, or just as easy, create your own supplement dictionaries on other discs for such things as specialized terms and client names.

Okay, so how do you spell relief now? M-P-I.

ORDER INFORMATION

When ordering CP/M software please specify the format you require, otherwise software will be despatched on an 8" single density disc.

All software items are subject to VAT. Manuals, when purchased separately, are not subject to VAT.

Please add £3.45 for postage, packing and insurance on each item purchased. For overseas please add £4.50 per item.

Most software in this advertisement is available from stock and a 72 hour return service is thereby offered on most prepaid orders.

These details and prices are all current as of August 1981. Our prices reflect an exchange rate of U.S. \$2.00 to £1.00. Should the exchange rate vary by more than 5 cents, a surcharge may be added or a discount given.

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Send Cash, Cheque, Postal Order, IMO, Access or Barclaycard/Visa number to Microcomputer Products International Ltd., Room PC 11, Cambridge House, Cambridge Road, Barking, Essex IG11 8NT. All payments must be in Sterling and drawn against a U.K. bank.

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COMPILERS AND UTILITIES

—Microfocus CIS-COBOL Compiler£425
—Microfocus FORMS-2 utility£100
—Micro Solution REPORTER (CIS-COBOL Report Generator)£100
—Microsoft MBASIC interpreter£155
—Microsoft BASIC 80 compiler£200
—Microsoft COBOL 80 compiler£390
—Microsoft FORTRAN 80 compiler£260
—Microsoft MACRO 80 assembler£85

—SPELLBINDER word-processing£250
—WORDSTAR word-processing£230
—Mail Merge option for above£75
—DATASTAR data management£160
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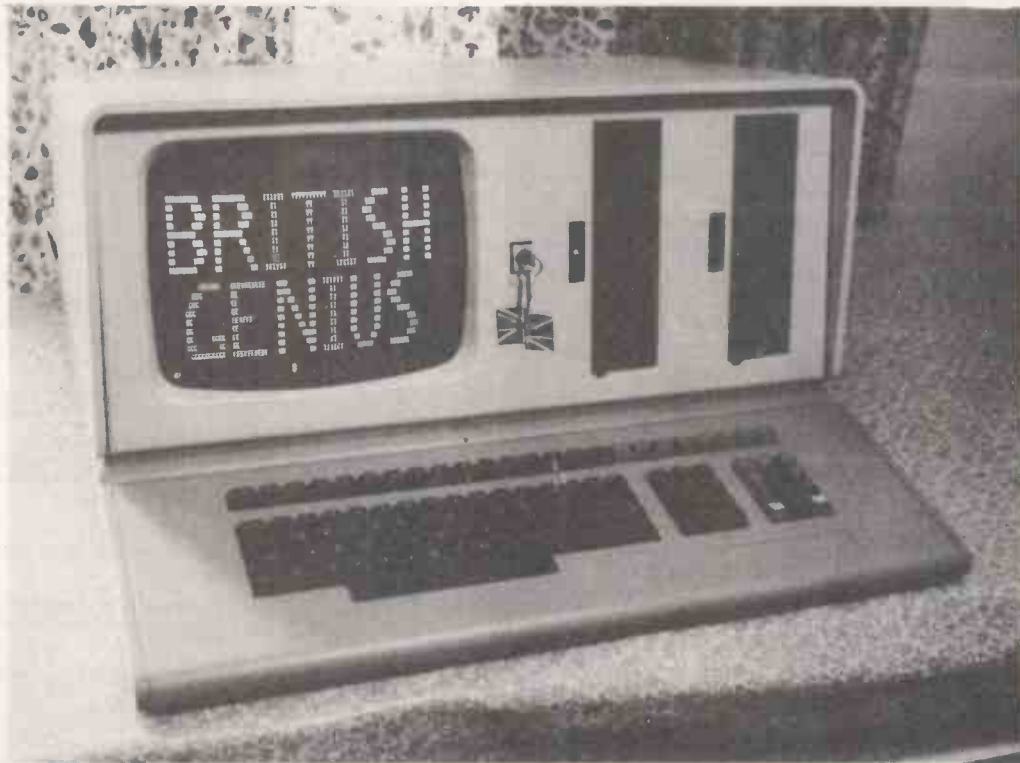


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Applications packages designed to work with specific terminals (e.g. Lear Seigler ADM3A, Televideo 912 or Hazeltine 1500) will need no modifications to work with the PET screen, as the SMALL SYSTEM SOFT BOX allows the PET screen to emulate any of these devices.

Specifications

- Full 60k byte RAM
- CP/M version 2.2
- Z80 CPU running at 4Mhz with no wait states.
- Dimensions : 25cm x 9cm x 16cm
- Operates with any series 2000, 3000, 4000, or 8000 PET
- Supports up to 8 Commodore disk drives in any mix of 3040, 4040, or 8050 drive types.
- Diskette containing CP/M system with utilities, and full documentation included in price lists. Please specify 3040, 4040 or 8050 disk format when ordering.
- Optional RS232 serial interface (with user definable baud rates) for use with a terminal or printer.
- Optional Corvus drive interface.

Disk format information

When ordering your SoftBox and software please ensure that you specify the correct code letter for your disk drives:

- A - 2040 or 3040 drives without upgrade ROMs
- B - 4040 drives, or 2040/3040 with DOS version 2.1 upgrade (the disk motor starts spinning immediately on power-up)
- C - 8050 drives.

Please specify the model or PET (2000 series, 3000 series, 4000 series, 8032 or 8096) to help us configure your CP/M correctly before shipping. For 2000 series PETs, specify old or new ROMs.

SoftBox prices

SoftBox	£550
SoftBox with RS232 interface	£595
SoftBox with hard disk interface for Corvus drive	£615
SoftBox with RS232 and hard disk interface options	£660

Corvus drive prices

5 M Byte	£2495
10 M Byte	£3795
20 M Byte	£4695

Designed and developed by Small Systems Engineering in conjunction with Unicorn Software Ltd.



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Softbox CP/M® software

Package name (author) price with manual/manual only

Languages

ALGOL-60 (Research Machines) £130/£20
ALGOL is a powerful block structured language featuring economical run-time dynamic allocation of memory. The compiler is very compact (24k) and supports almost all Algol-60 report features

BASIC-80 (Microsoft) £175/£20
This is Microsoft Extended BASIC interpreter, version 5. It is a powerful, ANSI compatible disk BASIC with many features not found in PET BASIC, such as WHILE/WEND, chaining, variable length file records, double precision floating point, PRINT USING facility, error trapping, hexadecimal numbers and more.

BASIC COMPILER (Microsoft) £195/£20
This compiler is language compatible with the Microsoft version 5 interpreter but generates 8080/Z80 machine code, so that program execution is typically 3 to 10 times faster.

C COMPILER (BD Software) £80/£15
This compiler supports most major features of the language, including structures, arrays, pointers and recursive function evaluation. The compiler produces compact, relocatable 8080 code for use with the linker and library supplied.

C COMPILER (Whitesmith's) £325/£20
This compiler conforms to the full UNIX version 7 implementation of the C language, which has more facilities than Pascal or BASIC and produces faster code.

CBASIC (Software Systems) £75/£12
This is a non-interactive BASIC used by many business application programs. It supports full file control, chaining, formatted output and sequential and random disk file access, 14-digit arithmetic, WHILE/WEND and optional line numbering.

S-BASIC £155/£20
A structured BASIC compiler generating 8080 native code, combining structured programming and the speed of machine code while maintaining the convenience of BASIC.

CIS-COBOL (Microfocus) £425/£30
An ANSI '74 standard COBOL compiler fully validated by U.S. Navy tests to ANSI level 1. The compiler also supports many features of level 2 including dynamic loading of COBOL modules and a full Indexed Sequential (ISAM) file.

CDBOL-80 (Microsoft) £375/£20
An ANSI '74 COBOL compiler producing relocatable modules compatible with FORTRAN-80 or MACRO-80 output. COBOL-80 has a complete ISAM facility and interactive screen handling.

NEVADA COBOL £80/£15
A subset of the ANSI '74 standard with 18-digit precision, a built-in debugging facility, interactive ACCEPT and DISPLAY screen handling commands, and very fast execution time.

FORTRAN-80 (Microsoft) £230/£20
The popular science and engineering language, complying with the ANSI '66 standard (except for the COMPLEX data type), with enhancements such as mixed mode arithmetic.

muLISP £110/£15
LISP is an interactive programming language widely used for artificial intelligence applications.

PASCAL/M £95/£15
This compiler produces p-code and is an extended implementation of standard Pascal, with long (32-bit) integers, a SEGMENT procedure type (for overlays), and an added STRING data type.

PASCAL/MT £135/£20
This is a subset of standard Pascal, which generates ROMable 8080 machine code and supports interrupt procedures, CP/M file input/output, and assembly language subroutines.

PASCAL/MT+ £265/£20
A Pascal-compiler meeting the ISO standard, with many enhancements including full string handling capability and random access files.

PASCAL/Z (Ithaca Intersystems) £205/£15
A compiler producing ROMable, re-entrants Z80 macro-code highly optimised for speed, supporting variant records, strings, direct I/O and debugging aids such as IMBED and TRACE.

PL/1-80 (Digital Research) £265/NA
A general purpose application programming language giving mainframe capability for developing large-scale structured programs in a microcomputer environment

TINY C £55/£30
An interactive, scaled-down version of the C language, ideal for teaching structured programming techniques.

TINY-C TWO £130/£30
A program written in TINY C. The source code is included on disk.

WORD PROCESSING

WORDSTAR (MicroPro) £255/£35
A powerful screen-oriented word processor designed for non-technical personnel. Text formatting is performed on the screen, so that what you see is what you print-out will look like. WORDSTAR's advanced facilities include justification, pagination, underscore, boldface, subscript and superscript, block movement of text,

WORDINDEX (MIDAS) £100/NA
A program to assist WORDSTAR users by generating a table of contents and index from a WORDSTAR document.

MICROSPELL £130/NA
This is a spelling help program which scans through a document file stopping at each dubious word, offering correctly spelt alternatives and allowing you to correct the word with a keystroke.

SPELLGUARD £155/£15
A spelling proofreader to assist in eliminating spelling mistakes in document files.

MAGIC WAND £215/£30
A word processing system with a simple, easy to use screen editor and a powerful print processor.

TEX (Digital Research) £55/£10
A text formatter to create paginated, page-numbered, justified copy from a text file. Output may be directed to the printer or to a disk file.

TEXTWRITER III £75/£15
A text formatter to justify and paginate letters and other documents.

LETTERIGHT (Structured Systems Group) £105/£15
This program can be used to create, edit and type letters and other documents.

MAILING LIST SYSTEMS

MAILMERGE(MicroPro) £80/£15
MAILMERGE is an add-on utility for WORDSTAR users allowing the production of personalized form letters or other documents from a mailing list made using DATASTAR or NAD. Requires WORDSTAR.

POSTMASTER £85/£12
A comprehensive, menu-driven package for mail list maintenance.

NAD (Structured Systems Group) £60/£15
NAD is an interactive Name and Address system, allowing a mail list to be created and maintained. Custom name and address labels may be printed, and reports may be generated.

TELECOMMUNICATIONS

BSTAM £105/NA
This telecommunications utility permits any type of CP/M file to be transferred to or from another computer also equipped with BSTAM. Transmission occurs at full speed with CRC error checking and automatic error recovery.

BSTMS £115/NA
An intelligent terminal program permitting communication with a mainframe computer.

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T/MAKER II £145/£15
An advanced utility for preparing management reports with tabular data, combining visual calculator with a full screen editor.

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The number one Financial Modelling and forecasting program.

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A customised data entry and reporting system in which the user specifies up to 75 data items per record, and can use interactive data entry, retrieval and update facilities to make information management easy.

FPL £365/£20
A Financial Planning program so advanced that it's like having a mainframe computer on your desk. FPL creates, modifies, displays and prints financial forecasts.

muSIMP/muMATH £135/£20
A package of programs including muSIMP, a high level programming language for symbolic and semi-numeric processing, and muMATH, an interactive symbolic mathematics system written in muSIMP.

STATPAK £260/£20
A professional statistics and probability package which can rapidly handle large files of data.

DATEBOOK £185/£20
This program allows you to manage your own time (and others') efficiently, just like an office appointment book but with the speed and memory of a computer.

DATA MANAGEMENT SYSTEMS

CONDOR £365/£20
Series 20/DBMS Data Base Management System simplifies information processing for inventory control, accounting, personnel records etc. CONDOR uses the relational database concept.

CBS £210/£25
Configurable Business System is an easy to use, interactive data management system with the capacity to define and implement custom accounting applications without recourse to programming languages such as BASIC and FORTRAN.

SELECTOR III-C2 £185/£20
This data base processor creates and maintains multi-key data bases. It prints formatted, sorted reports with numerical summaries or mailing labels.

HDBS £160/£20
A CODASYL-like Hierarchical Data Base System with user-defined SETs, RECORDs and ITEMs, bringing mainframe data-base management capabilities to your systems.

MDBS £475/£20
Micro Data Base System is a full network data base with all the features of HDBS, with fixed or variable record length, read/write protection at the ITEM, RECORD, SET and FILE levels.

MDBS.DRS £160/NA
Dynamic Restructuring System option for MDBS. This is a stand-alone program allowing data-bases already containing data to be re-designed without affecting the data.

MDBS.QRS £160/ENA
Query/Report Writing System for DBMS is a stand-alone program which provides and English-like query language, allowing non-programmers to interrogate the data base.

MDBS.RTL £160/NA
Recovery/Transaction Logging module for MDBS, which records any data base changes in a transaction log file which may be used by the recovery processor to update a back-up copy of the data base.

ACCOUNTING PACKAGES (GRAFFCOM)

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LANGUAGE APPLICATION TOOLS

BASIC UTILITY DISK £40/NA
This disk consists of the CRUNCH-14 compacting utility to reduce the size of and increase the speed of programs written in Microsoft BASIC-80. Also included is DPFUN, a set of double precision routines including square root, natural log, sinh, arctan - runs at high speed.

DATASTAR (MicroPro) £195/£35
A powerful, comprehensive forms control and display system for key-to-disk data entry. DATASTAR is menu driven with built-in learning aids such as help messages on the screen, and input fields may be verified by length, mask, or type (upper or lower case, numeric).

FORMS 2 FOR CIS-COBOL (Microfocus) £110/£12
A screen editor which automatically creates a query and update program of indexed files using CRT protected and unprotected screen formats.

FABS £105/£15
FABS gives you rapid access to large data files by using balanced tree structures containing up to 65,000 records. Instructions are included for use with CBASIC2, S-BASIC, BASIC-80, BASIC compiler, PL/I-80, Pascal/MT+ and FORTRAN-80.

MAGSAM III £75/£15
A sophisticated, versatile ISAM file management support system for use with CBASIC-2 and BASIC-80 business applications, allowing real-time enquiries, updates, additions and deletions.

MAGSAM IV £185/£15
A high-speed machine code version of MAGSAM III for CBASIC-2 only. It has a 75 percent faster execution time.

M/SORT FOR COBOL-80 £130/£12
A record-sorting utility for COBOL-80 conforming fully to the ANSI '74 level 2 sort/merge standard (except for alphabet-name collating sequence).

PSORT £55/NA
A high speed machine language sort-merge utility for files with fixed length, aligned field records, such as random access files created under BASIC-80.

QSORT (Structured Systems Group) £55/NA
A fast sort/merge program written in 8080 assembly language for files with fixed record length but variable field length. It can sort on up to five ascending or descending keys.

STRING/80 £50/£15
A set of routines to allow string handling as well as direct CP/M BDOS calls from FORTRAN-80 and other compiled Microsoft languages.

STRING/80 SOURCE CODE available separately £185

STRING BIT £40/£15
FORTRAN character handling routines allowing the FORTRAN user to find, fill, pack, move, separate, concatenate and compare strings.

SUPERSORT (MicroPro) £125/£25
A superior sort, merge and extract utility supplied both as a complete program and as a relocatable module in Microsoft format. SUPERSORT sorts up to 500 records per minute.

ULTRASORT II £105/£15
This high speed sort utility, equipped with select and exclude capabilities, will sort, merge and select data files either in stand-alone mode or called via CBASIC-2 subroutines. It sorts on five keys, each independently ascending or descending, with fixed or variable length field lengths.

SYSTEM TOOLS

MAC (Digital Research) £65/£15
A full Intel standard macro assembler including the pseudo-ops RPC, IRP, REPT, TITLE, PAGE and MACLIB. Macro libraries are included for CP/M sequential field access, assembling Z80 instructions (uses non-standard mnemonics), etc.

SID (Digital Research) £65/£10
An 8080 symbolic debugger with full trace, pass count, and breakpoint facilities plus back-trace and histogram utilities. SID works uses symbol files produced by MAC or the Microsoft linker to give a full symbolic display of user labels.

ZSID (Digital Research) £70/ENA
A version of SID which uses Z80 mnemonics.

MACRO-80 (Microsoft) £85/£15
A Microsoft utility package comprising a powerful macro assembler which will accept both 8080 and Z80 mnemonics producing a relocatable output file compatible with COBOL-80; FORTRAN-80 and compiled BASIC object files.

XMACRO-86 (Microsoft) £155/£15
An 8086 cross assembler which uses mnemonics slightly modified from the Intel ASM86 assembler. All the macro features and utilities of MACRO-80 are included.

XASM 05, 09, 18, 0, 48, F8, 65, COPS 400 and 51 £95/£10
Cross assemblers for the Motorola 6805, Motorola 6809, RCA 1802, Intel 8048, Motorola 6800, Fairchild F8, MOS Technology 6502, National Semiconductor 400 and Intel 8051 families.

PASM (Phoenix Software Associates) £70/£15
A Z80 macro assembler using Intel/TDL mnemonics, which will generate output in either Intel hex format or TDL object format or PSA relocatable binary format.

PLINK II (Phoenix Software Associates) £185/NA
A two-pass disk-to-disk linkage editor capable of producing ROMable code. It has full library facilities, and input can be PSA relocatable, TDL object or Microsoft REL files.

PMATE £100/NA
This new-generation screen editor is bursting with special features including full side scrolling, and two visible cursors, one in the text area and another in the command line.

BUG and µBUG (Phoenix Software Associates) £70/£15
A Z80 interactive machine language debugging tool with full mnemonic trace and interactive assembly, using PASM-compatible mnemonics.

DISTEL £60/NA
Disassembles 8080/Z80 machine code file to Intel 8080 or PASM/TDL mnemonics.

DISILOG £60/NA
A version of DISTEL for Zilog Z80 mnemonics.

ZDT £30/NA
A Z80 debugging tool to trace, break and examine registers with standard Zilog/Mostek mnemonic disassembly displays. Useful features include the ability to directly access input/output ports, search for hex or ASCII strings, and compare memory areas byte by byte.

Z80 DEVELOPMENT PACKAGE £70/NA
This package consists of a line editor, a relocating Z80 assembler using Zilog/Mostek mnemonics with conditional assembly and cross reference table facilities, and a linking loader producing in Intel format hex file.

WORDMASTER (MicroPro) £75/£25
In one mode this text editor has a superset of CP/M's ED commands including global search and replace, both forwards and backwards in the file.

RAID £130/£15
Real-time Assembler Interactive Debugger, for 8080 software emulation and real-time debugging.

RECLAIM £40/NA
A utility to validate disk media under CP/M. It checks a diskette or hard disk surface for errors, collecting any bad sectors into invisible files so that they cannot be accessed. The remainder of the disk can then be used as normal.

DESPOOL (Digital Research) £45/NA
A utility to permit the simultaneous background printing of a data from a disk file while the user executes another program from the console. DESPOOL occupies 3K of memory.

Please note - the prices in this catalogue are subject to change. Certain packages may require a software license agreement to be complete and returned before shipment can be made.

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Provides a cross-reference of line numbers and variable names.

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APPLESOFT UTILITY PROGRAMS (Gilder) Increase your BASIC programming speed and flexibility. Contains 9 useful sub-routines: 1. REM Writer 2. PRINT Writer 3. POKE Writer 4. Hexadecimal/Decimal Converter 5. Line Counter 6. Renumber 7. Append 8. Byte Counter 9. Slow List/Stop List
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RENUMBER & APPEND: Utility Programs for the Apple (Gilder) Renumber your Applesoft program and append a second program to the one in memory.
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REVIVE (Gilder) When a program is accidentally erased, REVIVE searches through memory and finds the information that enables it to restore the pointers that have been changed.
400036045 Apple II tape £14.70

SLOW LIST/STOP LIST: Utility Programs for the Apple (Gilder) Start, stop, and control the speed of your program with Apple II's game paddles.
400039044 Apple II tape £8.10

PSEUDODISK (Neuschatz) This money-saving program simulates a disk memory system for Integer BASIC programs. It allows multiple programs in memory at the same time which can be run from a catalog.
400048041 APPLE II tape approx. £15.55

6502 DISASSEMBLER (Stamm) Produce assembly language source files with labeled sub-routines and references from programs already in memory. It is compatible with Hayden's ASSEMBLY LANGUAGE DEVELOPMENT SYSTEM
400086093 APPLE II Disk approx. £30.05

DISK CERTIFIER AND COPIER (Jacc Inc.) A handy utility program that certifies the acceptability of blank diskettes and rejects those with flaws. It also includes a fast machine language disk copying program that will work on single and dual drive systems.
400078090 APPLE II Disk £13.35

DISK CATALOGER (LeBar) Automatically maintains a cross-reference listing of all your programs, their location by disk number, their function and use. Catalogs, lists and sorts programs.
400052032 TRS-80 Level II tape £12.50
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BUSINESS

HISTO-GRAPH (Boyd) A calendar-based histogram or bar-graph production system. Allows the user to enter numeric data that relates to a date, and reproduces that data as a high-resolution histogram.
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DATA MANAGER: A Data Base Management System and Mailing List (Lutus) Store information on a floppy disk, and retrieve it quickly and easily by specific names, or by category.
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GAMES

MICROSAIL (Johnson) A true test of your nautical skills as you race against wind, tides, and time.
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MAYDAY (Breitenbach) Out of fuel! Try to avoid crashing with this challenging airplane flight simulation.
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SARGON II (Spracklen) The first great computer chess program! "... an excellent program which will provide true challenge for many players ... Save your money and buy SARGON II ... '80 Software Critique.
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400034085 TRS 80 Level II Disk £25.75
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BLACKJACK MASTER: A Simulator/Tutor/Game (Wazaney) A serious game that performs complex simulations and evaluations of playing and betting strategies.
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40005308X TRS-80 Disk Version £22.10

REVERSAL (Spracklen) Winner of the software division of the First International Man-machine OHELLO™ Tournament, this version of the 200-year old game Reversi, features 27 levels of play and high-resolution color graphics.
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STARCLASH (Walton) An exciting game of galactic strategy for one or two players.
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ROYAL FLUSH: Competitive Poker Solitaire (Wazaney) A game you can play alone or with any number of players. High score wins in this poker-based, fun-filled card game. Choose from possible game variations.
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BACKGAMMON (Wazaney) A classic game of skill and luck played against a programmed opponent.
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MIND THRUST (Sackson) The concept is simple: the first to complete an unbroken chain across the playing board wins. It's up to you to out-manuever, out-guess your opponent, the computer. The player takes turn at either adding a piece to his or her chain or attacking the opponent's chain to make it shorter.
400074036 TRS 80 II tape £12.75

LANGUAGE

PROGRAMMING IN APPLE™ INTEGER BASIC; Self-Teaching Software (Banks & Coan) Teach yourself Apple Integer BASIC and control your own progress at all times with this interactive programmed instruction format.
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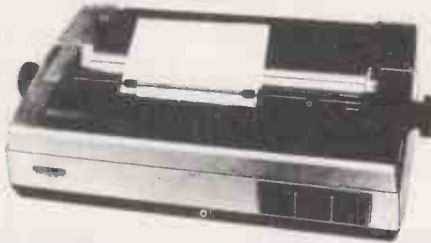
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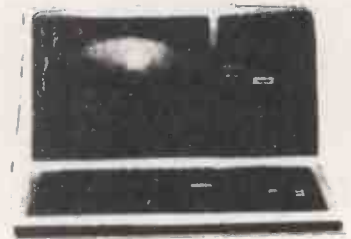
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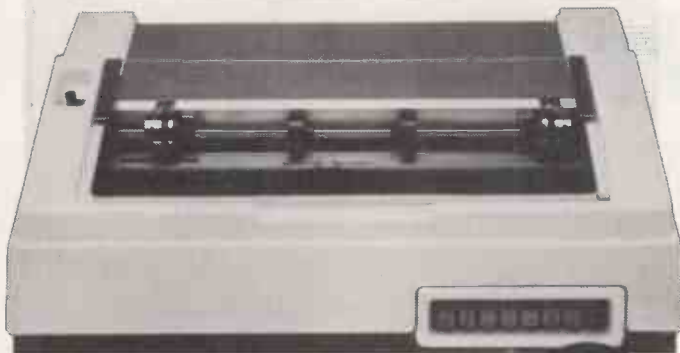
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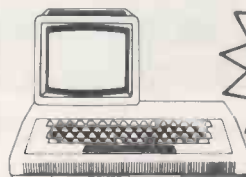
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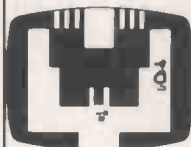
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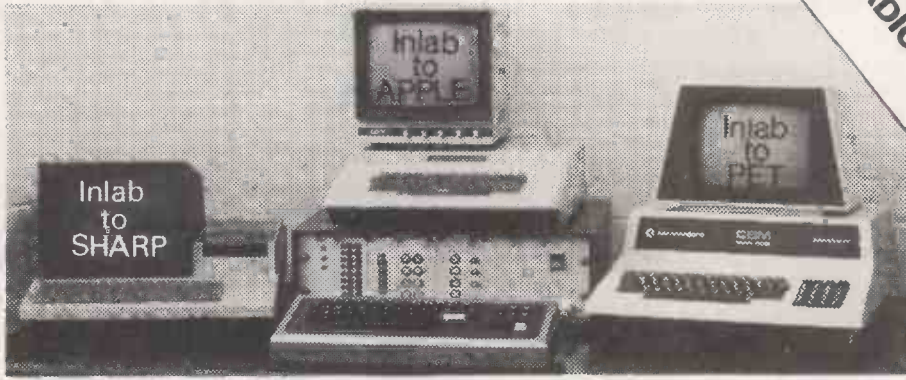
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LINK-UP

LINK-UP is a firmware package allowing several Commodore computers to share the same peripherals (disk drives, printers etc.) and, in its enhanced version, communication between computers themselves.

MAIN FEATURES

- Simple installation – NO external hardware.
- Solves the file handling problems with both sequential AND random access files.
- Makes the user aware of the 'transactions' on the IEEE Bus by displaying messages on the screen's status line.
- No theoretical limit on the number of computers in the system. Practically limited only by length of IEEE cable and peripheral access time.
- Three modes of operation; transparent; programmer – controllable; and stand-alone.
- Low cost compared to existing hardware solutions.

FUTURE ENHANCEMENTS

- Programming aids
- Printer spooling
- Messages between PET's
- File security options

INSTALLATION

The whole system consists of two EPROMS, one to exchange the existing F-ROM and another in 9\$ – or A\$ – slot (both versions are available).

FILE HANDLING

The firmware has been designed to cope with the problem of two computers reading simultaneously from the same file, so that no errors occur.

SCREEN MESSAGES

While the Bus is not free, a message is displayed on the screen of a computer that tries to access the disk, so that the user is aware of the fact and doesn't have to worry about the idea of the system having 'hung up'.

MODES OF OPERATION

In the transparent mode the computer performs as if it were the only one in the system.

In the manual mode Bus access can be fully programmed so that in an application package, the disk and printer handling can be optimized for a distributed processing environment.

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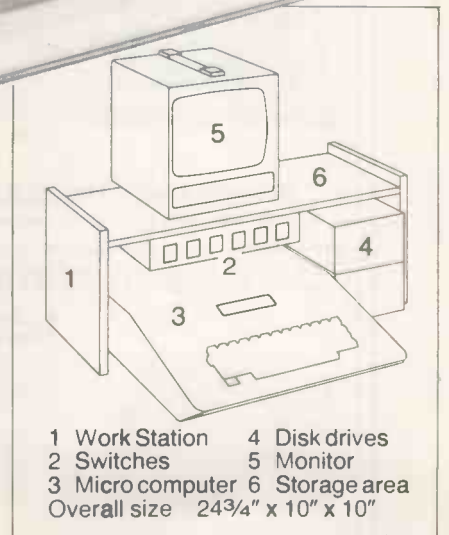
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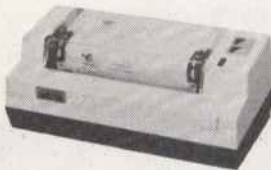


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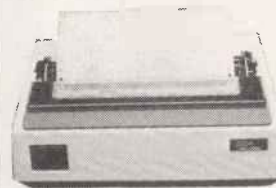


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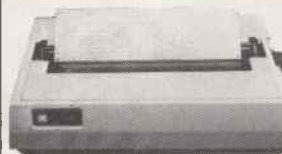
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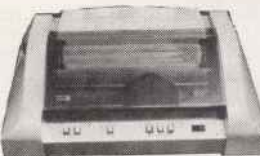


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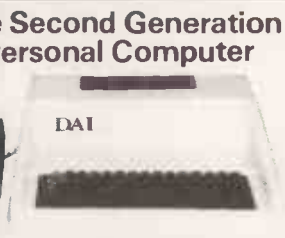
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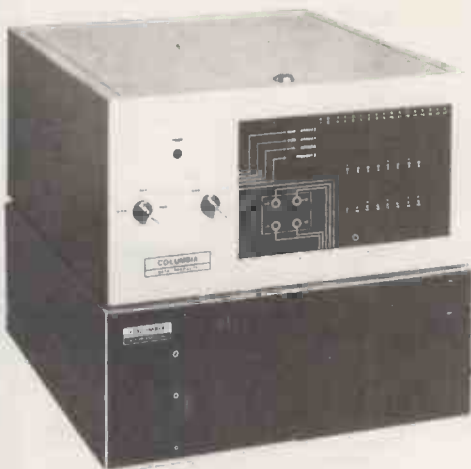
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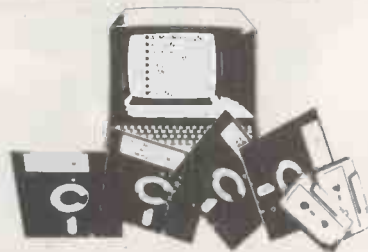
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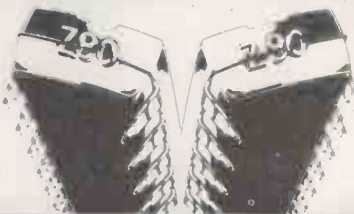
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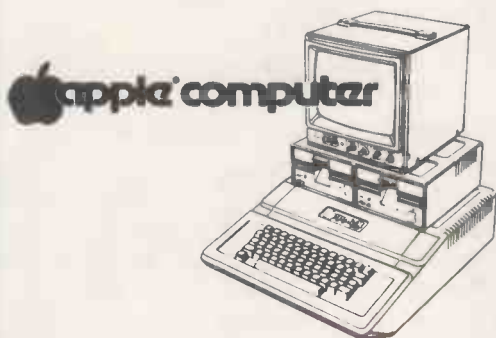
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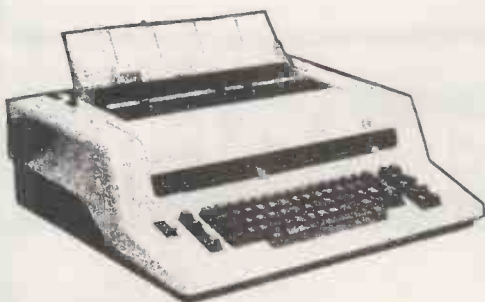
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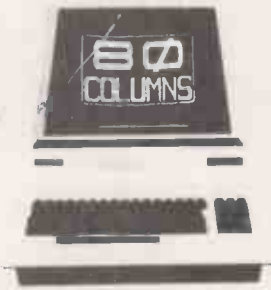


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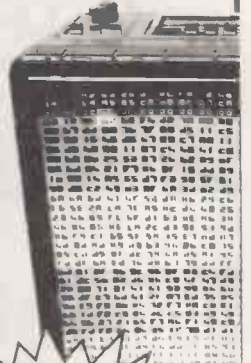
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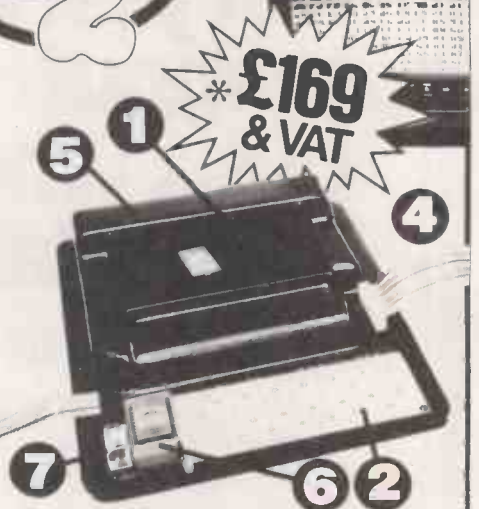
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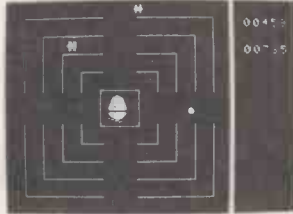
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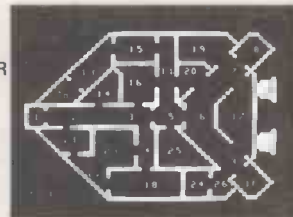


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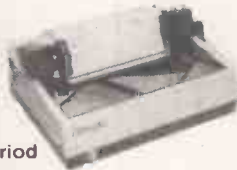
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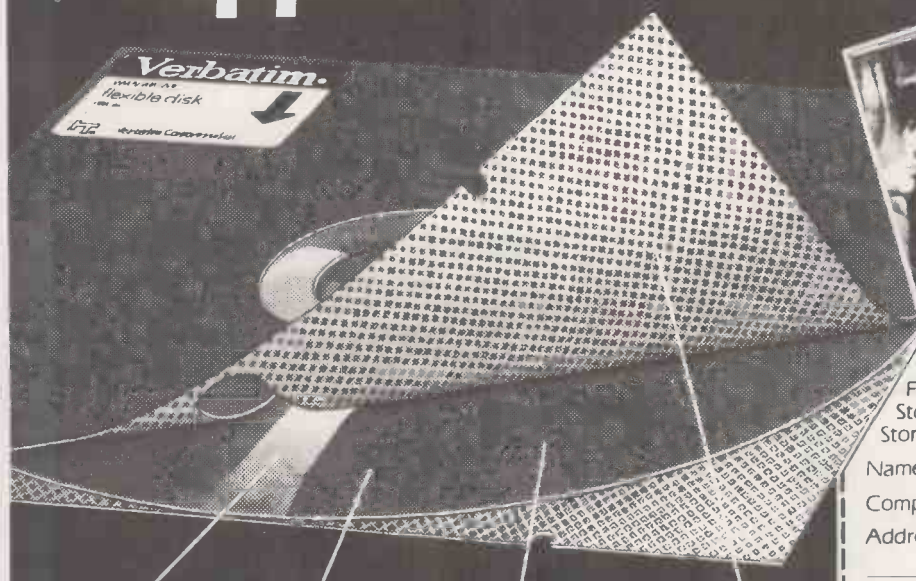
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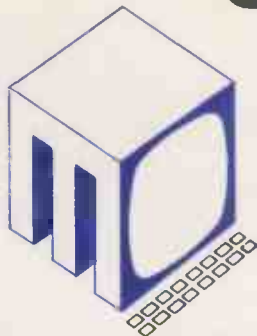
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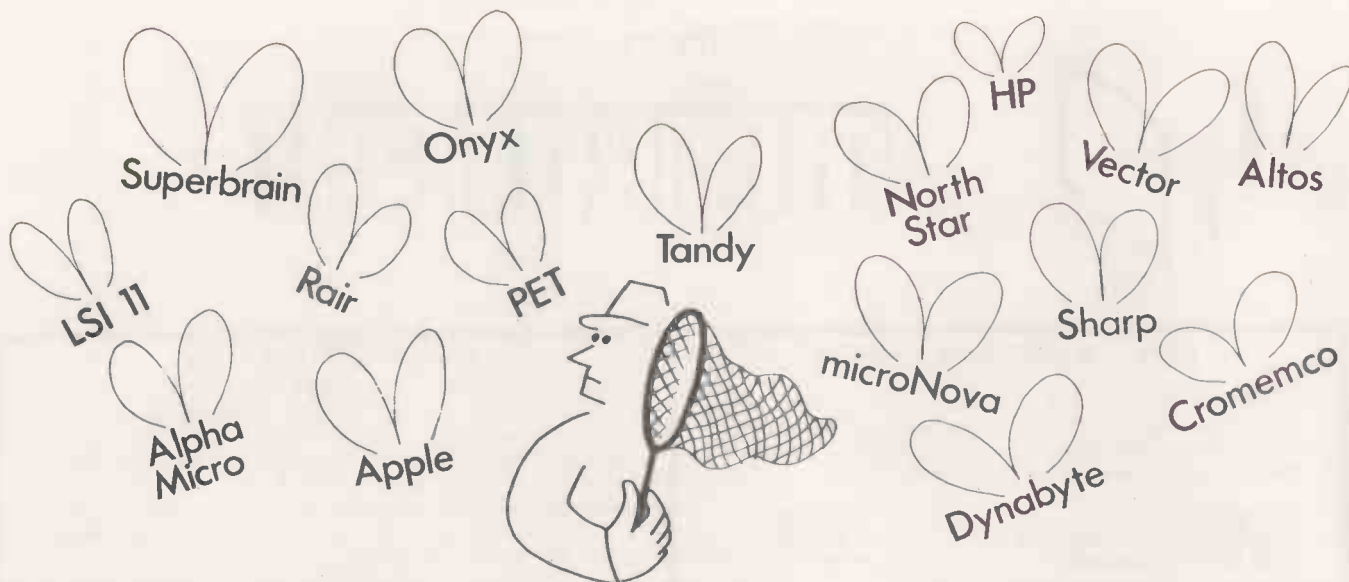
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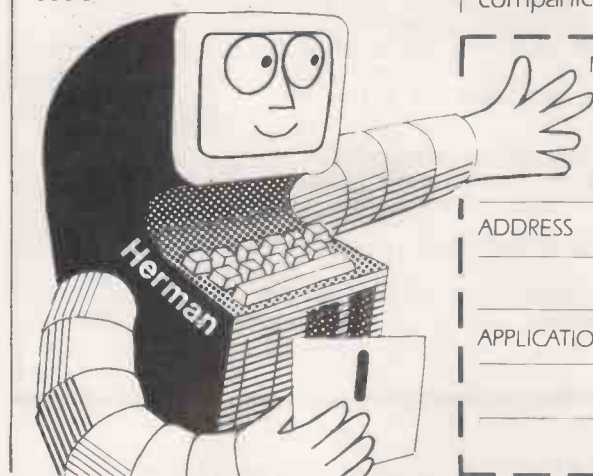
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Computer brainwork

ACCORDING TO a recent, widely-reported story, a chap has been found in Britain who rather upsets the received ideas about mental function. A brain scan reveals that his skull is full of water — he has, literally, no brain at all — while an IQ test puts his intelligence 20 points above average.

All his thinking, therefore, must be done in the nub of his spinal cord, and it makes one wonder more than usual why the all-wise Creator chose to furnish the human race with brains. It was quite clear before that most never used that mysterious organ: it now appears they did not need it anyway.

It further makes one wonder what point there is in trying to make computers imitate the action of the brain. There has always been a mystery about what most of the brain does for a living. One can estimate the number of bits of information the average mind stores by arguing from *Twenty Questions*.

Experience shows that about half the time, 20 yes-or-no answers will lead to any generally known object or concept — the “Prime Minister’s bathtub,” for instance. That in turn means that there are about 2^{21} , or 2 million, of these ideas in circulation — or equally, in each head. Even if we multiply this number by a factor of two for private concepts, by two again for visual and by two for aural ideas, we obtain a total brain store of 2^{24} bits.

However, if you attack the problem from physiology, arguing that a neuron can store one bit — it can probably store much more than that — and that there are 2^{34} neurons in the average brain, then it is clear that a large amount of grey matter is fast asleep all day like its owners.

Of course, it may be doing something totally different from storing information or performing logical operations. The difficulties of teaching mathematics show that the majority of brains find any kind of logical thought completely impossible. The fact that people have to be taught to think seems to demonstrate that brains were not designed for the task. What are they at all day?

It might help to look at what they were designed to do: to allow a small, edible, slow beast with no natural weapons to survive in a world of much bigger, faster and better-armed predators. Purely logical problems seldom arise in this kind of business.

While going about his affairs in the prehistoric African bush, *homo prototypicus* would hardly ever find scraps of paper saying: “Fourteen percent of the animals in the next clearing have yellow coats. One in six has teeth but no horns. The father of two is the grandfather of eight. One more than the number of lions is half the number of buffaloes less 13 times the count of wildebeest hooves —”.

We can be reasonably sure that history did not occur like that. What he and his friends had to decide was whether the beast making that bush twitch was an eater or an eatee. What evidence did he have to allow a well-thought-out decision? — none.

Since there is no logical way of deciding what is in the bush, the prototype must assume that everything may be relevant. Did the milk foam in his morning coffee? Is there a cloud on the far-off mountain top? Did his wife spit to the left or the right when she brushed her teeth? Has it rained or not in the last month? Did he pass an odd or an even number of blood-coloured flowers on the way here?

In a world with no obvious rules you have to look for the unobvious ones. To do that, you need a retentive and wildly associative mind: instead of the austere Meccano of logical thought, you need a warehouse of a brain. Picking and

roaming about in the mounds of rubbish in the gloom you may find the two essential, unlikely things side by side which explain it all.

The prototype also needs strong social bonds so that the group will function like one animal. Some whoop and yell in front of the thicket; others lie quietly in ambush behind. Any one of them must take the idea of the group seriously enough that he risks his own life for the benefit of all. We still have not accustomed ourselves to the stupidity of this notion.

His brain must be able to form models of other people to predict how they will behave. These models must be strong and complete enough that they can dictate his behaviour. Instead of doing such and such because he wants to, the prototype must do something else because the chief would prefer it.

To survive, the prototype had to become a theoriser. The most unlikely pieces of information might prove to be relevant, so he had to collect it all and weave it into some farrago of an explanation of what was occurring in the real world. Those who wove their theories incorrectly were eaten; those who did not lived to weave again another day.

At the end of millenia of this weaving we have the vast, tangled mess of ideas which, floating on the surface of the mind like the impenetrable mat of living and dead rubbish that covers some lakes, is laughingly called civilisation.

If most of the brain is doing anything, it must be storing, maintaining, wandering in this great heap of junk. You may be able to store all the ideas of a civilised human — all, that is which can be broadcast by the BBC — in an ounce or two of grey matter: it may well take the rest of the 5lb. of the stuff to connect it all together. As we know, it takes $(N-1)^{(N-1)}$ connections to link each of N things to all the others. That soon becomes an enormous amount.

All this would explain why people are so neurotic and unpredictable, why they are so hell-bent on inventing wrong theories to explain what cannot be understood — for example, Monetarism — why, while the world lies innocent and passive, tornadoes of illogical and incompatible ideas roar and fight above it.

We now reach the point of publishing a whimsical and unverifiable essay like this in a magazine about computing. Proponents of artificial intelligence lament that the computer clearly does not think like the brain does. They seem to want to make a machine that is as erratic and illogical as the human mind. Happily, so far, they are not succeeding.

There are people who say that the difficulties the human race gets itself into are very largely the fault of trying to force its poor brain to think logically. It can be done, but with very great difficulty, and at the cost of behaving madly elsewhere.

It may turn out that the kind of computer we have is ideal: able to do with ease just those things that people are so bad at: regularity, routine, accuracy, unthinking compliance with orders. Whenever an aircraft crashes it turns out that someone, somewhere was guilty of “human error”. It is a miracle that any planes ever arrive. They would do much better with a computer in charge, if and when we learn how to make it.

Having transferred the function of logical thought to silicon, the human race might then abandon trying to do what it clearly is no good at — thinking logically — and continue with what it does rather well, which is lying about playing and daydreaming. Freed of this unnatural burden the world might become a very much better place to live in than it is. □

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Our Feedback columns offer readers the opportunity of bringing their computing experience and problems to the attention of others, as well as to seek our advice or to make suggestions, which we are always happy to receive. Make sure you use Feedback—it is your chance to keep in touch.

Pet paradox

WITH REFERENCE to the problem encountered by R P Hope and I Powis, July 1981, Pet Corner page 111, the apparent paradox is resolved if it is remembered that the Pet displays fewer figures than it uses.

If their program is modified to read:
20 IF ABS(Z — 1) < ABS(1E — 12) THEN GO TO 50

30 PRINT "Z — 1 IS NOT 0 . . . IT IS"; Z — 1 then the display becomes:

Z — 1 IS NOT 0 . . . IT IS — 9.3132257 E — 10

I hope that they can modify their test on Z accordingly.

**A Jackson,
Preston,
Lancashire.**

Business confidence

IN HIS first article on "Writing your own business software" July 1981, Charles Somerville starts with the advice — do not — rather use a software house. From my own investigations in respect of much of the hardware advertised in your magazine, this advice is undoubtedly well-founded; indeed the rest of the article tends to prove the point.

However, it should be pointed out that any person who has a clear understanding of what he wishes to achieve in terms of the manipulation of data, and who is prepared to devote 100 or so hours of time and effort to the task, should be able to teach himself to write perfectly-acceptable programs for most business applications. The key to success is to choose equipment with top-quality business-orientated system software and good teach-yourself documentation.

In July, 1980, our company took delivery of an IBM 5120 computer at a total cost of £8,500 including the best-documented and most comprehensive version of Basic and set of system utilities I had been able to find in nearly two years of combing every kind of computer exhibition.

By November, we had implemented a complete management-accounting system covering job costing and a full set of monthly accounts for a total additional cost of less than £1,500.

We had a little starting help from a local lecturer in computer sciences; half of the 70 programs for the application were written as a vacation job by a student who had some previous programming experience in RPG.II, and the rest by myself in the evenings and at weekends.

Incidentally, I had never written a program in my life before we acquired the 5120. Such was the quality of the documentation that we have never once

had to ask IBM's advice on any software problem.

We now have the experience and confidence to tackle the principal justification for an in-house machine — a complex order-processing routine which could not possibly be covered by a standard package.

In my opinion, any businessman who seriously intends to make a computer the key link in his operations would be very ill-advised to rely wholly on outside support for application software development even if he can afford the expense.

**John Phillips,
The Reliance Rope
Attachment Company,
Cardiff.**

A Merry game

AFTER reading the July and August issues of *Practical Computing*, my father and I decided to load in Bob Merry's game Star System. After correcting the inevitable typing errors I made, we played the game a few times.

Soon, my father noticed that the nuclear fuel was not being added to the fuel units after being retrieved from mining. I looked through the program and found that the variable J was being used for both nuclear fuel and various loops throughout the program, one of which promptly makes J=3 at precisely the wrong moment.

To cure the problem, I changed J to NF in lines 930, 950, 1010 and 1020. The game now runs perfectly and I have had much enjoyment from it.

**Ian Payton,
Winnersh,
Berkshire.**

Wanted: dead or alive

I HAD always supposed that those interested in computing were likely to have given some thought to the similarities between the human brain and a computer and whether this could give rise to personal immortality.

According to Jim Yount, of the Bay Area Cryonics Society, their "present membership includes a disproportionate number of computer programmers and enthusiasts" — private correspondence, September 1980.

I have been in contact with various U.S. cryonics and immortalist organisations for the past two years, and have now amassed some considerable information on this subject.

I placed two advertisements in *New Scientist* earlier in the year inviting people

interested to correspond with me with a view to sharing this information, and with the ultimate aim of causing a viable immortalist organisation to form in the U.K.

I would be pleased to hear from anyone, even if only vaguely interested, and I make no charge for the information and material provided. My address is West Towan House, Porthowan, Truro, Cornwall TR4 8AX.

Our group would be particularly keen to add a solicitor, accountant, doctor, and funeral director who are sufficiently interested to correspond on aspects of immortalism and cryonic suspension relevant to their professions.

**John de Rivaz,
Truro,
Cornwall**

Centre of interest

MICRO-T will be one of the first of the new Information Technology Centres announced by Kenneth Baker. We are looking for personnel with a real creative flair in microcomputing.

Our centre has several objectives. The two principal ones are to train young people in computing and use of micros right through from fundamental programming up to implementation of successful systems in other organisations, whether small businesses, large high-technology companies — our adopted "parent" is likely to be Courtaulds (Engineering) Ltd. — and bodies like Coventry Chamber of Commerce.

The other main objective is to act as an impartial advice centre for businesses in Coventry and to direct them to appropriate consultancies. In addition to these aims, we want to function as a creative software organisation in the fields of instructional programs, using high-resolution colour graphics in academic and commercial skill-training, a wide variety of applications programs and also to explore self-programming programs.

We intend to keep updated with 16-bit and 32-bit micros as they appear. Micro-T is looking for three or four staff with a deep commitment to developing high-quality software. They are likely to be young and we are offering salaries in the £6,500 to £8,500 range. This will be an exciting and enjoyable organisation and if anybody is interested they can make contact with Keith Hudson, Micro-T, 79 Sutton Avenue, Eastern Green, Coventry CV5 7ER.

**Keith Hudson,
Micro-T,
Coventry.**

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Intractable problems

I HAVE recently bought a Pet 4022 tractor printer and have failed to overcome two problems:

- The command TAB (x) causes the print-head to index X spaces from its previous position, not the left-hand margin. This makes a neat lay-out difficult to achieve and greatly complicates graph plotting programs.
- The ability to print a user-defined character is most useful for high-resolution printing but it appears impossible to print a number of different user-defined characters on the same line without overprinting — a slow and irritating method.

I hope someone can come to my rescue. Others may be interested to know that L & J Computers has supplied me with all my equipment and has delivered on time, despite VAT, customs and postage problems for an overseas customer, and at the quoted price — a welcome example of good business practice in an industry that generally has a poor reputation for this kind of thing.

W V Legge,
BFPO 23.

Intimacy for export

YOUR EDITORIAL in the July 1981, issue regarding U.S./U.K. software can hardly pass without comment — but then editorials are supposed to be stimulating, are they not?

It is only the most general-purpose software which, is transportable across national boundaries. The way in which companies operate financially differs greatly in detail from one country to another. Then there are the tax systems, mailing addresses — City, State, ZIP etc. — and a host of other things which impact commercial routines. To write software for export in either direction demands the most intimate knowledge of the target market environment.

In Feedback, I do not know where T T Knox of Hull obtained his figures, but the capacity of the 5.25in. floppy discs used on Apple under DOS version 3.3 is 143Kbytes after formatting, not 82,944 bytes and the transfer rate of 125K bits/second makes his 200/300 baud look lethargic.

As to reliability, in a very long time of using Apple and all those Kbytes/second, I have yet to experience a read/write error. Perhaps I have been lucky or I have used the right operating systems, but the fact remains that none has been apparent.

In Printout, you mentioned that the new VisiCalc series of software is not yet available in the U.K. It is and here are the prices — all for Apple 16 sector DOS 3.3:

VisiCalc	£150
VisiPlot	£95
VisiDex	£150
VisiTrend/plot	£169

VisiTerm is probably not really suitable for U.K. communications.

The article on investment using discounted cashflow techniques for net-present-value calculation was very interesting although the program was rather limiting for anyone having used VisiCalc on the Apple. Even the iterations can be set up to be executed manually or automatically. The window technique in VisiCalc avoids problems associated with 40-column screens, but then the use of an 80-column card in the Apple helps greatly too.

Hugh O'Neill,
Chichester,
West Sussex.

Eliminating errors

AS I AM impressed by the usual high quality of the articles that you publish in *Practical Computing*, I was dismayed to read Mark Walker's "Essential tools for repetitive sums" in the July 1981 issue.

The content, mostly concerned with solving linear equations, was full of half-truths and non-sequiturs. More important, however, some statements of fact call for correction.

We are told, for example, that

- When solving m sets of equations of the form

$$AX_i = B_i, i=1,2, \dots, m$$

that Gaussian elimination would be a poor method since A^{-1} would have to be calculated m times.

- The LU factorisation method is a more accurate method than Gaussian elimination.
 - Row interchanges are not required in the LU method since rounding errors are not allowed to build up.
- All three statements are incorrect. In fact
- A^{-1} need not be computed explicitly at all; only one reduction of A to upper triangular form by Gaussian elimination is required to solve all m sets of equations.
 - LU factorisation and Gaussian elimination are computationally equivalent.
 - Row interchanges are just as necessary in LU factorisation as in Gaussian elimination to minimise the growth of rounding errors.

Any reader interested in the full story of the effect of rounding errors in such algorithms should read J H Wilkinson, *The algebraic Eigenvalue problem*, Chapter 4.

David Risk,
Stone,
Staffordshire.

Dountil dishonest

ROY ATHERTON, in the June 1981 issue, has either not read Sydney Leleux's article properly or is being somewhat dishonest. Flowcharts are used, initially, to illustrate the constructions but a pseudo-code is recommended for program development and refinement.

With respect to the Dountil, I quote: This is not recommended as the process is always executed at least once.

Atherton then goes on to extol the virtues of For and Repeat Until loops in Comal. A Dountil by any other name is still bad practice. If you have one fool-proof looping technique, why introduce more?

Teachers still have the problem of teaching Basic to beginners. Stepwise refinement is a very useful tool and bypasses the blank-paper stage by giving a routine to program development.

The Jackson approach, in the real world of commercial program design is, a very valuable technique. The figures 4, 5 and 6 of Atherton's article are far more confusing flowcharts than any in Leleux's one.

S G Davies,
Derby.

Key to Allan's code

I AGREE with Boris Allan's basic ideas, June 1981, but he should be sure that the programs used in the tests work as intended.

When I saw that the exponent in the MT1F test for TRS-80 double-precision had an exponent equal to -8 for matrices of order 2 to 8, I grew suspicious. A 16-digit double-precision function should have an accuracy better than $1D-8$ for a matrix of order 2.

The error is most likely to be that some of the operations in the program were single-precision where they should have been double-precision. I guess that the problem might lie in

$$Q = 1/(I + J - 1).$$

It should be

$$Q = 1D/CDBL(I + J - 1)$$

because of

$$X\# = 1/3 \text{ gives } .3333 \ 3334 \ 3267 \ 4408$$

but

$$X\# = 1D+0/3D+0$$

or $X\# = 1/3\#$ gives .3333 3333 3333 3333.

I have changed the code in the article to TRS-80 Basic, and the results were better than any of the competitors.

The other two tests may or may not have the same problem, but it is not significant — the TRS-80 has only single-precision maths functions.

My values for MT1F TRS-80 double-precision:

Matrix order	TRS-80 double-precision
2	0.000D+00
3	4.580D-16
4	1.588D-14
5	1.261D-13
6	2.019D-15
7	2.839D-11
8	8.690D-09
9	4.266D-07
10	3.224D-06

I found the time to be 252 seconds.

The time spared by removing Gotos to create some structure in the program and the increased time used by using Time\$ — the interrupt-driven software counter — is nothing compared to the time taken by the double-precision routines.

Kim Michelsen,
Glumso,
Denmark. □

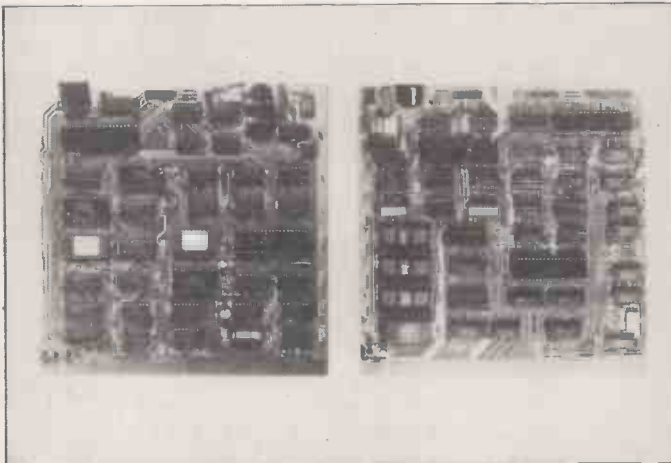
Gemini's MultiBoard is built for versatility

GEMINI Microcomputers has developed a new British microsystem on 8in. by 8in. boards. Based on a set of eight boards, the MultiBoard system has been developed by one of the most experienced micro-board design teams in the U.K. and they believe it to be more versatile than any other modular board system available in this country.

The CPU board is designed around the ubiquitous Z-80A processor running at 4MHz with link options for 2MHz and wait-state. In the memory section are four Bytewide sockets which will accept a large variety of EPROM, ROM or RAM devices. The complete memory block can be switched out of the memory map allowing a full 64K RAM system to be used in, say, a floppy-disc environment.

A socket exists for an ASCII keyboard and an uncommitted Z-80A PI/O is included in the parallel I/O section. The serial I/O has an 8250 UART with programmable baud rates, parity-stop bits and hand-shake. RS232 or CUTS cassette interfaces are switchable. A 12K Microsoft Basic and a comprehensive monitor form the software options.

MultiBoard video is on a



Video Board (left) and CPU Board are both Z-80A powered.

separate board which includes a dedicated Z-80A micro-processor. The intelligent video board has a character set which is split into EPROM and RAM sections which can be modified under program control.

The screen format may be changed but in most cases it is 80 by 25.

There is a 4MHz 64K dynamic random-access memory board, a floppy disc controller board which can support up to four 5.25in. or 8in. drives in single- or double-density modes, an EPROM/ROM board which can cope with up to 40K of firmware.

There are also non-8in. by 8in. boards which include a 3A PSU, an EPROM programmer and a 59-key ASCII keyboard. The whole arrangement will fit snugly into either a standard Vero frame or a special Kenilworth case.

All Gemini MultiBoard products are Gemini 80-Bus- and Nasbus-compatible and they can be bought at any of the MicroValue Group dealers. Prices for the multiboard modules are as follows: CPU £125, Video £140, 64K RAM £140, FDC £140, EPROM/ROM £70, EPROM PROG £27, 3A PSU £40, keyboard £57.50. □

Typesetting service can cut paper costs

THE PRODUCTION of manuals, reports, lists and items of reference data could be dramatically changed by the introduction of a new computer photo-typesetting service.

This service from Interface Graphics permits photo-typesetting from disc-stored, word-processor copy. The computerised transmission system will make the use of typeset material a viable alternative to typewriter script as camera-ready artwork.

The system can save up to half the paper costs, which in turn will reduce the cost of storage, postage and

transportation. In addition, the results are aesthetically more pleasing than those produced by traditional methods.

By direct linking of the word processor and the digital typesetting equipment, costs and preparation time can be reduced greatly. A remote station is possible by use of a modem and a telephone link between the customer's word processor and a device which writes the copy to disc. The equipment will convert the text and the word processing codes into a form suitable for typesetting, at Interface Graphics. □

Business decision aid

A PACKAGE designed to help small businessmen to make a decision about buying a micro is now available from the National Computing Centre. The training package is designed to give the person running a small business sufficient information to decide whether a computer would help, where to start and how to prepare for its arrival.

The package is entitled *How to choose your small business computer* and it consists of a cassette and a booklet. The price of the package is £9.85 and it is available from the National Computing Centre, Oxford Road, Manchester or The Microsystems Centre, 11 New Fetter Lane, London. □

Suppress spikes!

THE Kleanpower MB6 is a power-line surge suppressor designed to protect such devices as desk-top and personal computers and word processors, but will equally provide protection to home computers.

This type of device is necessary because of the dirty nature of much of the electricity supply current and the sensitivity of computers to fluctuations.

The main problem with current is that spikes often appear in the line which may cause untold harm. Data can be corrupted in the RAM, programs can also be affected but the far more serious problem is to the discs.

Disc units are particularly vulnerable to spikes and sometimes disc crashes occur. With software costing up to £1,000 a package, a crash can prove expensive. Losing software may be expensive, but to lose a database could be fatal.

Spikes and other noise on power lines can be caused by many things. In the home, a common cause of such interruptions to the power supply is the switching on and off of motors — the fridge is a major culprit.

In offices, such disruption may be caused by lift motors or other office equipment.

Not only is data at risk — if the power surge is very large, damage can be done to the hardware itself. Apart from the financial consideration, another good reason for investing in a power-supply protector is that the time spent re-entering lost data can also be saved.

The specifications of the Kleanpower MB6 are: 240V supply voltage; 6amp current rating; an upper voltage limit of 420V. It will handle 400 kilowatts for 1 millisecond, or 400 Joules.

At a price of £90 in one-off quantities, the Kleanpower unit will prove inexpensive if it is only required once in a blue moon. The Kleanpower unit comes from Lightning Elimination Associates Ltd, Moreton, Thame, Oxfordshire. Telephone: 084-421 3204. □

More Apple peripherals

U-MICROCOMPUTERS has developed two more peripheral cards for the Apple. They are U-S232 a serial interface and U-Z80 Auxiliary Processor.

The U-Z80 is a card which enables the Apple computer to run CP/M software at a small extra cost, if the U-RAM 16 is installed as well then 56K CP/M programs can be run. The U-Z80 card costs £95 in one-off quantities.

The U-S232 card provides the answer to the Apple serial-interfacing problem which many people encounter. It provides full handshaking and is Pascal, CP/M and Fortran compatible. Again the board costs £95 in one-off quantities.

U-Micro-computers, Winstanley Industrial Estate, Long Lane, Warrington, Cheshire, WA2 8PR.

Green Paper proposes tighter program copyright

THE LONG-awaited Green Paper on copyright has been published, and many of the points raised concern micro-computer programmers in a multitude of ways. A Green Paper is the government's version of a discussion document and the recommendations it contains are not necessarily implemented when formulating the White Paper which is the proposal for legislation — the document debated by MPs in the House.

To obtain a copy of the Green Paper, contact Her Majesty's Stationery Office. The paper's title is *Reform of the law relating to copyright, designs and performers' protection. A consultative docu-*

ment. Cmnd 8302 Price £3.90.

The Green Paper has its origin in the work of the Whitford Committee, which was set up in 1973 to review British copyright law, and which reported in 1977. The Green Paper indicates the Government's inclination to follow Whitford's recommendations on some issues, but to differ from Whitford on others.

The reason for the four-year delay between the report and the Green Paper is twofold: first, it is an immensely-complicated subject and has been dealt with in great detail; secondly, in the meantime there has been a change of government.

The present position on

computing is that it is generally accepted that the copyright law provides some protection for computer programs. However, there is no case law and the full extent of protection is not clear. The proposals in the Green Paper will clarify the application of copyright to computer programs and to other words stored in computers.

Other facts which will affect computer users include the reluctance of the Government to introduce a levy on blank tapes. The Green Paper contains proposals for increasing penalties for piracy of copyright material, and to make a new criminal offence of possession of an infringing copy in the course of trade.

In civil infringement cases, the Green Paper recommends the abolition of "conversion damages", equal to the full value of all infringing copies, but proposes that the scope for the award of penal damages for flagrant infringements should be broadened.

The term of a copyright at present lasts for the life of the author plus 50 years for some cases and for differing amounts of time in others. At present, the position affecting computer programs is slightly confused, but it should be resolved by the proposal that all copyrights shall exist for 50 years.

If any reader of *Practical Computing* is interested in making a contribution to the debate, he or she should contact the Patent Office, 25 Southampton Buildings, London WC2A 1AY.

Big RAMs from Texas

TEXAS Instruments has announced two series of standard RAM modules. Designated the TMS-10010 series and the TMM-40010 series, the modules provide expansion for the LSI-11 and Multibus systems. There are both 128K and 256K versions in the TMS-10010 series. The TMM-40010 is in 64, 128, 256 and 512 Kbyte versions.

Alternative energy comes a little closer

WINDLOGGER is a micro-processor-based device for windmill site evaluation. The product has been developed by the Northumbrian Energy Workshop — a workers' cooperative based in Hexham, Northumbria. The Workshop has been involved in wind energy for some time and have applied their collective knowledge to produce this micro-processor-based data logger.

Hailed as the largest step forward in wind measurement since the introduction of the Beaufort scale, the Windlogger can be used to investigate the potential of windmill generator sites. Existing measurement equipment is, on the whole, too crude or requires mains electricity.

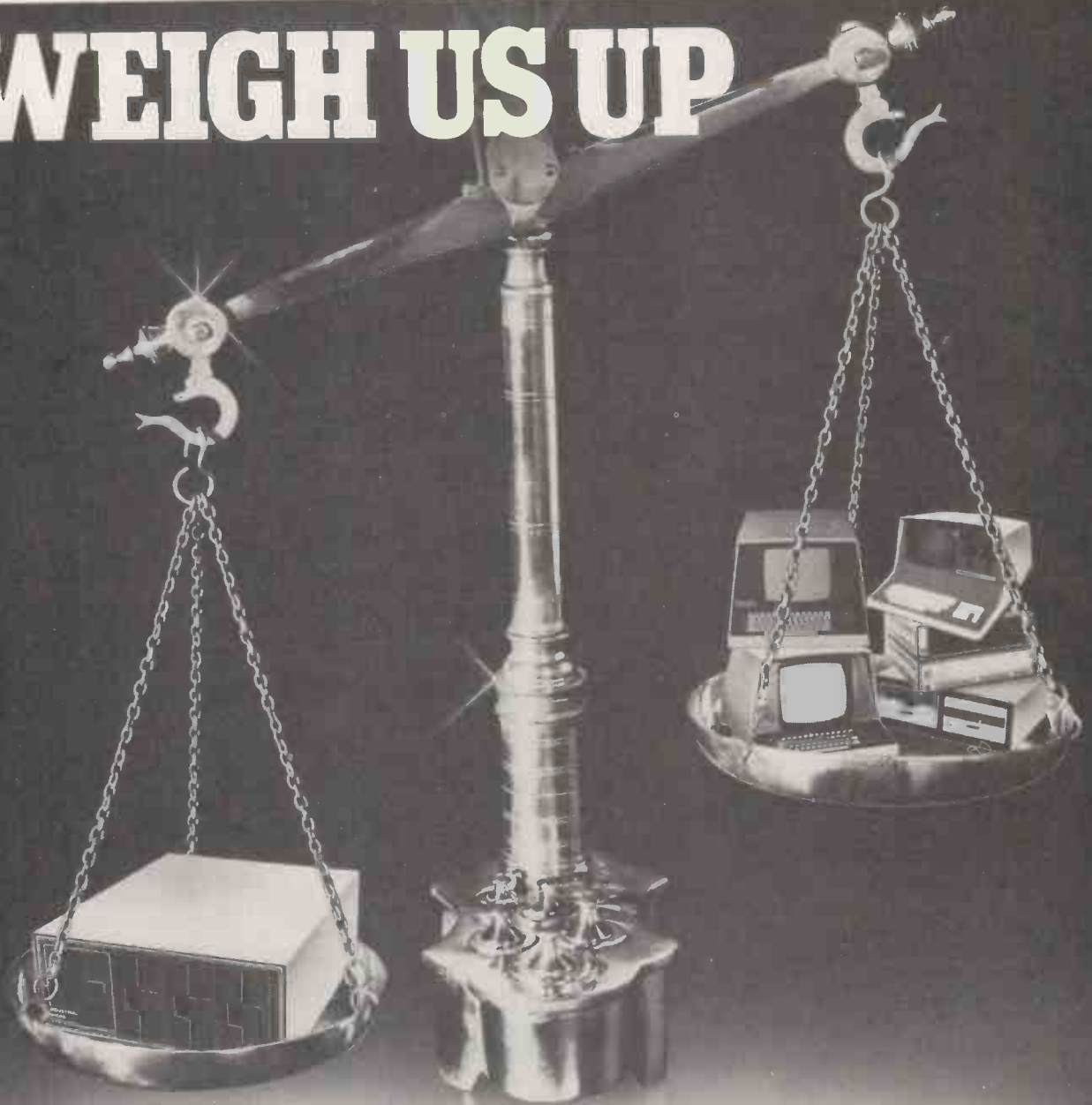
By employing CMOS technology the device has a very low power consumption. For example, the device will record wind data from a remote site for up to one month on pocket-sized batteries.

For further details contact Northumbrian Energy Workshop Ltd, Tanners Yard, Gilesgate, Hexham, Northumbria. Telephone: 0434 604809.



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UP TO eight VDUs can now be linked to the M-Two computer for parallel input, compared to four previously. This has been achieved without any change in the capacity of the M-Two's 20MB winchester disc, or any significant increase in the system response time. LSI has re-structured the accounting, invoicing, order-processing and stock-control software to take account of this. Now eight simultaneous input transactions to a single item of stored data are possible. LSI Computers Ltd., Copse Road, St Johns, Woking, Surrey. Telephone: 04862 23411.

Dictionary on disc helps the bad spellers

A COMPUTER dictionary which can compete with the full Oxford English Dictionary has been compiled by Compucorp for general business use.

The spelling of as many as 1,000,000 words can be checked and a total of 250,000 can be automatically corrected.

Compucorp believes that the facilities offered by the dictionary are unrivalled. The correcting capacity of 250,000 words is expected to be sufficient to meet most people's requirements.

There are in fact two lists and both have the facility for more words to be added. This will be of most use to people requiring specialist dictionaries of technical, scientific or medical terms.

Spelling follows the full Oxford English Dictionary. If for example you prefer to spell recognise with a "z", the operator can effect this change.

The word lists are held on magnetic disc, and may be accessed by either a word processor or a computer. Words may be referenced on a screen as they would in a book.

The checking dictionary will check everything in its

memory, an A4 page of 45 lines will take 15 seconds. When a misspelling is found the cursor on the screen stops at the end of the word.

Further information on the eight different types of dictionary available can be obtained from Steve Novick, Compucorp Ltd, Barnet House, 120 High Street, Edgware, Middlesex. Telephone: 01-952 7860. □

Willow offers a plug-in toolkit for the Atom

WILLOW Software has developed a utility ROM for use with the Acorn Atom. Simple to fit — the ROM plugs into the spare socket on the Atom board and adds 17 new commands, some of which may be used from Atom Basic. The ROM is designed to add the toolkit-type facilities often found on larger machines.

Residing in the ROM, the utility software does not have to be loaded in the usual manner from cassette and because it requires no RAM for its operation, it will work on an unexpanded Atom. The 17

Piccolo plays the Comal tune

THE RC 700 or Piccolo computer represents a first in British microcomputing. The feature which sets this Scandinavian-built computer apart from the rest is that it is designed and marketed as a Comal machine.

Over the past few years, there has been much debate over the use of structured languages with computer users divided into two camps; the structuralists and the non-structuralists. Until now, though, manufacturers were reluctant to grasp the nettle of adopting a structured language as a standard feature on their machine.

Much of the resistance to structured languages has been because of the ease of Basic; its proponents claim it is easy to use — and it is certainly easy to implement. This has meant that manufacturers have tended to use it in most micros.

Another reason for the resistance to structured programming is that Basic is always readily available. RC computers has now put its money where its mouth is and given the Piccolo a full implementation of Comal.

Comal is a form of structured Basic. It retains many of the forms of Basic but introduces program structures, mainly in the manner by which

control is operated. Comal was developed in Denmark by educationalist Borge Christensen, in an attempt to bridge the gap between Basic and Pascal.

Because of the Comal implementation, the Piccolo will be of most interest to educational computer buyers and this is definitely the market at which the machine is aimed. By providing the structures in the form of procedures, the While and Repeat statements, the Goto statement becomes redundant and students should gain a sounder programming basis.

The Piccolo machine itself is compact. It is Z-80A based, running at 4MHz, and provides 48K of RAM. Apart from the compactness, the main feature of the hardware is the yellow-on-brown display. Pascal and CP/M are also available.

The Piccolo has both RS232 and parallel interfaces — the RS232 is a V24 specification port. Options available include the statutory floppy discs, without which no system is complete, a line selector, a power distribution system, line loader, memory expansion — up to 64K, and various other bits and pieces.

RC Computer, Regnecentralen Ltd, CAP House, 9-12 Long Lane, London EC1. □

commands are: Ren, Auto, Find, Del, Krunch, Key, BSave, Blip, Alert, Size, BZero, BDump, Append, XRen, Dis.

The command set includes some extremely useful facilities including Dis, a full function disassembler which enables the user to convert machine code into assembler source statements. Another interesting feature is Krunch which compresses a program by deleting all Rem statements and unneeded spaces.

Two more functions provide the solutions to two difficult

processes on the Atom. The first of these is Key which provides a keyboard scan. This means that in a program it is possible to check the keyboard to see which key — if any, has been pressed.

The second of these special functions provides the ability to save a Basic program in a format which allows it to be automatically loaded and run.

The utility ROM is supplied with its own instruction manual, and costs £35. For further details contact, Willow Software, PO Box 6, Crediton, Devon. □

TANGERINE Computers has improved the software resident in the Tanel viewdata adaptor to improve its suitability for software. The firm now claims that its adaptor, of which nearly 4,000 have already been sold, will now interface with Apple, Nascom and its own Microtan micros to produce an intelligent Prestel terminal with colour display — at no increase in cost.

Tangerine claims to have captured 78 percent of the adaptor market with the Tanel, which boasts 3,700 sales to date. A further 500 of the devices are still in stock. Now Tangerine is changing the emphasis of its marketing and is aiming to tap the 200,000-strong micro-user market.

Tanel's Peter Harding says that trials with the Apple done with Apple dealers Blythe Computers of Suffolk have proved effective, and the re-vamped Tanel has gone on sale.

The improvements to the Tanel are in two areas. In addition to the normal Prestel adaptor facilities, which allow the micro user to treat his micro as a dumb Prestel terminal, it now offers full-colour capability and the ability to use

Zilog boosts Z-8 series

THE ZILOG Z-8 family of eight-bit micros has been supplemented by four new processors.

The Z-8611, Z-8612 and Z-8613 offer double the memory capacity of the Z-8601, Z-8602, and Z-8603. The Z-8681 is a processor chip configured to operate from external memory.

The new chips together with the existing Z-8 series will cover all single-chip processor needs from the simplest to the most complex according to the manufacturer.

The Z-8611 is a single-chip microcomputer with 4K of on-board ROM, 32 I/O lines and has the capability to address up to 60Kbytes of external program and data-memory. There are 124 general-purpose registers, four I/O port registers and 16 status and control registers. The chip requires a +5V power supply and all pins are TTL-compatible. □

Tangerine soups up Tanel as its rival hits the shops

the micro keyboard's full alpha-numeric set.

In effect, this means that anyone with a suitable micro and the Tanel could become an IP, information provider. Connection to the micro is effected through the DIN socket at the back of the Tanel.

Meanwhile, Tanel's main rival, the Ace Telcom, has reached the shops. The Telcom, which is manufactured by Radofin's Hong Kong factory and distributed by Ace, is designed in the first place as a viewdata adaptor and is wired for an RS232 interface — though there is no output in the current model.

The Telcom will soon be accompanied by its own 40-column printer which will cost between £125 and £150. A keyboard is also under development, which will be similar to the Cherry keyboard but will cost less. This is considered the first stage in a move towards Radofin's own micro, which is planned for



The Ace Telcom viewdata adaptor — rival to Tanel.

1983. It is expected to attack the same market as the Commodore Vic but with a strong viewdata bias.

Radofin, which is a 51 percent British-owned company, has a strong U.S. interest and is monitoring closely AT&T's moves towards establishing new American standards for viewdata. AT&T recently published a document titled *Prestation level protocol* which describes its own ideas on viewdata protocol and is now the subject of negotiation between British and European

PTTs and the U.S. corporation.

This document is, however, thought to lack precise details of the Americans' thinking on viewdata, though AT&T has put several years' research into the subject and is thought to have developed a 1200/1200 baud duplex modem on a chip for exactly this application.

Radofin will, however, be making a consignment of its adaptor available in the States, later this year, unmodified except for the U.S. 110V requirement. □

Hullforth fosters programming skills

HULLFORTH is a compiler/interpreter based on the language Forth which was invented by Charles Moore in 1970. Initially designed to run on Nascom micro-computers, the new compiler/interpreter can run on other systems provided a few simple modifications are effected.

Although most programs written in standard Forth will run on Hullforth with some modification, this implementation differs from standard Forth in a few important respects, and internally it is totally different.

Forth and Hullforth share the same advantages: that is the facility for developing complex software at the keyboard; the speed of Forth is also a common benefit. Those programmers interested in structured programming will be attracted by such control statements as Begin, Until, If, Else, Endif, Leave. It is a lan-

guage which fosters good programming skills — in Hullforth there are no Goto statements.

Hullforth is approximately 7K in size, including variables and stacks, but not dictionary space. The program is configured for a 16K machine but will run in a limited fashion on an 8K one.

The program is supplied in CUTS format at 300 baud on cassette and will run under either Nas-Sys or Nasbus. All that is required to run Hullforth on another non-Nascom Z-80-based system is a keyboard-to-A routine. That is a routine which prints the character in A on the screen, and a routine or series of routines which read and write to cassette in CUTS format.

The price is £25 and includes a cassette, documentation and updates. Further details: A FT Winfield and P S Cain, 148 Goddard Avenue, Hull HU5 2BP. □

Pet system is a real gem

A SOFTWARE package for the jeweller is now available on the Pet microcomputer and will soon be available on both the Apple and the Superbrain. The system has been running successfully for the past year in two jewellers' shops on a 32K Pet with a 3040 drive and a standard printer.

The program performs a whole series of functions some of which are individual to the jewellery trade. There are eight main options: add to or remove an item from stock, modify stock records, review stock records, add or delete stock records, review low stock items, gold-rate calculations, change shop discs, review financial records.

In effect, the package is a standard stock control package with a few facilities added for jewellers.

The package is available from TSMS Ltd at First Floor, The Parade, Frimley, Surrey. Telephone: 0276-23054. □

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The long-awaited 5Mb and 10Mb mini-Winchester drives are available now from Hotel Microsystems. The greatly improved speed and storage capacity made available by the mini-Winchesters now make realistic many applications, especially business and multi-user systems, for which floppy drives were too small, too unreliable or too slow.

XCOMP S100 controller

The XCOMP ST/S Winchester controller is a custom designed microprogrammable controller which consists of two S100 bus printed circuit boards. The ST/S controller is compatible with the 5 and 10Mb disk drives. These drives are formatted with 32 256byte sectors per track. With four heads and 153 cylinders the drives provide a formatted capacity of 5.0 megabytes.

Software: HMSOS or CP/M

Users have a choice of software; either the high-performance HMSOS single/multi-user operating system or CP/M.

Complete upgrade for Horizon

An upgrade kit for existing North Star Horizon owners contains all the hardware required — three S100 cards and the drive itself. Fitting to the Horizon is straightforward — no soldering is required and the Winchester is held by the same screws as the floppy drive it replaces.

HMS S100 power card

The mini-Winchester drives require higher supply currents than floppy drives. We have had an S100 card designed which provides the necessary supplies to connect to the Winchester.

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Prestel initiative will remove the barriers

PRESTEL HAS provided the initial impetus for the establishment of a national computerised information service and has started to dissolve the psychological barriers to computer terminals in the home. Perhaps even more importantly, the advent of Prestel has caused a great increase in the availability of cheap modems — albeit in most cases for use only with viewdata systems.

Consequently, many microcomputer manufacturers are busily creating viewdata interfaces for their machines, all of which have the potential for telesoftware reception.

In 1977 CAP/PPP made the first experiments with Prestel telesoftware for business users based on its Micro-Cobol operating system. In 1979 the Council for Educational Technology, CET, began work on viewdata telesoftware for education and published the *Format recommendations for Prestel telesoftware* in October 1980. CET has also designed a viewdata telesoftware system for the Research Machines 380-Z.

This system has been installed in several schools throughout the U.K., and CET is closely monitoring the use of 25

Mike Brown argues that telesoftware — the automatic transmission of programs and data to microcomputers — promises to be one of the most important developments in software distribution of the last decade for both computer hobbyist and educational or business user.



computer-assisted learning, CAL, packages available on its Prestel database — *211#. Recently, other information providers, IPs, have begun to plan Prestel-based program distribution systems.

An article by Peter Blower in *Practical Computing* August, 1981 made a comparison of three existing telesoftware formats and suggested a fourth. The arti-

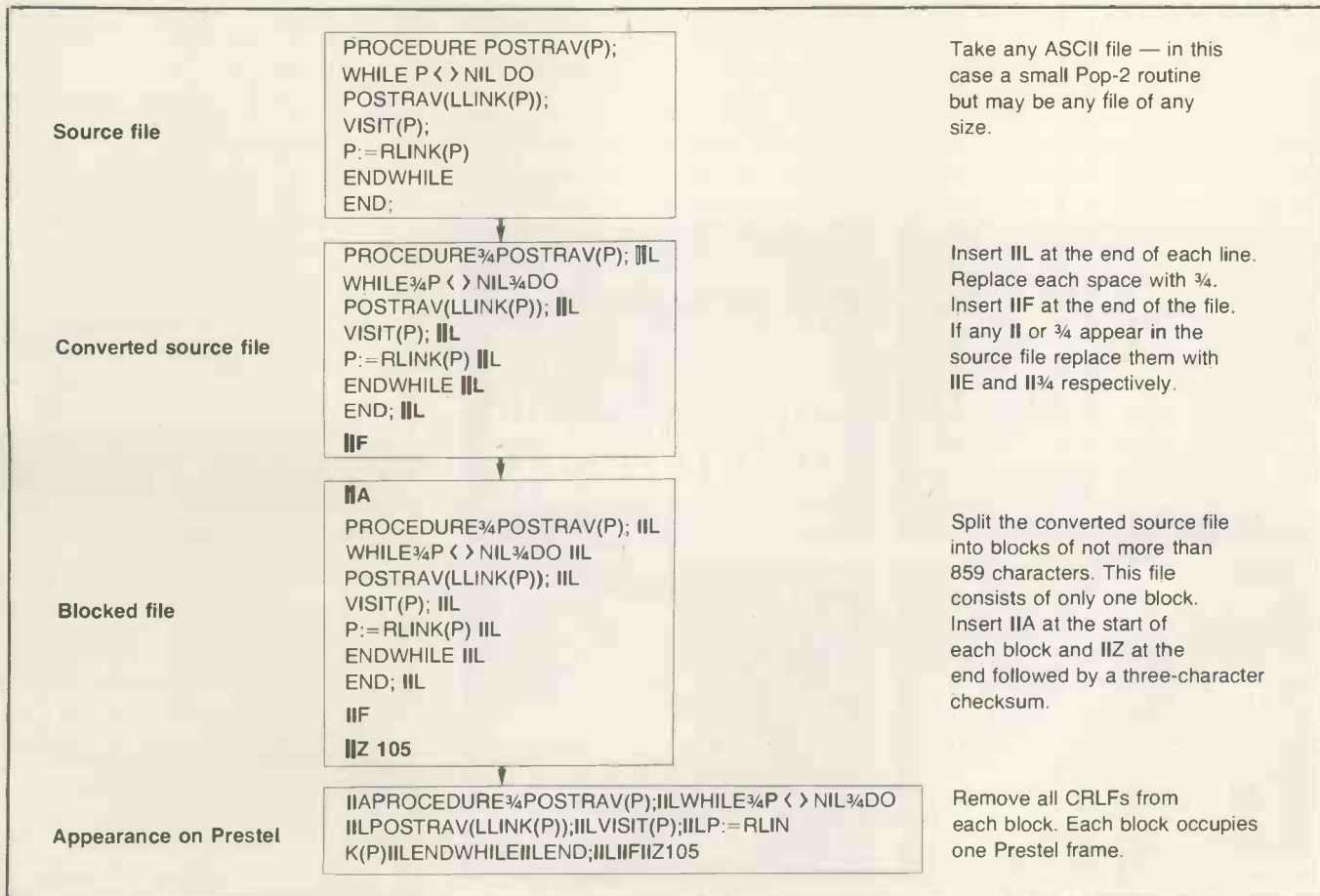
cle contained a number of inaccuracies and misconceptions which I would like to rectify briefly before moving on to a wider view of the evolution of a realistic telesoftware service on Prestel.

The document *Format recommendations for Prestel telesoftware* was the result of a number of discussions between CET, Prestel, Commodore, Research Machines, Cromemco, ITT, BBC, IBA and educational software agencies and represents 14 months' experimentation.

It is this format which is used by CET for all programs on its database and is likely to be used for those of the BBC computer literacy programme and Acorn Computers. It was published so that other interested parties could benefit from the CET research.

The document simply defines an *(continued on next page)*

Formatting a file for transmission via Bristol.



(continued from previous page)

"envelope" inside which any data may be sent so long as it can be represented as a sequence of seven-bit characters. This includes all dialects of all high-level languages, any data files and any machine-code in Hexadecimal notation.

The interpretation of received data may be performed by any operating system and the quality of the interface with the user is limited only by the imagination of its designer. This protocol is designed primarily to maintain the integrity of the character stream between the IP and the receiving terminal. That is, to enable a viewdata system to deliver files efficiently as a sequence of discrete data packets whose contents are not interfered with by the transmission system. This allows simple but effective error detection.

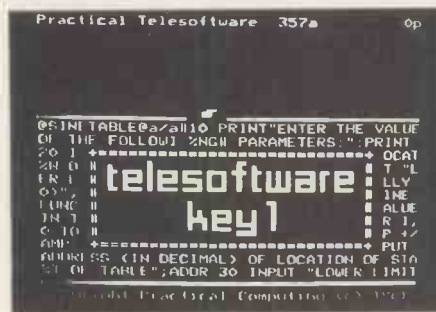
Prestel only sends a carriage-return-line-feed, CRLF, after lines of 38 characters or fewer. Trailing spaces — perhaps valid program characters — are lost. Therefore, these spaces are transmitted as `||` so that no CRLFs interfere with the character stream within a block.

Blower's suggestion that such interpretation is specifically dependent on a Basic operating system and that most computers would find it too complex a task is obviously untrue. Equally incorrect is the belief that sending programs to Prestel in such a form is a tedious, complex and expensive business: we have a simple program at CET which does the whole job completely automatically — checksums and all.

The ResD/GEC format has the peculiar page number access to each program block using only the "a" frame of each page. This method is rather wasteful of logical space and, since the page is the

logical unit of storage in a viewdata system, it is a page, as far as possible, which should contain a program. There is no greater flexibility to amend programs stored in this way rather than on continuation frames and neither is there increased security against noise corrupting the sequence in which blocks are received.

The IPC *Practical Computing* format provides no error checking, no packing to save space and reduces the character set available to the user. Blower goes on to outline yet another format every bit as complex as CET's while still providing no packing.



In fact, taking the author's own definition:

The methods of implementation should allow the receiving of software to be reliable, flexible, compact, efficient, inexpensive and as far as possible independent of machine or monitor.

CET's format, when correctly understood, is the very epitome of good software distribution.

The existence of a computer-readable index of all programs on Prestel, suggested by ResD/GEC is very important. This would allow an intelligent terminal to locate automatically and pull down a

program previously specified by the user. This index should be designed with great care and precision.

It should hold details not only of filename, language, target machine and start page, but also of size, cost, application area, etc., so that the user may use his intelligent terminal to search on a number of parameters for the software he wants.

It would be appropriate that such an index — which may easily be superimposed on the CET format — be maintained by Prestel alongside an alternative conventional hierarchical index through which potential customers may browse.

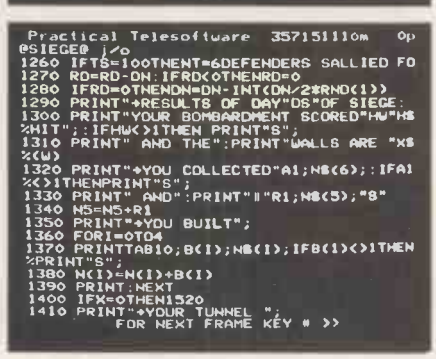
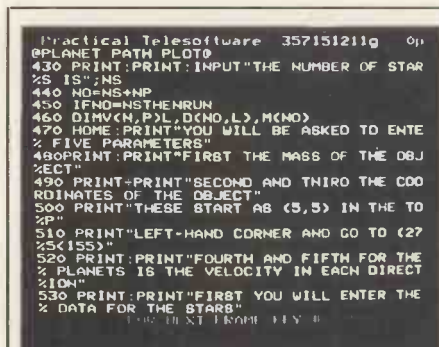
Readability is the basis of Blower's own format suggestions and the main platform of his criticism of the CET and ResD/GEC formats. There is a school of thought which maintains that all information on Prestel, whether or not it is intended for computer consumption, should be capable of being read by humans and, as a consequence, any computer programs should appear as listings, neatly laid out, indented for clarity and even colourful. If, in this form, they happen to lend themselves to automatic retrieval by an intelligent terminal, all the better.

This is not, I believe, the most sensible approach to telesoftware. There is no feasible compromise between readability and "reliable, flexible, compact, efficient and inexpensive" software distribution. There may well be a market on Prestel for readable program listings which can be scribbled down from the screens of conventional viewdata sets and typed into home computers. This must not, however, be confused with, or allowed to interfere with, the potentially much more powerful automatic distribution of software which is a direct computer-to-computer communication.

Many IPs may decide, quite properly, that the small number of intelligent terminals around at the moment will not justify their providing an automatic software distribution system and that colourful listings are a much more lucrative venture.

Others, like CET, are concerned with the development of intelligent terminals and with powerful facilities which can be superimposed upon national viewdata networks and therefore see streamlined automatic distribution as the more valuable avenue to explore.

There are now several parties around the country engaged independently in the field of telesoftware. The lesson to be learnt from the exchanges of the past few months is that a dialogue on a national level is essential, involving users, IPs and computer manufacturers as well as Prestel representatives, so that the development of telesoftware is discussed and directed rather than being allowed to take a number of diverse paths. The question of readability, having no bearing on telesoftware, would, I hope, not feature in such discussions.



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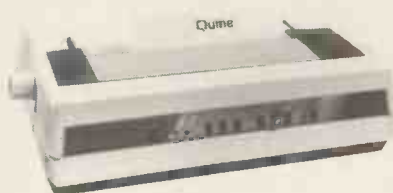
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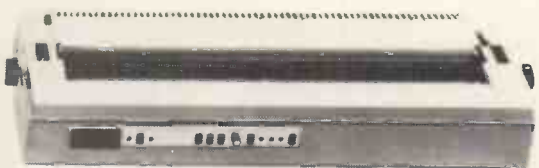
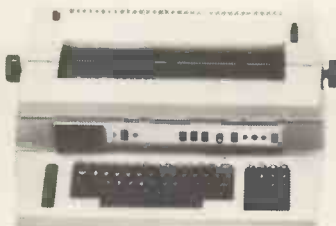
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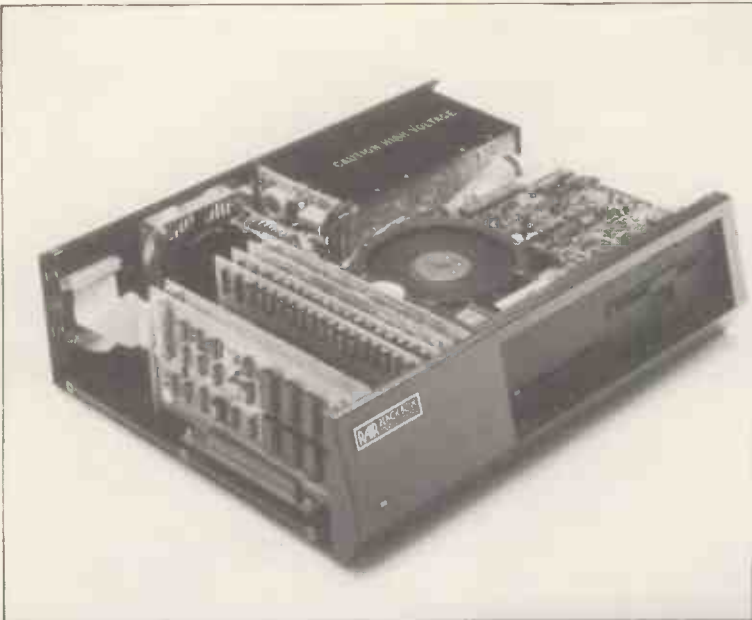


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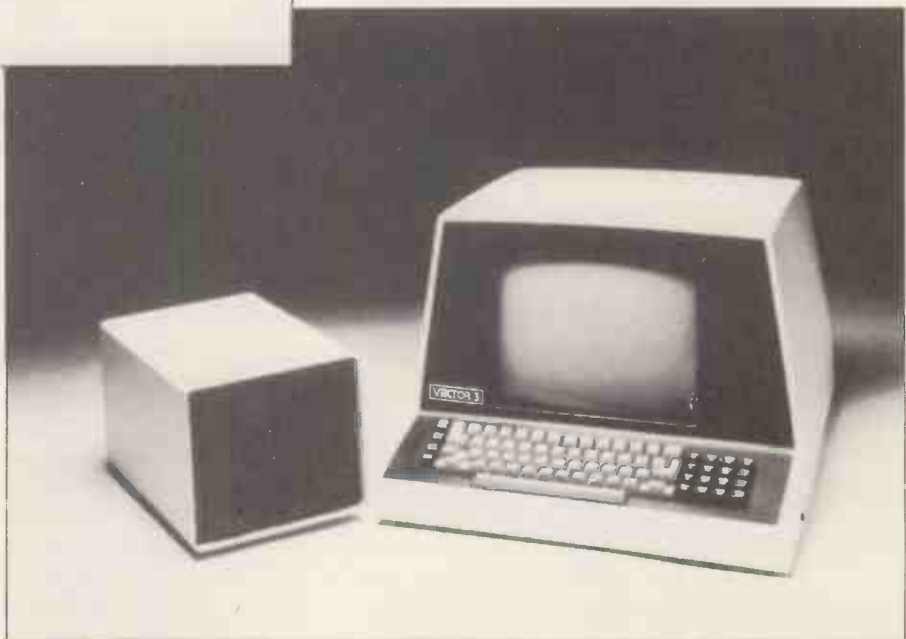


● Circle No. 145

Rair 3/30 v. Vector Graphic 3005



The hard-disc war is on. With Superbrain, Apple and Pet pressing at their heels, two companies, Rair and Vector Graphic, have each already laid claim to being the first in the U.K. to offer the new Seagate 5.25in. 5MB hard disc as part of a working micro system. Chris Bidmead umpires the contest by putting the U.S. and British offerings side by side for assessment.



The battle of the hard discs

ALMARC DATA Systems, the sole British distributor of the Vector Graphic range of computers from the States, weighs in with the Vector 3005, while in the British corner, Rair of Black Box fame puts up its 3/30.

To obtain some idea of the capacity of the Seagate 5.25in. 5MB hard disc in practical terms, you can think of it as 20 of the latest mini-floppy surfaces in one drive simultaneously.

This impressive capacity offers another important advantage — fast access time which speeds lengthy disc-crunching activities like compilation and greatly rejuvenates programs which rely on overlays.

The Seagate is sized to fit exactly into

the housing of a standard 5.25in. mini-floppy, replacing it at something like four times the cost. Specially-designed disc-controller boards hook the device into CP/M, where a new and expanded BIOS is necessary — the machine-dependent section of CP/M — incorporating more sophisticated error checking.

The speed advantage offered in any given system depends on the success of this hardware/software bridge to the operating system, and a considerable amount of research and development has gone into making it work. The result, on both the Rair and the Vector Graphic, is impressive. This is how discs should be.

Alongside the Seagate, the machines each incorporate a Tandon support

floppy disc drive, mounted vertically in the Vector Graphic and horizontally in the Black Box. The Vector Graphic one is a quad-density device, configurable as either double- or single-sided, squeezing a very useful 600K on to its 77 tracks and 16 hard sectors.

The single-sided mode is an option offered to maintain compatibility with the Micropolis II formatting used in earlier Vector Graphic machines, although users who have taken advantage of the older drive's remarkable tolerance to double- or even single-density surface certifications will find the Tandon far more choosy. It is also inclined to eat the middles of floppies unprotected by central reinforcement rings.

The Rair floppy disc, though double-sided, is soft-formatted to Rair's standard, and has a capacity of only 256K. As power-up boots the machine on to the hard disc automatically, Rair regards the floppy as stand-by only, but its limited capacity may well be a problem when the necessary precaution is taken of backing up the hard disc.

Rair supplied us with a box of diskettes which turned out to be single-sided, which, on formatting, threw up a few bad sectors.

The physical appearance of both machines has been blazoned over full-colour advertising pages in recent issues of this magazine. Attempts to glamourise the Vector Graphic do not really conceal its utilitarian origins as a work-horse scientific computer, and the truth is that the sleek low dark lines of the Rair win hands down where looks are concerned.

To be fair though, the Black Box has no elegantly matching terminal, and the Hazeltine VDU Rair provided for this review gave the same impression in its styling as the Vector console.

The Rair advertisements invite you to "look inside its modest enclosure", an invitation not anticipated by the designer, who has discouraged this kind of exploration by fastening down the lid with no less than 12 small screws.

Nosing around inside

The lid, which forms the top and two sides of the case, has then to be flexed to unhook a flange on either side. The same thin steel forms the base of the cabinet, — and without the lid to give the construction the necessary rigidity, the case is easily deformed — which articulates the boards in their motherboard. The machine is definitely not designed to be carried, or used, with the lid off.

Once inside, you are on your own — there is no hardware manual, and the chap at head office seemed to think we were being somewhat nose-ty to ask for one. The architecture supporting the 8085A central processor is Rair's own, and the company is clearly not keen for it to become public property.

The I/O board on the review machine, for example, was expandable from a four-user to an eight-user system by the addition of four standard chips, but the chip addressing for the empty spaces was locked out by an inscrutable Rair PROM, whose function is to make sure you touch home-base for your upgrade.

If other manufacturers cut development corners by sneaking a look at the Rair hard-disc implementation, the chips on the disc-controller — the only U.S. board in the machine — were sealed under a mysterious plastic case.

The bus is non-standard, and the well-made boards are an original Rair design, constructed, like the rest of the machine, in the Rair factory in London's Camden Town.

Vector Graphic's philosophy is very different. A standard architecture, based on the S-100 bus, has been the basis of its hardware since the early 8080 machine, the Vector 1. This is a more expensive way of laying out a computer than Rair's internal arrangements, but it has certainly paid off in enabling Vector Graphic to progress naturally to the Z-80 processor.

The documentation of this hardware is extensive, forming one massive ring-

Prices

The basic Rair 3/30, with one bank of 64K, costs £3,750. Hazeltine 1420 terminals are £525. Each 64K increment up to a maximum of 256K cost £500 extra. The I/O expander is another £100 and each additional port pair is £150. This means that the cost of the simplest configuration, including the terminal and some start-up software — say, Basic and a decent text editor like Edit-80 — is around the £4,500 mark. The Vector Graphic 3005 system, including console, systems software and Microsoft Basic is £4,750.

bound volume. A second volume details the software, much of it Vector's own.

Listings for the 2K PROM monitor, complete bus specifications, board layout and circuit diagrams form a thorough if somewhat unco-ordinated run-down on the whole system. Significantly, the only corner left unilluminated by this dazzle of documentation is the new disc-controller board, whose secrets have been shielded from inquisitive eyes by the simple expedient of shaving off the chip identification numbers.

The Vector is in two parts; the computer-cum-console, and, straggling at the end of a pair of ribbon cables and a power line, the dual-disc unit. Each cover is held in place by four bolts and opens easily to show the works. The Vector 3 console is an interesting example of the kind of space-saving the new technology makes possible.

For though only millimetres larger than the mindless terminal which serves the big rectangular System B, most of the larger machine's power has been packed under the Vector 3's trapezoid hood, with enough space left for two more S-100 boards.

The IBM-style lay-out of the Keytronics capacitance keyboard is retained, and the screen now has an anti-glare shield fitted as standard, producing white on black definition as good as any we have seen.

Unfortunately, the screen on the review sample suffered badly from that slow, seasick-making drift of the image which often results from interaction between a cathode ray tube and a transformer driven by British mains but designed to run at U.S. ratings.

Rair's Hazeltine VDUs exhibited the same "transatlantic swim", but low-cost, all-purpose serial consoles are never very easy on the eyes. A rock-steady screen image is an important feature of the Vector Graphic memory-mapped architecture, and we understand that Almarc is

now fitting metal screens to overcome the problem.

The Rair Black Box and its two terminals produced interaction headaches of a different kind, though whether one sees this as poor systems design or the necessary price of versatility is a matter of semantics.

Certainly, the hardware connections to the ports have a distinctly improvised feel to them: at the rear of the Rair, an unhelpful 37-pin socket hosts the Rair I/O expander box — a small, flat mounting for eight standard D24 plugs wired by a length of ribbon cable, as if the services of the designer were not available when Rair decided to go multi-user.

On the review machine this then offered four standard two-way RS232 interfaces, driven by programmable I/O chips on the internal I/O board. All the TTY ports are buffered, so that consoles hung on to the system will still accept commands while the processor is busy elsewhere. This went some way to speeding up the dialogue with the Hazeltine.

All things are possible

Given the flexibility of the Hazeltine at one end, and the chip, set up through a transient command called Set, at the other, all things are possible. Set allows software-parameter setting on any of the TTY ports, so that they can be re-configured in respect of any of the following: parity, baud rate, print width, soft handshaking DC3/DC3 — as well as other variables to send nulls and accommodate echoing and backspace protocol.

One Set command, Binary, controls whether port output and input is treated by the terminal as a literal binary code or as special instruction.

The interaction problems mentioned arose when we discovered that Binary had unfortunate consequences in running programs like DDT. If it was switched in, Control C return to command level was disabled. Binary has to be set, on the other hand, before entering Interpreter Basic, if the programmer is not to be dropped back into command level at each Control C interrupt.

This was hard to live with during our brief acquaintanceship with the machine, and life was further complicated by another Set parameter, Uparrow, without which ASCII characters are acted on literally by the terminal.

Additionally, the Hazeltine 1420 used tilde as a command lead-in character, with disastrous effects on a DDT dump — a switch on the terminal offered Esc as an alternative, but this fouled WordStar.

The practical consequence of all this is that, on the Hazeltine at least, the user is obliged to review his console Set parameters for every program he runs, as the price of the flexibility the Black Box provides.

The Vector Graphic avoids these prob-

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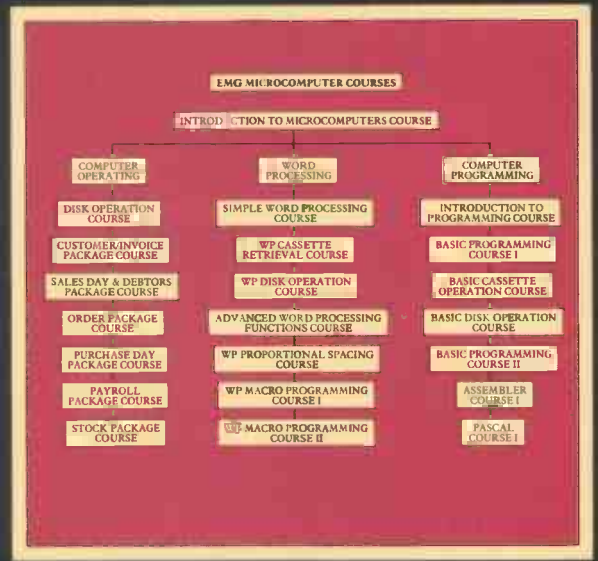
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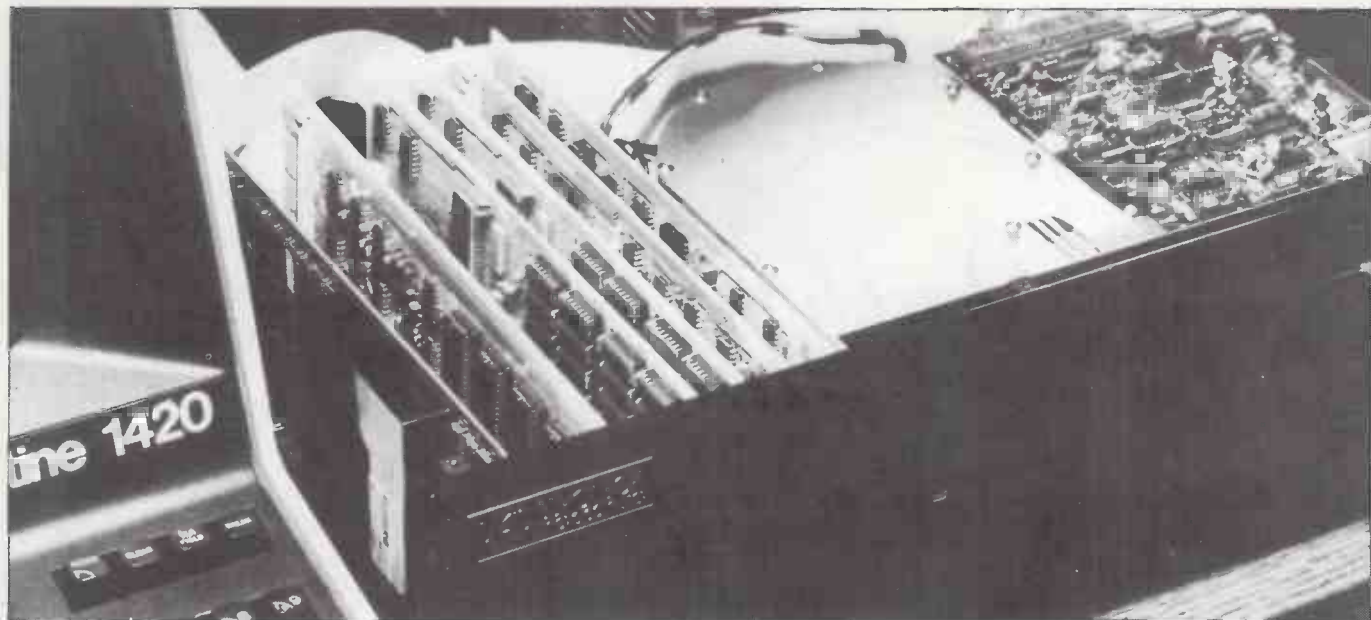
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(continued from page 57)

lems by restricting its I/O on the standard product to communication with the dedicated console and a single additional RS232 interface, the baud rate of which is set by an internal DIL switch.

Limiting the hardware environment has enabled the manufacturer to supply some extremely useful systems software which has no counterpart on the Rair. We have already mentioned the 2K monitor, which has provisions to do much of DDT's work without overlaying the operating system or making inroads on the TPA, so that, for example, transient programs or CP/M itself can be dumped to the screen in Hex or ASCII, and re-programmed in mid-flight.

The monitor can be supplemented as required by a .Com debugger called Raid — not to be confused with the Lifeboat product of the same name — which runs independently from the operating system and is re-locatable. Raid provides a stable memory-mapped window on the Z-80 chip, dynamically displaying all the register contents as the target program is disassembled and simulated.

Scope for editing

CP/M's ungainly Ed text editor forms part of the Vector Graphic standard operating package for what must be purely sentimental reasons, because the manufacturer includes as standard a really excellent full-screen editor called Scope for the manipulation of text files like assembler source code.

Scope works very like WordStar in its non-document mode, without the danger of including the invisibly high-bit-high ASCII characters which cause problems with some assemblers. Scope also offers on-screen line numbering and a well-designed library facility which enables disc files or defined parts of disc files to be patched in and out of the working file as required.

As well as scrolling or paging in a vertical direction, Scope text may be scrolled horizontally to a width of 255 characters.

Also included as standard in the Vector Graphic package is an extended Z-80 version of the CP/M ASM assembler, and the excellent Microsoft Basic-80.

Basic is an optional extra on the Rair machine, as, indeed, is all the software except CP/M itself. Rair offers MP/M as an additional operating system for users accessing the machine from different consoles. We had doubts about the philosophy of time-sharing an inexpensive and plentiful component like an eight-bit processor chip, particularly when the operating system is making significant demands of its own on the processing power in deciding whose turn it is next.

We, however, approached MP/M with an open mind, particularly interested in its ability to initiate a processing routine and then detach it from the console. A lengthy compilation, for example, can be left to brew while the user writes a letter.

Unfortunately, Rair MP/M, as delivered to us in its 1.1 version, was fragmentary and flawed, with many of the more interesting modules like Schedule omitted. Missing, too, was Gensys — Rair is apparently not keen that the user should re-configure MP/M for his own use.

Standard MP/M has its own version of DDT called MDDT, but in the Rair version MDDT's breakpoint setting did not match the re-start declared in MPM.SYS, and its Tn instruction failed to work.

In practice, MP/M ran sluggishly on the two terminals provided, and surprised us by being able to create duplicate file names in the directory, which played havoc with WordStar. In the short time the machine was available for review, we were not inclined to pursue MP/M further.

CP/M documentation was never good, and Rair continues the tradition of offer-

ing bunches of updates without much or any indication of which pages of which documents are being replaced. Rair's added software modules are not identified as such in the documentation. They are, however, sometimes evidenced by their non-standard idiosyncrasies that, though trivial in themselves, accumulate frustration in the user familiar with standard CP/M.

Unfriendly design

For example, where CP/M as standard practice throws back commands it does not understand, appending a question mark and returning the user to the same level, Rair's MakeCP/M, after a lengthy interrogation of options, rejects a lower-case response to DESTINATION DRIVE by junking the input data and returning abruptly to command level. If you respond with "B:", MakeCP/M repeats its question, leaving you in doubt as to whether it has accepted your command and is inviting a repeat with another disc, systemising in batch mode as with CP/M's standard Sysgen.

In fact, MakeCP/M has rejected your input and looped back, waiting for a single alpha character without the colon, though it may take you several attempts before you discover why CP/M is not appearing on your discs. This is hardly user-friendly program design, and the felony is compounded by the inclusion of a Format program which will only discuss the discs in terms of numerals, and only then if a colon is appended.

There is some sense in the use of numerals here — though not in the inconsistent use of the colon — to distinguish between physical and logical disc drives. Yet to discover this, you have to work your way through three conflicting versions of the Format documentation.

This and other minor irritations delayed our using the machine as an

(continued on page 61)



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SOME OFTEN-ASKED QUESTIONS

Q: What drives?

A: BASF double-sided, double-density 8" drives.

Q: How do I copy programs from 5¼" to 8" disks?

A: A utilities disk that provides a direct copy program for DOS 3.2 is supplied. DOS 3.3 files are transferred using FID (on the Apple System Master Disk). Pascal programs can be copied by using the Pascal Autoboot utility (£75).

Q: Is MEGASTOR any faster than 5¼" disks?

A: Yes. A program will operate faster on MEGASTOR than on mini-disks.

Q: Can I run mini-disks and MEGASTOR together?

A: Yes. The MEGASTOR can be used stand-alone, or in combination with mini-disk drives.

MEGASTOR software available from VLASAK:

LEDGERS: fully-integrated, 1500 accounts, 6000 transactions/month, Open-Item, or Balance-Brought-Forward.

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(continued from page 59)

everyday tool, and it was several days before we powered up Pascal on to the Rair.

Writing source code while wrestling with the shortcomings of ED is a pastime for long winter evenings, and we are grateful to the Software House for the loan of an evaluation copy of Edit-80, a line editor from Microsoft with facilities that are an extension of the excellent Edit command in Basic-80.

What Rair describes as Pascal-80 is in fact a minor adaptation of MT+ Pascal, a re-christening designed, we gather, to emphasise its REL file compatibility with Microsoft's Cobol-80, Basic-80, and Fortran-80 languages.

Although the documentation of the Rair version was still in the draft stage and time precluded prolonged experimentation, Pascal-80 is evidently a powerful implementation with excellent diagnostics. Like Cobol-80, the compiler is divided into overlays, but in Pascal-80 their use is controllable so that different overlays may be pulled in from different discs, or execution suspended while discs are changed.

This elaboration was not exactly appropriate to the hard-disc environment of the Rair, and did not work entirely as documented: there are five overlays, but the compiler's command line reader did not understand the figure 5.

Word processing effort

Extensions include the usual addition of a dynamically-dimensioned string type, and a highly un-Wirthian byte type to provide a handy meeting ground for characters and numerals. Intel assembler mnemonics can be included directly in the source code, following the reserved word "inline".

One useful touch is that although the language extends well beyond ISO standards, the compiler can be switched to flag non-standard constructs so that the programmer knows when he is straying beyond the bounds of portability.

Word processing is offered as an extra on both machines. Rair's is the ubiquitous WordStar, which worked reasonably without special re-configuring on the Hazeltine's provided. Rair has encased the standard WordStar manual in a shiny black cover. However, there has been no attempt to customise the software, so that, for example, the cursor keys on the Hazeltine remained inoperative, and there was no initialisation of the screen to bring it up into highlight mode. Before every run of WordStar the Set parameters of the TTY port had to be checked to ensure that crucial ASCII codes like Control Q were not being trapped.

This badge-engineering approach compares unfavourably to the genuine systems design offered by Vector Graphic. Memorite III is a hardware-dependent, word-processing program designed

for the Vector Graphic from the ground up.

Given the limited customer base for Memorite, it seems remarkable that it should have received the programming effort to become as good as, and in some important respects, better than the far more widely-portable WordStar.

Memorite differs from WordStar in not reproducing the print format on the screen, and in limiting file length to the size of user memory, somewhere around 30K.

These limitations have their compensations: formatting, even of complicated lay-outs like television scripts, is extremely simple and quick; the screen always shows as much text as it can, irrespective of how much white space is to appear round it on paper; and fewer keystrokes are necessary to key in special command characters.

Excellent file handling

File handling is excellent — the directory offers a kind of chest of drawers where each file is labelled with its name, author, a short description field, number of revisions, date of creation, date of last revision and a code to indicate whether the file is Protected from erasure or Secure against a password defined by the author.

CP/M-style ambiguous file names may be used to display subsets of the main directory, and the author field is allowed to be a further ambiguous or unambiguous defining factor.

Memorite and WordStar depend heavily on overlays, and so both benefit from the fast transfer provided by the Seagate drive.

The new technology has, however, one or two disadvantages.

Though described as silent, the drive is in fact several db noisier than an ordinary internal fan, and in quieter-than-average office environments it will have a definite acoustic presence.

Whereas diskettes can be physically organised in indexed trays or boxes, a hard disc easily becomes a kind of alphabet soup of program files, data files, back files and old junk. Even for the single user, the CP/M 2.2 division of disc space into separate user areas becomes a valuable way of organising files.

Unfortunate bug

This is rather better implemented on the Vector Graphic, which, in addition to allowing the hard disc to operate as two separate logical discs, includes a facility for accessing files on User 0 from any other user level by preceding the command with a dot.

We ran into an unfortunate bug, though, which caused Submit files run on the Vector Graphic to produce a system error on attempting to warm-boot back to command level. We gather that Vector Graphic is aware of this problem and

future versions of Putsys will have fixed this.

A hard disc is profligate with its space. Disc systems allocate their space in blocks, and the bigger the disc capacity, the bigger the blocks tend to be. Rair has configured its Seagate to work in 64 record blocks, which means that the smallest disc file is 8K.

Vector's blocks are half this size, so the minimum CP/M Save of one page will Stat at 4K. In both cases, the accompanying Tandon floppy drives use the typical double-density configuration of eight record blocks, with the result that the same file will give a different Stat size depending on the drive on which you save it.

Memory limits

Probably the most serious disadvantage of the Winchester is that it needs an extended BIOS, making inroads on the TPA.

Both Rair and Vector Graphic have been obliged to expand the operating system from its usual 8Kilobytes to something around 10.5Kilobytes including the CCP.

This overhead will almost certainly make little difference to Rair users contemplating an upgrade, but as the Vector Graphic begins as a 56K machine, there may be hazards on the upward path for Vector's existing customers.

For instance, Memorite III limits document size to the size of available memory, so it is possible that for old Vector hardware to have created one or two text files which will not load in their entirety into the new machine.

For similar reasons, software which makes large demands on working space may find itself elbowed out altogether by the new operating system. Microsoft's Cobol, Basic and Fortran present no problem in this respect, but Pascal in the Ithaca InterSystems "Z" implementation returns PROGRAM TOO COMPLEX when invited to compile the simple "Hello" test file on the Vector Graphic 3005.

Conclusions

- The Rair offers some features not available on the Vector Graphic — notably an extra 8K of workspace and software-reconfigurable TTY channels.
- The Vector Graphic hardware is complete and ready to go, and takes advantage of the fact in offering very useful dedicated software like Raid and Scope.
- Both machines make good use of the 5.25in. 5MB Seagate mini-Winchester drive, which drastically reduces waiting time in disc-intensive programming.
- The Rair 8085A chip will not run some of the more recent Z-80-based software like Silicon Disc and SuperFile.
- The U.S. machine seems to offer better value, but this may change if the pound continues to fall against the dollar. □

Until recently, VisiCalc's many admirable qualities have been enjoyed only in the preserves of the Apple and Pet communities. The arrival of several CP/M packages which mimic VisiCalc's attributes has now opened its flexibility to a wider audience. Chris Bidmead tests four of them: Report Writer, ExecuPlan, T/Maker and Target.

VisiCalc look-alikes

CP/M SOFTWARE tends to be of the grown-up variety: mature, unexciting and, in comparison with cassette-based games packages for the fun micros, expensive. Business users who have spent time with software which is immature, exciting and cheap will no doubt welcome the relatively more stately development of CP/M systems.

Yet with the recent arrival of VisiCalc, it is likely that they have found themselves casting envious eyes in the direction of the Apple and Pet fraternity.

VisiCalc hit the market with a bang as an all-purpose tool which any businessman could use without having to join the computer priesthood. It may make the CP/M aficionado feel special and intelligent to be able to plumb the depths of

B:PIP A: = B:PIP.COM [V]

with all the flexibility of control that kind of knowledge implies, but in acquiring that knowledge, you are not running your business, making money or even being good company. VisiCalc is not instant computing — the user still has to learn a language of sorts, but it is certainly a more direct and human approach than, say, acquiring a working knowledge of Basic.

Organised information

In addition, VisiCalc accepts data entry and presents information on the screen in an organised way which makes the typical scrolling Teletype style of many CP/M programs look as old-fashioned as it is.

Should the business user scrap his educational and financial investment in the power of CP/M and start life over again on a Pet? Or run the two systems side by side? Or bury his head in the sand?

Happily, help is at hand. Four sons of VisiCalc running under *bona fide* CP/M are currently available: Report Writer, ExecuPlan, T/Maker and latecomer Target.

Report Writer is a modest attempt to provide printout facilities similar to VisiCalc, and comprises a suite of compact and ingenious Basic programs dedicated to the production of tabular reports.

Like VisiCalc, it formats and manipulates numerical data, as well as accepting and formatting characters for headings and labels, though the results of this will not appear on the screen. Format masks and data are entered separately and manipulated through two-character coded instructions.

A good design idea is the adoption of

	1	2	3	TOTAL
1.0 UNIT'SALES	10000.00	15000.00	25000.00	0.00
2.0 UNIT'PRICE	11.00	11.00	12.00	0.00
3.0 SALES'REV	0.00	0.00	0.00	0.00
4.0 LABOR'COST	0.00	0.00	0.00	0.00
5.0 MATERIALS	0.00	0.00	0.00	0.00
6.0 SHIPPING	0.00	0.00	0.00	0.00
7.0 VAR'COST	0.00	0.00	0.00	0.00
8.0 OVERHEAD	35000.00	35000.00	35000.00	0.00
9.0 MISC'EXP	15000.00	0.00	0.00	0.00
10.0 FIXED' COSTS	0.00	0.00	0.00	0.00
11.0 TOT'EXP	0.00	0.00	0.00	0.00
12.0 PRETAX'INC	0.00	0.00	0.00	0.00
13.0 TAXES	0.00	0.00	0.00	0.00
14.0 NET'INCOME	0.00	0.00	0.00	0.00

EXECUPLAN™

Version 1.2

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----- Calculating Principle and Interest Payments for a Given Loan -----

	Number	Princl	Interest	Tot-Prin	Bal-Due	Tot-Int	Tot-Pay
Loan		30000.00					
Yearly		18.00 % Rate					
Payment		200.00 monthly					
Starting		1. number					

Monthly	Payment	Principle	Interest	Total	Balance	Total	Total
	Number	Amount	Amount	Principle	Due	Interest	Payment
1	1	-250.00	450.00	-250.00	30250.00	450.00	200.00
2	2	-253.75	453.75	-503.74	30503.74	903.74	400.00
3	3	-257.56	457.56	-761.30	30761.30	1361.30	600.00
4	4	-261.42	461.42	-1022.72	31022.72	1822.72	800.00
5	5	-265.34	465.34	-1288.05	31288.05	2288.05	1000.00
6	6	-269.32	469.32	-1557.37	31557.37	2757.37	1200.00
7	7	-273.36	473.36	-1830.73	31830.73	3230.73	1400.00
8	8	-277.46	477.46	-2108.19	32108.19	3708.19	1600.00
9	9	-281.62	481.62	-2389.81	32389.81	4189.81	1800.00
10	10	-285.85	485.85	-2675.65	32675.65	4675.65	2000.00

reverse-Polish logic, which a development of the symbolism devised by the Polish logician Lukasiewicz, who realised you could banish brackets by removing the operators from among the operands and placing them in front. Hewlett Packard *et al.* now put the operators behind: hence "reverse".

The installation of Report Writer was a simple matter of modifying a few of the code lines in accordance with instructions in the very clear and comprehensive manual. Once the principle of the system is learnt and the codes memorised, Report Writer becomes a useful tool for coping with all kinds of jobs involving data entry and tabular formatting.

Because there is no on-screen formatting of data, and because, due to the use of un-compiled Basic, the calculation process is ponderous, the system lacks the immediate appeal of VisiCalc.

Yet at Metrotech's current special price of £95, Report Writer is worth consideration by the many business users whose need is primarily for printed results of repetitive tabular work. Microsoft's older and more compact MBasic4 is a prerequisite.

Metrotech's sale price of Report Writer is almost certainly a response to the arrival in this country of T/Maker. Priced at around double the current figure of Report Writer, T/Maker offers a multi-purpose text editor as well as additional facilities to sort data.

In fact, T/Maker is such a comprehensive package that at a pinch it could probably cope, albeit slowly, with most of a business user's applications, including mass mailing, word processing and accounting. Any CP/M system of 48K or upwards is available and the terminal has some form of cursor addressing and a clear-screen facility.

Complex package

Installation of T/Maker took considerably longer than the Metrotech Report Writer — in part because the package itself is more complicated. The designer, Peter Roizen, also offers what would be a bewildering array of tailoring options, were it not for the excellent documentation of the process appended to the main manual.

The program must first be sized for the amount of memory on the user's machine. This is taken care of by de-bugging the various T/Maker modules, a lengthy process for which a CP/M Submit batching program is supplied. Users without Submit.Com and XSub.Com will have to do this by hand.

The initialisation is then transferred to a module called TModify, which takes the user down eight branches of a main menu for a substantial inquisition on the personal habits of his terminal, and his own preferences for mapping editing instructions to his keyboard. This last facility is very helpful: it is perilously easy to find

	1981	1982			
EX	999.99	999.99			
+	25.80	123.90			
+	2.50	311.02			
+	91.80	21.25			
+	90.82	357.90			
+	245.60	4.85			
+	223.40	1.48			
+	29.56	23.80			
+	12.00	45.90	% change	1983 (est)	
ex	999.99	999.99	999.99	9999.99	
ac1	+	*	!		
ac2		+	prj	+	
=	ANNUAL TOTAL	721.48	890.10	23.37	1098.13

A simple example of the use of T/Maker to prepare a table that:

- (1) Totals two series of figures by column (1981, 1982)
- (2) Derives a percentage change from the two totals (calculated in the equation designated by "ac1"
- (3) Uses this percentage to project (prj) a figure for 1983 based on the 1982 total.

Figure 1.

oneself in charge of a mixed bunch of software which sometimes uses, say, Control O to open a line, and sometimes Control I, or Esc I. If your favourite word processor has accustomed you to Control O to open a line, you can make the same keys behave the same way in T/Maker.

The initialisation process is supposed to leave you with what the suppliers call "a fully screen-orientated system", which lacks only the glamour of reverse video. This may just be possible with some of the more sophisticated serial terminals.

We installed T/Maker on a Vector Graphic and managed to produce a reasonable imitation of the rock-steady, memory-mapped presentation provided by Vector Graphic software. However, because T/Maker is not memory-mapped for reasons of portability, it can refresh the screen image only by blanking and re-drawing from the current line — a nuisance seen at its worst in scrolling upward.

If you do not know about memory-mapping — and thousands of happy users do not — the T/Maker approach is certainly a tremendous improvement on the traditional line-orientated scroll.

In this context, T/Maker works like a word processor which computes and is capable of elaborate calculations on screen. For this, some intricate coding has to be set up around the perimeter of the table — see figure 1.

Ensuring that this procedure is functioning properly requires more than a casual familiarity with the system. Once this is done, the instruction Compute calls an overlay to cope with the number-crunching.

Other command-line verbs are: Edit, for creating or altering text, and the instruction Align which justifies the text either right-ragged or double-justified according to pre-set margins.

Similarly, Sort will arrange data in ascending or descending order according to character or numeric keys of optional length, and Re-format swaps columns around the screen.

The environment provided by T/Maker seemed to us exemplarily friendly. Two features help produce this impression: the power of T/Maker to cope with a long stack of instructions and an ingenious command called, Do.

Instruction stacking means that, for example, the business of finding a file, formatting it, printing it and then modifying it before saving it back to disc can all be taken care of in a single command line of the form:

```
GET ZAP ALIGN PRINT 0 0 REPLACE
McTavish McAllister RENAME ZOT SAVE.
```

This produces a printout of the original file aligned to the margins imbedded in the text, and then goes on to alter all references to McTavish before re-saving the file under the name Zot. Zap, 0 0, McTavish, Allister and Zot are all parameters and the rest of the words are instructions.

Extraordinary variety

This kind of batch-processing gives T/Maker the power to cope with an extraordinary variety of tasks and to some extent helps to overcome the single disadvantage of the package: the speed of operation, though faster than Report Writer, is nowhere near that of machine-coded programs like VisiCalc and Execuplan.

The C-Basic pseudo-code — necessarily co-resident with its run-time compiler, CRun2 — is not so much slow as bulky, which means adequate workspace can be provided only by overlays. That means more disc waits than are strictly comfortable.

Meanwhile, by releasing the operator to take a walk or put the kettle on — hence the name? — instruction stacking makes T/Maker's leisurely pace reasonably tolerable.

If instruction-stacking adds a new dimension to the individual commands, the command Do adds a new dimension

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to instruction-stacking. Do tells the system to obtain its next instruction or instruction-stack not from the keyboard but from the current line in the logged-on file, and in doing so deletes the line from the text. This is a brilliant design idea.

It means, for example, that texts can contain their own instructions for manipulation, or that separate command files can be set up that work like CP/M.Sub files. It does, however, require some ingenuity on the part of the user to master the full utility of the concept, and the manual, excellent as far as it goes, largely leaves the possibilities to the imagination.

After T/Maker, the Vector Graphic Execuplan seems to flash like lightning through rows and columns of arduous computation. Execuplan's reverse video, instant screen refresh and stable scrolling produce an electronic picture on the 80-character wide screen which looks even more impressive than VisiCalc.

Presumably other hardware manufacturers will be following suit with their own versions, but Vector Graphic is unusual among S-100 machine manufacturers in the effort it seems to be putting into this kind of software development — presumably in the hope of increased hardware sales.

Like VisiCalc, the screen provides a grid into which either data or formulae can be pigeon-holed through the movement of a column-wide cursor. A second cursor is provided for command entry in the bottom line of the screen. At this level, editing facilities like delete, insert and erase to end of line are provided — very useful with the entry of complicated equations.

Additionally, the grid cursor can be used to pull down formulae or data into the command line locations, so that instructions can be assembled by copy-and-patch. Provisions are made for four levels of headings to tables, and status lines at the top of the screen keep the user informed of memory usage, cursor location and the otherwise invisible loaded formulae.

Easy grid set-up

The initial setting-up of the grid was considerably easier than with T/Maker. Even so, the early stages of learning a system like Execuplan involve constant reference to instructions. Recognising this, Vector Graphic provides screen help sheets which can be called from disc without destroying the current work-file.

Directory information can be assessed in the same way — a feature shared with Report Writer but unaccountably missing from T/Maker. Assembled tables can be printed with or without the grid co-ordinates and in their entirety or in part. Options are also available for the suppression of certain columns or rows.

There was little doubt in our minds that

of the three, the Vector Graphic Execuplan was the fastest, most robust and easiest-to-use system for the creation of numerical tables. However, the additional table-making facilities in T/Maker, like the text editor and the sort facility, made the Lifeboat Associates' offering the most comprehensive of the three systems.

Execuplan is intended for use as an extension of Vector Graphic Memorite III word processing software. Execuplan

```

LINE 1.1 CASH=1000 0000
LINE 1.2 ACCT=1000 0000
LINE 1.3 MERCHANT=0163 11300
LINE 1.4 TOT=CURRENT-SUM OF CASH THRU MERCHANT
SKIP 1 AFTER TOT=CURRENT
LINE 2.1 FIXEQUIP=7000 3000
LINE 2.2 PPE=EXP=500 300
LINE 2.3 IMPROVE=450 0
LINE 2.4 DEPRSTS=60 0
LINE 2.5 PPE=DEPR=234 0
LINE 2.6 OTHER=PPR=2000
LINE 2.7 TOT=ASSETS-SUM OF FIXEQUIP THRU OTHER=PPR
UNDEL/NE TOT=ASSETS
LINE 2.8 TOT=ASSETS-TOT=CURRENT + TOT=ASSETS
SKIP 1 AFTER TOT=ASSETS
LINE 3.1 ACCT=PAY=061 0000
LINE 3.2 NOTES=PAY=200 0
LINE 3.3 ACCT=EXP=7 200
LINE 3.4 TOT=CUM=SUM OF ACCT'S PAY THRU ACCT=EXP
SKIP 1 AFTER TOT=CUM=
    
```

and Memorite will only run on the Vector Graphic chunky memory-mapped hardware, whereas both Report Writer and T/Maker have the advantage of complete portability between CP/M machines.

All three systems had their bugs. Execuplan was the most crashproof, but it was possible occasionally to destroy the screen display and lose data by entering control codes while the screen was scrolling. Our review copy was an early version, 1.1, and we understand these problems are being eliminated.

Error trapping

Some reasonably comprehensive error trapping was incorporated into Report Writer, but the program tends to crash in the usual uncompiled Basic way. For example, the accidental entry of control characters as data tends to drop the user back to Basic command level. That is acceptable if you understand Basic, but the busy executive or secretary who is just trying to distribute a report may not appreciate it.

The original T/Maker I we were lent for review was written in compiled Basic, and had some surprising weaknesses — no error handling for disc-space and file-space errors which produce fatal crashes.

Lifeboat has solved these problems by issuing an all-machine-code version called T/Maker II. The upgrade is faster, and offers some additional facilities.

One other late entry was the compiled Microsoft Basic program Target, a kind of Report writer with added screen-handling facilities. The marketing idea is that you are dissatisfied with complicated matrix algebra or reverse-Polish notation, and would like to talk to your computer in English.

This fine sentiment is to some extent realised in the program, which allows you to write a totalising instruction line LINE 8 = SUM OF LINES 3 THRU 7 but equally, it is necessary to become entangled in constructs like LINE 79 PAY CALC = IF CUM FLOW<TOT INVEST THEN 1 ELSE IF PAY

CALC [-1C] = 1 THEN (TOT INVEST [=1C] - CUM FLOW [-1C] / NET FLOW which suggests that Lukasiewicz will still be in business for a while yet.

Target promotional material emphasises its user-friendliness. Certainly the manual is very good; why is the program initially so cumbersome? The first menu gives you the option of calling a directory of Target files — a good feature, but why not display it anyway? — but having glimpsed the directory, you then have to return to the menu, which wipes the screen again.

Buffering in your head the name of the file you want to access, you enter its name, load it — and find yourself back in the menu. To access the file, as opposed to merely loading it — but why else would you want to load a file? — you have to call another menu function called Continue.

Target looks as if it would be useful for simple repetitive report writing where data is laid out horizontally and most of the calculation is vertical. It has some neat and easily-accessed functions

GROW X BY Y%

for example, will establish a projection of X increasing at Y% in successive rightwards columns. Its slowness of response in accessing secondary data files and overlays, however, makes it a poor contender as a "What if?" programmer. Target costs £125 from Comput-A-Crop.

Comparing software can be a tedious business on a micro, which is usually only able to hold one system at a time in core. The Silicon Disc, a 1K software enhancement to CP/M designed to provide virtual memory on machines capable of bank-switching, solved that problem.


By making additional memory banks look like disc files to the operating system, Silicon Disc can shuffle files in and out of the work area at machine speed, some 500 times faster than normal disc access. Designer Jerry Karlin has made the Silicon Disc invisible to the user, and the only extra hardware needed are the add-on banks of RAM.

Conclusions

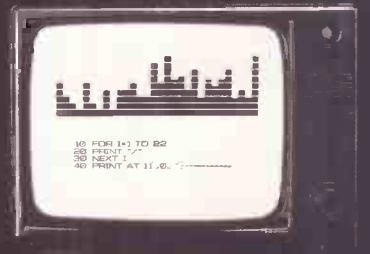
- Of the three systems, Execuplan is the most similar to VisiCalc, and is an excellent choice for Vector Graphic owners.

- Report Writer is a bargain-priced system suitable for applications which require hard copy of numerical tables without on-screen formatting. Because it is offered in MBasic4 source code, it should be adaptable for individual applications, though no additional documentation is supplied to cover this.

- As a formatting number-cruncher, T/Maker is harder to use than Execuplan, but is more generally useful in being able to sort and format text tables and alphanumeric lists. The new machine-code version is a completely re-written program suite, offering several new facilities.

- Their prices are: Report Writer £95; T/Maker £155; Execuplan £150. 

sinclair ZX81 PERSONAL COMPUTER



Sinclair ZX81 Personal Computer the heart of a system that grows with you.

1980 saw a genuine breakthrough – the Sinclair ZX80, world's first complete personal computer for under £100. Not surprisingly, over 50,000 were sold.

In March 1981, the Sinclair lead increased dramatically. For just £69.95 the Sinclair ZX81 offers even more advanced facilities at an even lower price. Initially, even we were surprised by the demand – over 50,000 in the first 3 months!

Today, the Sinclair ZX81 is the heart of a computer system. You can add 16-times more memory with the ZX RAM pack. The ZX Printer offers an unbeatable combination of performance and price. And the ZX Software library is growing every day.

Lower price: higher capability

With the ZX81, it's still very simple to teach yourself computing, but the ZX81 packs even greater working capability than the ZX80.

It uses the same micro-processor, but incorporates a new, more powerful 8K BASIC ROM – the 'trained intelligence' of the computer. This chip works in decimals, handles logs and trig, allows you to plot graphs, and builds up animated displays.

And the ZX81 incorporates other operation refinements – the facility to load and save named programs on cassette, for example, and to drive the new ZX Printer.



Every ZX81 comes with a comprehensive, specially-written manual – a complete course in BASIC programming, from first principles to complex programs.

Kit: £49.⁹⁵

Higher specification, lower price – how's it done?

Quite simply, by design. The ZX80 reduced the chips in a working computer from 40 or so, to 21. The ZX81 reduces the 21 to 4!

The secret lies in a totally new master chip. Designed by Sinclair and custom-built in Britain, this unique chip replaces 18 chips from the ZX80!

New, improved specification

- Z80A micro-processor – new faster version of the famous Z80 chip, widely recognised as the best ever made.
- Unique 'one-touch' key word entry: the ZX81 eliminates a great deal of tiresome typing. Key words (RUN, LIST, PRINT, etc.) have their own single-key entry.
- Unique syntax-check and report codes identify programming errors immediately.
- Full range of mathematical and scientific functions accurate to eight decimal places.
- Graph-drawing and animated-display facilities.
- Multi-dimensional string and numerical arrays.
- Up to 26 FOR/NEXT loops.
- Randomise function – useful for games as well as serious applications.
- Cassette LOAD and SAVE with named programs.
- 1K-byte RAM expandable to 16K bytes with Sinclair RAM pack.
- Able to drive the new Sinclair printer.
- Advanced 4-chip design: micro-processor, ROM, RAM, plus master chip – unique, custom-built chip replacing 18 ZX80 chips.



Built: £69.⁹⁵

Kit or built – it's up to you!

You'll be surprised how easy the ZX81 kit is to build: just four chips to assemble (plus, of course the other discrete components) – a few hours' work with a fine-tipped soldering iron. And you may already have a suitable mains adaptor – 600 mA at 9 V DC nominal unregulated (supplied with built version).

Kit and built versions come complete with all leads to connect to your TV (colour or black and white) and cassette recorder.



uter-



Available now - the ZX Printer for only £49.⁹⁵

Designed exclusively for use with the ZX81 (and ZX80 with 8K BASIC ROM), the printer offers full alpha- numerics and highly sophisticated graphics.

A special feature is COPY, which prints out exactly what is on the whole TV screen without the need for further instructions.

How to order your ZX81
BY PHONE – Access, Barclaycard or Trustcard holders can call 01-200 0200 for personal attention 24 hours a day, every day.
BY FREEPOST – use the no-stamp-needed coupon below. You can pay

At last you can have a hard copy of your program listings – particularly useful when writing or editing programs.

And of course you can print out your results for permanent records or sending to a friend.

Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.

The ZXPrinter connects to the rear of your computer – using a stackable connector so you can plug in a RAM pack as well. A roll of paper (65 ft long x 4 in wide) is supplied, along with full instructions.

by cheque, postal order, Access, Barclaycard or Trustcard.
EITHER WAY – please allow up to 28 days for delivery. And there's a 14-day money-back option. We want you to be satisfied beyond doubt – and we have no doubt that you will be.

16K-byte RAM pack for massive add-on memory.

Designed as a complete module to fit your Sinclair ZX80 or ZX81, the RAM pack simply plugs into the existing expansion port at the rear of the computer to multiply your data/program storage by 16!

Use it for long and complex programs or as a personal database. Yet it costs as little as half the price of competitive additional memory.

With the RAM pack, you can also run some of the more sophisticated ZX Software – the Business & Household management systems for example.

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ZX81

6 Kings Parade, Cambridge, Cambs., CB2 1SN.
Tel: (0276) 66104 & 21282.

To: Sinclair Research Ltd, FREEPOST 7, Cambridge, CB21YY.

Qty	Item	Code	Item price £	Order Total £
	Sinclair ZX81 Personal Computer kit(s). Price includes ZX81 BASIC manual, excludes mains adaptor.	12	49.95	
	Ready-assembled Sinclair ZX81 Personal Computer(s). Price includes ZX81 BASIC manual and mains adaptor.	11	69.95	
	Mains Adaptor(s) (600 mA at 9 V DC nominal unregulated).	10	8.95	
	16K-BYTE RAM pack.	18	49.95	
	Sinclair ZX Printer.	27	49.95	
	8K BASIC ROM to fit ZX80.	17	19.95	
	Post and Packing.			2.95

Please tick if you require a VAT receipt

TOTAL £ _____

*I enclose a cheque/postal order payable to Sinclair Research Ltd, for £ _____

*Please charge to my Access/Barclaycard/Trustcard account no. _____

*Please delete/complete as applicable. _____

Please print.

Name: Mr/Mrs/Miss _____

Address: _____

FREEPOST – no stamp needed.

PRC 10

How the ZX81 compares with other personal computers

SYSTEM IDENTIFICATION		ZX81	ZX80	ACORN ATOM	APPLE II PLUS	PET 2001	TRS 80 LEVEL I	TRS 80 LEVEL II
ROM		8K	4K	8K	8K	14K	4K	12K
GUIDE PRICE	Basic unit - inc. VAT	£70	£100	£175	£630	£435	£290	£375
	Unit plus 16K RAM (*12K RAM)	£120	£150	£285*	£630	£530	£360	£375
COMMANDS	LIST, LOAD, NEW, RUN, SAVE	●	●	●	●	●	●	●
STATEMENTS	PRINT, INPUT, LET, GOTO, GOSUB/RETURN, FOR/NEXT IF/THEN	●	●	●	●	●	●	●
	STEP	●		●	●	●	●	●
	TAB	●			●	●	●	●
ARITHMETIC	ABS, RND	●	●	●	●	●	●	●
FUNCTIONS	INT	●			●	●	●	●
	ATN, COS, EXP, LOG, SGN, SIN, SQR, TAN	●			●	●		●
	ARCSIN, ARCOS	●						
STRING	CHR\$	●	●		●	●		●
FUNCTIONS	LEN	●		●	●	●		●
	ASC(CODE), STR\$, VAL, INKEY\$	●			●	●		●
NUMBERS	FLOATING PT $\pm 10^{-38}$	●			●	●	●	●
	INTEGERS		●	●	●	●		●
NUMERIC	A-Z			●			●	
VARIABLES	AA-ZØ				●	●		●
	An-Zn, n = any alphanumeric string	●	●					
STRING	A\$ & B\$						●	
VARIABLES	A\$ to Z\$	●	●	●				
	An\$ to Zn\$, n = any alphanumeric character				●	●		●
NUMERIC	SINGLE DIMENSIONAL		●	●			●	
ARRAYS	MULTI DIMENSIONAL	●			●	●		●
DISPLAY	ROWS	24	24	16	24	25	16	16
	COLUMNS	32	32	32	40	40	64	64
	LOW RES GRAPHICS (<7000 pixels)	●	●	●	●	●	●	●
	HI RES GRAPHICS (>40000 pixels)			●	●			
SPECIAL	USR (CALL, LINK)	●	●	●	●	●		●
FEATURES	PEEK, POKE (OR EQUIV)	●	●	●	●	●		●

Sinclair software on cassette.



The unprecedented popularity of the ZX Series of Sinclair Personal Computers has generated a large volume of programs written by users.

Sinclair has undertaken to publish the most elegant of these on pre-recorded cassettes. Each program is carefully vetted for interest and quality, and then grouped with others to form single-subject cassettes.

Software currently available includes games, junior education, and business/household management systems. You'll receive a Sinclair ZX Software catalogue with your ZX81 - or see our separate advertisement in this magazine.

The ultimate course in ZX81 BASIC programming.



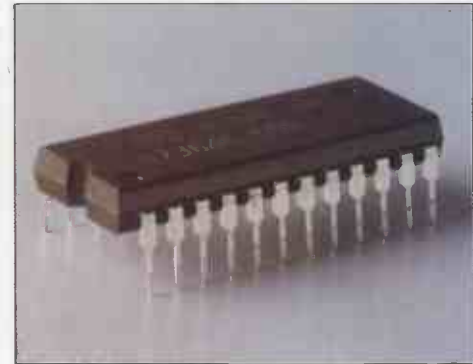
Some people prefer to learn their programming from books. For them, the ZX81 BASIC manual is ideal.

But many have expressed a preference to learn *on the machine, through the machine*. Hence the new cassette-based ZX81 Learning Lab.

The package comprises a 160-page manual and 8 cassettes. 20 programs, each demonstrating a particular aspect of ZX81 programming, are spread over 6 of the cassettes. The other two are blank practice cassettes.

Full details with your Sinclair ZX81.

If you own a Sinclair ZX80...



The new 8K BASIC ROM used in the Sinclair ZX81 is available to ZX80 owners as a drop-in replacement chip. (Complete with new keyboard template and operating manual.)

With the exception of animated graphics, all the advanced features of the ZX81 are now available on your ZX80 - including the ability to drive the Sinclair ZX Printer.

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ZX81

6 Kings Parade, Cambridge, Cambs., CB2 1SN.
Tel: (0276) 66104 & 21282.

Philip Ireland reviews some of the adaptors designed to turn the humble domestic television set into a fully-fledged Prestel terminal.

ADAPT TO CHOICE

SINCE THE introduction of the first adaptors, a variety of equipment has been developed, including units which will drive monitor sets, giving better picture quality than a normal UHF set, and others which permit interfacing to microcomputers.

In 1979, the appeal of these units began to gather momentum — the public were interested in them as an alternative to the considerably more expensive dedicated TV sets.

It was, however, not until August 1980 that prototype adaptors were produced. Such were the problems of designing, producing and testing the new units that it was not until nearly the end of that year that further movement was seen and more companies were able to produce their wares for review. The wait has been well worthwhile even though the long-heralded £100 adaptor has not yet materialised.

In assessing each unit, two TV sets were used; a 19in Baird colour and a 12in Hitachi black and white. In the case of the Ayr Viewdata P1 a different, 22in colour Baird was used. Tape tests were performed on a standard Sony cassette deck with TDK tapes.

This seemed a good combination since on most units, a reasonable amount of adjustment was required to obtain good recordings and was, in general, an unpredictable business.

Each adaptor was tested before three people who had not seen Prestel before. This was necessary as band-width problems cause the picture quality to drop below the standards of a dedicated set. Thus to avoid comparisons between the two systems, the units were shown to people who had only seen the UHF display output.

A number of points have been selected which are generally self-explanatory but one or two may need some further clarification.

An indication of whether a teletext decoder is included is given. Though none has it at present, there is at least one unit in the offing which will have this facility.

Through-the-unit TV aerial is included to indicate if the user must unplug the adaptor every time he wants to attach his TV aerial lead. The auto-identity feature indicates that the unit has a hard-wired numeric identity to introduce itself to Prestel.

I have appraised the six units available as an ordinary user would. The individual user must choose the best adaptor for his needs. The units all comply with Prestel terminal specification 6 which stipulates the basic requirements manu-



Zycor's Teledek 2000 offers "an almost 'Technicolor' display".

facturers must meet to obtain British Telecom approval.

Various companies have units available which are of a more specialist nature: others have standard Prestel adaptors at present in the development or pre-production stages.

The Videotronic 81 from Farquest Ltd falls into the second category. The unit, which was demonstrated in the pre-production form, has British Telecom approval, is microprocessor-driven and so can perform other small operations. Instead of a tape facility, it has a facility to store up to eight pages off-line. Several page numbers can be stored so that access can be made direct to those pages as soon as the unit is connected to Prestel. Projected price is £175 including VAT. Further details from the firm on Basingstoke 64646.

OEL is promising another new adaptor for a November launch. The unit, operated by infra-red keypad is aimed at the domestic market and will cost less than £1,000.

The product is scheduled for launch at the Viewdata Exhibition at the West Centre Hotel on 4, 5, 6 November.

Technologies has a new adaptor under wraps at present which will adapt an ordi-

nary UHF TV set so that it can receive Prestel and teletext—Ceefax and Oracle. Still in the pre-production stage, the Tecstel will sell for around £260 but has not been put up for British Telecom approval. More information can be obtained from Technologies on 051-207 3799.

A new adaptor from C W Cameron will drive a TV set, data monitor, computer or video monitor. Called the VDA, it has British Telecom approval and is scheduled to cost £740. The unit has a V24 connection for attachment to the Cameron acoustic coupler. In addition, there are RGBS TTL and RF outputs, an editing socket and a cassette interface. It can be packed, with the coupler, into a portable case to give access to Prestel anywhere.

Another important unit is the Bee which is manufactured by Technologies and marketed by B&B Computers, Bolton 26644. It can be used as a straightforward TV adaptor or, more significantly, attached to microcomputers complying to BS232 or IEEE standards to give full Prestel capability. As well as fulfilling the basic viewdata functions the adaptor will allow pages to be stored direct to disc or cassette and so can adapt the micro to run

(continued on next page)

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telesoftware programs. The price is £575.

With the cost of adaptors now so low when compared to the prices of dedicated sets, there must be some concern, if only in private, among the manufacturers of the dedicated equipment. The average cost of such sets now seems to be in excess of £1,000 which usually includes teletext.

That means it is possible to buy an adaptor with direct gun-drive, RGB synchronous plus a monitor and still have change to buy yourself a non-text colour set. This also would have the advantage of not tying up the household TV at peak times while using the Prestel terminal.

Teledek 2000

Marketed by: Zycor Ltd, 33 Fortress Road, London NW5. Tel: 01-485 1806.

Product status: Full-production model.

BT approval: Yes.

Price: £170 plus VAT.

AVAILABILITY

Dealerships and rental outlets not yet finalised.

FEATURES

Size: Unit 16.5in. by 8.5in. by 3.5in.

Keypad: 2.3in. by 1.5in. by 4.7in.

TV types: Both colour — toned grey on black and white sets. There is no switch to adjust signal to black and white.

Teletext decoder: No.

Plugs: Telephone: 96A.

Set: Aerial-lead type.

Other: None.

Through-the-unit TV aerial: No; aerial splitter can be used.

Sockets: Printer: yes.

Cassette: Yes.

Other: No.

Keypad: Remote; infra-red. Wired-in version available.

Keyboard: BT standard interface for serial alpha-numeric keyboard available.

Display: Colour: yes.

Background: Yes.

Double-height: Yes.

Page-store, off-line: Yes.

Half-page display: Yes.

Extra features: An RGB synchronous unit can be fitted which will allow sets with a suitable socket to receive signals direct on to the screen. This would eliminate the slight picture degradation which any adaptor has, caused by the necessity to send information via the aerial socket.

Auto-dialler: Yes.

Over-ride: Yes.

Auto-identity: Yes.

Over-ride: No.

User report

● The unit is finished in a dark-red wood with a metallic front panel, giving it the look of a stereo tuner. The front panel contains the main power switch, keypad detector and indicator bulbs, including

one to show when a signal from the keypad is received.

● The black-plastic, easy-to-handle keypad controls dialling, off-line page store, half-page display, printer and tape functions. It is driven by PP3.

● Operation starts with a menu of local computer numbers displayed; this allows tuning of the TV.

● Dialling is initiated by pressing the number by the computer required.

● Off-line page storage is brought about by keying the dial/off-line button — the last chosen stays on the screen.

● Display of the Teledek 2000 is good. Zycor has used a shades-of-grey system to indicate colour variation on monochrome sets. On the 12in. Hitachi, the half-page display feature was a boon. Colour display was very good — possibly due to enhancements which caused some over-run problems on difficult colour combinations, but these did not detract from the almost "Technicolor" display.

● Zycor adds that production is now in full swing with a delivery time at present of four weeks but this should improve soon. The company has also started selling a monitor, with non-interface scan display, which can be driven by the RGB synchronous output of the adaptor. This unit will retail for about £300 and will make the unit's output as good as a dedicated set. The price is around £250 plus VAT.

Labgear 7050

Manufacturer: Labgear Ltd.

Product status: Full-production model

BT approval: Yes

AVAILABILITY

Business users: Pye Business Communications, telephone Cambridge 45191.

Rental: Granada TV Rentals Ltd, PO Box 31, Ampthill Road, Bedford, MK42 9QQ. Bedford 55233 ext. 2266/2265.

Model number: PADVY 1.

Terms: One year rental, £143 pa ex VAT, four year rental, £95 pa ex VAT. Subject to revision.

FEATURES

Size: Unit 15in., by 12in. by 3½in.

Keypad: 8in. by 4in. by 2½in.

TV Types: Almost any TV type — colour on black and white. Black and white is adjusted by means of a switch.

Teletext decoder: No

Plugs: Telephone: 96A Jack.

Aerial: 10ft. aerial lead; STD fittings.

Other: None.

Through-the-unit TV Aerial: No.

Sockets: Printer: No.

Cassette: Yes; five-pin DIN.

Other: None.

Keypad: Cable: Yes.

Remote: No.

Keyboard: No.

Display: Colour: Yes.

Background: Yes.

Double-height: Yes.

Off-line page-store: Yes.

Half-page display: No.

Extra features: None.

Auto-dialler: Yes.

Over-ride: Yes.

Auto-identity: Yes.

Over-ride: No.

Unit status: Production unit.

User report

● A good, workman-like unit with a robust grey-painted steel case which can readily be hidden on skirting, the Labgear Viewdapta 7050 has a separate large plastic 16-key keypad which is more at home on a desk than in the hand. User control is via the keypad with clear line, page store and reveal buttons. There are also power and line indicator lamps.

● Viewdata functions are controlled by one button, i.e., to connect to Prestel, push it and one of the four telephone-number store buttons start the auto-dialler. For tape replay, press the viewdata button. This sometimes sets off the auto-dialler causing delay in display.

● There are various other switches on a rear panel, which is covered by a flap, that allows telephone-number programming; colour/black-and-white display.

● The display is good, though a half-page display facility would have made text clearer in black and white.

● On black-and-white sets, a toned-grey system is used, but unlike other adaptors, the 7050 has a switch to cut out colour output when used with monochrome, and gives a slightly better display. It is also possible to switch off background colour — a feature necessary on black-and-white sets as sometimes the toned grey alpha and background merge.

● There is no tune-in page to which to adjust the set before dialling — just a blank screen.

● On colour display, the unit is very good when the TV is properly tuned. It was found difficult to obtain red-and-green displays perfectly and yellow alpha was a little pale.

● To hold a frame off-line, you must push clear line and program. It then displays the last page looked at.

Tantel

Manufacturer: Tangerine Computers Ltd.

Marketed by: Tandata Marketing Ltd, Forehill Works, Forehill, Cambridgeshire CB7 4AE. Ely 0353 5489.

Product status: Full-production model.

BT approval: Yes.

AVAILABILITY

Dealerships: Various. A national network is being formed. Where no local dealer is available, and Tandata is still looking, local representatives, the company will deal direct with the buyer.

FEATURES

Size: Unit: 9.5in. by 6.5in. by 2in.

Keypad: Built into unit.

TV Types: Black and white and colour.
Teletext decoder: No.
Plugs: Telephone: 96A; 3.5m. lead.
Through-the-unit TV aerial: No.
Sockets: five-pin DIN combined printer and cassette.
Keypad: Integral TI touch-type.
Keyboard: An alpha-numeric message pad, version will be available shortly.
Display: Colour.
Background: Yes.
Double-height: Yes.
Off-line page store: Yes.
Half-page display: Yes.
Extra features: Tangerine printer for use with the Tantel adaptor is about to be launched. There will be two versions: an A4 impact; a thermal type.
Auto-dialler: Yes.
Over-ride: Yes.
Auto-identity: Yes.
Over-ride: No.

User report

- The most compact, yet one of the heaviest, of all the adaptors currently in production, the Tantel is supplied in a white metal box and has the feel of a giant keypad.
- Control is via the gently-slanting panel where the touch keypad is sited. With 16 touch-buttons in all, there are line-disconnect, big-character-display — i.e., half-page — tape and print functions, and “+” doubles as the viewdata button.
- The tape button allows a page to be displayed first then recorded and indicates on screen when it has finished.
- Another innovation is the noise suppression on the TV and, indeed, the adaptor uses the set's speaker to generate the telephone tones, instead of through a speaker in the adaptor.
- There are no indicator lamps or power

switches on the unit.

- When powering up, a multi-colour page is displayed which can be used for tuning purposes.
- The black-and-white display is again of the toned-grey type.
- On test, the colour display was very good although there was some bad over-run on graphics colour. The company assures me that this is due to a badly-adjusted TV set. The alpha colours were generally very good.
- There is a very slight gridding effect noticeable on graphics, which, while it does not detract from the adaptor's performance, can be reduced by careful tuning of the set.
- Tandata has just announced that the Tantel will be available shortly to interface with any microcomputer. Customers will be able to buy an adaptor which will have the capability to interface with their own specific machine with only minor adjustment to it. Additionally, it will provide facilities for the micro to display full-colour graphics even when not linked into Prestel. The price will be the same.
- A deal between Granada and Tangerine has brought about the AlphaData which is an alpha-numeric version of the Tantel. Pre-production units of the model should be delivered to Granada shortly.
- Granada plan to sell it at £289.50 or to rent at £118 on a four-year contract. These prices are likely to be revised substantially downwards after a review which is expected to be made public soon.

Ace-Telcom VDX 1000

Manufacturer: Radofin
Production status: Full-production model
BT approval: Yes
AVAILABILITY:
 Advanced Consumer Electronics Ltd,

Unit 3, Fulton Road, Wembley, Middx.
 Price: £229.95 plus VAT

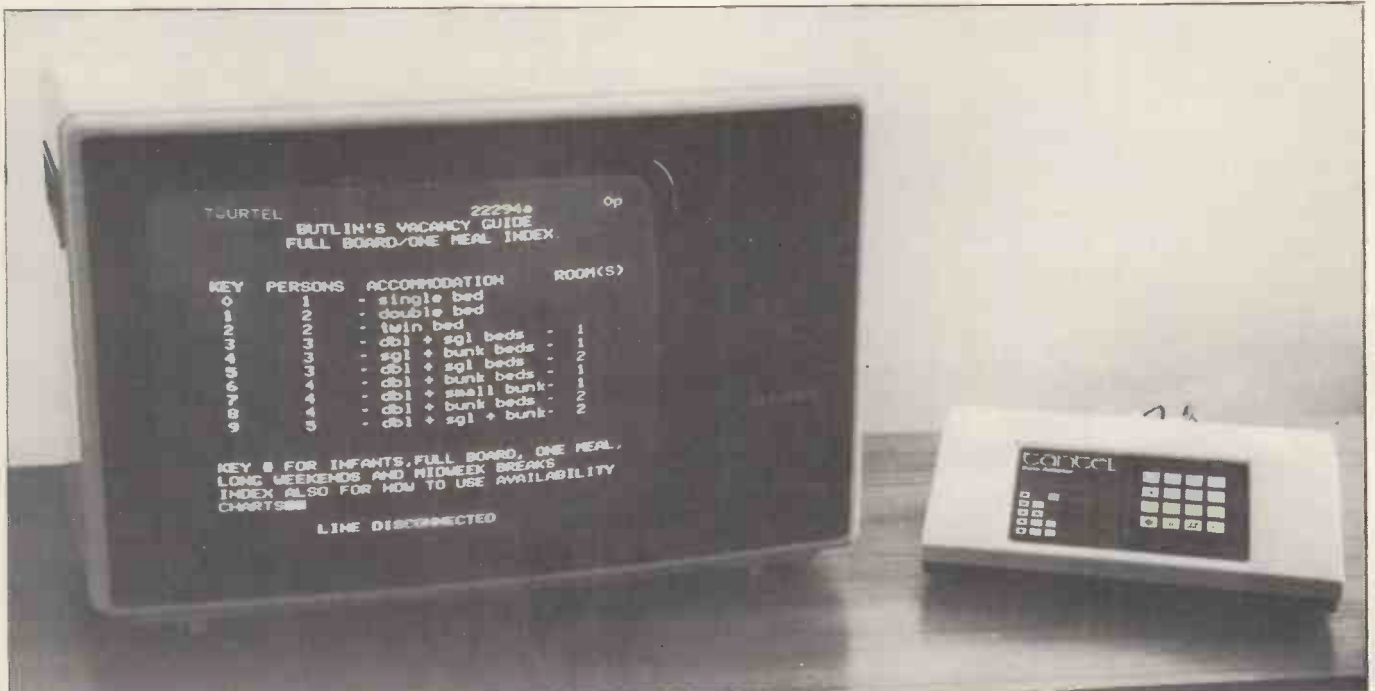
FEATURES

Size: Unit: 14in. by 8in. by 3.5in.
Keypad: 3.5in. by 2.5in. by .75in.
TV types: Any PAL colour TV
Teletext decoder: No
Plugs: Telephone: 96A
Aerial: STD fitting for TV
Through-the-unit TV aerial: No. Has switch-over unit for aerial lead and viewdata adaptor lead
Sockets: Printers: yes; thermal printer now available
 Cassette: Yes
Keypad: 18-key hand-held
Cable: Yes
Remote: No
Keyboard: Full-message keyboard is planned
Display: Colour: Yes
Background: Yes
Double-height: Yes
Off-line page store: Yes
Half-page display: Yes
Extra features: Reveal key; tape-recorder controls on key-pad
Auto-dialler: Yes
Override: Yes
Auto-identity: Yes
Override: No

User report

- Packaged in a smart black-and-silver case about the size of a stereo tuner unit, the ACE-Telcom would be equally at home in the lounge or office.
- The front panel has a power switch and indicator lamps while the back panel carries the input-and-output side of the unit. All leads except for power and telephone are detachable.

(continued on next page)



The Tantel unit is one of the most compact, yet one of the heaviest of the adaptors currently in production

(continued from previous page)

- Each socket is different to avoid wrong connections. The tape socket is six-pin DIN to allow control of tape record and replay from the keypad, but this makes life slightly difficult if you have only five-pin DIN leads.

- The socket for the printer is a type designed to be compatible with the ACE printer. The light-weight keypad is easy to handle and has 18 keys which are very positive to the touch.

- They include controls for viewdata, off-line, half-page display and reveal/conceal. There are two keys concerned with tape recording and replay. It is possible, using a recorder with remote pause, to record individual frames and to replay them one at a time without leaving your armchair.

- The display starts as soon as the unit is switched on with a page displaying the word "viewdata" and a series of colour bands to which to tune the TV.

- The adaptor uses a toned-grey system in black by white.

- Colour display is good with some vivid colours. There is some background over-run especially with blue/yellow combinations.

Pat (OEL)

Manufacturer: OEL, Unit 2B, Cross Croft Industrial Estate, Appleby, Cumbria, CA16 6MP. 0596-83222 or 01-236 1431/2

Product status: Full-production model
BT approval: Yes

AVAILABILITY

Dealerships: Yes
Price: £230 plus VAT

FEATURES

Size: Unit 12in. by 2.5in. by 10in.

Keypad: Built into unit

TV types: Works on both black-and-white and colour sets to BS415 on 625 line PAL UHF system.

Teletext decoder: No

Plugs: Telephone 96A on 9ft. 8in. lead

Aerial: STD fittings on 9ft. 9in. lead

Through-the-unit TV Aerial: No

Sockets: Printer: Yes

Cassette: Yes

Keyboard: Full alpha keyboard now available

Keypad: Built into unit

Display: Colour: Yes

Background: Yes

Double-height: Yes

Off-line page store: Yes

Half-page display: No

Extra features: RGB synchronous which will drive a TV video input socket giving much clearer screen image. Will support Cherry full-editing keyboard. Various modified versions becoming available for countries outside UK.

Auto-dialler: Yes

Override: Yes

Auto-identity: Yes

Override: No

User report

- Mainly for the business user, the PAT has a smart, black fibre-glass finish. The front panel slopes back for easy desk-top control. The panel has potted instructions, indicator lamps and a 16-key keypad. There is a reveal key, a key which will clear the TV screen — this will soon be replaced by a print key. The power switch is on the rear panel with the leads.

- Another version of the adaptor is now also available making use of a small, neat Apex message keyboard.

- When setting up the adaptor the telephone numbers can be input by only by down-line loading direct from Prestel during registration.

- Tape recording needs care in setting up but is very good once the recorder is properly adjusted for its task.

- On black and white, the display is a toned-grey type which gives a reasonable effect. Viewing on a 12in. portable was somewhat of a strain as the adaptor does not have a half-page display facility.

- When first switched on, the screen displays the word "Teleview" to allow the TV to be tuned.

- In testing, colour was dependent on set tuning but gave a good display once tuned.

- Use of a different character set gives a good, rather stylised effect to the display.

- The company has announced BT approval of its model PAT III which has an integral alpha-numeric keypad. In addition, the adaptor has RGB synchronous monitor drive and UHF drive. Users will be able to make full use of Prestel message frames with the Qwerty lay-out keyboard. The unit has a special print facility and will retail for about £272.

Ayr Viewdata

Model: P1

Manufacturer: Ayr Viewdata Ltd, 2 Canada Road, Byfleet Industrial Estate, Byfleet, Surrey. Byfleet 53134

Product status: Full-production model
BT approval: Yes

AVAILABILITY

Through dealers

Price: To sell around £165 plus VAT

FEATURES

Size: 13.5in. by 7.25in. by 4in.

Keypad: 5.06in. by 2.69in. by 1.13in.

TV types: Black and white and colour

Teletext decoder: No

Plugs: Telephone: 96A jack; lead 2m. long

Aerial: Standard fittings; approximately 1.3m. long

Through-the-unit TV aerial: No; aerial splitter provided

Sockets: TV output socket only. No printer or tape sockets. A printer socket is envisaged for the future.

There are no other sockets on the unit
Keypad: Infra-red remote type, powered by PP3 battery

Keyboard: None

Colour: Yes



The Ayr Viewdata P1

Background: Yes

Double-height characters: Yes

Off-line page store: Yes

Half-page display: Yes

Autodialler: Yes

Override: Has several numbers stored in one of four stores

Auto-identify: Programmable down-line

Override: No

User report

- The unit is housed in a rather attractive light-wood box with metal base. The front panel is finished in matt black and holds the power switch as well as two indicator lights and the keypad sensor. The rear panel has the telephone and power leads and the aerial output socket.

- The matt-black plastic keypad is comfortable to hold and its 16 keys have a rather unusual springy action. Its range seems to be short and directional but this does not detract from overall good handling. A well set-out summary of instructions is given on the top.

- I found it rather surprising that the unit did not have sockets for printer or tape facilities — both amenities which business users would find particularly useful.

- When starting to use the P1, the TV set is tuned to a page displaying the legend "teleview". The "#" button pressed to grab the telephone line and the telephone number is stored on one of four stores, denoted 1-4. Keying one of these starts the auto-dialler.

- The black and white display is of the shades-of-grey type and gives a clear picture. As on other adaptors, the half-page display facility proved very useful.

- There was some screen flicker — owing to non-interlace scan perhaps.

- Once again, the unit uses rather stylised character set which was used on the OEL Pat to good effect.

- By and large, the colour balance was easily obtained. It appeared better with the colour slightly paler than overdone.

- Once again, there were one or difficult combinations but these were no different from those already recognised on Prestel.

- Moving graphics, e.g., Prestel Man, seemed a little susceptible to drop-outs possibly caused by line noise.

- The adaptor is a very acceptable unit which is at home in the living room or the office. It compares very well to any in its field and deserves consideration along with the others when choosing an adaptor for a modern TV set.

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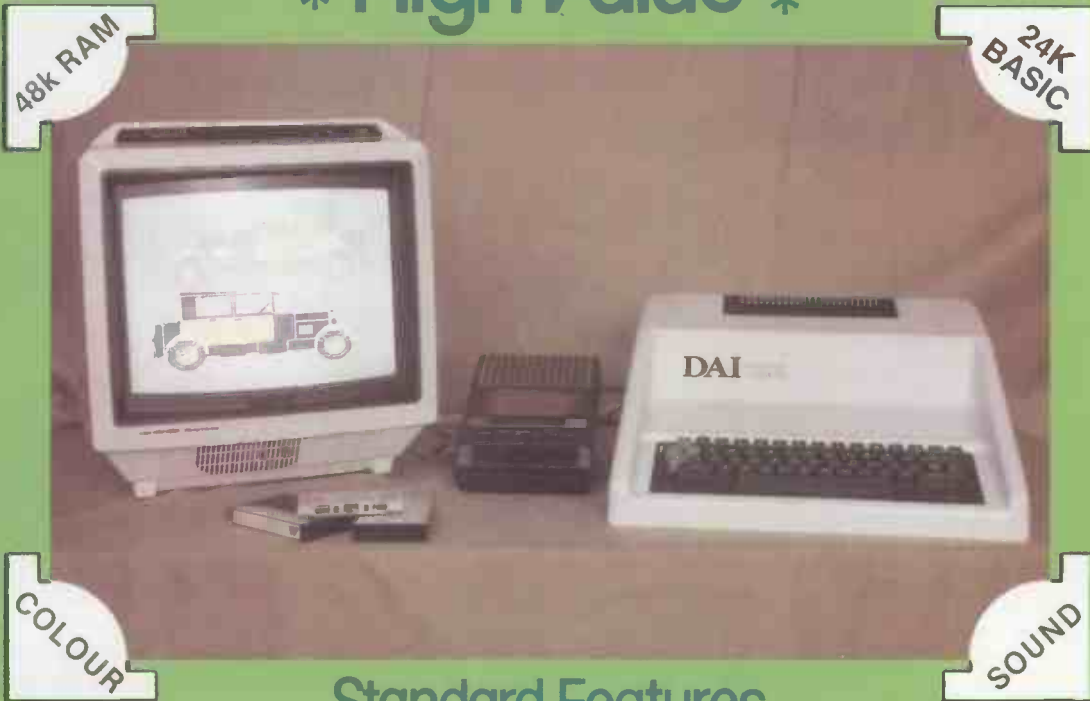
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NAME _____

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MY INTEREST IS: _____



WE GAINED a Pet just before we gained a baby; that was about two and a half years ago and both were planned. The timing was deliberate; it was to be our last frivolous purchase before acquiring both the responsibility of parenthood and having another mouth to feed.

Both acquisitions have changed our lives and the interaction between the two has been intriguing. It has led us into programming specifically for toddlers, our daughter and her friends, and for children of our friends.

We bought one of the early 8K Pets and had more than a year of teething problems with the hardware — quite apart

by Paula Melville

from the normal problems of early Pet users. New Pet owners can have no idea of the meagreness of the user information.

Feeding the baby at 2am is a bad experience and it seemed like a good idea to make use of the time in understanding the Pet — while rocking the baby to sleep with one foot. However, when the machine kept crashing, that was the last straw; I was never very close to baby bashing, but Pet bashing — I was very tempted.

One house and one extension later, Pet and baby, now both 18 months old, were still with us. The Pet had almost new insides, new ROMs, memory expansion, a sound box hanging on one edge and dual floppies. I cannot remember how we rationalised that purchase.

Programming is child's play



I had finally stopped work; we had filled the gaping hole in the side of the house and we had running water in the kitchen. Now I could have the Pet to myself all day. Martin and I would no longer have to bicker for possession in the evening.

I could not foresee our daughter Taleen being much of a problem — spoken with the ignorance of one who had had a nanny for a year — but, apart from the normal exhaustions of motherhood and house, my daughter had other ideas.

When did she realise that pressing the buttons was connected with happenings on the screen? I cannot remember, but it was the beginning of the end for my peaceful tinkering. I admitted defeat and decided she had better learn to use the machine constructively.

Her first tailor-made program was Flashcard which I have listed here. Under the influence of a book encouraging the teaching of reading to toddlers, I made up some conventional flashcards in clear, bold letters to introduce Taleen to words. She took an obvious enjoyment in this labelling of things, so I thought we could combine it with her delight in pressing buttons on the Pet.

The program prints, in large letters, words chosen randomly from a specified list whenever any key is pressed. I felt it was important, at least initially, for the letters to be large, although this has limited the word length to seven letters.

Amendment of the initial program from upper- to lower-case letters was almost forced on me when horrified teacher friends said that children are now taught to read in lower-case letters and that, consequently, she might be put at a disadvantage.

I am giving the suitably amended version. The program is liberally — and hopefully clearly — annotated but here is a summary: the characters are defined in

lines 1-27 plus overspill in lines 82-84. These lines and the spelling list, 1000-9999, are stored in arrays A\$ and W\$ respectively which are dimensioned in line 50.

Lines 130-230 randomly choose a word from the spelling list and have a provision for stopping the immediate repeat of a word. They then display it on the screen. Lines 500 and 560-590 give a short time delay before a keyboard input displays a new word — essential as key-bounce and multiple key-pressing are common with toddlers.

So that you do not leave the program inadvertently, the stop key has been disabled in line 120, but a controlled break is effected by first pressing the RVS key and then "Q", lines 510-540.

Run 60000 will save any amendments to the list. In the program given, it is set up

for the Commodore disc unit, but this is easily amended for other systems.

From the beginning, the program was a big success with Taleen and with visiting children. In common with most learning aids for this age group, it is really most successful when played with an adult who can give encouragement and praise even after the words have been learnt. Two or more children will, however, play happily together.

I have found it best to limit the words to about eight at a time, otherwise each word occurs too infrequently — the program allows up to 20. Learnt words are stored in Rem statements.

After reading, the next hurdle for a budding programmer would be typing and I foresaw many problems with the upper-case keyboard generating lower-

(continued on next page)

Flashcard.

READY.

```

1 DATA"000"
2 DATA"001"
3 DATA"002"
4 DATA"003"
5 DATA"004"
6 DATA"005"
7 DATA"006"
8 DATA"007"
9 DATA"008"
10 DATA"009"
11 DATA"010"
12 DATA"011"
13 DATA"012"
14 DATA"013"
15 DATA"014"
16 DATA"015"
17 DATA"016"
18 DATA"017"
19 DATA"018"
20 DATA"019"
21 DATA"020"
22 DATA"021"
23 DATA"022"
24 DATA"023"
25 DATA"024"
26 DATA"025"
27 DATA*
40 UP$="TTTTTT"
50 DIMA$(26),W$(20)
60 REM**A$( )-LETTERS*W$(20)-FLASH LIST
70 Z=0:REM**CREATE CHAR. ARRAY
80 READA$:IFA$( )="*"THENZ=Z+1:A$(Z)=A$:GOTO80
81 REM**AMEND THOSE WHICH ARE TOO BIG
82 A$(13)=A$(13)+"XXXXXXXXXX"
83 A$(16)=A$(16)+"XXXXXXXXXX"
84 A$(25)=A$(25)+"TTT"
100 NO=0:REM**CREATE FLASH WORD ARRAY
110 READA$:IFA$( )="*"THENNO=NO+1:W$(NO)=A$:GOTO110
120 POKE144,49:REM**BREAK DISABLE
130 K=(NO+1)*RND(1)+.5:K=INT(K):IFK=0OR(K>NO)THEN130:REM**SELECT WORD FOR FLASH
140 IFK=X9THEN130:REM**NEW WORD
150 X9=K
160 DISP#*W$(K)
170 REM**SET UP SCREEN AND DISPLAY THE WORD (DISP#)
180 PRINT"XXXXXXXXXX";
190 FORJ=LEN(DISP#)TO5:PRINT" ";:NEXT
200 FORK=1TOLEN(DISP#)
210 A#=MID$(DISP#,K,1)
220 PRINTA$(ASC(A#)-64);UP#;
230 NEXT
500 GOSUB560:REM**WAIT BEFORE DISPLAYING NEW WORD***
510 IFA#="Q"THEN540:REM**CONTROL BREAK
520 GOTO130
530 REM**IF BREAK RESTORE "STOP" & END
540 GOSUB570:IFA#="Q"THENPOKE144,46:PRINT"Q";:END
550 GOTO130
560 REM**WAIT FOR KEY INPUT***
570 GETA$:IFA$( )="*"THEN570
580 GETA$:IFA#=""THEN580
590 RETURN
999 REM**INSERT READING LIST IN LINES 1000-9998---MUST END LIST WITH "*" IN 9999
1000 DATAMUMMY,DADDY,TREE,GRANDMA,FISH
1010 DATATALEEN,TEDDY,FLOWER,BOOK
9999 DATA*
10000 REM**TALEEN,BALL,CHAIR,MILK,BATH
59999 REM**RUN60000 WILL SAVE ANY CHANGES TO THE LIST
60000 SAVE"00:FLASHCARD",8
60010 VERIFY"00:FLASHCARD",8
60020 END

```



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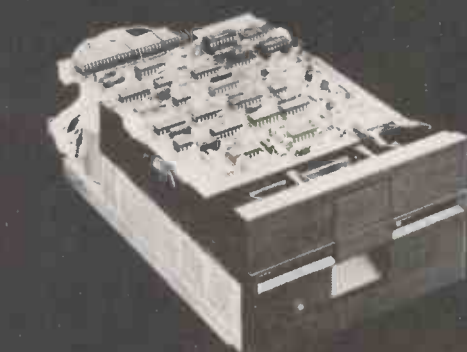
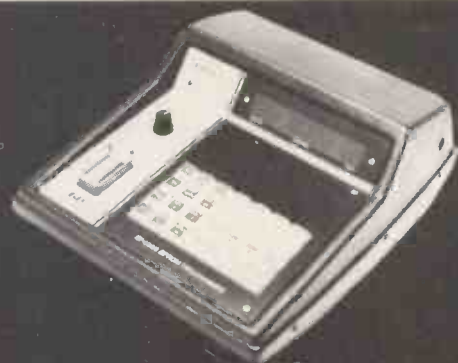
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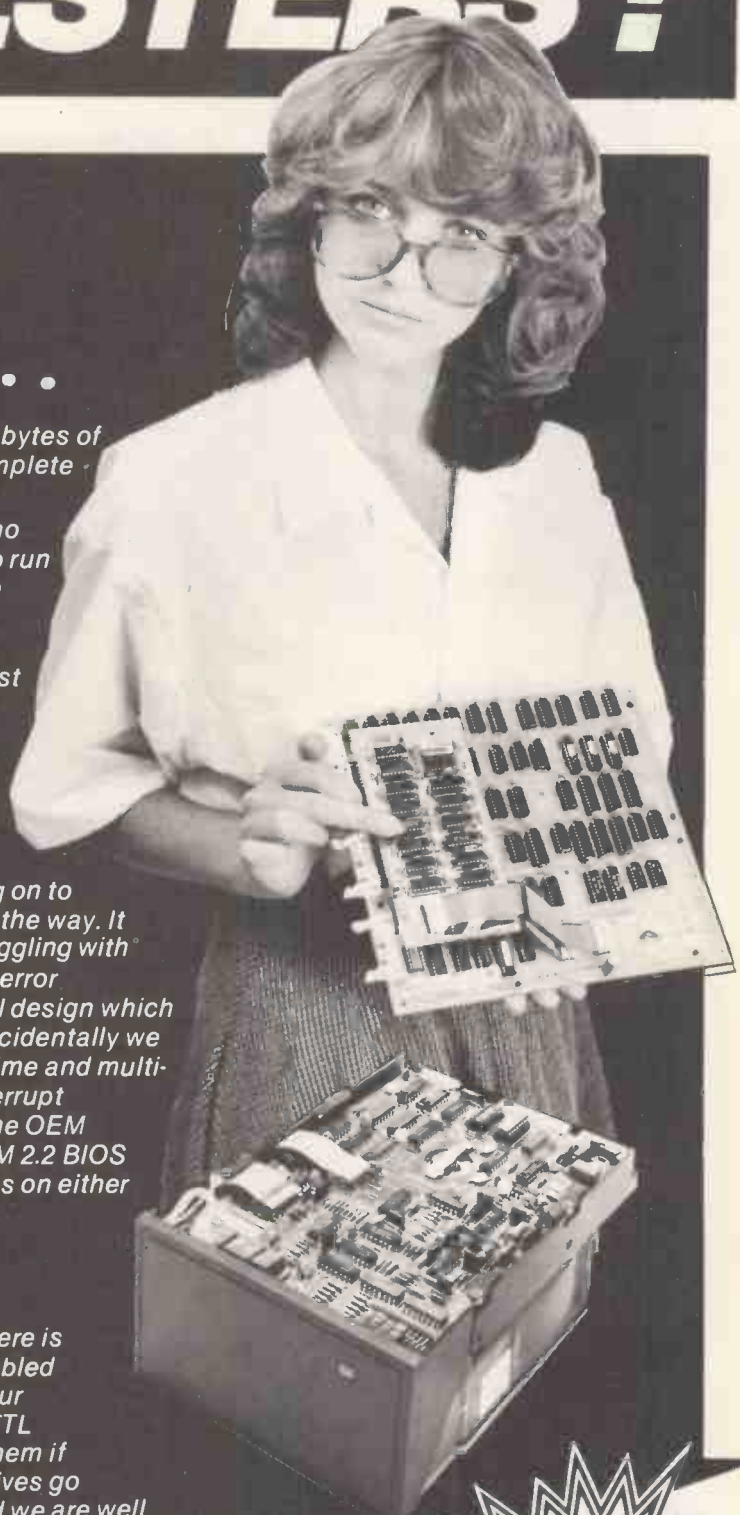
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The Strobe Model 100 can be interfaced to any computer through two parallel 8-bit output ports and one 8-bit input port. Optional interfaces for TRS-80*, Apple II*, PET*, and S-100 bus computers are currently available. Source listings of the assembly language motor drivers and vector plot routines for use on 8080, Z80, and 6502 microprocessors are supplied with Model 100. Flow charts of these routines simplify modifications of drivers for custom machine level software.

- * Unit price for plotter ex-delivery and ex-VAT
- * TRS-80, APPLE II, and PET are trademarks of Tandy Corp., Apple Computer Co., and Commodore Business Machines Inc., respectively.

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DEALER
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GALACTIC WARRIOR

IN THIS space game, you are controlling in real time a large Federation battle cruiser which spends most of its time in hyperspace and which can, when you want, return to normal space time.

Your mission is to travel through the Galaxy powered by hyperspace warp-drive engines, destroying enemy aliens with your photon torpedoes and laser blasters. The Galaxy is shown as a 10-by-10 grid, each sector of which is represented by a three-digit number that shows the number of stars, aliens, and starbases. This representation is called onto your own navigational computer screen in hyperspace control mode whenever you press "S" key which stands for sensors.

On this map, certain points in the Galaxy are highlighted. Starbase sectors are shown highlighted in half-intensity reverse video, and the sector in which your battle cruiser is situated is highlighted in flashing half-intensity reverse video.

When the program is run, the computer will set up the Galaxy with 100 sectors. Each sector contains a random number of stars and aliens. There will be three starbases located at random points in the Galactic matrix.

At the start of the game, you take control of the battleship and in 40 star-dates, you must destroy as many aliens as possible and perform other interesting feats to give you as high a score as possible.

You start in control mode which means that your ship is suspended in hyperspace above a sector. At the start, this is the central Galactic sector. On the

Christopher Histed's real-time, deep-space program has been designed to run on any machine with a memory-mapped screen or some form of cursor control.



screen the current status of your ship will be displayed.

The energy remaining in the ship's batteries, the sector you occupy, the number of photon torpedoes you have left, and what condition of alert the ship is on, will all be displayed and constantly updated on the top line of the screen.

If you are in a sector which contains only stars, the condition displayed on the screen will be green. If an alien is in the sector, it will be condition red, and if a starbase is in the sector, condition amber will be highlighted in inverse video.

From this hyperspace-based control

mode, you can press keys to perform various tasks. These keys are: P, I, S, E, W and here are their functions:

P: this will work only if an alien is present in your sector, and once pressed, it activates your photon-torpedo bays. You will see the message "Photon tubes primed, how many torpedoes?" and in response to this you must press a numeric key to indicate how many torpedoes you wish to fire. You fire these torpedoes from hyperspace into normal space, hoping to hit an alien — four or five will normally destroy the

(continued on next page)

```

1REM *****
2REM *** STAR TREK..... A SPACE GAME... ***
3REM *** BY CHRIS HISTED ***
4REM *** WRITTEN 5TH FEB. 1981 ***
5REM *****
6REM
7 OPEN#1,"SPOCK"\REM **** DATA FILE OF ODD COMMENTS !!! ****
8A=RND(-1)\DIM$(15,2)\O2$=CHR$(27)+"OP"\DIMA$(80)
9LINE133\S7=2800
10DIM A(10,10)\P=5\P1=5\FORX=1TO10\FORY=1TO10\A(X,Y)=(INT(RND(0)*8)*100)+100
11REM S9=FLAG FOR STARBASE
20IF INT(RND(0)*100)<40THEN21\A(X,Y)=A(X,Y)+1\U9=U9+1
21NEXTY\nEXTX
24 FORX=1TO3\X1=INT(RND(0)*10)+1\X2=INT(RND(0)*10)+1\A(X1,X2)=A(X1,X2)+10\nEXTX
25T=20\E=5000\O$=CHR$(27)+"OQ"\O1$=CHR$(27)+"O"+CHR$(64)
26O5$=CHR$(27)+"OS"
27INPUT" DO YOU WANT THE INSTRUCTIONS ",A$\IFLEN(A$)=0THEN27\IFA$(1,1)="Y"THEN
30!CHR$(12) 40000
35GOTO1080
40REM <<< PLOT INFO >>>
45S7=S7+0.2
46IFU9<1THEN60000
50!CHR$(27),"Y",CHR$(32),CHR$(32),O$, "ENERGY :",E," QUADRANT :",P," ",P1,

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601" PHO.TORFS :",T,02$,"COMMAND LEVEL",05$," CONDITION ",
61 IF K=1THENIFS9=0THEN!" RED ":"\IF S9=1 THEN!" AMBER ",
62IFK=0THENIFS9=0THEN!" GREEN ",
64!01$,"
65!CHR$(27),"Y",CHR$(33),CHR$(32),0$,"STAR DATE :",INT(S7),01$
66 IF INT(RND(O)*100)>60THENIF G7=1 THEN GOSUB 9000
68IFK=1THENIFINT(RND(O)*100)>75THENIF H8=0 THEN 8000
70N=INF(2)\IFN=215THEN1000\IFN=201THEN3000
71IF N=211 THEN 4000
72IF N=208 THEN IF K=1 THEN 6000\REM PHOTON TORPS
80IF N=197 THEN 60000
100 IF E<1 THEN 20000
110GOTO70
1000REM (( ( WARP )))
1001FORX=1TO50\NEXTX
1002!CHR$(27),"Y",CHR$(34),CHR$(33),0$,
1003K=0\57=S7+0.5\59=0\HB=0\G7=1
1010!"WARP ENGINES ENGAGED: INPUT HEADING )",01$,
1011X$=INCHAR$(X)
1020IFASC(X$)<47THEN1011\IFASC(X$)>58THEN1011\W=VAL(X$)
1030FORX=1TO10\CHR$(7),\FORY=1TO30\NEXTY\NEXTX\CHR$(12)
1040IFW>6THEN F=F-\IFW<4THENF=P+1\IF(W/3)=INT(W/3) THENF1=P+1
1050IFW=1THENF1=P-1\IFW=4THENF1=P-1\IFW=7THENF1=P-1
1060IF(F<1 OR P)>10 OR P1<1 OR P1>10 THEN 1065 ELSE 1070
1065!" YOU CANNOT LEAVE THE GALAXY "\GOTO10000
1070E=E-100-INT(RND(O)*100)
1080FORX=1TO(A(P1,P))/100\X(X,1)=INT(RND(O)*17)+2\X(X,2)=INT(RND(O)*76)\NEXTX
1081 I$=STR$(A(P1,P))\S9=VAL(I$(3,3))
1082IFS9<1)THEN1085
1083H1=INT(RND(O)*15)+3\H2=INT(RND(O)*78)+1
1085I$=STR$(A(P1,P))\K=VAL(I$(4,4))\IFK=1THEN1086\K=0\GOTO40
1086K=1\K1=INT(RND(O)*20)+1
1090K2=INT(RND(O)*78)\GOTO40
3000REM (( ( IMPULSE DRIVE )))
3001H=40\U=12
3005!CHR$(12)
3010!CHR$(27),"Y",CHR$(34),CHR$(33),02$,"IMPULSE ENGINES ACTIVATED.",0$
3020!" STAND BY TO LEAVE HYPERSPACE AND ENTER NORMAL SPACE-TIME"
50010 LET J$=CHR$(27)+"O"+" "+CHR$(27)+"O"+CHR$(64)
50040 LET H2=INT(RND(O)*73)+2
50050 LET V2=INT(RND(O)*15)+2
50060H=40\U=10\CHR$(12)\FORX=1TO100\NEXTX
50070 GOSUB 50080\GOTO50070
50080LETA=INF(2)\IFA=215THEN3500\IFA<176THEN RETURN\IF A)185THENRETURN
50090LETA=(A-176)\IFA=5THENRETURN\IFA=0THENGOTO50190\IF(A/3)=INT(A/3) THENH=H+1
50100IFA=7THENH=H-1\IFA=4THENH=H-1\IFA=1THENH=H-1\IFA<4THENV=V+1\IFA>6THENV=V-1
50110IFV>20THENV=20\IFV<2THENV=2\IF H>78 THEN H=78\IF H<2 THEN H=2
50120LET S$=CHR$(30+V)+CHR$(29+H)\LETX$=CHR$(31+V)+CHR$(29+H)
50130LET C$=CHR$(32+V)+CHR$(29+H)
50140!CHR$(12)\CHR$(27),"Y",CHR$(32),CHR$(33),0$,"ENERGY :",E,01$
50141 IF E<1 THEN 20000\E=E-1
50150!CHR$(27),"Y",CHR$(V2+31),CHR$(34+H2),("X")
50160!CHR$(27),"1",CHR$(27),"Y",S$, " D"
50170!CHR$(27),"Y",X$, "00000!\CHR$(27),"Y",C$, " D"
50180!CHR$(27),"2"\IFINT(RND(O)*100)>95 THEN 50310 ELSE RETURN
50190 !CHR$(7),\E=E-10\IFH<H2+4) THEN 50070\IF V<V2 THEN 50240
50200FORX=1TO3 \CHR$(7),\NEXTX
50210FOR X=1 TO 1000\NEXTX\CHR$(7),02$,"KLINGON DESTROYED "\S=S+1
50215S7=S7+0.5\K=0\U9=U9-1\CHR$(12)\A(P1,P)=(INT(A(P1,P)/100)*100)+(S9*10)
50230GOTO40
50240IF INT(RND(O)*100)+1)50 THEN 50070
50250H3=INT(RND(O)*3)+1\IF H3=3 THEN H3=-1\H2=H2+H3
50260 IF H2>77 THEN H2=77\IF H2<3 THEN H2=3
50270IF INT(RND(O)*100)+1)50 THEN 50070
50280V3=INT(RND(O)*3)+1\IF V3=3 THEN V3=-1\V2=V2+V3
50290 IF V2>19 THEN V2=19\IF V2<2 THEN V2=2
50300GOTO 50070
50310IFV2>V THEN C=-2ELSEC=2\IFH2>H THENH=-2ELSEH=2\H4=H2+3\H=H-1
50320FORX=V2TOSTEPFC\CHR$(27),"Y",CHR$(31+X),CHR$(32+H4),J$\NEXTX
50330FORX=H4TOSTEPB\CHR$(27),"Y",CHR$(31+V),CHR$(32+X),J$\NEXTX
50340!CHR$(7),CHR$(11),CHR$(11),CHR$(11),CHR$(27),"O", " MISSILE HIT ",CHR$(27),"O",
50350!CHR$(64)\FORX=1TO310\NEXTX
50360E=E-100\GOTO50070
60000REM (( ( EXIT FROM THE PROGRAM )))
60010FORX=1TO2000\NEXTX\CHR$(12)\!" YOU HAVE FINISHED YOUR TERM AS "
60020!" CAPTAIN OF THE ENTERPRISE , AND HAVE DONE WELL"
60030S1=(S*1000)-(E/5)+H6+(S7-2800) \!" YOU FINAL SCORE WAS ",S1
60035CLOSE#1
60040INPUT " DO YOU WANT THE MENU PROGRAM ? ",A$,\IFLEN(A$)=0THEN60040
60050 IF A$(1,1)="Y" THENCHAIN"EXEC" ELSE END
6100REM (( ( HIT KLINGON )))
6110K=0\5=S+1\A(P1,P)=(INT(A(P1,P)/100)*100)+(S9*10)\U9=U9-1\GOTO40
7000REM (( ( DOCK WITH STARBASE )))
7005H6=H6+10
7100E=5000\T=20\CHR$(27),"Y",CHR$(33),CHR$(32),02$,"ENTERPRISE DOCKED",01$
7110X$=INCHAR$(X)\X$=INCHAR$(X)
7120IFS9=1THEN!CHR$(27),"Y",CHR$(32+M1),CHR$(32+M2),"X"
7200!CHR$(27),"Y",CHR$(33),CHR$(32),"
7300GOTO3041
8000REM (( ( KLINGON FIRES AT YOU IN HYPERSPACE )))
8010E6=INT(RND(O)*200)+20
8020!CHR$(27),"Y",CHR$(34),CHR$(32),02$,"KLINGON ATTACK :",E6," ENERGY ",
8030!" BOLT HIT ON SHIELDS "\FORX=1TO 6\CHR$(7),\FORY=1TO500\NEXTY\NEXTX
8040!CHR$(27),"Y",CHR$(34),CHR$(32),01$,"
8050!"
8060E=E-E6\HB=1\GOTO40
9000R4=INT(RND(O)*14)+4
9010READ#1$(R4*80)-1,A$
9020!CHR$(27),"Y",CHR$(37),CHR$(32),0$,A$,01$
9030FORX=1TO5 \CHR$(7),\FORY=1TO400\NEXTY\NEXTX
9040!CHR$(27),"Y",CHR$(37),CHR$(32),"
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alien. You start with 20. If you have none left, you may replenish them by docking with a starbase.

I: Pressing this key will de-activate your hyper-drive and will initiate the jump to normal space time — at the same time activating your impulse engines for normal space travel. You will see a 10-second countdown, then the screen clears, showing an aerial view of the sector, with stars shown as asterisks, aliens as zeros and you as a cross. If a starbase is present in the sector it will be shown as an "x". In this mode, you control the ship's movement using the secondary keypad: press 8 to move up the screen, 2 down, 4 left, 6 right, with the appropriate diagonals. In this mode, the movement is real time — whatever key you pressed last will guide your direction. Non-numeric c keys will halt the ship, and as you move, your energy diminishes and, if it drops below zero at any point in the game, you are dead, and the game will end. If you move the ship into a star, you are also destroyed. If the Alien moves close to you — one space in any direction — you will enter the battlestations mode. To dock with a starbase, you move your ship over the "x", and all your supplies will be replenished to their starting level. To leave normal space, and to re-enter hyperspace, press "W" for warp.

In battlestations mode, the screen will again change — this time giving you a view of the attack computer gunnery computer screen. Here, you see the alien depicted as <#>, and as he moves around the screen, the aim is to move your laser blaster gunsights over him.

Destroy the alien

Your sights are shown on the screen as a fine crosshair which you move about with the aid of the secondary keypad — 8 up, 2 down, 4 left, 6 right, and diagonals. Once you have centred your guns, press zero to fire the guns and if you are successful, you will destroy the alien and jump back to hyperspace. In this mode and in the control mode, it is possible for the alien to fire back at you, and drain energy from your force shield.

S: Pressing S in the control mode will bring on to the screen the latest updated record of the Galaxy as a 10-by-10 grid of three-digit numbers. The first number represents the number of stars in the sector, the number of starbases, and the number of aliens in the sector. The sector you are in will flash in inverse video and starbases will also be highlighted.

E: Pressing this key will terminate the game, and jump to the end subroutine which calculates your final score. This works only in the control mode.

W: This command will activate your

Make the most of your Sinclair ZX Computer... Sinclair ZX software on cassette. £3.⁹⁵ per cassette.



The unprecedented popularity of the ZX Series of Sinclair Personal Computers has generated a large volume of programs written by users.

Sinclair has undertaken to publish the most elegant of these on pre-recorded cassettes. Each program is carefully vetted for interest and quality, and then grouped with other programs to form a single-subject cassette.

Each cassette costs £3.95 (including VAT and p&p) and comes complete with full instructions.

Although primarily designed for the Sinclair ZX81, many of the cassettes are suitable for running on a Sinclair ZX80 – if fitted with a replacement 8K BASIC ROM.

Some of the more elaborate programs can be run only on a Sinclair ZX Personal Computer augmented by a 16K-byte add-on RAM pack.

This RAM pack and the replacement ROM are described below. And the description of each cassette makes it clear what hardware is required.

8K BASIC ROM

The 8K BASIC ROM used in the ZX81 is available to ZX80 owners as a drop-in replacement chip. With the exception of animated graphics, all the advanced features of the ZX81 are now available on a ZX80 – including the ability to run much of the Sinclair ZX Software.

The ROM chip comes with a new keyboard template, which can be overlaid on the existing keyboard in minutes, and a new operating manual.

16K-BYTE RAM pack

The 16K-byte RAM pack provides 16-times more memory in one complete module. Compatible with the ZX81 and the ZX80, it can be used for program storage or as a database.

The RAM pack simply plugs into the existing expansion port on the rear of a Sinclair ZX Personal Computer.



Cassette 1 - Games

For ZX81 (and ZX80 with 8K BASIC ROM)

ORBIT – your space craft's mission is to pick up a very valuable cargo that's in orbit around a star.

SNIPER – you're surrounded by 40 of the enemy. How quickly can you spot and shoot them when they appear?

METEORS – your starship is cruising through space when you meet a meteor storm. How long can you dodge the deadly danger?

LIFE – J. H. Conway's 'Game of Life' has achieved tremendous popularity in the computing world. Study the life, death and evolution patterns of cells.

WOLFPACK – your naval destroyer is on a submarine hunt. The depth charges are armed, but must be fired with precision.

GOLF – what's your handicap? It's a tricky course but you control the strength of your shots.

Cassette 2 - Junior Education: 7-11-year-olds

For ZX81 with 16K RAM pack

CRASH – simple addition – with the added attraction of a car crash if you get it wrong.

MULTIPLY – long multiplication with five levels of difficulty. If the answer's wrong – the solution is explained.

TRAIN – multiplication tests against the computer. The winner's train reaches the station first.

FRACTIONS – fractions explained at three levels of difficulty. A ten-question test completes the program.

ADDSUB – addition and subtraction with three levels of difficulty. Again, wrong answers are followed by an explanation.

DIVISION – with five levels of difficulty. Mistakes are explained graphically, and a running score is displayed.

SPELLING – up to 500 words over five levels of difficulty. You can even change the words yourself.

Cassette 3 - Business and Household

For ZX81 (and ZX80 with 8K BASIC ROM) with 16K RAM pack

TELEPHONE – set up your own computerised telephone directory and address book. Changes, additions and deletions of up to 50 entries are easy.

NOTE PAD – a powerful, easy-to-run system for storing and

retrieving everyday information. Use it as a diary, a catalogue, a reminder system, or a directory.

BANK ACCOUNT – a sophisticated financial recording system with comprehensive documentation. Use it at home to keep track of 'where the money goes,' and at work for expenses, departmental budgets, etc.

Cassette 4 - Games

For ZX81 (and ZX80 with 8K BASIC ROM) and 16K RAM pack

LUNAR LANDING – bring the lunar module down from orbit to a soft landing. You control attitude and orbital direction – but watch the fuel gauge! The screen displays your flight status – digitally and graphically.

TWENTYONE – a dice version of Blackjack.

COMBAT – you're on a suicide space mission. You have only 12 missiles but the aliens have unlimited strength. Can you take 12 of them with you?

SUBSTRIKE – on patrol, your frigate detects a pack of 10 enemy subs. Can you depth-charge them before they torpedo you?

CODEBREAKER – the computer thinks of a 4-digit number which you have to guess in up to 10 tries. The logical approach is best!

MAYDAY – in answer to a distress call, you've narrowed down the search area to 343 cubic kilometers of deep space. Can you find the astronaut before his life-support system fails in 10 hours time?

Cassette 5 - Junior Education: 9-11-year-olds

For ZX81 (and ZX80 with 8K BASIC ROM)

MATHS – tests arithmetic with three levels of difficulty, and gives your score out of 10.

BALANCE – tests understanding of levers/fulcrum theory with a series of graphic examples.

VOLUMES – 'yes' or 'no' answers from the computer to a series of cube volume calculations.

AVERAGES – what's the average height of your class? The average shoe size of your family? The average pocket money of your friends? The computer plots a bar chart, and distinguishes MEAN from MEDIAN.

BASES – convert from decimal (base 10) to other bases of your choice in the range 2 to 9.

TEMP – Volumes, temperatures – and their combinations.

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	23	Cassette 3 - Business and Household	£3.95	
	24	Cassette 4 - Games	£3.95	
	25	Cassette 5 - Junior Education	£3.95	
	17	*8K BASIC ROM for ZX80	£19.95	
	18	*16K RAM pack for ZX81 and ZX80	£49.95	
		*Post and packing (if applicable)	£2.95	
			Total £	

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SOF 13

No trouble at t'mill!

THE INDUSTRIAL north is a Mecca to some people and to others, anathema. The cloth-cap, hard-working image of Lancashire disguises an economy divided into two camps: on the one hand there are the pits and on the other, the mills. Dark satanic monstrosities they may be to outsiders, but to the working folk of the area they are bread and butter.

In the midst of the industrial gloom and economic depression of the area lies Leigh. On the outskirts of metropolitan Wigan — of the casino and pier — to the west of Greater Manchester, Leigh is a staunch working-class town, with both pits and mills.

On the Leigh road, as you leave town, before the bus depot and the pits, is Forsters Mill. Anyone from Leigh will be able to tell you where it is because Forsters is the town's biggest employer. Soon, though, Forsters Mill will become biggest employer in another way — Leigh's biggest employer of microcomputers.

Forsters is not most people's idea of a mill: it does not look like a scene from a Lowry painting, and textiles are not produced there. In fact, it is a modern building engaged in the modern world of high-street fashion. Forsters supplies garments exclusively for Marks and Spencers — mainly ladies fashions — and because of Marks and Spencer's buoyant market share, the mill has weathered the economic storm well.

The man behind Forsters' move into microcomputers was Bob Dawson, the production engineer. He was lucky: as mill owners go, Donald Forster, the managing director was a go-ahead type — his willingness to invest in new machinery was rare in the industry. In fact the 15-year-old mill had relatively modern equipment, and this may have made an important contribution to the success of the company while other mills were closing.

Bob Dawson first became interested in microcomputers three years ago, when he found that everything he read or watched told him that they were about to revolutionise his life. As a result of the media bombardment, he decided to investigate. The first move was to attend a conference organised by the Clothing Institutes PAMSS, at Nottingham University. The plan involved discovering the micro's active and potential role in the clothing industry.

He left the conference with the opinion that there was still a long way yet to go in the development of microprocessor hardware, and that the time was not quite right for an entry into microcomputers — at least from the point of view of the clothing industry. A year later he had another

Bill Bennett tells how Forsters, a Northern clothing mill, has kept up with 20th century technology in the form of a general-purpose microcomputer system.



The mill has been described as a rabbit warren

brush with computers, this time, though, it was with a mainframe company.

Norprint Ltd manufactures a label-printing machine and its staff told Bob Dawson about a system it manufactures in conjunction with Barron McCann Ltd. An in-house demonstration was arranged for all the heads of departments from Forsters. Bob Dawson was encouraged by the response the demonstration generated. The outcome was that Forsters decided to commission a study. The study investigated the feasibility of applying microcomputers to the main administration processes of the business.

Forsters applied to the Department of Industry for financial assistance to pay for the study and were successful. The £2,000 required for funding was arranged under the MAPCON scheme. Barron McCann was thus commissioned to conduct the study in two parts.

The first part would investigate the individual administrative functions of the company. The second part would involve an in-depth analysis of those functions identified in the first part as being the most likely to benefit from the use of microcomputers.

Even though Bob Dawson was a production engineer during the day, and had been a design-room manager as well, he was an electronics hobbyist as well. At the same time as the feasibility study was getting under way, Dawson saw an advertisement for the Sinclair ZX-80 microcomputer. Reasoning that if he was going to have to work with microcomputers he might as well gain some experience first, and anyway, for a mere £100 he could not go far wrong.

He and thousands of others duly sent off their cheques and waited. The story of how Sinclair was overwhelmed by the

demand for his ZX-80 is well documented.

Dawson had to wait four months for his microcomputer to arrive but he had already started reading the Basic manual which had arrived before the ZX-80. This proved to be an inspiration to him, and he was very keen to have some hands-on experience and actually program.

The ZX-80 had still not arrived, so he asked his contacts at Barron McCann if he could borrow a machine for a few weekends. Amazingly they agreed and let him have a machine.

Dawson found — just like everybody else — that computer programming is addictive; in his own words, he was hooked. He found a sense of satisfaction from writing even simple programs. He would stay awake late at night debugging programs or re-writing software listed in *Practical Computing* to meet his machine's specification.

When at long last the Sinclair arrived, it promptly developed a fault. Rather than spend another four months waiting while the machine was returned and fixed, he decided to ask for his money back. Although he might have effected the repair himself, the detailed technical data he required to do this was not forthcoming from Sinclair.

Surprisingly, the experience with the Sinclair did not leave Dawson a microcomputer cynic. He takes a philosophical view of the event: "My experience should not be taken as typical, I know several people who have had much more success with them. Indeed, anyone contemplating an interest in programming will certainly find them invaluable as an educational tool".

The first part of the feasibility study

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had now been completed. Barron McCann had reported that there were four functions of the mill administration which merited investigation. They were: the order-acceptance processing function; the printing of work tickets together with wage calculation and work-in-progress control; stock control and costing of the labour for sample garments. The go-ahead was then given for the second part of the study.

Among the recommendations was a mention that for the labour costing of sample garments, a stand-alone system would be sufficient. The program for such a system would need to be tailor-written, but by now Bob Dawson was convinced that he could write it. After "only a small amount of persuasion" the managing director agreed, even though he was a little sceptical.

At first, only a basic machine was bought. Before the printer and disc drive could be acquired, Dawson would have to produce some "concrete results". He did not have to spend much time deciding which machine to use — he already had made up his mind that the 32K Pet would be the best machine for the job.

As far as the technical specification went, it fitted the bill. The machine could have been purchased off-the-peg from a southern supplier at a low price, but support would be lacking. Instead, the machine was bought from a local supplier, Stack of Liverpool. Since then, he has been convinced on many occasions that this decision was correct.

Program development was slow at first, confesses Dawson. The work had to be done at home, mostly at weekends and in the evening. As most people find when they begin programming in earnest, he lost all track of time. Often his wife would find him still huddled over the keyboard in the middle of the night. Rather than start from scratch, Dawson found a copy of a general-records program and decided it would make a base for the program he was developing.

Amending the program was a lengthy business. By the time it was finished, it bore little resemblance to the original. Then came the acid test. He took the machine back to the mill and the records for labour costing were entered. The manual process of costing a garment took on average 45 minutes, much to everybody's delight the Pet took only 10. It had worked and it looked like the micro was in the mill to stay.

The Pet needed a printer to produce a hard copy of the costing. Rather than buy one immediately — the choice was bewildering — they decided to rent one from Stack while they looked for one to buy. Meanwhile, the Pet was in constant use costing the garments. Dawson chose two more processes which could be computerised easily.

The next program he wrote produces a

complete up-to-date listing of garment types which forms the record used for costing. The list is circulated once a month to managers and engineers around the mill.

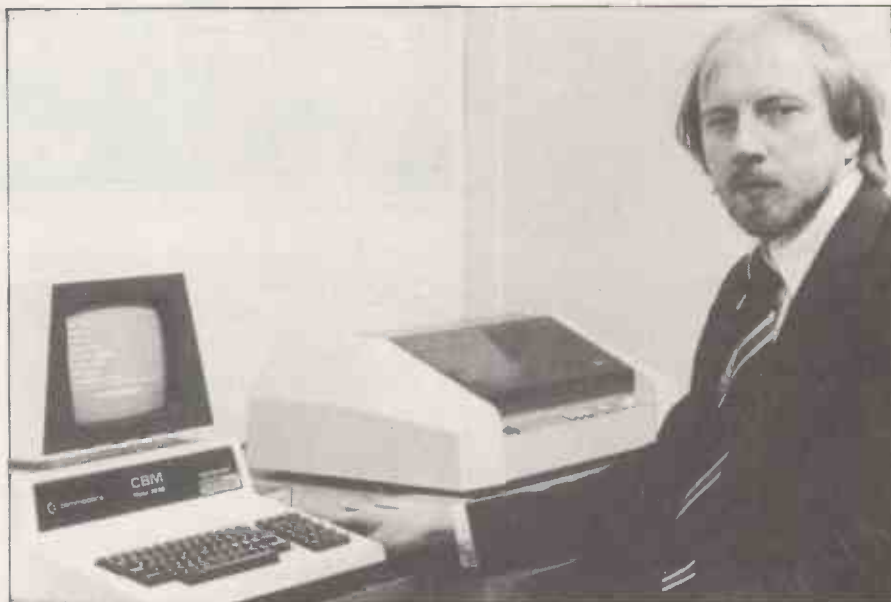
The values on the records reflect the cost of a process. Because in a mill the girls are on piece work — paid by the amount of work done, not time — each task performed has a cost or price. The price reflects the time an average operator would take to perform the task. If new machinery is introduced or higher rates are to be paid, the cost must be replaced by a more up-to-date value.

The program produced a useful by-product — a usual phenomenon in the microcomputer business. Each value used in costing is given a code number which

After all, as Bob Dawson correctly points out, at a cost of around £2,500 for a complete system, you cannot go wrong. Costs have been minimised because the software was developed by Dawson himself in his own time. The system still costs less than two sewing machines.

Because of the topology of the site — a rabbit warren is one description of the mill — rather than one central machine covering all the functions, it was decided to have six separate stand-alone machines. The Commodore Pet was chosen, mainly because of the sterling performance of the first one.

Machines will then be at various points around the mill — with one machine at another Forsters mill in Yorkshire. In the event of a hardware fault developing in



Bob Dawson has received a sterling performance from his Pet

can be cross-referenced to the garment listing so that the manager may discover from which garment style this value was obtained.

Dawson's third program was designed to calculate the number of cones of thread required per machine, per colour for the manufacture of a given number of garments. As a manual calculation, it was lengthy and prone to error. On the Pet, the calculation takes less than five minutes including the time spent inputting the data.

The total length of seams per machine type is input. The computer then calculates the total thread required and prints an analysis for each machine used in the production of a garment. The thread is allocated into optimum bobbin size per machine.

On completion of the feasibility study, managing director Donald Forster made the decision to process in all those areas highlighted in the report.

Despite his earlier reluctance the managing director was by this time convinced of the value of the microcomputer and was willing to invest in the machines.

one machine, all that the operator/programmer will have to do is move the software to another of the six locations.

The way in which Forsters mill arrived at the microcomputer solution was far from typical but it is one of a new breed of microcomputer users. The middle and upper management in the whole of industry can learn from the experience of Bob Dawson at Forsters.

First, he believes the knowledge he gained provided him with a greater understanding which he can now use when evaluating systems being sold by "experts". He has personally exorcised the mystique surrounding computers and achieved a certain degree of microcomputer acceptance among his management colleagues.

By developing the software himself, he knows not only what the system does but also how, in addition, the software performs in the environment for which it was written.

What of computers actually taking part in the production process? Bob Dawson does not see microcomputers making inroads in this field for a long time. □

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Even in today's technological age there are those for whom magic and the occult hold an irresistible attraction, and who will use the power of modern machines to harness forces older than mankind. Charles Christian tells the salutary story of . . .

A dead system and a demon at Howick Hall



J. LITTERICK '81

It was a cold, dark, wet and miserable November night and I was glad to see that they had an enticing log fire burning at the local when I arrived there for a drink. The place was almost deserted, but I noticed one of our service engineers sitting at a small table near the inglenook so I went over to join him. He had obviously been drinking rather heavily and as soon as I sat down, he started talking:

"I suppose doing this type of work every day, you cannot help but become rather thick-skinned and detached, for no

matter what you do, someone will always be dissatisfied. All the time their systems are working properly, your customers are whining about the premiums they have to pay. As soon as there is a fault, they start complaining to head office about poor service if you haven't arrived at their installation and got their computer up and running again within five minutes. You just cannot win.

"Of course they always make such a big deal about their problems. Everything is always a matter of life-or-death urgency. They always claim that contracts worth

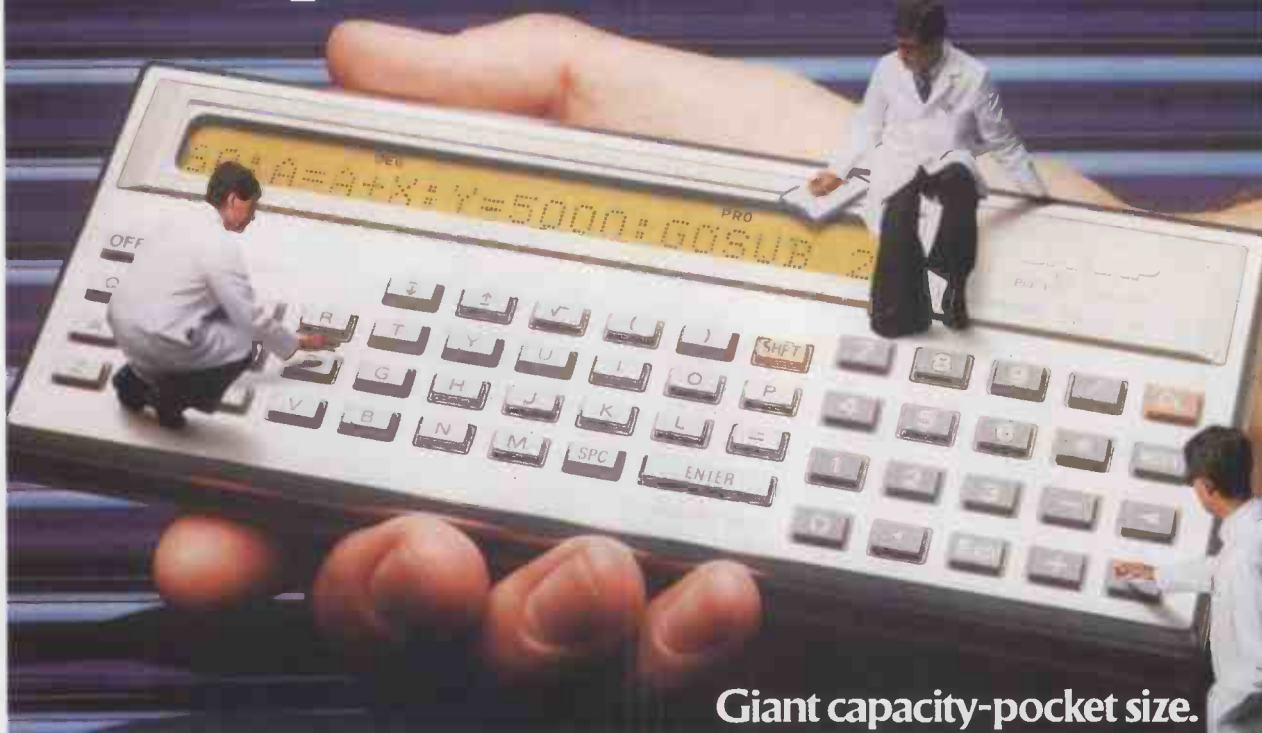
millions of pounds are at stake or that the whole nation's security is at risk. Yet what happens? You make the necessary repairs and they start running off limited editions of *Eskimo Nell* again on the line printer.

"Still, I do remember one occasion when a customer really did have a life-or-death emergency on his hands.

It all happened over a weekend just one year ago. I was on duty at the time, doing the evening shift, and I was just congratulating myself on the amount of

(continued on page 91)

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SHARP
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Sharp Electronics (UK) Ltd., Computer Division, Sharp House, Thorp Road, Newton Heath, Manchester M10 9BE. Tel: 061-205 2333.

"I faced a tall, gaunt and totally bald man . . ."

(continued from page 89)

overtime I would soon be reaping, when the telephone rang.

"It was one of our customers to announce that his computer had just gone down in the middle of running an important program and he sounded as if he was in a terrible state. He was weeping, sobbing, almost incoherent — but I got the message. It was essential that the system be back in action before midnight.

"Well, try and keep the customer satisfied, that has always been my motto and besides, I had nothing else to do, there was only yet another repeat of *Butch Cassidy and the Sundance Kid* on the television and I had run out of books to read.

"I looked up his file and discovered that the installation was situated near Chalfont St Giles, Buckinghamshire. Assuming that there were no traffic hold-ups, I could get there, via the M40 motorway, in just under an hour, so I phoned him back and said that I was on my way.



According to our files, he was running a fairly basic on-line information-retrieval system. Apparently, the installation was at some kind of private research institute which now stored all its records on magnetic disc. The hardware was all standard gear and from the sound of the system, the software would be the usual Boolean logic type of database interrogation program that big libraries have been using for years. In other words, I did not expect any trouble.

"I loaded up the company van, remembered to switch on the telephone-answering machine, and set off for Buckinghamshire. Forty minutes later I was driving along the narrow tree-lined lane that led up to Howick Hall, an ivy-enshrouded example of Victorian Gothic architecture

at its worst. I recollect thinking at the time that this was an unlikely site for a computer installation.

"The front door of the building opened almost as soon as I had left the van. Evidently my customer, Doctor Halsey, really was desperate to have his computer running again and had been eagerly expecting my arrival.

"The night was already quite dark and with Halsey standing at the doorway, silhouetted by the lights from inside the building, I was unable to see his features very clearly until I was close to him. When I did see him, however, I had quite a shock. Instead of the white-coated, greasy-haired, pimply research scientist I had anticipated meeting, I found myself faced by a very tall, gaunt and totally bald man, sporting a livid red scar across his left cheek.

If that were not enough, a further surprise was in store when I saw his clothes, for he was dressed in a flowing black gown embroidered with red silk geometric symbols.

"It did occur to me that I had become the subject of a practical joke but Doctor Halsey showed no signs of wanting to laugh. He was in fact every bit as agitated as he had sounded over the telephone and wasted no time in almost dragging me down a flight of stairs into a cavernous cellar, at the far end of which, I was glad to see, stood his computer system.

"I was about to walk straight over to it when suddenly I felt myself being grabbed by Halsey and pulled over to one side of the room. I looked around and realised that the reason for his precipitous action had been to prevent me from stepping into an elaborate pattern chalked on the cellar floor.

"It was the same pattern that was embroidered on his gown — a five-pointed star within a circle, and I had read enough Dennis Wheatley books to know that it was called a pentagram.

"A further glance around the cellar left me in no doubt that Doctor Halsey was playing with magic and, to judge by the cabalistic symbols on the walls and the human skulls at each of the pentagram's salient point, it was obviously black magic.

"Now in all the best Hammer horror films, when this point is reached and the wicked doctor's evil plans are unmasked, he usually retaliates by trying to convert his innocent victim into a human sacrifice. Yet this did not happen to me.

Doctor Halsey did not seem at all concerned that I had seen what he was doing, instead he continued to hurry me over to his computer, and, I must admit, to my own surprise, once we reached it, rather than try to escape, I settled down to checking the system for him.

"I went through the system thoroughly and rapidly reached the conclusion that it was a hardware fault. A few minutes later, it must have already been after 11 o'clock then, I was able to trace the problem to a worn channel in the system's video-control circuitry. It could be repaired but it would mean dismantling the central processor unit to access the control register — not an easy job, and it would take time.

"I explained the problem to Halsey who, looking decidedly unhappy, started to mutter something about midnight. When I asked him why midnight was so important, he proceeded to gabble what is probably the most fantastic story I have ever heard.

"With a perfectly straight face, he told me that the previous evening, October 31, has been All Saints' Eve, otherwise known as Halloween, one of the most important dates in the occult calendar. Taking advantage of the powers of darkness which, are abroad on such a night, he had prepared a magic circle with the intention of conjuring a friendly spirit



but, to his horror, had accidentally called up an arch-demon.

"He then went on to tell me that the demon had tricked him into signing a pact which, if enforced, meant he would forfeit his mortal soul. The pact had been written in blood drawn from the wound on his cheek.

It occurred to me that Doctor Halsey was either a grade A nutcase or high on drugs — possibly a little of both — but there was no stopping him. He continued his tale by explaining that, according to arcane laws "older than mankind", having summoned a demon, he was allowed one day in which to banish it back

(continued on next page)

"She was the sort of woman you have fantasies about . . . dressed in a clinging black jump-suit"

(continued from previous page)

to the nether regions of the universe.

"If he failed, then he would no longer be protected by the forces of the pentagram and the demon would be able to claim his soul. I could not help but make the obvious remark that he would have done better to have called in a priest rather than a computer-maintenance engineer, but apparently that was not the case.

"According to Halsey, buried within the eldritch writings of the ancient masters of the black arts, were spells and incantations powerful enough to bind and defeat demons. All he had to do was to find the right words. That was where the computer came in. Because these ancient writings were so rare, Halsey had spent the last 10 years of his life building up a library of their texts — a library stored on the magnetic discs of his computer system.

"He had actually been searching for the correct formula by displaying the data, page by page, on the visual display unit when the system had gone down. His file-index organization, it seems, left a good deal to be desired.

"Halsey's big problem was that the 24



hour period was due to expire at midnight — by then, less than 50 minutes away.

"I have always believed that the best way to handle weirdos is to humour them, so I played along with Halsey and set about trying to find a way for him to access his data before midnight, even though the VDU was out of action.

Fortunately, the system incorporated a terminal typewriter on one of the other input-output ports, so I keyed in the

appropriate instructions and let the computer dump its entire memory onto print-out.

The typewriter was not as fast as I would have liked, but at least it gave Halsey a chance to read through all the hard copy in the search for his missing spell.

"You should have seen the stuff issuing from that computer. There was something called the *Corpus Hermeticum*, pages of extracts from the *Grimorium of Honorious*, the *Lemegeton*, *Saducismus Triumphatus* and so on. Halsey had certainly not been exaggerating when he had said it had taken him years to collect all the material.

"Quite frankly I soon became bored watching him wade through all that gibberish, so I decided to go outside for a cigarette. I left him reading through the *Necronomicon* of Abdul Alhazred and climbed up the staircase and out of the cellar.

"And then I saw her. She was the sort of woman you have fantasies about. Her hair was auburn and long, very long. Her eyes were emerald green and flashed in the light, and her face had an almost wanton beauty. As for her clothes — well, she was dressed from head to foot in a clinging black leather jump-suit that made it only too obvious that her body was equally as desirable. When she saw me, she just stared straight at me and smiled. I felt myself go weak at the knees.

She told me that her name was Lilith and that she was waiting to see Halsey. I remember thinking at the time that seemed rather odd. However, when she started talking I ceased to care, she was enchanting. We talked and talked, I have forgotten what about, and I totally lost track of the time.

"Suddenly a clock started to chime, it must have been in the room somewhere. There were 12 strokes; midnight had arrived. It was only then that I remembered why I was at Howick Hall and I remarked that I had better go and see how Doctor Halsey was managing. The woman agreed with me and together we walked down the cellar staircase. Trying to be the gentleman, I opened the cellar door to let her enter first. This she did, but, to my surprise, she then slammed the door firmly shut behind her.

"The lock was stiff and it took me a moment to open the door but when I did, I was greeted by an almost unbelievable sight. Halsey was cowering on the floor, almost buried in printout from the computer, and looming over him stood the woman.

"Slowly, she leaned forward and, reaching down, she placed her hands around his quivering neck. Then, as if to

pluck Halsey off the ground, she jerked upright, but in that very instant there was a blinding flash of light, closely followed by the sound of an explosion.

"When my eyes had recovered from the dazzle, to my consternation I saw that the whole computer was engulfed in flames; and of the Doctor and Lilith, there was no sign. I tried to beat out the flames but the intense heat drove me back and within seconds the fire had ignited the cellar's wooden ceiling joists.



Soon the cellar was starting to fill with smoke and in face of the worsening conflagration, I was forced to flee back up the staircase into the main part of the house.

Naturally, I telephoned for the fire brigade but the house must have been tinder-dry, for by the time they arrived, the fire had already reached the roof.

"A little after one o'clock that morning, the house collapsed. Of course, in the light of my story, the ruins and ashes of Howick Hall were carefully sifted, but no human remains were ever found. In fact nothing was ever heard of Doctor Halsey or the woman again. The police took the view that I was the victim of an elaborate hoax, possibly connected with an insurance fraud. What do I think happened?

"I cannot help worrying that, by dumping the memory through the typewriter terminal, I overloaded the system and caused a short-circuit which ignited all the printout that was lying all over the floor. No wonder there were no remains, they must have been burnt to a crisp.

"The alternative is to believe that Halsey told the truth. But we all know that magic and superstition belong in the middle ages with no place in today's world of science and scepticism don't we?"

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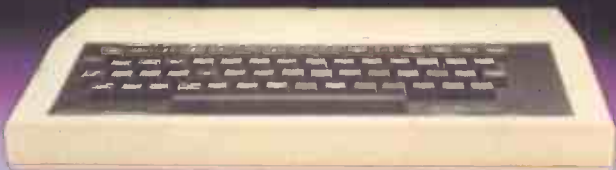
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For the record

THIS PROGRAM is designed to be run on a 32K Pet, linked preferably to a 3022 series printer. Its objectives are to be able to store as a data file, the names and relevant information regarding a school's intake for a particular year, to be able to interrogate a file and to produce hard-copy listings of the information required.

The program is capable of handling a file of up to 150 children at any one time — each child holds a maximum of 12 records. Data is to be entered and stored on cassette. That is, perhaps a little time-consuming, but certainly worthwhile if you are unable to buy a set of discs. Although the program has been written in Basic, it should be adapted easily to run on capable machines other than the Pet.

The data-file is created by inputting the relevant information into the cassette buffer in response to a prompt on the screen.

operator or user must satisfy one of two decisions before proceeding, either: CREATE A FILE or READ A FILE

On creation of a file, the operator is asked for the name of his or her file and then instructed to place a new cassette into the Pet so that the header part of the file may be recorded. After a few seconds,

By Clive Bulmer

the program asks for the relevant information required for the file, i.e., name of child, junior school, etc. — see data section.

After the last item of data has been entered for each child the program asks the operator if the records for that child look satisfactory. If not, the operator is able to re-type the information without fear of it being recorded on the tape. When the last child has been reached, the file is closed by typing End after the prompt NAME OF CHILD?

On reading a file, the operator is asked for the name of the file required — I use such things as Intake '79 etc. — then proceeds to search and load the file. As the file is being read into memory, the records of each child are displayed on the screen so that the operator can see at a glance that it is being loaded correctly.

Once the operator has either created or read a particular file, the program switches to the menu which is:

1. READ ANOTHER DATA TAPE
2. CREATE ANOTHER DATA TAPE
3. SEARCH AND LIST PARTICULAR DATA
4. CHANGE OR ADD INFORMATION TO A DATA TAPE
5. LIST ALL THE DATA TAPE

It is worthwhile to note that if one has interrogated a file of up to 150 boys in a particular year then by selecting item 1, it is possible to interrogate a file of up to 150 girls without having to re-load the program.

Item 3 of the menu is perhaps the most useful part of the program for it allows one to interrogate the file — lines 799 to 1002. For each child on file, there are 12 records and it is possible to interrogate each record. Lines 929 to 1062 of this subroutine produce a hard-copy listing on the 3022 series printer.

By altering the variable it is possible to

be given different information but after many combinations, I feel that the output produced as it stands is quite sufficient.

Before one is given a listing of the required information, there are the options in lines 826 to 829 of whether to have headings or not. This is helpful when a listing has been given, then a new data tape loaded, for it prevents another heading being printed half-way down a class list.

The CHR\$(141) command causes the printer to execute a print without a line feed. It adds a little time to the print-outs but ensures all printing to be done in perfect columns.

Item 4 of the menu allows the user to change or add information to a data tape. There is the option of either changing any of the 12 records for one particular person or the whole file — lines 694 to 698. Use of this option will allow the user to produce several copies of the same data file — something I always do in case the gremlins attacked my original copy.

If one wishes to add an extra person to the data tape, one must call the last person — who incidentally will have the name End — insert the records for this new child then call the n'th person End to close the file.

Item 5 produces a listing of the name of each child and its records — lines 504 to 532 — automatically. This takes about 15 minutes to list a complete file of 150 names/records. To save time, I have not included an algebraic sort but prefer to enter each child's name alphabetically as I create a data tape.

Lines 507 and 832 can be changed to the name of the school or institution being listed.

I have tried to make the program as simple as possible to run so that a person with little knowledge of computing should be able to obtain satisfactory results. It is reasonably idiotproof, but not totally.

If one obeys the instructions then little, if anything, should go wrong. Once all the information has been entered, the dividends will follow for all one has to do is change a child's year and add a few grades as he progresses through the school.

List and details of variables used:

A\$	Name of child	— 21 characters maximum	
B\$	Junior School	— 2 characters maximum	
C\$	House	— 2 characters maximum	
D\$	Form	— 3 characters maximum	
E\$	maths	— 1 character	
F\$		Junior-English	— 1 character
G\$	school	overall	— 1 character maximum
H\$		grades	nfer maths
I\$	grades	nfer English	— 3 characters maximum
J\$		spare	— 2 characters maximum
K\$ to P\$	English grades	1 character each	
Q\$ to V\$	science grades	if unknown use	
W\$ to 2B\$	maths grades	A'—' character	

The creation of a data file of this structure will be particularly useful to secondary schools who receive similar information from their feeding primary/junior schools.

The school grades — two per subject per child per year — are written into a data tape file after each exam or half-year period up to a maximum of three years. Lack of memory has resulted in only the essentials, maths, English and science to be recorded, as the children progress through the school. If grades are unknown, i.e., future exams, then a '—' character should be used.

Once the program has been loaded, the

```

1 REM C. BULMER JULY 1980 COPYRIGHT
2 PRINT "*****SCHOOL RECORDS**"
3 FOR L=1 TO 150: NEXT L: PRINT " "
4 REM ALLOCATE MEMORY FOR DATA
5 DIM A$(150), B$(150), C$(150), D$(150)
6 DIM E$(150), F$(150), G$(150), H$(150)
7 DIM I$(150), J$(150), K$(150), L$(150)
8 DIM M$(150), N$(150), O$(150), P$(150)
9 DIM Q$(150), R$(150), S$(150), T$(150)
10 DIM U$(150), V$(150), W$(150), X$(150)
11 DIM Y$(150), Z$(150), ZB$(150), ZB$(150)
12 PRINT "DO YOU WISH TO CREATE A DATA TAPE?"
13 GET ZH$: IF ZH#="" THEN 31
14 IF ZH#="Y" THEN 50
15 IF ZH#="N" THEN 35
16 GOTO 21
17 PRINT "DO YOU WISH TO READ A DATA TAPE?"
18 GET ZI$: IF ZI#="" THEN 36
19 IF ZI#="Y" THEN 300
20 IF ZI#="N" THEN 40
21 GOTO 36
22 PRINT "YOU MUST CREATE OR READ A TAPE !!!" PRINT GOTO 30
23 REM CREATE FILE ROUTINE
24 PRINT INPUT "NAME OF YOUR DATA " " " C$(150)
25 PRINT "WHEN YOU HAVE FINISHED ENTERING"
26 PRINT "YOUR DATA - TYPE 'END' AFTER NAME"
27 PRINT "MAKE SURE IT IS WOUND BACK TO THE START"
28 PRINT "PRESS ANY KEY TO CONTINUE"
29 GET ZY$: IF ZY#="" THEN 58
30 OPEN "1", "C:"
31 REM SET FOR 150 CHILDREN MAX.
32 FOR A=1 TO 150
33 PRINT "CHILD NO. " "A
34 INPUT "NAME " "B(A): IF B(A)="" THEN 250
35 INPUT "JUNIOR SCHOOL " "C(A)
36 INPUT "HOUSE " "D(A)
37 INPUT "FORM " "E(A)
38 PRINT "USE A COMMA BETWEEN EACH GRADE"
39 INPUT "SIX JUNIOR GRADES " "F(A), G(A), H(A), I(A), J(A), K(A)
40 INPUT "SIX ENGLISH GRADES " "L(A), M(A), N(A), O(A), P(A), Q(A)
41 INPUT "SIX SCIENCE GRADES " "R(A), S(A), T(A), U(A), V(A), W(A)
42 INPUT "SIX MATHS GRADES " "X(A), Y(A), Z(A), ZB(A), ZB(A), ZB(A)
43 PRINT "CHILD NO. " "A," " FILE OK ?"
44 GET ZZ$: IF ZZ#="" THEN 180

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(continued on next page)

(continued from previous page)

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190 IFZ2#="N"THEN80
200 IFZ2#="Y"THEN220
210 GOTO180
220 PRINT#1,A$(A);PRINT#1,B$(A);PRINT#1,C$(A)
222 PRINT#1,D$(A);PRINT#1,E$(A);PRINT#1,F$(A)
224 PRINT#1,G$(A);PRINT#1,H$(A);PRINT#1,I$(A)
226 PRINT#1,J$(A);PRINT#1,K$(A);PRINT#1,L$(A)
228 PRINT#1,M$(A);PRINT#1,N$(A);PRINT#1,O$(A)
230 PRINT#1,P$(A);PRINT#1,Q$(A);PRINT#1,R$(A)
232 PRINT#1,S$(A);PRINT#1,T$(A);PRINT#1,U$(A)
234 PRINT#1,V$(A);PRINT#1,W$(A);PRINT#1,X$(A)
236 PRINT#1,Y$(A);PRINT#1,Z$(A);PRINT#1,Z$(A)
238 PRINT#1,Z$(A)
240 NEXTA
250 PRINT#1,"END"
260 CLOSE1,1,1,2,3
270 PRINT"DATA FOR# 20# IS NOW COMPLETE"
271 REM WHAT THE PROGRAM CAN DO
272 PRINT"PRINT" PUS# ANY KEY TO CONTINUE" P=0
273 GETZ$ IFZ$#=""THEN273
274 LL=0 PRINT"YOU CAN EITHER "
276 PRINT"1. READ ANOTHER DATA TAPE"
278 PRINT"2. CREATE ANOTHER DATA TAPE"
279 PRINT"3. SEARCH AND LIST PARTICULAR DATA"
280 PRINT"4. CHANGE OR ADD TO YOUR CURRENT"
281 PRINT" DATA TAPE"
282 PRINT"5. LIST ALL YOUR DATA FILE"
283 PRINT"INPUT"ENTER OPTION NUMBER YOU REQUIRE" P
284 IFF=1THEN300
285 IFF=2THEN50
286 IFF=3THEN80
287 IFF=4THEN80
288 IFF=5THEN80
289 PRINT"PRINT"TRY AGAIN !!! GOTO283
290 REM READ FILE ROUTINE
300 PRINT"INPUT"NAME OF DATA FILE REQUIRED" JZD#
301 PRINT"PRINT"ENTER YOUR DATA TAPE NO#
302 PRINT"PRINT"MAKE SURE IT IS SOUND BACK TO THE START"
303 PRINT"PRINT"PUSH ANY KEY TO CONTINUE"
304 GETZ$ IFZ$#=""THEN304
310 OPEN1,1,0,ZD#
320 FORA=1TO150
325 INPUT#1,A$(A);IF#(A)="#END"THEN500
330 INPUT#1,C$(A);D$(A);E$(A)
340 INPUT#1,F$(A);G$(A);H$(A);I$(A);J$(A)
350 INPUT#1,K$(A);L$(A);M$(A);N$(A);O$(A)
360 INPUT#1,P$(A);Q$(A);R$(A);S$(A);T$(A)
370 INPUT#1,U$(A);V$(A);W$(A);X$(A);Y$(A)
380 INPUT#1,Z$(A);Z$(A);Z$(A)
385 PRINT"?"
390 PRINT"CHILD NO.#" A
400 PRINT"NAME" B$(A)
410 PRINT"JUNIOR SCHOOL" I$(A)
420 PRINT"HOUSE" C$(A)
430 PRINT"FORM" D$(A)
440 PRINT"JUNIOR GRADES" E$(A);F$(A);G$(A);H$(A);I$(A);J$(A)
450 PRINT"ENGLISH GRADES" K$(A);L$(A);M$(A);N$(A);O$(A);P$(A)
460 PRINT"SCIENCE GRADES" Q$(A);R$(A);S$(A);T$(A);U$(A);V$(A)
470 PRINT"MATHS GRADES" W$(A);X$(A);Y$(A);Z$(A);Z$(A);Z$(A)
480 PRINT"NEXTA"
500 PRINT"PRINT"THE DATA FOR# "ZD#" IS NOW LOADED"
510 CLOSE1,1,0,ZD#
520 GOTO272
530 PRINT"PRINT"DO YOU REQUIRE HEADINGS" GOSUB5000
505 OPEN6,4,CMD 6:IF#F#=""THEN520
506 PRINT#6,"S" PRINT#6:PRINT#6
507 PRINT#6,SPC(25);"SET, TRINIAN SCHOOL RECORDS"
508 PRINT#6,SPC(25);"*****" PRINT#6:PRINT#6,SPC(35);ZD#
509 PRINT#6,PRINT#6,CHR$(141);SPC(40);"JUNIOR GRADES" I=1;A=2;B=3;4;5;C=6;D=7;E="
510 PRINT#6,CHR$(141);SPC(5);"NAME"
511 PRINT#6,CHR$(141);SPC(23);"JUNIS."
512 PRINT#6,CHR$(141);SPC(31);"HO."
513 PRINT#6,CHR$(141);SPC(35);"F."
514 PRINT#6,CHR$(141);SPC(39);"M E O NFM NFE S"
515 PRINT#6,CHR$(141);SPC(56);"ENG. GR"
516 PRINT#6,CHR$(141);SPC(64);"SCI. GR"
517 PRINT#6,CHR$(141);SPC(72);"MAT. GR"
518 PRINT#6,"*****"
519 PRINT#6,"*****"PRINT#6
520 FORA=1TO150:IF#(A)="#END"THEN532
521 PRINT#6,CHR$(141);A;PRINT#6,CHR$(141);SPC(4);A$(A);
522 PRINT#6,CHR$(141);SPC(25);B$(A);
523 PRINT#6,CHR$(141);SPC(31);C$(A);
524 PRINT#6,CHR$(141);SPC(34);D$(A);
525 PRINT#6,CHR$(141);SPC(39);E$(A);F$(A);G$(A);H$(A);I$(A);
526 IFFVAL(C$(A);100)THENPRINT#6,CHR$(141);SPC(49);J$(A);" J$(A)";GOTO528
527 PRINT#6,CHR$(141);SPC(49);J$(A);" J$(A)";
528 PRINT#6,CHR$(141);SPC(56);K$(A);L$(A);M$(A);N$(A);O$(A);P$(A);
529 PRINT#6,CHR$(141);SPC(64);Q$(A);R$(A);S$(A);T$(A);U$(A);V$(A);
530 PRINT#6,CHR$(141);SPC(72);W$(A);X$(A);Y$(A);Z$(A);Z$(A);Z$(A)
531 NEXTA
532 PRINT"PRINT"END OF LISTING" CLOSE6
533 GOTO272
590 REM CHANGE FILE ROUTINE
600 PRINT"YOU CAN NOW CHANGE OR ADD INFORMATION" PRINT
610 PRINT"TO YOUR DATA FOR# "ZD#
615 FORJ=1TO1000:NEXTJ
660 GOSUB2000
694 PRINT"PRINT"DO YOU WISH TO CHANGE PARTICULAR DATA"
695 PRINT"FOR ALL THE YEAR?"
696 GETZ$ IFZ$#=""THEN696
697 IFZ$#="Y"THEN700
698 IFZ$#="N"THEN700
699 GOTO696
700 PRINT"PRINT"NO. OF CHILD WHOSE DATA YOU WISH"
701 INPUT"TO CHANGE" E
702 FORA=1TO150
704 IFA$(E)THENNEXTA
706 GOTO710
708 FORA=1TO150:PRINT:IF#(A)="#END"THEN730
710 PRINT"CHILD NO." A
712 IFF=1THENPRINT#(A);INPUT"ENTER NEW NAME" B$(A)
714 IFF=2THENPRINT#(A);INPUT"ENTER NEW JUNIOR SCHOOL" I$(A)
716 IFF=3THENPRINT#(A);INPUT"ENTER NEW HOUSE" C$(A)
718 IFF=4THENPRINT#(A);INPUT"ENTER NEW FORM" D$(A)
719 PRINT IFF=5ORF=6ORF=7ORF=8THENPRINT"USE A COMMA BETWEEN EACH GRADE"
720 IFF=5THENINPUT#(A);F$(A);G$(A);H$(A);I$(A);J$(A)
721 IFF=6THENINPUT"ENTER NEW JUN. GRADES" E$(A);F$(A);G$(A);H$(A);I$(A);J$(A)
722 IFF=7THENINPUT#(A);K$(A);L$(A);M$(A);N$(A);O$(A);P$(A)
723 IFF=8THENINPUT"ENTER NEW ENG. GRADES" Q$(A);R$(A);S$(A);T$(A);U$(A);V$(A)
724 IFF=7THENPRINT#(A);R$(A);S$(A);T$(A);U$(A);V$(A)
725 IFF=7THENINPUT"ENTER NEW SCI. GRADES" Q$(A);R$(A);S$(A);T$(A);U$(A);V$(A)
726 IFF=8THENPRINT#(A);X$(A);Y$(A);Z$(A);Z$(A);Z$(A)
727 IFF=8THENINPUT"ENTER NEW MAT. GRADES" W$(A);X$(A);Y$(A);Z$(A);Z$(A);Z$(A)
728 IFZ$#="Y"THENNEXTA
730 PRINT"PRINT"DO YOU WISH TO CHANGE ANYTHING ELSE?"
732 GETZ$ IFZ$#=""THEN732
734 IFZ$#="Y"THEN660
736 IFZ$#="N"THEN740
738 GOTO732
743 PRINT"PLEASE ENTER YOUR DATA TAPE NO#
742 PRINT"PRINT"MAKE SURE THAT IT IS SOUND BACK"
744 PRINT"PRINT"TO THE START"
746 PRINT"PRINT"PUSH ANY KEY TO CONTINUE"
748 GETZ$ IFZ$#=""THEN746
752 PRINT"INPUT"ENTER NAME OF YOUR DATA" ZC#

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756 OPEN1,1,1,2,3
757 OPEN1,1,1,2,3:IF#(A)="#END"THEN250
758 GOTO220
759 GOTO250
760 REM SEARCH AND LIST ROUTINE
800 PRINT"J" GOSUB2000 GOSUB2011 PRINT
810 PRINT"ENTER EXPRESSION YOU ARE LOOKING FOR"
815 INPUTZ$
820 PRINT"PRINT"
825 REM LINE PRINTER HEADINGS ROUTINE
826 PRINT"PRINT"DO YOU REQUIRE HEADINGS"
827 GETZ$ IFZ$#=""THEN827
828 IFF#="Y"ORF#=""THEN830
829 GOTO827
830 OPEN6,4
831 PRINT"PRINT#5,"S" PRINT#5,PRINT#5,PRINT#5,IFOF#=""THEN845
832 PRINT#5,SPC(25);"SET, TRINIAN SCHOOL RECORDS"
833 PRINT#5,SPC(25);"*****" PRINT#5
834 PRINT#5,PRINT#5,SPC(32);ZD# PRINT#5
835 IFF=1THENPRINT#5,SPC(32);"NAME"
836 IFF=2THENPRINT#5,SPC(29);"JUNIOR SCHOOLS"
837 IFF=3THENPRINT#5,SPC(32);"HOUSES"
838 IFF=4THENPRINT#5,SPC(32);"FORMS"
839 IFF=5THENPRINT#5,SPC(29);"JUNIOR GRADES"
840 IFF=6THENPRINT#5,SPC(29);"ENGLISH GRADES"
841 IFF=7THENPRINT#5,SPC(29);"SCIENCE GRADES"
842 IFF=8THENPRINT#5,SPC(29);"MATHS GRADES"
843 PRINT#5,"( "ZJ";" )"
844 PRINT#5,SPC(29);"*****" PRINT#5 GOSUB6000
845 FORA=1TO150
847 IFF=1AND#(A)=ZJ#THEN829
848 IFF=2AND#(A)=ZJ#THEN829
850 IFF=3AND#(A)=ZJ#THEN829
852 IFF=4AND#(A)=ZJ#THEN829
854 IFF=5AND#(A)=ZJ#THEN829
856 IFF=5AND#(A)=ZJ#THEN829
858 IFF=5AND#(A)=ZJ#THEN829
860 IFF=5AND#(A)=ZJ#THEN829
862 IFF=5AND#(A)=ZJ#THEN829
864 IFF=5AND#(A)=ZJ#THEN829
866 IFF=5AND#(A)=ZJ#THEN829
868 IFF=5AND#(A)=ZJ#THEN829
870 IFF=5AND#(A)=ZJ#THEN829
872 IFF=5AND#(A)=ZJ#THEN829
874 IFF=5AND#(A)=ZJ#THEN829
876 IFF=5AND#(A)=ZJ#THEN829
878 IFF=5AND#(A)=ZJ#THEN829
880 IFF=5AND#(A)=ZJ#THEN829
882 IFF=5AND#(A)=ZJ#THEN829
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886 IFF=5AND#(A)=ZJ#THEN829
888 IFF=5AND#(A)=ZJ#THEN829
890 IFF=5AND#(A)=ZJ#THEN829
892 IFF=5AND#(A)=ZJ#THEN829
894 IFF=5AND#(A)=ZJ#THEN829
896 IFF=5AND#(A)=ZJ#THEN829
898 IFF=5AND#(A)=ZJ#THEN829
900 IFF=5AND#(A)=ZJ#THEN829
902 IFF=5AND#(A)=ZJ#THEN829
904 IFF=5AND#(A)=ZJ#THEN829
906 IFF=5AND#(A)=ZJ#THEN829
908 IFF=5AND#(A)=ZJ#THEN829
910 IFF=5AND#(A)=ZJ#THEN829
920 NEXTA:IFLL=1THEN1060
921 PRINT#5:PRINT#5,"SORRY - NO CHILD HAS THAT PARTICULAR DATA"
922 PRINT"PRINT"SORRY - NO CHILD WITH THAT PARTICULAR" LL=0
923 CLOSE 5
924 KJ=0:PRINT"PRINT"DO YOU WANT TO TRY AGAIN?"
925 GETZ$ IFZ$#=""THEN925
926 IFZ$#="Y"THEN800
927 IFZ$#="N"THEN272
929 GOTO925
929 KJ=KJ+1:LL=1:IFF=1THEN950
930 IFF=4THENPRINT#5,CHR$(141);SPC(4);A$(A)
932 IFF=4THENGOTO1050
934 IFF=3THENPRINT#5,CHR$(141);SPC(4);A$(A)
935 IFF=3THENPRINT#5,CHR$(141);SPC(4);A$(A)
936 IFF=3THENGOTO1050
937 PRINT#5,CHR$(141);SPC(4);A$(A)
938 PRINT#5,CHR$(141);SPC(31);C$(A)
940 IFF=2THENPRINT#5,CHR$(141);SPC(41);D$(A);CHR$(141);SPC(54);K$(A);
941 IFF=2THENPRINT#5,CHR$(141);SPC(56);L$(A);CHR$(141);SPC(64);O$(A);
942 IFF=2THENPRINT#5,CHR$(141);SPC(66);R$(A);CHR$(141);SPC(74);V$(A);
943 IFF=2THENPRINT#5,CHR$(141);SPC(76);X$(A);GOTO948
945 PRINT#5,CHR$(141);SPC(41);D$(A)
948 GOTO1050
950 PRINT#5,CHR$(141);A;PRINT#5,CHR$(141);SPC(4);A$(A);
951 PRINT#5,CHR$(141);SPC(25);B$(A);
952 PRINT#5,CHR$(141);SPC(31);C$(A);
953 PRINT#5,CHR$(141);SPC(34);D$(A);
954 PRINT#5,CHR$(141);SPC(39);E$(A);F$(A);G$(A);H$(A);I$(A);
955 PRINT#5,CHR$(141);SPC(49);J$(A);" J$(A)";
956 PRINT#5,CHR$(141);SPC(56);K$(A);L$(A);M$(A);N$(A);O$(A);P$(A);
957 PRINT#5,CHR$(141);SPC(64);Q$(A);R$(A);S$(A);T$(A);U$(A);V$(A);
958 PRINT#5,CHR$(141);SPC(72);W$(A);X$(A);Y$(A);Z$(A);Z$(A);Z$(A);
1050 GOTO920
1060 PRINT"PRINT"END OF SEARCH" IFF=1ORF=4THEN1862
1061 PRINT#5,PRINT#5,KJ;" CHILDREN IN THIS GROUP"
1062 CLOSE 5
1070 GOTO924
1999 REM SORT OPTIONS ROUTINE
2000 GOSUB3000
2005 GOSUB4000
2010 PRINT"J" RETURN
2011 PRINT"J"
2012 IFF=5THENPRINT"THESE ARE 6 JUNIOR GRADES" GOTO2022
2013 IFF=6THENPRINT"THESE ARE 6 ENGLISH GRADES" GOTO2078
2014 IFF=7THENPRINT"THESE ARE 6 SCIENCE GRADES" GOTO2078
2015 IFF=8THENPRINT"THESE ARE 6 MATHS GRADES" GOTO2078
2020 RETURN
2022 PRINT"1. MATHS" PRINT"2. ENGLISH" PRINT"3. OVERALL GRADE"
2024 PRINT"4. NFER MATRS" PRINT"5. NFER ENGLISH" PRINT"6. SPARE"
2026 PRINT"PRINT"ENTER ITEM NO. YOU REQUIRE"
2027 INPUT
2040 GOTO2095
2078 REM REPORTS AND YEARS
2079 PRINT"1. YR 1/REPORT 1" PRINT"2. YR 1/REPORT 2"
2080 PRINT"3. YR 2/REPORT 1" PRINT"4. YR 2/REPORT 2"
2082 PRINT"5. YR 3/REPORT 1" PRINT"6. YR 3/REPORT 2"
2090 GOTO2010
2090 LL=0 PRINT"THESE ARE 8 DATA ITEMS FOR EACH CHILD"
2091 PRINT"1. NAME" PRINT"2. JUNIOR SCHOOL (+1ST YR. GRADES)"
2092 PRINT"3. HOUSE" PRINT"4. FORM" PRINT"5. JUNIOR GRADES" PRINT"6. ENGLISH GRADES"
2093 PRINT"7. SCIENCE GRADES" PRINT"8. MATHS GRADES"
2094 PRINT"PRINT" RETURN
2095 PRINT"ENTER ITEM NO. YOU REQUIRE"
4001 INPUT
4003 RETURN
5000 GETZ$ IFZ$#=""THEN5000
5001 IFF#=""THENRETURN
5002 IFF#=""THENRETURN
5003 GOTO5000
5000 IFF=2THEN PRINT#5,SPC(27);"GRADES AFTER FIRST YEAR"
5001 IFF=2THEN PRINT#5,SPC(27);"*****" PRINT#5
5002 IFF=2THENPRINT#5,SPC(42);" S KEY# 1=A 2=B 3=C+ 4=D 5=C- 6=D 7=E" PRINT#5
5003 IFF=2THENPRINT#5,SPC(53);"NAME" PRINT#5,SPC(53);"HOUSE" PRINT#5
5004 IFF=2THENPRINT#5,CHR$(141);SPC(52);"ENGLISH" CHR$(141);SPC(62);"SCIENCE";
5005 IFF=2THENPRINT#5,CHR$(141);SPC(72);"MATHS"
5006 IFF=2THENPRINT#5,CHR$(141);SPC(52);"*****" PRINT#5
6011 RETURN
READY.

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● Circle No. 164

Douglas Fyffe gives some tips on how to get the best out of Word Pro Four run on a Pet. He emphasises the importance of getting your page format right at the outset.

The way to success with Word Pro Four

THE FIRST and normally the hardest operation to perform is to format your page as it will be printed and in the format that you require. This will depend on the size of stationery that you use, the type of printer you use, and the style of presentation of the document you prefer. Due to the complexity of the page formatting for the first-time user, it is a good idea to create a format you are happy with, and re-use it again and again.

This is done by using the commands lm, left margin, rm, right margin, the pp, number of lines on the page, and the pg, the number of lines you wish to use for printing. These commands will give you the three defined borders to your page, as you define the top of the form by the positioning of the page in the printer.

All you must now decide is whether to use the right-margin justification, normally used on reports but not on letters. This command like text centring is switched on, with a 1 following the command, and switched off with a 0 following the command.

A typical document will use the following commands to set the format of the page:

```
1m10 : rm70 : pp66 : pg62 : ju1
```

This is for A4 stationery, using the right-margin justification. Note that the command string starts in column 2, and is immediately preceded by the control character, or tick mark, and must always be superseded by the return key, or right arrow.

You will notice that when the individual commands are on the same line they are separated by a colon. If the last command in a string is followed by the text of the document, it must be followed by a semi-colon, and not a return.

I mentioned that once happy with a page format you should re-use it again and again. I shall now show how to use this to your best advantage. There is a



A typical Pet system suitable for word processing applications.

command, cm, which will create a comment line, this means that anything on a line that starts with

```
'CNTRL' cm:
```

will not be printed as output, this then lends itself to being used for notes which you can insert into the text, and that will not be printed.

You may ask how this helps you to re-use the same format. It is very simple — you use the comment lines to describe which format you are using, so you can immediately tell whether this format will fit your requirements. An example is given in figure 1.

None of this will be printed, but it is displayed on the screen, at the front of the file, for your guidance. The format commands are on the last line.

There are two other useful tips about the comment lines: the first is something I emphasise more than any other of these tips, and that is to use the first line in every file to show the file name as a comment line, as shown in figure 2.

This allows you to know which file you are in, and can save you a good deal of time and effort. One of the most common mistakes that I and many others make is the incorrect spelling of the filename, when we wish to recall or memorise a file.

If you always have the filename as the first line in the file, you can access that line by pressing CLR/Home once to reach the top of the screen, and again to place you at the beginning of the file. If you have access to a machine, try and repeat the following commands. Having loaded the program, load a disc into drive 0, then position the cursor over the first character of the filename. Now press CNTRL and CLR/Home together, press M to memorise, press 0 for the drive number with the disc in and now press the oblique key — to the left of the cursor up/down.

The filename as you typed it now appears on the control line as the filename under which you wish to store this file. If you always do this, you save key-

(continued on page 103)

Figure 1

```
'CNTRL' cm:*****'RET'
'CNTRL' cm:** This document is set up as plain A4, using **'RET'
'CNTRL' cm:** 70 cols and 62 lines per page. **'RET'
'CNTRL' cm:** OK with ASCII or CBM printers, **'RET'
'CNTRL' cm:** remember to check the printer type before **'RET'
'CNTRL' cm:** starting to print. **'RET'
'CNTRL' cm:** SAVE FILE FIRST ! **'RET'
'CNTRL' cm:*****'RET'
'CNTRL' 1m10:rm70:pp66:pg62:ju1'RET'
```

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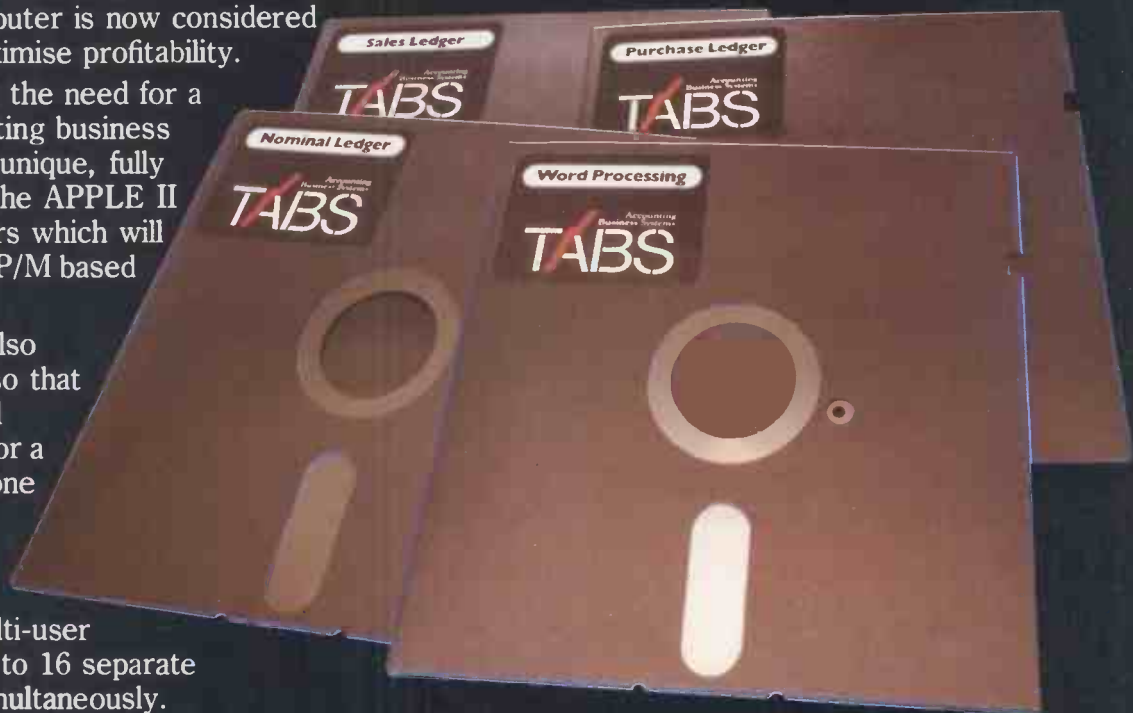
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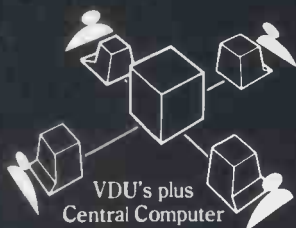


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Figure 2

```
'CNTRL'cm:Blank File'RET'
'CNTRL'cm:*****'RET'
'CNTRL'cm:** This document is set up as plain A4, using **'RET'
'CNTRL'cm:** 70 cols and 62 lines per page. **'RET'
'CNTRL'cm:** OK with ASCII or CBM printers, **'RET'
'CNTRL'cm:** remember to check the printer type before **'RET'
'CNTRL'cm:** starting to print. **'RET'
'CNTRL'cm:** SAVE FILE FIRST ! **'RET'
'CNTRL'cm:*****'RET'
'CNTRL'lm10:rm70:pp66:pg62:ju1'RET'
```

(continued from page 101)

strokes by not having to re-type the filename again and again and you will not have the original and revised files stored under mis-spelt versions of the file.

The other use for the comment line is when checking the spelling or grammar in a large or complicated document. I frequently use a comment line inserted on a blank line to show how far through the file I have reached before one distraction or another. To do this, all that is required is:

'CNTRL' cm: ** Checked to here ** 'RET'

This legend is enough to take me straight back to where I was before I was interrupted. As you can probably see, by using the filename as the first line of the file, making the storing of the file far easier and more accurate, and by using the comment line to show how far you have reached, you will be able to see the

ease with which you can achieve another goal — that is, always store the file when you leave the machine, even if only to turn round and answer the telephone.

I have cause to send a large number of letters and memoranda which do not need to be typed by a typist. I have a disc for memoranda and another for letters, and they contain the program, a blank format of the document, and an index file. This allows me to use more than the 16 characters to describe what the file contains.

All my letters and memoranda have a filename that is in the format of "Letter

XXX" or "Memo XXX" where XXX is a number allocated sequentially. Every time I am about to write a letter or a memorandum, I call the file Letter Index or the file Memo Index, make the appropriate entry and re-store the index file.

Then I call the blank format, write the filename into the comment line as the first line of the file, and then type the letter or memorandum. Having completed the job I then store the file on to the disc before printing. An example of an Index file is shown in figure 3.

(continued on page 109)

Figure 3

```
'CNTRL'cm:Memo Index'RET'
File To Whom Date Subject'RET'
==== ====='RET'
Memo 1 J.Smith 16/4/81 Bonus scheme repayments'RET'
Memo 2 J.Bloggs 17/4/81 Prod'n of sales statistics'RET'
```

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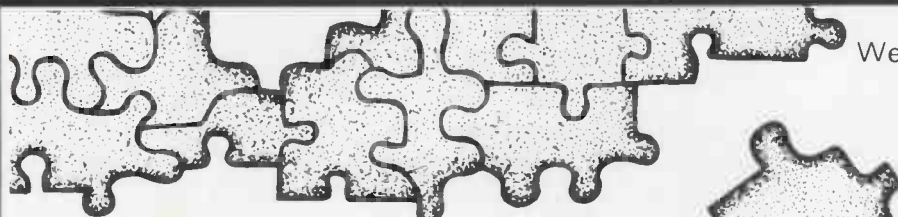
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● Circle No. 170

(continued from page 103)

The more ambitious you grow, the more complicated and intricate the documents you produce become. This obviously means that the text has to be laid out in a format which will look right when you want to print it. This is when you will be very glad of the facility to display the document as it will be produced by the printer.

To produce the document on the screen, you must be in control mode. In other words the "C" on the control line must be lit by the cursor. Then press "O" for output, and follow this by "V" for video. If the format of the document does not conflict with any of the commands given, the screen will be filled with the document as in printed format. The document will be displayed and all you can do is press any key and the text will scroll vertically.

If you cross page boundaries, you will see a continuous line across the screen, and you may wonder why you have lost the first line on the new page. This is because you cannot give line-feed commands from the head of the page, with the If command.

If you want a blank line, you must press Ret in the first column of the line you wish to be blank. At the end of the document you will see a continuous line across the screen with three up-arrows in the left of the screen. To regain the text editing mode, you now have to press CNTRL.

If at any point the screen reverts to the text-edit mode, it is because you have a format error, and while you are pressing a key to scroll, the error message appeared, and then disappeared in response to your finger struggling on trying to scroll the text in output to video.

A format error will normally occur, for example, when you specify the left margin as 10 for the body of the text, re-specify the left margin as 15, for indenting a section, and trying to give the left margin release command a value of more than 5. In other words, further to the left than the first left margin.

The indent and left-margin release are used to produce a section which looks like the following:

- The left margin has now been set at 15, it was 10.
- The left margin release is set at three, this allows the first line to start in what is position 12.

As you can see the lines have been reduced in length, but the margin release allows the numbering system to be put outside the normal constraint of the left margin.

When printing large documents, you will often find, to your anger, the spelling mistake that slipped through, or that the printer ribbon has run out halfway down the page. There is a simple way to deal with this particular hurdle, if you remember what I said about the comment lines being used to describe the format of the document.

'CNTRL'cm:Reprint.'RET'	Figure 4
'CNTRL'cm:*****'RET'	
'CNTRL'cm:** Use this to reprint all reports, but not	**'RET'
'CNTRL'cm:** letters or memos.	**'RET'
'CNTRL'cm:** PAGE NUMBERING !!	**'RET'
'CNTRL'cm:*****'RET'	
'CNTRL'cm:** This document is set up as plain A4, using	**'RET'
'CNTRL'cm:** 70 cols and 62 lines per page.	**'RET'
'CNTRL'cm:** OK with ASCII or CBM printers,	**'RET'
'CNTRL'cm:** remember to check printer type before	**'RET'
'CNTRL'cm:** starting to print	**'RET'
'CNTRL'cm:** SAVE FILE FIRST !	**'RET'
'CNTRL'cm:*****'RET'	
'CNTRL'l10:rm70:pp66:pg62:ju1:p#16'RET'	

Apply the same thinking to the problem of the uncompleted printout: re-use the same format, and use the comment lines as previously described — see figure 4.

The additions to the previous version are to show that this is to re-print a file. The note about the page numbering is to remind you that you are not starting the pagination at page 1. You could be anywhere through the document. In the example, the page numbering will start again at 16. This assumes that you have printed pages 0-15 successfully.

All you now have to do is Recall the file you were printing with the cursor positioned below the bottom line of the example above. You now remove the sections that have been printed, making sure that the complete document is safely stored, and commence the printing from page 16.

I am reasonably proud of the fact that I can type as fast as I can write — and why write anyway when it has only to be transcribed later? If you have the luxury of being able to compose the document as you type, you will find the lack of a notepad somewhat of a disadvantage. Do not despair — why not use the extra text?

If you are not using constants with the append function or variable data blocks, there is at the very least one screen of spare memory not being used. You can jot down your notes when you think of them, and gain access to them with 'CNTRL'X, and then revert back to the main text with 'CNTRL'X. You can then look up your notes wherever you like.

As you will be aware the first question you are asked, after loading the system is 'Lines Available : 151 How many for main text?'

This is because there is a trade-off depending on the value you input, of the amount of memory available to the main text and the amount of memory available to the extra text. If you select the maximum of 151, you will have only 23 lines available in extra text.

As mentioned, there is a trade-off of space in the main text against space in the extra text. There is one way to minimise the waste of space in the text and that is to put as few commands as possible into the text. As you will have seen from the earlier examples, you can put many commands on to one line, thus saving space.

Yet perhaps the most commonly mis-used of the functions is the line feeding.

How many people do you know who resort to a Ret in column one of the line to produce a blank line, and how many times do they have to do it to format a document?

You can achieve the same as 10 lines with a Ret in column one as you can with 'CNTRL'In10.

All you lose here is six characters, as you can continue typing text after the semi-colon, as opposed to 10 wasted lines. Ten lines is nearly seven per cent of available space wasted.

At last we arrive at the frills — the bits and pieces which make the effort worthwhile. The Header and Footer commands are the first two we shall look at.

The Header and Footer commands allow you to reserve an area at the top and bottom of the pages, that you cannot otherwise use. The format of the commands are as follows:

```
'CNTRL'hd2:;Test Document,1/5/81'RET'
'CNTRL'ft4:;- <>'RET'
```

In both of these commands, you specify a number. In the Header it relates to how many blank lines you wish to be printed between the header line and the start of the text, and in the footer command, it relates to how many lines from the bottom of the page the foot will be.

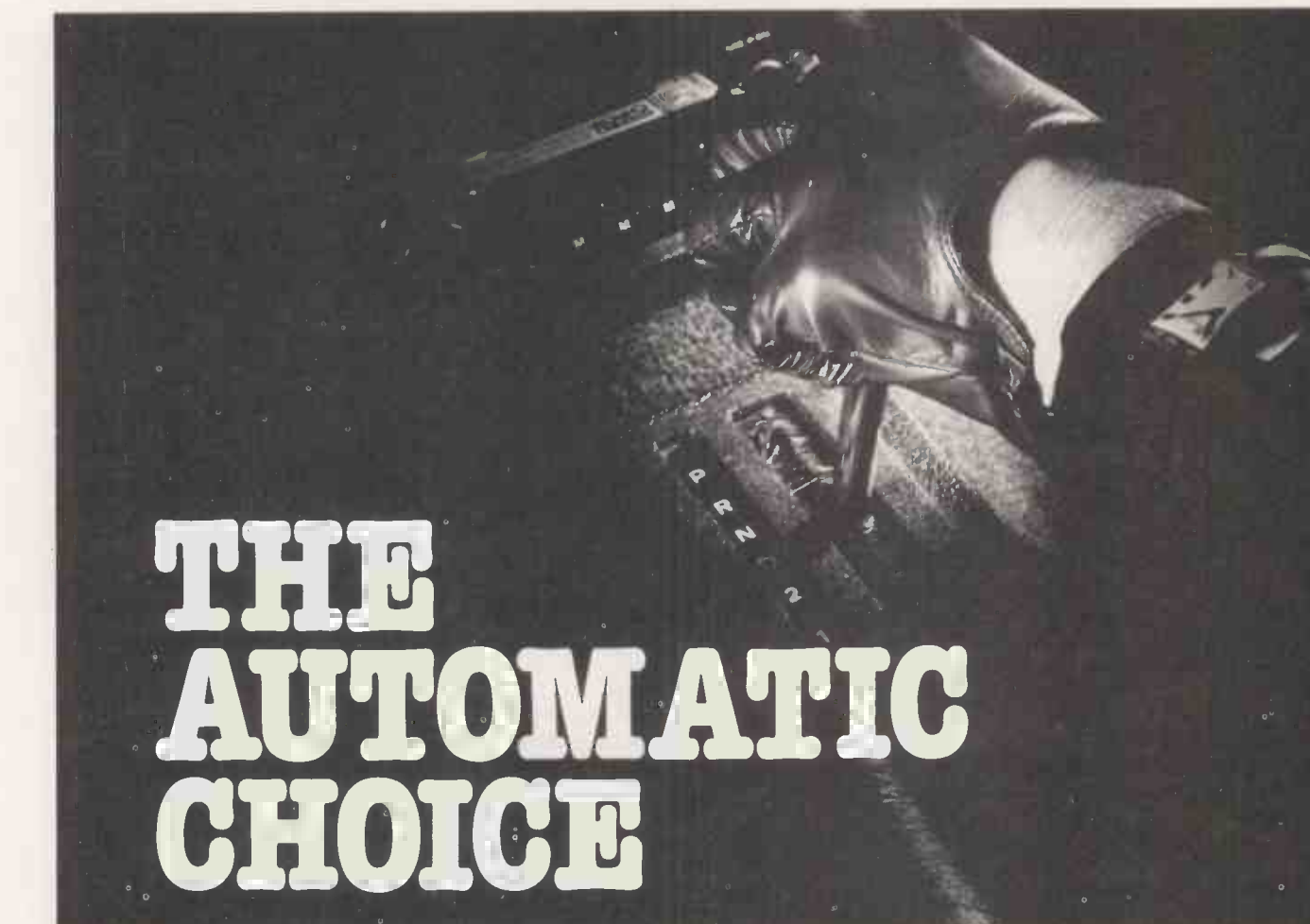
You will cause a format error if the difference between the pp and pg values is, for example, 6, and the footer specifies 6 blank lines. In both cases, the comma is to indicate that the first of the three preset fields is not to be used.

The less-than and greater-than symbols placed in this position in the ft command will cause automatic page numbering. Always leave at least one space either side of the less-than and greater-than symbols, as when you reach double figures, the result looks a little cramped.

You can arrange the legends you wish to appear in any combination, as long as they do not over-run the format commands for page width and length.

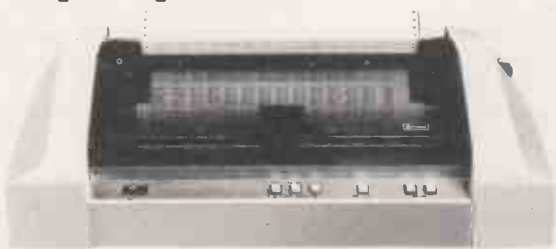
The Next File command is used when you fill the 151 available lines for one file. The command must be the last entry in the file and is in the following format 'CNTRL'nx:Next filename'RET'.

You can now link more than one file together, and when trying to output them, to either the screen or the printer, you must specify "G" for global output, this will link together all the files in a specific sequence. □



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Boris Allan compares the performance of some popular micros in handling mathematical calculations, and finds that there are some big differences.

Times for accuracy

IN COMPUTING, we must be careful about which is the more important: the task, or the language. In an earlier report, *Practical Computing*, June 1981, I suggested that the task or problem was more important than idiosyncratic characteristics of languages. If one has a clearly-defined task, one should be able to express it in most languages.

For the tasks in the June 1981 article: Magi Test 1 Floating, MT1F, used a matrix-inversion routine; MT2F calculated square-roots by a Newton's method iteration; and in MT3F the value of pi was calculated by use of Simpson's method.

These tasks were chosen because I felt they represented fairly the range of problems with which one is faced in numerical work. The results were given in the June piece and some extra results to accompany this discussion are shown in tables 1, 2, and 3 of this article.

MT1F tests the numerical accuracy of a matrix-inversion routine and the implementation of basic floating-point operations for the version of the language used. The type of matrix used in the tests was the Hilbert matrix series.

The coding is simple, and most people who have reported on the test have no problems in setting up the program for

their computer. For Pascal, the coding is complicated by the fact that Pascal is not really designed for matrix routines.

When I started to code MT1F for the Acorn Atom, 12K+12K, the program was rather more complex to write because in most Basics on larger machines, one does not need to distinguish between real and integer variables. In Atom Basic variables are implicitly "typed".

A further complication arose because Atom Basic does not allow two-dimensional arrays. The Atom took longer to calculate the results than many other computers — the Pet and TRS-80 are even slower. On accuracy, however, it was on a par with the Apple II and Pet.

Andrew Holt of Rayleigh, Essex sent some times for a 6809 1MHz system where there were no problems with the coding. The accuracy for the 6809 system is by far the greatest, and the time taken is slightly less than that for the Atom — table 1.

MT2F sets out to perform a calculation by use of a very popular method of iteration to convergence called Newton's method. The method normally converges to a fixed value though, as Andrew Holt points out, there may be oscillations around the true value.

Matrix order	Atom	6809
2	0.00e0	0.00e0
3	0.00e0	1.37e-15
4	7.66e-8	5.41e-16
5	1.30e-6	1.14e-13
6	8.02e-6	2.81e-12
7	4.23e-3	4.99e-11
8	2.32e-2	9.40e-9
9	1.14e0	4.08e-8
10	1.01e0	3.59e-6
Time	110 secs	106 secs

Use is made of a generally more accurate square-root function, FN S, which is Defined within the program: the TRS-80 does not allow the Definition of functions, and as this was also true for the Acorn Atom, the program had to be slightly modified for both these machines.

The Atom square root is exactly accurate in every case tested, and the 6809 system, using TSC Basic, is, again, remarkably accurate. The Atom is as fast as the Pet, slower than the Apple II, but more accurate than both; the 6809 is slow — even slower than the TRS-80 single-precision — and has the claim to fame that it is the only computer tested for which the square root of unity is not unity — table 2.

For the Pascal version of MT2F there were slight problems in that all loops must be in steps of 1 or -1, so that to calculate the values of I for the square-root calculations extra coding was needed. The problem with loops is common to all Pascals, but for the implementation of Pascal used — Apple Pascal, a UCSD variant — before one could use anything as common as a square-root, one had to load a library of transcendental functions by USES TRANSCEND; which was somewhat messy.

The problem MT3F tackles is to calculate an area under a curve by numerical means; the function to be evaluated is $X \cdot \sin(X)$ from 0 to pi — the true value of the integral is pi. The method to be used is the popular Simpson's method of approximation, and this task produces

(continued on page 113)

```
PROGRAM MT1F;
(* MAGI TEST 1 INTEGER
*****
ITERATIVE VERSION
(C) G J BORIS ALLAN, 1981 *)
VAR M,N,I,A,Z,X,Y,EXIT: INTEGER;
SS: ARRAY[1..1000] OF INTEGER;
PROCEDURE ONE; FORWARD;
PROCEDURE TWO; FORWARD;
PROCEDURE THREE; FORWARD;
PROCEDURE FOUR; FORWARD;
PROCEDURE FIVE; FORWARD;
PROCEDURE SIX; FORWARD;
(* TO SAVE PROBLEMS ABOUT ORDER *)
PROCEDURE ONE;
BEGIN
A:=N+1;
IF I>0 THEN THREE
ELSE EXIT:=1;
END;
PROCEDURE TWO;
BEGIN
IF N=0 THEN FOUR
ELSE FIVE;
END;
PROCEDURE THREE;
BEGIN
M:=SS[I];
N:=A;
I:=I-1;
END;
PROCEDURE FOUR;
BEGIN
M:=M-1;
N:=1;
END;
PROCEDURE FIVE;
BEGIN
IF I=1000 THEN EXIT:=1
ELSE SIX;
END;
PROCEDURE SIX;
BEGIN
IF Z[I+1] THEN Z:=I+1;
I:=I+1;
SS[I]:=M-1;
N:=N-1;
END;
```

```
BEGIN (*MAIN PROGRAM*)
I:=0;
Z:=1;
A:=1;
EXIT:=0;
WRITELN;WRITELN;READLN(M,N);
X:=M;Y:=N;
REPEAT
IF M=0 THEN ONE ELSE TWO
UNTIL EXIT=1;
WRITELN('A('X','Y')='A);
WRITELN;
Z:=Z+1;
WRITELN('MAX DEPTH OF STACK IS ',Z);
END.

PROGRAM MT1F;
(* MAGI TEST 1 INTEGER
*****
RECURSIVE VERSION
(C) G J BORIS ALLAN *)
VAR M,N,ANS: INTEGER;
FUNCTION A(M,N: INTEGER): INTEGER;
BEGIN
IF M=0 THEN A:=N+1
ELSE
IF N=0 THEN A:=A(M-1,1)
ELSE A:=A(M-1,A(M,N-1));
END;
BEGIN(* OF MAIN PROGRAM *)
WRITELN;WRITELN;
READLN(M,N);
ANS:=A(M,N);
WRITELN('A('M','N')='ANS);
WRITELN;
END.
```

Number	Atom	6809
1	0.00	1.36e-15
11	0.00	0.00
21	0.00	7.77e-16
31	0.00	0.00
41	0.00	2.89e-15
51	0.00	5.66e-15
61	0.00	0.00
71	0.00	3.33e-15
81	0.00	5.77e-15
91	0.00	0.00
Time	7.3 secs	12.5 secs

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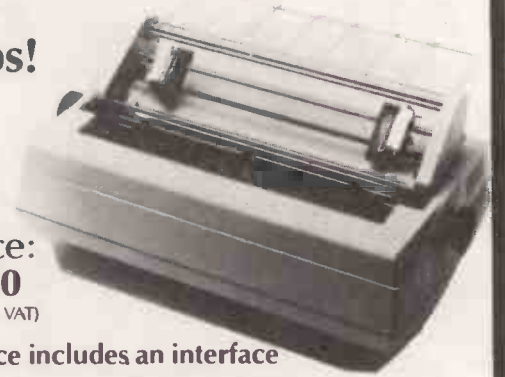
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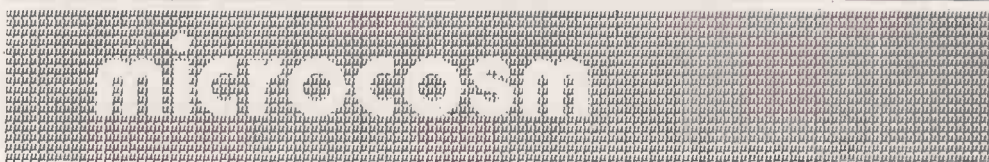
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```

>LIST
1 REM
2 REM   MAGI TEST 1 INTEGER
3 REM   *****
4 REM
5 REM   (C) G J BORIS ALLAN, 1981
6 REM
7 REM   ALL RIGHTS RESERVED
8 REM
9 REM
1010 DIM STACK(1000): REM   SOFTWARE ST
    ACK
1020 INPUT X,Y: REM   BECOME M,N
1030 M=X:N=Y: PRINT : PRINT
1040 GOSUB 2000
1050 PRINT "A(";X;";";Y;") = ";A
1070 GOTO 1020
1080 END
1990 REM

2000 A=0:I=A
2010 IF M>0 THEN 2040: REM   CONDITION(1
    ) CHECK
2020 A=N+1: IF I>0 THEN 2100: REM   CHEC
    K TO SEE IF STACK EMPTY
2030 RETURN
2040 IF N<0 THEN 2060: REM   CONDITION(2
    ) CHECK
2050 M=M-1:N=N-1: GOTO 2010
2060 IF I<1000 THEN 2090
2070 A=0: RETURN
2090 I=I+1:STACK(I)=M-1:N=N-1: GOTO 2010
    : REM   CONDITION(3) IS OPERATIVE G
    OING DOWN
2100 M=STACK(I):N=A:I=I-1: GOTO 2010:
    REM   GOING BACK UP THE STACK
2110 PRINT "IMPOSSIBLE BRANCH": REM   WE
    SHOULDN'T BE HERE !!
2120 END
    
```

(continued from page 111)

more problems in coding than any other.

For the TRS-80 and the Atom, as functions could not be defined, the timings underestimate the comparison, and other functions are less easily used. All one should need to do is merely alter the definition of FN M(X).

Apple Pascal, and Andrew Holt's TSC Basic on the 6809 system, could not cope with ATN(1E35), and there were overflow errors. The variables VA, CF, PI, and SUM, are not standard — though they are allowed on the Pet and Apple II — so they have to be modified. For the Atom and the 6809, "PI" is an in-built constant.

Some Basics object to the 21 digits in the assigned value of PI. Simpson's method is an approximation, and the error is a function of the accuracy of the Sin values, the cumulated accuracies of the multiplications and additions, and the number of points used.

The result is rarely exactly correct, due to the three reasons, though as the number of points increases, the first two reasons predominate. The 6809 results show that, after modification to ATN(1E12), the arctan values are accurate, and that the overall errors are of the same order as the Apple II, Pet, double-precision TRS-80, Sharp PC-1211 — and the Atom.

The 6809 is very slow, and the Atom is slow — table 3. Furthermore, the Atom should be faulted because it does not allow Defined functions, and to code floating-point arithmetic for all tests was very cumbersome. The Atom was not easy to use for floating-point work.

The task for MT4F has not been finalised: Andrew Holt has suggested a program to calculate the Gamm measure, but the program he suggests has many affinities with MT2F. The original program to calculate the Gamm measure was written

in Fortran, and Andrew Holt notes: "This Fortran program translates reasonably easily into Basic". I am open to suggestions.

I had hoped to obtain some timings for compiled rather than interpreted Basics, but I have none so far — that Pascal is compiled may explain its superior speed, as well as the case that Pascal, on the Apple II, does less work, ie, it is less accurate.

I have asked Keen Computers on many occasions if a member of its staff would run the Magi Tests on the Apple II, using the Keen "super-fast" arithmetic processor: on each occasion the staff have been "too busy". As the Magi Tests are so compact, Keen Computers must be very busy not to wish to validate its product — I do notice that it explains in the company literature that the accuracy is rather less than the normal Applesoft Basic.

Integer calculations can occur in three main environments:

- A purely Integer Basic;
- A purely floating-point Basic
- Defined integer variables in a floating-point Basic.

Magi Test 1 Integer MT1I is the calculation of Ackerman's function — *Practical Computing*, September 1981 — and, as it is a task not an attempt to show the prettiness of a language, the task can be coded recursively or non-recursively. Ackerman's function can be described by three conditions.

1. $A(0,n) = n + 1$
2. $A(m,0) = A(m-1,1)$

Table 4 — MT1I

System	Time
Communicator	
MT + Pascal (R)	1.8 secs
MT + Pascal (I)	3.0 secs
Microsoft B (F)	120 secs
NorthStar B (F)	191 secs
Apple II	
UCSD Pascal (R)	18.8 secs
UCSD Pascal (I)	48.1 secs
Integer B (I)	208 secs
Applesoft B (F)	257 secs
Applesoft B (F/I)	268 secs
Acorn Atom	
Atom B (I)	125 secs
Atom B (F)	333 secs
Pet/CBM	
Pet B (F)	252 secs
Pet B (F/I)	278 secs

3. $A(m,n) = A(m-1,A(m,n-1))$ and can be solved recursively, or iteratively by use of a software stack, called SS in the programs. I give a recursive program in Pascal, MT1IR, as well as iterative programs in Pascal and Basic, MT1II. The Basic program has been run in all the above three environments, integer I, floating-point, F, and defined integers in floating-point, F/I.

For the Apple II and Pet, "X%" represents an integer variable, different from the real variable "X", and for the TRS-80 the statement DEF INT A-Z defines all variables to be integer. The standardised task is the calculation of A(3, 4), and results for a variety of computers are given in table 4. One is immediately struck by how much faster are the recursive Pascal timings than even the iterative Pascal versions.

The Pascal programs are quicker than any of the Basic programs. Yet to what extent the speed differential is due to the compiled nature of the Pascals compared to the interpreted Basics is uncertain.

For the Basics on show, the clear winners are the Microsoft Basic on the Communicator, and the Acorn Atom in its default integer mode — however, when the calculations are performed in floating-point mode, the Atom is the slowest machine.

To claim that Atom Basic is very fast is only true for integer manipulations. Integer Basic on the Apple II is only about as speedy as North Star Basic on a communicator — though ordinary floating-point Basic on the Apple II is only about as speedy as the Pet. When variables are defined as integer on the Apple II and Pet, the programs run more slowly — contrary to expectations.

This task has emphasised use of arrays, and the making of comparisons, and so a Magi Test 2 Integer should involve arithmetic — I am open to suggestions. If one compares computers on both sets of tests, the superiority of one machine over another becomes less clear, and emphasises a need for a true multi-dimensional evaluation which includes cost of computer, and cost of software. M

Table 3 — MT3F

	Atom	6809
Error 1	0.00	3.33e-13
Error 2	9.31e-10	0.00
Error 3	5.34e-6	51.16e-6
Time	92.1 secs	115 secs

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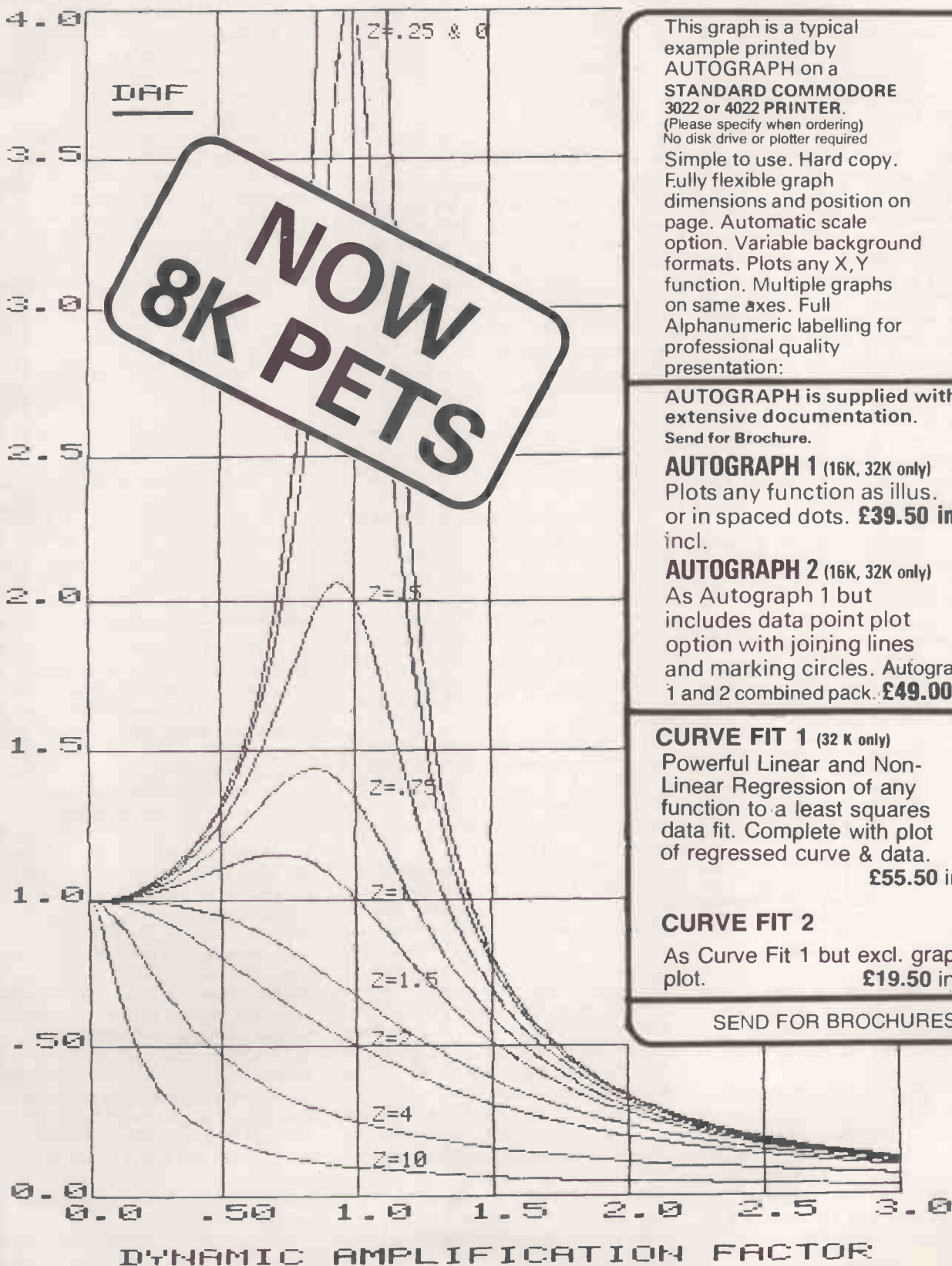
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The minimum configuration is a 32K Apple with discs, for which a few small alterations are required. On a 48K Apple, the capacity is approximately three A4 sheets, although it is impossible to be absolutely accurate because of the many facilities available. If you print entirely in elongated characters, the capacity is doubled.

In terms of characters, the maximum number is 14,000 unformatted, but this is likely to exceed the overall capacity of 28,200 formatted and unformatted combined. On a 32K Apple, the capacity would not be much more than a single A4 sheet.

Before describing what the program will do, let me first say what it will not do. If these facilities are essential to you, you need read no further:

- It will not number pages or insert headings. In fact, it takes no account of pages at all, but prints in a continuous stream.
- It will not produce personalised circulars — if you want to send the same letter to more than one person, you have to change the name and address yourself.
- It does not perform any on-screen formatting. With the widest letter being three times the width of the narrowest — six times if you mix normal and elongated print — high-resolution graphics would have been needed to put anything sensible on screen, which would not have left any space for the text.
- It will not move part of the text into a new location, this is not as serious as it might appear, since text may be input and written to disc in small sections, which may later be assembled in any order.

The facilities were omitted only because I did not require them and wanted as much space as possible for the text. I expect that I shall eventually introduce paging and moving of text, but conversion to machine code is the first priority.

I find the program easy to use and do not feel deprived by the lack of screen formatting. Occasionally, I forget the odd capital letter, but this would be true of any system on the standard Apple. Slow speed is the only real complaint, but speed of editing may be improved by writing many small files instead of a few large ones.

When the program is Run this menu is displayed:

28200 CHARS

1. INPUT
2. AMEND
3. READ
4. APPEND
5. SAVE
6. FORMAT
7. PRINT
8. END

SELECT REQUIRED OPTION

The number of characters displayed at the top of the menu is the free space available for holding the unformatted and formatted text and the actual figure shown will change accordingly. The option is selected by entering the appropriate number followed by Return.

With the Input option, any existing text is destroyed and the free space set to 28200. The screen is cleared and the cursor positioned at the top-left corner. Text is then entered at the keyboard and appears as a continuous stream of 40 characters per line on the screen. All editing facilities are available in Input mode.

If you choose Amend, any existing formatted text is destroyed and the free space set to 28200 minus the unformatted text. The unformatted text for the first 960 characters of it is displayed on the screen, complete with all embedded formatting characters, and the cursor positioned at the top-left corner. The text may then be edited from the keyboard. If there is no unformatted text, this command is not accepted.

The Read mode means that any existing text is destroyed and the free space set to 28200. The screen is cleared and READ TEXT is displayed at the top. The name of the file containing the required unformatted text is requested.

If the file name has been forgotten or it is not known which disc contains the file, typing asterisk when the file name is requested causes the directory of the disc in drive 1 to be displayed. This is held until any other key is pressed, when the file name is again requested. A further response of asterisk will cause the directory of the disc in drive 2 to appear. Obviously, a small program change is required if you have only one drive. This sequence may be continued indefinitely.

When the desired file has been located, its name is input and the drive number is requested. A reply of 1 or 2 is expected to this, following which the question "Check?" is asked. A reply of any word beginning with "N" causes the whole process to be re-started; a reply beginning with "Y" causes the file to be read, and any other reply causes the question to be put again. When the file has been read,

the free space is calculated and the program returns to the main menu.

The Append option enables you, if there is no existing text, to take the Read action. Otherwise, any existing formatted text is destroyed and the free space set to 28200 minus the unformatted text. The screen is cleared and APPEND TEXT displayed at the top. The remaining action is as for Read, except that the file read is appended to the existing text.

In Save mode, the screen is cleared and SAVE TEXT displayed at the top. The file name and drive number are requested as

MEMORY MAP: APPLESOFT			
		49152	\$C000
	DDS, FILES (3)	38400	\$9600
		HM 9999	\$270F
HIRES	STRINGS	9982	\$26FE
24576 \$6000	FREE SPACE	28	\$001C
16384 \$4000			
		9954	\$26E2
8192 \$2000	ARRAYS	9359	\$248F
	VARIABLES		
	PROGRAM	LM 8939	\$22EB
		2049	\$0801
		2048	\$0800
PRINT (Y)?			

for Read, and the same facility to display directories is available. When the file has been specified, the unformatted text is written to it as a binary file. If there is no unformatted text, this command is not accepted.

Under Format, any existing formatted text is destroyed and the free space set to 28200 minus the unformatted text. The screen is cleared and the position of the left margin is requested. The response is the amount in inches by which the left margin is to be indented beyond the normal start position and may be any suitable value.

The next request is for the print width. This is the actual width of printing — ignoring the left margin — and must be a value not greater than 7.9 — the left margin. Although the print width specified does not include the left margin, the program has to consider the overall width to keep within the capacity of the printer. The reason for the odd figure is that, although the print width is nominally 8in. the 737 will not begin a new character within 0.1in. of the limit, even though many characters in the proportional set are under 0.1in. wide.

The positions in inches relative to the left margin, of up to 10 tabulator positions are requested. Each must be displaced to the right of the one before and

none must be beyond the right margin. If fewer than 10 tabulators are needed, a response of "0" will inhibit the request for the remainder. If an illogical entry is made, the screen is cleared and the whole procedure re-started.

The program then asks whether justified margins are required. Any response beginning with "Y" will cause justification codes to be inserted between words to ensure that the right margin is even — except, of course, where a CR is embedded in the text.

The Right Align embedded-format command may be used even if justified margins are not requested.

Finally, the required line spacing is requested — the response is 1, 2, 3 for single, one and a half, double spacing respectively. These parameters remain on screen throughout the formatting phase, which may take quite a long time — more than six minutes for a full A4 page with justified margins. A typical set of parameters may be:

```
LEFT MARGIN (INCHES): .2
PRINT WIDTH: 6.6
TAB 1: 5
TAB 2: 1.5
TAB 3: 4
TAB 4: 0
JUSTIFIED MARGINS? YES
LINE SPACING 1
```

If there is no unformatted text, the command is not accepted.

The Print mode means that the formatted text is output to the printer. This is done in a continuous stream, so if you are using cut sheets or wish to introduce extra blank lines at intervals, the printer must be switched to Local to change the sheet or insert the blanks. This can be achieved, without loss of information providing the printer is not switched off. If there is no formatted text, the command is ignored.

The screen is cleared and DOS is re-booted when you use the End option. This clears the program from memory and re-sets Himem to its normal value.

Editing functions, which are available in both Input and Amend modes, are provided by two special keys and by control codes, i.e., holding down CTRL while pressing a letter. The following functions are provided:

CTRL-A: Advance Cursor — moves the cursor down 1 line — advances it 40 characters. If the cursor is already on the bottom line, it remains where it is and the text is scrolled. If this command would cause the cursor to move beyond the end of the text, it has no effect.

CTRL-B: Cursor Back — moves the cursor up 1 line — back 40 characters. If the cursor is already on the top line, this command has no effect — there is no reverse scrolling.

CTRL-C: Capitals — causes all following alphabetic characters to be treated as upper case and one or two others to change their meaning.

CTRL-D: Delete Character — the character at the cursor position is deleted and all following characters shifted left.

CTRL-E: Delete to End — all characters from the cursor position to the end of the text are deleted.

CTRL-F: Not used.

CTRL-G: Open/Close Gap — when this com-

mand is first issued, all characters from the cursor position to the end of the text are shifted to the right 40 characters and 40 spaces are inserted. Text may then be typed into the gap. If the gap is completely filled, the alarm sounds and a further gap is opened. Issuing the command for a second time causes the remainder of the gap to be deleted and the text closed up.

CTRL-H: Cursor Right — the cursor is moved one character to the right, moving to the start of the next line and scrolling the screen if necessary. This command may also be given by using the right-arrow key. If the cursor is already positioned after the end of the text, this command has no effect.

CTRL-I: Insert Character — all characters from the cursor position to the end of the text are moved one place to the right.

CTRL-J: Not used.

CTRL-K: Not used.

CTRL-L: Lower case — this causes all following alphabetic characters to be regarded as lower case. They appear on the screen as normal upper-case letters.

CTRL-M: This is a formatting command.

CTRL-N: Not used.

CTRL-O: Not used.

CTRL-P: Delete Paragraph — all characters from the cursor position up to, but not including, the next Newline are deleted and the gap is closed. If there is no Newline between the cursor and the end of the text, this has the same effect as CTRL-E.

CTRL-Q: Quick Shift — this causes the next character input to be regarded as upper case and following characters as lower case.

CTRL-R: Not used.

CTRL-S: Delete Sentence — all characters from the cursor position up to, but not including, the next full stop, exclamation mark, or question mark are deleted and the remaining text is closed up. If none of these characters exists between the cursor and the end of the text, the command has the same effect as CTRL-E.

CTRL-T: Not used.

CTRL-U: Cursor Left — the cursor is moved one character to the left, moving to the end of the previous line if necessary. This command may also be given by using the left-arrow key. If the cursor is already positioned in the top-left corner of the screen, this command has no effect.

CTRL-V: Not used.

CTRL-W: Delete Word — all characters from the cursor position up to, but not including, the next Newline, full stop, exclamation mark, question mark, space, tabulator or comma are deleted and the remaining text is closed up.

CTRL-X: Cross Out — this is a throwback to the early development of the program, before all the multi-character delete commands had been introduced. It causes 40 characters from the cursor position to be deleted and the remaining text closed up.

CTRL-Y: Not used.

CTRL-Z: Terminate Mode — this terminates input or amendment and returns to display the main menu.

Formatting functions are provided by means of escape codes — that is, pressing Esc followed by a letter or digit. The formatting codes appear on the screen as inverse characters. In this list, each escape code is followed by the corresponding inverse screen character.

ESC, 1 1 1 Dot Space. A dot space is a gap of 1/150in. **ESC, 2** — Esc, 6 provide two to six dot spaces. Dot spaces may be used to increase the separation between letters — they are used automatically to increase the separation between words for justified margins — but are particularly useful for replacing ordinary spaces where words must appear on the same line, e.g., initial and surname.

ESC, A Not used.

ESC, B Not used.

ESC, C = Centre. The following text — up to the next Newline — is centred between the current line position and the right-hand margin. If the text is terminated by a tabulator, it is centred between the current line position and the first tabulator position after the natural end of the text.

ESC, D Not used.

ESC, E < Elongated print. All following characters are printed double-width until the appropriate control code is found. Newline does not turn off elongated print.

ESC, F Not used.

ESC, G Not used.

ESC, H Not used.

ESC, I + Indent margin. All subsequent lines commence at the current line position until further indented or returned to the original setting. If this would produce a line width less than 2.5in., the command is ignored.

ESC, J Not used.

ESC, K † Condensed print. Following text is printed using the condensed character set.

ESC, L Not used.

ESC, M * Newline. The following text starts on a new line — end of paragraph — and no justification is carried out on the current line unless there is a current centre or right-align command outstanding. This command may also be given by CTRL-M or Return.

ESC, N > Normal width. The following text will be printed in normal width — proportional or condensed.

ESC, O # Original Margins. The left and right margins are restored to their original positions. The right margin is affected immediately, the left margin from the next line.

ESC, P " Proportional print. Following text is printed using the proportional character set.

ESC, Q Not used.

ESC, R & Right align. The following text up to the next Newline is preceded by sufficient blank space to align the end of the text to the right margin. If the text is terminated by a tabulator, it is right aligned to the first tabulator position after the natural end of the text. This is particularly useful for numbered paragraphs and may also be used for tabulating columns of variable length numbers.

ESC, S Not used.

ESC, T ? Tabulator. The following text begins at the next tabulator stop position. If justified margins are required, no justification will take place to the left of the tabulator position.

ESC, U — Underline. All following text will be underlined. Blank space inserted for right alignment, centring, tabs, and indented margins will not be affected.

ESC, V / End underline. Following text will not be underlined.

ESC, W — Width reduction. The right-hand margin is indented by .5in. This remains in effect until the margin is further indented or the original margins are restored. If this command would result in a line width of under 2.5in., it has no effect.

ESC, X \$ Reverse half-line feed.

ESC, Y % Forward half-line feed.

ESC, Z Not used. It actually has the same effect as Esc. 1.

As far as non-standard characters are concerned, normally, not all of the ASCII characters can be input directly from the keyboard and some cannot even be displayed on the screen. Each line of the following list shows what to key, the character produced on the printer, and the representation of that character on the screen, in that order.

Two of the characters listed are normally available from the keyboard and can be displayed on the screen. The reason for their inclusion is that, in Apple Spiel, they are only available in Capital shift. *(continued on page 119)*



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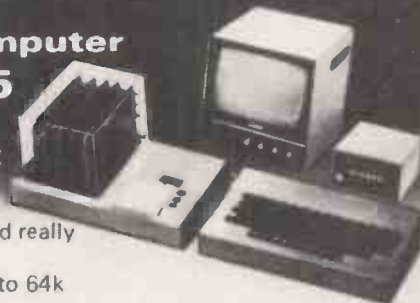
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(continued from page 117)

```
C-A      ^      ^
C-]      ]      ] — ']' is shift-M
L-A      ~      ^ — inverse
L-]      }      ] — inverse
ESC, 7   |      \ — inverse
ESC, 8   [      [
ESC, 9   {      { — inverse
ESC, 0   \      \
ESC, :   —      —
ESC, ;   '      ' — inverse
```

Where a symbol is preceded by "C-," it must be input in Capital shift. A symbol preceded by "L-" must be input in Lower shift to obtain the desired result.

Apart from the title line, there is not a single Rem in Apple Spiel. This was done to give the maximum capacity and speed, but does make the program a little difficult to follow without some explanation.

Lines 9400-9510 are the widths in dots of the 96 printable characters in the proportional set. They are for the U.K. set which differs from the U.S. set only in one character. The English pound and the American hash are not the same width, however, and are as taken from the printer manual with two corrections.

Lines 9600-9630 are the addresses of the 24 screen lines in memory. The curious interlaced memory map is one of the less endearing features of the Apple. Lines 9700-9850 are the codes for the screen representations of the 128 ASCII characters. If you have a non-standard character generator e.g., with lower case, these values will need to be changed. Line 9900 contains the end-point codes for the various block deletion functions.

The program really starts at line 9600, and line 9070 is the start of the menu display and the point to which return is made at the end of each phase.

Lines 2000-2690 constitute the input function, lines 2020 onwards being shared with the amend phase. The

method used to read from the keyboard is first to call the Monitor's character input routine — which handles the cursor but puts the character where a Basic program cannot access it — and then re-Peek the keyboard.

This is done on line 2030 and again on 2080. Most of this section is concerned with handling the editing functions, and frequently-used subroutines are at line 50 — transferring text to screen — 100 — deleting text — and 150 — inserting a gap in the text.

Lines 4000-4020 set up the amend phase before going to the shared-input phase code.

Lines 8000-8050 comprise the file selection routine, which is called by the read, lines 6000-6050, append, 7000-7010 plus most of the read routine, and save, 5000-5030, phases.

The most complex part of the program is the formatting routine — lines 1000-1530. The system used is simply to scan the unformatted text a word at a time, copying it into the formatted text area if it is short enough to fit on the current line. If it is too long, the justification routine is entered, if required, and the new word begins a new line. The space between this word and the previous one is, of course, discarded.

This simple process is greatly complicated by all the formatting facilities provided. Lines 450-550 make up the word-scan routine, while 300-410 handle embedded-format characters. Lines 250-290 are the large-white-space routine, used for tabulators, centring, and left-margin setting. The initial formatting parameter input is done by lines 8500-8620. Note that the left margin is not put on every formatted line, but is stored just once, from location 768 onwards.

The actual printing — lines 3000-3010

— should have been the simplest part of the program, but there are one or two quirks of the system to be overcome. If the command to switch back to 10 cpi mode after printing, line 3060, is not followed by a Return, the command to switch off the printer card is not recognised by DOS, but if it is followed by A RETURN, an extra blank line is printed.

The low setting given to Himem means that there is very little free space available to Applesoft when running Apple Spiel. It is most important, therefore, that all spaces except those in the title line and literal strings are removed when typing in the program.

Applesoft inserts spaces liberally when producing program listings, but is not quite as good at removing them again. Any superfluous spaces could result in ?OUT OF MEMORY ERROR when the program is run, or worse, when having input and edited a large amount of text, you try to specify a file name to save it.

The program is written for a standard parallel interface card. If you have a Centronics card, remove PRINT\$;"K": from line 3010.

If you have only one disc drive, remove DD = 3 — DD: from line 8050 and change line 8000 to DD = 1.

If you have more than two drives, Apple Spiel only accesses the drives on the controller from which it was loaded. If your controller is not in slot 6, amend line 9170 as appropriate.

If you only have 32K of memory, the addresses Peeked at line 6030 should be 27232 and 27233, while TF and TU, line 9060, should be reduced to 21816 preserving the 200-byte safety margin and 15808 respectively. Users of DOS 3.3 should check the normal Himem value and the address of the length of the last binary file read in their manuals.

APPLE SPIEL PROGRAM LISTING

```
10 REM APPLE SPIEL - N.LOMAS - MAY 1981
20 HIMEM: 9999: GOTO 9000
50 MH = H - 1: HV = V - 1: U = T - S: Y = S
60 W = U - 1: IF W > 39 - HH THEN W = 39 - HH
70 X = UVZ(HV): FOR A = 0 TO W: Z = PEEK(Y + A): POKE X + H
  H + A: CSZ(Z): NEXT
80 U = U - W - 1: Y = Y + W + 1: HV = HV + 1: IF U > 0 AND
  HV < 24 THEN 60
90 RETURN
100 IF S = T THEN R = 0: RETURN
110 IF R > T - S THEN R = T - S: GOTO 130
120 FOR A = S + R TO T: Z = PEEK(A): POKE A - R, Z: NEXT
130 FOR A = T - R TO T - 1: POKE A, 32: NEXT
140 GOSUB 50: T = T - R: RETURN
150 FOR A = T + 39 TO S STEP - 1: Z = PEEK(A): POKE A + R
  , Z: NEXT
160 FOR A = S TO S + R - 1: POKE A, 32: NEXT: T = T + R
170 GOSUB 50: RETURN
200 IF LC = 0 THEN 220
210 FOR A = 1 TO LC: POKE MC, 27: POKE MC + 1, 6: MC = MC + 2:
  NEXT
220 IF LD = 0 THEN RETURN
230 POKE MC, 27: POKE MC + 1, LD: MC = MC + 2: RETURN
250 LA = INT(LM / 18): LB = LM - LA * 18: IF LB = 18 THEN L
  B = 0: LA = LA + 1
260 LC = INT(LB / 6): LD = LB - LC * 6: IF LA = 0 THEN 200
270 POKE MC, 27: POKE MC + 1, 20: POKE MC + 2, 27: POKE MC + 3
  , 14: MC = MC + 4
280 FOR A = 1 TO LA: POKE MC, 32: MC = MC + 1: NEXT: GOSUB 2
  00
290 POKE MC, 27: POKE MC + 1, 17: POKE MC + 2, 27: POKE MC + 3
  , 15: MC = MC + 4: RETURN
300 ON Z GOTO 400, 400, 410, 400, 310, 400, 400, 400, 370, 400, 340, 4
  00, 410, 320, 390, 330, 400, 410, 400, 410, 400, 400, 350: GOTO 40
  0
310 EL = 1: GOTO 400
320 EL = 0: GOTO 400
330 PR = 1: GOTO 400
340 PR = 0: GOTO 400
```

```
350 IF WD - ST < 450 THEN 400
360 WD = WD - 75: GOTO 400
370 IF WD - DY < 450 THEN 400
380 ST = DY: GOTO 400
390 ST = 0: WD = WX
400 SA = SA + 1: RETURN
410 POP: RETURN
450 Z = PEEK(SA): IF Z < 26 THEN GOSUB 300: GOTO 450
460 IF Z < > 32 THEN 510
470 NT = NT + 1: DX = 7: IF PR = 0 THEN DX = 9
480 IF EL < > 0 THEN DX = DX + DX
490 DY = DY + DX: SA = SA + 1: GOTO 450
500 Z = PEEK(SA): IF Z < 26 THEN GOSUB 300: GOTO 500
510 IF Z < 32 THEN DX = Z - 25: GOTO 550
520 IF Z = 32 THEN RETURN
530 DX = 9: IF PR < > 0 THEN DX = DTX(Z - 32)
540 IF EL < > 0 THEN DX = DX + DX
550 DY = DY + DX: SA = SA + 1: GOTO 500
600 IF PS = 0 THEN POKE S, 27: POKE S + 1, 20: S = S + 2
610 IF EM < > 0 THEN POKE S, 27: POKE S + 1, 14: S = S + 2
620 IF UM < > 0 THEN POKE S, 15: S = S + 1
630 RETURN
1000 IF UF = 0 THEN RETURN
1010 GOSUB 8500
1020 PS = 1: EM = 0: UM = 0
1030 DT = 0: IF SC > = T THEN FT = 1: POKE S, 0: RETURN
1040 IF DT = 0 AND ST < > 0 THEN MC = S: LM = ST: GOSUB 250
  : DT = ST: S = MC
1050 DY = DT: NS = 0: NT = NS: JN = JM: SA = SC: PR = PS: EL = EM:
  UL = UM
1060 IF S > TF THEN SC = T: CALL 64477: GOTO 1030
1070 SE = SA: GOSUB 450: IF DY > WD THEN Z = 32: GOTO 1150
1080 IF DY = WD THEN DT = DY: SB = SA: GOTO 1150
1090 DT = DY: NS = NT: IF Z = 32 THEN 1070
1100 SB = SA: JN = 0: IF Z < > 20 THEN 1150
1110 IF RJ = 0 AND CN = 0 THEN 1190
1120 IF RJ < > 0 THEN TX = 1
1130 FOR I = 0 TO 9: IF TB(I) > = DT + 12 THEN LM = TB(I) -
  DT: GOTO 1160
1140 NEXT: Z = 13: TX = 0
1150 LM = WD - DT
```

(continued on next page)

(continued from previous page)

```

1160 IF CN < > 0 THEN LM = INT (LM / 2): GOTO 1180
1170 IF RJ = 0 THEN 1190
1180 DT = DT + LM: POKE S,14:S = S + 1:MC = S: GOSUB 250:S =
MC:JN = 0:CN = 0:RJ = 0
1190 IF JN = 0 OR NS = 0 THEN LC = 0:LD = 0:XE = 0: GOTO 12
20
1200 XD = INT (LM / NS):XE = LM - NS * XD: IF XE = NS THEN
XD = XD + 1:XE = 0
1210 LC = INT (XD / 6):LD = XD - 6 * LC
1220 IF SC = SB THEN 1430
1230 IF SC > SB THEN 1040
1240 GOSUB 600
1250 Y = PEEK (SC): IF Y < 26 THEN 1320
1260 IF Y < 32 THEN POKE S,27:Y = Y - 25:S = S + 1
1270 POKE S,Y:S = S + 1: IF Y < > 32 THEN 1300
1280 MC = S: GOSUB 200:S = MC: IF XE = 0 THEN 1300
1290 POKE S,27: POKE S + 1,1:S = S + 2:XE = XE - 1
1300 SC = SC + 1: IF SC < SB THEN 1250
1310 GOTO 1430
1320 IF Y = 5 THEN EM = 1:X = 14: GOTO 1410
1330 IF Y = 11 THEN FS = 0:X = 20: GOTO 1410
1340 IF Y = 14 THEN EM = 0:X = 15: GOTO 1410
1350 IF Y = 16 THEN EM = 1:X = 17: GOTO 1410
1360 IF Y = 21 THEN UM = 1:X = 15: GOTO 1420
1370 IF Y = 22 THEN UM = 0:X = 14: GOTO 1420
1380 IF Y = 24 THEN X = 30: GOTO 1410
1390 IF Y = 25 THEN X = 28: GOTO 1410
1400 GOTO 1300
1410 POKE S,27:S = S + 1
1420 POKE S,X:S = S + 1: GOTO 1300
1430 IF Z = 18 THEN RJ = 1: GOTO 1530
1440 IF Z = 3 THEN CN = 1: GOTO 1530
1450 SC = SC + 1: IF Z < > 20 THEN POKE S,13:S = S + 1: GOTO
1500
1460 IF TX < > 0 THEN TX = 0: GOTO 1040
1470 FOR I = 0 TO 9: IF TB(I) > DT + 6 THEN 1490
1480 NEXT :SC = SC - 1:Z = 32: GOTO 1450
1490 LM = TB(I) - DT: GOTO 1180
1500 IF DS = 0 THEN 1030
1510 IF DS = 1 THEN POKE S,27: POKE S + 1,28:S = S + 2: GOTO
1030
1520 POKE S,13:S = S + 1: GOTO 1030
1530 SC = SC + 1: GOTO 1040
2000 HOME :UF = 0
2010 S = SS:T = S:H = 1:V = 1
2020 FT = 0: IF S > TU THEN CALL 64477: RETURN
2030 HTAB H: VTAB V: CALL 64780:Z = PEEK (49152): IF Z > 1
27 THEN Z = Z - 128
2040 IF Z > 31 THEN 2200
2050 ON Z GOTO 2430,2400,2310,2540,2590,2020,2380,2330,2370
,2020,2020,2320,2220
2060 ON Z - 13 GOTO 2020,2020,2600,2300,2020,2610,2020,2480
,2020,2620,2570,2020,2680,2080
2070 GOTO 2020
2080 CALL 64780:Z = PEEK (49152): IF Z > 127 THEN Z = Z -
128
2090 IF Z < 48 THEN 2020
2100 ON Z - 47 GOTO 2140,2190,2190,2190,2190,2190,2190,2150
,2160,2170,2180,2130
2110 IF Z < 65 OR Z > 90 THEN 2020
2120 Z = Z - 64: GOTO 2220
2130 Z = 96: GOTO 2220
2140 Z = 92: GOTO 2220
2150 Z = 124: GOTO 2220
2160 Z = 91: GOTO 2220
2170 Z = 123: GOTO 2220
2180 Z = 95: GOTO 2220
2190 Z = Z - 23: GOTO 2220
2200 IF C < > 0 AND Z > 64 THEN Z = Z + 32
2210 IF CX < > 0 THEN CX = 0: C = 1
2220 POKE S,Z: POKE (VUX(V - 1) + H - 1),CSX(Z)
2230 S = S + 1: IF S > T THEN T = S
2240 H = H + 1: IF H < 41 THEN 2270
2250 H = 1: IF V < 24 THEN V = V + 1: GOTO 2270
2260 CALL - 912: IF S < T THEN GOSUB 50
2270 IF GG = 0 THEN 2020
2280 GG = GG - 1: IF GG < > 0 THEN 2020
2290 CALL 64477: GOTO 2380
2300 CX = 1
2310 C = 0: GOTO 2020
2320 C = 1: GOTO 2020
2330 IF H = 1 AND V = 1 THEN 2020
2340 H = H - 1: IF H = 0 THEN H = 40:V = V - 1
2350 IF GG < > 0 THEN GG = GG + 1
2360 S = S - 1: GOTO 2020
2370 R = 1: GOSUB 150:S = S + 1: GOTO 2350
2380 IF GG = 0 THEN R = 40: GOSUB 150:GG = R: GOTO 2020
2390 R = GG: GOSUB 100:GG = 0: GOTO 2020
2400 IF V = 1 THEN 2020
2410 IF GG < > 0 THEN R = GG: GOSUB 100:GG = 0
2420 V = V - 1:S = S - 40: GOTO 2020
2430 IF T - S - GG < 40 THEN 2020
2440 IF GG < > 0 THEN R = GG: GOSUB 100:GG = 0
2450 IF V < 24 THEN V = V + 1:S = S + 40: GOTO 2020
2460 CALL - 912:H = 0:HV = 23:IU = 40:Y = S + 41 - H
2470 GOSUB 60:S = S + 40: GOTO 2020
2480 IF S = T THEN 2020
2490 S = S + 1
2500 H = H + 1: IF H < 41 THEN 2530
2510 H = 1: IF V < 24 THEN V = V + 1: GOTO 2530
2520 CALL - 912: IF S < T THEN GOSUB 50
2530 GOTO 2550
2540 R = 1: GOSUB 100
2550 IF GG < > 0 THEN GG = GG - 1
2560 GOTO 2020
2570 R = 40
2580 GOSUB 100:GG = 0: GOTO 2020
2590 R = T - S: GOTO 2580
2600 E = 0:F = 0: GOTO 2630
2610 E = 1:F = 3: GOTO 2630
2620 E = 0:F = 6
2630 R = 0: IF S = T THEN 2020
2640 R = R + 1: IF S + R = T THEN 2580
2650 FOR A = E TO F: IF PEEK (S + R) = EPZ(A) THEN 2670
2660 NEXT : GOTO 2640
2670 A = F: NEXT : GOTO 2580
2680 S = T: IF PEEK (S - 1) < > 13 THEN POKE S,13:S = S +
1:T = S
2690 UF = 1: RETURN
3000 IF FT = 0 THEN RETURN
3010 HOME : PRINT D$;"PR#1": PRINT I$;"K": PRINT I$;"255N"
;
3020 PRINT CHR$(27); CHR$(17); CHR$(27); CHR$(10);
3030 S = T - 1: GOTO 3080
3040 Y = PEEK (S): IF Y = 13 THEN 3080
3050 IF Y < > 0 THEN PRINT CHR$(Y);S = S + 1: GOTO 304
0
3060 PRINT CHR$(27); CHR$(19); " "; CHR$(27); CHR$(10)
3070 PRINT D$;"PR#0": RETURN
3080 S = S + 1: PRINT CHR$(14): IF NM = 0 THEN 3040
3090 IF PEEK (S) = 0 THEN 3060
3100 FOR A = 0 TO NM - 1: PRINT CHR$(PEEK (A + 768)); NEXT
: GOTO 3040
4000 HOME :S = SS: IF T < = S THEN RETURN
4010 FOR A = T TO T + 39: POKE A,32: NEXT
4020 H = 1:V = 1: GOSUB 50: GOTO 2020
5000 IF UF = 0 THEN RETURN
5010 HOME : HTAB 15: PRINT "SAVE TEXT"
5020 GOSUB 8000
5030 PRINT D$;"BSAVE ";F$;"A10000,L";T - SS;"D";DD: RETURN
5000 UF = 0: HOME : HTAB 15: PRINT "READ TEXT":S = SS
6010 FT = 0: GOSUB 8000
6020 PRINT D$;"BLOAD";F$;"A";S;"D";DD
6030 T = S + PEEK (43616) + PEEK (43617) * 256
6040 UF = 1:S = T: IF S > TU THEN CALL 64477
6050 RETURN
7000 IF UF = 0 THEN 6000
7010 HOME : HTAB 14: PRINT "APPEND TEXT":S = T: GOTO 6010
8000 DD = 2
8010 POKE 34,2: HOME : INPUT "FILE NAME ";F$: IF F$ = "X" THEN
8050
8020 VTAB 5: INPUT "DRIVE NO. ";DD
8030 VTAB 7: INPUT "CHECK? ";C$: IF LEFT$(C$,1) = "N" THEN
8000
8040 POKE 34,0: RETURN
8050 DD = 3 - DD: PRINT D$;"CATALOG,D";DD: GET F$: GOTO 8010
8500 S = T:SC = SS:PR = 1:EL = 0:UL = 0:ST = 0: HOME
8510 INPUT "LEFT MARGIN (INCHES) ";LM:LM = INT (LM * 150)
8520 INPUT "PRINT WIDTH: ";WD:WD = INT (WD * 150):HX = WD:
IF LM + WD > 1185 THEN 8500
8530 FOR I = 0 TO 9:TB(I) = 0: NEXT
8540 FOR I = 0 TO 9: PRINT "TAB ";I + 1: INPUT " ";TB(I)
8550 TB(I) = INT (TB(I) * 150): IF TB(I) = 0 THEN I = 9: NEXT
: GOTO 8600
8560 IF I = 0 THEN 8580
8570 IF TB(I) < = TB(I - 1) THEN I = 9: NEXT : GOTO 8500
8580 IF TB(I) > = WD THEN I = 9: NEXT : GOTO 8500
8590 NEXT
8600 INPUT "JUSTIFIED MARGINS? ";C$: IF LEFT$(C$,1) = "Y"
THEN JM = 1
8610 OS = 0: INPUT "LINE SPACING ";C$:DS = INT (VAL (C$)) -
1
8620 MC = 768: GOSUB 250:NM = MC - 768: RETURN
9000 D$ = CHR$(4):I$ = CHR$(9)
9010 DIM DTX(95),VUX(23),CSX(127),TE(9),EPZ(6)
9020 FOR I = 0 TO 95: READ DTX(I): NEXT
9030 FOR I = 0 TO 23: READ VUX(I): NEXT
9040 FOR I = 0 TO 127: READ CSX(I): NEXT
9050 FOR I = 0 TO 6: READ EPZ(I): NEXT
9060 SS = 10000:TF = 38200:TU = 24000:S = SS
9070 TEXT : HOME : PRINT TF - S;" CHARS":F$ = ""
9080 VTAB 8: PRINT "1. INPUT"
9090 PRINT "2. AMEND"
9100 PRINT "3. READ"
9110 PRINT "4. APPEND"
9120 PRINT "5. SAVE"
9130 PRINT "6. FORMAT"
9140 PRINT "7. PRINT"
9150 PRINT "8. END"
9150 VTAB 20: INPUT "SELECT OPTION ";Z
9160 IF Z = 8 THEN HOME : PRINT D$;"PR#6"
9180 ON Z GOSUB 2000,4000,6000,7000,5000,1000,3000: GOTO 90
70
9400 DATA 7,7,10,12,12,16,14,7
9410 DATA 7,7,12,12,7,12,7,12
9420 DATA 12,12,12,12,12,12,12,12
9430 DATA 12,12,7,7,12,12,12,12
9440 DATA 14,16,15,14,16,14,14,16
9450 DATA 16,10,14,16,14,18,16,16
9460 DATA 14,14,15,12,14,16,16,18
9470 DATA 16,16,10,12,12,12,12,12
9480 DATA 7,12,12,10,12,12,10,12
9490 DATA 12,8,6,12,8,16,12,12
9500 DATA 12,12,10,12,10,12,12,16
9510 DATA 12,12,10,10,7,10,12,0
9600 DATA 1024,1152,1280,1408,1536,1664
9610 DATA 1792,1920,1064,1192,1320,1448
9620 DATA 1576,1704,1832,1960,1104,1232
9630 DATA 1360,1488,1616,1744,1872,2000
9700 DATA 64,65,66,61,68,60,70,71
9710 DATA 72,43,74,33,76,42,62,35
9720 DATA 34,81,38,83,63,31,47,45
9730 DATA 36,37,49,50,51,52,53,54
9740 DATA 160,161,162,163,164,165,166,167
9750 DATA 168,169,170,171,172,173,174,175
9760 DATA 176,177,178,179,180,181,182,183
9770 DATA 184,185,186,187,188,189,190,191
9780 DATA 192,1,2,3,4,5,6,7
9790 DATA 8,9,10,11,12,13,14,15
9800 DATA 16,17,18,19,20,21,22,23
9810 DATA 24,25,26,219,220,221,222,223
9820 DATA 39,193,194,195,196,197,198,199
9830 DATA 200,201,202,203,204,205,206,207
9840 DATA 208,209,210,211,212,213,214,215
9850 DATA 216,217,218,27,28,29,30,31
9900 DATA 13,46,33,63,32,20,44

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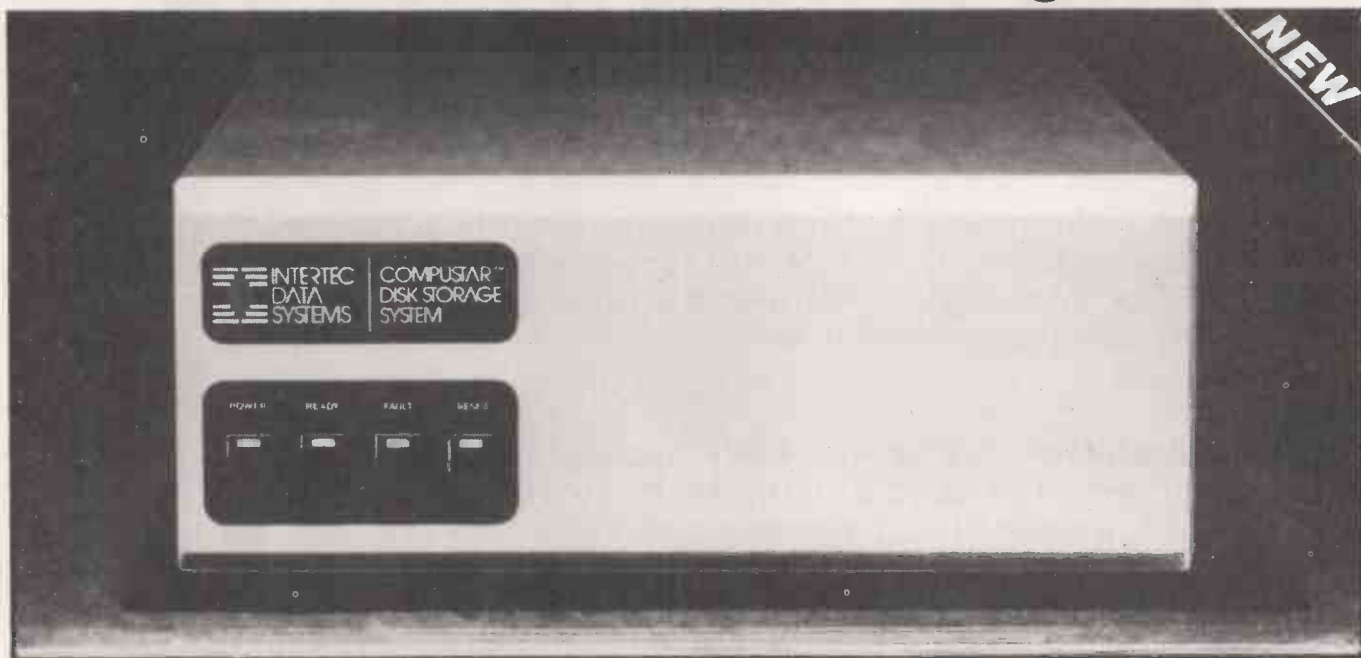
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DEALERS' ENQUIRIES INVITED

Virtual memory: micro's delusion of grandeur

How do you run a 128K program on a 64K machine? Peter Bloor's answer is to use virtual memory — your micro has an inflated idea of its capacity, and your software chooses to believe it.

AS THE cost of memory chips has fallen in recent years, the amount of memory offered as standard on microcomputers has increased. At the same time, the applications programs offered with machines have become more complex to use the extra memory available.

The end result is that whatever memory is available is soon consumed by the programmer trying to provide ever more comprehensive facilities. With the cur-

Real storage		Virtual storage	
Real address		Virtual address	
00000	Page frame 0	00000	Page 0
00800	Page frame 1	00800	Page 1
0F000	Page frame 30	1F000	Page 62
0F800	Page frame 31	1F800	Page 63
0FFF		1FFF	

Figure 1.

rent generation of eight-bit processors, the maximum memory available for a program is 64K. Beyond this point, the programmer must split his program into several modules or omit some facilities.

The restriction to 64K memory is due to the fact that all the common eight-bit processors use 16 bits to hold data and instruction addresses. The largest number

Figure 4.

Page table			Real storage		
Entry number	Virtual address of page		Page frame number	Real address	
0	0000	0000	0	0000	Page 0
1	0800	0001	1	0800	Page 30
2	1000	2000	2	1000	Page 31
3	1800	2800	3	1800	free
13	6800	7800	4	2000	Page 2
14	7000	0001	5	2800	Page 3
29	E800	0001	14	7000	Page 12
30	F000	0800	15	7800	Page 13
31	F800	1000			

which can be held in 16 bits is 65,536 — or 64K. The new generation of 16-bit processors is capable of handling addresses of 24 or even 32 bits to give addresses up to 16MB — 16,777,216 — or 4,096MB respectively.

Unfortunately, that does not entirely solve the memory problem. Even at today's prices, 16MB is still not cheap. Remember, although a single program with data might not occupy more than, say, 256K — not a large figure as high-level languages become less memory-efficient and applications more complex — a system offering that capacity will often be a multi-user one. Sixteen users, each with 256K, means 4MB, or about £25,000 at today's prices.

During the last decade, the most common solution to this problem has been the introduction of virtual storage systems. Most mini and mainframe manufacturers have developed such systems, and with Zilog offering virtual storage hardware for the Z-8000, it seems that micros will follow the same path.

Virtual storage is a technique whereby a computer appears to a program to have a larger amount of memory than it really has. This means, for instance, that a 128K program could be run on a 64K machine.

There are several systems of virtual storage and each offers its own degree of sophistication. The most popular — and that likely to be used on microcomputers — is the paging system.

In the paging system, the memory which the system appears to have, virtual storage, is divided into blocks or pages. Each page will typically be 1K, 2K, or 4K in length.

The memory which is really present in the machine, the real storage, is divided into page frames, each the same size as a virtual-storage page. Each page frame in real storage starts at a real address which is a multiple of the page size. For instance, in a system with 2K pages, successive page frames will start at Hex 0000, 0800, 1000, 1800, and so on.

Similarly, the pages of virtual storage start at virtual addresses which in a system

Page table		
Entry number	Virtual address of page — not of table entry	
0	0000	0000
1	0800	0001
2	1000	0001
3	1800	0001
29	E800	0001
30	F000	0800
31	F800	1000

Figure 2.

with 2K pages would again start at Hex 0000, 0800 and so on. However, since the idea of the system is that virtual storage should be larger than real storage, there will be more pages than page frames, and virtual storage will extend to a higher address than real storage. Figure 1 shows a system with 64K real storage, 128K virtual storage and 2K pages.

Each page frame in real storage can hold one page of virtual storage. Since, with a few exceptions, any page frame may hold any page, there is a table, the page table, which shows what page is in which page frame at any time.

As there are more pages than page frames, there will be pages for which no page frame is available. These pages are held on disc in a page file which consists of a number of page slots. Each page slot performs the same function as a page frame — it holds a page of virtual storage.

Since programs see only virtual storage, the addresses they use are only virtual addresses. Before program instructions and data can be fetched from their locations in real storage, their virtual addresses must be converted to real addresses. This process is known as address translation.

Address translation is performed by hardware attached to the central processor. This hardware uses the page table to

(continued on next page)

(continued from previous page)

find the correct real address for any virtual address. If the page table shows that the page containing the address is not currently held in a page slot, the translation hardware passes control to a software routine called the paging supervisor. This routine finds a vacant page slot and reads the correct page from its page slot on disc into the page frame in real storage. The page table is updated to reflect the movement. That process is known as a page-in.

If there are no vacant page frames, the paging supervisor first undertakes a page-out to move another page to disc and thus frees a page frame.

As well as data addresses contained in the program, the address held in the central processor's instruction pointer must be translated before each instruction is fetched.

The important thing to remember is that all of this is transparent to the user program and to most of the operating system — the obvious exception is the paging supervisor. A program written for a real-storage system should run without alteration in a virtual-storage system.

Using the concepts explained for a paging system of virtual storage, let us see how a simple system would work in practice.

Imagine a system using 16-bit addresses to give an address range from 0 to 64K. The machine has, say, 32K of real storage, but virtual storage is to be 64K. The page size will be set to 2K, to give 32 pages of virtual storage, 16 of which may be held in real storage at any one time.

When the computer is started up, initialisation routines will have to build a page table containing 32 entries, one for each page of virtual storage. For each page held in real storage, the corresponding element of the table will contain the

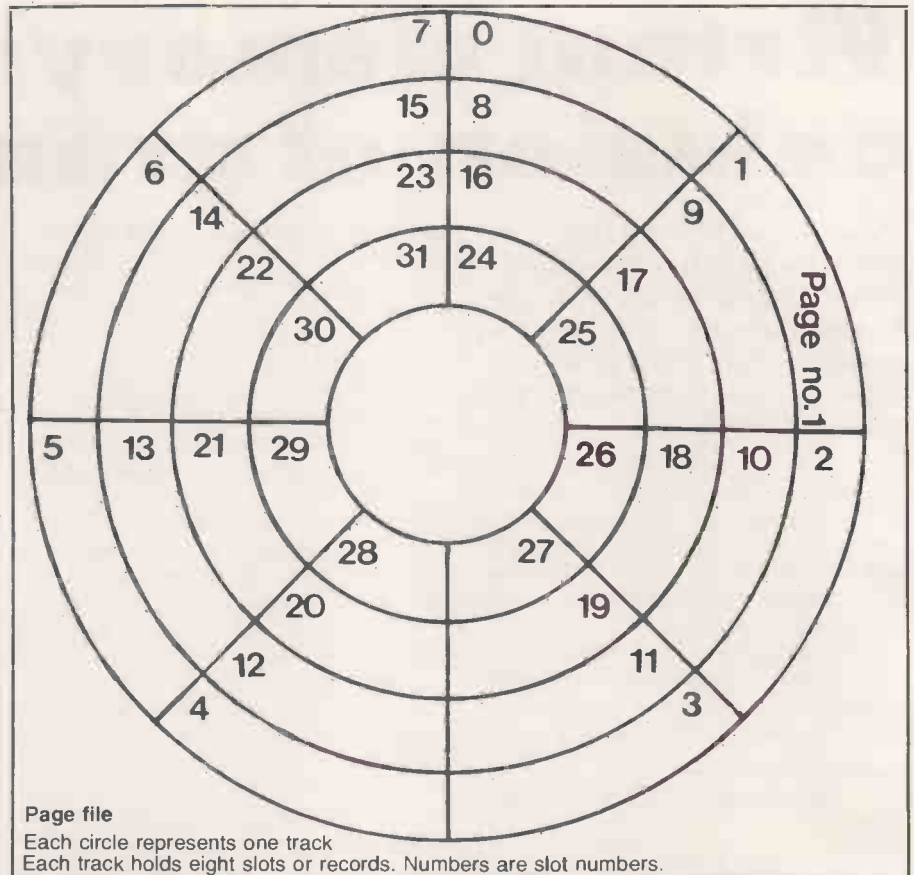


Figure 5.

starting address of the page frame containing it.

If the page is not currently held in real storage, the low-order or rightmost bit of the page-table entry will be set on, i.e., set to one, to show that the page is paged out.

This bit can be used since the page frame addresses are multiples of 2K. The low-order bit will always be zero if the page is allocated to a page frame. Initially, the operating system might need the first

page and the last two pages of virtual storage for itself, so the initial appearance of the page table would be as shown in figure 2.

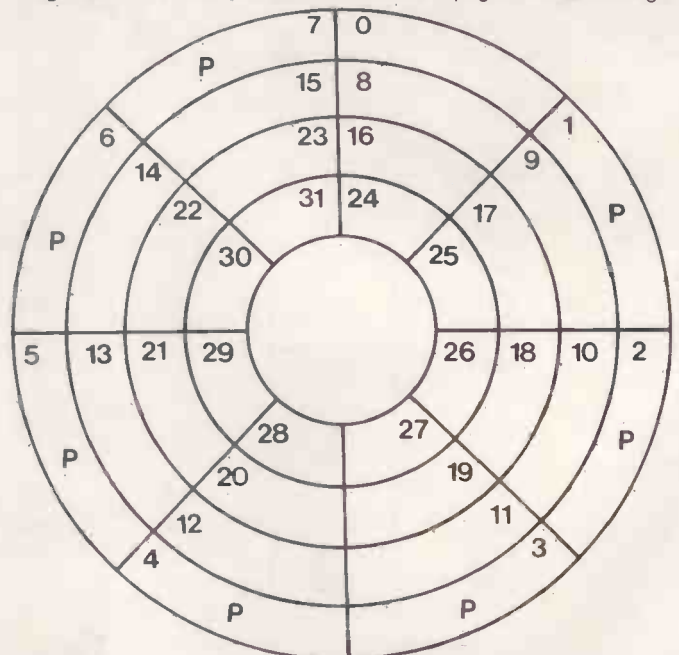
Only the first three page frames of real storage have been allocated — figure 3. At this stage the choice of these three frames is purely arbitrary — any three frames would have done just as well.

If a program of size 40K is now loaded, the paging supervisor will allocate page

Figure 6.

Page table		
Entry number	Virtual address of page	
0	0000	0000
1	0800	0001
2	1000	0001
3	1800	0001
4	2000	0001
5	2800	0001
6	3000	0001
7	3800	0001
8	4000	5000
9	4800	5800
10	5000	6000
11	5800	6800

Page file P shows that the slot contains a page of virtual storage.



frames 3 to 15 to the 13 pages from virtual address 0800 to 6FFF which contain the first 26K of the program. At this point, all the page frames are assigned to pages of virtual storage, but there is still 14K of the program left to be loaded. The paging supervisor therefore has to page out some of the pages currently held in real memory.

Suppose that the paging supervisor chooses to page out the first page of the user program — think for a moment what might happen if the part of the operating system containing the paging supervisor was paged out. The page table and real storage will then be as shown in figure 4.

There is now one page frame vacant and available for allocation to a page of virtual storage. A change has also been made to the page file on disc. This comprises 32 2K records or page slots, each corresponding to one of the 32 page-table entries.

Only one page has been written out so far, and as this was page 1, it is held in slot 1 as shown in figure 5.

The other slots may be assumed to be empty — that is, they contain rubbish — as they have never been written to.

The paging supervisor can now return control to the operating-system loading routine which can load a further page of the program. Now all the page frames are

Real storage		
Page frame number	Real address	
0	0000	Page 0
1	0800	Page 30
2	1000	Page 31
3	1800	free
4	2000	free
14	7000	free
15	7800	free

Figure 3.

occupied once again. The page-out process will be repeated, and by the time the program is completely loaded, seven pages will have been paged out to their slots on the page file. The page table and page file will now be as shown in figure 6.

Note that the table looks like this only because of the way the paging supervisor has selected pages for paging out. If it had repeatedly paged out the page from page frame 3, the page table and page file would instead be as shown in figure 7. Either way, the whole process is invisible to the application program and hence to the programmer.

The operating system, having loaded the program, will now run it by branching to the first instruction. Since the address contained in the branch instruction is a

Page table		
Entry number	Virtual address of page	
0	0000	0000
1	0800	0001
2	1000	2000
●	●	●
●	●	●
●	●	●
13	6800	7800
14	7000	0001
15	7800	0001
16	8000	0001
17	8800	0001
18	9000	0001
19	9800	0001
20	A000	0800
21	A800	0001
22	B000	0001

Figure 7.

virtual address, it must be translated before the instruction at the branch address can be fetched and executed by the system.

The translation hardware therefore attempts to translate the address to a real address as follows. Since virtual storage is organised in 2K pages, the virtual address must be divided by 2K, Hex 0800, to discover in which page it is contained. A diagram can show the current lay-out of virtual storage — figure 8.

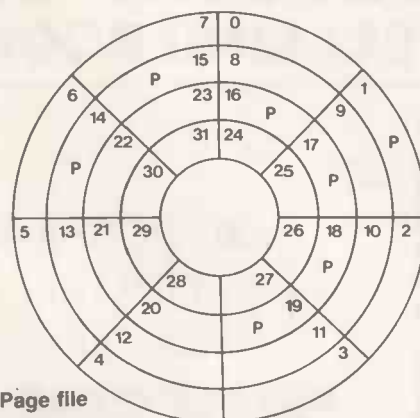
The first instruction of the user program is at virtual address Hex 0800: dividing by 2K gives an answer of one with remainder zero. To find the real address of the start of the program, the address of the page frame held by element 1 of the page table is added to the remainder which is the displacement of the address within the page.

If we look back to the current state of the page table — figure 6 or figure 7 — we find that there is no page frame currently allocated to page 1 of virtual storage; the page has been paged out to the page file.

Control is, therefore, passed to the

Figure 8.

Virtual storage	
Virtual address	
0000-07FF one page	Operating system
0800-A7FF 20 pages	Application program
A800-EFFF nine pages	Free
F000-FFFF two pages	Operating system



Page file

P shows that the slot contains a page of virtual storage.

page supervisor to page in the required page. As all page frames are currently allocated, another page must first be paged out. If page 10 is selected for page-out, the updated page table will be as in figure 9.

The translation can now be retried. Translation of Hex 0800 will give:
Real address = contents of page table entry 1
+ remainder
= Hex 6000 + Hex 0
= Hex 6000

The instruction at virtual address Hex 0800 / real address Hex 6000 can now be fetched and executed. If this references data held in memory, translation of the

Page table		
Entry number	Virtual address of page	
0	0000	0000
1	0800	6000
10	5000	0001

Figure 9.

virtual data address or addresses must take place. If the instruction moves one byte from virtual address Hex 4B08 to virtual address Hex 5090, the first address is translated as follows:

Divide Hex 4B08 by 2K, Hex 0800, gives 9 with remainder Hex 308.
Real address = contents of page-table entry number 9 + Hex 0308
= Hex 5800 + Hex 0308
= Hex 5B08

Try translating the second address.

The system explained has some disadvantages. It is very slow, for instance — a move instruction requires three memory accesses just for address translation. No mention has yet been made of how the paging supervisor selects which pages to page out, or how it knows which pages must remain permanently in real storage.

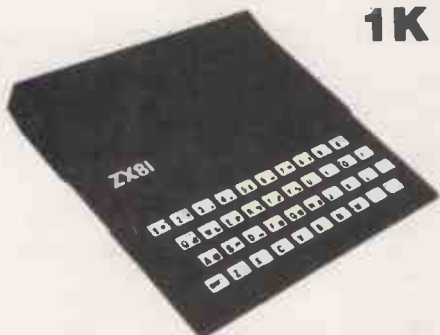
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Time to get down to business software

Charles Somerville continues his series on business software with an examination of applications routines. He describes how file initialisation should be approached, and gives some tips on data protection in sensitive areas such as financial systems.

Listing 1

```

11000 ROUTINE TO ADD NEW CAR TO FILE
11010
11020 LOOP UNTIL CONFIRMATION IS RECEIVED
11030 REPLY$="NO"
11040 WHILE REPLY$="NO"
11050 GET CAR ID NO.
11060 PRINT FNTAB$(20,6) "CAR IDENTIFICATION NUMBER:"
11070 TYPE%=NUMBER%: MIN=1: MAX=9999: HELP%=NO%
11080 CURSOR$=FNTAB$(50,6)
11090 OK%=NO%
11100 LOOP UNTIL A VALID ID IS GIVEN
11110 WHILE NOT OK%
11120 GOSUB 31000
11130 RECORD%=VAL(REPLY$)
11140 GET CARFILE%: RECORD%
11150 IF CARNUMBER$=MKI$(0)
    THEN
        OK%=YES%
    ELSE
        PRINT XERR$ "NUMBER ALREADY IN USE" RETEY$
11160 WEND
11170 START BUILDING RECORD
11180 LSET CARNUMBER$=MKI$(RECORD%)
11190 ADD MAKE OF CAR
11200 PRINT FNTAB$(33,8) "SELECT CAR MAKE"
11210 CODE$="MAKES": ADD%=YES%: HELPPOLI%=31: HELFNEW%=32
11220 GOSUB 37000
11230 PRINT FNTAB$(33,8) CLL$ FNTAB$(20,7) "MAKE:"
        FNTAB$(50,7) DECODE$
11240 LSET CARMMAKE$=CODING$
11250 ADD MODEL
11260 PRINT FNTAB$(33,9) "SELECT CAR MODEL"
11270 CODE$="MODELS": ADD%=YES%: HELPPOLI%=33: HELFNEW%=34
11280 GOSUB 37000
11290 PRINT FNTAB$(33,9) CLL$ FNTAB$(20,8) "MODEL:"
        FNTAB$(50,8) DECODE$
11300 LSET CARMODEL$=CODING$
11310 ADD DATE FIRST REGISTERED
11320 PRINT FNTAB$(20,9) "DATE FIRST REGISTERED:"
11330 TYPE%=DATE%: NULL%=NO%: HELP%=35
11340 CURSOR$=FNTAB$(50,9)
11350 GOSUB 31000
11360 LSET CARDATENEW$=REPLY$
11370 ADD REGISTRATION NUMBER
11380 PRINT FNTAB$(20,10) "REGISTRATION NUMBER:"
11390 TYPE%=STRING%: MIN=2: MAX=8: NULL%=NO%: HELP%=36
11400 CURSOR$=FNTAB$(50,10)
11410 GOSUB 31000
11420 LSET CARREGNO$=REPLY$
11430 VERIFY INPUT
11440 PRINT FNTAB$(20,20) "ARE ALL DETAILS CORRECT:"
11450 TYPE%=C.: FIRM%: NULL%=NO%: HELP%=37
11460 CURSOR$=FNTAB$(50,20)
11470 GOSUB 31000
11480 LOOP BACK TO CHECK REPLY
11490 WEND
11500 WRITE OUT RECORD
11510 PUT CARFILE%, RECORD%
11520 RETURN

```

THIS MONTH, we are ready to concentrate on application routines. We are about to start loading useful details on to our system, and recover them again — a fundamental of data processing.

Starting with the first menu option of our historic-car register program — ADD NEWCAR — we can examine what processing is still required. When this first option is given control, the screen is already formatted with the system title and current menu selection. The help, error message and working areas of the screen have already been cleared.

We shall use this lay-out for collecting and displaying information in the working area:

```

CAR IDENTIFICATION NUMBER:    2387
REGISTRATION NUMBER:         LOT 14
MAKE:                         LOTUS
MODEL:                         ELITE
DATE FIRST REGISTERED:      10/03/62

```

We shall ask for each item of information in turn, and accept the user's replies using the input-and-code routines given in earlier articles. Almost all the data verification required will be supplied by these routines. We are left only with the task of ensuring that the car identification number is not already in use.

To do this, we shall use the technique of initialising the car file on disc before we add any car details. We write records 1 to 9,999, and set the car-identification number in each record to zero, to show that the record is not in use.

This technique has a number of advantages. It ensures that there will always be enough space on a disc for any new addition to the register. With many machines, initialising a file in advance of using it will also give some protection against data loss when someone inadvertently unplugs your computer, and can give considerable performance improvements.

Having accepted the data on a new addition, we wish to ensure that it has all been entered correctly and so ask ARE ALL DETAILS CORRECT? before committing the record to disc. If the reply is "No", all the details will be re-entered.

Listing 1 shows the code required, and will serve as a model for you to write the code for your specific application. All the dialogue is contained within a loop, which is repeated until the information input is verified as being correct. At this juncture, the loop is exited and the record is written to disc. Control then returns to the menu-display routine.

Having stored the record, we now wish to display, and perhaps update, the information it contains. Menu option 2 —

(continued on next page)

(continued from previous page)

DISPLAY/UPDATE CAR DETAILS — will result in a display in the same format as the completed details for adding a car. Once again, the question ARE ALL DETAILS CORRECT? will be asked. Answering "Yes" will return control to the menu-display routine. If the reply is "No", the user will be allowed to update the information displayed.

Where possible, updating is performed by typing the new information over the old on the screen. The cursor is positioned at the start of each field in turn. The field can then be changed by typing the new contents, followed by Return, or left unchanged by pressing just the Return key.

When all the fields have been offered for update, the user is again asked ARE ALL DETAILS CORRECT?

If the answer is "Yes", the updated record is written to disc. If the user replies "No", the original contents of all the fields are restored, and the user is given another chance to carry out the update.

Two refinements must be made to this technique for it to be suitable for general use. First, it must be possible to protect a field from update. This will be required if an item of information — we shall use the car identification number as an example — should not be changed as other records, either manual or computer-

based, are keyed to it.

Protection may also be required in the case of financial information. For instance, it may be decided to protect an account balance against this form of update, and only alter it through menu options to record debits and credits with full details.

Protection is implemented by jumping past the protected fields when positioning the cursor to allow updates. The code in listing 2 does this to protect the car-identification number from change.

The second enhancement needed is the ability to update fields which were originally entered using the code routine. The car make was originally selected from a menu of makes, and any replacement should be entered in the same manner.

For this reason, when it is the turn of the "Make" field to be offered for update, the message DO YOU WISH TO CHANGE THE MAKE? is first displayed. If the answer is "Yes", the code routine assumes control and displays the menu of makes, to allow a new choice to be made.

To allow rapid updating of a record, and to maintain consistency, a null reply — only Return pressed — will be accepted and treated as "No". This means that the user can tabulate to a field which he wishes to update by repeatedly pressing the Return key.

Deleting a record from the file, menu

```


13000 'ROUTINE TO DELETE CAR FROM FILE
13010
13020 'GET CAR ID NO.
13030 PRINT FNTAB$(20,6) "CAR IDENTIFICATION NUMBER:"
13040 TYPE%=NUMBER%: MIN=1: MAX=9999: HELP%=50: NULL%=NO%
13050 CURSOR%=FNTAB$(50,6)
13060 GOSUB 31000
13070 RECORD%=VAL(REPLY%)
13080 GET CARFILE%, RECORD%
13090 IF CARNUMBER%="K1$(0)
    THEN
        PRINT XERR% "CAR ALREADY DELETED" HIOFF% BELL%:
        RETURN
13100 'DISPLAY CAR DETAILS
13110 GOSUB 40000
13120 'ASK FOR VERIFICATION
13130 PRINT FNTAB$(20,20) "IS THIS THE CORRECT CAR:"
13140 TYPE%=CONFIRM%: HELP%=51: NULL%=NO%
13150 CURSOR%=FNTAB$(50,20)
13160 GOSUB 31000
13170 'DELETE RECORD
13180 IF REPLY%="YES"
    THEN
        LSET CARNUMBER%=MKI$(0):
        PUT CARFILE%, RECORD%
13190 RETURN
    
```

Listing 3

option 3, is done by setting the car-identification number field of the record back to zero, to show that the record is no longer in use.

Before the deleted record is written out, the details should be displayed on the screen. The user can then be asked IS THIS THE CORRECT CAR TO DELETE? to guard against mistakes.

In the event of the user trying to delete a record which is not in use, an error message is given and control returned to the menu display routine. Listing 3 shows the required code.

Before next month, update the help file to include all the messages necessary for the routines given this week. Then write a small program to initialise the car file. You will then be able to try creating, updating and deleting car records. 

Listing 2

```

12000 'ROUTINE TO DISPLAY AND UPDATE CAR DETAILS
12010
12020 'GET CORRECT RECORD
12030 PRINT FNTAB$(20,6) "CAR IDENTIFICATION NUMBER:"
12040 TYPE%=NUMBER%: MIN=1: MAX=9999: HELP%=40: NULL%=NO%
12050 CURSOR%=FNTAB$(50,6)
12060 OK%=NO%
12070 WHILE NOT OK%
12080     GOSUB 31000
12090     RECORD%=VAL(REPLY%)
12100     GET CARFILE%, RECORD%
12110     IF CARNUMBER%="K1$(0)
        THEN
            PRINT XERR% "NUMBER NOT IN USE" RETRY%
        ELSE
            OK%=YES%
12120 WEND
12130 'DISPLAY DETAILS
12140 GOSUB 40000
12150 'GET READY TO UPDATE IF REQUIRED
12160 DONE%=NO%
12170 FIRSTTRY%=YES%
12180 'SEE IF UPDATE REQUIRED
12190 WHILE NOT DONE%
12200 PRINT FNTAB$(20,20) "ARE ALL DETAILS CORRECT:"
12210 TYPE%=CONFIRM%: HELP%=41: NULL%=NO%
12220 CURSOR%=FNTAB$(50,2)
12230 GOSUB 31000
12240 IF REPLY%="YES" AND NOT FIRSTTRY%
    THEN
        PUT CARFILE%, RECORD% 'WRITE OUT CHANGED RECORD
12250 IF REPLY%="NO" AND FIRSTTRY%
    THEN
        GOSUB 41000 'UPDATE DETAILS
12260 IF REPLY%="NO" AND NOT FIRSTTRY%
    THEN
        GET CARFILE%, RECORD%:
        GOSUB 40000:
        GOSUB 41000 'RESTORE AND UPDATE DETAILS
12270 IF REPLY%="YES"
    THEN
        DONE%=YES%
    ELSE
        FIRSTTRY%=NO%
12280 WEND
12290 RETURN
40000 'DISPLAY FIELDS FROM A CAR FILE RECORD
40010 PRINT FNTAB$(20,7) "MAKE:" FNTAB$(20,8) "MODEL:"
40020 PRINT FNTAB$(20,9) "DATE FIRST REGISTERED:"
40030 PRINT FNTAB$(20,10) "REGISTRATION NUMBER:"
40040 CODE%="MAKES"
40050 CODING%=CARMAKE%
40060 GOSUB 36000
40070 PRINT FNTAB$(50,7) DECODE%
40080 CODE%="MODELS"
40090 CODING%=CARMODEL%
40100 GOSUB 36000
40110 PRINT FNTAB$(50,8) DECODE%
40120 PRINT FNTAB$(50,9) CARDATENEW%
40130 PRINT FNTAB$(50,10) CARREGNO%
40140 RETURN
41000 'UPDATE RECORD ON SCREEN
41010
41020 'BYPASS ID NO.
41030 'UPDATE MAKE IF REQUIRED
41040 PRINT FNTAB$(20,20) "DO YOU WISH TO CHANGE THE MAKE:"
41050 TYPE%=CONFIRM%: HELP%=42: NULL%=YES%
41060 CURSOR%=FNTAB$(50,20): GOSUB 31000
41070 IF REPLY%="YES"
    THEN
        CODE%="MAKES": ADD%=YES%: HELPPOLD%=43: HELPNEW%=44:
        GOSUB 37000:
        LSET CARMAKE%=CODING%:
        PRINT FNTAB$(50,7) DECODE%
    ELSE
        PRINT FNTAB$(20,20) CLL%
41080 'UPDATE MODEL IF REQUIRED
41090 PRINT FNTAB$(20,20) "DO YOU WISH TO CHANGE THE MODEL:"
41100 TYPE%=CONFIRM%: HELP%=45: NULL%=YES%
41110 CURSOR%=FNTAB$(50,20)
41120 GOSUB 31000
41130 IF REPLY%="YES"
    THEN
        CODE%="MODELS": ADD%=YES%: HELPPOLD%=46: HELPNEW%=47:
        GOSUB 37000:
        LSET CARMODEL%=CODING%:
        PRINT FNTAB$(50,8) DECODE%
    ELSE
        PRINT FNTAB$(20,20) CLL%
41140 'UPDATE DATE FIRST REGISTERED IF REQUIRED
41150 TYPE%=DATE%: HELP%=48: NULL%=YES%
41160 CURSOR%=FNTAB$(50,9)
41170 GOSUB 31000
41180 IF REPLY%<>"
    THEN
        LSET CARDATENEW%=REPLY%
41190 'UPDATE REGISTRATION NUMBER IF REQUIRED
41200 TYPE%=STRING%: MIN=2: MAX=8: HELP%=49: NULL%=YES%
41210 CURSOR%=FNTAB$(50,10)
41220 GOSUB 31000
41230 IF REPLY%<>"
    THEN
        LSET CARREGNO%=REPLY%
41240 RETURN
    
```


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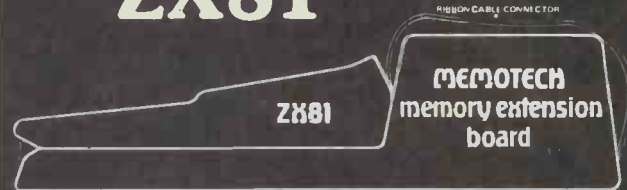
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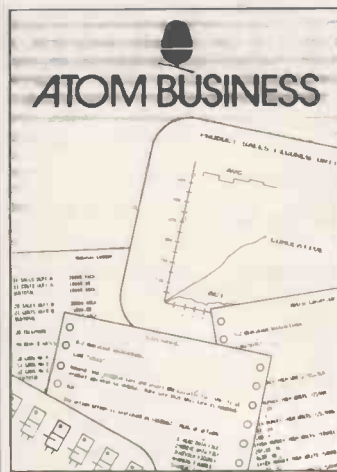


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● Circle No. 183

New instructions

I HAVE discovered a set of new instructions on the Z-80 microprocessor which are not shown in the Zilog manual, writes A Johnson of Sevenoaks, Kent. The first program is a typing tutor written on a Tandy TRS-80. It prints a copy of the keyboard and then flashes a key on this while waiting for it to be pressed. See typing tutor.

If the wrong key is input, the program replaces the correct one on the display, waits for a short time and then repeats the flashing of the same key. If the correct key is pressed, the program selects another for flashing.

The second program Hex Converter — is a fast Hex-to-decimal converter for machine-code programs which Tandy users who do not have a monitor or facilities for machine-code saving may find useful. It converts one-byte Hex numbers in Data statements into decimal and Pokes them into the memory starting at First. This routine could also be used on most other machines which use Basic and have facilities for Boolean algebra.

The Z-80 op-codes are shifts, situated between CB 30 and CB 37 Hex, and also the related IX and IY codes. I call them SLI, shift left and increment, and their function is to shift the relevant register one bit to the left.

However, they differ from the normal shift left because they introduce a binary 1 into the right-hand bit, bit 0, instead of the normal 0. A friend tells me that these op-codes alter the parity/overflow flag, and I think this must be the reason they were omitted from the Zilog documentation.

High resolution

THIS simple program is for the Research Machines 380-Z microcomputer, writes Peter Wilkin of Kidbrooke, London. The program allows the user to obtain a copy of a drawing in high resolution mode 2, on a Oki Microline printer. See Drawing Program.

As the memory arrangements of the high-resolution board are peculiar you have to devise a routine to print out the

points. Each byte in HR2 contains the intensity at four x-points.

So the intensity at the first point if the first and second bits of the bytes. So to obtain the intensity at the first x point, you have to divide the byte by four and then compare it to the integer of the division. If the two portions are the same, the intensity at that point is 0; if the two portions are not the same, the intensity is above 0, i.e., 2.

The memory is arranged in blocks of 16 bytes, the bytes are the y points below that point on the screen. There are 80 blocks across the screen and 12 blocks down.

	0	4	8	x-axis	319
191	i				
	1st block	2nd	3rd	79th	80th
i75	i6				
174	i				
	81st	82nd	83rd	159th	160th
i69	i16				

As the Microline is normally set to 80 characters per line, the screen is split into two pages. Page 1 contains points 0-160, page 2 contains points 161-320. Line 10000 reserves memory space for the variables and space for when the board memory is opened.

Line 10001 opens the high-resolution board's memory for examination and line 10002 obtains the location of the point o,i,191 in the memory. The rest of the program converts these memory locations into low-resolution pixels which may be printed by the Microline printer.

The program may be adapted for other printers with graphics characters such as the Epson MX-80 F/T-2 and takes about 20 minutes to print the screen. When it prints page 1, move the paper on the Microline up then press Return. This may be changed to a subroutine by changing line 10016 from End to Return.

Typing Tutor

```

10 CLS: DIM A$(43), C(43)
20 DATA 1,2,3,4,5,6,7,8,9,0,":", "-
30 DATA Q,W,E,R,T,Y,U,I,O,P,@
40 DATA A,S,D,F,G,H,J,K,L,:
50 DATA Z,X,C,V,B,N,M,":", ".,/
60 FOR A=0 TO 11: F=F+1: READ A$(F): C(F)=A*4: NEXT
70 FOR A=0 TO 10: F=F+1: READ A$(F): C(F)=A*4+65: NEXT
80 FOR A=0 TO 9: F=F+1: READ A$(F): C(F)=A*4+131: NEXT
90 FOR A=0 TO 9: F=F+1: READ A$(F): C(F)=A*4+196: NEXT
100 FOR A=0 TO F: PRINT@C(A), A$(A): : NEXT
110 R=RND(F): IF R=L THEN 110 ELSE L=R
120 A$=INKEY$: IF A$="" THEN 150
130 IF A$=A$(R) THEN PRINT@C(A), A$: GOTO 110
140 PRINT@C(R), A$(R): : FOR A=0 TO 50: NEXT
150 IF FL THEN FL=0: PRINT@C(R), CHR$(143): : GOTO 120
160 FL=-1: PRINT@C(R), " ": : GOTO 120
    
```

Drawing Program

```

10000 CLEAR 100,120*128
10001 CALL "GBAVE",0
10002 E=PEEK(&11C)+256*PEEK(&11D): HR=EM+1
10003 LL=0: UL=39
10004 FOR ND=1 TO 2
10005 FOR I=0 TO 191 STEPS
10006 FOR K=LL TO UL
10007 GOSUB 10017
10008 NEXT K
10009 LPRINT CHR$(13)
10010 NEXT I
10011 LPRINT
10012 PRINT "PAGE", ND
10013 INPUT A$
10014 LL=LL+40: UL=UL+40
10015 NEXT ND
10016 END
10017 Z=INT(I/16): J=I-(16*Z)
10018 A=PEEK(HR+(K*16)+J+(Z*128))
10019 IF I=191 THEN C=0: E=0: GOTO 10024
10020 Z1=INT((I+1)/16): J1=(I+1)-(Z1*16)
10021 C=PEEK(HR+(K*16)+J+(Z1*128))
10022 Z2=INT((I+2)/16): J2=(I+2)-(16*Z2)
10023 E=PEEK(HR+(K*16)+J+(Z*128))
10024 FOR X=1 TO 2
10025 A4=A/4: A=INT(A4)
10026 B4=B/4: B=INT(B4)
10027 C4=C/4: C=INT(C4)
10028 D4=D/4: D=INT(D4)
10029 E4=E/4: E=INT(E4)
10030 F4=F/4: F=INT(F4): Q=0
10031 IF A4<>I1(A4) THEN Q=Q+1
10032 IF B4<>A THEN Q=Q+2
10033 IF C4<>I1(C4) THEN Q=Q+4
10034 IF D4<>C THEN Q=Q+8
10035 IF E4<>I1(E4) THEN Q=Q+16
10036 IF F4<>E THEN Q=Q+32
10037 Q=Q+128
10038 LPRINT CHR$(Q):
10039 NEXT X
10040 RETURN
    
```

Dropping bombs

MY SIMPLE machine-code routine will give up to 10K of single byte pseudo-random numbers on a Nascom 2, writes Richard Cotterill of Bury St Edmunds, Suffolk. I used it to drop bombs in an invaders game.

It works by loading the A register from the machine's ROM, using index register IX as a pointer. There are no trap routines shown, so when you have used 10,240 random numbers — this takes almost three hours at one per second — the numbers will be drawn from the VDU RAM, where they may all be the same for long periods. IX is initialised to the start of ROM, this is E000-07FF H on the Nascom 2.

Z-80 Code	Mnemonics	Comment
DD 21 00 E0	LD IX, START	:INITIALIZE POINTER
		:REST OF PROGRAM
DD 7E 00	LD A, (IX + 0)	:GET RANDOM NUMBER
		FOR A
DD 23	INC IX	:INCREMENT POINTER
		:REST OF PROGRAM

Hex Converter

```

10 DEFINT A—Z:A = 16:B = 65:C = 7:D =
112:E = 784
20 FOR I=firstTOI+length:READ As
30 L=ASC(As):r=ASC(RIGHTS(As,1))
40 POKEI,A*L+r+(L*B)*D+(R*B)*C—E
50 NEXT
60 REM Hex of routine in data statements
SLI B CB 31
SLI C CB 31
SLI D CB 32
SLI E CB 33
SLI H
CB 34SLI L CB 35
SLI (HL) CB 36
SLI A CB 37
SLI (IX+d) DD CB d 36
SLI (IY+d) FD CB d 36
    
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Microline users can generate charts, graphs and illustrations and explain them with captions of double width characters. The Microline 82A prints 64 block shapes in addition to the full character ASCII set.

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Microline 82A users do not have to purchase different models for different forms. The standard platen accommodates friction and pin feed forms and optional tractors snap in place and adjust to suit form width. The Microline 82A provides versatile forms controls including vertical tab, top of form and a vertical format unit that provides switch and program selection for up to ten form lengths.

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Number conversion

HERE ARE two short and simple programs for changing number bases — useful for machine-code programming, writes Roger Holme of Ulverston, Cumbria. They will each fit easily into 1K on a ZX-81 and could be combined into one program on a 16K machine.

The programs are self-explanatory: the user inputs the number to be converted, then the base which the number is in, or the base into which the number is to be converted. Depending on which program is used, the computer prints out the desired converted number and waits for a key prompt to go again.

The maximum base which may be used is 35 due to the character set — if you can supply me with a genuine reason for working in base 36 I will devise a program.

In your review of the ZX-81 in your June 1981 issue you state that it is difficult to break from an input loop if a string input is required. This can be done simply, if not clumsily, by pressing Edit then Stop, producing Error D.

I am having considerable problems loading programs from cassette tape with the ZX-81. Does anyone have a solution. The problem appears to be the signal level, which seems very critical.

Inverse video

MY MACHINE-code subroutine converts all the characters on the ZX-80 screen to inverse video, and *vice versa*, writes D. Piponi of Willesden, London. It leaves the spaces untouched — if this were not done, irregular shapes would occur as a result of irregular ZX-80 screen memory.

To enter it, type the following program:

```
To convert decimal numbers to Base N
10 DIM B$(9,1)
20 PRINT "INPUT DECIMAL NUMBER"
30 INPUT D
40 PRINT"BASE REQUIRED ?"
50 INPUT B
60 LET Q=D
70 FOR I=1 TO 9
80 LET X=D/B
90 LET R=D-(INT(X)*B)
100 LET B$(I)=CHR$(28+R)
110 LET D=INT(X)
120 NEXT I
130 PRINT
140 PRINT "NUMBER IN BASE " ; B
150 PRINT
160 FOR I=9 TO 1 STEP -1
170 PRINT B$(I) ; " "
180 NEXT I
190 PRINT
200 PRINT
210 PRINT"PRESS ANY KEY TO CONTINUE"
220 IF INKEY#="" THEN GOTO 220
230 CLS
240 GOTO 20
```

Machine code listing

6 23	LD B,22	set line counter
42 12 64	LD HL,(16396)	find d-file
35	INC HL	move to next character
126	LD A,(HL)	fetch it
254 118	CP 118	end of line ?
40 9	JR Z,3	then move to next line
254 0	CP 0	is a space?
40 3	JR Z,3	then leave it
198 128	ADD A,128	invert character
119	LD (HL),A	print it
24 241	JR 241	move on
16 239	DJNZ 239	start new line
201	RET	return to basic

Inverse video

```
10 DIM A(11)
20 LET A(0)=5638
30 LET A(1)=3114
40 LET A(2)=9024
50 LET A(3)=-386
60 LET A(4)=10358
70 LET A(5)=-503
80 LET A(6)=10240
90 LET A(7)=-14845
100 LET A(8)=30592
110 LET A(9)=-3816
120 LET A(10)=-4336
130 LET A(11)=201
```

If this is now run, the routine will now be held in the array A. To enable it, use the following line within the program:
xxxx LET A=USR(PEEK(16392) + PEEK(16393)*256+2)

As long as Run is not typed, the program for entering the routine can be overwritten. The machine-code listing is shown above.

Kaleidoscope vision

THE PROGRAM creates symmetrical patterns on the screen similar to those made by a kaleidoscope, writes G P Jeffries of Stockport, Cheshire. The Usr (52) command in line 70 has the same effect as PEEK (16396) + PEEK (16397)*256. It gives the memory location of the first character on the screen, but takes up less memory. There are 32 spaces in line 20.

Kaleidoscope

```
10 FOR F=1 TO 23
20 PRINT "
30 NEXT F
40 LET X=0
50 LET Y=0
60 RANDOMISE
70 LET K = USR(52)+350
80 FOR F=1 TO RND(20)
90 LET X=RND(16)
100 LET Y=RND(11)-1
110 POKE K+(33*(Y+1))+X,8
120 POKE K+(33*(Y+1))+X+1,136
130 POKE K+(33*-Y)+X,136
140 POKE K+(33*-Y)-X+1,8
150 NEXT F
```

To convert Base N numbers to decimal

```
10 LET A=0
20 LET M=1
30 PRINT "INPUT NUMBER IN BASE N"
40 INPUT D$
50 PRINT
60 PRINT "WHAT IS BASE N"
70 INPUT B
80 LET A=LEN D$
90 FOR I=A TO 1 STEP -1
100 LET S=(CODE(D$(I))-28)*M
110 LET M=M*B
120 LET D=D+S
130 NEXT I
140 PRINT
150 PRINT " IN DECIMAL THE NUMBER IS "
160 PRINT
170 PRINT D
180 PRINT
190 PRINT "PRESS ANY KEY TO CONTINUE "
200 IF INKEY#="" THEN GOTO 200
210 CLS
220 GOTO 10
```

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Posh Printing

I HAVE recently bought myself a Daisy-wheel II from Tandy and was surprised to find that, despite its price, it will continue printing, regardless of the width or length of paper used, writes Frank Johnson of Runcorn in Cheshire. The printer is, therefore, only useful for word-processing, and only then with the correct size paper. I had expected some form of tabulator on the printer to select paper width.

For listings you must use paper the full width of the printer to ensure that you do not print on the platen. A number of lines per page is checked in the ROM driver, but produces no result when the desired number of lines is reached and obviously requires software halts in programs.

This is all very well until you try listing programs — no control over the output format is allowed. Since then, I have found that this is the case with many printers and have devised a modified driver for them.

The routine supplied is in Basic and can, therefore, be used and stored very easily. It works exactly like the original, with a few added differences.


Memory location 16424 is used for the number of required lines to be printed, plus one. Location 16425 is the driver line-count which is set to zero when the value equals the number of selected lines. When the zero is detected, it becomes incremented to one, a graphics block is displayed on the screen and the line-count re-set to the pre-selected amount. You may now replace the paper.

If you then press enter, the next page will be written. If, however, you press break, you will return to Basic with a ready message.

Memory location 16426 is not used normally and is always zero. The printer-driver routine uses this address to check on the number of bytes per line. On a daisywheel, the backspace, CHR\$(8) is also taken into account, as is the number of forced carriage returns produced on the printer when the specified number of bytes per line is reached before the end of the line.

Data storage on cassette has always been a tedious, time-consuming problem. There is no real need for this, as only eight bytes of leader are all that are necessary for the data-input routine.

The other listing replaces the ROM, Print# to cassette routine and with only an eight-byte leader. This means that all data output requires only half the time previously required.

Input# will accept this type of data as before, but you may find that with some cassette players, especially if operated on batteries, that you may have to omit the remote plug to allow the player's motor to reach the correct speed. This routine works well on the model I TRS-80 using the CTR-80 cassette player — other configurations may not work as easily. 

```

0 REM*** LINE PRINTER DRIVER ROUTINE ***
10 CLEAR500:B#=PEEK(16562)*256+PEEK(16561):IFB#>32767THENB=-65536+B#ELSEB=B#:REMEMBER TO RESERVE AT LEAST 71 BYTES FOR THIS ROUTINE
20 FORA=B-25TOB+71:READC:POKEA,C:IFPEEK(A)<>CTHEN50ELSENEXT:B%=B-25:POKE16422,PEEK(VARPTR(B%)):POKE16423,PEEK(VARPTR(B%)+1):LPRINT:REM EACH END OF PAGE IS PRECEDED BY A GRAPHICH CODE. PRESS ENTER WHEN NEW SHEET ENTERED. PRESS BREAK TO RETURN TO BASIC.
30 DATA42,177,64,35,34,38,64,17,207,255,25,34,160,64,205,77,27,33,1,80,34,41,64,195,24,26,221,126,4,183,32,21,221,52,4,62,188,205,51,0,58,64,56,254,4,202,24,26,254,1,32,244,201:REM ITEM 20 IS NUMBER PER LINE SET @ 80,CHANGE WHEN TYPING TO SUI.
40 DATA197,205,141,5,193,121,254,8,32,8,58,155,64,61,50,155,64,201,254,13,32,7,221,126,4,183,40,207,201,58,155,64,221,190,5,192,175,50,155,64,14,13,24,212:REM POKEL6424 No LINES+1, POKE 16425,1 SIMULATES TOP OF PAGE, POKEL6426,BYTES PER LINE.
50 PRINT"NOT ENOUGH MEMORY RESERVED FOR THIS ROUTINE"

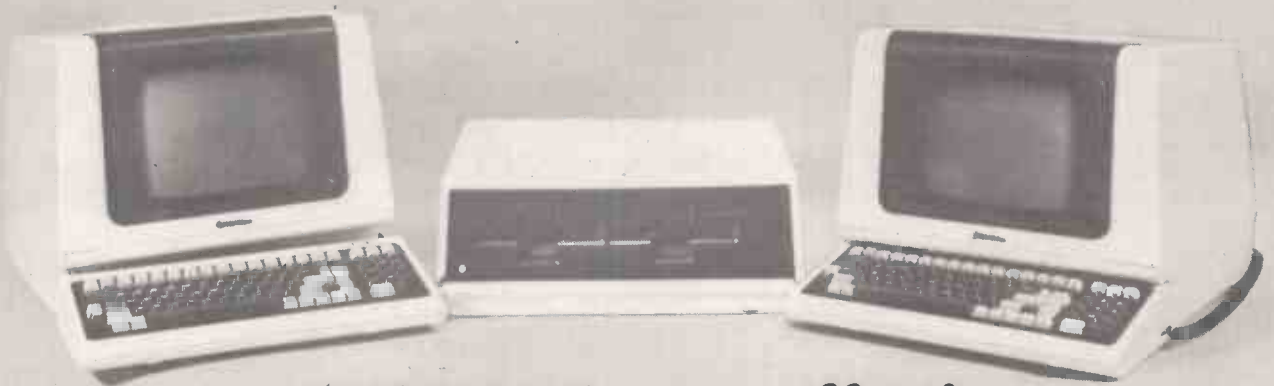
```

```

0 REM** PRINT# TO TAPE DRIVER ROUTINE **
10 CLEAR500:B#=PEEK(16562)*256+PEEK(16561):IFB#>32767THENB=-65536+B#ELSEB=B#:REMEMBER TO RESERVE AT LEAST 15 BYTES BEFORE RUNNING: MORE DATA IS NEEDED TO ENABLE PRINT# TO DISK AS WELL AS TAPE
20 FORA=B-19TOB+15:READC:POKEA,C:IFPEEK(A)<>CTHEN40ELSENEXT:B%=B-19:POKE16842,195:POKE16843,PEEK(VARPTR(B%)):POKE16844,PEEK(VARPTR(B%)+1):PRINT#-1,"A":REM THIS SECTION SETS UP PROGRAM WHICH DELETES THE PROGRAM & RETURNS TO READY
30 DATA42,177,64,35,34,203,65,17,205,255,25,34,160,64,205,77,27,195,24,26,254,35,192,193,205,254,1,6,7,205,137,2,195,150,32:REM THE PROGRAM ALWAYS RESIDES IN MEMORY FROM ONE BYTE PAST RESERVED ADDRESS
40 PRINT"NOT ENOUGH MEMORY RESERVED FOR THIS ROUTINE"

```

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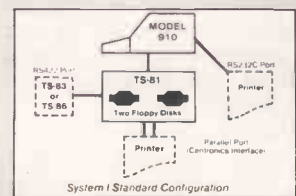
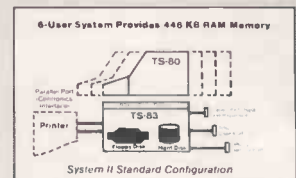
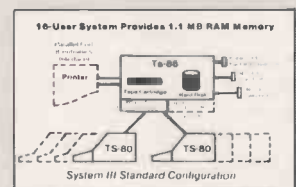
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To the rescue

HERE ARE some hints for Superboard II users to help rescue programs from system crashes, writes Phil Ogden of Halifax, West Yorkshire. All Superboard programs should start with the program line:

```
0 POKE769,20:POKE770,3.
```

This initially does nothing because when the line is entered, the Basic interpreter Pokes location 769 with 20 and 770 with 3 automatically.

The program does, however, ensure that the user knows the pointer to the start of the Basic program. Without line zero, the contents of location 769 cannot be guaranteed as it is different for different program lines.

If the user types New and then changes his mind before entering any further program lines to retrieve the old program, type:

```
POKE769,20:POKE770,3
```

In immediate mode, and the program will once again be accessible. This becomes more important because, if by accident, a number is Poked into a location used by Basic as a flag, pointer or register, the system will crash — and only a cold-start will enable the computer to be used again.

If there is no number input by the user to the "Memory size?" prompt, the computer executes a memory test routine to see how much memory is available which unfortunately destroys any program already in memory.

To re-set the Basic flags, pointers and registers without losing your program, you need to know the memory size of your system — usually 4096 or 8192 but if you have a different amount of RAM, the number will be different. Also, if you have a machine-code program protected at the end of the user RAM, the number will be different.

To protect the RAM, you must know the number given to the "Memory size?" prompt so there will be no problem. All you need do is enter the number of bytes available when the cold-start prompts for "Memory size?", set up Terminal Width? as usual and when the OK prompt appears, type:

```
POKE769,20:POKE770,3.
```

The program has a very good chance of still being there. It's a good idea to have your tape recorder to hand because in some cases, even with this procedure, the system can crash after the first listing. So, if you type Save:List and save the listing, and if the computer hangs up on the last line, you can cold-start again and load the salvaged program from tape.

Graphic headache

THE STRANGE half alpha-numeric, half-graphic format of the Superboard II error codes can be quite a headache, especially to new users. Fortunately, it is simple to change the format to standard — this program will do it:

```
0222 29 7F AND £7F
0224 4C 69 FF JMP FF69
```

The program is initialised in Basic by the statement

```
POKE 538, 34:POKE 539, 2
```

Note that the statement must be entered as one line. The program checks each character in the accumulator before it is printed, and sets the most significant bit to zero. This automatically causes the characters with ASCII values above 127 decimal to be printed as characters with an ASCII value of 128 less than expected.

Since the graphic section of an error code falls in this category, the error is printed in standard alpha-numeric form. Unfortunately, all characters will be printed like this, so to place characters with ASCII values above 127 on the screen, the Poke command must be used.

This does not usually cause problems as the offending characters are not accessible from the keyboard — only by using the CHR\$ function.

It is possible to alter the method to improve things a little by taking a completely different approach:

```
0222 48 PHA
0223 AD 67 D3 LDA D367
0226 29 7F AND £7F
0228 8D 67 D3 STA D367
022B 68 PLA
022C 4C 69 FF JMP FF69
```

Again, the routine is initialised by POKE 538, 34:POKE 539, 3.

This routine looks at the location in the video RAM where the graphic code will appear and masks the most significant bit. All locations immediately above this location — i.e. after subtracting multiples of 32 from the location — will be affected, but no others. Again, Poke will ensure correct graphics.

Both programs are re-locatable providing the initialisation routine is altered correspondingly. The programs are for the Synmon monitor.

Names on cassette

THE FOLLOWING program allows you to name your programs on cassette. When you load a program saved using the program, the title of the program will be displayed and will remain on the screen until the program has loaded, the programs are self-starting — that is, they will run automatically when they have been loaded.

If a program line is rejected due to an error on the tape, the computer will start to display the loading program from the point at which the error occurred. Errors within a program line are not detected. The program works because of two important conditions.

Anything entered following a colon in immediate mode is treated as a Rem statement and no action is taken — including error checking, providing the colon is the first character entered. Thus we can send characters from the cassette to the computer which do not follow the syntax of Basic, and yet will not generate an error — the title of the program is a

good example of this.

Secondly, the character with ASCII value 15 decimal acts as a toggle, alternately suppressing and allowing characters to be displayed on the VDU — exactly as control-0 does in the keyboard-input mode. In immediate mode, the CHR\$(15) character must be preceded by a colon because if an error is generated, the display is switched on again.

If you have files of data on cassette, they can be stored as strings. The first string has a CHR\$ character to switch off the display, the last is a CHR\$(15) to switch the display on again.

```
63989 END
63990 REM PROGRAM LIST
63991 FOR I = 1 TO 30:PRINT:NEXT
63992 INPUT "PROGRAM NAME" ; A$
63993 SAVE
63994 FOR I = 1 TO 30:PRINT:NEXT
63995 PRINT ":" A$ CHR$(15)
63996 POKE 4, 194:POKE 5, 165
63997 LIST —63988
63998 PRINT:PRINT "POKE 515, 0:RUN:"
CHR$(15)
63999 POKE 4, 195:POKE 5, 168:POKE 517,
0
```

To use, just type Run 63990. The program you wish to save must, of course, already be in memory. Do not forget to turn the tape recorder on, as the Return after entering the program name will cause the program to be Saved.

Clearing the screen

AFTER reading the June 1981 6502 Special and Robert Schiften's letter asking about a clear-screen routine accessible from a spare key on the Superboard, I have written this program, writes A Lightowler of Pontefract, West Yorkshire.

It uses the Rub-out key but that could be changed for any key. It is written in the spare RAM from 0222 but is fully re-locatable without any changes. The keyboard input vector is changed by:

```
POKE 536,34: POKE 547,15
```

This has to be re-written after a warm-start. The routine may also be called from within a program by X=USR(X) after the USR vector is changed by:

```
POKE 11,42 : POKE 12,02
```

Also by changing the 10th Data statement to anything other than 32 (blank) will fill the screen with that particular character. It can be changed, at its present address, by Poke 555,N where N=value of character to be used.

The second program will print the value of any key or combination of keys pressed in decimal. This can be used to find the value of any key to be used for the program.

Address	Code	Mnemonic
0222	20 BA FF JSR FFBA	
0225	C9 7F CMP 7F	
0227	F0 00 BEQ (1)	
0229	60 RTS	
022A	A9 20 LDA 20	
022C	A2 00 LDX 00	
022E	9D 00 D3 STA D300,X	
0231	9D 00 D2 STA D200,X	
0234	9D 00 D1 STA D100,X	

(continued on next page)

(continued from previous page)

```
0237      9D 00 D0 STA D000,X
023A      CA      DEX
023B      D0 F1   BNE (-15)
023D      60      RTS
```

Here is the Basic loader for the program:

```
10000 DATA 32, 186, 255, 201, 127, 240, 1,
96, 169, 32, 162, 0, 157
10010 DATA 0, 211, 157, 0, 210, 157, 0, 209,
157, 0, 208, 202, 208, 241, 96
10020 FOR M=546 TO 573: READ D: POKE
M,D: NEXT M: POKE 536,34: POKE 537,15:
NEW
5 REM KEY VALUE FINDER
10 DATA 32, 186, 255, 133, 225, 96
20 FOR X=546 TO 551: READ D: POKE X,D:
NEXT
30 POKE 11,34: POKE 12,2: X=USR: PRINT
PEEK (225): GOTO 30
```

Storing strings

THE LETTER from Roger Cuthbert, 6502 Special, January 1981, is a detailed exposition of the UK101 FRE(X) hang-up problem and of the methods used for storing strings on the UK101, writes Ian King of Greenford, Middlesex.

However, for uncomplicated programs there is a simple remedy. The clue is given in Cuthbert's list of zero-page locations, particularly \$0081/2 (129/130) which holds the pointer to start of string space.

If we take the program example given:

```
10 DIM CB$(3)
20 INPUT CB$(1), CB$(2), CB$(3)
30 GOTO 20
```

This will eventually hang up when sufficient strings have been entered to invoke the garbage collection routine. By adding:

```
15 SH=PEEK(130):SL=PEEK(129)
25 POKE130,SH:POKE129,SL
```

garbage collection is prevented as line 15 notes contents of \$0081/2 prior to inputting CB\$(1) for the first time and line 25 restores \$0081/2 to this value, allowing current strings CB\$(1-3) to overwrite previously entered strings.

Referencing of the strings is taken care of by the Basic string-handling routine and, of course, any computing on current strings, e.g., IF CB\$(2)="END" THEN ... must be carried out between lines 20 and 25.

Page-mode facility

IN PUBLISHED programs for the Acorn Atom, I have yet to see any reference to or use of the page-mode facility, writes G. Blakemore of Loughborough, Leicestershire. For instance, it can be used to List a long program, a page or full screen, at any time by pressing Control-N, Return — which produces an error 94 message — Return, List, Return.

Pressing any key scrolls up another page of the listing until the cursor returns. Control-O, Return with same error message turns the page mode off.

During a program, page mode is set by Print \$14 and turned off by Print \$15. This enables a listing — numbers or words of any length — to be viewed a page at a time. This prevents the awful situation of

data scrolling faster than you can read it. Also it simplifies programming.

The Inkey facility can be achieved by a single line of Basic programming and does not require the use of the assembler: X=#81;?X=#20;X?1=#71;X?2=#FE;X?3=#84;X?4=#80;X?5=#60

Use this subroutine by Link #81 and the key is found by Peeking at memory location #80; i.e. K=?#80.

Access the graphics

AS THE owner of an Atom computer but also having used the Apple, Pet, Nascom, etc., I was disappointed to find that there was no way to access the Atom grey-and-white graphics blocks from the keyboard as on the Pet, writes R J Fernandez of Montrose, Angus.

However, I overcame this by writing a routine which partially replaces the operating system-write character routine. This is implemented by the user at the beginning of a programming session by running the following program.

Written in standard Atom assembler/Basic, it assembles the m-code from #288E onwards above the floating-point variables. The piece of memory is safe as far as I know, but the routine can be changed easily and assembled in some other area.

The routine provides an extra shift-lock, such that CTRL-A sets the keyboard to produce graphics blocks and CTRL-@ resets it to normal mode. Once implemented, the routines are useful — especially with Printing graphics blocks, as the extra shift can be used as liberally as normal shift.

Once Run the program can be Newed. Take note of the number printed after the routine as this is the address of the code which re-implements the routine after using the Break key. For example, if the number printed was 28AO, then Link#28AO will restore the routine after Break.

I have found it to be extremely useful for printing neat patterned borders when formatting the screen for games or accounts programs.

```
10 DIM LL4: REM ASM LABELS
15 LL3 = 0
20 F.I = 1 TO 2: P = #288E; ? #28FF = LL3
25 GOS.M: N.
30 L.I.LL2: P.& LL2
40 E
100m REM M-CODE
105 [ GR SHIFT ROUTINE
110 CMP@0; BEQ LL2; CMP@#YF; BEQ
LL1; CMP@#21; BC.LL1 CHECK FOR
CTRL CODES, ETC.
115 ADC@#80 SHIFT TO GRAPHICS
BLOCKS
120: LL1 JSR#FE52; RTS PRINT CHAR
130: LL2 LDA @ #28 ; STA #209 ;
LDA #28FF; STA #208; LDA@0; RTS
135: LL3 CMP@1; BEQ LL4; JSR#FE52;
RTS
140: LL4 LDA@ #28 ; STA #209 ; LDA@
#8E STA#208; LDA@0; RTS
150 ]
160R
```

The space inserted between mnemonics and comments in assembler is as in standard Atom format.

Stopping scrolls

ALAN SAUL'S Scroll stopper in the July edition works only on the UK101; here are the modifications so that Cegmon-based Superboard owners may use the utility, writes Fergus Boyd of Ballykelly, County Derry. Re-locate to \$0235, i.e., line 10 becomes:

```
10 FOR I = 565 TO 588
and the 105 in line 60 becomes 155.
```

In addition, here is a way for Superboard owners to re-claim some of the free RAM for use in Basic program. Immediately after cold-starting, type:

```
WITH CEGMON; POKE565,0:POKE
121,54:POKE122,2:NEW
?FRE(X)
WITHOUT CEGMON; POKE546,0:POKE
121,35:POKE122,2:NEW
?FRE(X)
```

You should find you have an extra 200-220 bytes. This works because the beginning of Basic workspace is stored in 79,7A Hex. The modifications are untouched by subsequent warm-starts.

Block display

THE FOLLOWING program will run on Acorn system one computers connected to the Acorn teletext VDU interface, writes Nicholas Cooper of Norwich, Norfolk. It allows the user to display a 200-byte block of memory on the screen and sits conveniently out of harms way in the two RAM I/O chips.

The program is in two blocks and may be entered via the Hex keypad. It is executed from OE80 where the user enters the four-digit Hexadecimal address of the beginning of the memory block that is to be displayed, and presses a command key.

```
Block 1:
0980: A2 1A 20 A0 FE D0 03 4C
0988: AA 0E A5 20 29 07 F0 03
0990: 4C E4 0E A0 0B A2 21 20
0998: A0 FE 88 D0 F8 4C C5 0E
09A0: 85 24 29 0F AA BD BC 09
09A8: A0 01 91 27 88 A5 24 4A
09B0: 4A 4A 4A AA BD BC 09 EA
09B8: EA 91 27 60 30 31 32 33
09C0: 34 35 36 37 38 39 41 42
09C8: 43 44 45 46 A2 21 20 A0
09D0: FE 60 3F 28 33 05 1E 02
09D8: 19 1B 00 09 20 09 04 00
09E0: 04 00 20 88 FE A5 20 29
09E8: F8 85 20 60 00 00 00 00
Block 2:
OE80: A0 00 A9 20 99 00 04 99
OE88: 00 05 99 00 06 99 00 07
OE90: C8 D0 F1 A0 0F 8C 00 08
OE98: B9 D2 09 8D 01 08 88 10
OEA0: F4 A9 00 A2 08 95 0F CA
OEA8: D0 FB A2 20 20 E2 09 DB
OEB0: A5 20 18 69 C8 85 22 A5
OEB8: 21 69 00 85 23 A9 00 85
OECO: 27 A9 04 85 28 A5 21 20
OEG8: A0 09 20 CC 09 20 CC 09
OEDO: A5 20 20 A0 09 20 CC 09
OED8: 20 CC 09 A9 3A A0 00 91
OEE0: 27 20 CC 09 A9 20 A0 00
OEE8: 91 27 20 CC 09 A0 00 B1
OEF0: 20 20 A0 09 20 CC 09 20
OEF8: CC 09 4C 80 09 00 00 00
```




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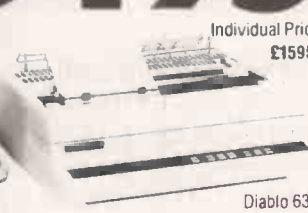
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Irritating scrolls

ONE OF the many irritating things which I find when programming the Pet is the screen scrolling, writes Cliff Stanford of Impetus Computer Systems of London NW4. When one is listing programs, it can be very irritating when the part of the program in which you are interested scrolls off the top of the screen just as you are trying to read it.

I felt that there had to be a better way. I decided, therefore, that it would be preferable if I could list my program to the screen, one page at a time. On the other hand, sometimes it is convenient to scroll a few lines to arrive at the precise page required. I produced, as an aid to development, a single-page listing routine.

This routine works only on the 8032 computer as it uses the facility of having the output routine jump through a RAM vector. The routine works by checking to see whether the Pet is about to print a character on the bottom line. If it is and that character is a carriage return, the routine waits for a key to be pressed.

There are then three possibilities:

- If the cursor-down key is pressed, one further line is listed.
- If the stop key is pressed, the cursor is returned to the home position and the listing is terminated so that amendments to the program may be made.
- If any other key is pressed, the next page is listed.

The routine sits in the first cassette buffer. I have produced both the source listing and the absolute Hex code for those people without an assembler. The routine is completely re-locatable except that the second and fourth bytes should contain the low and high address, respectively, of the 10th byte of the routine.

The routine as produced is initialised by typing Sys 634. If this is done near the bottom of the screen, the Pet will appear to hang up — but pressing the stop key will return you to Basic.

Wordsearch game

THIS program, is the game of Wordsearch for which the rules are very simple, writes Ian Ogdan of Heywood, Lancashire — see next page.

A grid is produced in the top left-hand corner of the screen which is 15 squares wide by 15 squares high. Each square contains a letter and somewhere among them are the 10 words which have to be found in less than four and a half minutes.

These words may be written horizontally, either left to right or right to left; vertically, top to bottom or bottom to top, or diagonally in any direction. When all 10 have been found, the time to find them is given as well as the best time so far.

If the 10 words are not found in time, the program shows you where they are and tells you that you took too long. A few notes of explanation follow which

(continued on next page)

```

LINE# LOC CODE LINE
0001 0000
0002 0000
0003 0000
0004 0000
0005 0000
0006 0000
0007 0000
0008 0000
0009 0000
0010 0000
0011 0000
0012 0000 DOWN = $11
0013 0000 HOME = $13
0014 0000 CUDOWN = $11
0015 0000 CLEAR = $93
0016 0000 RETURN = $0D
0017 0000 STOP = $03
0018 0000 MARGIN = $D5
0019 0000 BOTTOM = $E1
0020 0000 OUTVEC = $EB
0021 0000 CULINE = $D8
0022 0000 CUCHAR = $D9
0023 0000 CURSOR = $C6
0024 0000 READY = $B406
0025 0000 OUTPUT = $E202
0026 0000 OUTCNT = $E20C
0027 0000 GETBYT = $FFE4
0028 0000
0029 0000
0030 0000 * = $027A
0031 027A
0032 027A
0033 027A A9 83 INIT LDA #<PAGE
0034 027C 85 EB STA OUTVEC
0035 027E A9 02 LDA #>PAGE
0036 0280 85 EC STA OUTVEC+1
0037 0282 60 RTS
0038 0283 A5 D9 PAGE LDA CUCHAR
0039 0285 F0 18 BEQ CONT
0040 0287 29 7F AND #$7F
0041 0289 C9 13 CMP #HOME
0042 028B F0 12 BEQ CONT
0043 028D A5 D9 LDA CULINE
0044 028F C5 E1 CMP BOTTOM
0045 0291 D0 0C BNE CONT
0046 0293 A5 D9 LDA CUCHAR
0047 0295 C9 00 CMP #RETURN
0048 0297 F0 09 BEQ WAIT
0049 0299 A5 C6 LDA CURSOR
0050 029B C5 D5 CMP MARGIN
0051 029D F0 03 BEQ WAIT
0052 029F 4C 0C E2 CONT JMP OUTCNT
0053 02A2 20 E4 FF WAIT JSR GETBYT
0054 02A5 F0 FB BEQ WAIT
0055 02A7 C9 03 CMP #STOP
0056 02A9 F0 0A BEQ BREAK
0057 02AB C9 11 CMP #CUDOWN
0058 02AD F0 F0 BEQ CONT
0059 02AF A9 93 LOA #CLEAR
0060 02B1 85 D9 STA CUCHAR
0061 02B3 D0 EA BNE CONT
0062 02B5
0063 02B5
0064 02B5 A9 13 BREAK LDA #HOME
0065 02B7 20 02 E2 JSR OUTPUT
0066 02BA 68 PLA
0067 02BB 68 PLA
0068 02BC 68 PLA
0069 02BD 4C 06 B4 JMP READY
0070 02C0 .END
    
```

Single Page Listing

```

*****
**
**SINGLE PAGE LISTING ROUTINE.
**
** V1.2
**
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*****
;CURSOR DOWN
;CURSOR HOME
;CURSOR DOWN
;CLEAR SCREEN
;CARRIAGE RETURN
;RUN/STOP KEY
;RIGHT-HAND MARGIN
;BOTTOM OF WINDOW
;OUTPUT VECTOR
;LINE FOR CURSOR
;OUTPUT CHARACTER
;POSITION OF CURSOR
;WARM START BASIC
;OUTPUT A BYTE - START
;OUTPUT - CONTINUATION
;GET ONE BYTE
;
;
;FIRST CASSETTE BUFFER
;
;
;INITIALISE - POINT
;VECTOR TO OUR ROUTINE
;
;
;LOOK AT CHARACTER WE ARE
;ABOUT TO PRINT
;RESET TOP BIT
;HOME OR CLEAR?
;MIGHT BE OURS SO LET IT THROUGH!
;
;ARE WE ON THE BOTTOM LINE?
;NO - CARRY ON
;
;ARE WE PRINTING A CARRIAGE RETURN?
;OK THIS IS IT!
;OR ARE WE ABOUT TO PRINT INTO
;THE LAST SCREEN POSITION?
;YES! WELL DON'T
;WHERE OUTVEC NORMALLY POINTS
;KEY PRESSED?
;NO! - GO BACK
;STOP KEY?
;YES.
;CURSOR DOWN?
;YES - PRINT ANOTHER LINE
;ANYTHING ELSE
;PRINT CLEAR SCREEN INSTEAD
;CONTINUE ALWAYS
;
;
;OUTPUT A HOME CHARACTER
;THIS IS WHY WE TESTED - REMEMBER?
;POP THE ACCUMULATOR
;AND THE Y REGISTER
;AND THE X REGISTER
;WARM START - BUT DON'T PRINT "READY"
    
```

ERRORS = 0000

SYMBOL TABLE

SYMBOL	VALUE	SYMBOL	VALUE	SYMBOL	VALUE	SYMBOL	VALUE
BOTTOM	00E1	BREAK	02B5	CLEAR	0093	CONT	029F
CUCHAR	00D9	CUDOWN	0011	CULINE	00D8	CURSOR	00C6
DOWN	0011	GETBYT	FFE4	HOME	0013	INIT	027A
MARGIN	00D5	OUTCNT	E20C	OUTPUT	E202	OUTVEC	00EB
PAGE	0283	READY	B406	RETURN	00D0	STOP	0003
WAIT	02A2						

END OF ASSEMBLY

```

C*
PC IRO SR AC XR YR SP
.; B780 E455 2C 34 3A 9D FD
.;
.; 027A A9 83 85 EB A9 02 85 EC
.; 0282 60 A5 D9 F0 18 29 7F C9
.; 028A 13 F0 12 A5 D8 C5 E1 D0
.; 0292 0C A5 D9 C9 0D F0 09 A5
.; 029A C6 C5 D5 F0 03 4C 0C E2
.; 02A2 20 E4 FF F0 FB C9 03 F0
.; 02AA 0A C9 11 F0 F0 A9 93 85
.; 02B2 D9 D0 EA A9 13 20 02 E2
.; 02BA 68 68 68 4C 06 B4 20 2E
    
```

(continued from previous page)

may help readers who wish to adapt the ideas in the program to their own systems.

Lines 20-50 dimensions the matrix containing the word-search and fills with zeros. Lines 70-168 gives in the quotation marks three blank spaces followed by a number followed by three cursor left symbols four in line 160. The words to be found are selected by the player but the programme checks to ensure they are not too long.

The shorter the words chosen, the easier it is for the Pet to construct the grid but the reader is advised not to use words of less than four letters due to the possibility of duplication; also palindromic words should be avoided as it is necessary to know which end is the beginning.

In lines 170-310, the words have now been chosen and must be positioned in the initially blank grid. This section picks a starting point, A1, A2, and a direction, X, Y, and checks to ensure that each word does not destroy part of another — although it may run through it — and that it does not run outside the grid. If it does,

a new position is picked.

In lines 320-360: once a suitable position for a word is found, the word is positioned there and its position is recorded.

In lines 365-430: once the words are in position, the rest of the grid must be filled with letters, so a string is made which contains the 10 words one after the other and letters are chosen at random from this string to fill the rest of the grid so that the matrix is filled with the most frequent letters of the words being the most frequent in the grid.

Lines 357-375 give a countdown while the grid is being set up. The characters in quotations are the clear-screen symbol, 12 cursor-down symbols and 19 cursor-right symbols.

In lines 450-540 the grid is printed on the screen a line at a time and a list of the words to be found is printed beside it. The symbol in quotation marks in line 510 is the cursor home command.

The cursor down characters are followed by about 20 blank spaces, line 550, which delete the previous input. In lines

545-699, the time is set at zero and the game begins. So that the time taken may be checked continually, the loop from 554 to 556 is used. When a word is found, pressing any key will take you out of this loop. The method for indicating the location of a found word is best explained by example.

If the seventh word starts five lines down and in the eighth line across, the searcher would type 5,8,7 followed by return. The word is then indicated as found in two ways: The word in the grid will be printed in reverse-field characters; a greater-than symbol points to the word in the list.

If the same word is entered twice or the word does not start in the position entered, Pet tells you that you have failed and continues with the next game.

Lines 700-730 mean that when complete, your time and the best time are displayed. If the player runs out of time lines 800-870 show where the words are by changing them to reverse-field characters and when ready, the player starts the next game by pressing any key.

Wordsearch game

```

5 U=1E+25
10 PRINT"Q"
20 DIMA$(15,15)
30 FORI=1TO15
40 FORJ=1TO15
50 A$(I,J)="0":NEXT: NEXT
60 PRINT"ENTER YOUR TEN WORDS"
70 INPUT" 10000";B$(0)
80 INPUT" 20000";B$(1)
90 INPUT" 30000";B$(2)
100 INPUT" 40000";B$(3)
110 INPUT" 50000";B$(4)
120 INPUT" 60000";B$(5)
130 INPUT" 70000";B$(6)
140 INPUT" 80000";B$(7)
150 INPUT" 90000";B$(8)
160 INPUT" 100000";B$(9)
161 FORI=0TO9:IFLEN(B$(I))>10THEN164
162 NEXT
163 GOTO170
164 PRINTB$(I)" IS TOO LONG A WORD."I
165 PRINT"PLEASE CHOOSE ANOTHER"
166 INPUTB$(I)
167 IFLEN(B$(I))>10THEN164
168 GOTO162
170 FORI=0TO9
190 A1=INT(RND(1)*15+1)
200 A2=INT(RND(1)*15+1)
210 X=INT(RND(1)*3)-1
220 Y=INT(RND(1)*3)-1
225 IFX=0ANDY=0THEN210
230 IFA1+X*(LEN(B$(I))-1)>15THEN210
240 IFA2+Y*(LEN(B$(I))-1)>15THEN210
250 IFA2+Y*(LEN(B$(I))-1)<0THEN210
260 IFA1+X*(LEN(B$(I))-1)<0THEN210
270 FORJ=0TOLEN(B$(I))-1
280 IFA$(J*X+A1,J*Y+A2)=MID$(B$(I),J+1,1)THEN310
290 IFA$(J*X+A1,J*Y+A2)="0"THEN310
300 GOTO190
310 NEXT
320 FORJ=0TOLEN(B$(I))-1
330 A$(J*X+A1,J*Y+A2)=MID$(B$(I),J+1,1)
340 NEXT
350 C(I)=X: D(I)=Y: E(I)=A1: F(I)=A2
355 PRINT"QAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA"24-I
360 NEXT
365 FORI=0TO9
366 C#=C#+B$(I):NEXT
367 L=LEN(C#)
370 FORI=1TO15
375 PRINT"QAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA"16-I
380 FORJ=1TO15
390 IFA$(I,J)=""0"THEN420
400 R=INT(RND(1)*L+1)
410 A$(I,J)=MID$(C#,R,1)
420 NEXT
430 NEXT
440 PRINT"Q"
450 FORI=1TO15
460 FORJ=1TO15
470 I#=D#+A$(I,J):NEXT
480 PRINTD#
490 I#=""
500 NEXT
510 PRINT"Q"
520 FORI=0TO9
530 PRINT"AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA" I " "B$(I)
540 NEXT
545 TIME#="000000"
550 PRINT"AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA"
552 PRINT"AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA"
554 IFTI>270*60THEN800
555 GETB#:#
556 IFB#="" THEN554
570 INPUTG1,G2,G3
575 IFTI>270*60THEN800
580 IFG1<E(G3)THEN680
590 IFG2<F(G3)THEN680
600 IFH(G3)=1THEN680
601 POKE32768+40*G3+18+40,62
610 H(G3)=1:M=M+1
620 FORI=0TOLEN(B$(G3))-1
630 K=32768-41+40*G1+G2+I*D(G3)+I*40*C(G3)+40
640 IFPEEK(K)<30THENPOKEK,PEEK(K)+128
650 NEXT
660 IFM=10THEN700
670 GOTO550
680 PRINT"QYOU HAVE FAILED"
690 C#=""
695 FORI=0TO9:H(I)=0:NEXT:M=0
699 FORI=0TO2000:NEXT:GOTO30
700 T=TI/60
705 PRINT"QYOU HAVE COMPLETED THIS WORD SEARCH"
706 PRINT"IN "INT(T)" SECONDS"
710 IFINT(T)<UTHENU=INT(T)
720 PRINT"QTHE BEST TIME SO FAR IS "U" SECS"
730 GOTO690
800 PRINT"QAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAYOU HAVE TAKEN TOO LONG"
810 PRINT"QTHE WORDS ARE POSITIONED THUS"
820 FORG3=0TO9
830 FORI=0TOLEN(B$(G3))-1
840 K=32768-41+40*E(G3)+F(G3)+I*D(G3)+I*40*C(G3)+40
850 IFPEEK(K)<30THENPOKEK,PEEK(K)+128
860 NEXT:NEXT
861 PRINT"TO CONTINUE HIT A KEY"
862 GETB#:#
863 IFB#="" THEN862
864 PRINT"Q"
870 GOTO690

```


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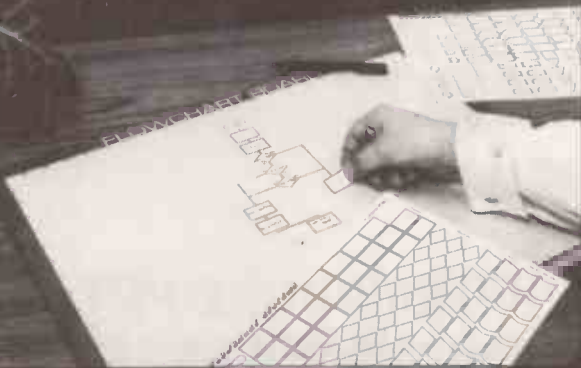
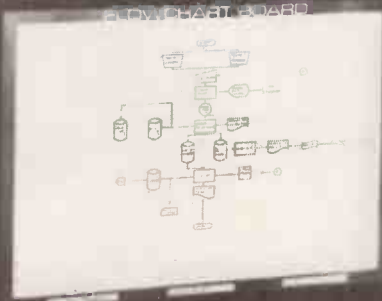
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Soft aid

THIS PROGRAM is designed to run on a 48K Apple with ROM Applesoft, writes Ian Pawson of Leicester. When BRun, the program sets up the "&" vector, and re-sets Himem below itself and then returns to Basic. Now, at any time the "&" command is used from Basic, the screen will clear and the following information will be shown in both Hex and Decimal. The current setting of Lomem and Himem, the length of the program and the amount of free memory. The program then returns to Basic.

The assembler used is the Apple DOS 3.3 Toolkit. As it uses the space character for tabulation, the ASC information is spaced out where spaces do not exist. This can be seen from the code generated. If you re-set Himem by mistake, the program can be re-run with Call 37888. This will re-set the vectors and return to Basic.

Append and Hex-Data

THESE PROGRAMS are designed to be of most use to those with an Apple or ITT and who do not possess a disc drive or printer, writes G R Buckeridge of Yate, Bristol — see next page.

The purpose of Append, listing 1, is self-explanatory. It joins two, floating-point Basic, programs together to make one. To use it, load a low line number program in the normal way, type Call 777. Next, load a high line number program, and type Call 888.

It is no coincidence that some kind of Append program is indispensable if you want to run Hex-Data, listing 2. During the development stage of any Basic program which calls machine-code sub-routines, you will probably save these as separate programs on two tapes. When both are debugged it is sometimes a good idea to have Basic Poke the machine-code routines into memory at run time.

This involves converting all the Hex values, between certain memory locations, into decimal, and re-entering those numbers in the form of data statements. A single line of Basic will do the conversions for you.

FOR X = ST TO EN : PRINT PEEK (X) : NEXT

Where ST and EN are the start and end addresses.

Hex-Data eliminates the need to write anything down as it makes full use of Apple/ITT's ability to copy from-screen to input buffer, simply by running the cursor over displayed characters.

To use it, load your machine-code program first, then append Hex-Data to your Basic program and type Run 60000. You will be asked the start and end addresses in Hex, the line number at which you want data statements to start and the line increment.

The screen will then display one line of Basic subroutine, five lines of data statements and an immediate-mode com-

(continued on next page)

```

9400:      2 *****
9400:      3 *   APPLE BASIC AID   *
9400:      4 *                               *
9400:      5 * I. PAWSON JUNE 1981 *
9400:      6 *                               *
9400:      7 *****
9400:A9 9D      9 BC800 LDA £)BD000 ;SET '&' FOR BASIC ENTRY
9402:8D F6 03  10 STA $03F6
9405:A9 94      11 LDA £(BD000
9407:8D F7 03  12 STA $03F7
940A:A9 00      13 LDA £)BC800 ;SET HIMEM
940C:85 73      14 STA $73
940E:A9 94      15 LDA £(BC800
9410:85 74      16 STA $74
9412:60         17 RTS
9413:4C ED FD  18 BC861 JMP $FDED ;OUTPUT VIA VECTOR
9416:      19 * CONVERT HEX TO 2 ASCII DIGITS
9416:48         20 BC0AC PHA ;SAVE 'A'
9417:4A         21 LSR A ;MOVE UPPER NIBBLE
9418:4A         22 LSR A ;TO LOWER NIBBLE
9419:4A         23 LSR A
941A:4A         24 LSR A
941B:20 1F 94  25 JSR BCAB5
941E:68         26 PLA ;RECOVER 'A'
941F:29 OF      27 BCAB5 AND £$0F ;MASK OFF UPPER NIBBLE
9421:07 B0      28 ORA £$B0 ;CONVERT TO ASCII DIGIT
9423:C9 BA      29 CMP £$BA ;IS IT A LETTER ?
9425:90 02      30 BCC BCABF
9427:69 06      31 ADC £$06 ;IF SO, ADD 6
9429:4C 13 94  32 BCABF JMP BC861 ;AND PRINT
942C:A9 8A      33 BC805 LDA £$8A ;DO CR/LF SUBROUTINE
942E:20 13 94  34 JSR BC861
9431:A9 8D      35 LDA £$8D ;'CR'
9433:4C 13 94  36 JMP BC861
9436:A9 A0      37 BCC51 LDA £$A0 ;OUTPUT SPACE SUBROUTINE
9438:4C 13 94  38 JMP BC861
943B:20 36 94  39 BCFDB JSR BCC51 ;OUTPUT SPACE
943E:A9 AD      40 LDA £$AD ;'-'
9440:20 13 94  41 JSR BC861 ;PRINT IT
9443:20 36 94  42 JSR BCC51 ;OUTPUT SPACE
9446:A0 00      43 LDY £$00 ;SET FOR FIRST SUBTRACTION
9448:A2 00      44 BCFDC LDX £$00 ;SET DIGIT TO ZERO
944A:A5 06      45 BCFDF LDA $06 ;GET LSB
944C:38         46 SEC
944D:F9 8D 94  47 SBC BCFEF,Y ;DO SUBTRACTION
9450:85 06      48 STA $06
9452:A5 07      49 LDA $07 ;GET MSB
9454:C8         50 INY
9455:F9 8D 94  51 SBC BCFEF,Y ;DO SUBTRACTION
9458:90 07      52 BCC BCFE5 ;IF CARRY SET DO AGAIN
945A:85 07      53 STA $07
945C:E8         54 INX
945D:88         55 DEY
945E:4C 4A 94  56 JMP BCFDF
9461:88         57 BCFE5 DEY ;BACK TO ONE
9462:A5 06      58 LDA $06
9464:79 8D 94  59 ADC BCFEF,Y ;DO SUBTRACTION
9467:85 06      60 STA $06
9469:8A         61 TXA ;PUT NUMBER OF LOOPS IN 'A'
946A:09 B0      62 ORA £$B0 ;CONVERT TO ASCII
946C:20 13 94  63 JSR BC861 ;AND PRINT
946F:C8         64 INY
9470:C8         65 INY
9471:C0 08      66 CPY £$08 ;DONE ALL ?
9473:90 D3      67 BCC BCFDC
9475:A5 06      68 LDA $06
9477:09 B0      69 ORA £$B0 ;CONVERT TO ASCII
9479:20 13 94  70 JSR BC861 ;AND PRINT
947C:20 36 94  71 JSR BCC51
947F:A0 00      72 LDY £$00
9481:B9 95 94  73 BCFE7 LDA BCFE4,Y ;OUTPUT 'DECIMAL'
9484:F0 06      74 BEQ BCFE8
9486:20 13 94  75 JSR BC861
9489:C8         76 INY
948A:D0 F5      77 BNE BCFE7
948C:60         78 BCFE8 RTS
948D:10 27      79 BCFEF DW $2710 ;'10,000'
948F:E8 03      80 DW $03E8 ;'1,000'
9491:64 00      81 DW $0064 ;'100'
9493:0A 00      82 DW $000A ;'10'
9495:C4 C5 C3  83 BCFE4 ASC 'DECIMAL'
9498:C9 CD C1
949B:CC
949C:00         84 DFB $00
949D:      85 * ENTRY POINT
949D:20 58 FC  86 BD000 JSR $FC58 ;CLEAR TEXT SCREEN
94A0:20 2C 94  87 JSR BC805 ;DO CR/LF
94A3:A0 00      88 LDY £$00
94A5:B9 32 95  89 BD005 LDA BD03A,Y ;OUTPUT HEADING

```

(continued on next page)

(continued from previous page)

mand. The prompt will precede the first line. So, using cursor right and Rept, copy that line and hit Return at the end.

The prompt will now be at the beginning of the second line, so repeat that

process until you reach the command Goto 60250. If you copy that, the next five lines of data statements will be displayed.

Continue until the end address has been reached, when the last line displayed

will read Del 59999,60250. Copying this will cause Hex-Data to be deleted, leaving you only with your program

It remains only to insert a Gosub to the memory-Poke routine at a convenient point in your main program.

Listing 1.

APPEND

```

0309 - A9 04 LDA # $04 ; Call 777 from Basic
030B - 8D 27 03 STA $327
030E - 20 23 03 JSR $323
0311 - A0 00 LDY # $00
0313 - B1 67 LDA ($67),Y
0315 - C9 00 CMP # $00
0317 - F0 03 BEQ $31C
0319 - CE 27 03 DEC $327
031C - CE 27 03 DEC $327
031F - 20 23 03 JSR $323
0322 - 60 RTS
0323 - 38 SEC
0324 - A5 69 LDA $69
0326 - E9 04 SBC # $04
0328 - 85 67 STA $67
032A - A5 6A LDA $6A
032C - E9 00 SBC # $00
032E - 85 68 STA $68
0330 - 60 RTS

0378 - A9 01 LDA # $01 ; Call 888 from Basic
037A - 85 67 STA $67
037C - A9 08 LDA # $08
037E - 85 68 STA $68
0380 - 4C F2 D4 JMP $D4F2
    
```

Listing 2.

HEX - DATA

```

59999 END : REM SAFETY PRECAUTION
60000 HOME : VTAB 3 : PRINT TAB (15) "HEX-DATA" : A(0) = 1
        : A(1) = 16 : A(2) = 256 : A(3) = 4096 : GOTO 60070
60009 REM HEX TO DEX CONVERSION
60010 S = 0 : L = LEN (A$) : IF L < 1 OR > 4 THEN 60050
60020 FOR X = L TO 1 STEP -1 : T = ASC ( MID$ ( A$,X,1 ) )
60030 IF T > 47 AND T < 58 THEN T = T - 48 : GOTO 60060
60040 IF T > 64 AND T < 71 THEN T = T - 55 : GOTO 60060
60050 X = 5 : RETURN
60060 S = S + ( T * A ( L - X ) ) : NEXT X : RETURN
60069 REM QUESTION TIME
60070 VTAB 7 : CALL - 868 : INPUT "START ADDRESS (HEX) " ;
        A$ : GOSUB 60010 : IF X = 5 THEN 60070
60080 ST = S
60090 VTAB 9 : CALL - 868 : INPUT "END ADDRESS (HEX) " ;
        A$ : GOSUB 60010 : IF X = 5 THEN 60090
60100 EN = S : IF EN =< ST THEN 60090
60110 VTAB 11 : CALL - 868 : INPUT "START LINE NUMBER " ; N
        : IF N < 0 OR N > 50000 THEN 60110
60120 VTAB 13 : CALL - 868 : INPUT "INCREMENT " ; I : IF I
        < 0 OR I > 255 THEN 60120
60129 REM DISPLAY FIRST LINE
60130 HOME : VTAB 2 : PRINT " " ; N ; " FOR X = " ; ST ;
        " TO " ; EN ; " READ D : POKE X , D : NEXT X : RETURN"
        : PRINT : N = N + 1
60139 REM DISPLAY FIVE DATA STATEMENTS
60140 FOR X = ST TO ST + 40 STEP 10
60150 PRINT " " ; N ; " DATA " ;
60160 FOR Y = X TO X + 8
60169 REM END ADDRESS REACHED
60170 IF Y = EN THEN PRINT PEEK ( Y ) : PRINT : PRINT " DEL
        59999,60250" : VTAB 1 : END
60180 PRINT PEEK ( Y ) ; " " ;
60190 NEXT Y : IF X + 9 = EN THEN 60170
60200 PRINT PEEK ( X + 9 ) : PRINT
60210 N = N + 1
60220 NEXT X
60230 ST = ST + 50
60239 REM SAVE VARIABLES
60240 PRINT " GOTO 60250" : POKE 0 , INT ( ST / 256 ) :
        POKE 1 , ST - ( INT ( ST / 256 ) * 256 ) : POKE 2 ,
        INT ( EN / 256 ) : POKE 3 , EN - ( INT ( EN / 256 ) *
        256 ) : POKE 4 , INT ( N / 256 ) : POKE 5 , N - ( INT
        ( N / 256 ) * 256 ) : POKE 6 , I : VTAB 1 : END
60249 REM RESTORE VARIABLES
60250 HOME : VTAB 2 : ST = PEEK ( 0 ) * 256 + PEEK ( 1 ) :
        EN = PEEK ( 2 ) * 256 + PEEK ( 3 ) : N = PEEK ( 4 )
        * 256 + PEEK ( 5 ) : I = PEEK ( 6 ) : GOTO 60140
    
```

Both "APPEND" and "HEX - DATA"

Are Original Programs

Written on an iTT 2020 by G.R.Buckeridge

(continued from previous page)

```

94EE: E5 68 121 SBC #68
94F0: 85 07 122 STA #07
94F2: A0 00 123 LDY #000
94F4: B9 4E 95 124 BDO20 LDA BDO3E,Y ;OUTPUT HEADING
94F7: F0 06 125 BEQ BDO25
94F9: 20 13 94 126 JSR BC861
94FC: C8 127 INY
94FD: D0 F5 128 BNE BDO20
94FF: 20 22 95 129 BDO25 JSR BDO35
9502: 38 130 SEC
9503: A5 73 131 LDA #73 ;CALCULATE BYTES FREE
9505: E5 AF 132 SBC #AF
9507: 85 06 133 STA #06
9507: A5 74 134 LDA #74
950B: E5 80 135 SBC #80
950D: 85 07 136 STA #07
950F: A0 00 137 LDY #000
9511: B7 62 95 138 BDO3A LDA BDO10,Y ;OUTPUT HEADING
9514: F0 06 139 BEQ BDO30
9516: 20 13 94 140 JSR BC861
9519: C8 141 INY
951A: D0 F5 142 BNE BDO2A
951C: 20 22 95 143 BDO30 JSR BDO35
951F: 4C D0 03 144 JMP #03D0 ;EXIT TO BASIC WARM START
9522: A5 07 145 BDO35 LDA #07 ;HI BYTE
9524: 20 16 94 146 JSR BCAC ;CONVERT TO ASCII & PRINT
9527: A5 06 147 LDA #06 ;LO BYTE
9529: 20 16 94 148 JSR BCAC ;CONVERT TO ASCII & PRINT
952C: 20 3E 94 149 JSR BCFDB ;CONVERT TO DECIMAL
952F: 4C 2C 74 150 JMP BC805 ;DO CR/LF
9532: CC CF CD 151 BDO3A ASC 'LOMEM IS AT #'
9535: C5 D0 A0 152 DFB #00
9538: C9 D3 A0 153 BDO3C ASC 'HIMEM IS AT #'
953B: C1 D4 A0 154 DFB #00
953E: A4 155 BDO3E ASC 'PROGRAM LENGTH IS #'
9540: C8 C9 CD 152 DFB #00
9543: C5 D0 A0 153 BDO3C ASC 'HIMEM IS AT #'
9546: C9 D3 A0 154 DFB #00
9549: C1 D4 A0 155 BDO3E ASC 'PROGRAM LENGTH IS #'
954C: A4 156 DFB #00
954E: D0 D2 CF 155 BDO3E ASC 'PROGRAM LENGTH IS #'
9551: C7 D2 C1 156 DFB #00
9554: CD A0 CC 157 BDO40 ASC 'FREE MEMORY IS #'
    
```

Apple Basic Aid

```

9557: C5 CE C7 156 DFB #00
955A: D4 CB A0 157 BDO40 ASC 'FREE MEMORY IS #'
955D: C9 03 A0 158 DFB #00
9560: A4 159 **** END OF PROGRAM ***
9561: 00 156 DFB #00
9562: C6 D2 C5 157 BDO40 ASC 'FREE MEMORY IS #'
9565: C5 A0 CD 158 DFB #00
9568: C5 CD CF 159 **** END OF PROGRAM ***
956B: D2 09 A0 156 DFB #00
956E: C9 D3 A0 157 BDO40 ASC 'FREE MEMORY IS #'
9571: A4 158 DFB #00
9572: 00 159 **** END OF PROGRAM ***
9573: 159 **** END OF PROGRAM ***
*** SUCCESSFUL ASSEMBLY: NO ERRORS
94A3: F0 06 70 BEQ BDO0A
94AA: 20 13 94 91 JSR BC861
94AD: C8 92 INY
94AE: D0 F5 93 BNE BDO05
94B0: A5 68 74 BDO0A LDA #68 ;LOMEM HI
94B2: 85 07 95 STA #07 ;MSB FOR CONVERSION
94B4: 20 16 94 76 JSR BCAC ;CONVERT TO ASCII & PRINT
94B7: A5 67 97 LDA #67 ;LOMEM LO
94B9: 85 06 98 STA #06 ;LSB FOR CONVERSION
94BB: 20 16 94 99 JSR BCAC ;CONVERT TO ASCII & PRINT
94BE: 20 3B 94 100 JSR BCFDB ;CONVERT TO DECIMAL
94C1: 20 2C 94 101 JSR BC805 ;DO CR/LF
94C4: A0 00 102 LDY #000
94C6: B9 40 95 103 BDO10 LDA BDO3E,Y ;OUTPUT HEADING
94C9: F0 06 104 BEQ BDO15
94CB: 20 13 94 105 JSR BC861
94CE: C8 106 INY
94CF: D0 F5 107 BNE BDO10
94D1: A5 74 108 BDO15 LDA #74 ;HIMEM HI
94D3: 85 07 109 STA #07 ;MSB
94D5: 20 16 94 110 JSR BCAC ;CONVERT TO ASCII & PRINT
94D8: A5 73 111 LDA #73 ;HIMEM LO
94DA: 85 06 112 STA #06 ;LSB
94DC: 20 16 94 113 JSR BCAC ;CONVERT TO ASCII & PRINT
94DF: 20 3B 94 114 JSR BCFDB ;OUTPUT SPACE
94E2: 20 2C 94 115 JSR BC805 ;DO CR/LF
94E5: 38 116 SEC ;CALCULATE PROGRAM LENGTH
94E6: A5 AF 117 LDA #AF
94E8: E5 67 118 SBC #67
94EA: 85 06 119 STA #06
94EC: A5 B0 120 LDA #B0
    
```


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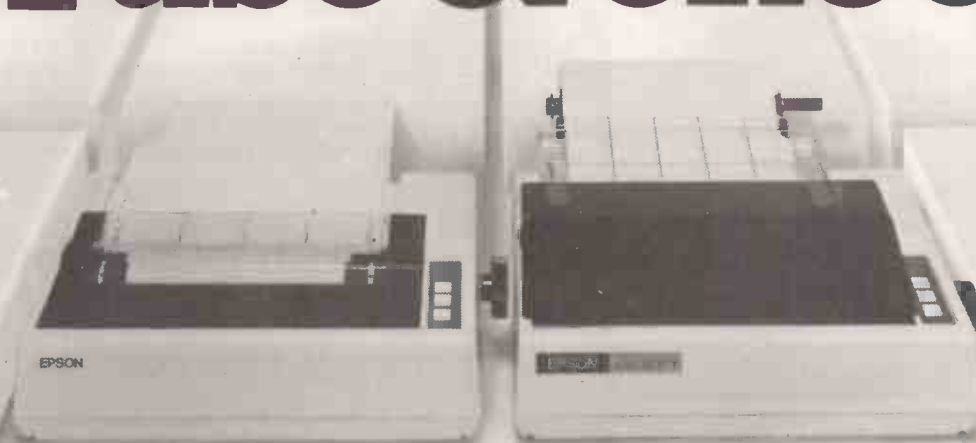
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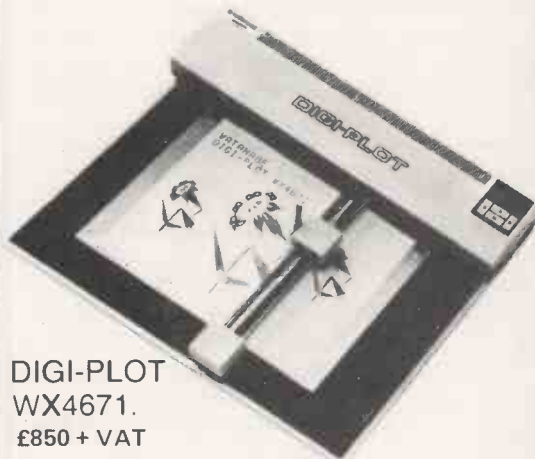
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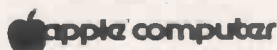


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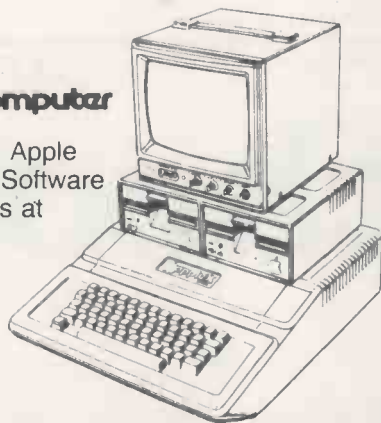
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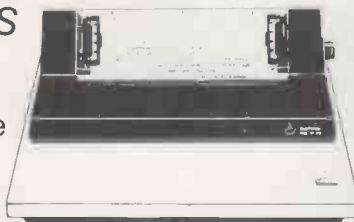


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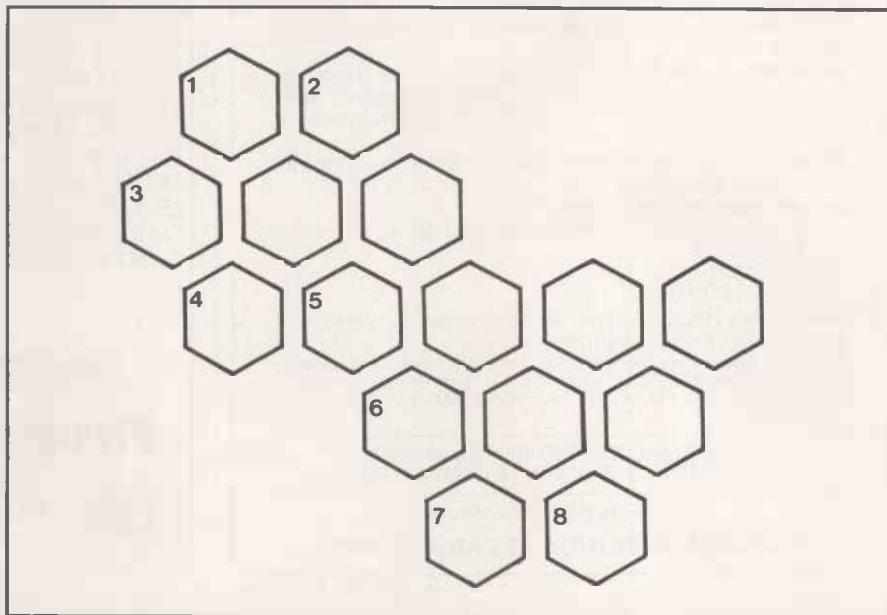
ANSWERS to this TriBal Twister are written in the grid much as in a crossword . . . except that they are all numbers, and are written Up (↗), Across (→) or Down (↘).

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Now that you've jotted down the answers, you'll note that 6U is the mean of the children's ages, that 6A is the sum of the ages, and that the amount left to the youngest is the exact square root of the total! 

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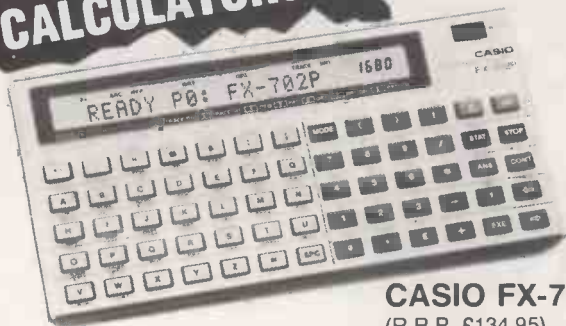
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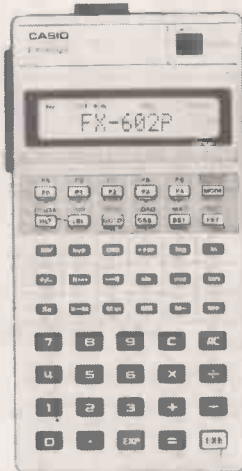
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Amazing show

THE SECOND U.K. Micromouse contest held at Wembley was very encouraging for those of us who have been involved with this contest since its inception nearly three years ago.

The reason for this encouragement was twofold, firstly the excellent quality of some of the entries and secondly because it saw the first serious contender from a company or academic institution.

The corporate sponsored entry which was also the winner with an outstanding shortest maze traversal time of just 47 seconds, and came from GKN Technology in Wolverhampton; it shows that at

by Nick Hampshire

least one British company is taking robotics seriously.

Two other 'mice' succeeded in successfully traversing the maze; both were private entries and their designers are to be commended for the ingenuity shown in their design. There were a total of nine entries for the maze running competition, and besides the three successful 'mice' several of the entries looked like promising candidates for future competitions.

The aim of the competition is for the entrant to design and build a small mobile robot — a micromouse — capable of traversing a maze; the maze used in this year's competition is shown below. Constructing such a robot is no easy task and calls for skills in mechanical engineering, electronics and computing.

The robot must be independent of all external computing devices this means that it must have its own internal computer and power supplies, and be small enough to travel in the seven inch maze passages. The maximum time allowed for the robot to traverse the maze is 15 minutes, if it succeeds within that time

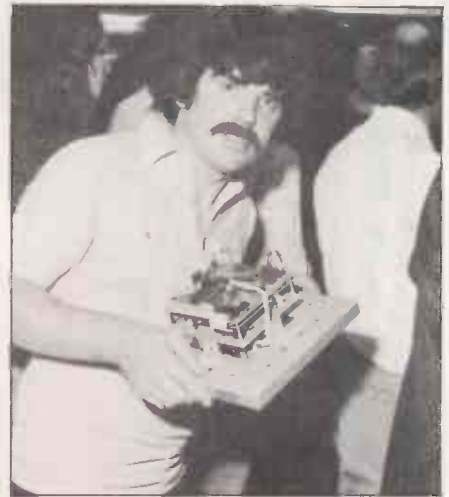
limit it may try again and the shortest traversal time will be taken.

The winning 'mouse' was Thumper which was entered by a group of three people from GKN Technology; its handler at the competition was Dave Woodfield. They won the first prize of a Sharp MZ80K computer donated by Newbear Computing Store. It succeeded in traversing the maze four times in the 15 minutes allowed, with each traversal having a faster time as the 'mouse' learnt the maze and found the shortest route. The four times were: 2 mins 24 secs; 2 mins 21 secs; 49 secs; 47 secs.

Thumper was designed around an 8085 processor, the positioning and sensory system used photocells to sense the top of a maze wall — the success of this technique relied on heavy screening from ambient light. A single drive motor was used for locomotion via an ingenious system of pulleys, a second motor was used to drive a retractable turntable foot which was used to rotate the device. A unique and endearing feature of Thumper was the inclusion of a speech synthesiser which gave the robot a voice output. This was imaginatively used to provide diagnostics and as a psychological warfare device to intimidate other entrants. The speech synthesiser used was a Votrax single chip phoneme synthesiser.

The runner up was Stirling Mouse from Nick Smith who is well known to readers of *Practical Computing* from his regular micromouse column. Stirling Mouse traversed the maze three times during the 15 minutes allowed. The times were: 2 mins 51 secs; 1 min 39 secs; 1 min 37 secs. Stirling Mouse was the winner of last year's competition and has since then undergone little change.

The third place went to an entry from Alan Dibley called Thezius. It succeeded



Dave Woodfield and Thumper.

in traversing the maze twice in the 15 minutes allowed, the traversal times were: 4 mins 53 secs; 2 mins 27 secs.

This was a very ingenious entry which used a Sinclair ZX80 as the on-board computer, the major part of the software was written in Basic. Steering was done with a simple mechanical system and sensory whiskers with associated microswitches were used to detect entrances in the maze walls. Locomotion was provided by three model aircraft servomotors each driven by a simple serial line with pulse length controlling the servo position.

One of the three servos provided the forward locomotion via a single drive wheel, a second servo operated a retractable turntable foot while the third servo rotated that foot to turn the robot. This design used the minimum amount of electronics external to the computer and relied on simple mechanical systems to replace time consuming computer software. This entry would have done much better if it had not been for battery problems which slowed it down. □



This year's Micromouse contest at Wembley attracted a wide range of high-standard entries.



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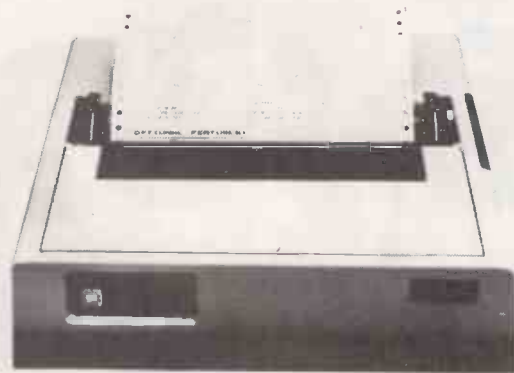
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PRACTICAL COMPUTING October 1981

Programming in Fortran, Structured Programming with Fortran IV and Fortran 77

By Vladimir Zwass. Published by Harper and Row as a Barnes and Noble Outline. 223 pages of 100 percent re-cycled paper, paper-bound. £3.95. ISBN 0 06 460194 3.

"OF MAKING many books there is no end". There needs to be a very good reason to add to the existing multitude of Fortran programming texts. Dr Zwass's aim appears to be multiple avoidance. This book is designed as an introductory textbook for direct classroom use, for individual study, as a review book and as a reference manual.

It is based on Fortran 77 but allows the programmer to use Fortran IV systems by identifying the new features of Fortran 77. Reference is also made to Watfor and Watfiv.

The difficulty with the many-targeted approach is that the design aims are contradictory. To take one example, because this is an introductory text, we have a selective table of intrinsic functions — not the complete table to be expected in a reference manual.

Thus Tan, which does not form part of the old 1966 standard, is included, but not Atan nor any of the Double-Precision or Complex functions.

Similarly, the use of the Intrinsic statement is encouraged without any indication that it is an extension to the 1966 standard and may not be available to the user without access to Fortran 77.

This book is nearest to meeting its objectives as a text to accompany a lecture course. The individual reader with no previous experience of programming will find parts of it heavy going.

Before he is introduced to Fortran, he is expected to master both flowcharts and a formal Algol-like pseudocode, as well as having been given a quick tour of such concepts as binary representation, secondary storage, assembly languages and loaders. This occupies the first two chapters.

The remaining seven are a steady plod through the major Fortran language features.

Points of good programming practice appear in boxes throughout the text. These are generally sound.

Although I must admit to having learnt from the author's exact treatment of named Common blocks, it is disappointing to see the novice encouraged in the prevalent heresy that Stop always falls immediately before the End of a main program.

Conclusions

- This book cannot be recommended. Books aimed more specifically just as introductions to programming using Fortran 77 are now becoming available.

- Most compilers seem to be adhering closely to the standard language and experienced programmers will probably be able to convert to Fortran 77 without difficulty by using their manufacturer's language manual.

- For the professional programmer or lecturer who requires an exact language specification for Fortran 77, the ANSI X3.9-1978 Standard Programming Language Fortran is readable, if somewhat expensive, and may be ordered through the British Standards Institution.

- For an introductory text to 1966 standard Fortran, try one of the established classics, such as J S Rohl's *Programming in Fortran*, Manchester University Press. This has the advantage of reproducing the complete, though indigestible, text of the 1966 standard as an appendix.

C J Higley

Pascal programming

By Laurence V Atkinson. John Wiley & Sons, Chichester, England. Hardcover £16.50, paperback £6.95.

THE popularity of Pascal has resulted in the publication of a number of text books during the past two years. Like many others, *Pascal Programming* is intended as an introductory text for those with no previous experience of programming as well as a description of the more advanced features of the language for the experienced programmers.

The book is divided into four parts. Part one deals with the fundamental concepts of Pascal: data types, conditional

flow, Boolean variables, loop, procedures and functions, and program construction.

There are plenty of examples throughout and at the end of each chapter, a number of exercises are given. The hints for the solution to some of them appear in a short appendix.

Structured programming techniques and practices are well advertised throughout the book. There are, however, instances where the particular programming technique of the author may seem somewhat odd. For example, the use of case statement where there is only one condition for testing — rather than the traditional If-Then statements.

Readers, particularly novices, are also very likely to lose track of the book in the chapter on procedures and functions. The description of parameter-passing mechanism between procedures and functions is not very clear. Perhaps it needs more, and simpler, examples.

Also, the recursion and backtracking could do with better explanation and ideally would be a separate chapter towards the end of the book. This section is concluded with a chapter on how to construct programs using top-down design and testing through the two case studies.

Part two presents two features characteristic of Pascal and those languages derived from it: the symbolic and subrange types.

Examples of the previous section are reconstructed again with the aid of the symbolic and subrange types. The advantages gained in terms of transparency and security of programs are pointed out. This part ends with a rather interesting case study.

The third part deals with the data structure facilities of Pascal: sets, records, files, arrays and pointers. The author states that these structures are presented in the order of increasing complexity. I do not believe that the ordering is correct or logical: the progression from arrays to records and files is more sensible than *vice versa*.

Finally the Goto statement is the subject of the last part of the book which is concluded with a set of appendices. The

relegation of Goto to the end of the book is presumably because most computer scientists are against its use altogether. I feel that a passing mention in the chapter on loops would have served the purpose.

Conclusions

- I think as a text for beginners, *Pascal Programming* is a good introduction to the language even though parts of it lack clarity.

- As a more advanced introduction, whether the book will be very successful is doubtful: better books on Pascal are available to the public.

Ali Tabatabai

Introduction to 8080/8085 assembly-language programming

By Judi N Fernandez and Ruth Ashley. Published by John Wiley. U.S. price \$8.95; U.K. price £5.95. 300 pages paperback. ISBN 0 471 08009 8.

A PALPABLE hit — this is a really outstanding work. Subtitled *A self-teaching guide*, it really is. There are two main problems with assembly-language books. The first is that of dialect; the second is that authors either understand the material so well that they cannot comprehend incomprehension, or they do not understand it, so they cannot explain it.

The authors of this book have not surmounted the dialect problem. On the other hand, they have brilliantly smashed down the communications barrier.

Their approach is superbly structured, charmingly gentle, carefully developed — and entirely successful. The material is reduced to small chunks — a page or so — with self-assessment questions, long and short, at the end of each. The 12 chapters have good introductions and summaries, and far more self-assessment questions. There are four useful appendices.

If you need to learn 8080 or 8085 assembly coding, this book cannot be beaten. If you do not, it will still teach you.

Conclusions

- A very well-structured self-teaching guide to assembly work.

- Very highly recommended.

Eric Deeson

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In this, the first two articles, Wynford and Jane James present three programs, Wallball, Substrike and Mastermind which have been written to demonstrate software portability and which tackle its problems.

Portability carried out in practice

FEW published programs can be used immediately — unless, it seems, one owns a Pet. Owners of less popular micros often find that only non-graphics programs can be used without major changes.

For example, the numeric version of Mastermind shown here should run on any micro with only a few line changes. Lines 610 and 540 are keyboard control Pokes, and line 390 Peeks the keyboard. The algorithm used by the computer to reject obviously wrong guesses is from the Mastermind article in *Practical Computing*, November 1978.

However, running the program reveals all the limitations associated with using the VDU purely for Print statements: previous guesses disappear from the top of the screen as the game progresses. Unless the page can be scrolled backwards, one is eventually forced to resort to pencil and paper to keep track of the game.

Using Peek and Poke to transfer responses to the screen seems the obvious answer — but then the program is limited to a particular variety of micro — or is it?

Substrike Symbols

- LB — Back of submarine travelling from left of VDU
- LF — Front of submarine travelling from left of VDU
- RF — Front of submarine from right of VDU
- RB — Back of submarine from right of VDU
- ES — Explosion symbol
- TS — Torpedo symbol
- MS — My symbol — torpedo launcher

The two problems associated with the transfer of programs from one micro to another are that

- Memory locations for the screen display differ.
- Graphics symbols vary from machine to machine.

Provided care is taken, both these problems can be circumvented. In the remaining programs in this article, all of which involve graphics, the following approach is used:

All memory locations are defined in

Substrike Amendments

TL, TR, BL and BR in line 30 are top-left, top-right, bottom-left, bottom-right of VDU respectively. LL is line length. Change these as necessary. Line 40: substitute your own graphic symbols using the list given. If you don't have any symbols appropriate to create a submarine-like image, a line could serve: in that case set LB, LF, RF and RB to the same value. Lines 20, 160, 180, 240, and 430 are keyboard Peeks and Pokes. If you want a longer play each time, amend line 220 — T is the time count. Line 110 sets the submarine velocity — higher multiples of RND(1) will give slower submarines. SV is minimally 2, SC, the submarine move count ensures that the submarine moves only when SV = SC — the player can move the torpedo launch at least twice as fast as the submarine with the present line 110.

terms of a few stated in lines at the start of the program. Changes are thus minimised when the program is run on a different micro.

The graphics symbols used are all assigned variable names at the beginning of the program. The reader must insert his own values on these lines, using graphics symbols of his own which appear appropriate.

Other lines which must be changed are those relating to keyboard controls. The graphics symbols used in the program are those of the Ohio Scientific Superboard II — those for the UK101 are identical. In the interests of program portability, we have avoided using some of the game symbols available.

Early in each program some or all of the following are defined — TL, TR, BL, BR and LL. The first four are the crucial memory locations — top-left, top-right, bottom-left and bottom-right of the VDU respectively. LL is the line length for your particular micro.

Instructions for playing each game are given in the program listing. Note that RND(X) chooses a random number between 0 and 1. In numeric Mastermind, the player must guess a number chosen by

(continued on next page)

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the computer before his own number is guessed. Line 390 gives the player the opportunity to interrupt if he finds himself waiting too long for the computer guess. Do not cheat in your responses — there are checks to detect this.

The player must try to avoid hitting his own or the computer's trail in Wallball. Skill level can be varied. Finally, in Sub-strike the player must fire torpedoes at submarines of various speeds which appear from either side of the VDU at random.

```

1 REM SUBSTRIKE
10 FORX=0TO25:PRINT:NEXT:GOSUB500
20 K=57088:POKE530,1:POKEK,251
30 TL=53350:TR=53372:BL=54054:BR=54076:LL=32
40 LB=7:LF=8:RF=5:RB=6:ES=188:TS=139:MS=4
50 T=0:S=0:BF=0:BE=0:MP=BL+INT((BR-BL)/2)
55 POKEMP,MS
60 DL=INT((BL-TL)/LL):MN=MP
70 RN=LL*(INT(RND(1)*.8*DL)+1)
80 SP=TL+RN:S1=LB:S2=LF:SM=1:SF=TR+RN
90 IFRND(1)>.5THEN110
100 SP=TR+RN:S1=RB:S2=RF:SM=-1:SF=TL+RN
    
```




```

110 SV=INT(RND(1)*3+2):SC=0
120 SC=SC+1:IFSC=SVTHENSC=0:GOTO140
130 GOTO160
140 SN=SP+SM:IFSN=SFTHENPOKESP,32:POKESP+SM,32:GOTO70
150 POKESP,32:POKESP+SM,32:SP=SN:POKESP,S1:POKESP+SM,S2
160 IFPEEK(K)<>191THEN180
170 MN=MP-1
180 IFPEEK(K)<>223THEN200
190 MN=MP+1
200 IFMN=MPORMN<BLORMN>BRTHEN220
210 POKEMP,32:MP=MN:POKEMP,MS
220 T=T+1:IFT=400THEN400
230 IFTF=1THEN260
240 IFPEEK(K)<>239THEN120
250 TP=MP-LL:TF=1
260 IFPEEK(TP)<>32THEN300
270 POKETP,TS:FORX=0TO50:NEXTX
280 TN=TP-LL
290 IFPEEK(TN)=32ANDTN>TRTHEN350
300 POKETP,32:POKETN-1,ES:POKETN,ES:POKETN+1,ES
310 FORX=0TO10:NEXTX
320 POKETN-1,32:POKETN,32:POKETN+1,32
325 TF=0:IFTN<=TRTHEN120
330 NS=INT(S/10)+5-NV:S=S+NS
340 GOTO70
350 POKETP,32:TP=TN:GOTO120
400 PRINT"YOUR SCORE WAS ";S
410 PRINT"ANOTHER GAME";:INPUTA$
420 IFLEFT$(A$,1)="Y"THENFORX=0TO25:PRINT:NEXTX:GOTO20
430 POKE530,0:END
500 PRINT"SUBSTRIKE"
510 PRINT"TRY TO DESTROY AS MANY SUBS AS YOU CAN IN"
520 PRINT"THE TIME LIMIT. C MOVES TORPEDO LAUNCH LEFT"
530 PRINT"V MOVES IT RIGHT, B FIRES TORPEDO. YOU CAN"
540 PRINT"ONLY FIRE A NEW TORPEDO WHEN THE PREVIOUS"
550 PRINT"ONE HAS EXPLODED. THE FASTER SUBS COUNT MORE"
560 PRINT"TOWARDS YOUR SCORE."
565 FORX=0TO10000:NEXT
570 FORX=0TO25:PRINT:NEXT:RETURN

1 REM WALLBALL
5 GOSUB1000:FORX=0TO25:PRINT:NEXT
20 K=57088:POKE530,1:POKEK,251
30 MS=187:CS=42:WS=161:ES=188
40 TL=53350:TR=53372:LL=32
50 TD=TR-TL:BL=TL+TD*LL:SD=BL-TL
60 X1=INT(TD/3):Y1=INT(SD/2)
70 IFY1-(LL*INT(Y1/LL))<>0THENY1=Y1-INT(LL/2)
80 C(1)=1:C(2)=LL:C(3)=-1:C(4)=-LL
90 A=INT(RND(1)*4+1):CD=C(A):SC=BL+X1+(LL*2)
100 A=INT(RND(1)*4+1):MD=C(A):SM=BL+2*(X1+LL)
110 CP=TL+X1+Y1:MP=TR-X1+Y1
120 T=INT(TD*SD/LL)
130 FORA=TLTOTR:POKEA,WS:POKEA+SD,WS:NEXT
140 FORA=TLTOBLSTEPLL:POKEA,WS:POKEA+TD,WS:NEXT
150 POKECP,CS:POKEMP,MS
200 IFPEEK(CP+CD)>32ANDRND(1)<SLTHEN220
210 IFRND(1)<CHTHEN270
220 FORA=1TO4
230 IFPEEK(CP+C(A))<>32THEN250
    
```

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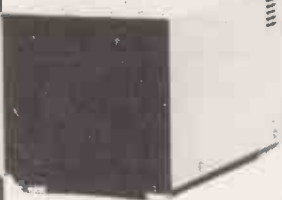


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240 CD=C(A):GOTO270
250 NEXT
270 IFPEEK(CP+CD)=32THEN280
275 MC=MC+1:EP=CP:SP=SM:S$=STR$(MC):GOTO360
280 CP=CP+CD:POKECP,CS
290 IFPEEK(K)=127THENMD=-1
300 IFPEEK(K)=191THENMD=1
310 IFPEEK(K)=251THENMD=-LL
320 IFPEEK(K)=253THENMD=LL
330 IFPEEK(MP+MD)=32THEN340
335 CC=CC+1:EP=MP:SP=SC:S$=STR$(CC):GOTO360
340 MP=MP+MD:POKEMP,MS
350 FORX=0TOT:NEXT:T=T-5:GOTO200
360 POKEEP,ES:FORX=0TO1000:NEXT
370 FORY=2TOLEN(S$):POKESP+Y,ASC(MID$(S$,Y,1)):NEXT
380 IFCC=NGTHENPRINT:PRINT"I WIN.":GOTO440
390 IFMC=NGTHENPRINT:PRINT"YOU WIN.":GOTO440
400 A=TL+LL+1
410 FORX=ATOATD-2:POKEX,32:NEXT
420 A=A+LL:IFA<BLTHEN410
430 GOTO90
440 POKE530,0:END
1000 FORX=0TO25:PRINT:NEXT
1010 PRINT"IN WALLBALL BOTH YOU AND THE COMPUTER"
1020 PRINT"LEAVE A TRACK AS YOU MOVE. THE FIRST"
1030 PRINT"TO HIT A TRACK OR WALL LOSES."
1040 PRINT"X MOVES LEFT, C RIGHT, M UP, COMMA DOWN."
1050 PRINT"ENTER NUMBER OF GAMES TO WIN";:INPUTNG
1060 PRINT"YOUR SKILL LEVEL(0 TO 1)";:INPUTSL
1070 PRINT"CHANCE MOVEMENT (0 TO 1) - THE LOWER"
1080 PRINT"THIS IS SET THE MORE OFTEN THE"
1090 PRINT"COMPUTER CHANGES DIRECTION";:INPUTCH
1100 PRINT"NOTE THAT CHANCE MOVEMENT IS"
1110 PRINT"MUCH LESS FOR SKILFUL PLAYERS."
1120 FORX=0TO5000:NEXT:RETURN

1 REM-MASTERMIND-NUMERIC VERSION
5 FORX=1TO25:PRINT:NEXT:GOTO600
20 Z(GD)=Z(GD)+1:IFZ(GD)<=0THENPC=PC+1
30 Z(TD)=Z(TD)-1:IFZ(TD)>=0THENPC=PC+1
40 RETURN
50 G(1)=INT(YG/1000):YG=YG-(G(1)*1000)
60 G(2)=INT(YG/100):YG=YG-(G(2)*100)
70 G(3)=INT(YG/10):G(4)=YG-(G(3)*10)
80 IFG(1)>LDORG(2)>LDORG(3)>LDORG(4)>LDTHENDL=1
90 RETURN
100 CC=0:PC=0:FORI=0TOLD:Z(I)=0:NEXT
110 PRINT"YOUR GUESS - A 4 DIGIT NUMBER";:INPUTYG
120 IFYG>LNORYG<0THEN110
130 GOSUB50:IFDL=1THENDL=0:PRINT"DIGIT TOO LARGE":
GOTO110
140 FORI=1TO4
150 IFG(I)=E(I)THENCC=CC+1:GOTO170
160 GD=G(I):TD=E(I):GOSUB20
170 NEXT
180 IFCC<4THEN210
190 PRINT"YOU'VE GUESSED IT!"
200 PRINT"WHAT WAS YOUR NUMBER";:INPUTYN:YG=YN:GOSUB50
205 FORA=1TO4:E(A+4)=G(A):NEXT:GOTO320
210 PRINT"DIGITS COMPLETELY CORRECT - ";CC

```




```

220 PRINT"DIGITS PARTIALLY CORRECT - ";PC
230 PRINT" MY GUESS ";E(5);E(6);E(7);E(8)
240 PRINT"NUMBER COMPLETELY CORRECT";:INPUTCC
245 IFCC>4ORCC<OTHEN240
250 PRINT"NUMBER PARTIALLY CORRECT";:INPUTPC
255 IFPC>4ORPC<OTHEN250
260 IFCC=4THENPRINT"I WIN. I HAD ";E(1);E(2);E(3);E(4)
265 IFCC=4THEN520
270 FORA=1TO4:C(N,A)=E(A+4):NEXT
275 R(N)=CC:P(N)=PC
280 E(8)=E(8)+1:IFE(8)>LDTHENE(7)=E(7)+1:E(8)=0
290 IFE(7)>LDTHENE(6)=E(6)+1:E(7)=0
300 IFE(6)>LDTHENE(5)=E(5)+1:E(6)=0
310 IFE(5)>LDTHENE(5)=0:E(6)=0:E(7)=0:E(8)=0
315 NC=NC+1:IFNC>NTTHENPRINT"CHEAT!":GOTO200
320 FORH=0TON:CC=0:PC=0:FORI=0TOLD
330 Z(I)=0:NEXTI
340 FORJ=5TO8
350 IFE(J)=C(H,J-4)THENCC=CC+1:GOTO370
360 GD=E(J):TD=C(H,J-4):GOSUB20
370 NEXTJ
380 IFCC=R(H)ANDPC=P(H)THEN420
390 IFPEEK(K)=247THEN100
400 IFYN>0THEN440
410 GOTO280
420 NEXTH
430 IFYN=0THEN510
440 IFH=N+1THEN520
450 PRINT"CHEAT! YOU FORFEIT THE GAME."
460 PRINT"YOU SAID ";C(H,1);C(H,2);C(H,3);C(H,4)
465 PRINT" THE ANSWERS WERE:"
470 PRINT"HAD ";R(H);" COMPLETELY CORRECT"
480 PRINT"AND ";P(H);"PARTIALLY CORRECT."
490 PRINT"THIS IS NOT TRUE!":GOTO520
510 N=N+1:GOTO100
520 PRINT"ANOTHER GAME";:INPUTA$
530 IFLEFT$(A$,1)="Y"THENRUN600
540 POKE530,0:END
600 DIMC(8,4)
610 K=57088:POKE530,1:POKEK,251
620 PRINT"NUMBER MASTERMIND"
630 PRINT"YOU MUST GUESS A 4 DIGIT NUMBER"
640 PRINT"OF THE COMPUTER'S BEFORE YOUR"
650 PRINT"NUMBER IS GUESSED. YOU PICK THE"
660 PRINT"LARGEST DIGIT ALLOWED IN EACH"
670 PRINT"POSITION.EG IF YOU PICK 2 THE"
680 PRINT"NUMBERS WILL ONLY BE MIXTURES"
690 PRINT"OF 0,1, AND 2.WHAT IS YOUR"
700 PRINT"LARGEST DIGIT";:INPUTLD
710 IFLD>9THEN700
720 PRINT"PRESS N IF THE COMPUTER KEEPS"
730 PRINT"YOU WAITING TO MAKE YOUR GUESS"
740 FORI=1TO8:E(I)=INT(RND(1)*LD+1):NEXT
750 NT=(LD+1)^4
760 LN=LD*1111:DL=0:YN=0:N=0:GOTO100
    
```



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Software side of the interface equation

Despite a profusion of articles on printing from the parallel port, every treatment of this well-covered subject has neglected the software side of the interface. Now, Douglas Fyffe gives an account of the routines required to drive the printer, emphasising the need to write in machine code.

IN MANY ways the software required to drive a printer is likely to be the cause of most problems in this type of interfacing. Anyone capable of using a soldering iron to join two or more pins should be capable of making the necessary connections.

Before any driving software can be written, it is very important to check exactly what signals the printer is to expect, and in what form. In particular, it is vital to note any timing requirements which apply to the various signals. Driving routines written for one particular printer may fail to work for another because of differences in timing — even if the two machines have compatible input signals.

Having mentioned the importance of correct timing, it should be obvious that any driving software must be capable of speedy execution and so must be written in machine code. It would be possible to generate this code from a compiler, but since few people possess a Basic compiler, assembly language will be used.

Now let us look at an example. Consider that we were interested in interfacing a Trendcom 100 thermal printer to a Nascom machine. First, we need to look at the signals required by the printer — see figure 1. These are straightforward

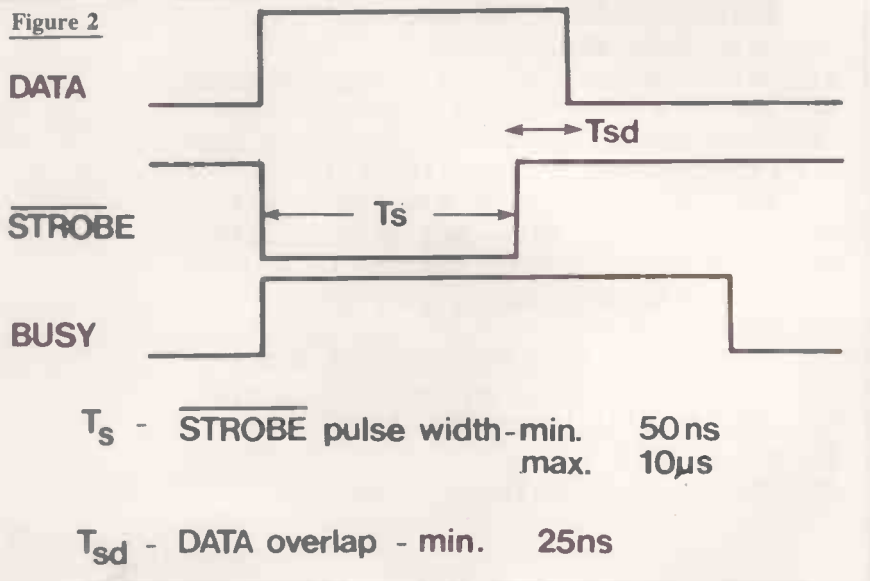
and consist mainly of the eight data bits together with a STROBE which indicates that valid data is available on the data lines, and an outgoing Busy signal which indicates that the printer is not yet ready to accept more data.

The Nascom has available two uncommitted parallel input/output sockets. Each has the eight data bits together with two handshaking signals, STROBE — an incoming signal indicating that the peripheral has received the data on the data lines — and Ready which shows that valid data is available on the data lines. The eight data lines can easily be supplied directly from the parallel port, as both sets are active high.

However, the STROBE required by the printer is active low, and as the parallel port Ready is active high, these signals are not compatible. This problem could be overcome by the use of an inverter between the port and the printer, but a simpler solution is available. As the printer and, except for control characters, the Nascom use standard ASCII codes, data bit 7 is not used. We can, therefore, conveniently use this data bit as a STROBE signal by setting and re-setting it as the data is output in bits 0 to 6.

The Nascom 1 programming manual

Figure 2





The Nascom has two uncommitted parallel input/output sockets.

lists a program to output data to a Centronics printer using this method. However, this routine will not drive the Trendcom due to the differences in timing requirements between the two printers.

Considering the timing requirements of the Trendcom, we find that the **STROBE** signal should last between 50ns and 10µs, and that the data itself must still be valid at least 25ns after the **STROBE** has gone high again — see figure 2. Armed with this information, we can begin designing our driving routine.

So that the printer accepts the data fed to it, we must ensure the timing of the **STROBE** signal is correct. After outlining our basic driving routine, we will need to check that the timing falls within the required limits. All we need to do to send data to the printer is:

- Set bit 7 of data byte
- Output data byte to a port
- Re-set bit 7 of data byte
- Output data byte again
- Set bit 7 of data byte
- Output data byte a third time.

In this way, data bits 0 to 6 are output normally while bit 7 is toggled from high to low and back again, at the same time to provide the **STROBE** signal.

Assuming that we are using Nascom port 4 to output the data held in register A, our routine becomes:

```
SET 7 A      ;8 T-states
OUT (4) A    ;11 T-states
RES 7 A      ;8 T-states
OUT (4) A    ;11 T-states
SET 7 A      ;8 T-states
OUT (4) A    ;11 T-states
```

The number of T-states — CPU clock cycles — taken for each of these instruc-

(continued on next page)

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(continued from previous page)

tions is also given. These timings are set out for each instruction in the back of the Z-80 technical manual. To check that the timing conforms to that required, we need to know how long it will take for data bit 7 to be set and the whole byte output for the third time.

That is the time taken for bit 7 to be pulsed low. It can be seen that this takes 19 T-states in all. As the Nascom 1 is normally run at 2MHz, each T-state occupies 0.5µs, and 19 T-states occupy 9.5µs.

Theoretically then, this routine ought to be just fast enough for the printer. In practice, this is not so and we need to make the output of the data byte for the third time occur sooner after the second output. The only way to do this would be to perform the three outputs in succession, using register B to store the data byte with bit 7 clear, and A to store it with bit 7 set.

However, the Z-80 does not have an OUT (n) B instruction to match the OUT (n) A. Instead we must set register C to the port number required and use the OUT (C) B instruction.

Our routine now becomes:

LD C 4; 7 T-states
LD B A; 4 T-states

SET 7 A; 8 T-states
OUT (4) A; 11 T-states
OUT (C) B; 16 T-states
OUT (4) A; 11 T-states

As OUT (C) B takes only 16 T-states, 8µs, this will be fast enough and it can output a single character to the printer. Before it can be used, it remains to initialise the PI/O to the required mode before outputting any data. We require mode O, for output, so we need to output the following control word to the control port associated with port 4, i.e., port 6:

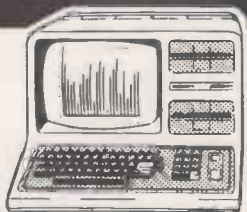
Bit	7	6	5	4	3	2	1	0
Value	0	0	X	X	1	1	1	1
Bits 7/6 indicate mode								
Bits 5/4 not used								
Bits 1 to 3 indicates set mode.								

So we output OFH to port 6 to initialise socket A to output mode.

If we wish to output more than one character to the printer, we must ensure that it is ready to receive more data before sending the next character. That is most easily done by connecting the printer Busy signal to data bit 7 of the second PI/O socket, and using this port — port 5 — as an input port.

If we then read this data before outputting a character, bit 7 set indicates that the

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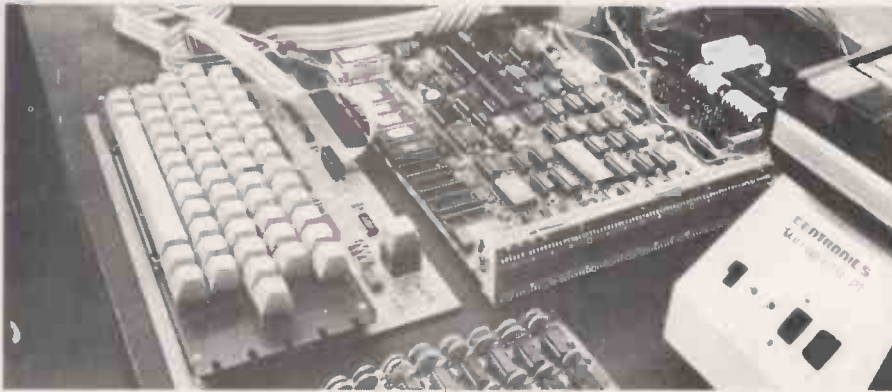
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printer is busy. The quickest way to test bit 7 is to use the Rotate Left Accumulator, RLA, through carry instruction. Again we must initialise port 5 as input by writing the control word 4FH to port 7.

Next, on initialisation we require the strobe signal to be high as the printer would continually output a Busy signal if strobe was low. This is assured by outputting 80H to the printer before reading the Busy line.

Now we have a routine which will output to the printer the contents of register A each time it is called. The last task we must perform is to convert the non-ASCII Nascom control codes to the correct ASCII values as they occur on entry to the routine. Figure 3 gives the assembler listing of our complete program.

We now have the program to drive the printer — but what exactly are we to print? We will surely want to output programs and data, but how can we arrange to use the printer from within the Basic interpreter, Zeap, or even the Nasbug monitor? In fact using the printer from within Zeap is simplicity itself as this facility has been specifically allowed for when designing Zeap.

Within the Zeap code, locations F22H and F23H contain the location of the output routine used by the TTY, Teletype-listing option. This is set initially to point to the Nasbug routine SRLOUT which outputs data to the UART. We must just change the contents of these

Figure 1. Printer and parallel port signals.

Pin Number	Printer signal	PI/O signal
1	Ground	Data bit 0
2	Busy	Data bit 1
3	n/c	Data bit 2
4	n/c	Data bit 3
5	Ground	Data bit 4
6	Ground	Data bit 5
7	Ground	Data bit 6
8	STROBE	Data bit 7
9	Ground	Ready
10	Data bit 0	STROBE
11	Data bit 1	n/c
12	Data bit 2	n/c
13	Data bit 3	n/c
14	Data bit 4	n/c
15	Data bit 5	n/c
16	Data bit 6	+5v
17	Data bit 7	n/c
18	+15v	n/c
19	Self test	n/c
20	Ground	n/c

bytes to point instead to our printer routine.

Using the printer from the monitor or from within Basic is not much more complicated. The Nasbug monitor uses location SCRT, C4BH, to store the location of the Nasbug routine to display the contents of register A on the screen: CRT @ 13BH.

We can change this pointer to point to our printer routine instead, but this would result in loss of VDU operation and thus no commands could be entered. Again, this is rectified by changing the Return at the end of our routine to a jump to the original CRT routine — that is, C9H becomes C3 3B 01 — so that data is sent to the printer before being written to the VDU. Another conversion is, however, required to change the ASCII control codes back to the non-ASCII Nascom values before jumping to CRT.

The same modification will allow printer use from within Basic as long as the CRT routine is used to service the VDU. However, a cold-start to Basic may result in the SCRT pointer being overwritten with the original CRT value.

Finally, if you are the lucky owner of Xtal Basic V2.2, you can make use of its facility to allow user-definable commands to write a new command to switch the printer on and off under program control. This new command or commands would change the SCRT pointer between the CRT routine and our own printer routine as required.

So, providing that we make sure that we know exactly what signals the printer expects to be provided with, it is a very straightforward business to write the required driving routine.

Signal name	PI/O pin and port	Printer pin
Ground	9A	9
Printer busy	7B	2
Printer STROBE	8A	8
Data bit 6	7A	16
Data bit 5	6A	15
Data bit 4	5A	14
Data bit 3	4A	13
Data bit 2	3A	12
Data bit 1	2A	11
Data bit 0	1A	10

Figure 4. Hardware connections.

(continued on next page)

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(continued from previous page)

Figure 3. Assembler listing.

	0100 ;	
	0110 ; printer drive	
	0120 ; routine for	
	0130 ; NASCOM 1 to	
	0140 ; TRENDCOM 100	
	0150 ;	
	0160 ; fully relocatable	
	0170 ;	
2A08 C5	0180 PRTCHR	PUSH BC
2A09 D5	0190	PUSH DE
2A0A E5	0200	PUSH HL
2A0B FE1D	0210	CP #1D
2A0D 2002	0220	JR NZ SC1
2A0F 3E08	0230	LD A 8
2A11 FE1E	0240 SC1	CP #1E
2A13 2002	0250	JR NZ SC2
2A15 3E0C	0260	LD A #C
2A17 FE1F	0270 SC2	CP #1F
2A19 2002	0280	JR NZ SC3
2A1B 3E0D	0290	LD A #D
2A1D F5	0300 SC3	PUSH AF
2A1E 3E0F	0310	LD A #F
2A20 D306	0320	OUT (6) A
2A22 3E4F	0330	LD A #4F
2A24 D307	0340	OUT (7) A
2A26 3E80	0350	LD A #80
2A28 D304	0360	OUT (4) A
2A2A DB05	0370 BUSY	IN A (5)
2A2C 17	0380	RLA
2A2D 38FB	0390	JR C BUSY
2A2F F1	0400 PRINT	POP AF
2A30 47	0410	LD B A
2A31 CBFF	0420	SET 7 A
2A33 0E04	0430	LD C 4
2A35 D304	0440	OUT (4) A
2A37 ED41	0450	OUT (C) B
2A39 D304	0460	OUT (4) A
2A3B CBBF	0470 CONCHR	RES 7 A
2A3D FE08	0480	CP 8
2A3F 2002	0490	JR NZ RSC1
2A41 3E1D	0500	LD A #1D
2A43 FE0C	0510 RSC1	CP #C
2A45 2002	0520	JR NZ RSC2
2A47 3E1E	0530	LD A #1E
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2A51 C1	0590	POP BC
2A52 C9	0600	RET



BUYERS' GUIDE

The Buyer's Guide to microcomputers is a summary of low-cost computers available in the U.K. It appears every third month; we add new computers and amend existing information, as required, to keep it up-to-date. Systems are listed by manufacturer.

Microcomputers

ACORN COMPUTERS

Systems 1,2,3: 6502-based, 1-8K RAM, COS or DOS, Hex or full keyboard, TV interface, Acorn bus. Personal or scientific use. Reviewed September 1979.

From £65 for System 1 kit; £285 for System 2 kit; £670 for System 3 kit

Atom: 6502, 2-12K RAM, up to 40K external memory, full keyboard, Basic in ROM, high-resolution graphics, cassette and TV interface, parallel port, I/O lines. Should eventually be able to link into a ring. Acorn Computers Ltd., 4a Market Hill, Cambridge CB2 3NJ (0223) 312772. Reviewed November 1980.

From £130

ALAN PEARMAN LTD

Maple: Z-80A, 16-64K RAM, S-100 bus, CP/M, 8in. discs, RS232 serial and parallel. Sold mainly as Micro-APL system. Alan Pearman Ltd., Maple House, Mortlake Crescent, Chester CH3 5UR. (0244) 46024.

From £2,450

ALPHA MICRO

AM-1010, AM-1051: WD-16, 64K-16MB RAM, S-100, four 8in. up to 90MB hard discs, RS232 up to 20 ports. Alpha Micro, 13 Brunswick Place, London N1 6ED. (01) 250 1616.

From £7,500

APPLE COMPUTERS

Apple II Plus: 6502, 16-48K RAM, 8K ROM, colour graphics, 5¼in. discs, general use. Own bus. Reviewed October 1979.

From £695

Apple III: 6502A with supporting chips, giving it a superset of 6502 instruction set. 96-128K RAM, colour graphics, integral 5¼in., RS232, four 50-pin expansion slots. Microsense, Finway House, Hemel Hempstead, Hertfordshire HP2 7PS. (0442) 48151.

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Attache: 8080, 64K RAM, S-100, parallel port, 8in. discs, business system. Friargrove Systems Ltd., 494 Great West Road, Hounslow, Middlesex. (01) 572 3784. *From £1,737 to £7,000*

BASF

System 7100: Z-80A, 64K RAM, RS232, 5¼in. discs, business systems. MPR, 4 Fitzroy Square, London W1. (01) 388 4200. *From £4,937*

BILLINGS

BMS: Z-80A, 64K RAM, 8in. 200MB hard discs, business system. Mitech Data Systems, 8 Guildford Road, Woking, Surrey. (04862) 23131. *From £4,295*

BL MICROELECTRONICS

Biproc: Z-80 or TMS9980 kit, 1K RAM, 2K monitor, RS232, cassette, TV. BLM, 1 Willow Way, Loudwater, High Wycombe, Buckinghamshire HP11 1JR. (0494) 443073. *From £150*

BLEASDALE COMPUTER SYSTEMS

UDS: 8080, Z-80, 6809, 32K-1MB, Multibus, CP/M, 5¼in., 8in., hard, RS232, four parallel ports, IEEE 488, development system. Bleasdale Computer Systems, Francis House, Francis Street, London SW1. (01) 828 6661. *P.O.A.*

BMG MICROSYSTEMS

BMG MS 5000 RANGE: 8085 or 8086, 64-768K RAM, CP/M, MP/M, BOS 8in. discs or Hard Disc — 40Mbytes, 20Mbytes of which are in an exchangeable cartridge. Up to 8 remote VDU's and printers. BMG Microsystems Ltd., Micro House, Hawksworth, Swindon, Wiltshire SN2 1DZ. (0793) 37813. *From £6,000*

BRUTECH ELECTRONICS

BEM: Single-board processor with 6502 and no RAM. Data Precision Equipment, 81 Goldsworth Road, Woking, Surrey GU21 1LJ. (04862) 67420. *From £133*

BYTRONIX MICROCOMPUTERS

Megamicro: 8080/Z-80, 64K RAM, 8in. discs, CP/M. Business and University use. Bytronix, 83 West Street, Farnham, Surrey GU9 7EN. (0252) 726814. *From £6,080*

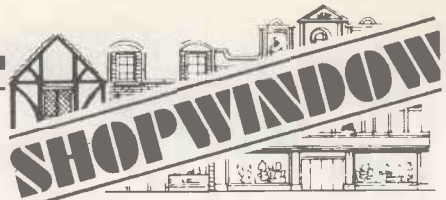
CANON BUSINESS MACHINES

Canon BX-1/BX-1d: 6800, 64K RAM, 5¼in. integral, RS232, V24 ports, business use. Canon Business Machines, Wadden House, Stafford Road, Croydon, Surrey. (01) 680 7700. *From £3,250*

COMMODORE BUSINESS MACHINES

Pet: 6502, 8-32K RAM, IEEE ports, integral 9in. screen, personal and general use. Reviewed August 1979. *From £460*

8000 Series — SuperPet: Upgrade of original Pet. 12in. screen, 5¼in. discs, business and general use. Reviewed October 1980. *From £895*



Kim-1: 6502, LED six-digit display, 1K RAM, cassette and Teletype interface, evaluation board for 6502 chip, Commodore Business Machines, 818 Leigh Road, Slough Industrial Estate, Slough, Berkshire. (75) 74111. Reviewed November 1978. *From £99.95*

COMPSHOP

UK101: 6502, 4-8K RAM, TV interface, RS232, full keyboard, single-board, personal use, similar to Ohio Superboard. Compshop, 14 Station Road, New Barnet, Hertfordshire EN5 1QW. (01) 441 2922. Reviewed May 1980. *From £199 for kit*

COMPUCOLOR

Compucolor II: Z-80, 8-32K RAM, 5¼in. integral discs, 13in. colour VDU, RS232. General use. Dyad Developments, The Priory, Great Milton, Oxfordshire OX9 7PB. (08446) 729. Reviewed June 1979. *From £998*

Copernicolor II: 8080A, 8-32K RAM, 5¼in., 8in. and Winchesters available, VDU, RS232 bus, standard ASCII keyboard with optional keyboards available, graphics 128 by 128, Basic, assembler, Fortran. Based on Compucolor II, wide range of software. General use. Copernicus Ltd., 7 Wey Hill, Haselmer, Surrey. (0428) 52888. *From £1,200*

COMPUCORP

655-675: Z-80, 60K RAM, own OS but will run CP/M with modifications, RS232, IEEE and others optional. 1-4 5¼in. discs, 16 by 80 VDU. Business use. Barnet House, 120 High Street, Edgware, Middlesex. (01) 952 7860. *From £2,595 to £4,750*

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Minikdt: Z-80, 16K RAM, serial and parallel, 5¼in., CP/M, S-100. *From £800*

Maxikdt: Z-80, 16K RAM, serial and parallel, 8in., CP/M, S-100. Computer Centre, 9 De la Beche Street, Swansea SA1 3EX. *From £911*

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Computermart 2000 range: Z-80A, single/multiple, 16-256K, CP/M, S-100 bus, graphics, 8in. single-density double-sided 180MB hard disc, general/business use. Computermart, 60 St. Faiths Lane, Norwich, Norfolk. Norwich 615089. *From £6,000*

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Act System 800: 6502, 48K RAM, full keyboard, graphics, 5¼ or 8in. discs, 12in. VDU integral. Business system. Act, 66-68 Hagley Road, Edgbaston, Birmingham B16 8PF. (021) 455 8686. Reviewed February 1980. *From £4,000*

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Systems 1000-8000: Z-80, 32-65K RAM, 6000 is S-100, 3000 single-board, CP/M, graphics, 5¼in. discs, three serial and parallel ports. Business, scientific and general use. Haywood Electronics Assoc., 11 Station Approach, Northwood, Middlesex. (01) 428 9831. *From £2,359*

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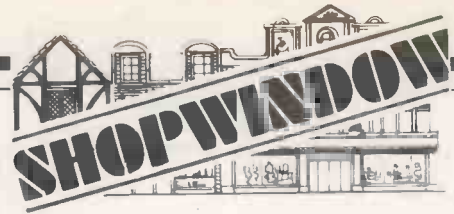
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APPLE II 48K, disk drive, manuals, word processing package, chess, invaders etc. £900. Decwriter IV 132 col. printer and serial interface card, £400 or complete system £1,200. Tel: Coleshill 62875 (STD 0675).

NASCOM 2, Car Chase. Excellent graphics game. Knock down the cones and avoid the crash car. Succeed, and next time it's harder. Send only £5.50p to, A. Culshaw, 219b Garstang Rd., Fulwood, Preston, Lancs.

ACORN ATOM, Quality high resolution graphic games (require 8K ROM + 12K RAM). Lunar Lander, £5 (rotating ship, thruster flames, numeric speed & fuel indicators, etc. etc.). Air Raid, £4 (bomb buildings, but beware crashing into skyscrapers!). Swarm, £5 (space battle with 'diving' aliens). Colour Games (12K ROM):— Tank Battle (2 players) £5.50, + versions of above @ 50p extra. Games are written in machine code for fast action. From T. Hall, 319 John Nash Crescent, Manchester M15 5DT. Send sae for further details & full price list.

PET-8K (£330) + manual & programs. Listing paper (3 x 600) sheets (£60). Tel: Colchester (0206) 45667 (after 7.30pm).

TELE-TYPE DATA DYNAMICS 390, contains printer, keyboard, paper tape punch and reader, suitable for RS232, £100. Bransgore (0425) 72123.

FOR SALE ZX80, £120 ono. 16K, 8K ROM. Sinclair built, both manuals. Sheffield 0742 489967.

UK 101-8K with new monitor, in custom made case, assembler, & super space invaders, including 10" metal cased monitor, £200 ono. Telephone: 0444 53737.

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SOUND DIRECT THROUGH TELEVISION. This assembled unit adapts MICROS and Games that have ASTEC or similar video modulator. Simple connections ONLY £10. Frank Woodcock, 32 Langley Close, Redditch, Worcs., B98 0ET.

3 ACORN ATOM programs on cassette: Tennis, Target, Rocket Attack. Need 2K text, 1K graphics, £4 for tape. Cheques payable to Paul Farr, send to: 45 Hamilton Street, Larkhall, Lanarkshire.

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HIGH QUALITY Computer Grade Tape Cassettes (C60), certified error free, £1.25 inc. p&p each in library box, 4 or more £1 each inc. p&p. S. L. J. Gilinsky, 15 Thornhill Park, Sunderland, SR2 7LA.

SWTP 6800 COMPUTER, 40K, twin mini-disks, Elbit VDU with Centronics 779 printer, £2,950 or with Diablo Hytype II £3,500. (0255) 820878.

SOLID STATE TECHNOLOGY

Athena: 8085, integral dual mini-floppies and mini-cassette, and matrix printer, can be expanded with 10 micros beyond CPU. Memory to 1.2GB. Claims performance similar to DEC PDP-11/34. Butel-Comco, 50 Oxford Street, Southampton, Hampshire SO1 1DI. (0703) 39890. *From £3,000*

SORD COMPUTER SYSTEMS

M200 Range: Z-80A, 64K RAM, S-100 bus, Sord OS, graphics, 5¼in., 8in. or hard discs, two RS232, integral 80 x 24 VDU. Business use. Midas Computer Services Ltd, 2 High Street, Steyning, Sussex. (0903) 814523. *From £1,850 to £6,950*

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C/09: 6800, 56K RAM, Flex OS, 5¼in., 8in. or 15MB hard discs, business, educational and scientific packages. *From £3,000 to £10,000*

S/09: 6800, 128K RAM — 380K RAM, Uniflex, OS, support up to 16 users in foreground and background mode. Southwest Technical Products, 38 Dover Street, London W1X 3RB. (01) 491 7507.

SPENCER JOHNSTON LTD

SJL 8000: Z-80A, 64-208K RAM, integrated database system to user specifications, 8in. discs to 4MB Winchester to 80MB. Sun Computer Services, 60 Broad Lane, Hampton, Middlesex. (01) 979 9824. *From £8,000*

SYNERTEC

Sym-1: 6502, 4K-64K RAM, port-expansion kit, TV interface, Kim software, hobbyist use. Newbear, 40 Bartholomew Street, Newbury, Berkshire. (0635) 30505. *From £160*

TANDBERG DATA

TDV Series: 8080A, 32-64K RAM, Intel bus, 4K Basic disc system in ROM, one plus three 8in. discs, or 2.5MB disc cartridge, eight ports, semi-graphics, CP/M version available, educational use. Tandberg Data, 81 Kirkstall Road, Leeds, LS3 1HR. (0532) 35111. *From £4,000*

TANDY

Model 1: Z-80, 4-48K RAM, RS232, Level I and Level II Basic in ROM, separate keyboard and 12in. VDU, small business and personal use. Reviewed November 1978. *from £349*



Model 2: Z-80, 64K RAM, integral 8in. disc, integral 12in. VDU, detachable keyboard, CP/M serial and parallel ports, Level III Basic, business use. Tandy, TRS-80 Division, Bilston Road, Wednesbury, West Midlands WS10 7JN. (021) 556 6101. Reviewed March 1980.

From £1,995

Model 3: Z-80, 4-48K RAM, 12in. display, integral unit with slots for two 5¼in. drives, 65-key keyboard, 12-key data pad, printer interface, compatible with Model 1 software.

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TANGERINE COMPUTER SYSTEMS

Microtan 65: 6802, 1-48K RAM, Tanbus, IEEE 488, Tanbug in ROM (1K), Pixel graphics, 5¼in. discs, 32 I/O lines and three serial ports, from single-board upwards. Tangerine Computer Systems, Forehill, Ely, Cambridgeshire. (0353) 3633.

From £69

TECHNALOGICS

TECS: 6800, 56K RAM, Basic and Prestel terminal software, RS232, two cassette ports, two parallel ports, 5¼in. discs. Technalogs, Windmill Works, Station Road, Swinton, Manchester M27 2BU. (061) 793 6323. Reviewed November 1979.

From £895 for kit

TERODEC MICROCOMPUTER SYSTEMS

TMZ-80: Z-80, 64K RAM, CP/M, MP/M, CP/Net, twin 8in., up to 32MB hard discs, multi-user business use. Terodec, 17 The Gallop, Yately, Camberley, Surrey. (0252) 874790.

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TEXAS INSTRUMENTS

TI-99/4: 990 16-bit, 16K RAM, Basic in 26K ROM, high-resolution, colour graphics, up to three 5¼in. discs, joystick, cassette and other ports, RS232, personal use. Texas Instruments Ltd., Manton Lane, Bedford MK41 7PU. (0234) 67466. Reviewed August 1980.

From £950

TRANSAM COMPONENTS

Triton: 8080, 32K RAM, CP/M, 1K TBIOS in ROM, up to three 5¼in. discs, or four 8in., serial and parallel ports. Reviewed December 1979.

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Tuscan: Z-80, 8-64K RAM, S-100 bus, CP/M, RS232, TV and cassette interface, from single-board, personal use to full business system. Transam, 59 Theobalds Road, London WC1. (01) 405 5240.

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CENTRONICS 779 matrix printer with tractor drive. As new, £500, new price approx £1,000. (0255) 820878.

FOR ZX81 (1K) two player "Arcade", screen scoring and end of game indicator. Cassette £2.50, listing £1.50 plus S.A.E. F. McCarthy, 1 Sholebroke Terrace, Leeds LS7 3HF.

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TRS-80 16K LEVEL II, taperecorder, tapes, books, magazines. £300. Sheffield 308518.

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MICROTAN 65 GAMES. Adventure 7.1, The Sceptre of Hamloth, £5.00. Adventure 7.2, Mansion of the Mad Professor, £5.00. Many m/c and Basic programs, eg: Crash-Landing, £4.00. Thud & Blunder, £5.00. Basic pack 1, £4.00. SAE for lists. Mr I. Dickinson, 1 The Hemplands, Chedworth, Cheltenham, Glos.

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1K ZX81 'Arcade'-type listings, 50p; three for £1.25 — Sea Strike, Fighter Pilot, Ack-Ack. Richardson, 67 Old Exeter Street, Chudleigh, Devon.

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ITT 2020 — 48K, with disk drive, controller and large quantity of software for sale. Computer £550, disk drive £320 — software free if both purchased. Tel: 01-863 6290.

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C12 CASSETTES. £2.95 for 5, £13.50 for 25. 7 Grahame Close, Blewbury, Oxon.

ZX80 8k ROM for sale. Manual + programs, £75 ono. Bethsheen, Symington, Biggar, ML12 6LJ.

APPLE 11 PLUS 48K with manuals and tapes. Five months old. £600 ono. P. J. Clarkson, 58 Rectory Lane, Chelmsford, Essex.

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Powerhouse II: Z-80, 16-32K RAM, RS232, 5in. internal VDU, *From £1,200* integral mini-cassette, 2K monitor, IEEE, 14K Basic DOS, OEM users. Powerhouse Microprocessors, 5 Alexander Road, Hemel Hempstead, Hertfordshire HP2 5BS. (0442) 42002.

VECTOR GRAPHIC

MZ: Z-80, 48K-64K RAM, CP/M, 5¼in. discs, optional graphics, *From £2,300* serial and parallel ports. Business and general use. Almarc Data Systems, 906 Woodborough Road, Nottingham (0602) 625035. Reviewed October 1980.

WESTERN DIGITAL

Pascal Microengine: MCP1600, executes P-code directly, 64K *From £2,295* RAM, own bus, 5¼in., 8in. or hard discs up to 18MB, two RS232, two parallel ports. Pronto Electronics Systems, 466-478 Cranbrook Road, Gants Hill, Ilford, Essex IG2 6LE. (01) 554 6222.

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PRACTICAL COMPUTING October 1981

Son of Hexadecimal Kid

Samson Synapse's dream nearly comes true one night when he finds himself alone with the lovely Mantissa in the library of the Institute of Esoteric Ideas, but their romance breaks off before it has begun when — as she leans forward to be kissed — he bites her neck.

Samson trudged back disconsolately to his room in the hall of residence and packed his few belongings, including Zapple. Before dawn, he was wandering along the dockside of the Blottonian spaceport looking for a berth on a vessel bound for Terra Firma.

He scuffed his heels along the quay, head bowed. Above him space gulls wheeled, cawing their melancholy cries, but he did not heed them. Presently he sat down and gazed at the stubby but powerful hulls of the star freighters. Yet he looked with unseeing eyes: his mind was still full of Mantissa and the way he had thrown away his chance of happiness.

He had to escape. There was no place for him on Blotto now — but how could he work a passage? He had not stayed at the Institute long enough to obtain his astro-pilot's licence. He was not even an able spaceman.

Very shortly his question was answered for him.

"Hello there! If it isn't the earthling. Haven't seen you since the night of the vernal equinox. Have a good time, eh"?

It was Ram, the salacious old space dog who had got him into this pickle in the first place.

Abruptly, almost without pausing for breath, Samson spilled his story. Ram was unimpressed by his ill-fated encounter with Mantissa — "preying Mantissa" he called her dismissively. It appeared that everyone around Omega Solaris knew of her.

"You're well rid of her", he said unsympathetically, and cackled when Samson confided, still smarting at the memory, his unchivalrous deed. He was not very sympathetic when Samson asked for a job either.

"We've our full complement on board at present", he said.

"But you must take me aboard. I can be very useful. I know my way around the Green Tangerine".

"I'm not on the Green Tangerine any more", Ram replied. "I've my own ship now. I command the Green Orange".

"Not another green fruit", said Samson.

"Yeah, there's a whole fleet of them: Green Tangerine, Green Orange, Green Lemon, Green Tomato . . .".

"And Green Apple"?

Ram looked askance at him. "Green Apple? What a silly name for a spaceship". In the end Samson persuaded Ram to take him to the offices of the Green Fruit Salad Line. There he met Prestel the parrot again, who had been

promoted to a perch on the ground as controller of voyages.

For all Samson's earlier prowess Prestel was far from keen on employing him without the proper paperwork.

"But I saved your lives", pleaded Samson. "You didn't ask for a certificate then". Prestel consulted the crew sheet in front of him once more.

"Oh, all right. I'm short of a cabin boy on the Green Banana, bound for Optima Pascalis 4 with a cargo of error diagnostics".

"A cabin boy"? Samson had hoped for a navigator's post, at least.

"It's the best I can do. From there you can catch the shuttle to Tau Ceti. Then you're only 11 light years from your own planet".

"Eleven light years. What am I supposed to do — swim"?

"I said: it's the best I can do. You know no ships call at Terra Firma".

Samson acquiesced with a sigh. "OK. When do I join"?

"Blast-off's at midnight tonight".

They kept Samson very busy at first on the hyper-space cruiser — pumping out the bilges, sweeping floors, mixing cocktails for the first-class passengers and doing other menial tasks too demeaning for robots. However, once they reached the long free fall through intergalactic space between the Lesser Magellanic Cloud and the Milky Way there was less to be done. He even found some time to relax on the Observation Deck when the passengers were at dinner.

The walls of the Observation Lounge were lined with port-holes with image-intensifying binoculars mounted at each one. He could peer out through these at the main galaxy spread out in all its majesty below them. Their sophisticated fibre-optic photoprocessors not only enlarged the image but also corrected for their large blue-shift and displayed a stereoscopic view.

Just by twiddling a knob he could make the scene appear to rotate or obtain a cross-sectional view which the instrument calculated from the spin of incoming photons. It could even seem to take the observer inside an exploding supernova.

It was while gazing out at the detailed panoramic splendour of the galaxy that Samson had his revelation.

Suddenly, he saw a meaning etched out in the sky by millions and millions of densely packed stars. All the words about Megabrain, which he had treated with

such cynicism and half forgotten, rose up from his subconscious in a flash of insight.

It was all so clear, so obvious once you saw it: it made sense of everything — and yet the key, the answer to the cosmic question, had miraculously been granted not to the monks practising their austere meditative disciplines at the Intergalactic Think Tank, not to the whizz kids with their arrays of array processors at the Galactic Computer Centre but, amazingly, to him.

"What in hyperspace do you think you're doing"? It was the captain, who had entered to find Samson kneeling on the floor by a port-hole. His harsh voice shattered the luminous moment of inspiration.

"Don't you understand"? Samson demanded urgently. "It's true. Megabrain does exist. The hardware is in place. All it needs is the software — one little bootstrap program to start it all going. That's me. That's you. We are Megabrain — every living being in the universe, just waiting to link up into the ultimate ethernet. Megabrain's body is the physical universe: we are his soul".

"Get down below where you belong, and spare us all this religious fanaticism. I've got a ship to run".

"But don't you see"?

"See what"?


"Megabrain".

"I see a cabin boy suffering from star-stroke, who will be slung overboard if he doesn't obey my orders".

Samson retreated below decks, but the vision still haunted him. He had no one with whom to share it except Zapple. When he tried to explain it to the officers they laughed, and the deck hands just ignored him. With Zapple he felt a sense of communion. Alone in their cabin he poured out his revelation — how Megabrain lay sleeping waiting for the awakening in a trillion hearts and minds.

When they arrived at Optima Pascalis Samson was unceremoniously dumped. The captain had taken him on only as a favour to Prestel, and his tiresome religious proselytising had made him even less welcome. The pittance he had earned as a cabin boy was just enough for a standby ticket to Tau Ceti.

This left him stranded on a desolate moon with a thin atmosphere and no indigenous population. Since he had no exit visa he had to remain cooped up in the Transit Lounge and the duty-free shop would not even accept his American Express card.

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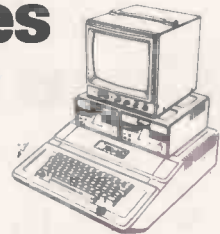
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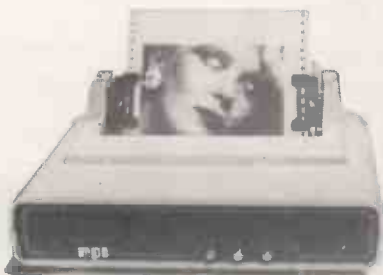
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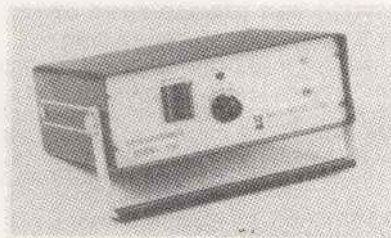
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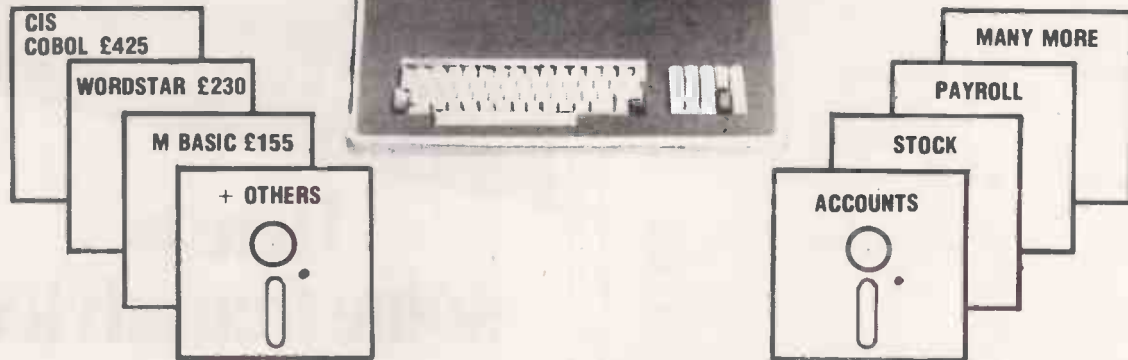
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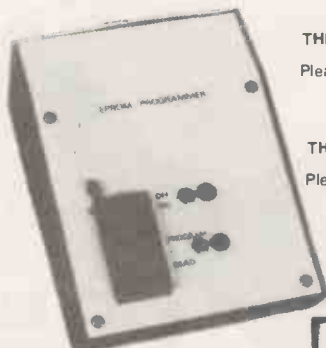
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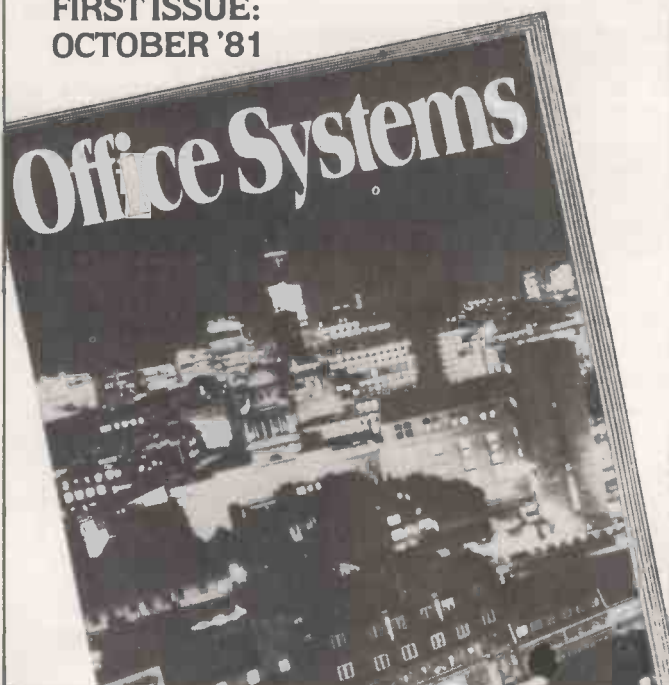
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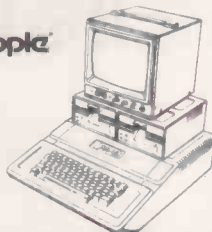
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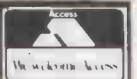
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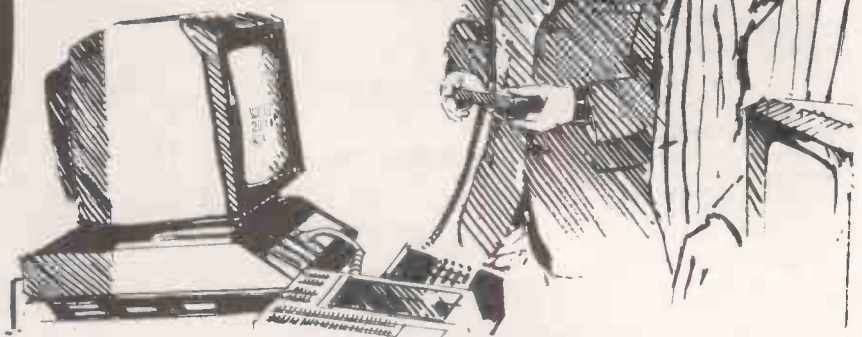
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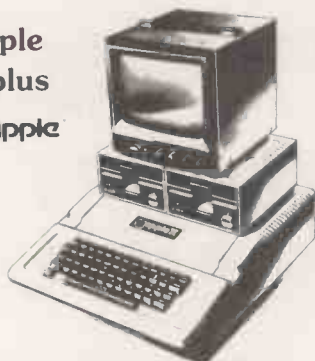
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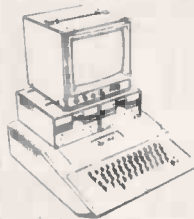
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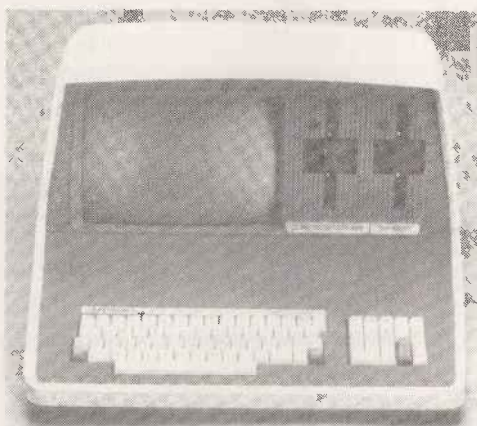
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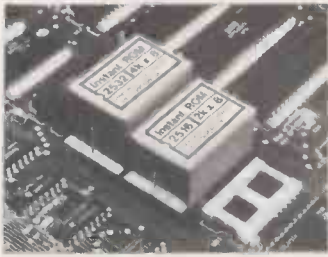
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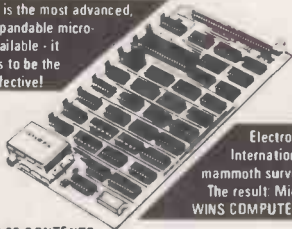
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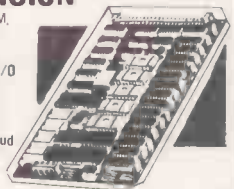
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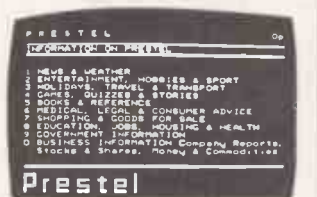
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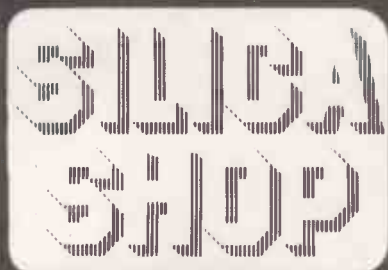
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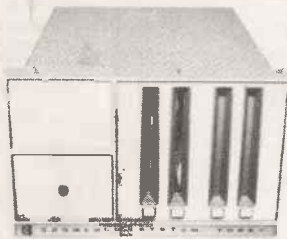
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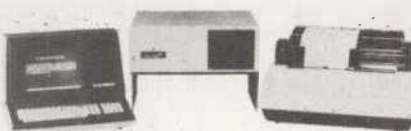
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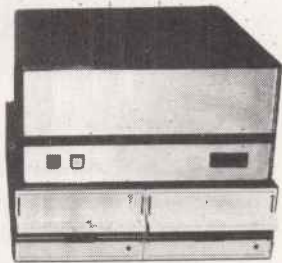
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TIMETABLE

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09.15	Opening remarks
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09.30	Opportunities for entrepreneurs and investors – the scope of the conference
10.15	Developing suitable financial controls
10.45	Coffee
11.15	Getting the best out of a clearing bank
	The approach of the investment fund
	The role of the stockbroker
12.30	Lunch
14.00	Finance through the Stock Exchange/ Growth by acquisition
14.30	Department of Industry assistance and the MAP scheme
15.00	Experiences of successful computer companies
15.30	Tea
16.00	Experiences of successful computer companies
16.30	Panel discussion
17.30	Summary and close

SPEAKER

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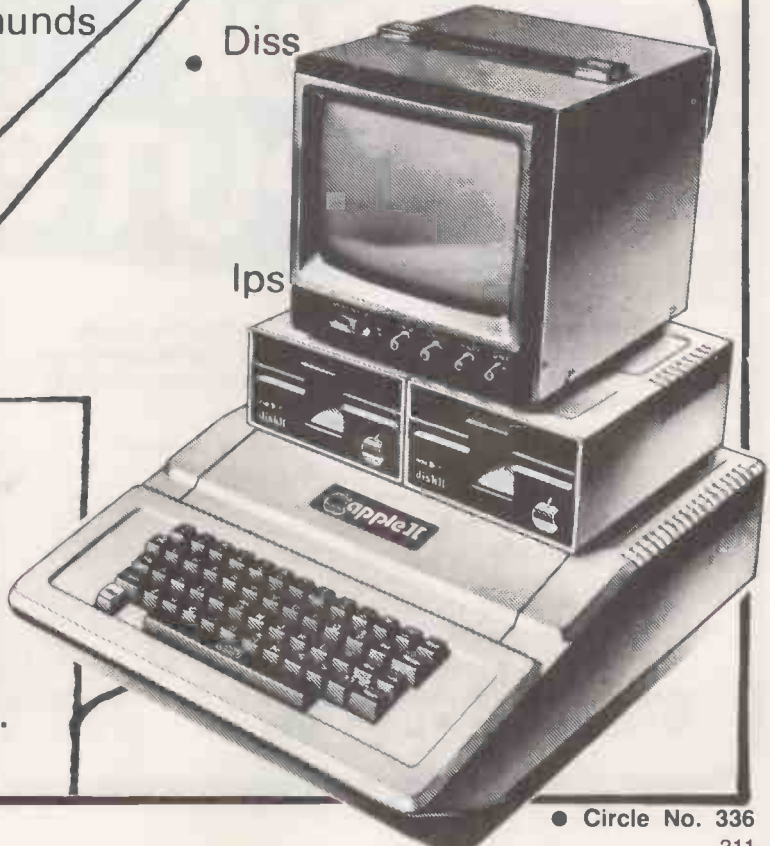
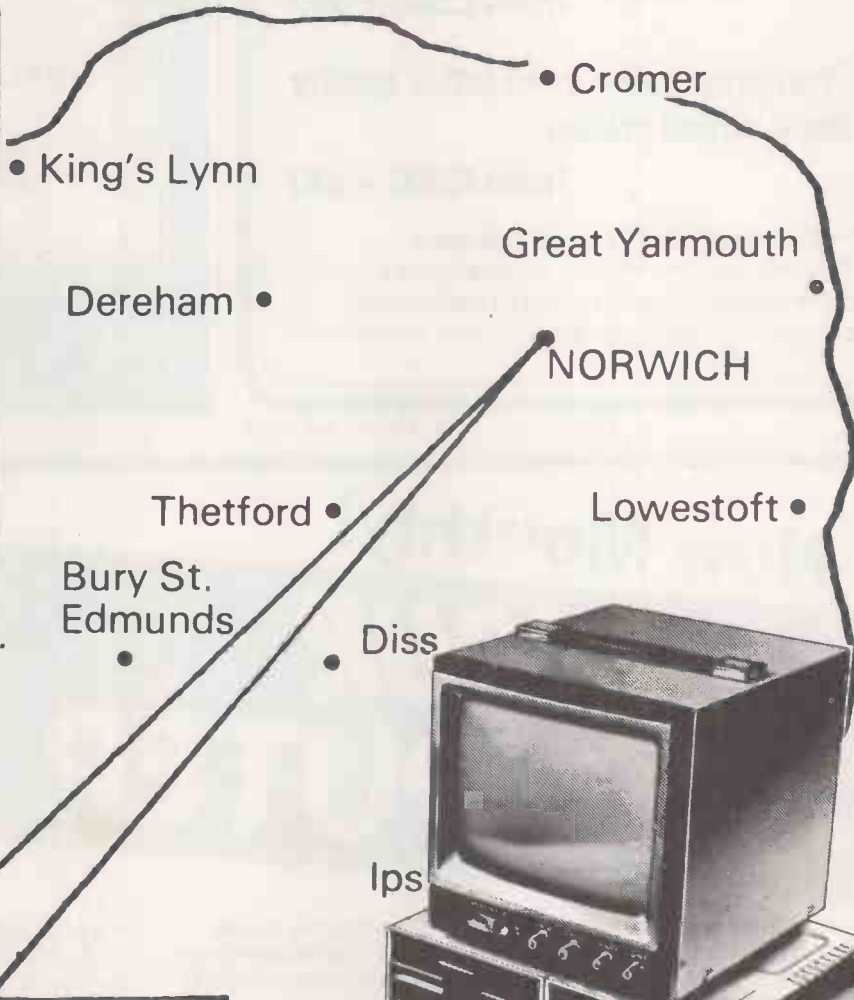
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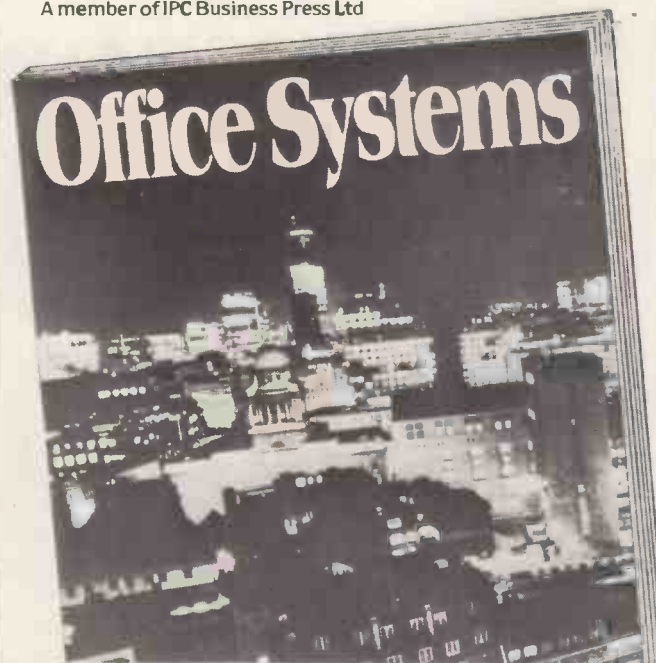
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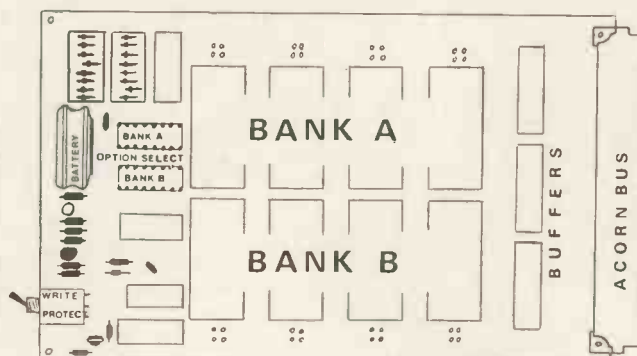
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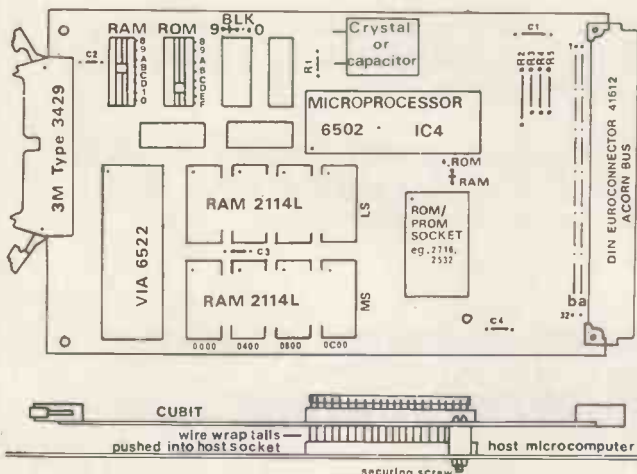
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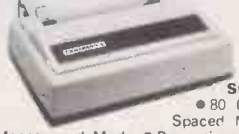
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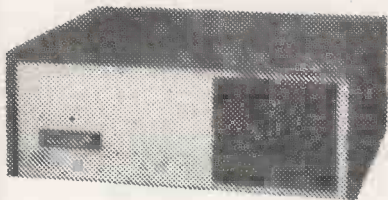
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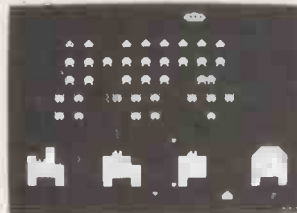
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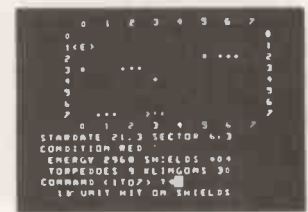


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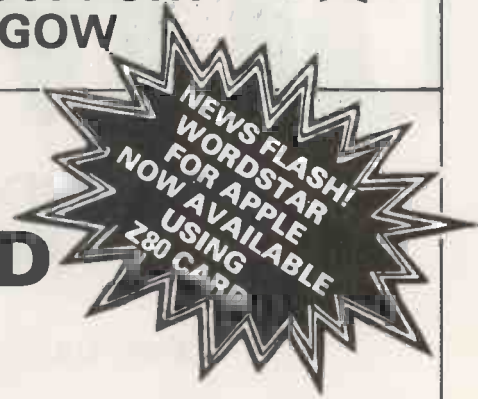
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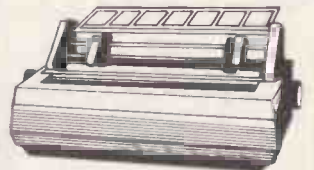
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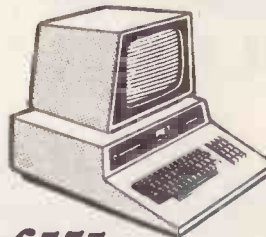
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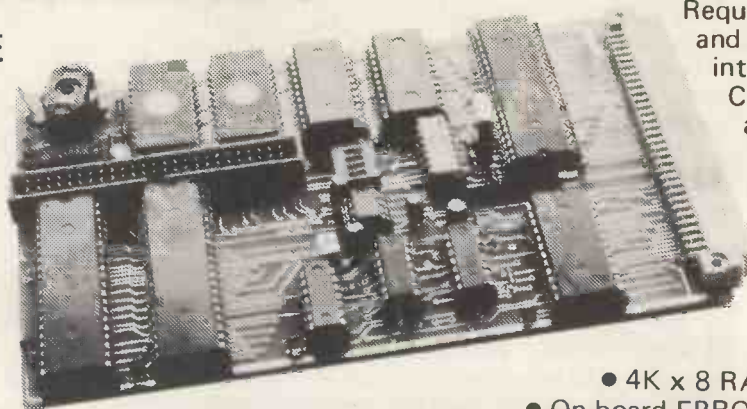


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It is impossible to describe all of the features of LDOS in an advertisement. For instance it includes no less than 35 library commands as follows:—

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ROUTE	RUN	SET	SPOOL	ATRIB	AUTO	BOOT
BUILD	CLOCK	CREATE	DATE	DEBUG	DUMP	FREE
PROT	PURGE	SYSTEM	TIME	TRACE	VERIFY	XFER

All of the useful abbreviations in Newdos are included and the System Commands in Basic (CMD) now number eleven. A program called LBASIC/FIX is included, with which the normal TRSDOS Disk Basic may be patched to include a number of new commands and features. A Job Control Language is included and in fact is one of the most powerful features of LDOS. It allows the user to compile a sequence of commands or key strokes for later execution as a chain, with or without user intervention. There are too many new features to list them herein, but examples are: The ability to provide an audible signal, output through the cassette port. To flash or blink a one line message on the video display. A WAIT feature is included so that the machine can be put into a "sleep" state until such time as the system clock matches the time specified. And so on!

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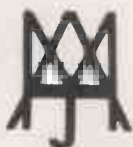
A Basic Renumber facility is included, as is a Basic Cross Reference function. Both are similar to the ones in Newdos+ and Newdos80. Most of the utilities are library commands which were existent in the previous DOS's, have been improved with the addition of new functions or facilities.

The prime development team of LDOS consisted of no less than 8 first rank programmers and they had the support and advice of six other well known programmers. They have done an excellent job to bring to the user what must be the best disk operating system so far produced for a microcomputer, which is destined to become the Standard DOS.

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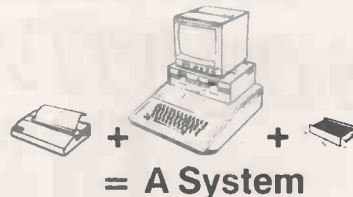
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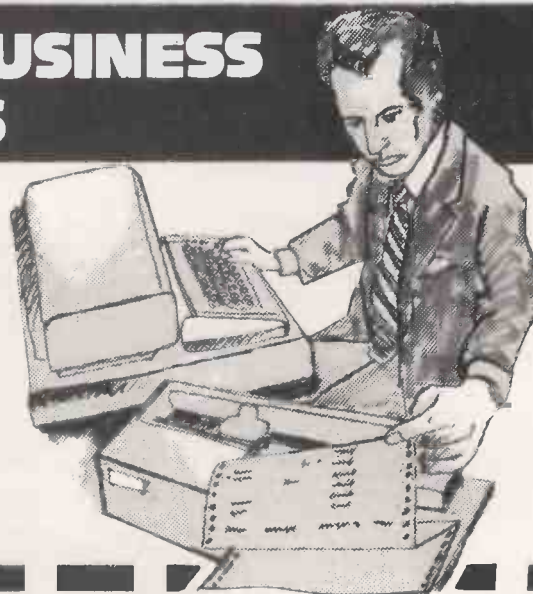
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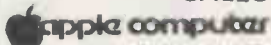
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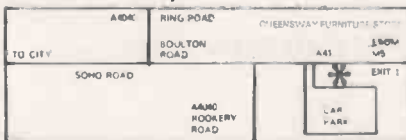
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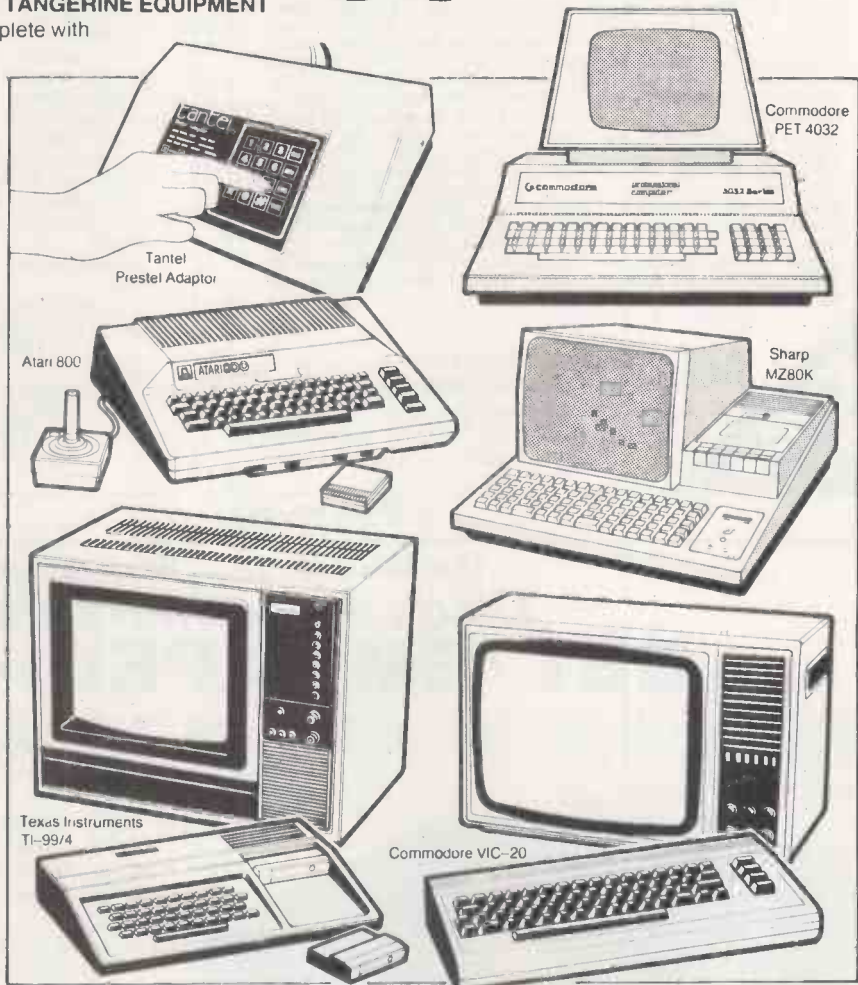
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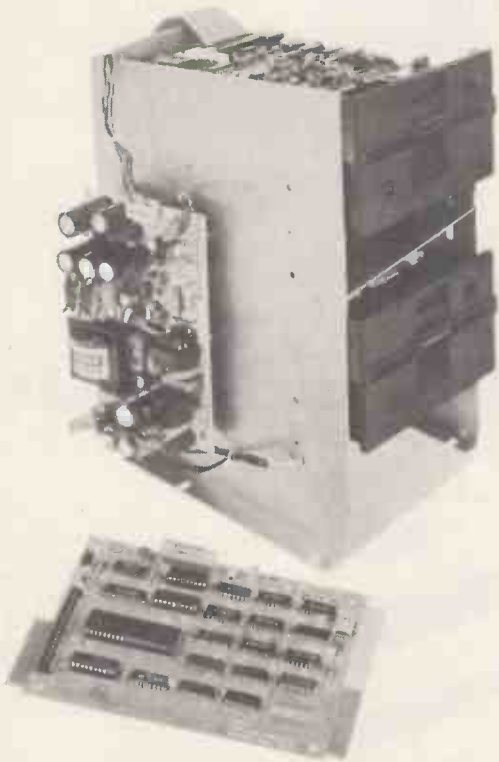
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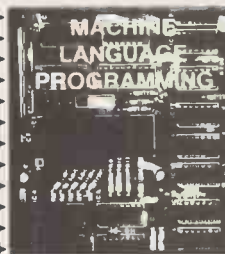
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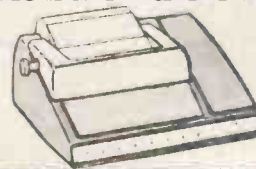
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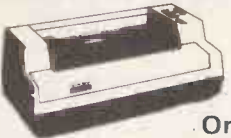
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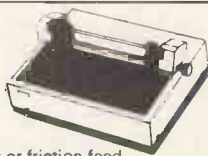
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		74250 120	LS259 85		
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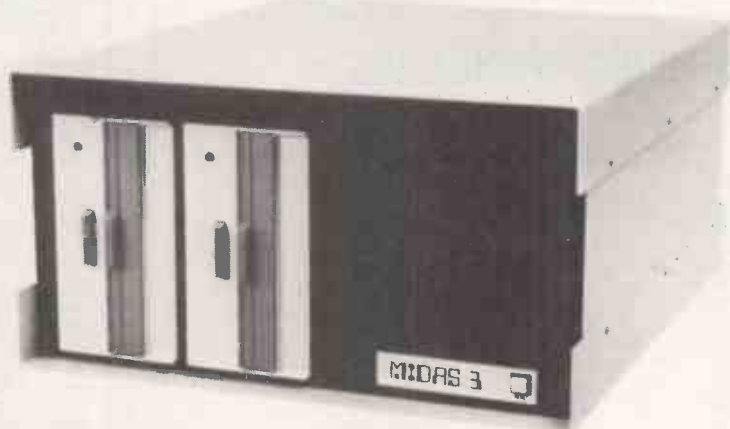
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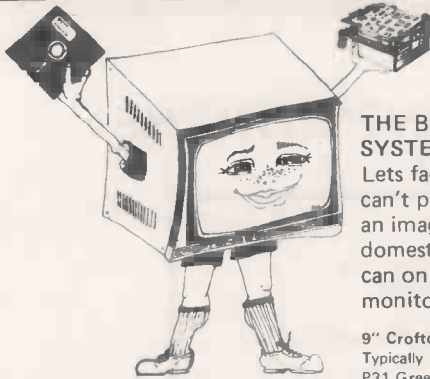
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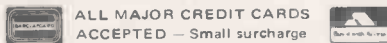
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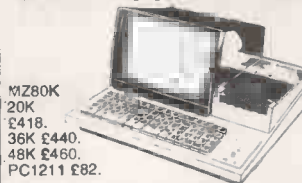
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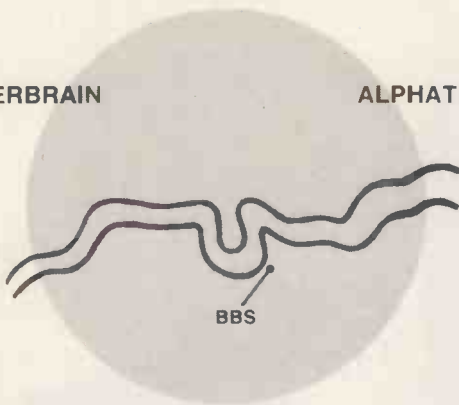
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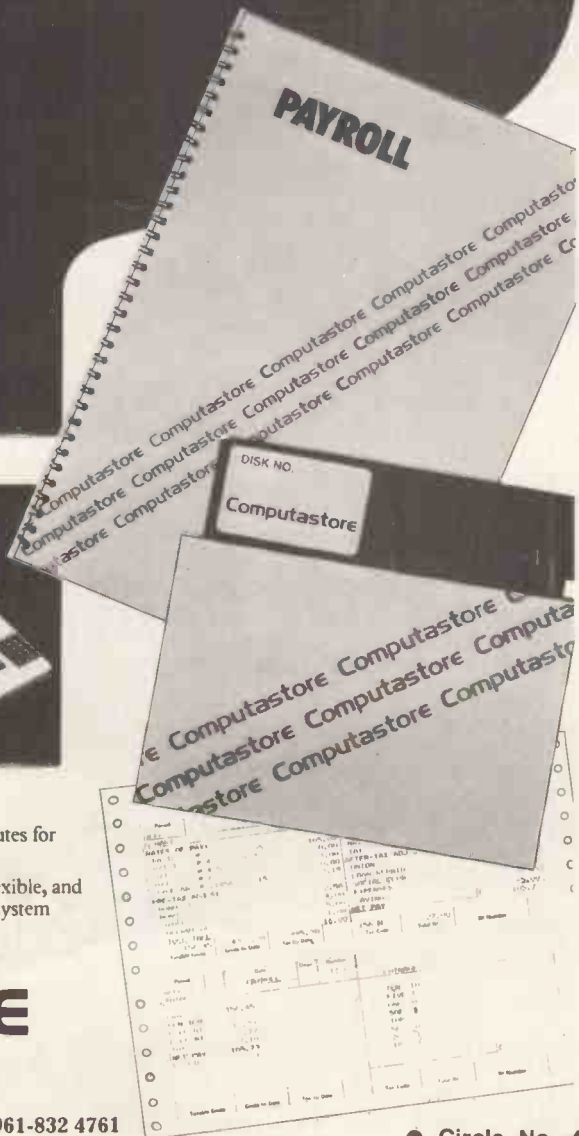
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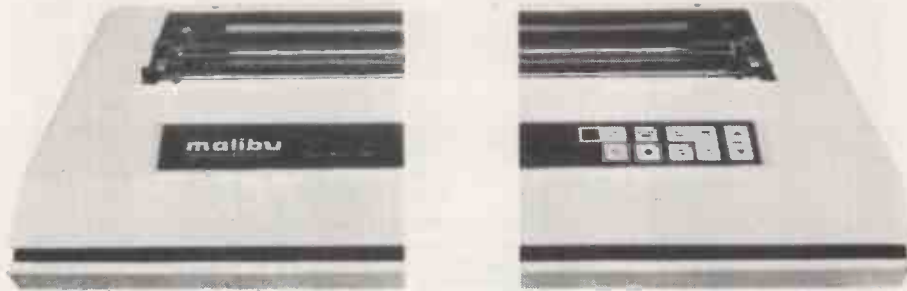
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