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Reviews: Tomy's 16-bit Tutor and Tomy MC-10

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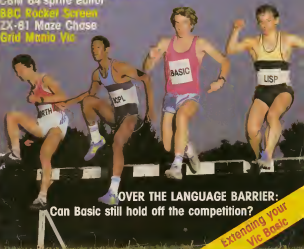
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Atari 1300. Photo by Bob



Atari 800. Photo by Bob



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| <b>ACCOUNTING</b><br>ACCOUNTING I<br>ACCOUNTING II<br>ACCOUNTING III<br>ACCOUNTING IV<br>ACCOUNTING V<br>ACCOUNTING VI<br>ACCOUNTING VII<br>ACCOUNTING VIII<br>ACCOUNTING IX<br>ACCOUNTING X<br>ACCOUNTING XI<br>ACCOUNTING XII<br>ACCOUNTING XIII<br>ACCOUNTING XIV<br>ACCOUNTING XV<br>ACCOUNTING XVI<br>ACCOUNTING XVII<br>ACCOUNTING XVIII<br>ACCOUNTING XIX<br>ACCOUNTING XX<br>ACCOUNTING XXI<br>ACCOUNTING XXII<br>ACCOUNTING XXIII<br>ACCOUNTING XXIV<br>ACCOUNTING XXV<br>ACCOUNTING XXVI<br>ACCOUNTING XXVII<br>ACCOUNTING XXVIII<br>ACCOUNTING XXIX<br>ACCOUNTING XXX | <b>ANIMATION</b><br>ANIMATION I<br>ANIMATION II<br>ANIMATION III<br>ANIMATION IV<br>ANIMATION V<br>ANIMATION VI<br>ANIMATION VII<br>ANIMATION VIII<br>ANIMATION IX<br>ANIMATION X<br>ANIMATION XI<br>ANIMATION XII<br>ANIMATION XIII<br>ANIMATION XIV<br>ANIMATION XV<br>ANIMATION XVI<br>ANIMATION XVII<br>ANIMATION XVIII<br>ANIMATION XIX<br>ANIMATION XX<br>ANIMATION XXI<br>ANIMATION XXII<br>ANIMATION XXIII<br>ANIMATION XXIV<br>ANIMATION XXV<br>ANIMATION XXVI<br>ANIMATION XXVII<br>ANIMATION XXVIII<br>ANIMATION XXIX<br>ANIMATION XXX | <b>ARTWORK</b><br>ARTWORK I<br>ARTWORK II<br>ARTWORK III<br>ARTWORK IV<br>ARTWORK V<br>ARTWORK VI<br>ARTWORK VII<br>ARTWORK VIII<br>ARTWORK IX<br>ARTWORK X<br>ARTWORK XI<br>ARTWORK XII<br>ARTWORK XIII<br>ARTWORK XIV<br>ARTWORK XV<br>ARTWORK XVI<br>ARTWORK XVII<br>ARTWORK XVIII<br>ARTWORK XIX<br>ARTWORK XX<br>ARTWORK XXI<br>ARTWORK XXII<br>ARTWORK XXIII<br>ARTWORK XXIV<br>ARTWORK XXV<br>ARTWORK XXVI<br>ARTWORK XXVII<br>ARTWORK XXVIII<br>ARTWORK XXIX<br>ARTWORK XXX | <b>BOOKS</b><br>BOOKS I<br>BOOKS II<br>BOOKS III<br>BOOKS IV<br>BOOKS V<br>BOOKS VI<br>BOOKS VII<br>BOOKS VIII<br>BOOKS IX<br>BOOKS X<br>BOOKS XI<br>BOOKS XII<br>BOOKS XIII<br>BOOKS XIV<br>BOOKS XV<br>BOOKS XVI<br>BOOKS XVII<br>BOOKS XVIII<br>BOOKS XIX<br>BOOKS XX<br>BOOKS XXI<br>BOOKS XXII<br>BOOKS XXIII<br>BOOKS XXIV<br>BOOKS XXV<br>BOOKS XXVI<br>BOOKS XXVII<br>BOOKS XXVIII<br>BOOKS XXIX<br>BOOKS XXX | <b>BUSINESS</b><br>BUSINESS I<br>BUSINESS II<br>BUSINESS III<br>BUSINESS IV<br>BUSINESS V<br>BUSINESS VI<br>BUSINESS VII<br>BUSINESS VIII<br>BUSINESS IX<br>BUSINESS X<br>BUSINESS XI<br>BUSINESS XII<br>BUSINESS XIII<br>BUSINESS XIV<br>BUSINESS XV<br>BUSINESS XVI<br>BUSINESS XVII<br>BUSINESS XVIII<br>BUSINESS XIX<br>BUSINESS XX<br>BUSINESS XXI<br>BUSINESS XXII<br>BUSINESS XXIII<br>BUSINESS XXIV<br>BUSINESS XXV<br>BUSINESS XXVI<br>BUSINESS XXVII<br>BUSINESS XXVIII<br>BUSINESS XXIX<br>BUSINESS XXX | <b>COMICS</b><br>COMICS I<br>COMICS II<br>COMICS III<br>COMICS IV<br>COMICS V<br>COMICS VI<br>COMICS VII<br>COMICS VIII<br>COMICS IX<br>COMICS X<br>COMICS XI<br>COMICS XII<br>COMICS XIII<br>COMICS XIV<br>COMICS XV<br>COMICS XVI<br>COMICS XVII<br>COMICS XVIII<br>COMICS XIX<br>COMICS XX<br>COMICS XXI<br>COMICS XXII<br>COMICS XXIII<br>COMICS XXIV<br>COMICS XXV<br>COMICS XXVI<br>COMICS XXVII<br>COMICS XXVIII<br>COMICS XXIX<br>COMICS XXX | <b>CONSTRUCTION</b><br>CONSTRUCTION I<br>CONSTRUCTION II<br>CONSTRUCTION III<br>CONSTRUCTION IV<br>CONSTRUCTION V<br>CONSTRUCTION VI<br>CONSTRUCTION VII<br>CONSTRUCTION VIII<br>CONSTRUCTION IX<br>CONSTRUCTION X<br>CONSTRUCTION XI<br>CONSTRUCTION XII<br>CONSTRUCTION XIII<br>CONSTRUCTION XIV<br>CONSTRUCTION XV<br>CONSTRUCTION XVI<br>CONSTRUCTION XVII<br>CONSTRUCTION XVIII<br>CONSTRUCTION XIX<br>CONSTRUCTION XX<br>CONSTRUCTION XXI<br>CONSTRUCTION XXII<br>CONSTRUCTION XXIII<br>CONSTRUCTION XXIV<br>CONSTRUCTION XXV<br>CONSTRUCTION XXVI<br>CONSTRUCTION XXVII<br>CONSTRUCTION XXVIII<br>CONSTRUCTION XXIX<br>CONSTRUCTION XXX | <b>DEVELOPMENT</b><br>DEVELOPMENT I<br>DEVELOPMENT II<br>DEVELOPMENT III<br>DEVELOPMENT IV<br>DEVELOPMENT V<br>DEVELOPMENT VI<br>DEVELOPMENT VII<br>DEVELOPMENT VIII<br>DEVELOPMENT IX<br>DEVELOPMENT X<br>DEVELOPMENT XI<br>DEVELOPMENT XII<br>DEVELOPMENT XIII<br>DEVELOPMENT XIV<br>DEVELOPMENT XV<br>DEVELOPMENT XVI<br>DEVELOPMENT XVII<br>DEVELOPMENT XVIII<br>DEVELOPMENT XIX<br>DEVELOPMENT XX<br>DEVELOPMENT XXI<br>DEVELOPMENT XXII<br>DEVELOPMENT XXIII<br>DEVELOPMENT XXIV<br>DEVELOPMENT XXV<br>DEVELOPMENT XXVI<br>DEVELOPMENT XXVII<br>DEVELOPMENT XXVIII<br>DEVELOPMENT XXIX<br>DEVELOPMENT XXX | <b>EDUCATION</b><br>EDUCATION I<br>EDUCATION II<br>EDUCATION III<br>EDUCATION IV<br>EDUCATION V<br>EDUCATION VI<br>EDUCATION VII<br>EDUCATION VIII<br>EDUCATION IX<br>EDUCATION X<br>EDUCATION XI<br>EDUCATION XII<br>EDUCATION XIII<br>EDUCATION XIV<br>EDUCATION XV<br>EDUCATION XVI<br>EDUCATION XVII<br>EDUCATION XVIII<br>EDUCATION XIX<br>EDUCATION XX<br>EDUCATION XXI<br>EDUCATION XXII<br>EDUCATION XXIII<br>EDUCATION XXIV<br>EDUCATION XXV<br>EDUCATION XXVI<br>EDUCATION XXVII<br>EDUCATION XXVIII<br>EDUCATION XXIX<br>EDUCATION XXX | <b>ENTERTAINMENT</b><br>ENTERTAINMENT I<br>ENTERTAINMENT II<br>ENTERTAINMENT III<br>ENTERTAINMENT IV<br>ENTERTAINMENT V<br>ENTERTAINMENT VI<br>ENTERTAINMENT VII<br>ENTERTAINMENT VIII<br>ENTERTAINMENT IX<br>ENTERTAINMENT X<br>ENTERTAINMENT XI<br>ENTERTAINMENT XII<br>ENTERTAINMENT XIII<br>ENTERTAINMENT XIV<br>ENTERTAINMENT XV<br>ENTERTAINMENT XVI<br>ENTERTAINMENT XVII<br>ENTERTAINMENT XVIII<br>ENTERTAINMENT XIX<br>ENTERTAINMENT XX<br>ENTERTAINMENT XXI<br>ENTERTAINMENT XXII<br>ENTERTAINMENT XXIII<br>ENTERTAINMENT XXIV<br>ENTERTAINMENT XXV<br>ENTERTAINMENT XXVI<br>ENTERTAINMENT XXVII<br>ENTERTAINMENT XXVIII<br>ENTERTAINMENT XXIX<br>ENTERTAINMENT XXX | <b>FINANCE</b><br>FINANCE I<br>FINANCE II<br>FINANCE III<br>FINANCE IV<br>FINANCE V<br>FINANCE VI<br>FINANCE VII<br>FINANCE VIII<br>FINANCE IX<br>FINANCE X<br>FINANCE XI<br>FINANCE XII<br>FINANCE XIII<br>FINANCE XIV<br>FINANCE XV<br>FINANCE XVI<br>FINANCE XVII<br>FINANCE XVIII<br>FINANCE XIX<br>FINANCE XX<br>FINANCE XXI<br>FINANCE XXII<br>FINANCE XXIII<br>FINANCE XXIV<br>FINANCE XXV<br>FINANCE XXVI<br>FINANCE XXVII<br>FINANCE XXVIII<br>FINANCE XXIX<br>FINANCE XXX | <b>GAME</b><br>GAME I<br>GAME II<br>GAME III<br>GAME IV<br>GAME V<br>GAME VI<br>GAME VII<br>GAME VIII<br>GAME IX<br>GAME X<br>GAME XI<br>GAME XII<br>GAME XIII<br>GAME XIV<br>GAME XV<br>GAME XVI<br>GAME XVII<br>GAME XVIII<br>GAME XIX<br>GAME XX<br>GAME XXI<br>GAME XXII<br>GAME XXIII<br>GAME XXIV<br>GAME XXV<br>GAME XXVI<br>GAME XXVII<br>GAME XXVIII<br>GAME XXIX<br>GAME XXX | <b>GRAPHICS</b><br>GRAPHICS I<br>GRAPHICS II<br>GRAPHICS III<br>GRAPHICS IV<br>GRAPHICS V<br>GRAPHICS VI<br>GRAPHICS VII<br>GRAPHICS VIII<br>GRAPHICS IX<br>GRAPHICS X<br>GRAPHICS XI<br>GRAPHICS XII<br>GRAPHICS XIII<br>GRAPHICS XIV<br>GRAPHICS XV<br>GRAPHICS XVI<br>GRAPHICS XVII<br>GRAPHICS XVIII<br>GRAPHICS XIX<br>GRAPHICS XX<br>GRAPHICS XXI<br>GRAPHICS XXII<br>GRAPHICS XXIII<br>GRAPHICS XXIV<br>GRAPHICS XXV<br>GRAPHICS XXVI<br>GRAPHICS XXVII<br>GRAPHICS XXVIII<br>GRAPHICS XXIX<br>GRAPHICS XXX | <b>HOME</b><br>HOME I<br>HOME II<br>HOME III<br>HOME IV<br>HOME V<br>HOME VI<br>HOME VII<br>HOME VIII<br>HOME IX<br>HOME X<br>HOME XI<br>HOME XII<br>HOME XIII<br>HOME XIV<br>HOME XV<br>HOME XVI<br>HOME XVII<br>HOME XVIII<br>HOME XIX<br>HOME XX<br>HOME XXI<br>HOME XXII<br>HOME XXIII<br>HOME XXIV<br>HOME XXV<br>HOME XXVI<br>HOME XXVII<br>HOME XXVIII<br>HOME XXIX<br>HOME XXX | <b>IMAGES</b><br>IMAGES I<br>IMAGES II<br>IMAGES III<br>IMAGES IV<br>IMAGES V<br>IMAGES VI<br>IMAGES VII<br>IMAGES VIII<br>IMAGES IX<br>IMAGES X<br>IMAGES XI<br>IMAGES XII<br>IMAGES XIII<br>IMAGES XIV<br>IMAGES XV<br>IMAGES XVI<br>IMAGES XVII<br>IMAGES XVIII<br>IMAGES XIX<br>IMAGES XX<br>IMAGES XXI<br>IMAGES XXII<br>IMAGES XXIII<br>IMAGES XXIV<br>IMAGES XXV<br>IMAGES XXVI<br>IMAGES XXVII<br>IMAGES XXVIII<br>IMAGES XXIX<br>IMAGES XXX | <b>INTERNET</b><br>INTERNET I<br>INTERNET II<br>INTERNET III<br>INTERNET IV<br>INTERNET V<br>INTERNET VI<br>INTERNET VII<br>INTERNET VIII<br>INTERNET IX<br>INTERNET X<br>INTERNET XI<br>INTERNET XII<br>INTERNET XIII<br>INTERNET XIV<br>INTERNET XV<br>INTERNET XVI<br>INTERNET XVII<br>INTERNET XVIII<br>INTERNET XIX<br>INTERNET XX<br>INTERNET XXI<br>INTERNET XXII<br>INTERNET XXIII<br>INTERNET XXIV<br>INTERNET XXV<br>INTERNET XXVI<br>INTERNET XXVII<br>INTERNET XXVIII<br>INTERNET XXIX<br>INTERNET XXX | <b>LANGUAGE</b><br>LANGUAGE I<br>LANGUAGE II<br>LANGUAGE III<br>LANGUAGE IV<br>LANGUAGE V<br>LANGUAGE VI<br>LANGUAGE VII<br>LANGUAGE VIII<br>LANGUAGE IX<br>LANGUAGE X<br>LANGUAGE XI<br>LANGUAGE XII<br>LANGUAGE XIII<br>LANGUAGE XIV<br>LANGUAGE XV<br>LANGUAGE XVI<br>LANGUAGE XVII<br>LANGUAGE XVIII<br>LANGUAGE XIX<br>LANGUAGE XX<br>LANGUAGE XXI<br>LANGUAGE XXII<br>LANGUAGE XXIII<br>LANGUAGE XXIV<br>LANGUAGE XXV<br>LANGUAGE XXVI<br>LANGUAGE XXVII<br>LANGUAGE XXVIII<br>LANGUAGE XXIX<br>LANGUAGE XXX | <b>LIBRARY</b><br>LIBRARY I<br>LIBRARY II<br>LIBRARY III<br>LIBRARY IV<br>LIBRARY V<br>LIBRARY VI<br>LIBRARY VII<br>LIBRARY VIII<br>LIBRARY IX<br>LIBRARY X<br>LIBRARY XI<br>LIBRARY XII<br>LIBRARY XIII<br>LIBRARY XIV<br>LIBRARY XV<br>LIBRARY XVI<br>LIBRARY XVII<br>LIBRARY XVIII<br>LIBRARY XIX<br>LIBRARY XX<br>LIBRARY XXI<br>LIBRARY XXII<br>LIBRARY XXIII<br>LIBRARY XXIV<br>LIBRARY XXV<br>LIBRARY XXVI<br>LIBRARY XXVII<br>LIBRARY XXVIII<br>LIBRARY XXIX<br>LIBRARY XXX | <b>LOGIC</b><br>LOGIC I<br>LOGIC II<br>LOGIC III<br>LOGIC IV<br>LOGIC V<br>LOGIC VI<br>LOGIC VII<br>LOGIC VIII<br>LOGIC IX<br>LOGIC X<br>LOGIC XI<br>LOGIC XII<br>LOGIC XIII<br>LOGIC XIV<br>LOGIC XV<br>LOGIC XVI<br>LOGIC XVII<br>LOGIC XVIII<br>LOGIC XIX<br>LOGIC XX<br>LOGIC XXI<br>LOGIC XXII<br>LOGIC XXIII<br>LOGIC XXIV<br>LOGIC XXV<br>LOGIC XXVI<br>LOGIC XXVII<br>LOGIC XXVIII<br>LOGIC XXIX<br>LOGIC XXX | <b>MANAGEMENT</b><br>MANAGEMENT I<br>MANAGEMENT II<br>MANAGEMENT III<br>MANAGEMENT IV<br>MANAGEMENT V<br>MANAGEMENT VI<br>MANAGEMENT VII<br>MANAGEMENT VIII<br>MANAGEMENT IX<br>MANAGEMENT X<br>MANAGEMENT XI<br>MANAGEMENT XII<br>MANAGEMENT XIII<br>MANAGEMENT XIV<br>MANAGEMENT XV<br>MANAGEMENT XVI<br>MANAGEMENT XVII<br>MANAGEMENT XVIII<br>MANAGEMENT XIX<br>MANAGEMENT XX<br>MANAGEMENT XXI<br>MANAGEMENT XXII<br>MANAGEMENT XXIII<br>MANAGEMENT XXIV<br>MANAGEMENT XXV<br>MANAGEMENT XXVI<br>MANAGEMENT XXVII<br>MANAGEMENT XXVIII<br>MANAGEMENT XXIX<br>MANAGEMENT XXX | <b>MUSIC</b><br>MUSIC I<br>MUSIC II<br>MUSIC III<br>MUSIC IV<br>MUSIC V<br>MUSIC VI<br>MUSIC VII<br>MUSIC VIII<br>MUSIC IX<br>MUSIC X<br>MUSIC XI<br>MUSIC XII<br>MUSIC XIII<br>MUSIC XIV<br>MUSIC XV<br>MUSIC XVI<br>MUSIC XVII<br>MUSIC XVIII<br>MUSIC XIX<br>MUSIC XX<br>MUSIC XXI<br>MUSIC XXII<br>MUSIC XXIII<br>MUSIC XXIV<br>MUSIC XXV<br>MUSIC XXVI<br>MUSIC XXVII<br>MUSIC XXVIII<br>MUSIC XXIX<br>MUSIC XXX | <b>OPERATIONS</b><br>OPERATIONS I<br>OPERATIONS II<br>OPERATIONS III<br>OPERATIONS IV<br>OPERATIONS V<br>OPERATIONS VI<br>OPERATIONS VII<br>OPERATIONS VIII<br>OPERATIONS IX<br>OPERATIONS X<br>OPERATIONS XI<br>OPERATIONS XII<br>OPERATIONS XIII<br>OPERATIONS XIV<br>OPERATIONS XV<br>OPERATIONS XVI<br>OPERATIONS XVII<br>OPERATIONS XVIII<br>OPERATIONS XIX<br>OPERATIONS XX<br>OPERATIONS XXI<br>OPERATIONS XXII<br>OPERATIONS XXIII<br>OPERATIONS XXIV<br>OPERATIONS XXV<br>OPERATIONS XXVI<br>OPERATIONS XXVII<br>OPERATIONS XXVIII<br>OPERATIONS XXIX<br>OPERATIONS XXX | <b>PERSONAL</b><br>PERSONAL I<br>PERSONAL II<br>PERSONAL III<br>PERSONAL IV<br>PERSONAL V<br>PERSONAL VI<br>PERSONAL VII<br>PERSONAL VIII<br>PERSONAL IX<br>PERSONAL X<br>PERSONAL XI<br>PERSONAL XII<br>PERSONAL XIII<br>PERSONAL XIV<br>PERSONAL XV<br>PERSONAL XVI<br>PERSONAL XVII<br>PERSONAL XVIII<br>PERSONAL XIX<br>PERSONAL XX<br>PERSONAL XXI<br>PERSONAL XXII<br>PERSONAL XXIII<br>PERSONAL XXIV<br>PERSONAL XXV<br>PERSONAL XXVI<br>PERSONAL XXVII<br>PERSONAL XXVIII<br>PERSONAL XXIX<br>PERSONAL XXX | <b>PRODUCTION</b><br>PRODUCTION I<br>PRODUCTION II<br>PRODUCTION III<br>PRODUCTION IV<br>PRODUCTION V<br>PRODUCTION VI<br>PRODUCTION VII<br>PRODUCTION VIII<br>PRODUCTION IX<br>PRODUCTION X<br>PRODUCTION XI<br>PRODUCTION XII<br>PRODUCTION XIII<br>PRODUCTION XIV<br>PRODUCTION XV<br>PRODUCTION XVI<br>PRODUCTION XVII<br>PRODUCTION XVIII<br>PRODUCTION XIX<br>PRODUCTION XX<br>PRODUCTION XXI<br>PRODUCTION XXII<br>PRODUCTION XXIII<br>PRODUCTION XXIV<br>PRODUCTION XXV<br>PRODUCTION XXVI<br>PRODUCTION XXVII<br>PRODUCTION XXVIII<br>PRODUCTION XXIX<br>PRODUCTION XXX | <b>RECORDING</b><br>RECORDING I<br>RECORDING II<br>RECORDING III<br>RECORDING IV<br>RECORDING V<br>RECORDING VI<br>RECORDING VII<br>RECORDING VIII<br>RECORDING IX<br>RECORDING X<br>RECORDING XI<br>RECORDING XII<br>RECORDING XIII<br>RECORDING XIV<br>RECORDING XV<br>RECORDING XVI<br>RECORDING XVII<br>RECORDING XVIII<br>RECORDING XIX<br>RECORDING XX<br>RECORDING XXI<br>RECORDING XXII<br>RECORDING XXIII<br>RECORDING XXIV<br>RECORDING XXV<br>RECORDING XXVI<br>RECORDING XXVII<br>RECORDING XXVIII<br>RECORDING XXIX<br>RECORDING XXX | <b>SCIENCE</b><br>SCIENCE I<br>SCIENCE II<br>SCIENCE III<br>SCIENCE IV<br>SCIENCE V<br>SCIENCE VI<br>SCIENCE VII<br>SCIENCE VIII<br>SCIENCE IX<br>SCIENCE X<br>SCIENCE XI<br>SCIENCE XII<br>SCIENCE XIII<br>SCIENCE XIV<br>SCIENCE XV<br>SCIENCE XVI<br>SCIENCE XVII<br>SCIENCE XVIII<br>SCIENCE XIX<br>SCIENCE XX<br>SCIENCE XXI<br>SCIENCE XXII<br>SCIENCE XXIII<br>SCIENCE XXIV<br>SCIENCE XXV<br>SCIENCE XXVI<br>SCIENCE XXVII<br>SCIENCE XXVIII<br>SCIENCE XXIX<br>SCIENCE XXX | <b>SPORTS</b><br>SPORTS I<br>SPORTS II<br>SPORTS III<br>SPORTS IV<br>SPORTS V<br>SPORTS VI<br>SPORTS VII<br>SPORTS VIII<br>SPORTS IX<br>SPORTS X<br>SPORTS XI<br>SPORTS XII<br>SPORTS XIII<br>SPORTS XIV<br>SPORTS XV<br>SPORTS XVI<br>SPORTS XVII<br>SPORTS XVIII<br>SPORTS XIX<br>SPORTS XX<br>SPORTS XXI<br>SPORTS XXII<br>SPORTS XXIII<br>SPORTS XXIV<br>SPORTS XXV<br>SPORTS XXVI<br>SPORTS XXVII<br>SPORTS XXVIII<br>SPORTS XXIX<br>SPORTS XXX | <b>TOOLS</b><br>TOOLS I<br>TOOLS II<br>TOOLS III<br>TOOLS IV<br>TOOLS V<br>TOOLS VI<br>TOOLS VII<br>TOOLS VIII<br>TOOLS IX<br>TOOLS X<br>TOOLS XI<br>TOOLS XII<br>TOOLS XIII<br>TOOLS XIV<br>TOOLS XV<br>TOOLS XVI<br>TOOLS XVII<br>TOOLS XVIII<br>TOOLS XIX<br>TOOLS XX<br>TOOLS XXI<br>TOOLS XXII<br>TOOLS XXIII<br>TOOLS XXIV<br>TOOLS XXV<br>TOOLS XXVI<br>TOOLS XXVII<br>TOOLS XXVIII<br>TOOLS XXIX<br>TOOLS XXX | <b>TRAVEL</b><br>TRAVEL I<br>TRAVEL II<br>TRAVEL III<br>TRAVEL IV<br>TRAVEL V<br>TRAVEL VI<br>TRAVEL VII<br>TRAVEL VIII<br>TRAVEL IX<br>TRAVEL X<br>TRAVEL XI<br>TRAVEL XII<br>TRAVEL XIII<br>TRAVEL XIV<br>TRAVEL XV<br>TRAVEL XVI<br>TRAVEL XVII<br>TRAVEL XVIII<br>TRAVEL XIX<br>TRAVEL XX<br>TRAVEL XXI<br>TRAVEL XXII<br>TRAVEL XXIII<br>TRAVEL XXIV<br>TRAVEL XXV<br>TRAVEL XXVI<br>TRAVEL XXVII<br>TRAVEL XXVIII<br>TRAVEL XXIX<br>TRAVEL XXX | <b>VIDEO</b><br>VIDEO I<br>VIDEO II<br>VIDEO III<br>VIDEO IV<br>VIDEO V<br>VIDEO VI<br>VIDEO VII<br>VIDEO VIII<br>VIDEO IX<br>VIDEO X<br>VIDEO XI<br>VIDEO XII<br>VIDEO XIII<br>VIDEO XIV<br>VIDEO XV<br>VIDEO XVI<br>VIDEO XVII<br>VIDEO XVIII<br>VIDEO XIX<br>VIDEO XX<br>VIDEO XXI<br>VIDEO XXII<br>VIDEO XXIII<br>VIDEO XXIV<br>VIDEO XXV<br>VIDEO XXVI<br>VIDEO XXVII<br>VIDEO XXVIII<br>VIDEO XXIX<br>VIDEO XXX | <b>WORLD</b><br>WORLD I<br>WORLD II<br>WORLD III<br>WORLD IV<br>WORLD V<br>WORLD VI<br>WORLD VII<br>WORLD VIII<br>WORLD IX<br>WORLD X<br>WORLD XI<br>WORLD XII<br>WORLD XIII<br>WORLD XIV<br>WORLD XV<br>WORLD XVI<br>WORLD XVII<br>WORLD XVIII<br>WORLD XIX<br>WORLD XX<br>WORLD XXI<br>WORLD XXII<br>WORLD XXIII<br>WORLD XXIV<br>WORLD XXV<br>WORLD XXVI<br>WORLD XXVII<br>WORLD XXVIII<br>WORLD XXIX<br>WORLD XXX | <b>WORKS</b><br>WORKS I<br>WORKS II<br>WORKS III<br>WORKS IV<br>WORKS V<br>WORKS VI<br>WORKS VII<br>WORKS VIII<br>WORKS IX<br>WORKS X<br>WORKS XI<br>WORKS XII<br>WORKS XIII<br>WORKS XIV<br>WORKS XV<br>WORKS XVI<br>WORKS XVII<br>WORKS XVIII<br>WORKS XIX<br>WORKS XX<br>WORKS XXI<br>WORKS XXII<br>WORKS XXIII<br>WORKS XXIV<br>WORKS XXV<br>WORKS XXVI<br>WORKS XXVII<br>WORKS XXVIII<br>WORKS XXIX<br>WORKS XXX |
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# HERE COMES HORACE!

Just when you thought microcomputer games had nothing more to offer, here comes Horace!

It has been said that Horace games are in a class of their own. In fact, the fact is almost a legend.

Horace is a cute, lovable, animated character who races through adventures, crawling holes, whatever he goes, and the goal never fails. Horace games are now available for most micro-computers.

When Horace was first introduced to computer users in the game "Sleepy Horace", he immediately attracted a following, winning the hearts of thousands of computer owners. Now, you can get away from the boring, pedestrian adventures of Horace.

The Horace series of games through the animated graphics, with the game play made micro-computer friendly for only \$2.95 per cassette.



## Horace's World:

Throughout the year adventures, Horace creates a name in the game as he gets the flowers, crosses the ground and moves from level. Family members and guests are

## Horace's World Series:

Get your Horace World Series. It's all in the name of Horace. When you're finished with a pair of levels, he has to sleep the night away until he wakes the next day. Horace is complete with a color display, music and graphics. It's worth it. Horace!

## Horace's World: The Horace's

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## MELBOURNE HOUSE



### Melbourne House Publishers

#### Spectrum

Spectrum version of Horace games are available from selected retailers at 149 South Eastern Highway in Geelong, Victoria 3210.

For more information, please contact us at:

Please send my name to:

Every day

Department

Name

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Periodically

#### Commodore 64

Commodore 64 version of Horace's World is available from selected retailers at 149 South Eastern Highway in Geelong, Victoria 3210.

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At Melbourne House Publishers, 149 South Eastern Highway, Geelong, Victoria 3210.

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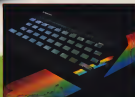
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# sinclair special

4



*Inside...  
Two special offers...  
Six new software titles...  
Microdrive!*

## Something for everyone, from Sinclair!

Welcome to another Sinclair Special! Even if you're not yet a Sinclair owner, I believe you'll find something of interest in this latest issue.

For instance, if you're looking for the best way to begin computing, turn to our back page. You'll see that leading Sinclair retailers are now offering the popular Z801 complete with a 128K RAM Pack and a free software cassette, all for £45. That means savings of at least £25 on one of the world's all-time best-selling computers.

These same retailers are also offering the ZX Printer at its regular price of £39.95, but accompanied by a free 5-roll Paper Pack, worth £11.95.

If you want to add even more speed and versatility to your ZX Spectrum system, you'll be pleased to hear that the new ZX Microdrive has now been officially announced.

Microdrives are being released on an order of priority basis. Spectrum owners who purchased direct from us will be sent order forms, in a series of mailings that began with the earliest names on our list of Spectrum owners. If you don't buy direct from us by mail, order, send us your name and address (use the coupon in this Sinclair Special). We'll add your name to the list, and send you a colour brochure and details on how to order.

Finally, if you're looking for more ways to use your ZX system, take a look at the software opposite. There are programs for programmers, a space-chase and car race for arcade-game players, a brand new logic game for those who've exhausted "the cube".

The Cuffed IQ Test is based on the definitive professional psychological test—and forms an accurate but easy way of measuring your own IQ. All the new programs are available direct from us, through the order form in this issue.

You'll see what I mean about Sinclair having something for everyone. And we'll have even more to show you at two forthcoming exhibitions: the PCW Show at the Barbican Centre, from September 26th to October 2nd, and the Great Home Entertainment Spectacular at Olympia, from September 17th to 23rd.

*Nigel Seale*

Nigel Seale, Managing Director  
Sinclair Research Ltd

# ZX Microdrive System preview!



## ZX MICRODRIVE

At least 65K bytes storage. Loads a typical 48K program in as little as 9 seconds. £49.95



## ZX MICRODRIVE CARTRIDGE

Compact, erasable, revolutionary. Complete with its own storage sleeve. Copying up to 50 files, with a typical access time of 3.5 seconds. £4.95



## ZX INTERFACE 1

Necessary for sending and receiving information from ZX Microdrive. Includes RS232 interface and local area network facility for 2 to 64 Spectrums. Attaches to the underside of your Spectrum. Purchased with ZX Microdrive just £39.95. As a separate item, £49.95.



# PSYCHOLOGY, GRAND PRIX RACING, BRAIN TEASING, PROGRAMMING, SPACE-BLASTING!

Sinclair have it all taped with six brand-new programs for ZX Computers!



**Chequered Flag**  
For 48K RAM Spectrum £5.95

Have you ever wanted to drive a Formula One or flat-out round a Grand Prix circuit? With Chequered Flag you'll need one eye on the road as close eye on the instruments, as you steer and brake to avoid hazards, and work through the gears in search of the lap or race record. This outstanding new program puts you in the driver's seat with stunning realism, and gives you a choice of three cascaded ten different circuits. Don't crash!



**Mothership**  
For ZXII with 128K RAM £4.95

Screen down the claustrophobic confines of the Zanyway. Engage automated drone fighters in deadly laser combat. Dodge duck and dive in a high speed 3-D race to attack the evil Mothership before she cleans your home planet. Mothership is a truly tough challenge, and test, furious fun!



**Cattell IQ Test**  
For 48K RAM Spectrum £12.95

Although there are a number of so-called self-administered IQ tests on the market, the only reliable way of finding your IQ has - until now - been to visit a qualified psychologist and take a battery of tests - for a fee. Now Victor Semenovskoff, International President of Mensa, has produced Professor Cattell's test in a form which enables you to use your ZX Spectrum to test your IQ.

The Cattell Scale IQ test is timed by the computer, marked immediately, and the marks standardised against your age. This is the first time that an accepted, standardised test has been available to the general public.



**Zeus Assembler**  
For 48K RAM Spectrum £13.95

A powerful and easy-to-use programming aid, designed to simplify the entire process of producing machine code programs, enabling you to write in assembly language instructions. Comes complete with comprehensive range of support facilities.



**Monitor and Disassembler**  
For 128K & 48K RAM Spectrums £12.95

This powerful Disassembler translates machine code into comprehensible assembly language instructions, allowing you to examine the NASIC ROM, to investigate the workings of the Spectrum or to analyse your own machine code routines.

With the highly versatile Monitor, you get an extensive set of facilities to aid the entry, inspection, modification and debugging of your own machine code programs.



**Floppit**  
For 128K or 48K RAM Spectrums £5.95

Like those cube games, Floppit looks simple. But its formulae are mostly results in the ultimate game of logic and patience. Test, turn and swap the nine Floppit pieces in search of the elusive magic square. But be warned, those pieces can be arranged in millions of combinations.

# TWO SPECIAL OFFERS FROM SINCLAIR STARTER PACK: £45

Powerful passport to home computing - now at the lowest price ever!

## ZXB1

Sinclair ZX81 - 800 000 sold so far!  
16,000 sensitive keyboard - black and white graphics - just plugs into most TV sets.  
With Z10-page BASIC manual - step-by-step guide to the world of personal computing.  
Normal price £39.95

## ZX 16K RAM PACK

Gives the ZX81 more power - the power to run sophisticated software like Flight Simulation and Chess. Normal price £29.95

## CASSETTE

Worth £4.95 or more in every starter pack, there's a top-flight 16K cassette - like Chess or Fantasy 100 - plus one of the valuable education series. Actual Silverline with great ability. And since you own your starter pack, there are 37 other Sinclair cassettes available (plus dozens from other manufacturers)

Look for the special packs at WH Smith, Boots, John Menzies, Currys and other leading Sinclair stockists. Not available by mail order.

Offers subject to availability while stocks last.



## ZX PRINTER AND FREE 5-ROLL PAPER PACK: £39.95



## ZX PRINTER

Designed exclusively for use with the Sinclair ZX81 and ZX Spectrum personal computers. Printing speed: 80 characters per second; 32 characters per line (4 lines per vertical inch). Plus graphics direct from screen. Now with a free pack of 5 rolls of special paper. Normal price £71.95

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Sinclair Research Ltd, Brackley Road, Cosfordley, Bury, MK7 0TH. Telephone: (0278) 832211

## How to order

Simply fill in the relevant section(s) on the order form below. Note that there is no postage or packing payable on Sinclair 81 Packs unless 38 days for delivery. Orders may be sent **PROPOST** (no stamp required). Credit-cardholders may order by phone, calling 01-300 0203, 24 hours a day. 14-day money-back option (Z81 Starter Pack and Printer and Paper offers are not available by mail order)

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Section A: hardware purchase

| Qty | Item                | Code | Item Price<br>£ | Total<br>£ |
|-----|---------------------|------|-----------------|------------|
| 1   | ZX Spectrum - 48K   | 2082 | 129.95          |            |
| 1   | ZX Spectrum - 16K   | 2083 | 38.95           |            |
|     | Postage and packing | 2028 | 4.95            |            |
|     |                     |      | <b>TOTAL £</b>  |            |

Z81 Starter Pack and Printer and Paper offers are not available by mail order

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\*To receive a charge/postal order made payable to Sinclair Research Ltd for £ \_\_\_\_\_

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Section B: software purchase

| Qty | Cassette                  | Code | Item Price<br>£ | Total<br>£ |
|-----|---------------------------|------|-----------------|------------|
| 1   | High Jump (Z81)           | 2029 | 12.95           |            |
| 1   | LLS Monitor & Test number | 2030 | 12.95           |            |
| 1   | Z81 Test Assembly         | 2031 | 12.95           |            |
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ORDER FORM

\*Please charge to my Access/Barclays and Postcard account no \_\_\_\_\_

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## ZX Microdrive information request

Please add my name to the Microdrive Mailing List, and send me a colour brochure with full specifications of ZX Microdrive/Interface 1  (tick here). You can use the above form to send us your name and address

MICROMEGA

3D



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## LUNA CRABS

by R. P. Meehan

Set on the moon, Luna Crabs is a two player board game for ages 10 and up. The game is played on a 10x10 board.

## HAUNTED HEDGES

by R. P. Meehan



3D

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Available exclusively through the MicroMega website

# Why the BBC Micro? It might be fairer to let someone else answer that question.

"The BBC Microcomputers are the backbone of home computers. The graphics are probably the best of any machine in this class. You are paying for a smart machine which would not disgrace the home of a professional."

*Video World, Feb '82*

"Its design has given the BBC Micro an unparalleled potential for business, educational and serious home applications. It has been equipped to function as the heart of a system which can be expanded to suit its owner's taste."

*W. David Mervin, Software Review, Feb '82*

"The most attractive and exciting feature of the BBC Microcomputer is its enormous potential for expansion which will allow a highly expensive system to be built-up."

*Andrew Corbridge, W. David Mervin, June '82*

"They (the graphics) are tremendously exciting, and they are one of the features that make this machine stand out head and shoulders above everything else that is available in the market place at this time."

*Steve Parker, Educational Computing, May '82*

"It is expandable and has a powerful BASIC. It has superb sound and graphics, the software is readily available and the price is right."

*W. A. Allen, a BBC Micro owner from Hampden*

"The boxes are easy to follow. We wife has developed a program for teaching our daughter French vocabulary. Our daughter uses it mainly for games and simple programming."

*Dr. J. Inwood, a BBC Micro owner from Leighton*

"It is a very powerful computer. My husband has written his own data base. I have been writing programs and programming games. Even the children have written small programs."

*Mrs. J. M. Thomas, a BBC Micro owner from Devon*

"No other computer can offer such ease of use when dealing with complex control effects."

*W. David Mervin, June '82*

"It isn't often a journalist can sit down to write about a computer with the certain knowledge that he has never seen a nicer machine."

*Les Keen, a Personal Computer World, Dec '82*

"It has got huge potential. Besides playing the games, the whole family are learning basic programming."

*Mr. J. S. Green, a BBC Micro owner from Southwicks*

"Everything possible seems to have been done to ensure that this is not a dead end machine..."

*Paul Davies, Personal Computer World, July '82*





Perhaps we could just add that the BBC Micro is the machine which was chosen to beat the hearts of the BBC's massive Computer Literacy Project.

It is also the machine which, having won the Department of Industry's blessing, will account for over 80% of the computers bought by British schools this year.

And now, for some facts about the machine itself.

The BBC Micro is light, compact and, with a conventional electric typewriter keyboard, easy to get the feel of.

It can be loaded from virtually any cassette recorder. And there is a wealth of ready-made programs available covering games, education and business subjects.

The BBC Micro uses BBC BASIC, a sophisticated version of the most popular computer language.

However, as your confidence and fluency grow, it can be adapted to switch to other languages.

It can also become a word processor, with the facility to link with a word processor for high-powered business use.

A disc drive unit can also be added. And with an adaptor, the BBC Micro is the first micro to be able to pick up programs from the Microcom-Protext system. Another adaptor converts your TV into a Teletext receiver, with further ability to download programs.

#### All this for only £399

The most sophisticated version of the BBC Micro, the Model B, is only £399. The basic Model A is £299. (Both come with a "Welcome cassette" and comprehensive introductory manual.)

They are both available from John Lewis, selected branches of Boots or local stockists.

Alternatively, if you would like to order a BBC Micro B with your credit card, or if you want the address of your nearest stockist, just phone 04-280 0200.

Or, you can buy a Model B by sending off the order form below to: BBC Microcomputers, c/o Vector Marketing, Devington Estate, Welbournborough, Northants.

Your order will be dispatched by fully insured courier.

Finally, you can also use the coupon simply to get full details of the articles from which the press cuttings featured have been taken.

 04-280 0200 credit card holders.

To BBC Microcomputers, c/o Vector Marketing, Devington Estate, Welbournborough, Northants, NN8 2BL.

Please send me more information on the BBC Micro. Please send me \_\_\_\_\_ BBC Model B Microcomputers at £399 each, inc. VAT and delivery.

I enclose P/B cheque payable to Acorn Computers Limited Readers A/C, or charge my credit card.

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Registered No. 148 885/2374 20/04/82

## The BBC Microcomputer System.

Designed, produced and distributed by Acorn Computers Limited.



# TOP TEN

Available from your favourite software retailer, or direct from the publisher: **MATTHEW THOMAS** 0521 761 7671



Millers Point, Canning Place, Liverpool L1 8JF Telephone



**ADMIRAL GRAP GYPS**  
by Simon Marsland  
Machine: ZX1 1981  
Spectrum 4.5k

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Marsland  
Machine: ZX1 1981  
Spectrum 4.5k

**SPECIAL MISSION** by  
Toby Ferguson  
Machine: ZX1 1981  
Spectrum 4.5k

**GIORGIO MARCHI** by  
Gordon Marsland  
Machine: ZX1 1981  
Spectrum 4.5k

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**NEW**

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The most advanced chess program ever developed for the Spectrum. It's a real chess program. It's not like any other.

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# AMSOFT

## MACHINE CODE, ASSEMBLER, AND BULK DATA HANDLING SYSTEMS FOR THE SERIOUS SINCLAIR USER

### NO EXTRA HARDWARE NEEDED

**AM-ZORLE** allows you to create data files of unlimited size on cassettes from your own basic programmes. You can read and write files in the same program, and use tapes just as if you had a big machine. Ideal for club records or small businesses.

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**AM-ZXMON** is a superb machine code monitor and operating system which allows you to create, edit, run, and checkpoint machine code routines, and to save them on tape. You can build libraries of your own routines on tape, and merge them into new programs. **AM-ZXMON** is the operating system for the other programs below.

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On the **ZXBI** you can create assembly language source tapes and assemble them into machine code using **AM-ZXEDIT** and **AMAZON** running under the control of **AM-ZXMON**. **AMAZON** can assemble programs of up to 6K in size at one time, and accepts user symbols, hex, decimal, and string constants and the full Zilog nomenclature.

Combined pack, two tapes, of **AM-ZXEDIT** and **AMAZON**, for **ZXBI** £9.00

On the Spectrum **AM-SOZOR** is a combined editor/assembler with all the facilities you need to assemble and save machine code programs fast. It can be used to create, edit, and assemble up to 1600 lines of assembly language text at one time to produce up to 4 k of machine code. The code and source programs can be saved on tape for later use or for merging with other programs. Output tapes can be added to BASIC programs by the LOAD CODE command. Code can be assembled to run at any address, at a speed of 800 lines/minute.

**Spectrum** version £10.00

**AM-ZXZORNY** will load tapes created by the **ZXBI** versions of **AM-ZXMON** or **AMAZON**, and load them into the Spectrum, the easy way to transfer machine code from one to the other.

**Spectrum** version £4.00

All prices include VAT, post & packing. We provide a professional advisory service from 9.30-5.00 Mon-Fri and 9.00 until 12.00 Sat.

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## DAKLEAF COMPUTERS LIMITED

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For some time a specially formulated professional quality data tape has been available to software producers and duplicators. This high quality tape has been specially formulated for micro based data storage systems. With the rapid growth of home-computers and the unavailability of most audio tapes used in short lengths, it has been decided to make this tape available to the general public under the name of PIRANHA.

The PIRANHA computer tape will soon be obtainable through selected retail outlets, but to give you a taste of the PIRANHA's astonishing data performance we are launching a short mail order campaign in the leading Micro magazines where we are offering a limited number of PIRANHA computer cassettes of an amazing price.

# piranha Computer Cassettes

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Please send the following DC 15 cassettes:

- Pack of ten of £3.99 plus £1.00 p.p. No.   
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MC 10

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**A micro technology breakthrough.**

And now a few reasons for adults why

**NOW WE'VE MASTERED MONSTERS,  
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MANAGEMENT**

the Electron is such an exceptional machine at the price.

The Electron is neat and compact. Yet it is fast and powerful. (Full details, for the technically minded, are in the box opposite.)

It produces high quality sound using its own internal speaker.

And it offers a range of facilities many larger more expensive machines just cannot match.

For example the Electron's colour graphics have the highest resolution of any home computer.

This is because the chip that controls the graphics, specially designed by Acorn, is one of the most advanced of its kind. As a result,

the Electron delivers twice as many characters across the screen as its closest competitor.

**Both to use and to grow.**

The Electron has been designed and built to be a permanent part of the family, year in year out.

Particular care has been paid to the keyboard. It is electric typewriter style robustly constructed with a good solid 're-CH' has a space bar and single entry keys for key commands.

In other words it's comfortable and easy to use, avoiding the need for the manual gymnastics sometimes associated with calculator style key boards.

And it will grow with you via expansion modules, that Acorn are developing, to take peripheral additions such as printers and disc drives. So as your knowledge, interest and ambitions develop, the Electron can develop with you.

Additionally, to give you all the support you'll need to generate your own applications software, we've established a phone-in service attended by specialists to give advice, encouragement and practical help.

**A gentle teacher.**

The Electron plugs straight into virtually any TV set and cassette player so you will be



ready to go as soon as you get it home.

It comes not only with a comprehensive user guide, which describes the machine and its functions, but also with a book that takes you step by step through the basic principles of programming.

A free taste of universality.

You will also receive an "Introductory" cassette which will put the Electron through its paces, showing you a little of what it can do with its 64k of memory (32k ROM, 32k RAM).

The cassette will give you a taste of those exceptional colour graphics we mentioned earlier, of its ability to play and compose music, and show you how it might help in home accounting. It will challenge you to a few games and will, if you ask it, do your whole family's hourly tasks in a matter of seconds.

You will in short, through the 15 separate programs it contains, get a glimpse of the Electron's potential. But only a glimpse, for that potential is as limitless as your own interest and imagination.

A widening range of software.

To help you realise some of that potential, Electron software already ranges from "Personal

Money Management" through "Starship Command" to "Creative Graphics" (which, incidentally, includes some spectacular three-dimensional rotating shapes). Naturally, with its strong educational links, educational software will be extremely

EXPERTS LIKE "WHAT MICRO?"  
AND "RATE THE ELECTRON"  
HIGHER THAN ANY OF THE  
COMPETITION



important for the Electron and even now O and A Level revision papers are being processed for Electron users.

How to get your Electron.

The Electron is available from selected W H Smith and local Acorn stockists. However, if you would like to order one with your credit card, or if you would like the address of your nearest supplier, just phone 01-260 0200.



The Acorn Electron keyboard

**Hardware:**  
240k core;  
3.5, 10 1/4, 32k RAM (64k avail)  
High resolution graphics (640 x 256 dots,  
Screen display modes,  
8 colours and 8 lighting colours,  
2800 baud CDT-type interface with master control,  
Expansion slots for add-on interface modules,  
Internal keyboard  
FNL LHF output in colour or black and white (dedicated TV  
RGB output for colour monitor),  
On top full travel QWERTY keyboard with speaker

**Software:**  
ROM BASIC.  
3 accessories include integer floating point and string variables, multi dimension arrays (0-255 x 65536), arrays, 0-255, procedures with local variables,  
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The Acorn  Electron.

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The light pen is supplied with a control interface in order to adjust the sensitivity/pen position.

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Internal fixing for spectrum keyboard case.

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# The Hobbit. Now the best is

After a year of reviews that told me The Hobbit was something that I was going to enjoy, the reviews that I did not read for a while told me again and again that I felt that all the time that I spent on an added to my enjoyment. But now I am looking back on the reviews of the game and feel that I have become a fan of the Hobbit and a fan of the game.

**MR J STERN** *Hobbit*

I have at last enjoyed your Hobbit program and wish like to congratulate you on its excellent play. After four days of rest and tears, I have just finished it at 10.0 pm end of the adventure. The program has lived up completely to expectations, and there is no doubt about it being the best production for the Spectrum to date. You have surpassed all other titles in my opinion.

A lot of fun

**COMPUTER**

The excellent game The Hobbit is a fantastic game that is easy to play and fun to play. It is a great game for the whole family and is a great game for the computer. It is a great game for the computer.

**POPULAR COMP**

I am writing to you because I have enjoyed your Hobbit program. I have enjoyed your program and I have enjoyed your program. I have enjoyed your program and I have enjoyed your program.

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I have enjoyed your Hobbit program and I have enjoyed your program. I have enjoyed your program and I have enjoyed your program.

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I have enjoyed your Hobbit program and I have enjoyed your program. I have enjoyed your program and I have enjoyed your program.

**COMPUTER REVIEW**

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**CHRISTINE VERHAAR** *Hobbit*

I have enjoyed your Hobbit program and I have enjoyed your program. I have enjoyed your program and I have enjoyed your program.

**VIEWPOINTS**

This is an important and dedicated Adventure game which makes good use of the Spectrum's colour graphics. They have not only produced one of the best games for the Spectrum, but given everyone else a lesson in good game design.

**PERSONAL CO**

I am the owner of a copy of The Hobbit which is wonderful entertainment and very challenging. I have other tapes and software of yours, all of which are excellent.

**MR D J BASHFORD** *Hobbit*

Having received the most excellent piece of programming I have ever seen, I have had no time to stop playing. The Hobbit has been demanding our lives since January and many nights have been spent until 3 o'clock trying to conquer it.

**LINDA ROGERS** *Adventure*

I have recently purchased your magnificent adventure game The Hobbit. It is a great game and I have had no time to stop playing. It is a great game and I have had no time to stop playing.



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I am the proud owner of your excellent  
 program 'The Hobbit' and have spent  
 many happy hours, with my children,  
 hours trying to solve the puzzles.



...d for my ZX  
 ...you supply called  
 ...to excellent  
 ...the money I had  
 ...my wallet. The  
 ...sincerely. It took  
 ...book, which is  
 ...is very compelling

**JOHN CASSON** Essex  
 ...ng recently purcha... a Sinclair  
 ... I have decided to buy 'The Hobbit'  
 ... I have been doing a literature project  
 ... based on 'The Hobbit' with my class of 10  
 ... and 11 year old children. Over the last 30  
 ... weeks the children, having read the book,  
 ... have been attempting the program with my  
 ... assistance. Let me congratulate you on a  
 ... most entertaining program.

**MR. G. REID AND OLIVE J**  
 ...llingham

... more of an experience than a  
 ... program!  
**POPULAR COMPUTING WEEKLY**  
 ... the most enjoyable factor of this program  
 ... is that the user instructs the computer in  
 ... completely ordinary English sentences. The  
 ... Hobbit program is capable of very  
 ... sophisticated conversations.

**JOHN CASSON**  
 ... I purchased 'The Hobbit' not long ago and  
 ... since then I have been engrossed in the  
 ... game, and I'm beginning to think no one  
 ... wants to talk to me as I talk about my  
 ... adventures in 'The Hobbit'.

**DAVID ROWLEY** Essex-on Trent  
 ... The use of graphics is one of the features  
 ... which makes 'The Hobbit' special. The  
 ... addition of graphics allowed us three whole  
 ... whole new dimensions to the Adventure. It is  
 ... certainly a marvellous game, which should  
 ... set the standard for future Spectrum  
 ... adventures.

**JOHN CASSON**

... I would like to thank you on a  
 ... I have enjoyed  
 ... I must thank you  
 ... I must thank you  
 ... I must thank you  
 ... I must thank you

**MRS. J. BYDRAFT** Northampton  
 " 'The Hobbit' is a beautifully re-  
 ... created, it is so full of exciting  
 ... moments, gloriously beautiful,  
 ... thoroughly exciting adventure - far  
 ... better than I could have hoped for and  
 ... certainly the finest of the dozen or so  
 ... adventure programs I have to date. I  
 ... congratulate the four who worked for  
 ... a year and a half to create such a  
 ... superb result."

**MR. PETER JONES** Southsea  
 " Nothing is more to this Adventure,  
 ... but (unintentionally) add to this the  
 ... brilliant graphics that are used to  
 ... describe many of the locations and we  
 ... have an Adventure that, if going to  
 ... become a classic for the Spectrum  
 ... POPULAR COMPUTING WEEKLY

" I am writing to congratulate you on  
 ... your excellent program 'The Hobbit'  
 ... for the Spectrum. I make up to the  
 ... middle of the night with an idea, and  
 ... have to lead the adventure to try it  
 ... out."

**MR. PHELIP HARRIS** Southsea  
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**SAM BISHOP**

" ... we are not making food, we  
 ... are being sleep and it's great. I  
 ... think you can give why life isn't  
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## Your Computer Atari competition

### ACROSS

- 1 The machine built marked for making parts (7)
- 2 August and a girl with a top? (7)
- 3 Delay when? (2, 4)
- 10 Teaching of the law is being given (10)
- 11 Atari refers to the most... word (3-4)
- 14 Love the kind in Peter to use the computer (7)
- 16 50/50 in word-mean definition (7)
- 18 It's a kind of ball struck but with striking power! (7)
- 19 Yes — quickly becoming round the stadium (7)
- 20 Strong mathematical space — shows how... in some (4)
- 21 Output because I was pressed wrong! (7)
- 22 The sound/singing off for the statement a job (7)
- 23 Atari and a number with the top (3, 2)

### DOWN

- 1 Bug an officer or find title in a magazine (8)
- 2 Electronic lines with a striking feature (7, 4)
- 3 Multisyllable sentence that is marked by 11 words 4-6 and 13 words 10, 15- 12
- 4 Total a business growth (8)
- 5 Copies in squares (8)
- 7 Steps in 1980? A 62 (2, 7) (4)
- 10 Saw the delicate and hollow plate (8)
- 12 Saw my cousin at some time (8)
- 15 Member entering the bodyguard (8)
- 17 Took away the last group or over an area (8)

Your Computer Atari competition

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Atari  
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House

Your Computer Atari competition

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- The winner of the competition will be the person who enters a correct solution to the crossword and, in the view of the editor, completes the unfinished sentence in the most interesting way.
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## ATOMS LEFT BY THE Wayside

Two months ago I purchased an Atari 5200. After many weeks of careful thought about which computers were available for the time I was sure I had made the right choice. I felt that I had bought the ideal recreational and games computer to use with my family and by myself.

Now it is becoming increasingly more apparent to me that Atari's success has been due to the expertise by AtariSoft and the excellent software component. In light of the newer more popular computers:

When I purchased my Atari, it was quite popular with many programmers and much software was available.

Nowadays there is hardly anything available for my computer. I can write software in BASIC paired with CROM-style for what is now a piece of hardware not covered by its programmers.

What I am wondering, is how long will it be before Spectrum and Model B owners feel themselves in the same boat as myself?

All I ask is that the programmers and manufacturers think of the computers that have been on the market, every year as a whole. Also how about, *Top Computer*, publishing an update for — maybe only once a quarter — of software currently available for the various machines and, "The-News" machines, along with contact addresses of where we can purchase the software.

*M. Johnson, Portland, Oregon*



Send the program listing to the appropriate price in the article, and be the winner!

**WIN A COMPUTER**  
to appear and save quickly break the program. Move change all calls to New, then add the first line by adding three bytes to the address given in the listing. This can be done by a few simple steps:

- Address 21750 = 42 (internal)
- 21998 = 42
- 22000 = 42
- 22002 = 42
- 22004 = 42

Can you find the program to follow and then should be an extra obstacle between you and the *Microphone* program. You could, of course, spend up the listing and bring by using a modified version of *Texter*. This is the program from the March 13 issue of *Four* Computer.

After the program to load along *BASIC* and *Microphone*, then:

- 0000 00
- 10 REM MICROPHONE
- 20 DIM A(100)
- 30 READ A(0) TO A(100)
- 40 READ A(0) TO A(100)

Use the well known text loader to enter the following machine code: 4000 2A 00 10 00 00 00 00 00 00

4000 1000 10 00 00 00  
4000 10 00 00 00 00  
4000 00 00 00 00 00

4000 10 00 00 00 00  
4000 10 00 00 00 00  
4000 10 00 00 00 00  
4000 10 00 00 00 00  
4000 10 00 00 00 00  
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4000 10 00 00 00 00

This will, when done, load the code above into MEM, then it will show *BASIC*, then *Microphone* to 131 and open up the basic program.

*Herbert Kahlert, Irvine, Germany*

## SHARP TONGUE

I am one of those lucky few owners of a Sharp MC 100 computer. It serves my purposes very well, with only a few shortcomings, and the best of which is "Sharp" itself.

So, I read the July review of the "new" MC 100 with some interest.

This has been available some time before in Japan, where it has sold very well. In fact, it competes with BBC and CTR in market share. The Japanese distributor has the custom of Japanese computers in Japan. But then in the marketplace, I am sure the MC 100 will work without any problems. (It is not built and probably all the bits and screws of the world.) It will make basic and spreadsheet software's confidence. Still, the average buyer here is quite on faith, voltage and lights, which is not always favorable of several other areas. This is why the MC 100 will not appear overseas.

My only impression on seeing it last January in an Osaka store was of a somewhat MC 100 with color. It would be at least 12 months later in these 12 months, how many loyal Sharp owners have forsaken their old old MC 100, as well as the owners, (I don't know) because they are so likely to return, return. Meanwhile, what has Sharp been up to?

Well, not supporting its product fully. There is some difference between the present requirements and its overseas subsidiaries. Sharp Japan will continue their for its systems to sell various built-in systems, various companies supply a few range of additions, software and programs. For example, I own several other Sharp, a 1000, BASH and for the MC 100, Japanese and

color cards for all the models, and even a 1000 conversion kit.

In Britain, Sharp only has a few large amounts of such things. The MC 100 is Japan has few Sharp, the few large amount Sharp have and it will and various Microsoft Basic from the Machine Company of Sapporo City, it seems that the latter — perhaps in copyright issues — has not survived the city. However, how much better than very worthy computers would have sold here if there had been similar support!

Perhaps Sharp, with the 100, is making a slow and gradual withdrawal from a low performance personal computer market in the U.K. The introduction of the MC 100 into your market of last year may be a good pattern for its remaining Sharp owners.

*Alan D. White, Reading, Britain*

## FILES HEADACHE

As my middle age I was lucky enough to discover a copy of *Texter* Computer at my local newspaper and I have not missed any of its monthly issues ever since. I greatly appreciate the news on various applications — particularly those in machine code — current of the world's many computer games.

What gave me a bit of a headache was David Hill's Tape File program and I found that the MC 100 seems to be using a 2K-41 with an old ROM. So, for all your readers who purchased their models after the fall of 1981 here is what can be done to fix it.

## PLAYING THE 1802 OVERTURE

Following the launch of the Coma II and the numerous disappointing remarks that have been leveled at us CPU — *May Computer*, August — I feel I must thank you as my only fan and make a stand for the CPU 1802.

To start with *Mc Pico* refers to the 1802 as an extended CPU.

If this is the case an old there is no doubt that the 1802.

How many CPUs have an instruction set where all instructions are either one or three machine cycle long? How many CPUs have user-definable program counters, stack pointers and? How many CPUs have seven input and seven output lines available. Such many CPUs have a single bit register that is provided simply for the use as a flip-flop?

How many CPUs are address a full 18K and jump to any address within that block on a single instruction? (I should mention) How many CPUs have a carry flag? If it is a 24-bit block that can be set and then you are at address 0. Finally, if it is that old has why is there an output the work as CPU?

The Basic on the Coma is probably also best that if you want speed you use machine code or Fortran. Most you I do with I could find a machine of the Coma as I could give it a try because I do not believe it can be much slower than Sharp SP 1000 Basic.

I am not impressed with RCA in any way, it is just that having used SC-MP, 6400-600, 6760, 6700, 240 and just 1802 based machines, I have found the 1802 was the most productive in its response to my comments.

As a newspaper publisher why is every machine apparently concerned with its ability, or otherwise, to support them or drop off the face of the globe? Of course the real answer could be that as 5%, I suspect that I am not a model programmer. Still I do not think *Four Computer's* preference is one of the others because it is readable — a major enough than they.

Finally you probably all remember when you get your first computer have the nightmares all about "What do you use it for?" Well at a recent evening show on my local radio club stand, I got involved in a conversation with a young boy regarding computers.

He possessed a Dragon, and when I asked my assistance in this, he immediately asked what games I had for it. On being told that I had none, one — he said, "No" — he looked most shocked and asked me, "Well what do you do you do with those that if you do not play games?" Obviously I'm getting old.

*Bob White, Reading, Eng*



# EDITORIAL

they might not like the idea of downloading their IBM PCs the first of having the other computers. This problem is solved easily by typing the following:

MODE=IBM PC/XT/AT

This will change RAMdisk to D:, so as far as your Auto is concerned you are not even using a RAMdisk!

Now the loader will run as if there is no RAMdisk installed, so you can program the computer as if you had the standard 80 K RAM.

Once you have your program, it will run on any loader. And if loading it as you would any other program.

At Capital  
Liberation  
Group

## COMPILING SINS

I was amazed when I saw that you were publishing a computer for the ZX81. I was in the range of having one and it was with excitement I bought Acorn's advice. The machine only being as difficult, but after six hours I had a 11 hours in an editor's manual using Richard Taylor's Quick Load program - then Four Computer Jobs.

The compiler seemed perfectly. I was very pleased about will found able to use the editor and OPER sources of Basic, as well as the Basic Pac/Turbo routines. Unlike most manufacturers programs, you can break out of the program using the Break key. This can be disabled by the direct extension.

FOUR LOAD T2  
FOUR LOAD B2

The advice in the compiler do not tell you that the program must not have a Stop command, as after the compiler will stop with an error message. The Break key can be used to stop the program by:

FOUR STOP C2  
FOUR STOP B2

These values are at the address the computer will jump to when the Break key is pressed, and when obtained by using the machine code editor of Turbo Hall in Four Computer, March.

Paul Hudson,  
Swindon,  
Wiltshire

Notwithstanding the more interesting than preparing peak computers for girls and this may be boys, but if such a future suggestion actually led more girls into computing it might even be worth taking seriously.

Of course it is exactly the kind of peak and the amount which has at the root of the problem. While this goal is being given little, the goal that boys play will make the late investment in computer about cheap games may not materialize.

In general, mechanical and technological needs are the boys, and girls who take an interest in them are considered maintenance. A check of recent surveys gives statistical substance to this sorry state of affairs.

Clowley's report published early this year showed that the father and son partnership makes up 88 percent of home-computer owners. New research from Acorn paints from a similar message.

In all the families that have computers you will find that boys are 13 times more likely to be using them than girls.

Because the boys are putting in the extra work at home they pull ahead in the classroom. This discipline which little maintenance the girls have, and makes them more likely to become discouraged and so even more likely to drop out.

Some schools have decided to take the matter into their own hands. They have given the a form of positive discrimination by setting computing classes for girls only. This is an attempt to get away from the idea that computers are male machines.

The problem is not a particularly British experience either. Across the Atlantic, researchers at California's Stanford University found that three times as many boys attended computer summer courses than girls - and that it had been particularly in 11 classes from 1976 to 1978 that

if being treated as companion to school depends ultimately on creating a child's imagination at home, then creating software for the home computer is appeal to girls as well as boys will clearly be of key importance. To do this the software houses will have to produce more than just arcade game "wrap-ups. But of course that idea can't rely on all games - according to Acorn Pac-Man has a large following among women.

Most of the programs that have so far been written for women and girls have either been programming or the use of applications (either carried out with a pen and a piece of paper. Recipe storage is used planners are typical).

Perhaps the real problem with the kind of software is that because it is consciously aimed at females it often founders on the gaping gap of sexual stereotyping. After all, most commercial programs are not designed to appeal to boys exclusively, so why should the reverse be necessary?

If some enterprising software companies manage to increase the proportion of female computer enthusiasts at all, it would not need to be done from the highest moral principles. A software software market - at least the sort of the training one - is waiting to be tapped.

Acorn's findings revealed the only four percent of home users are noted by the modern language the use of spending power that would be released if that figure were improved to even 30 percent.

Although women could benefit considerably from computers, it is clear that the female-dominated job areas are the most most under threat from new technology. There's some little about but to catch the wave over from junior and start computing before the boys get exclusive facilities a permanent solution.

## How to write for Your Computer

We called this magazine Your Computer precisely because we welcome your views, tips and hints and even your criticism of machines and software in general. If you would like to use your name in print, whether on a Software File program or a full-blooded article, here is how to go about it. Ideally, all articles should be typed double spaced on one side only of uniform sheets of paper. If listings can be dumped directly from a printer - you can always use a friends or user group's

has, you must use the rule of error - in a perfect world a cassette would accompany the article. That considerably speeds up the check-out process. Not only do you get to air your own discoveries and opinions, but we will even play you for the postage. We pay £35 per published page - that's on it appears in the magazine and includes first class.

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The article concerning the ZX81 See More articles in September requested to maintain those available which need to be supplied since shortly from the editorial. What you may be asked to do is to provide a list of the articles from the following categories:

LET C2 = 12 issues  
LET C8 = 12 issues  
LET H2 = 12 issues

Some of the specific categories in the September's Software program has not been listed printed to give full the categories are: Categories C and H and H. It is to be noted that the categories in graphics 8.

## Advance into IBM country with a home micro with recognised business potential

With 128K and a 1MHz processor for the price of a BBC Micro the Advance looks almost too good to be true. The Advance sets out to be a good home computer with speed and power plus cost and includes high resolution but the real advantage comes if you wish to upgrade to a full size board system when you can afford to.

For a further 2500 you can upgrade to the Model B with two floppy disc drives and the capability to run software from the IBM Personal Computer. The total cost will be £3,200 - a third of the price of an equivalent IBM PC, yet the Advance Model B is based on a 40 percent faster than the IBM because it has an 8MHz central processor, and it will prove much more of the best software available, WordStar, dBase, and dBase, and dBase included in the package.

Initially most Key Computer dealers will be more concerned as the 128K Model A because the keyboard is designed to compete with professional machines it is of a far higher standard than those computers are used to.

It is separate from the main control board which is housed in a sliding unit, although you can save the sliding keyboard in the case for storage.

The Advance is being built in Broom, the name Main Computers



Model B, and the extra board, two floppy, and having a Personal dBase.



## Price war hots up and NewBrain bites dust

The most costly item of the home computer price war are now being covered. Grundy Business Systems, manufacturers of the NewBrain, has gone into liquidation, while its customer performance of the Dragon 32, Dragon Data has been forced to arrange a bid of £1.5 million.

Further up the market scale,

Debut who produced the 8m portable Business computer, the Delta 1, has also collapsed leaving debts worth £1.5 million. The debtors are now beginning to consider if an Apple spokesman Apple was planning to sue after the latter end of the home computer market but has now decided to hold

## Spectrum Stewart's naps beat the bookies

SEVENTEEN Year Old David Stewart's horse racing prediction program for the 1985 Spectrum has a 48 per cent success rate a perfect success - certainly a higher rate than that achieved by most seasonal tipsters.

Ralph Chivers had heard about young David Stewart's tip before this year. Recently the national daily took up the story and he is now under contract to the Sun to supply the paper's readers with these tips a day.

David says that in many points we are looking for selections that they are influencing the odds dramatically. This is not a problem that troubles him usually since he does not bet himself. He says he gets pleasure simply from writing programs and picking winners.

In fact, last year he completed the program during which he achieved a very creditable over the last three years. The current program is 50K long and runs in data files which together hold the details on over 11,000 horses. The program runs for three quarters of an hour before a show-up the day a likely winner.



David Stewart's success, calculating over any has to date on the BBC. He is not a tipster and the possibility of a good prediction program.

## Elan Enterprise warps in to add a new dimension to the £200 computer market

Increasingly sophisticated Elan Enterprise looks like the computer we have all been waiting for. The only problem is we will have to wait some. Agreed or not, out of it is as good as it comes.

The Elan has higher resolution graphics than the BBC Master, with a percentage of 611x510, across 16 types of raster colours in its current mode, 256 on off, and 192 of memory available in the year since this is our very best computer.

As the Elan also has a built in word processor and a price tag of just £200 it is no wonder that Savilegate Software's David Levy is confident it will sell well. "It is one of the best bargains in software," he says, and he is quite confident that his team has not only achieved the expectations — it has produced the best three programs in a month, Cyber — for the hardware. One of our experts designed the Acorn Image, another designed the Master.

The Elan has a real keyboard although the best is one you go on to that of the Electron in Commodore 64 and a built in speaker which can be used either to make word processing easier or for



game playing. The Elan is still available in a 128K version, and with the 64 and 128K versions can be expanded up to 4 Megabytes of RAM using page stealing.

The Elan has a 2-MHz processor rated at 6MHz and has a 128 Kbytes cache on a 6501 chip. It has a fixed in-circuit programmable fast channel through eight access levels

a device option. Output is through the TV speaker but you can also plug a pair of Walkman headphones into the stereo socket in the back.

When the Elan is launched in April there will be plenty of software.

The Elan also has two cartridge and two floppy ports, RAM, Commodore and local network interfaces and one control via

memory to make comprehensive. The keyboard has eight definable function keys.

Elan will also be selling two 3.5in floppy disks which will plug into a Base 120 which can also take additional RAM modules and other peripherals. The Base 120 connects to the Elan through a 40-way connector.

While other manufacturers are working on later models for next year the Elan seems to set a high price when its basic computer has gone before but it is offering the best of all the existing computers a table for more for a fraction of the price it would cost you today. Let us hope it does not turn out as good as it looks.

## BBC, Oric and Atom learn to speak with the Microtalker

Microtalker is a common interface with a low cost speech synthesizer compatible with the Oric, BBC and Atom, and seems to be available for other systems, too.

The Atmel-based Microtalker plugs into the BBC's own port and the Oric and the Atom. On the latter two machines a separate using standard printer commands. For the BBC a simple driver module consisting of about three lines of assembly is used.

Based on the VO SP3-216 speech synthesis chip, the J40 Microtalker has built-in amplifier, volume control and speaker and can

be obtained with documentation software from RPS Electronics, Sutton, Wokingham, Ashley Lane, Slough, West Yorks in Telephone 0274 708190.

If you are trying to turn your Spectrum into a filing system you have probably already discovered that you need a controller as automatically Load and Save stacks of information. Ideally the world shows you an external unit like Transfers to the Spectrum so that a program could take new data from your cassette and fit it on a database or another cassette. The Nova Micro Systems Tape Control is designed to meet the need. The CPU controller plugs in between the cassette sockets of the computer and the control and volume sockets of one or two cassette recorders. It also doubles as a tape amplifier for the Spectrum's sound channels.

## Horace and Hobbit move

Two of the most popular characters in Spectrum games are moving to other machines. Hunger-Horace and The Hobbit have both followed Horace's more popular Spectrum games but now Horace is moving on to the Dragon 32 and the Commodore 64. Meanwhile back on Mobile Earth, The Hobbit, which was killed in the last midnight extension game when a fire appeared, has moved on to the BBC Master, Commodore 64 and Cui



## YOUR COMPUTER TOP 20

| Game                | Company         | Machine  |
|---------------------|-----------------|----------|
| 1. Adventure        | Imagine         | VO-60    |
| 2. Chess            | Smile           | 2048     |
| 3. King             | Imageworks      | VO-60    |
| 4. King             | Imageworks      | 2048/60  |
| 5. Book             | Smile           | Apple    |
| 6. Death            | Smile           | 2048/60  |
| 7. Death's Mountain | Smile           | 2048/60  |
| 8. Magic            | Smile           | 2048/60  |
| 9. Overlords        | Origin Software | Apple    |
| 10. Overlords       | Origin Software | Dragon   |
| 11. High            | Origin          | Spectrum |
| 12. Spectrum        | Origin Software | Dragon   |
| 13. Hobbit          | Origin Software | Spectrum |
| 14. Hobbit          | Origin Software | Spectrum |
| 15. Horace          | Origin Software | Spectrum |
| 16. King            | Imagine         | VO-60    |
| 17. King            | Imagine         | BBC      |
| 18. King            | Imagine         | BBC      |
| 19. King            | Imagine         | BBC      |
| 20. King            | Imagine         | BBC      |



## Sir Clive joins the monochrome set — this is where the flat screen revolution starts

Sir Clive Sinclair seems to have a lot of the small screen. His solution lies in the £80 flat-screen TV which he hopes will lead to a new era of portable, or the world's television-viewing public.

Although Sinclair is not the first to make a set with a retractable screen — Sony has done so with the £250 Waddington — his TV is smaller, for cheaper and more-linear components. Our Preview shop handles most of the £80 screen's initial production.

The 10-year-old Sinclair project that produced the 9-inch black and white TV will have a more exciting one in development involving components in the monochrome future.

The re-engineered video path, again developed for the TV, will remain to be used in a portable screen, although Sir Clive claims that "ultimately we are not a real screen manufacturer".

What has not yet been decided is whether or not a larger tube will be needed especially for the computer. The alternative would be to use the TV's 4.2in by 3.1in by 0.7in tube and achieve a larger size by engineering in black projection.

David Southwood, Sinclair's director of research and development, says this is the probable outcome, while Sir Clive himself believes that "a bigger tube is required".

When Five Computer first revealed Sinclair's plans for a portable in November of last year, the main impression on published showed a fold-down screen, which would be in line with the engineering of such previous models.

In any case if you are thinking of buying the flat screen TV as a main monitor for your Spectrum, you will find there is more on it than the 9-inch screen. The 10-inch screen is a 10-inch screen — better as the screen will not be visible without use.

This is the CPD-8000 Computer Program Case Arranger £80 from WH Smith. It features an electronic scanner designed to be controlled by the computer via the video monitor control socket. Don't let this figure! Save yourself by using normal monitoring in computer with different sized screen upgrade. The need approach possible this also be achieved.



The will also have to open the TV up and more around with its controls because it has an aerial which is not carrying with a camera.

Sir Clive calls his TV "a consumer video with a purpose". Unfortunately it does not have a tube as yet. Clearly he hopes that the component remains beyond the

TV's screen, into the 9-in. by 3.1-in. by 0.7-in. black and white tube of the set.

A special for Federal history points the TV to the 15 hours. Three WJ include features that £80 for three and you should see that they push the price of the TV up to almost £250 because that's

replaced with the set. Alternatively, you can plug the TV into the main using a £8 adaptor.

Finally the TV will only be available mid-1984, and production will only reach 10,000 units a month by the end of the year — so be prepared for the new technology market too.

## WH Smith software comes in through the back window

WH Smith plans to get software into the home through The Window. This will be a series of video games that will be available in a variety of formats and a computer monitor to the other means every neighborhood. From The Window is the WH

Smith's selling to the venture into video games.

The idea is that each video game will have 10 computer games in a package in the background with a screen. People could then subscribe to a game service which would send out boxes to the video screen a 41K computer which would download games from the video. The new games would be put on the central computer each month.

The idea comes from America and WH Smith is negotiating with a California company. As yet the price of the subscription has not been fixed, but a California to run the operation of £1 to £10 a month.

If the idea is successful it will be 12 years before even half the households in Britain are on cable TV networks or in the meantime the new information will download programs from the telephone lines via Windows while the rest of us buy cassette or tape programs from the pages of The Computer.

Sinclair's launch of his own Spectrum 4 for the Spectrum line and started the flow of plug-in expansion boards from various other peripheral companies.

Microcomputers is now used to making add-on boards for the Apple II for use in a portable or plug-in module which can take four cards offering features such as an RS 232 interface and control from the keyboard from the television to electric network. Microcomputers is an 8000 94117.



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## I could do that...

If you have been doing the same design of Post-Script graphics you will be sure that a program they can add and address any job of creative numbers. It is easy now to use the multiplications and divisions plus multiplication is just a matter of repeated addition division is repeated subtraction.

At least that is all that is needed for simple integers and fractions, which all the numbers included will be able to do. However, for here is the main's task - write your own computer Arithmetic Unit!

To keep it simple you will need two Registers, A and B. Both eight bits long for the numbers to be operated upon, and a small C to hold the solution. The eight numbers must not be bigger than 16 - that is they are to into 4 bits, so there is no problem with overflow carries and the like.

Then you will need to be able to input the two binary numbers and the register, specify the operation...

... and calculate the result. If you want a nice set of keys to enter the additional part of the program - put that in the program panel below as the panel from two installed keys.

So and large most of the credit for Apple's Binary Arithmetic program took the same approach. They found that it was easier to get the two numbers in binary, gave the first of these programs to be pulled from the computer bag came from P. Russel, Rochester 43, 800 N. Avenue Holland and turn on a 200 BT.

# BEGINNERS

## first bytes

Starting out in home computing? First Bytes is for you. Just write to Your Computer with any hardware or software problems, no matter how small or simple.

### Heart of silicon

I have got a game that will not run on my friend's computer. He says it is because my computer has got different processors. Can you explain what he means by that?

AS THE HEART of every microcomputer is the logic for that makes the rest of the computer work. The game is the microprocessor, and it is in this that your friend is talking about. There are many different microprocessors around - see Table 1 for a few examples - and the one you have got will depend on which machine you have.

The processors are usually grouped together in families. For example the Intel 8080 series includes 8080 and 8085 processors, the Intel 8088 series includes the 8088 and the 8086, and the Motorola 6800 series includes the 6801 and the 6809. To say that a program is part of a particular family means that the chip is normally based on the pattern of the series, but has minor differences.

Each processor has an own language which, for the system made for that chip, allows it to be in a language which makes the chip work, and no other. This form the each processor's language takes is mostly dependent on the structure of the processor. In all microcomputers, the length of each instruction in the language for the machine is fixed. The length depends on the processor so, when a



series is quoted as being 8 or 16 bit machine, it means that the machine can accommodate 8 or 16 bits long.

The language used, and any programs based on the machine, are only a matter of bits that are 0 or 1 and it is not easy to program to suit the only one, to help people to write programs in the machine language, manufacturers have invented the assembly language. This assembly language allows you to use instructions, which will mean the variation, so that you have some idea of what is going on - where the memory lives, it simply controls the computer's microprocessor, which has into the two end types of binary numbers.

It would, from all of this, that if you have two machines on the same volume of Table 1, then you will be able to run programs from one on the other. This is largely wrong. There are many machines that contain bits would probably that are called, as the two machine languages are the same, but you will not always find the language of the manufacturer.

Even two machines made by the same manufacturer with the same chip are largely incompatible. This

is often because of input/output, and the way that the memory is organized. If the pattern part of the memory, the memory size, or the way the instructions are handled are different between two machines, then programs for one, which use any graphics or I/O, will not work properly.

If it is in the nature of the industry that machines should be more portable - it is in the user's interest that they should be the opposite. Unfortunately, the choice that governs which microprocessor is used always run at cost. If Intel for example, was to approach the market of a new series, and offer a half a million processors at almost no price, then the new machine is likely to be Motorola. This does not mean cheap designs decrease are taken the way.

There are attempts to break the dependency microprocessor industry, and one of these is the use of the microcontroller. This device takes a program in one machine's language and converts it into another. Very clever, but if the destination machine's graphics, I/O are not different, then it is not much good.

I could do that...writing program

```
10 INPUT A$
20 INPUT B$
30 LET C=0
40 FOR N=16 TO 1 STEP -1
50 LET B=C*B, B=INT B/N
60 LET C=C AND B/N:1 OR NOT C/N
70 IF A=C:1 THEN LET C=A/B
80 PRINT AT B,N:0
90 NEXT N
100 IF C=1 THEN PRINT "OVERFLOW"
```

### Life without Basic

"You switch on, and you find yourself in Basic Mode?"

ACTING ON THE assumption that it is because Basic is really easy to use. This is a really easy to use computer in MPL or Advanced Programming Language - the

computer's Basic. When you have done writing your own computer then you are there. Basic is a wonderful, for you have had it in only a couple, but leaving. This again, it is dependent on the Basic 2 (continued on page 87)

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Continued from page 25  
you are playing around with them. Plus I will extended the handling, then you can go a different league from the rest of us, and I need say no more.

Of course, what I am trying to say is that there is more to life than love. With the same, in with you, and you must decide what you are doing in the work. If you are speaking in using it for but necessary — family type, business etc. — and you are paid accordingly. If you are speaking your own writing, the power, or anything involving that profession then my friends, if you are an education then you may well be involved with Logic.

There are, however, many reasons for wanting your programming days to flow in, among other things, it is interesting, you can save

MARK TAYLOR

and something will happen straight away. No much, I admit, but it is a start. If you start trying this in MacroCal, you would probably get the computer laughing at you. This is more when the correct order of things is to be made in logic or MicroCal, MacroCal, and the young children of the world will discover Calcal, has the doubtful honour of being one of the very few programming languages available at home.

However, once you have logic in master logic, why not move into better things? Well, used recently these simply have not been many computers around the other programming languages. It is all very well to read the names of Logic or Pascal but if you have not got any way of comparing to your particular machine, then you can read good through some books. In fact they are both wonderful, in their own way.

# BEGINNERS

## first bytes

### specialist ways

Pascal is a programmer's language, and it is my guess that most of you are not his province but worthy programmers. If you have been here then you can almost certainly learn Pascal.

Now you have got the means to write readable, structured, self-documenting programs, you can use

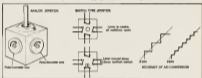
your means to do truly useful things like you. It is all right not to consider the microcomputer as some kind of multi-purpose game board, but it has the potential of being in much more powerful than that. And of course, if you are content to stay in one age should before you start. Can yourself the video advantage, and get one Pascal. Peter Lister

## Choosing joysticks

Make sure you buy the right sort of joystick.

As everyone may not realize your program may require the joystick people usually have controls as they allow them to go back and forth as they say the co-ordinating others.

The simplest type of joystick is just a lever which is controlled by a ring of switches. With four switches you can rotate controls North, South, East and West, but if you add more switches, more than a couple of points can be used, although of course there is a practical limit to how close together the switches can be. This means that you can only select a maximum of about 12 different directions. This type of joystick is used in programs in the same way as the button keys.



The second type of joystick uses potentiometers or variable resistors instead of switches. Two of these are placed at right angles to each other in such a way that the moving North-South coils, one potentiometer and moving East-West steps the other. Moving in diagonal directions gives, back, potentiometers or all

### directions can be selected

These potentiometers are like the volume control on a radio and the voltage coming out of the joystick will depend upon how far round they are turned.

The variation in voltage can be directly measured using a large scope and therefore these are known as analogue joysticks. The CPU can only handle digital signals so the most you should use an A/D converter which you can built into the computer — if it has a parallel port — or be an add-on box. The system will then allow you to read the digitalized voltage using the built-in potentiometer. Usually, I have not used this sort of joystick you have 64 steps on both X and Y axes.

Analogue joysticks can be used in software development programs. First you must read the joystick value —

the secret is for the Dragon  
10.10 - JOURNAL 10  
11 - JOURNAL 11

To achieve absolute position you can just plot X and Y coordinates — but remember you may have to shift the value to fit.

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0010000 10

To achieve direction you need to use two bits for the joystick, it gives the centre position at each direction.

10 10 10 10 10 10 10 10  
10 10 10 10 10 10 10 10  
10 10 10 10 10 10 10 10  
10 10 10 10 10 10 10 10  
10 10 10 10 10 10 10 10

You can also use the sensitivity of the joystick by changing the value output against the sensor they are in the matrix using the same number the joystick. Mark and Steven Brown

## Analogue to digital

The CPU can not understand off and on as any information you want it to process must be converted to either zero or binary digits or bits.

So what do you do if you want your computer to measure something like light or temperature which can vary in intensity over a large range? How you must convert the light or heat into an electrical signal by means of some sort of transducer.

The complex of these will produce a voltage which changes in synchrony with the factor you want to measure. Now you must convert this voltage to binary digits with an A/D converter.

The main difficulty lies in a series of switches which are linked together by logic. If the voltage is 50% of maximum on off. When the voltage starts to rise the first switch is turned on, and then the second on, keeping the second switch low and a stepped signal form. The accuracy of the A/D converter depends on how many bits are used. With one bit you only four steps can be

selected.

01 both off  
10 first on  
01 second on  
11 both on

With three bits eight steps are available.

000 both  
001 01  
010 01  
011 01  
100 11  
101 11  
110 11  
111 11

In the same way four bits give 16 steps, eight bits 256 steps, 12 bits 4K steps and 16 bits 16K steps.

The accuracy of the conversion depends on how well the input are. With only four steps you are only measuring to 1 part in 4 but with 16 bits you are measuring to 1 part in 1K.

Digital to analog — D/A — conversion is similar but the order you round to then sending a binary number to the D/A converter produces a varying voltage which you could use to control something, although you would need several of them to control a great device.



# PRINT OUT



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We would like to hear of anything which has made your club a success. Contact us on 01-561

## Local news

### Runcom

The North-west Computer Club meets every month at 20 Mary a Church Hill, Waltham Chase, Runcom, Cheshire. For more details contact Mike Roper on 061-428-8860.

### Watford

Having started out as a Commodore user group with a few specialist business users, Watford ECPUZ already has a lot of BBC Micro owners in its membership, and is looking to increase its area of interest. They are to be found at Watford Co operates Hall, at 25 Alford Road, Watford on the second Monday of every month. Telephone Stephen Rudgeley on 0822 52611 for further information.

### Nailsea

The Nailsea User Club has the advantage of offering one of the earliest of 7:00 on the first hour reserved for newcomers. The club meets weekly with a special topic meeting once a month. Their venue is the Tap & Mill, Silver Street, Nailsea. Avon Contact Steve Smith on 0275 881287.

### Barnsley

Graciously Teedy offers the Barnsley Co experience. Computer Users Groups meet at a lot of Video Clubs, Spectrum and BBC users. They meet at the Dover Sports Club, Barnsley. Teedey is the last Tuesday of every month. Contact James Entwistle on 0228 41702.

### Brixham

Another club starting its new season, the Brixham Dragon (named) Brixham Computer Users Club meets at Computer Systems, Pump Street, Brixham. Drop-in every Saturday afternoon. Phone 0804 18224.

# COMPUTER

# club

Paul Bond takes to the hills and discovers another sort of popular Derbyshire RAM.

## KINDER PEEK



Author staring at a screen on game.

Derbyshire just has Peak District computer users of Britain's most spectacular scenery. The users of New Mills centre primarily at the foot of the hills — the town has once been an even more carefully developed town, as people making regular pilgrims. But the combination of the natural gift and new concerns as to development in the area would pass them by. For this town is the home of people whose careers is a challenge land of Peak: The New Mills and District Professional Computer Club, in the area were recently named. Another Peak Computer Club was formed in September 1982 and has around 100 members.

There is a lot of the town, with Norman (John) Braxton, secretary Peter Langham, and up to name secretary John Mark Chappin all aged 40. New Mills is the club's exclusive membership, with 14 year old members they secretary Andrew Price responsible for maintaining the large file on a specially adapted ZX-81.

President Martin Phipps — who handles ACC finance — and John Kern — who has played the role of public relations, since the club's main aim is to act as an office of the club there is now more than 100 members. Phipps Technology is a local level. Martin Phipps, working his school progress has now opened in the town of New Mills the an initiative of non-computer use schools you pass in the programme where starting. Thanks to the office of Phipps, an initiative in the good month, which is a good number of people. There is a lot of interest in the town of New Mills.

The club's expansion was aided by projects for schools held at New Mills Youth Club, which was only one year in the past. There is a

lot for that the Youth Club there expansion was proposed by the young side of membership like a programme under the general programme John Kern on an ACC, was now working in a committee, given course on club starting your town computer and local level.

The club's members are no doubt, when Jonathan 1982 and last Bond here had their progress in the BBC Micro, Garry White, accepted by BCP — the New Mills Education Programme.

From Computer started the club during the course of a local meeting was held in the local school. After four years and another year, for a small fee of that was given is now possible to get some business experience of various computer games.

As well as events like this, the club has many to computer activities, club members and to many clubs, for local organisations — for example, there is the club's PTA in the members John Tails and Andrew Phipps, about various aspects of computing on the ground.

The club, which meets in New Mills, is held every Monday.

Author got in the New of Green Mountain.



whether new members whether they have their own computer or not, you interested in computing. Right now they would be keen to welcome anyone at the New Mills area who would like to get talks on 2-40 machine code.

Members are encouraged to bring their equipment along to meetings, but a must be covered by the members own resources. Various support groups available under the umbrella of the New Mills Club — there is a limited user group, all four user groups, a 5-40 group and a Commodore user group.

If members want to software equipment, the club provides a regular service on which helps members to help on their with club activities and has a "file addressed" service.

"Borrowing or training at the Brixham programme is open on a regular public basis. And you as they do not stop you in the local level, the club's membership is for Brixham Peak Computer Club is only £2 per session — £2 for members under 11 years old — and there is no other charge. For further information contact Martin Phipps on New Mills 40027. ■

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**J. MORRISON (MICROS)**

# Star chart

**Barrage**  
BBC Model A (28K)  
Shoot 'em-up  
Programs Plus  
£7.95

★  
Barrage is a very misleading title for this game. Each side only fires bullets that are in the name. You must be the state and volume of your shot and then at least that way to see if your opponents have survived. Use of 80-column video can help matters.

**Oblivion**  
BBC Model A (28K)  
Shoot 'em-up  
Jug-Flow  
£7.95

★★★  
Spies invade your game, the less is more players. The random nature may be annoying as they descend towards you, and shoot you up the screen if you try and escape that way. Unfortunately, since everything is so simple you cannot shoot and become only prey to your enemies.

**Alien**  
BBC Model A (28K)  
Adventure  
Masthead  
£9.95

★★★  
You can see the whole scene you get exploration for yourself the freedom of wandering around a hazy opening (aided by a sensitive laser

A left-hand accelerometer would have made this game more accessible, but if you like exploring might find instructions from the screen, this is the way for you.

A vertical graphic display shows you where you are and another window lets you know how far away the alien is.

**Haunted Hedges**  
BBC Model A (28K)  
Shooting  
BBC  
£9.95

★★★  
It is a great combination of a Pac-Man super-remaster and with good odds to collect instead of power pills, and use a side entrance to bypass. The maze and its obstacles are shared from above and at a right angle. Excellent graphics, a fast game, with ghosts which regenerate can be used from top to stop.

# SOFTWARE

## Shortlist

### Harrier Attack

■ BBC Spectrum  
■ £9.95  
■ Devil Software

★★★

LIKED AWAY FROM the self-titled Harrier deck and gliding over the wastage towards the great wreckage of an island (regarding to the gag of being safe, your mission is to reach the island base).

In a game that features a lot of Duffers in its lineage, you have to take off from an aircraft carrier — an always easy to control — and fly towards the airfield base. The Harrier team fly reasonably fast at the 100-mph speed of a white-hot jet engine contrary. That is, if you get there — they judge the airwaves made hazardous from the landing carrier point of view. There is ample opportunity for rolling up your nose gear to increase enemy aggression, apart from allowing the missile to be a catch in some the low three times and fly straight through the wreckage.

If you fly high enough to avoid the ship, you will attract the attention of the fighter defence who shoot at you. You will also be under constant attack from land-based air support too. As the carrier will level it is possible to fly through most of the ship but at higher levels the chance of being hit will have greatly increased.

Mid-air explosions is a result of dropping ordnance besides are also dangerous to you, as the game is a scoring substitution in scoring, keeping and bonus, just the various bits of fuel and altitude that make you feel a complete hero. The game has five skill levels and expects you to deal with some difficult ones — but you can get by in combat with the controls. Fixating the space-bar means it's a case of geometry — a fairly easy to practise thing. But while your instincts are the ground is flat as usual. The graphics are simple but well implemented and the game proved popular with many people while under test. I received them all so we'll control them all back.

### Sea Lord

■ BBC Model A (28K)  
■ £9.95  
■ Mag-Byte

★★★

THE TEN COMMANDMENTS of the Law of the Sea may not be getting much support from the US & A, but that is nothing compared to the problems posed by the present-contracting Law. The new contract does not allow that you have violated the 100-year old disputes a fleet of every ship



to destroy you. They lose gradually when the same depth, warning effectively created the strong white overcast red-cyan, which being an impression on the same square of the ocean. Do not be deceived — if they don't see you, it is they don't know the sea, stop.

The end of the sea game comes from developing the development necessary to get your mission, making in the same direction in which you wish to fly. It is a way enough to get the ship on the higher levels, but you may have truly wanted the sea of the day, because of the sea. In your own words, "the sea is the top of the sea." My sub-titled will thank you all — and it may be one, perhaps the most difficult and most time well. The ship can be used to control the ship, to control the mission in the left, Q, to move the controls to the right, G, to fire the weapons, and you can also break the game with the 10 Commandments.

Your mission always moves on the direction of the ship — you can walk three times and a bonus (which is awarded the every 1,000-point score).

You can see a bonus (which is awarded the every 1,000-point score), and the program will keep a count of the high score. Sea Lord can be run on any Model BBC Model A — or Model A with memory expansion — with one of the primary suitable operating systems. It will also run on the Sea interface board.



### Pitman Seven

■ BBC Spectrum  
■ £9.95  
■ Vision

★★★

THOUGH IT ISN'T on the software scene and it isn't in contention that an approach is really fresh in a hard to stand out from the rest of the first three releases, it is a classic strategy problem in South Africa, meant to give the same approach by showing attention in the right of the world, or by departing from the world with confidence of those who profit from this too.

You don't have to have the same of some trapped mine that has been the of the mine in the surface. The game is actually a King Street one you get past the spectacular action-drama graphs which is unfortunately into the scene in its environmental location.

Periodically bonuses will show from the surface — you can avoid them by jumping over them or passing through the trap lines or showing up before in another level.

Another danger is presented by probes of study here you can avoid them by putting in yourself, but this means you bring up to half the number of legs you have to be able to run. This certainly is a departure from normal games. If you like the idea of the kind of multiplicity of controls, here, but perhaps the work should be in the part of the programmer rather than the user.

LIST LOAD RUN OR DIE

VERIFY . . ENTER . . ATTACK . . RESTORE . .

VERIFIED

**OVERVIEW**

The main objective of this program is to verify the integrity of the data stored in the system. This is done by comparing the current state of the data with a known good state.

**PRINCIPLE**

Mathematical operations are used to verify the integrity of the data. This is done by comparing the current state of the data with a known good state.

**GROUND ATTACK**

By using a ground attack, the user can verify the integrity of the data. This is done by comparing the current state of the data with a known good state.

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**CONCLUSION**

The results of the verification process show that the data is intact and that no errors were detected.

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# REVIEW

Simon Gooday looks at the latest machine from the 'land of the rising sun' — the Tommy Tutor. To find out if it is the country to the Great Britain of the Tutor...



# JAPAN'S LAT CONTEND

Japan is renowned for taking a good idea and producing a superior product from it quickly and at a lower selling price than its competitors. So far the computer field has witnessed the three but with each new Japanese machine that comes onto the British market this trend grows stronger.

The latest machine from Japan to come up for review is the Tommy Tutor. Tommy is one of Japan's leading top manufacturers in the country the computer will be sold by Adam Roberts as the Goodland Tutor for around £150 and should be in the shops by October. Along with the TI 994A the Goodland

uses a 16 bit processor, a Texas 9901 chip running at 3 MHz. It comes with 128 KRAM — expandable to 448 — and 32K ROM.

Measuring 36 cm by 24 cm the tutor has a more solid appearance and feel to it than most of its sub-£200 rivals. It has 56 raised rubber keys like the Spectrum's but these are linear and include a spacebar. Above the keyboard there is a carriage (the red part) so it is powered on light. An on/off switch sits at the side of the casing.

Alongside the cassette and printer sockets at the back there are sockets for cassette and video output. There is also an I/O port which

will take the usual range of peripherals — disc drives, raster graphics and expansion units. These are promised to arrive next year.

When you power on you are greeted by a menu with three options — Display, Run or Carriage. The Tommy's pride is its graphics option. What this offers could be described as a built in character generator-cum-drawing pad. Effectively it is a computerised paint box.

Once you enter it, as Graphix Composition Mode, you are presented with a 32 by 24 grid. Overlaying the bottom half are 16 colour bars each with the number or letter of its associated key. To the right of the colour bars is what



# TESTER

Tommy make the palette box.

This acts as an enlargement on the individual cells on the grid. Like a standard character generator it is an eight by eight square in which you can move the cursor to fill in any of its 64 pixels. Each pixel, moreover, can be assigned one of the colours from the colour menu, although you are restricted to two colours per line.

While you draw at the palette box one of the cells on the grid is also drawn on. Pressing the spine bar toggles the cursor between the grid and the palette. Once on the grid you can move the cursor to fill in further cells and then

return to the palette box to enlarge a new character.

There is at least one the number of different characters you can design and if you are painstaking enough you can fill up each of the 168 cells in a different way. When you move the cursor down the colour menu and palette box works in the top half of the screen leaving you free to fill out the bottom of the grid.

In this way a detailed picture is to be built up over the whole grid. Press the Mode key and the Grandstand switches to Graphic Format Viewing Mode where the colour menu and palette box fall away to reveal your finished work.

There are two additional graphic modes which allow you to design and view up to four sprites on the same grid as your usual picture. Again the palette box is used to define the sprite shape. In the final viewing mode which shows the sprites and cell picture together, the sprites can be moved smoothly around the screen using Grandstand's row-by-row controllers.

All in all the Grandstand's graphic modes supply a novel and entertaining drawing facility. There are, of course, character generator and drawing programs available but the colour menu that they are tied to is not so easy or as comprehensive as the Grandstand's built-in facility.

In fact, on other home computers under £200 permit you to compose pictures in such sharp detail. The machine's pixel resolution — 128 by 128 — is at least double that of the Spectrum's but its colour resolution is considerably superior. Whereas the pixels within a character space can only be assigned one colour on the Spectrum, each character on the Grandstand can contain 16 different colours. Only the BBC Micro offers the same scope for creating multi-coloured characters.

If you feel your pictures should be preserved you can save it on tape. The loading and saving rate is 480 baud.

To handle the pictures created in the graphics modes there is a graphics Basic dialect from the enhanced Basic system offered in the retail menu. This is a highly stripped down version of the language designed solely to manipulate the cells and sprites on the grid.

It is simpler only and lacks arrays and string variables. Its control commands are

CELL, IN = CELL, IN

which copies the cell at position **N** to position **S**.

Repeat statements Basic statements such as Goto, Goto, For Next and If Then are the set of available commands a good deal. There is a simple print statement which prints a string or a number at a given cell position, a key statement which reads the keyboard or joystick, a Wait variable, Turn which issues a small range of turns, and commands to move the sprite.

To use GBasic you must first enter the Grandstand's monitor and type in GBasic. The monitor then prints the program on the bottom two lines of the graphics screen. To exit from GBasic is equally awkward and can only be done by typing an End as a program line.

You cannot list or edit a program line

although the key command prints and executes the program a line at a time. Another limitation is that the error message simply informs you that an error has occurred without saying why or where.

As a programming tool GBasic is limited in the extreme. It would be sufficient, however, to create unusual graphics or write simple games involving the position and sprites previously defined.

In its retail version the Grandstand computer contained only GBasic. When Adam Imports representatives first saw the computer early this year at the Earls Court Toy Fair they felt that the machine would need a far more advanced version of the language if it were to compete at the lower market. They duly obliged by adding an another Basic.

The second-enhanced Basic is indeed a more sophisticated version but it differs from the first in that it exists as a separate system and has to link with the machine's graphic facilities. It is almost as if two computers were housed in the one casing.

It is not possible to access high resolution graphics from within the enhanced Basic, either to plot a point or to design and move sprites. Instead this option confines the user to a mere eight screens with 24 rows of 32 characters in upper and lower case.

Seven colours are well available but only to set the foreground and background colours for the whole screen with the exception of defined characters. Up to 32 of these can be defined by the BASIC command and can then be assigned different colours from the rest of the screen characters.

There is no Print Tab command but instead SColl will place one or more of the same character at a given position. GCell returns the code of a character at specified screen coordinates.

Auto, Trace and Remember are usefully included and there is also a Sound command with parameters for volume, tone and pitch.

Although the Basic is an improvement on GBasic it is not as especially extensive version of the language. It does not accept multiple statement lines and — a strange omission this — lacks any string handling statements such as MID\$. Compare Terry's Basic with Number or even Grandstand Basic and it begins to look a little threadbare.

Two other statements which are notably absent are Peek and Poke in their expanded form. Both would have been particularly handy for the system since there is no information on the machine's memory organisation. Just how the graphics display is stored and how much RAM it takes up remains a mystery.

Adam Imports is so much on the alert on this as a questioner — a stream of letters to Japan requesting more gas on the machine has so far brought an illustration. Q&A, ERM is twice the normal price for a machine of this size and one wonders what it is allowed for. It may well be possible to bridge the gap between Basic and the graphics modes — for example, to harness the sprite generator.

Clearly the cartridge game I looked at suggests that the Grandstand has considerably unexploited potential. The graphics on these games are probably superior to those on other

*Continued on next page*



mentioned from previous pages) machines in this price range and the screen is fast. 30 cartridges have been produced so far in Japan and most of these will be available over here for around £15.

If enough software is forthcoming, the Commodore could well find a place as a games machine. But whether many people will be prepared to write programs for a relatively unknown 16 bit processor is another matter.

The machine's other possible role is indicated by its full name, the Torrey Tamer — in the UK, the Commodore Tutor. This would be a highly suitable vehicle to introduce

children to computing. The graphics option does it interesting. You can change simple sets drawing on the graphics grid without any knowledge of programming. And if this stimulates the desire to learn programming there is at least a limited facility for doing so.

However, on the under £200 market it is difficult to compete with a £100 48K computer like the Spectrum. Success breeds success and particularly in the home computer world. Once a market starts to sell well more people are encouraged to write software for it and the more available software the more attractive the device.

## CONCLUSIONS

■ There is already an enormous amount of quality software for established machines like the Spectrum and there is very little software support for newcomers.

■ The Torrey Commodore may not be able to compete with the Spectrum on its own ground but it could find a niche in a more specialised area — as an educational device which doubles as a games machine.

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MAD MARTHA II

Five for the good holiday and Marthy decides to opt for hair-shirted Marthy, who is a witch in a pink forest in Scotland. One afternoon Marthy sets out on a hot new walk for tea, young Marthy, leaving Marthy for Marthy to take on the one three. Unhappy to Marthy, Marthy Marthy sets in Spanish part, and the Marthy 4 Marthy Marthy. Marthy Marthy the best, Marthy with Marthy Marthy and Marthy (she is really Marthy) a key on the line. The Marthy takes an strange tea drink and spins all a Marthy Marthy, taking an strange Marthy Marthy, a full light in Marthy Marthy is forced to play the Marthy Marthy Marthy Marthy and can for all the Marthy.

Mad Martha is a medieval adventure. The whole program is really simple and is interesting enough for most of the experienced players. The occasional knowledge of this game you will see you in the next stage would not be the present occasion. **Popular Computing Weekly**

This is a game to avoid to — it's boring, it's gradually ignored and the graphics are poor. — **MI** The key to Marthy, the Spectrum game is not Marthy Marthy Marthy Marthy Marthy and the best is an. **Popular Computing Weekly**

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...and it's right there after you've already

The *visual*...the *visual*...the *visual*

VISIONS

100% VISIONS...100% VISIONS...100% VISIONS...  
100% VISIONS...100% VISIONS...100% VISIONS...  
100% VISIONS...100% VISIONS...100% VISIONS...



Tandy's latest package — the MC-10 microcomputer and the TP-10 thermal printer — is aimed at the computing novice. Is it suitable for the beginner? How does it compare with the well-tried and established Spectrum and Oric? Kathleen Peal investigates.



# REVIEW TANDY

Tandy has recently brought out a number of new machines aimed at increasing sales and revitalising the product range. The Model 800 will do just that in the portable market, but whether the MC-10 will have the same success remains to be seen.

The MC-10 is aimed at the computing novice who wishes to learn about computing on a simple no-fuss home machine. It will be launched with a compatible new thermal printer, the TP-10, priced mid-way between the low cost/low quality ZX printer and the highly successful badge-engineered Sharp four-colour printer/printer.

The computer is based on the 6800 processor — a 64K1 without the on-chip 1K RAM — and the MC6847 video display processor. 64K of user RAM is provided which may be extended to 256K by using a RAMPack. The computer is capable of displaying text colour and of producing sound through the external speaker.

As with all Tandy products, there is little one can criticise as the quality of the construction. The release case — the case weighs nearly 2lb — contains a printed circuit-board which is well laid out without any changes or modifications.

The keyboard is a full size and looks really hard plastic keys provide a feel as good as any other keyboard of this type and it has three in a speaker. There is, however, no auto feedback or auto-repeat on the keys.

Words may be typed in full or control typed as if it is a keyboard and if it is above one of the keys it is good that both are available but as not all the common keywords are represented you do need to spend rather a long time looking for those you know. I wonder who decided to put the Break Key just above Enter — I thought that type of mistake had been eliminated, but it is tending to creep back



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With 100,000

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#### Typical printer output



Figure 7. Printer output of characters



continued from page 28

number of the chapters are specifically for the Colour-Gatepage, it is perhaps a good starting book.

To enable machine-code programs to Run-Gatepage, Basic and VBK are implemented in the Basic. The machine also seems to understand the speech commands, but quite where they will be used I am not sure.

There are obvious differences between the MC-10 and the Colour-Computer besides price: the display file has been moved and generally the memory map has been changed.

It remains to be seen whether the user can access the page editor, register, video display processor and display control register to obtain the high-resolution of the Colour-Computer.

Compared with the MC-10 and the Colour-Computer, the TP-10 BX110 thermal printer manufactured by Canon for Teletype is chosen to become very popular.

The printer is 2 by 4 by 1 and weighs 14.6 lb. It prints 30 characters per second, 10 characters per line on 14-inch wide thermal paper with a line spacing of 0.167 inch. The print rate matches that of the MC-10 and the TP-10 is also very well made. The print head is rotated across the paper by a stepper motor which operates mainly quietly, the only noise is on the line feed mechanism. The proof-of-concept head is well laid out with the sensors circuit well enclosed.

There are two operational modes, a dot/line

cut-off at the side and a membrane type touch switch for the paper feed. An led indicates power on/off and will flash if the print head is on.

The printer operates at 400 baud with one start bit, eight data bits and two stop bits — no parity.

Paper may be 11.5-in to the printer and you can also LP from a line, but there is no copy facility on the MC-10 to produce a screen dump which is a pity. Having created a membrane on the screen, to make a hard-copy requires every line with a proof statement to be repeated in full — there is no edit.

Do not try to float or to force the connect with the TP-10 connected to your computer to the printer wants to produce garbage if you do. It also found occasionally that the print buffer was not cleared from previous calls. As this machine is alleged to be compatible with the MC-10, this particular problem is hard to understand, a lot of searching but no real problem.

Paper loading was simple and straight forward, via a recessed edge, feed into slot and press the paper advance button — very good.

The characters set is given in Table 2. There is provision for double width printing, underlining, overprinting and repeating characters. The alphanumeric characters are made up of a 5 by 7 dot matrix, the graphics characters are produced at a 3 by 12 dot matrix which conveniently means that the

graphic quarter blocks are unique to use, the left hand quarter blocks are 1 by 4 and the right hand blocks 4 by 4. Figure 1 gives the printer output of the character set.

The print quality is very good. Figure 1 which shows the full character set also demonstrates the only major fault of the printer — no pound sign and no 'less than' characters for g, p and q. The print is exceptionally clear, one can even pick out the individual dots in the graphics characters. An excellent well laid out manual should get anybody started.

From The MC-10 at £2995, TP-10 at £2940, BAXprint at £2990, and paper rolls at £275 each of two.

#### CONCLUSIONS

Without high resolution graphics, I think the MC-10 is over-priced. It is effectively a 20-BT with colour screen and a better keyboard which compared to the TR Spectrum with its established software base, makes the MC-10 a non-runner. A year ago when there was significantly less choice it might have developed a following, but now there are too many better machines available.

The TP-10 is a different story. Teletype seems to have the ability to print quality accessories to go with its printers and this is no exception. The print quality is good and the 400 baud represents extremely good value for an 83200 printer.

The running costs will probably be lower than the 24 printer so I think there will be a very large number of Spectrum owners who, when they acquire their Microbita interface, will find this an extremely acceptable printer. The graphics characters are not the same for the two machines so the Spectrum will require a translator. I can see no reason why the Spectrum copy facility should not work.

Table 1. Speed comparison

|                             | MC-10 SPECTRUM GBC | GBC  |      |
|-----------------------------|--------------------|------|------|
| TIME TO LOAD ARRAY (Basic)  | 8                  | 10   | 16   |
| TIME TO SORT ARRAY (Basic)  | 94                 | 260  | 300  |
| SPACE OCCUPIED BY PROGRAM   | 127                | 136  | 208  |
| SPACE OCCUPIED BY VARIABLES | 8000               | 6007 | 6008 |

Table 2

| CODE        | FUNCTION                   |
|-------------|----------------------------|
| CHR 0 (00)  | Blank                      |
| CHR 1 (01)  | Return with linefeed       |
| CHR 2 (02)  | Return without linefeed    |
| CHR 3 (03)  | CHR 0 (14) (longest mode)  |
| CHR 4 (04)  | or                         |
| CHR 5 (05)  | CHR 0 (16) (shortest mode) |
| CHR 6 (06)  | or                         |
| CHR 7 (07)  | CHR 6 (16) (full screen)   |
| CHR 8 (08)  | CHR 6 (16) (full screen)   |
| CHR 9 (09)  | CHR 6 (16) (full screen)   |
| CHR 10 (0A) | CHR 6 (16) (full screen)   |
| CHR 11 (0B) | CHR 6 (16) (full screen)   |
| CHR 12 (0C) | CHR 6 (16) (full screen)   |
| CHR 13 (0D) | CHR 6 (16) (full screen)   |
| CHR 14 (0E) | CHR 6 (16) (full screen)   |
| CHR 15 (0F) | CHR 6 (16) (full screen)   |

Oric, is once a simple command to its elder brother Vic, Spectrum and BBC, yet already the software is beginning to separate itself, few software houses have thought to produce anything very original, producing instead to rely on the tried and tested, and put a safe bet on, arcade standards. For too many producers seem to think that familiar trends ensure, perhaps the consumers will soon reach their wits the proverbial reality.

The available examples in storehouse almost original in theme from UK software houses, because the old heads among you will discern traces of Galaxian in that game, albeit woefully mutated. As a first commander in the Space Squad Academy you learn to journey in the planet Babilon and prevent it from the Zorpan Battle war.

On the way you take on a variety of foes, beginning with the warlike snails. These are whirling, unpredictable creatures which show no direction, thus proving rather difficult to avoid. They also bear a strange resemblance to that prickly fruit, the Chamae genestery. The next based in a shower of lethal meteors which you can dodge but not destroy. The final obstacle before reaching your destination are the parasites, rather cute little protruding entities relaxing down the worm.

### Use the Oric's graphics

Despite its slightly derivative nature *Temon* is an entertaining game which uses the Oric's graphics with flair and imagination. UK also produce *Candyfloss*, a business game for the Jovial Captain. Here you turn a real sailing your sturdy vessel on the Golden Mile in *Blackpool*.

You are given a limited amount of capital to spend on raw materials and advertising and have to maximize your profits on the face of the variables all entrepreneurs face: the weather, overheads, rigid discounts etc. The program begins with a paucy rendition of 100 dollars to be made this month and a colorful graphic display of *Blackpool's* beach complements to the summer coastline.

You set up your stall, fix your price and hope for the best. Theoretically more hot business, summer means more profits. The game introduces younger players to the rudiments of business and will also help improve those master Oldie players, though, may not find it holds their interest for too long. Also on the tape is *Hagman*, unfortunately there were no loading instructions, so I cannot pass judgment.

*Arcade* has a variety of invaders on the screen, so marks for organizing them. The book claims that this is "an arcade performance, shoot 'em-up, action packed, video game... indistinguishable from the original arcade blockbuster".

Well, we hang on a moment there here. *Arcade's* invaders is a pretty good version, with good colour and nice sound-effects, but if anyone cannot tell the difference between it and the original arcade blockbuster they need their CPU looking at Invaders in another form not more than standard size.

Paragon makes well realize that the same blockbuster *Mania* concerns a well-known comic previously with many legs. This



Above: *Hagman* from P&S Software

# ORIC SOFTWARE

Pete Connor gets that feeling of déjà vu as he tackles the cards and penitents, repels the invaders, flies a Harrier mission, tries to take over the Ewing oil empire and boldly goes where no man has gone before. And you thought that software reviewers had it easy.



*Arcade* game is a good version of an arcade needed. All the usual features are there, brightness, speed and a convenient "powerup" which gobble everything in its path.

Again, too, *Arcade* makes soundly inflated claims for the game, "The higher your score rises, the faster the screen becomes, and it is only a mere blink of colour and sound". Perhaps that is why the Oric has a real buzz.

### No jiggery-pokery

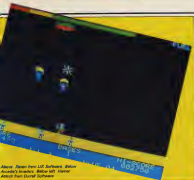
P&S Software declines any jiggery-pokery with names. In the company's catalogue as a catalogue. There is no mark to choose between the and *Arcade's* version, both being fun, fun and difficult to play without a yawn.

Invaders, the best P&S is the usual thing.

The colours are good and the sound effects increasingly better. Unfortunately, I can find no reason for preferring P&S's programs to *Arcade's* and vice versa.

P&S also produce *Hagman*, a game in which you must guide a big space ship north and southward without veering. Perhaps you are familiar with that kind of thing? I believe there is a game called *Foggy* which is rather similar. Here the screen are shockingly bright, but there is the slight novelty of having to avoid a steady rain of meteors falling down on the other side of the sea. Otherwise standard size.

On the subject of shoot 'em up games, there is *Harrier Attack*, from Darryll Software, to be considered. At a variety of many a going on. So-called missions I looked forward to this one, and was even prepared to sit patiently through the 10-minute loading process.



Above: Screen from *F100* Software: *F100*  
 Arcade's *Invaders*; Below left: *Warner*  
 Arcade from *Dynal* Software



During this war it is possible to study and witness the cover discussion, which shows two *Warner* heading high above somewhere like *Game* *Game*.

### Scramble at sea

When the game eventually starts, it is evident that it is really *Scramble at sea*, you take off from an aircraft carrier, fly your mission and try to conserve enough fuel to land again afterwards. The sea is a compelling blue and the graphics are not at all bad. The game is quite fun, even at the lower levels, and not easy to master.

My most fascinating death came when I crashed into the control tower on *Invaders*. However, there is a lack of variety in the scenarios, these seem to consist entirely of planes and anti-aircraft guns.

Although I found the game acceptable, almost gripping, for a while I suspect that repeated scenarios would soon become rather boring.

*Dallas* and *Archie* are two strange games from *Cam Computer Simulations*. The first, says the blurb is a "board game of exploration and exploitation in *Texas*". You start accumulating \$200 million assets and bills in

cash in order to take over the *Living Legends Sound* families, but unfortunately there is no *J K* — or *San Elias*, or *Lucy* — to add human interest.

You have a rather crude map on which you choose a sea to make a seismic survey. If you strike oil you then have to transport a rig, build a pipeline to *Dallas* and develop more fields. All this, of course, costs money and, if you do not find a greater penny asset, you will be begging for loans, get too deeply in debt and you will be ripe for takeover by those nasty things. But the game never really grips, perhaps because there is not real skill or strategy involved on the player's part.

### British Airways takeover

*Archie* is similar, but a little more interesting. The game is a kind of "Every man has his own *Freddie Laker*". You must increase your £1m to £10m within three years in order to take over *British Airways*.

You must decide how many planes to charter, how many cabin and ground crew to employ and how much insurance to buy. Make the wrong decision and your planes could be damaged by a crash or grounded under safety regulations. After each year's trading you are shown a balance sheet which gives you your profits, or loss, figures. If you lose too much you will become *Freddie Laker*, as I did, or being liquidated!

As with *Dallas* the problem in this game is that there is no real challenge for the player, too much depends on chance and not enough on any skill or expertise. Still, these with a desire to be a living instant magnate will find it worth investigating.

*ADF* Software has produced a version of *Flatten* for the *Oric*. This board game, in which you have to draw round a number of boxes while pursued by a shuffling thing, is more or less the same as versions I have seen for other machines. The rules are quite pleasing and there are different configurations of boxes as you progress through the game. There are also a host game of *Flatten* here and this will not be disappointed.

### Star Trek-based game

*Oric Trek*, from *Salamander Software*, is one of those games based on *Star Trek* where you must seek out and destroy hostile life forms wherever they are found. To find them you have a long range scanner on which appears blinking and to me, unrecognisable data. Then you destroy them using phasers or photon torpedoes. Alternatively you can use your shields to run run away. I do not really understand the appeal of such games but *Salamander's* version for the *Oric* seems to be up to scratch.

We finish down in *Warner* 7 software for the *Oric* program. This is a games pack, featuring seven different games. The first, *Archie*, *Invaders*, features a green flying saucer raining down balls on your laser bases. You fire laser beams to score the sky and you have to try to destroy the balls and the saucer streams to living ranges. Each time you fire your energy is depleted until, if you are not careful, the energy has decreased and you have run out of ammunition.

Continued on next page

Continued from J&J Software.

# BLACKPOOL WEATHER REPORT

SUNNY



PRESS SPACE TO CONTINUE

*(Continued from previous page)*

Demolition, another game in the pack, is a simple version of SimCity, though not without charm. Here you find yourself on "an old simulated planet with only three steps. In order to land you must first destroy the raised area. These consist of blocks of skyscrapers. You also repeatedly fire over them while you drop bombs in an attempt to flatten them out. Heavens! The game is quite enjoyable but so simple that an opponent is liable to imagine it requiring any more for long.

Other games in the tape are Houghton and Casson, Obstruction, a maze game and a maze game. While such packages seem curiously missing, they may well be a false economy, with more games on one tape, how can any of them have any old complexity or lasting appeal?

Last, and by all means best, is Worm from P.A.S.E. This is a Snake-style game where you have an antwormy you control around the screen and gobble numbers. The more you eat

the more you grow and the more difficult it becomes to avoid obstacles. Unfortunately, Worm is a very boring version with a dull screen display.

On the whole the Gnu software is far

produced is a disappointment. It is the same old stuff in the same old way. Of course, there is nothing wrong with producing hardware for a niche—a pop size few people have taken the opportunity provided by a core machine to do something different.


| Company             | Program      | Price |                  |                |       |
|---------------------|--------------|-------|------------------|----------------|-------|
| P.A.S.E. Software   | Centipede    | £9.95 | Sunsoft Software | Warrior Attack | £9.95 |
| 402 Sneyby (Gaston) | Invaders     | £9.95 | Castle Lodge     |                |       |
| Psall Coventry      | Pepper       | £9.95 | Castle Green     |                |       |
| CNR 8003            |              |       | Torrox           |                |       |
| P.A.S.E.            | Worm         | £4.95 | Sevenson         |                |       |
| 213/215 Market      |              |       | Case Computer    | Detail         | £7.95 |
| Street Hyde,        |              |       | Swalesdon        | Archie         | £7.95 |
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| J.J.J. Software     | Cardficus II |       | London           |                |       |
| 8 King Street,      | Hangman      | £7.95 | SEI TTL          |                |       |
| Blackburn           | Xerox        | £9.95 | Enter T Software | Cometpost      | £7.95 |
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| Salesmaster         | Orb Tree     | £9.95 | Newson Aldon     |                |       |
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| 27 Orchard Way      |              |       | J&J Software     | Parasit        | £9.95 |
| Brighton,           |              |       | 800 Hyde Road,   |                |       |
| East Sussex         |              |       | Manchester       |                |       |
| Arcoate Software    | Invaders     | £9.95 | M18 7JD          |                |       |
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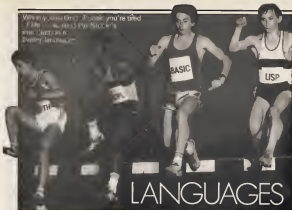
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# LANGUAGES

Professor Klauer and Kurt could not have guessed back in 1965 how successful their new language, Basic, was going to be. Their immediate problem was how to break the use of the computer at Durham College in the U.S.A., where they taught, beyond the students and engineers who were maintaining the system. So they developed an easy language suitable for anyone to use — their *Engineer's All-purpose Symbolic Language Code*.

Basic does its job really well, but when someone asks you why you're a beginner? Are other languages more advanced, or more powerful, or more fun than Basic? In this

survey we look at some of the other languages used on microcomputers, giving special mention to Perl, Pascal, BCPL and Logo.

First let us go straight when a programming language is. Back in the 1940s, the very first computers were programmed physically. To get a machine to do a different set of calculations would involve a skilled engineer physically reconfiguring it on a great job board consisting of old-fashioned telephone exchanges.

Machine language was the first big break through. The key idea was to store all these instructions inside a memory, as a sequence of program steps. Memory was already being

used to hold the intermediate results of calculations, so the memory technology was used.

What this new stored program computer would do was load a program into memory, and the computer would then look the stored instructions in sequence and automatically translate its own electronic pathways to carry out the operations specified. To people at the time this must have seemed magical — almost like the machine controlling itself! But it was only the beginning of programming as we know it.

What was needed was a higher level language to program in, a language which would allow you to write your instructions in a way convenient to you. An automatic translation process would then generate the necessary machine language steps in very easy to use high level language instructions.

In this way the computer would still operate according to low level machine language instructions stored in memory, but the human programmer would not have to program them directly. All modern high level languages, such as the ones covered in this survey, are still based on this principle of translation to machine language.

Perman was the first such high level language. The name stands for *FORmula TRANSLation*, which indicates that engineers and scientists were still the main users of computers when it emerged in 1954.

Once you can program in a language which is close to the way human beings think about

(Continued on page 78)

## DRAGON FORTH

Dragon Fg Forth from M and J Software offers virtually Fg Forth, includes the full editor capabilities of one of the ones and also includes an assembler as an IBM on-program. There are no Dragon graphics control words and primitive sound commands. However, this is balanced by very good documentation including the complete Fg Forth installation manual.

The M and J manual that comes with it is full of Forth programs, examples and one or

two words are very useful. Forth makes an added definition permanent by moving the first to the latest defined word, thus obviating the Forget instruction. At the same time there is no Forth Save in order to Save an unaltered version of Forth, it is necessary to get Forth via Dragon Basic. It is also possible to find out where the program is, how the user address, number of bytes and user address into that class.

Missing instructions can easily be added. The computer already has built into its Basic many commands and operations, such as floating point arithmetic, which are not available to the Forth user.

To get around this, another version for the Dragon II by Dale Software allows the user to hop between Forth and Basic using the best features of both systems.

Daniel Zacher

# BBC



# BCPL

BCPL was developed in 1987 by Martin Richards as a follow on from the Combined Programming Language project at Cambridge and London Universities. It is the first ROM based language other than Basic to be licensed for the BBC micro by Acornsoft.

Upon getting with your ROM file for the BCPL pack you receive a 198 ROM which slips into one of the spare Page ROM sockets of the BBC. A ROM test disc containing utility and example programs, and a very comprehensive 460 page user guide in pdf-back book form. There is also a very necessary function key strip so that the program editor utility can be easily used.

I found the system easy to get up and running and there is a section of the user guide devoted to getting started. In the chapters there are examples of installing the ROM, testing the language, and using some of the utilities in conjunction with some example programs in the BCPL disc.

Similarities to BCPL will find a resemblance between the former BBC Basic and BCPL. It would appear that the authors of the modern version of Basic were well versed in the use of structured languages such as BCPL. On the surface this would appear to make it easy to switch from Basic to BCPL, and in fact some of the former Basic commands such as `Align` (longer `Module`), `Sound` (`OSU` have been supplied as equivalent standard procedures in the BCPL ROM to aid you in the conversion.

BCPL has a much more formal appearance than Basic, with conventions such as nesting of variables to be declared using a LET statement before use. For example:

```
LET total = 0;
```

and set the compiler that the variable `total` has an initial value of 0. Several variables can be declared at once. For example:

```
LET x = 1; y = 2; z = 3;
```

There are all the usual control structures such as `if`, `then`, `for`, `do`, `repeat`, etc. There is no excuse for not writing a perfectly structured program. Binary procedures are used to make the program as well structured as possible.

BCPL appears only on 18-bit words which can be used to store integers. ASCII characters themselves are held as is up to you to decide if the program is doing something stupid like substituting ASCII characters. This single data type means that functions such as floating point arithmetic are not available and you are limited to `-1` to `1`. No And/Or etc. Similarly only single dimension arrays or variables are available.

In this version of BCPL the compiler does not produce any machine code for the BBC

micro. The processor chip (instead of intermediate code) is produced. The Compiler is then recompiled by the BCPL ROM when the program is run. In this way the compiler can be kept small enough to fit onto the BBC and run at reasonable speed. The Compiler is a very compact way of making the programmer take the advantage of being fully relocatable. In this way sections of the program can be loaded into memory only when needed.

This scheme positively encourages the use of module programming, allowing coding and testing of each part of program in isolation where things are well understood. Procedures are easy to deal with. An object focus in that modules can be collected into files and included in other programs.

Of course, looking across for files and the program being using Crotchet is the speed one due to having the interpretation of Crotchet into BBC machine code in the program is nothing. This means that a typical BCPL program will run about three times faster than an equivalent BBC Basic program (based on the approach 90 to 100 times if a real compiler was used).

In conclusion I found the package interesting but I feel that there is not much advantage in the home user in writing in BCPL rather than the excellent BBC Basic. If a real compiled version of BCPL was available with the reasonable speed increase I might be forced to change my mind.

David Simpson

# LISP

Lisp is one of the most concise and powerful languages of its ability wrought is not very well known. Until comparatively recently it has only been available on mainframes and minis but now Acornsoft's release of Lisp empowers the growing alternative home based microcomputers to more specific languages for specific purposes.

Lisp or List Processing language was first used in the very unusual field of database manipulation, particularly in medical and structural uses, where it is still used to control the scanning of data from very complex pieces of information or keys to do more complicated searches or data that the programmer. (Field Address Smith, 2)

It was the unique property of the language that allowed it to be useful as a tool for reasoning into artificial intelligence and it is the use of Lisp that has afforded the language most of its publicity — artificial intelligence makes good copy. In fact some of the best reported progress of all have been written in Lisp programs to write programs, design integrated circuits, make conventions, control robots or write poetry. (I've all been well published.)

Oddly enough there is no definitive version of Lisp — unlike Dartmouth Basic or Java or even IBM's Pascal — as many dialects have arisen from the original idea. Fortunately most of these are not too disparate and the adaptations needed to enable you to take Lisp from one dialect to another are generally few. For the reason Lisp is considered to be a fairly portable language — unlike Pascal for example, which is different enough in the full specifications I have used — to make portability tricky.

Acornsoft's implementation arrives in three

possible formats: disc, cassette or ROM — all of which are simple enough to use though cassette is obviously more flexible. The remaining part of the package is the book which at 170pp may not make you see that there — the software is hard to use without the book.

The Lisp mail is easy to use since it is both a complete implementation and features the added benefits of the BBC's ROM and call commands. It also allows the most obvious way to use Pascal and Fortran. Pascal and Basic have their normal functions though Old Fortran is replaced by Call Page 3 and a number choice of editing. It is compiled Lisp (Grand Imperial America features I found installing rather than actively developing into the heap of info means that later when you have installed functions. Count them in we have many functions you are missing. I am sure the computer could have been persuaded to do this initial set for you.

Fortunately Acornsoft had had more sense when it comes to some displays. It has left the Call M and Call D functions available and this is particularly important with Lisp's very error messages. Until I discovered the I switched with some concern as pages of error messages in on their way to oblivion.

The reason for this quantity of error information is known on the backside and is ultimately rather trivial. Lisp is easy to debug. The hardware help provided just when it was you stopped up.

The manual is extremely well written and also structured well. In that it allows you to play with and program in Lisp before you even start to understand it. It also works as an effective teacher — I passed the package on to a non-acquainted user who knew Lisp and told me he now knows more Lisp and a little more.

Peter Lecher

# PASCAL

Pascal is one of the most strictly and useful programming languages. It is totally structured, easily readable and well thought out. All of which you would expect from something designed by Niklaus Wirth. In its full implementation it showcases many of the features that are often deemed to more common languages such as Basic.

For example, only with structuring the possibility of avoiding the `goto` statement, recursion and highly sophisticated parameter handling, is and loop constructs are all features of Pascal or its base to only single disadvantages you now have seen to occur later. One and the lack of any special graphics handling features.

The further it has already to Wirth's desire to keep Pascal portable. To this end no 140 was defined as all and one left to each machine implementation to be sorted out. Pascal also has two major advantages over many languages: it is easy to read and to write. The former is due to good Pascal programs being almost entirely self-documenting. Obviously the readability is governed by sensible programming in sensible variables and procedure names, and a practical top down or bottom up structure.

In both cases the instructions for how to get into Pascal into your machine are excellent though Wirth's proposal of an extra loose sheet of A4 for this a package dispenser. Loose sheets of A4 can get lost!



Heath's idea that that its manual is not intended to teach you Pascal, but is intended to be a reference document detailing Heath Pascal 47. It does however contain the syntax diagrams so if you want to know whether Code is successful just look it up under Statement.

HCCS's manual has the immediate advantage of giving an example you can type in, it immediately shows you how you can do something beginning before you have got to the end of page 3. If it had used a short while later that you realize that immediate mode Pascal is a bit of a waste of time if as business you have to retype the whole program if you make a mistake.

When you have installed Heath's Pascal it will hold your breath — (another take time) You will find you have to wander through the manual and you finally get something out of our Spectrum manual page 40. And that is only when you have installed the complete editor. The next problem that befalls you is that if you compile a program the Spectrum asks you if you want to re-compile it. If you say yes your computer is deleted and you have to re-compile it.

HCCS's compile and run capabilities and debugging system are much better and easier to use and generally speaking conform quite closely to UCSD Pascal. There is though one serious limitation with HCCS's Pascal. That is that you cannot do more than 32 lines at a time, it also the ultimate obstacle for module programming!

Of the two HCCS's Pascal is the easier to use, but you would expect it to be — with ROM and the board being a waste of either knowing if it is a waste whose faulted out to be better. Heath's Pascal is good in theory but rather laborious in practice. Neither compiler or interpreter are particularly fast and while this may well leave people happy to plug in with their old Basic, it may be hard to make people see the real beauty of Pascal but it is a great language. (Editorial)

Phil Lecher

## FORTH

Access: Forth is available supplied on tape or disc and cartridge versions as well as on the way.

With Forth loaded you are left with only just over 20K of memory free. The maximum screen mode supported by the system is modes 4 and 8 requiring 80K leaving about 16K for user applications. If the latter is required the plate 25K. However Forth is much more efficient in its use of memory than Basic.

Forth supports its own operating system for handling the users and the loading store interface. Calls can be made to the Machine Operating System by prefixing them with the Forth word OS. So OS "CAT" will work in the same way as the catalogue command given from any other environment. Unfortunately the system can become confused and on exiting from the catalogue using the escape key control is sent back to Basic via Forth. This is an work relating and potentially disastrous as any attempt to issue a Forth command which could be interpreted as a Basic line is any command prefixed by a number will be issued as a Basic line. This makes it easy to Forth innocents, and causes a delay of another 1/2 minute to reload Forth the editor and any applications. (Continued on page 48)

(Continued from page 75)

problems, you can just feature in the language that usually help people think. The emphasis for the programmer shifts from worrying about how the machine is going to solve a problem to how to actually think about it on the low plane.

You can have languages with a special bias towards a particular type of application — which goes some way to explaining why there are probably a least 200 languages in common use today.

Another important advantage of high level languages is that the programs are largely self-products of the particular hardware used, unlike machine language. The first major high level languages for non-research and engineers was Cobol, which has become the world's most successful commercial language largely because efforts were made to keep it largely independent. Cobol stands for COmmon Business Oriented Language.

Cobol, Fortran and Basic are all well known, and because languages develop, Old languages never die, they just re-emerge. Without standardisation a large market for software packages cannot develop, as only a small proportion of the machines in existence will be able to run a program written in any particular dialect of the language so eventually a big meeting of the minds took place to define a definition of the language.

Cobol has developed in a language mostly because the US Department of Defense took responsibility for enforcing standardisation from its early days, so there are few computing dialects.

Basic has gone through the process of growth perhaps more than any other and suffers from widely differing dialects. Many of its core features were copied directly from Fortran — For / Basic jumps and the way subroutines are specified for example. But Fortran had gone through handling as dialects of Basic had no obvious model.

In fact, strong handling is where the biggest differences between Basic dialects were to. There are two major approaches. Most microcomputer Basic allow only three strings, usually of less than 255 characters in length, and use the Left, Right, Mid functions to select substrings.

Most versions of Basic running on the large DEC, Hewlett Packard, and IBM main computers, on the other hand, as well as Sinclair Basic, are closer to the American National Standards Institute ANS-Basic problem, and allow very long strings and use a system where "Example" [1,4] specifies the substring "Any".

Most microcomputer Basic can be loaded back to the Basic written for the INTS Alter main-computer — probably the first micro — by Ed Clark in 1971. His company, Macromail, has gone on to write the Basic for many other machines and these all have a family resemblance. The Macromail style of Basic has been widely copied by other companies as a more standard but emerged without formal agreement. But there is always the temptation to add wonderful new commands, like the Owl's Zap and Ping, which Kenney and Kurt would not recognise. Even some, Paks and Paks to cite



an array of a particular machine's word and program abilities and many times a complete, readable Basic, back on the days of machine language. There can be no doubt that Basic is a very good language, not because it is simple, useful, and friendly, because it survives all the conditions. But it is a great pity it may make sense to change to another language.

Forth is currently in vogue and it shares the treatment on page 48.

## ORIC



## FORTH

One Forth type Tascote offers standard 80 Forth a screen editor, an assembler and various extensions to take advantage of the sound and colour of the machine.

Systems and an editor are used as preferences to the listing system of the Jupiter Ace. These are Forth standard and make the language more portable.

The core is standard 80 Forth and offers all the usual words without the two additions. Forth Basic allows the saving of the full dictionary without all the fiddling with pointers addresses or number of bytes involved about.

The editor is next on the tape and occupies seven 1K screens. The above programs for load and edit before they are loaded into Forth, edit and are executed. The assembler is only five screens long and offers all the 800 instructions and takes in order to create machine-code primitive Forth words.

Seven screens of extensions offer such facilities as VDU I/O routines, maintain the creation of arrays, the use of C++ — a programming technique borrowed from Pascal, and all the Basic graphics and sound commands translated into Forth.

Finally on the tape is Funworld, a music playing program from Paul Kaufman which makes entering a tune in just four harmony words more than it is in Basic. All this is accompanied by a useful manual with full listings of the Forth words and what they do. (Editorial)

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continued from page 85

hierarchically is passed to the modules doing more detailed things and within most general modules.

This all helps when you are writing large programs, as Pascal has turned out to be very important commercially, but I think it is unlikely to reach as far as the environment: Pascal is a compiled language, which means that your high level instructions are not converted to machine code until you have completed the whole program (at least if you program, unlike Basic, which is generally converted line by line as you type it). This makes changing a top bit of a Pascal program tedious and time consuming by comparison.

Another reason Pascal is unlikely to become more than a minority microcomputer language is that the original academic investigators of its design made extending the language in a quick and easy way a deliberate major difficulty.

Lisp has a great Fortran to envy. It again has academic origins, but the academics who designed this one in the late 1960's, Seymour Papert, Daniel Bobrow and Wallace Perrier of MIT, had a lighter touch. They were thinking mostly of young children and how they come to understand visual and spatial ideas.

Think graphics, where you draw on the screen by giving movement orders to an imaginary turtle, in the most obvious result of the thinking in Lisp. You can now get versions of other languages that have had turtle graphics added as a non-standard extension.

Lisp's real strength is the way it holds data in with the descriptions of how you manipulate it as the main part of the program. Basic, for instance, is quite limited in the way it lets you to think about data, with strong and constant variables which are just like paper holes, and arrays that are just like tables.

The Lisp model is more useful for manipulating non-numeric textual data as the way basic programmers must often want to do it and could end up being the language used to support versions of the popular text.

Many Lisp features are ideas over from Logo, which although an earlier language dating back to 1965, is still going strong in the artificial intelligence community. The language was designed expressly for manipulating non-numeric data, which it does by organizing the data as lists. The name Lisp is derived from List Processing language.

Lisp itself will serve your mass popularity because of its syntax. The way you write it involves enormous numbers of brackets, the ritual cult of counting to make sure you have the right number of brackets, matched up properly, is a pain.

BCPL is a much more recent structured language widely used in universities as an alternative to assembly or machine code. I have had no contact with it, but the article by David Benjamin in this issue describes the newly released version of the language for the BBC computer.

Although any language is more suited to some tasks than others all the languages I have mentioned so far are quite general purpose. As long as a language smacks enough in the hand of way it lets you hold data and the way it lets

# SPECTRUM FORTH

Atari's 48K Spectrum Forth — with graphics — impressed me almost as much as the Center Forth. This loaded in just 39 seconds including the editor. This is a 76 Forth implementation with extensions to make best use of the Spectrum capabilities.

All the Forth standard words are included and a better selection of double precision operators. The Spectrum specific extensions include graphics words such as Draw, Arc and Aa but apparently no Circle. All these words are the same as those Basic systems. Draw is not the same as Spectrum Basic Draw.

All these parameters are related directly to the machine-code logic, allowing the amount to be more creative if less easy to use than Basic. User defined graphics commands are never to continue.

There are two ways to save definitions both of them non-standard. The first of these is a routine to save the Forth source

you control 80 devices, you can write virtually anything as it.

Again it makes little sense to talk about good and bad languages unless you are when talking you are trying to program and what your idea of a good outcome is — compact code, rapid execution, easy and fast programming, beautiful looking output, so compatible with programming, or whatever. In my fairly confident I could write after creation in C, a long tedious language for such a purpose. The graphics would not be much good but you could say character code coming down the screen as you.

Basic would clearly be better, and Forth or C would be ideal. Machine language would of course be capable of producing an excellent game, but the job would take longer and demand more detailed knowledge of the particular system. What a lot depends on what you want to program. It is horses for courses.

So what will happen in the future? Basic will keep existing. The only real challenge in the mass market I think will be Logo, not because it is going to get onto the schools and it is good for graphics and it is easy to make extensions to it to take account of new computer features like sound or speech.

In the longer term what matters is helping people to think, as with memory power falling and processor power going up languages designers will have to think less and less about efficiency on the machine. There will probably be more languages — personal taste will matter even more.

People will choose a language which gives them something for thinking about the things they are trying to program. It will not be the case that programming languages will disappear, to be replaced by some automatic way of controlling machines, because programming is too enjoyable. And it is only partly about control — it is also a thought exercise. ■

definitions and your definitions in the same form as the system is supplied in. This is not standard but a good idea.

The other method involves 35 standard Forth screens. Each screen can be compiled individually but can only be performed to and from tape as a group of 35 screens. Atari's program Microdrive file support in the next issue hopefully this will allow the screens to be individually numbered and the filing operations to be carried out automatically.

The Forth screen editor is again a standard Forth editor. The presentation of the screens on the VDU is a little different. It is used for a Forth screen which conventionally consists of 18 lines of 80 characters to be presented in 14 blank lines. This allows the whole Forth screen to be visible on the VDU screen. The editor usually presents with less an 84 question marks (causing it to screen off the screen).

This is equivalent to Forth. It is friendly but flexible is compared with can be defined which puts a carriage return only once each line.

Also included is a printed booklet which includes the usual introduction to Forth loading details and a glossary.

Simon Calver



# VIC FORTH

There is a certain something about products associated with the language Forth. The people involved seem to make the extra special effort that gives their product the edge over others.

It seems to be quite a coincidence with the language and some memory packaged neatly and concisely with explicit instructions about what to do with a clear and well written manual, suffering only from being a little heavy, but the content is excellent.

# MSX BASIC

Bill Gates, right, wrote the first modern microcomputer Basic in 1976. Now his company, Microsoft, is ready to launch MSX Basic and Graham Bland explains its importance.

So what makes MSX Basic so special? A standard, universal BASIC, was prepared by ASCII Microsoft in Japan and was adopted by 24 companies in the computer electronics field. MSX makers include such home electronics businesses as Sony, Yamaha, Saaya, JVC, Pioneer and Sanyo in the United States.

The standard outline specifications for a home micro system, the hardware and software that will define an MSX machine. The new general standard is broken as far as the hardware is concerned: the old 280k 280 workhorse is the processor at the system, and support chips include Texas Instruments' 8018 video display processor, and the AD-DA102 sound chip. MSX Basic comes as part of the machine and is resident in ROM or ROM. The usual RAM supplied will be 64K, but back RAM and ROM will be considerable.

What this in effect proposes is that the basic configuration of all MSX computers will be the same. Support for I/O devices, graphics and sound will be handled in precisely the same manner. Basic use manufacturer's system to market software compatibility will already make software products happy because of supporting their products for one machine, or simply making software for a range of machines, there will be a large number of machines to run a single item of software.

MSX products are aimed at the area of the market now occupied by the Sinclair ZX Spectrum. Although there is a plethora of software for just about any application available, to gain access to a you are still stuck with the narrow capabilities of the Spectrum — the word-processed format very large. With MSX, if you do not like the look of one manufacturer's offering, you can always go for another. The availability of a large software base is guaranteed.



MSX Basic leads its roots to Microsoft's highly successful MS-Basic, and incorporates the features of QW-Basic, which runs on the IBM PC, plus numerous enhancements over its predecessor. Programmers familiar with the Apple II and the Basic will find the transition to MSX Basic painless, and those whose interests have been on the Spectrum will find that the language offers so much more, particularly in the area of graphics and sound.

It is important that any graphics commands should be instantly accessible, so this is the



feature which is probably most appealing for the first-time user. In MSX Basic, there are three screen modes available: a text screen, low and high-resolution graphics. These screens may be used with the range of bit colors provided — the Spectrum has had the number — with the usual ability to specify foreground, background, and border colors.

The high-resolution screen is 256 by 192 pixels. Each pixel may be addressed individually using the Fore and Posx commands, which respectively turn a pixel on and off. Commands to draw shapes such as circles and boxes are also provided. The Circle statement is very similar to the Spectrum's, but it offers options to draw any shape you can so specify.

Drawing a loop is again much the same as Sinclair's Basic, but with an optional pair of brackets at the end of the statement, one of which draws a rectangle, the other drawing a rectangle and filling it in with a specified color.

A new feature, derived back by the graphics and sound capabilities of the language, is the concept of macro language. There are languages beneath the Basic which allow character strings to define shapes or patterns of pixels. The graphics macro language allows any shape to be defined and displayed on the screen using the Draw statement. A simple example is the drawing of 20 by 40 rectangle, which may be achieved by using the following statement in graphics mode:

```
10 DRAW "240 000 040 100"
```

As you may have guessed, 240 means draw up 40 pixels, 000 means move right, and so forth.

Once a picture has been drawn, it can be

*(Continued on page 88)*

The package saves you the frustration of loading programs and enables you to edit directly in. The designers have obviously thought long and hard about what they are doing, and this is immediately apparent when you start to read the manual.

Your Forth program has been divided into screen windows which allow you to edit where you are told in the bottom left hand corner. Each has a width of 64 and height of 20 giving you 8K at a time to play with. The month has a lot of memory of each so that Autopage have been sensible enough to put in a powerful screen compression routine.

A third screen displays in the lower indicating the screen number. When you press any key in Screen 0. This is the

interactive screen so anything you type in at that will be accepted. The screen editor is easy to use and not dissimilar to the manual so you can go straight on to the part where you write your program — Screen 1 and following.

The manual has supposedly been written for people with prior knowledge, but if you have mastered one programming language you could plug in the end start to program in Forth.

Forth is a strange beast: there are no retained words at all. The only bits being set are the reserved words which you define on your own words that have been previously defined. So actually a Forth program never looks quite the same in memory than it looks

make other people a Forth program hard to understand.

If you want to program in Forth on your VLSI Autopage, first come up with a real quality product. Forth is generally thought of as being a specialist language. However it is extremely fast compared to Basic — and as a test case to see this machine code once you can define your functions starting simply and working on.

I don't unfortunately, lead to the most unworkable programs I have seen — you definitely could not expect to debug someone else's program. And it is not easy to change your own. Nevertheless the implementation is the best I have used.

*Alan Jackson*







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SPECTRUM

```

1 ROM for 2 rowed hash character
2 CLM# 30480: PAPER 0: IN# 7: WORKER 0: CL# : FOR#
35676,127
10 PRINT ""CAPMAN"" BY ANDREW CAPLE 1983: IN# 3:
PL#F 128,0: DRAW OVER 3:0,153,277:IN# 7: PRINT AT
31,31: FLASH 1:"COMPLING"
15 FOR F=0 TO 15: READ AN: LET AN="LULLL" + AN + "LULLL"
LL:" FOR S=0 TO 31: FOR E (32000+32)*E-81,DOSE AN*(S)-8
S: NEXT S: NEXT F
20 LET A=10: LET B=12: LET C=12: LET D=13: LET E=14:
LET F=15: LET G=0
25 IF G="0" THEN READ AN: LET AN=""
30 IF G="" THEN S=0: AN
35 IF G="1" THEN S=1 TO 300
40 FOR R=0,14:FOR L=0,15:R=L:R=L:LET AN=AN+S: LET
AN=AN+S TO 1: GO TO 25
60 DATA "LULLLULLLULLLULLL"
61 DATA "K00P00000000000000"
62 DATA "M0TTTTTTTTTTTTTT"
63 DATA "K0P00000000000000"
64 DATA "K0000000000000000"
65 DATA "K0000000000000000"
66 DATA "K0000000000000000"
67 DATA "K0000000000000000"
68 DATA "K0000000000000000"
69 DATA "K0000000000000000"
70 DATA "K0000000000000000"
71 DATA "K0000000000000000"
72 DATA "K0000000000000000"
73 DATA "K0000000000000000"

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CAPMAN is a version of the popular arcade game Pac-Man and is written to run on a ZX Spectrum. The program will run on a ZX Spectrum though memory will be just as cramped. This is because the machine code is located in the same address as on the smaller machine. The features of the program are:

- Fast machine code action
- 4-way maze play
- 40 levels of play
- On screen scoring
- Precognised high score
- Match points and lives in the direction of level
- Two enemies
- Colours

The program is self-contained so the listing print is the only file needed. The hardware, hardware, main data and basic control programs are stored in the one routine. This method was adopted to prevent mistakes about saving the code separately to the control programs. The disadvantage of this program is that an occasional omission of program area is said up by the hardware, so an extra machine code routine will take up more than three times its length. Before you start typing in the listing, maybe your Spectrum then remembers it, this means that you have the maximum amount of memory dedicated to the program.



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DRAGON EXPLORE, published by GAMES, GAMES, GAMES, is a computer game for the Atari 2600, 400, and 800. It is a strategy game for two players. The objective is to explore the outer reaches of the galaxy. The game is set in a galaxy with a central sun and a ring of planets. The player starts with a small fleet of ships and a small base. The player must explore the planets and build up a fleet of ships and a base. The game is a strategy game for two players. The objective is to explore the outer reaches of the galaxy. The game is set in a galaxy with a central sun and a ring of planets. The player starts with a small fleet of ships and a small base. The player must explore the planets and build up a fleet of ships and a base.

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No exploration of the outer reaches of the galaxy in this game. It is set a little closer to home — the British Isles. The object is simply to get rich and stay rich. A. P. Chybalski explains.

This game is based on the geography, history and agriculture of the British Isles. The player divides up which of the five areas they wish to explore.

- Southern England and Wales
- Northern England and Wales
- Scotland
- Ireland — North
- Ireland — South

A map of the area shown is then displayed, divided into squares by a grid. The object of the game is to explore the area on the map by means of small square islands. Exploration costs £50 per square, the player will receive:

Resources can be found in some squares, the player finding these receives a regular payment. If these squares are subsequently developed, a fixed revenue per year is obtained from them.

Development costs to start and a player has more than £10,000 of ready cash. Individual squares can be developed or a village program can be set up (costs just over £100 per year). A village program is set up by a player when he wishes to develop more than one square at one centre.

The program is controlled by the computer. When the development of one square finishes, the next is started because it received from any square that has been fully developed. Players can have a maximum of five villages.

Money can be lost in the bank at a rate of 30 percent interest and borrowed at 20 percent. A player may not run out of ready cash or show a bank deficit of more than £10,000. If this occurs, the player cannot take on

more than in the game as he is declared bankrupt.

Players can explore a given number of squares per turn, depending on how much ready cash they have. This is summarized in Table 1.

| Ready cash    | Number of squares |
|---------------|-------------------|
| 0 - 2000      | 1 square          |
| 2000 - 5000   | 2 squares         |
| 5000 - 10000  | 3 squares         |
| 10000 - 20000 | 5 squares         |
| 20000 - 50000 | 7 squares         |
| 50000 plus    | 8 squares         |

A player can move from any of his own squares to explore others in the same helicopter mode to a nearby unexplored square. Such a helicopter ride is equivalent to two squares worth of exploration. Development also costs one square worth of exploration.

Players move across the map by pointing the joystick left. They may only enter a square that has not already been visited. Pressing Enter allows the player to define a new starting point for any exploration that remains to him.

The price table when visited of the player, are brought up. All the available squares have been explored. The game can be ended earlier by pressing Shift + C to begin to define a square code number in the next of exploration. When listed is given in the next of exploration with no square code—no more exploration is carried out for the current turn for the current player.

Pressing Enter will allow a square code during development shows the development and sets whether the player wishes to continue.

Specialist on the map:  
Player 1 — Yellow squares  
Player 2 — Red squares  
Player 3 — Blue squares

# DRAGON EXPLORER

Leaving on the squares on the map indicates development. Good starting squares are undeveloped squares, obviously leaving on a player's colored square indicates that the square has been developed.

If a player wishes to enter on the map while he is entering a square code number, he has only to press C. Typing in a code number returns to the next screen.

This program is about 25K in length before running. It takes about 150 lines to play. Typed copies of this program and programs based on Prince, Germany, Antares, Aquarius or the ISA can be obtained from A. P. Chybalski, 81 South Avenue, Route 114, Northbrook, IL 60062, enclosing a check or postal order for \$4.

|   |            |
|---|------------|
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| B | Costa Rica |
| C | Costa      |
| D | Costa Rica |
| E | England    |
| F | France     |
| G | Spain      |
| H | China      |
| I | Iran       |
| J | Portugal   |
| K | Spain      |
| L | Spain      |
| M | Costa Rica |
| N | Costa Rica |
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| R | Costa Rica |
| S | Costa Rica |
| T | Costa Rica |
| U | Costa Rica |
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| W | Costa Rica |
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| Y | Costa Rica |
| Z | Costa Rica |

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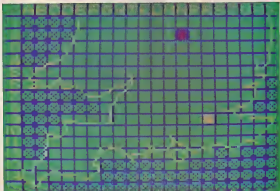
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Listing continued on page 100



# Introducing The Tandy

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- Powerful Built-In Software
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# DOOS

## Discover the ease of programming with a Disc Operating System on the ZX-81 with Carlo Delfino.



Whenever you want to use **Save**, **Load** the program which starts **RAMDISK** at address 12500. Now you can start entering the line codes in Figure 1, using program 2 — a second line loader with one extra advantage: when data has to be entered, you do not have to type the line codes corresponding with the data. You use just the data provided and coded by a dollar sign.

So, when you want to enter **Save** as data, you do not have to type 102001091030 — the line codes for the individual letters — but simply **SAVE1030**. This facilitates entering data. The **Load**, **Save** and **Reverse** statements in the data at address 12600 can be obtained from the keyboard by typing **T** then, followed by the statement concerned and finally by defining the keyboard. This and putting the cursor back in its correct position. Figure 1 consists of the machine-code instructions and every four bytes of data is provided with an address-indication, so you can check whether or not you have forgotten one or more bytes or double-typed some.

If you think you have mistyped a byte, break into the program by entering **Ctrl-T**. You will get an error-message, but do not bother about that. Make a note of the address at which you made your mistake, let, for instance 70 and change 17000 into your address. When you Run again you can start entering the line codes from this address onwards. After having entered all the hexadecimals and data you will have to adjust the program to a final size by means of program 3.

Check everything very carefully as one little error might cause an irreversible program-crash. Once you have tested all the bytes for accuracy, you can Save them.

This has to be done with a special program as the position of **RAMDISK** and the bytes above it are not Saved by the Basic-level. Program 4 sets machine code to copy a block of bytes into memory A, then Saves the program and again sets machine code to copy the contents of A, placing them at their proper positions, starting at address 12600.

The machine-code program to achieve this is shown in Figure 2. The second time this machine code is used the **Ctrl-D** is changed into **Msg** if you have done everything as described, the program can be Run.

**Save** offers three possibilities after being executed. I will discuss them one by one.

**Save**. One statement that has to be used is to include a program-name. This name has to be put behind a **Reverse** statement in the first line of the program. It must contain at least one and at most 30 characters which all have to have a code between 10 and 64. Spaces are also allowed.

An error-message is displayed if the first line does not contain a **Save** statement or the number of characters behind the **Save** is too

small or too large or illegal characters are found. If all is correct, the program is Saved. On entering the program one can then be seen, as Run.

**Reverse-Load** will put a back into visible memory. If you have machine code stored in the first line here is a hint for you as to how to adapt a **First-type** Pake 10310.2. The instructions transfer the first line, the one with the machine code, to line 2. If you already have a line 2 in your program that will not be overwritten by the new line 2.

Next, add line 1 including the program name. To Run the machine code — in the second line — see **Read USB** (2+4+Peak 8511) instead of **Read USB** 2, where X is something around 10314. You will have to go through your Basic and machine-code program to change the addresses that are called by **USB** and **Call**.

For example, if you give a certain program the name **Name** then **Peak 10311** equals 2. The machine code that first stored at address 8516, now starts at address 2+4+Peak 8511 or 10314+4+4 = 10322. If you want to Save a Program without having to pass the memory, see **Read USB** 12423.

**Load**. Having Saved several programs using the above routine, you will probably want to reload them. This can be done employing **Reverse-Load** after having executed **Read USB** 12500 just before **Load**. Now the computer will display a menu, showing all the programs available.

Pick out one of them by pressing the key corresponding with the number — or letter if there are more than nine programs — on the menu — or then of the name. The program will now reappear as first code and **Load** the program positioned. Although the Loading job is very fast it will might take a little while.

Once the program has been loaded it is automatically executed if you do not want the intermediate list, just type **Pake 10320.2** and to regain the **Reverse** Pake 10320.04. Error messages are given when no programs are

available from the disc or when the program is already in memory, or not so called.

When one program is Saved and another Loaded, all the variables used with the first may remain. You can use this with different programs to preserve and manipulate strings.

The programs are stored above each other, all before the display list, that is shifted up each time you add a program.

After being Run program 3 will show all the programs stored.

New will destroy the total contents of the disc, not only the one that can be seen.

When **USB** 10425 or **Save** is executed within the program, the machine code remains until a **Go to**, **Go to** or **Run** statement is found, then the computer will stop with an end-of-operation message. **Go to** and **Run** are always ignored after **Save** and **Load**.

To use a disc on cassette I should use program 6. The machine code is not Saved by the **Basic-Save-Use** program 4 instead.

If it is best to you all the full "ideas" on our cassette, provided by program 1 — which costs **RAMDISK** — and program 2 which loads the machine code about **RAMDISK**.

If you have any questions write to me: Carlo Delfino, Krommstraat 3, 6851 BV Steenbergen, Holland. Finance include all mailing.

```
Program 1
100 000 000000 00 0000 000000 00
101 000 000000 00 0000 000000 00
102 000 000000 00 0000 000000 00
```

```
Program 2
100 000 000000 00 0000 000000 00
101 000 000000 00 0000 000000 00
102 000 000000 00 0000 000000 00
103 000 000000 00 0000 000000 00
```

Figure 2

| Address | Code     | Label | Comment  |
|---------|----------|-------|----------|
| 10000   | 00000000 | 00    | 00000000 |
| 10001   | 00000000 | 00    | 00000000 |
| 10002   | 00000000 | 00    | 00000000 |
| 10003   | 00000000 | 00    | 00000000 |
| 10004   | 00000000 | 00    | 00000000 |
| 10005   | 00000000 | 00    | 00000000 |
| 10006   | 00000000 | 00    | 00000000 |
| 10007   | 00000000 | 00    | 00000000 |
| 10008   | 00000000 | 00    | 00000000 |
| 10009   | 00000000 | 00    | 00000000 |

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# SPRITE EDITOR

THIS IS HOW THE SCREEN SHOULD APPEAR  
WHEN YOU RUN THIS PROGRAM

## SPRITE EDITOR

PRESS CTRL + E TO EXIT

This program by Njal Fiskeröjn makes it easy to create sprites of all kinds on the Commodore CBM 64.



\*: FILL BOX  
SPACE CLEAR BOX

- F3: EXPAND XDIR YES/NO
- F5: EXPAND YDIR YES/NO
- F7: MULTICOLOUR YES/NO
- F4: SELECT 1ST MULTICOLOUR
- F6: SELECT 2ND MULTICOLOUR
- F8: SELECT BACKGROUND COLOUR

CTRL/CBM KEYS CHANGE SPRITE COLOUR  
F1: PRINT SPRITE DATA F2: DISPLAY ON/OFF

This little program lets you create a sprite on the screen and display or print the necessary Data and Plot statements.

To change the colour of the sprite use the CTRL or Ctrl key together with keys 1 to 8 just as you would do to change the colour of the cursor. To make the drawing of vertical lines easier there are four commands (as shown on the display, U, R, D and L).

These change the direction in which the cursor will move after a " " or a " " to up, right, down and left respectively.

### Multicoloured sprite

If you use a multicoloured sprite the resolution is 12 by 10 and each 'dot' on the sprite is represented by one dot in the large area.

- \* is the background colour
- \* is 1st multicolour (0)
- \* is background colour
- \* is 2nd multicolour (1)

Expanded colour mode on the Commodore 64 allows you to have four different background colours on the screen at once, but it also reduces the character set to the 64 first characters of the Print set, ie, no graphics.

Normal character set background colour 1  
 PRINT:00001  
 Shifted character set background colour 1  
 PRINT:00001  
 Normal character set background colour 2  
 PRINT:00001  
 Shifted character set background colour 2  
 PRINT:00001

If the printer makes the computer beep you should change these two lines  
 AND P001:0000 PRINT:0000 AND P00  
 AND P001:0000 PRINT:0000 OR 10

This will cause the screen to go blank while the computer is printing.  
 It is advisable to reset lines 2400 and 2410 only when you are sure that the program is working correctly.



(Being continued on page 176)

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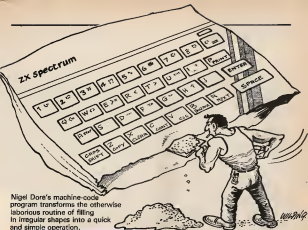
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Nigel Dora's machine-code program transforms the otherwise laborious routine of filling in irregular shapes into a quick and simple operation.

## SPECTRUM

# PAINT ROUTINE

Before using fill



After using fill with paint inside of shape



After using fill with paint outside of shape



FILLING IN (IRREGULAR) shapes on the Spectrum can be a long and laborious process, which can be avoided by using this fill routine.

The program, which is entirely in machine code, will fill any enclosed area simply given one paint shade of it. The machine code is approximately 900 bytes long but requires about 8K for storage of a normal screen. The use of assembly is no problem on a 48K Spectrum but leaves the 16K with about 2.

The fill routine is entered into memory by using the program in figure 1. The length of the machine code means that machines can easily make use of this routine: the program is

extremely short-circuited. So much so that the computer will tell you in which lines you have made your mistake!

Having entered the program, save it before you Run it, then Run it. If there are no flagged variables the basic program will now self-destruct. If variables are detected then correct them and rerun the program, repeating if necessary. Check the machine code has been entered it can be saved with the command

SAVE: PLOT: CODE: 32000: 600

and loaded with the command

CLEAN: 28000: LOAD: PLOT: CODE:

(continued on page 120)

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# ROCKET SCR

## BBC

**MINIABLE COMMAND** is an arcade-type game for the BBC Micro Model B or Model A with ME. The program makes extensive use of the BBC's graphics and procedures to make a fast-moving fireworks in BBC Basic and machine code.

After each of the three programs have been Cleared, the computer will display the instructions. These show what the use of the game is and the control keys. The game is based on the arcade game *Minable Command*, but has some minor changes. Instead of using a ball to move your sights, you must use four keys. Also, instead of three separate missile boxes, you have one base in the centre which

can be used three times. This number is shown. It starts at three and works down. Six coins will be placed into your base and you must defend these. Waves of enemy missiles appear from the top of the screen and work down towards your base. You can destroy these missiles by firing clouds of explosives in their path. The missile will be destroyed if a mine is cloud.

Each missile has come off with 10 minutes, which are fired by pressing the S key. To move your sights use the following keys:

W = up  
N = down  
A = left

D = right

Every so often, an enemy missile will fly across the screen and can only be destroyed by a direct hit from one of your missiles. Bonus points are gained for destroying these as well as for completing a wave. After each wave you will be awarded points for any missed missiles or coins left unattended. You also gain points by shooting the missiles and your score is displayed in the top right hand corner of the screen. If all your coins are destroyed the game will end. A bonus city is awarded every 10,000 points. Also, each wave of enemy missiles is slightly faster until they reach an incredible speed and wipe out all your coins.

# EEN

When you start the program, it asks for the name of the file you want to use. It then displays a screen of the program's options. You can use the arrow keys to move the cursor to the option you want, and then press the Enter key to select it. The program will then display the options you have selected.

To fit the programming into the BMC's 64K memory limit, the program must be split up into three parts, which have the following functions:

- Display title page and set page to 0,1100
  - Display control keys, define overlays, define graphics characters and assemble machine code
  - The main game
- Unfortunately, the printer used has changed all occurrences of # in the program to & in the listing. This is most noticeable in the machine code, as every time a & appears in the listing, change it to #.

The program defines characters 070 to 07F

### Program 3

```

1000  REM ***** EXPLOSIONS *****
1010  REM *****
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1970  REM *****
1980  REM *****
1990  REM *****
2000  REM *****

```

is well as 234 to 255. Therefore, page must be set higher up in the memory to avoid overlapping the program. This is achieved in the first program, so that all subsequent programs will be loaded from location 0,1100 onwards.

The machine-code program is assembled from ASCII keywords and requires slightly over one page. Therefore, once the program has been fixed, pressing the Reset key will corrupt the machine code and you must restart it. Do not press the Reset key until you have finished playing. The machine-code subroutine is used to print the explosions and should be quite easy to follow. The program requires data for the explosions to be stored in 0,0800 onwards. This tells the computer what size explosion to print and in which order. The program copies with some different sizes of explosion in, sometimes, when two explosions overlap, a gap might appear between them. Therefore, try to avoid overlapping explosions when playing the game.

The main program should be quite easy to follow. To help with understanding how the program works, I will give a brief description of what the main parts do.

### Program 1 description

- |        |                                  |
|--------|----------------------------------|
| Lines  | Use                              |
| 00-111 | Print up title page              |
| 120    | Define text screen               |
| 130    | Set page and Chain next program. |

### Program 2 description

- |         |                                  |
|---------|----------------------------------|
| Lines   | Use                              |
| 20-120  | Print up control keys            |
| 120-150 | Define overlays                  |
| 170     | Define text screen               |
| 160-200 | Define characters for explosions |
| 210     | Define constants                 |
| 220     | Define C0                        |
| 230     | Define C1                        |
| 240     | Define C2                        |
| 250     | Define C3                        |
| 260     | Define C4                        |
| 270     | Define C5                        |
| 280     | Define C6                        |
| 290     | Define C7                        |
| 300     | Define C8                        |
| 310     | Define C9                        |
| 320     | Define CA                        |
| 330     | Define CB                        |
| 340     | Define CC                        |
| 350     | Define CD                        |
| 360     | Define CE                        |
| 370     | Define CF                        |
| 380     | Define CG                        |
| 390     | Define CH                        |
| 400     | Define CI                        |
| 410     | Define CJ                        |
| 420     | Define CK                        |
| 430     | Define CL                        |
| 440     | Define CM                        |
| 450     | Define CN                        |
| 460     | Define CO                        |
| 470     | Define CP                        |
| 480     | Define CQ                        |
| 490     | Define CR                        |
| 500     | Define CS                        |
| 510     | Define CT                        |
| 520     | Define CU                        |
| 530     | Define CV                        |
| 540     | Define CW                        |
| 550     | Define CX                        |
| 560     | Define CY                        |
| 570     | Define CZ                        |
| 580     | Define CA                        |
| 590     | Define CB                        |
| 600     | Define CC                        |
| 610     | Define CD                        |
| 620     | Define CE                        |
| 630     | Define CF                        |
| 640     | Define CG                        |
| 650     | Define CH                        |
| 660     | Define CI                        |
| 670     | Define CJ                        |
| 680     | Define CK                        |
| 690     | Define CL                        |
| 700     | Define CM                        |
| 710     | Define CN                        |
| 720     | Define CO                        |
| 730     | Define CP                        |
| 740     | Define CQ                        |
| 750     | Define CR                        |
| 760     | Define CS                        |
| 770     | Define CT                        |
| 780     | Define CU                        |
| 790     | Define CV                        |
| 800     | Define CW                        |
| 810     | Define CX                        |
| 820     | Define CY                        |
| 830     | Define CZ                        |
| 840     | Define CA                        |
| 850     | Define CB                        |
| 860     | Define CC                        |
| 870     | Define CD                        |
| 880     | Define CE                        |
| 890     | Define CF                        |
| 900     | Define CG                        |
| 910     | Define CH                        |
| 920     | Define CI                        |
| 930     | Define CJ                        |
| 940     | Define CK                        |
| 950     | Define CL                        |
| 960     | Define CM                        |
| 970     | Define CN                        |
| 980     | Define CO                        |
| 990     | Define CP                        |

```

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```

- |         |  |
|---------|--|
| 210     | Define variables   |
| 220-230 | Set up pointers to explosion in 0,400                                    |
| 240-250 | Make up explosion from character and store in appropriate place in 0,400 |
| 260-280 | Assemble machine-code program  |
| 290-310 | Reset position of explosion data   |
| 320     | Chain this program   |

### Program 2 description

- |         |  |
|---------|--|
| Lines   | Use  |
| 50      | Top screen                                   |
| 60      | Assemble explosion                           |
| 110     | Make screen variable                         |
| 120     | Get page                                     |
| 130     | Delay your flight                            |
| 140-150 | Your movement                                |
| 160-170 | Update score                                 |
| 200     | Plot your flight                             |
| 210     | Fire missile                                 |
| 220     | Countdown timer for missile firing           |
| 230     | Miss counter                                 |
| 240     | Missed missile print explosion, miss missile |
| 250     | Printed miss?                                |
| 260     | Score update                                 |
| 270     | Score finished?                              |
| 280-300 | Make up explosion                            |
| 310-320 | Print up miss screen                         |
| 330-340 | Set up position of C0                        |
| 340-350 | Print missile base                           |
| 360-370 | Put missile inside base                      |

Continued on page 127



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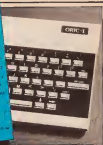
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```



## Boolean algebra puts the zip in this fast Oric game by Russ Whitehead.

MATRIX MAN'S speed is achieved primarily by reducing the repeated part of the program to just three lines, and by making possible such the use of Boolean algebra and by taking rather than placing characters on to the screen.

It was developed after having played many other slow games and being bored by the effects of false computer screens in which not so the more as which I had I was determined to find a game which was interesting, colourful and fast moving. It was an obvious attempt at a few logic cycle programs which eventually allowed me to produce Matrix Man.

Even then my problems were not resolved. The usual program was so slow that I could have done so much while playing the game and still not see a life. I finally achieved success after discovering the advantages of Boolean algebra, and with the help of an April 1982 First Computer article on Spectrum life graphics which gave me some hints on quick plotting.

The object of the game is to move the 200 cycles or movements of the runner without crashing into a wall, a grass obstacle or a blue obstacle. These obstacles are placed at every row and column and the blue obstacles are placed randomly. On completion of 200 cycles there is a pang and a new screen appears. The blue water grass and blue obstacles to avoid. Each new screen becomes increasingly harder and the 170 when a new type of maze situation appears.

The screen consists of consecutive squares and the aim is to reach the centre of the maze. However, as you drift out of you are lucky enough to get the life there are no opponents in the squares. To cross them you must pass

# MATRIX RUN

```

Program
A. Plot on of the runner - 1000 on
    the screen
B.0 B. Variables used in the five lines
    least, most common - D
C. The direction of the runner if P is
    1 then the direction is up
    if P is 2 then the direction is right
    if P is 3 then the direction is down
    if P is 4 then the direction is left
D. The difficulty of the runner - how
    slow the path becomes the the
    more often
E. The number of lines used up
    the screen and how many squares
    have been passed - also the number
    of blue obstacles
F. The character at position A before
    the runner is plotted
G. A 200 numeric number - 200 - is
    used only to keep the 50 possible
    frequency of the five first two to
    10 of the runner crosses when he
    is in a screen but some are the 5
    screen is awarded and is stored in
    at the next run
H. What is open on the line - used
    to make key use up slow

```

directly through the Open Gates sign.

The game uses the left and right keys as a only. But a must be done at most in all times that left and right apply to the runner and not to the gate.

At the start of the game you have three seconds to decide which way you want to go, and pressing on key means you will go straight onwards.

Line 8 defines all the variables which are set

at at 8, and decides whether to Give the runner the goal screen on the main screen.

Line 18 defines the use of the main Run Next loop - how far the runner has to go - and sets the direction of the runner, P, when a key is pressed.

Line 20 sets the position of the runner - makes the runner move in the direction indicated by the key, and finds out which obstacles occupied the position the runner now occupies. Line 30 determines if the character is an obstacle, and makes two statements for the completion of a grid.

Line 40 contains the list of instructions for the runner taking an obstacle.

Lines 50 to 80 set the screen - place the random blue dots, and draw the grid. They also type the name of the game at the top of the screen.

Lines 90 to 120 set the maze screen. Line 130 starts Open Gates at the top of the screen, sets up a repeat loop and sets the direction of the runner when a key is pressed.

Line 140 has the same function as line 20.

Line 150 opens the gates into the maze when the runner passes through the Open Gates sign. Line 160 finds out if you have reached the centre of the maze. Lines 170 and 180 do in the same function as line 40. Lines 200 to 230 contain the list of instructions for reaching the centre of the maze.

# Let battle

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# Commence

IS YOUR ONLY DEFENCE!



**5 PATHS TO  
EXCITEMENT  
ON THE 16K  
SPECTRUM!**



#### **CATERPILLAR**

The giant caterpillar is coming to get you, helped by a host of wild creatures. Don't get segment by segment, then it's only through the earth's veins that the ugly creature, *Butterflymania*, turns a danger everywhere!



#### **LEAP FROG**

A frog necessary danger as far as bones. Like a host of first message cards, a partying-filled jumping frog family. They bring nature and every situation. Do you have the will to see *Butterflymania* baby?



#### **PAINTER**

The bones come looking easy to you, help the already (what) paint the 3-D world. Can you tell before it hits you? Will the computer save you? And *Butterflymania* - the game goes better if you go better!



#### **BODY BOMB**

By which life being a host in an *Butterflymania* game. That's all you need! If you can't find it, *Butterflymania* too if you are lucky. Find it, then right and *Butterflymania* - the game goes better if you go better!



**and  
we'll  
keep on  
coming  
to  
get you!**



# DUEL

HINT: at 10:00:00 on the August issue, is the dual computer version of Submarine Warfare. Enough time has been allowed for fledgling programmers to get their capable eyes on with the role program. Here for the moment of truth — a suitable opponent.

To link up two Spectrum for our present purpose clearly demands some hardware. In fact, I have written the IO handling routines of the program around the Programmable Sound Generator and IO board — (PSGIO) — used for the Moscow courses featured in the March edition of Your Computer. That interface sometimes gets ugly a little more than a manual volume in the IO work of Submarine Warfare, but was chosen nevertheless for several reasons.

In the first place, a considerable number of readers already have a PSGIO board. Secondly, such such versatile sound and IO capabilities, it can lay some claim to being the most useful general purpose add-on for the Spectrum. Finally, the course can be very easily built by home constructors, or bought ready made for a very reasonable price. This is not to say that other IO interfaces might not be used. Indeed, machine code adapts should find modifications of the relevant benefit of various a very straightforward manner.

As a substitute for two Spectrums and three operators, Submarine Warfare adds a novel exciting extra dimension to home computing, the atmosphere and tension are of a different order. But for all that, the dual system is simply achieved. During each major program loop, one of the computers — shall we say the master — will inform the others — the slave — that it has data ready to send.

Meanwhile, every 20 ms the slave polls the master to check whether data is ready. If that should be the case then the slave will receive data, on completion of which roles are exchanged, the slave becoming the transmitter. The roles of master and slave are established automatically during initialization — line 9400 on — and are reversed through program routine. Through the usual process of priority services, one computer will dominate on agreed upon at the same time.

Polking at 20 ms intervals is achieved by polling the slave computer via interrupt;

# AT SEA



This interactive submarine game by Rod Hopkins means you can pit your wits against another sub commander.

mode 2 and switching to server mode to enable reading the PSGIO input port. The method of switching inside has the great advantage that the performance of one computer does not depend on that of the other.

Some time later high industry standard status information are being maintained, accuracy of data is important. For this reason, deadweight has been employed during exchanges, or has stackman verification. The former is an obvious result of communication and acknowledgment, while a checksum is some numerical fraction of the data sent, appended to that data, and used by the receiver to verify the data.

Hardware lines were being available, deadweight was replaced by using the upper three bits of each byte of acknowledgment, the lower eight bits being reserved for data. This involves a certain amount of processing of both data for transmission and data received.

For each message, appended to the six variable transmission bytes, is a return to the sender submarine. It has program format and sends a data checksum, a device format and sends a return data to the master so. The variable contained are shown at table 1.

| Table 1 |                   |
|---------|-------------------|
| data    | return/ready data |
| data    | return/ready data |
| data    | return/ready data |
| data    | return/ready data |
| data    | return/ready data |
| data    | return/ready data |

Let me emphasize at this point that the dual version of Submarine Warfare is very much an extension of the solo edition, rather than a separate entity. For the most part in fact, it is the same basic code additions being mostly executed with IO.

Therefore the assumption is made that the hardware on next page!

Figure 2 Master-slave connection



Figure 3



Continued from previous page

reader: taking on the task of a pig in the dual program has already made a copy of the data on Figure 1 into the main addresses of main and program, of the two computers set up, these marked with an asterisk, reading the 10000 board, and so that the routine which will need modification to allow use of the program with any other interface.

If the steps outlined below are followed carefully, then the conversion from solo to dual operation should be fairly painless.

- 1) Write your own interface program ending with the line

```
200 F1:R01=2000:20000:1
CLEAR 2000
```

```
210 LOAD0=0000:10000
```

Save this as routine main in the unit of a dual tape, which we shall refer to as tape 1.

- 2) Type Clear 10000 New and then load in the Code 10000:10000 of the solo program.

3) - as you prefer Word and Base to be in their main memory operation, and assuming you have kept a copy of the Classroom Drawing Routine, load in this routine, make the necessary change to line 100, Run, and save the new routine on a different tape. (Always do this! Load a fresh one via 100 block of code by typing,

```
LOAD CODE=10000:10000
```

If you intend making this change, it must be done in this way.

- 4) Check the reader routine given in the Appendix (page 112), top left, about the seven blocks of code given in Figure 2. If the job is loaded in main, then not taking, always save and reload using

```
CODE 10000:10000
```

- 5) Carefully enter the following in a decade

successor line:

```
FOR R=0000 TO 0001 STEP 1 FOR
```

```
Q=0: F000=0:0001=0
```

Place in these lines in the right octagonal address format: 0750-1.

Simple register set up

```
GRANDMA * 0:0000
```

```
GRANDMA * 1:0000
```

```
GRANDMA * 2:0000
```

```
GRANDMA * 3:0000
```

```
GRANDMA * 4:0000
```

```
GRANDMA * 5:0000
```

```
GRANDMA * 6:0000
```

```
GRANDMA * 7:1:000
```

```
GRANDMA * 8:1:000
```

```
GRANDMA * 9:1:000
```

```
GRANDMA * 10:1:000
```

```
GRANDMA * 11:1:000
```

```
GRANDMA * 12:1:000
```

```
GRANDMA * 13:1:000
```

```
GRANDMA * 14:1:000
```

```
GRANDMA * 15:1:000
```

Figure 4b: Bit manipulation in decoder

| BIT | BIT | BIT | BIT | BIT | BIT | BIT | BIT |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   |
| 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   |
| 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   |
| 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   |
| 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   |
| 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   |
| 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   |
| 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   |

Register 7 bit functions

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

```
0000 00 00 04 07 00
0000 00 00 00
```

- 6) For the addresses listed below, take in the corresponding type:

```
0000 00 00 01 00 0000 0 0000 0
0000 00 00 00 0000 000 0000 000
0000 00 00 0000 000 0000 000
0000 0 0000 0
```

Save the entire block of code in Code 10000:10000 on tape 2 immediately following the solo page program.

Change to the Base being set to follow:

- 7) Delete line 100, which should not be present in the solo version either. Also line 0004, line 0005 to 0000 and line 0000 are void.

- 8) Type in the 14th page in Figure 3.

9) Using the Vat function and combinations of assigned variables, compare non-dynamic parts of the program or, as a possible, for example the Pattern routine, the Bit routine and the Decoder routine. Note that variables A through H are used in constants, having the values 0 to 7. To replace the number 38 for constant, VAL "38" saves three bytes, while H"3" saves five. Do not use the technique of base constant jumps since it will slow down interpretation too much.

- 10) Save the resulting listing on tape 2 in code run mode, immediately following the 1000 block of code. This will complete the routine.

It will be noted that in both versions of the

program, usual has been preserved away the Appendix longer. The method has been retained in the dual version both to make the run version more straightforward and to allow room for individual code which varies greatly in this area. Needless to say, the responsibility is made of the greater change than the longer, and a complete staff to program. Lack of space precludes a full discussion of several programming in this context. Suffice it to say that the usual chip is represented as two-by-two bits.

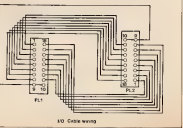
11) Press in a register = 011) as far as sound is concerned - by accessing in Out 101), Run the instruction in Base as machine code.

12) Send this to the register by executing in Out 111), type instruction, open either in Base or machine code.

Continued on page 120



Figure 2: General output interface





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Continued from page 120

Figure 4 summarizes the functions of each PSC register. Ah gives a breakdown of the functions of register 7 along with an example of its manipulation in decimal, and a couple of other examples for experimenting with equal or less. For more detail, readers might refer back to the March issue of *Your Computer*.

Figure 5 lists the code for a general purpose PSC subroutine — a SUBRO — and two other routines to replace the longer or more program lines 2760, 4800, 101, 145, 365 and 4026. To use the routine at 47900 for your one strand effects is very straightforward, as I will show. And a spare slot in RAM. Incidentally, following the figure 5 code up to 41211 is the end having decided on the required register data using the basic experimenting routine, start it at 48 requested addresses in descending register order. That is, register 11 first, register 9 last. From the next line address, enter a seven-byte routine.

It is most critical of register data out 42800

or

Then, 21 bytes or all are needed for each wire routine, a very small overhead value. Almost, however.

Figure 6 shows the schematic of the two-computer link. Both computers are precisely the same program. Now doing maintenance, Part A is set up to output, Part B to input. It follows therefore the communication is managed by connecting one computer's Part A to its opposite number's Part B and vice versa. For home constructors, probably the easiest method of constructing the link would be to buy a pair of 18-pin dual in-line header plugs, and using flexible stranded wire, hardware according to Figure 6. For those without the resources or confidence, an easier solution is offered at the end of the article.

Whatever, both parts are TEL-compatible and can easily drive the couple of feet of cable required. The various stages of the PSC10 board in green in it can confirm that is not readily available, and presents an

operational problem. It is worthwhile emphasizing that were a parent, the board and cable can perform an endless variety of interesting tasks effectively. It is to A or A or B, separate, sound to logic units, send to parallel or serial, perhaps even a little power status or not!

180 programming follows the same format as that for equal generation. First of all, set up the parts in the desired configuration. Line 8 and 7 of register 7 describes the lines, controlling Part A and Part B in that order. A logic 1 in the appropriate bit sets the corresponding part to output mode and vice versa, so that:

OUT 221 7 OUT 222 266

would place both parts at output mode, whereas:

OUT 221 7 OUT 222 227

leaves Part A in output mode, Part B in input mode. Registers 14 and 15 set a data count for parts A and B respectively, at which A set to output,

OUT 221 14 OUT 222 227

would establish the data base 120 on the part A part of the expansion section. Similarly, with B set to input,

OUT 221 15 IN 222 227

will count whatever data is present on the B part of the system. With nothing connected these two parts would flow at around two volts, sufficient to be seen as logic 1s, giving the appropriate count of 255. That's all there is to it.

Switch all both computers before connecting the soundboards, plug in the cable at both ends before switching on. After verification, if other party intends to do any experimenting with the soundboards, both should use type:

OUT 221 7 OUT 222 227

Then, when using register 7 for sound control, ensure that any number loaded into it is greater than 81 and less than 128. This of course, only applies when two boards are linked together. Both computers could Load Subroutine Mason at the same time, if a simple Typewriter adapted is made to connect between their 44 sockets and the one order of

the tape recorder. If by any chance, one of the computers should crash for whatever reason, it would be wisest to switch both off!

A variety carrying both the side and dual versions of Subroutine Mason, the PSC10 interface and the cable can all be obtained, the hardware fully built and tested, from French Computing, Chrysler Bank Buildings, South Queensferry, Midlothian the price is:

Cables 19.99

PSC10 interface 218.25

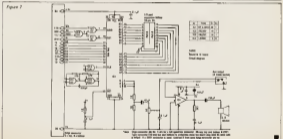
180 cable 14.75

Figure 7 lists machine-code routines for dual Subroutine Mason.

| Register | Function  |
|----------|---|
| 0        | set Channel A tone period 1.02                              |
| 1        | set Channel A tone period 1.01                              |
| 2        | set Channel A tone period 1.00                              |
| 3        | set Channel B tone period 1.01                              |
| 4        | set Channel C tone period 1.02                              |
| 5        | set Channel C tone period 1.01                              |
| 6        | enable tone period of channels                              |
| 7        | enable tone and to start on all channels, control 0 disable |
| 8        | channel A amplitude 81 to 127                               |
| 9        | channel B amplitude 81 to 127                               |
| 10       | channel C amplitude 81 to 127                               |
| CONTROL  |   |
| 11       | envelope period of channels 0.25                            |
| 12       | envelope period of channels 0.50                            |
| 13       | define envelope shape                                       |
| 14       | 10 Part A data store  |
| 15       | 10 Part B data store  |

Figure 8 PSC register functions.

| Register | Function  |
|----------|---|
| 0        | set Channel A tone period 1.02                              |
| 1        | set Channel A tone period 1.01                              |
| 2        | set Channel A tone period 1.00                              |
| 3        | set Channel B tone period 1.01                              |
| 4        | set Channel C tone period 1.02                              |
| 5        | set Channel C tone period 1.01                              |
| 6        | enable tone period of channels                              |
| 7        | enable tone and to start on all channels, control 0 disable |
| 8        | channel A amplitude 81 to 127                               |
| 9        | channel B amplitude 81 to 127                               |
| 10       | channel C amplitude 81 to 127                               |
| CONTROL  |   |
| 11       | envelope period of channels 0.25                            |
| 12       | envelope period of channels 0.50                            |
| 13       | define envelope shape                                       |
| 14       | 10 Part A data store  |
| 15       | 10 Part B data store  |



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**THE PROGRAMME ON THIS PAGE**  
A board game for the SPECTRUM. You are a player who must roll dice and score points. The game is simple and fun, with a variety of rules and strategies. It is a must-have for any board game fan.

**WORK FORCE**  
140 WILSON AVENUE  
LUTON MK5  
Post included

Listing 1. *Circle program*

```

1000 FOR C=1800
1010 CONTRACTOR
1020 @=CONTRACTOR+RND*PI
1030 FOR X=0 TO 2
1040 Y=
1050 @+RND*2
1060 X=
1070 @-RND*2
1080 Y=
1090 @+RND*2
1100 X=
1110 @-RND*2
1120 Y=
1130 @+RND*2
1140 X=
1150 @-RND*2
1160 Y=
1170 @+RND*2
1180 X=
1190 @-RND*2
1200 Y=
1210 @+RND*2
1220 X=
1230 @-RND*2
1240 Y=
1250 @+RND*2
1260 X=
1270 @-RND*2
1280 Y=
1290 @+RND*2
1300 X=
1310 @-RND*2
1320 Y=
1330 @+RND*2
1340 X=
1350 @-RND*2
1360 Y=
1370 @+RND*2
1380 X=
1390 @-RND*2
1400 Y=
1410 @+RND*2
1420 X=
1430 @-RND*2
1440 Y=
1450 @+RND*2
1460 X=
1470 @-RND*2
1480 Y=
1490 @+RND*2
1500 X=
1510 @-RND*2
1520 Y=
1530 @+RND*2
1540 X=
1550 @-RND*2
1560 Y=
1570 @+RND*2
1580 X=
1590 @-RND*2
1600 Y=
1610 @+RND*2
1620 X=
1630 @-RND*2
1640 Y=
1650 @+RND*2
1660 X=
1670 @-RND*2
1680 Y=
1690 @+RND*2
1700 X=
1710 @-RND*2
1720 Y=
1730 @+RND*2
1740 X=
1750 @-RND*2
1760 Y=
1770 @+RND*2
1780 X=
1790 @-RND*2
1800 Y=

```

```

40000
47000 @+RND*2
48000 @-RND*2
49000 @+RND*2
50000 @-RND*2
51000 @+RND*2
52000 @-RND*2
53000 @+RND*2
54000 @-RND*2
55000 @+RND*2
56000 @-RND*2
57000 @+RND*2
58000 @-RND*2
59000 @+RND*2
60000 @-RND*2
61000 @+RND*2
62000 @-RND*2
63000 @+RND*2
64000 @-RND*2
65000 @+RND*2
66000 @-RND*2
67000 @+RND*2
68000 @-RND*2
69000 @+RND*2
70000 @-RND*2
71000 @+RND*2
72000 @-RND*2
73000 @+RND*2
74000 @-RND*2
75000 @+RND*2
76000 @-RND*2
77000 @+RND*2
78000 @-RND*2
79000 @+RND*2
80000 @-RND*2
81000 @+RND*2
82000 @-RND*2
83000 @+RND*2
84000 @-RND*2
85000 @+RND*2
86000 @-RND*2
87000 @+RND*2
88000 @-RND*2
89000 @+RND*2
90000 @-RND*2
91000 @+RND*2
92000 @-RND*2
93000 @+RND*2
94000 @-RND*2
95000 @+RND*2
96000 @-RND*2
97000 @+RND*2
98000 @-RND*2
99000 @+RND*2

```

```

A FORMER CHECK
ANOTHER LOOP
A70 .CHECK LINE #71
A80 .CHECK #800
A90 .CHECK #1000
A100 .CHECK
A110 .CHECK LINE #7
A120 .CHECK
A130 .CHECK
A140 .CHECK
A150 .CHECK
A160 .CHECK
A170 .CHECK
A180 .CHECK
A190 .CHECK
A200 .CHECK
A210 .CHECK
A220 .CHECK
A230 .CHECK
A240 .CHECK
A250 .CHECK
A260 .CHECK
A270 .CHECK
A280 .CHECK
A290 .CHECK
A300 .CHECK
A310 .CHECK
A320 .CHECK
A330 .CHECK
A340 .CHECK
A350 .CHECK
A360 .CHECK
A370 .CHECK
A380 .CHECK
A390 .CHECK
A400 .CHECK
A410 .CHECK
A420 .CHECK
A430 .CHECK
A440 .CHECK
A450 .CHECK
A460 .CHECK
A470 .CHECK
A480 .CHECK
A490 .CHECK
A500 .CHECK
A510 .CHECK
A520 .CHECK
A530 .CHECK
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A550 .CHECK
A560 .CHECK
A570 .CHECK
A580 .CHECK
A590 .CHECK
A600 .CHECK
A610 .CHECK
A620 .CHECK
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A640 .CHECK
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A670 .CHECK
A680 .CHECK
A690 .CHECK
A700 .CHECK
A710 .CHECK
A720 .CHECK
A730 .CHECK
A740 .CHECK
A750 .CHECK
A760 .CHECK
A770 .CHECK
A780 .CHECK
A790 .CHECK
A800 .CHECK
A810 .CHECK
A820 .CHECK
A830 .CHECK
A840 .CHECK
A850 .CHECK
A860 .CHECK
A870 .CHECK
A880 .CHECK
A890 .CHECK
A900 .CHECK
A910 .CHECK
A920 .CHECK
A930 .CHECK
A940 .CHECK
A950 .CHECK
A960 .CHECK
A970 .CHECK
A980 .CHECK
A990 .CHECK

```

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A100 .CHECK
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A120 .CHECK
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A140 .CHECK
A150 .CHECK
A160 .CHECK
A170 .CHECK
A180 .CHECK
A190 .CHECK
A200 .CHECK
A210 .CHECK
A220 .CHECK
A230 .CHECK
A240 .CHECK
A250 .CHECK
A260 .CHECK
A270 .CHECK
A280 .CHECK
A290 .CHECK
A300 .CHECK
A310 .CHECK
A320 .CHECK
A330 .CHECK
A340 .CHECK
A350 .CHECK
A360 .CHECK
A370 .CHECK
A380 .CHECK
A390 .CHECK
A400 .CHECK
A410 .CHECK
A420 .CHECK
A430 .CHECK
A440 .CHECK
A450 .CHECK
A460 .CHECK
A470 .CHECK
A480 .CHECK
A490 .CHECK
A500 .CHECK
A510 .CHECK
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A530 .CHECK
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A590 .CHECK
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A610 .CHECK
A620 .CHECK
A630 .CHECK
A640 .CHECK
A650 .CHECK
A660 .CHECK
A670 .CHECK
A680 .CHECK
A690 .CHECK
A700 .CHECK
A710 .CHECK
A720 .CHECK
A730 .CHECK
A740 .CHECK
A750 .CHECK
A760 .CHECK
A770 .CHECK
A780 .CHECK
A790 .CHECK
A800 .CHECK
A810 .CHECK
A820 .CHECK
A830 .CHECK
A840 .CHECK
A850 .CHECK
A860 .CHECK
A870 .CHECK
A880 .CHECK
A890 .CHECK
A900 .CHECK
A910 .CHECK
A920 .CHECK
A930 .CHECK
A940 .CHECK
A950 .CHECK
A960 .CHECK
A970 .CHECK
A980 .CHECK
A990 .CHECK

```



**Fintan Culwin** describes a drawing program for the BBC.

This revolutionary sophisticated graphics drawing system for the BBC Micro was originally designed for use with a digitizing tablet but has been revised for use with mouse or keyboard.

Because developers of this idea have retained a part of the screen for the mouse. This has the advantage of allowing all the mouse changes to be interpreted directly by the drawing program, however it is that part of the

screen which could be used for drawing the next character.

This is a particular disadvantage if you are using the system to produce a picture for a different application. Part of the specification for this system has been for the mouse to only be set visible when it is called. This was achieved by a short machine-code routine which will exchange the top of the screen for a reserved block of memory before returning.

When the mouse is required the code will change the screen to make it visible and the screen hangs down when the mouse is no longer required.

Other parts of the specification allow for plotting points, continuous lines and dotted lines freehand, plotting some straight and dotted lines by having a marker, plotting triangles and quadrilaterals by having two or three

*(Continued on page 147)*

There's an older, more basic version of this game, but it's the advanced version that's worth your attention. The game is a puzzle game for the Amiga. The manual gives you a lot of information about a staff program that you can use to help you solve the puzzles. The game is a puzzle game for the Amiga. The manual gives you a lot of information about a staff program that you can use to help you solve the puzzles. The game is a puzzle game for the Amiga. The manual gives you a lot of information about a staff program that you can use to help you solve the puzzles.

486-Transvision

Go and get this new program for the Amiga. It's a golf game for the Amiga. The manual gives you a lot of information about a staff program that you can use to help you solve the puzzles. The game is a puzzle game for the Amiga. The manual gives you a lot of information about a staff program that you can use to help you solve the puzzles.

Amiga 20

An exciting and fast-paced action game for the Amiga. The manual gives you a lot of information about a staff program that you can use to help you solve the puzzles. The game is a puzzle game for the Amiga. The manual gives you a lot of information about a staff program that you can use to help you solve the puzzles.

Amiga 20

A classic vampire game for the Amiga. The manual gives you a lot of information about a staff program that you can use to help you solve the puzzles. The game is a puzzle game for the Amiga. The manual gives you a lot of information about a staff program that you can use to help you solve the puzzles.

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recovered from page 184) markers, and the production of filled or open circles by hitting one marker.

The main program uses the 16-color mode, and makes use of all 16 colors. This uses 20K of memory, as necessary for the program as of a program. This led to upgrading the system one two parts. The first part — being — is used to assemble the code for the memory exchange routine, on the user-defined character, contains a table which will be used by the main program and, finally, I did not Run the main program. It may also be useful if you include the example code for a printer dump routine in the program, if you intend to use this facility.

The main program — being 2 — is Changed automatically by the first program. It commences by constructing the menu and then exchanging it. You may just see a flash onto and all the screens after the program is loaded. Following this it sets for input (keyboard, joystick or keyboard) and also allows for a previously stored screen to be released — obviously for disc access only.

The program has two modes of operation: automatic and manual. In the automatic mode the position of the cursor is indicated by a flashing horizontal cross. This cross can be positioned by using the joystick or by using the shift keys. In order to make this less tedious, pressing the shift key in automatic mode with a cursor key, will speed up the movement of the cross.

In order to cause output to the screen, either the fire button on the joystick, or the Return button on the keyboard, has to be pressed. When using the keyboard options output is immediate and, in the case of lines, is between the current point and the point last marked. In the joystick mode this either causes an offset heading, or to be left as a marker on, if

it is the last point needed, the whole shape is produced.

To enter in positioning the markers the system produces a line between the last marker and the current position of the cursor as the cursor is moved. This is known as rubber banding. If a cross is required then pressing key X on the keyboard causes the first marker to be removed.

The screen can be cleared to the currently selected colour by pressing the C key in the mode and the printer stamp, if installed, can be pulled by pressing the G key. By pressing the M key the menu can be called.

When the cursor is on the screen the colour and function can be changed. The menu is divided into two parts, the left hand part is the colour available. The currently selected colour is the one which is flashing, it can be toggled onto the next colour by pressing the C key.

The functions are displayed on the left of the menu. Again the currently selected function is the flashing one and can be toggled by pressing the F key. In control mode the pointer can be fixed by pressing the S key. In order to preserve the screen the screen information system is turned off.

After pressing the R key the recorder has to be prepared and when it is ready the Return key has to be pressed as usual. The current row or LEDs will light up and return on and the file has been completed and the same functions can be accessed again. This is, of course, automatic if you are using discs. To run from control to automatic mode the M key is pressed again.

The keys have been chosen to have a maximum value. If you would like to change these then the appropriate files in the program will have to be changed. For details see page 215 of the user guide.

The structure of the program is quite straightforward. The main control routine between lines 180 and 340 displays in several high-level control procedures depending on which key is pressed. Free-Headings will direct to one of two subsequent screens — JoyStick or Keyboard — depending on the mode, and update the global variables X% and Y% which are the current position.

Free-Colour first calls the machine-code routine labelled by MCON% and then directs to either Free-Function, Free-Colour or Free-Line as a function is selected. Functions used the M key are listed in next.

Free-Function is probably the most complex part of the routine and depends upon three global variables: Count%, Target% and Plot%. Target% and Plot% are dependent upon the current function. The values are stored as an external entry. The data is stored in Page 4820 and is controlled by loading.

The base address of the table is known and the offset is dependent upon the function value. This method is at a much lower level than array handling by base and is only possible by the low-level programming.

Remembering the Free-Function, Target% represents the number of markers, this has to be on the screen before output is called. Count% is the number already on the screen and Plot% is the Plot value needed as coincidence with the line. Plot contained the co-ordinates of the markers on the screen are stored in the dimensional array P% (L,2).

So when Free-Function is called, if Count% is less than Target% that is needed is the current co-ordinates to be stored at the screen, the value of Count% is increased and a marker to be left on the screen. If Count% is equal to Target% then control is passed to one of the drawing routines. The complete code is contained within Free-Action.

#### Listing 2: Main program

```

1000  REM *****
1001  REM *****
1002  REM *****
1003  REM *****
1004  REM *****
1005  REM *****
1006  REM *****
1007  REM *****
1008  REM *****
1009  REM *****
1010  REM *****
1011  REM *****
1012  REM *****
1013  REM *****
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1015  REM *****
1016  REM *****
1017  REM *****
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1301  REM *****
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1400  REM *****

```

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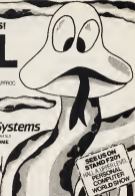
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#### MAKING CODE... IT MAKES ALL THE DIFFERENCE

...and you will be able to enjoy the best of both worlds. You can enjoy the best of both worlds. You can enjoy the best of both worlds. You can enjoy the best of both worlds.

#### MAKING CODE... IT MAKES ALL THE DIFFERENCE

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#### MAKING CODE... IT MAKES ALL THE DIFFERENCE

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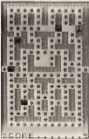
#### MAKING CODE... IT MAKES ALL THE DIFFERENCE

...and you will be able to enjoy the best of both worlds. You can enjoy the best of both worlds. You can enjoy the best of both worlds. You can enjoy the best of both worlds.



|           |                            |       |                   |               |                   |
|-----------|----------------------------|-------|-------------------|---------------|-------------------|
| Listing 1 | 01                         | START | 011               | LET B = 0 + 1 | PRINT B;GOTO 4    |
| 10        | PRINT "MAZE (1)            | 002   | PRINT 0+0         | 004           | PRINT 0+0         |
| 20        | PRINT 0+0                  | 003   | PRINT 1+0         | 005           | LET C = 0+0 + 1   |
| 30        | PRINT 0+0                  | 004   | LET B = 0 + 1     | 006           | PRINT 0+0         |
| 40        | GOTO 0+0                   | 005   | LET C = 0 + 1 + 1 | 007           | PRINT 0+0, 0+0    |
| 50        | LET 0+0 = 0+0              | 006   | GOTO 1+0          | 008           | PRINT             |
| 60        | IF 0+0 = 0+0 THEN GOTO 0+0 | 007   | PRINT "ENDGAME"   | 009           | LET B = 0 + 0     |
| 70        | IF 0+0 = 0+0 THEN GOTO 0+0 | 008   | PRINT 0+0         | 010           | PRINT 0+0         |
| 80        | PRINT 0+0, 0+0             | 009   | PRINT 0+0 + 0 + 0 | 011           | LET C = 0 + 0 + 1 |
| 90        | PRINT 0+0 + 0+0            | 010   | GOTO 0+0          | 012           | PRINT 0+0         |

# ZX-81 MAZE CHASE



This ALIENWARE CODE VERSION of the popular Pac-Man game for the ZX-81 contains the main features of the original, including power points and fruit. The machine code is one of a 4-Kbit economy 1K15 bytes long. This is obtained as the following way. First, enter the first line:

1 REM #P characters

Then, erase lines 2 to 9 by entering line 1. Finally, erase line 10 by entering line 1 and then adding one more character. Now

PRINT 00000  
PRINT 00000  
PRINT 00000

This clearing one long Rem statement numbered 10, so that it cannot be accidentally erased. Do not let this get you. To arrange to do so will put the display into an endless loop.

Now enter listing 1. This is a few bytes and few lines program which works entirely at hexadecimal, including addresses. If the program is Rem it aids for the starting address to be low. The machine code at listing 1 should now be entered starting with address 4081. A number of hex numbers can be entered together but they must be entered as pairs and not single characters. Once all the program has been entered, type 5 to stop the first line and

then save the program a couple of times on tape.

Now enter the following lines

1 SAVE MUNCHMAN  
2 FORD FORN 12  
3 CLR  
4 RAND USR 1000

and then delete the line leader by entering the hex numbers one by one and pressing NewLine. Now Running the program will save the game and then Run it. Before doing this, however, it is advisable to first enter an 8 character

RAND SEED

This is to ensure that a suitable number is in the random number seed. Some numbers cause the program to crash if the program runs correctly, then you will now have a correct version recorded which will save you when restarted. If not, then you will have to go back to one of your original saved versions or look for the number at the machine code. Run 500 will produce a listing.

Lines 2 and 3 are necessary in the final program as the program was originally written to fit into line 20, 2K and elsewhere uses the minimum display file.

(Continued on page 140)

Speedy munchman Chris Bailey gobbles ghosts, pops power points and feeds on fruit to clear 16K of ZX-81 screen.

|           |                            |       |                   |               |                   |
|-----------|----------------------------|-------|-------------------|---------------|-------------------|
| Listing 2 | 01                         | START | 011               | LET B = 0 + 1 | PRINT B;GOTO 4    |
| 10        | PRINT "MAZE (1)            | 002   | PRINT 0+0         | 004           | PRINT 0+0         |
| 20        | PRINT 0+0                  | 003   | PRINT 1+0         | 005           | LET C = 0+0 + 1   |
| 30        | PRINT 0+0                  | 004   | LET B = 0 + 1     | 006           | PRINT 0+0         |
| 40        | GOTO 0+0                   | 005   | LET C = 0 + 1 + 1 | 007           | PRINT 0+0, 0+0    |
| 50        | LET 0+0 = 0+0              | 006   | GOTO 1+0          | 008           | PRINT             |
| 60        | IF 0+0 = 0+0 THEN GOTO 0+0 | 007   | PRINT "ENDGAME"   | 009           | LET B = 0 + 0     |
| 70        | IF 0+0 = 0+0 THEN GOTO 0+0 | 008   | PRINT 0+0         | 010           | PRINT 0+0         |
| 80        | PRINT 0+0, 0+0             | 009   | PRINT 0+0 + 0 + 0 | 011           | LET C = 0 + 0 + 1 |
| 90        | PRINT 0+0 + 0+0            | 010   | GOTO 0+0          | 012           | PRINT 0+0         |

Listing 2 continued on page 140

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Usually, these positions on the grid do not change during the course of any one run and, as the player is usually provided with a map, play becomes fairly predictable after a fairly short time is gained. With the C and G adventures, the program structure, therefore, does not commonly allow for more than one fixed response per occurrence, and a message and the always tells you, at least on a certain coordinate and you will always be at the mouth of the same cave.

You can, of course, introduce one or two modifications to provide at least a little variation in the ordering of features, such as the location of the treasure to be discovered, but even so, more elaborate development is rather restricted. Nevertheless, designing computer and grid games is always a good exercise in writing code and in using particular values when it comes to gaining experience or assembling useful and legible screen displays.

With more advances within the apparatus of instruction and other mainly text pages seems to more low cost a message than the design of "classroom" notices — whereas they are quite happy to spend hours fitting parts to improve the looks of a disintegrated program. When you remember how many come run and where will be conditioned by the rest of the run, it is a fairly worthwhile to design just a little time making them use and readable.

So, what should you watch for? First, screen capturing more than a short line or one of one usually look better, and can be read more easily, if they are kept on upper and lower case. Alternatively, if you have a generous supply of RAM to play with, you might prefer to copy over each's screen RAM-based alphabet and digits onto a chunk of preserved memory and then refresh them specially for optimum readability.

Working through the pages of the weekly colour supplement, for example, will provide you with plenty of typographic inspiration for your electronic alphabet, as the site in particular make use of minutes and often novel approaches for their text copy.

Secondly, do not overlook the value and flexibility of the SPC and TAB functions as screen browser, and always use them in preference to the Cursor Right and Cursor Down keys when you want to advance more than one or three screen positions away. Doing so will save keys as well as keyboard wear.

Next, remember to make the most of the role that colour can play in improving the appearance and player comprehension of screen displays — and in aiding to the atmosphere.

For example, an encounter with a diaphanous dragon might be appropriately declared as white floating against a black red background — whereas the player's sword would hang through the wall of a cave could best be



shown in a text display of white against a black background, but as most design the adventure programs rely heavily for their critical operation on the careful usage of GOS and GOTO statements.

Every instance of these use must be carefully thought through if you are not to end up at the wrong end of the advanced dragon's tongue when you really expected to be home and dry with the foot and/or dammed as divers.

In this connection, keyboard response benefits from some form of suitable confirmation and it should be an easy matter to move at a key instruction to provide that.

In the case of any GOS, it is always advisable to add a map key so that control will loop back to the starting line not only if the key is pressed but also in any but one of the designated keys is pressed.

Still on the subject of GOS statements, it is worth mentioning a warning flag about operational — and available — bug that can arise whenever GOS or GOTO does not follow a screen display and that effectively breaks the screen in each instance, you must introduce a delay loop so that the user cannot see very long enough to be lost.

If you fail to do so, all you will see is a unnecessary change of screen before the program speeds on to the next instruction.

Before leaving what can be the increasing subject of screen presentation and associated comments, a word or two about the Great Two screen Text and Graphics Editors. The past year's games played on Scott Adams adventures were quite content with working more than words.

Then along came Melbourne House and The Hobbit, with its bill of operativity incorporating no fewer than 30 graphically illustrated screens. However, players might argue that the whole point of adventure gaming is that it allows the player's imagination to role a full job. Indeed, the American software house Infocom, publishers of the now famous Zork and Dungeon, makes that case rather well in its advertising:

| Variables |                           |
|-----------|---------------------------|
| DL        | Difficulty level          |
| B         | Buffs                     |
| LN        | Location North            |
| LS        | Location South            |
| LE        | Location East             |
| LW        | Location West             |
| BB        | Bread selection           |
| S         | Strength of torch battery |
| TL        | Time limit                |
| RS        | Response                  |

If there are graphics from the limited images of text imagination — a technology is possible, a modern day player that is not come out of a screen into life prefer to compare.

So that you may, it is also necessary to note that even Scott Adams is now beginning to make his graphics-enhanced versions of Adventureland, The Cave and other famous titles which started life when an ASCII CHR\$(10) was about all you could see around the screen.

In any case, and even if you do have the spare RAM and the imagination and spirit to produce dazzling graphics, the most is probably now to create it. Working for a high resolution screen to build every other more screen around in the terminal states is watching paint dry.

The overall program structure for an open menu style of adventure — of which The Night Forest is a modest example — is fairly easy to grasp and design. The listing shown will run on a Vic 20 plus 32 expansion but — the title screen, page and help routine apart — the program is easily portable to other basic dialects.

Think of the program as a group of almost self-contained modules. One is there to create the playing area, one to make and implement each screen, and others pose encounters or role and they report the outcome. There are smaller modules to check the player's current position and other parameters.

In fact, elegantly structured it is not — yet does a part of the charm of open-style adventures, as they allow for plenty of



background — the assembly or substitution of complete modules in other play variations and handoff events occur in the module's mind. It is even possible to add entirely new modules by simply updating only the ES logic and using a Gate that passes control to the rank and most elements of a training module.

A walk through The Night Patrol's living, while referring to the guide notes which follow, should help you to understand how it all comes together and to start writing your own message-on-eye's adventure.

You had better keep it simple to start with. Only you have the experience of constructing an original program that runs the way it should, you can then look at other modules, graphics and sound effects.

In The Night Patrol, lines 120-134 make a start by taking 180 rich symbols — 1800, actually — into random locations and collecting them green. Lines 136-149 set up the instructions option, and the first trap trap occurs in the last of them, looping control back to 170 if any but key Y or N is touched. On this screen page, all characters, information here appear in white and response demands in yellow — both against a black background.

The difficulty level is set in lines 200-210, where 20, 30 or 50 more turns is awarded to the variable DL for the hard, medium and easy options respectively. This may allow one or

more of these figures to vary, the overall or respective difficulty of the different options.

The player's starting position on the available playing grid, which is 90 elements square, is set in lines 240-244, together with other variables. Line 270 sets the number of bullets in three — you can increase this number but remember to amend the rest in line 14200-146 — and gives a value to S — representing total battery strength — which may be lowered to make for a tougher game.

After 114, control branches off to the substitution program in line 3000, which first deducts two points from the S variable on each turn, while 3014-3070 set up the score prompt display and update the player's grid position accordingly.

If the player reaches into zones on the North, South, East or West boundaries — or comes next to a trap — an error message is triggered by lines 1500-1503 or 1520-1523 respectively. Meanwhile, lines 3014-3045 subtract one from DL on each turn and end the game if DL zero. Line 3430 serves the same purpose in checking the remaining battery strength.

If the result is negative in either case, control passes to the report play option beginning with line 1510. If the response is positive, the variables are reset and the program flows again while bypassing the

usual screen display and page — which can go unmentioned.

If more of these conditions are met, control passes back to line 110, which randomly selects one of several events. The first encounter is with a leader of foot, where a trap is set by line 430 and implemented by 442. Another challenge occurs in line 460, with fire options. In this module, the results of the other options lets you increase the player's current strength rating and update simple inventory variables. Showing us the various dimensions the number of bullets left by triggering line 580.

Line 660 presents a poisonous water trap, which you may or may not escape, while a warning in line 715, which also denotes the existence of the last trap encountered is at line 800. The good module ending in line 815 also presents another hazard to your search history, namely, what is listed of current games in 840.

Whenever a number or letter key is touched, or if the space bar is pressed, the instructions in lines 9000-9050 contain a help 1 data on the numerous page's found when something needs to about to happen to your courses of line 9000-9090. Lines 12000-12040 set the initial trap page, which can be controlled — but remember to use lines 130-130 and area 1 of line 131 to clear 200.



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- BROTHER 27000 Series (27000, 27000, 27000) 100% Duty 12 Pin 150/150/150
- BROTHER 28000 Series (28000, 28000, 28000) 100% Duty 12 Pin 150/150/150
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Damian McComb details a method of extending Vic-20 commands vocabulary. A 3K expansion is necessary to execute this program.



In this BASIC FOR the Vic-20 I aim to explain how it is possible to add commands to the Vic-20 Basic, and to extend the Basic by 42 commands. The program to do this will require a 3K expansion but if you have no expansion board you can also use additional RAM or RAM Expansion.

The set of commands I have written give several advantages to the user. First, there are some commands which are programming aids, including Trace and Breakpoint. There are others which will make convenient programs extended the other way: a list would such as Cursor — an equivalent to F-trace — Paper, Zap and Page.

There are some commands which will merely speed up operations which would have needed to be done in several steps before, such as Fill. But perhaps most important are the commands which exploit the very good colour, sound and graphics features of the Vic and make it very easy to use them. These include Sound, Mode, Window, Ink and

(Continued on next page)

# VIC EXPANSION

```
FOR #P READ INVERSE FOUND 610H
@ POKESG,22:POKESG,7 CLR
1 POKESG,236:PRINT"-----" PRINT"##### EXTENDED BASIC"
2 PRINT"###" PRINT"#####COPYRIGHT 1983" PRINT"#####
v
3 PRINT"#####DAMIEN MC COMB" PRINT"#####PLEASE WAIT..."
7 REM ##
@ REM ## INITIALISE
9 REM ##
10 BTR20:46,04,20,1A,04,38,4C,75,03,02,00,00,26,04
20 BTR0D:00,03,0A,10,F7,60
30 DAT0A:C4,03,C4,79,89,00,00,0E,00,04,00
40 DAT0C:11,91,20,34,F7,20,E1,FF,00,00,20,4A,04,6C,82,C0,4C,06,FF
50 DAT0E:6D,0A,20,6D,0A,20,F7,FD,20,10,00
60 DAT0F:22,00,10,03,0D,FE,03,17,03,00
67 REM ##
68 REM ## DISPATCH 66 REM ## LOCATIONS
69 REM ##
70 BTR09:FF,62,06,00,06,32,36,C3,00,03,00,2E,07,5C,07,60,07,92,07,37,07,0E,07,
D1,07,05,07
71 BTR0F:04,33,FB,F9,07,07,00,10,00,2F,05,03,00,63,00,21,00,20,00,0F,00,37,00,
F7,00,17,00
72 DAT0A:00,70,00,00,00,20,0A,42,00,00,03,17,05,57,0A,03,0A,00,0A
73 BTR0D:00,03,0A,F4,00,01,00
64 DATA END
67 REM ##
68 REM ## TOKEN TABLE
69 REM ##
70 DAT05:45,53,53,40,C3,4C,49,4C,CC
71 DAT0A:4C,00,45,52,02,57,45,4E,4A,4F,37,55,4F,55,4E,C4
72 BTR0A:55,53,45,45,00,49,4E,4E,C0,50,41,50,45,32,42,44,3C,41,55,00,52,453,50,43,
41,34
73 DAT00:41,55,53,C5,43,50,52,53,45,04,52,45,53,45,04,49,49,4C,CC
74 DAT0A:4F,43,45,C0,48,49,43,45,C0,50,45,54,49,41,55,C5,43,52,45,41,C0
75 BTR0A:52,01,42,43,45,0A,46,45,54,45,40,43,4C,14,45,53,36,42,4F,4F,C0,50,41,
10
76 BTR00:49,4E,07,43,4F,44,C5,52,45,4E,55,40,42,45,3C,54,52,41,43,C5,44,4F,43,
C5,50,55,1A
```

(Continued on next page)

continued from previous page

Scan! There is a complete list of the commands in table 1.

For the Yu, to be able to recognize commands it must have a list of these stored somewhere in memory and, in fact, it has from ROM in ROM. This list is called the Token Table and is used for two purposes — to recognize commands entered and to repeat them when a listing is required.

As well as the list of keywords there is also a table of dispatch locations — held from ROM in ROM. This table holds the address for each command that the interpreter jumps to — each command has a code for example Puts a 171. When the interpreter encounters the Puts command it simply reads the 171st address from the list of dispatch locations and jumps to it. That address is the start of the machine code routine to perform Puts.

The solution to adding new commands is now fairly obvious. We simply add more addresses to the end of the Token Table and add the appropriate addresses to the list of dispatch locations. However, there are two problems with this. First, there is no room above these lists in a 4K taken up by other data and secondly they are held in fixed ROM.

However, there is one feature of the Yu which makes it very easy to bypass this problem and custom the Yu extremely versatile in this and other respects. That feature is the existence of address vectors from 76h to 319

which are held in RAM. These vectors are used by the interpreter to redirect jump addresses to carry out various operations. Table 2 shows the vectors used by the operating Basic statements.

By reassigning the last four of these vectors it is possible to extend the Basic. The console allows making various commands entered by the user use their appropriate codes. These codes appear on the Basic, and save a lot of memory. The last sixteen vectors are the codes

such as the print forms and print form. The third vector code the code of a command, reads the corresponding user address or dispatch location and jumps to it. The first vector is used for calculating numbers which accompany commands — the parameters.

There are two kinds of statements in Basic — statements and functions. These we dealt with in the last two vectors respectively.

You may now be wondering how can these vectors help you to add to the token table and dispatch locations. To accomplish this, you would like to be written to jump out of the memory of the four above mentioned vectors. These vectors are known as window gates they are simply windows into the computer. Whereas the original vectors read the data from ROM, your new routines will read the new commands from RAM and then jump to read the original ones.

Listing 1 is the first part of the three part program and its purpose is to assist you to set the four vectors needed and to store the new Token Table and dispatch locations in RAM.

If you cannot wait for the further installment of this program or would rather not have to type these in, a cassette is available containing the extended Basic and a few demonstration programs since with a year for the new Basic. The cassette costs \$150 from Extended Basic Office, 25 Woodman Drive, Douglass, Co. Tyson, NT70 1AJ.

| Keywords | Flags    | Search   |
|----------|----------|----------|
| File     | File     | File     |
| Dir      | Dir      | Dir      |
| File     | File     | File     |
| Write    | Write    | Write    |
| Sound    | Sound    | Sound    |
| Misc     | Misc     | Misc     |
| File     | File     | File     |
| Language | Language | Language |
| Print    | Print    | Print    |
| File     | File     | File     |
| Print    | Print    | Print    |
| File     | File     | File     |
| Print    | Print    | Print    |
| File     | File     | File     |
| Print    | Print    | Print    |
| File     | File     | File     |
| Print    | Print    | Print    |

| Address | Description            |
|---------|------------------------|
| 76h-77h | Address of user window |
| 78h-79h | Address of user window |
| 7ah-7bh | Address of user window |
| 7ch-7dh | Address of user window |
| 7eh-7fh | Address of user window |
| 80h-81h | Address of user window |
| 82h-83h | Address of user window |
| 84h-85h | Address of user window |
| 86h-87h | Address of user window |
| 88h-89h | Address of user window |
| 8ah-8bh | Address of user window |
| 8ch-8dh | Address of user window |
| 8eh-8fh | Address of user window |
| 90h-91h | Address of user window |
| 92h-93h | Address of user window |
| 94h-95h | Address of user window |
| 96h-97h | Address of user window |
| 98h-99h | Address of user window |
| 9ah-9bh | Address of user window |
| 9ch-9dh | Address of user window |
| 9eh-9fh | Address of user window |
| a0h-a1h | Address of user window |
| a2h-a3h | Address of user window |
| a4h-a5h | Address of user window |
| a6h-a7h | Address of user window |
| a8h-a9h | Address of user window |
| aa-ah   | Address of user window |
| ac-ah   | Address of user window |
| ad-ah   | Address of user window |
| ae-ah   | Address of user window |
| af-ah   | Address of user window |
| b0-b1   | Address of user window |
| b2-b3   | Address of user window |
| b4-b5   | Address of user window |
| b6-b7   | Address of user window |
| b8-b9   | Address of user window |
| ba-bb   | Address of user window |
| bc-bd   | Address of user window |
| be-bf   | Address of user window |
| c0-c1   | Address of user window |
| c2-c3   | Address of user window |
| c4-c5   | Address of user window |
| c6-c7   | Address of user window |
| c8-c9   | Address of user window |
| ca-cb   | Address of user window |
| cc-cd   | Address of user window |
| ce-cf   | Address of user window |
| d0-d1   | Address of user window |
| d2-d3   | Address of user window |
| d4-d5   | Address of user window |
| d6-d7   | Address of user window |
| d8-d9   | Address of user window |
| da-db   | Address of user window |
| dc-dd   | Address of user window |
| de-df   | Address of user window |
| e0-e1   | Address of user window |
| e2-e3   | Address of user window |
| e4-e5   | Address of user window |
| e6-e7   | Address of user window |
| e8-e9   | Address of user window |
| ea-eb   | Address of user window |
| ec-ed   | Address of user window |
| ee-ef   | Address of user window |
| f0-f1   | Address of user window |
| f2-f3   | Address of user window |
| f4-f5   | Address of user window |
| f6-f7   | Address of user window |
| f8-f9   | Address of user window |
| fa-fb   | Address of user window |
| fc-fd   | Address of user window |
| fe-ff   | Address of user window |

```
Listing continued from previous page
97 DATA 52,48,20,45,24,23,43,22,45,45,48,53,42,32,4F,4C,1C,4D,4F,34
98 DATA 46,4F,39,58,48,0E,38,41,14,48,45,33,51,57,43,54,43,03
118 DATA 99,018
117 PER # 118 VECTOR 0 117 PER #
118 DATA 88,7C,03,68,85,13,8B,81,8F,5F,C3,22,85,47
119 DATA 9,41,40,40,C9,58,88,3C
120 DATA 4,01,0C,80,66,00
121 DATA 6,FD,14,04,F0,13,C9,90,F0,16
148 DATA 8,04,00,27,30,03,8B,80,F6
150 DATA 28,04,01,80,C0,80,F8,81,00,80,00
168 DATA 6,01,00,03,18,87,0C,28,F3,81
178 DATA 0,C0,20,F8,01,7D,F1,01,20,F6,84,80
198 DATA 20,10,01,40,86,C0,30,00,F6,F0,F1,00
200 DATA 0,C0,0F,F0,20,20,0F,30,20,C3,0C,30,20,00
210 DATA 0,03,C0,00,04,40,40,FF
228 DATA 4,F0,04,C0,80,01,00,18,F0,20,F5
230 DATA 3,00,01,04,70,05,20,30,FF,00,F5
240 DATA 0,0F,C0,20,40,18,07
250 DATA 20,70,00,C0,0C,30,1F,C0,F1,20,10,20,1F,06,4C,8E,C7
260 DATA 0,C0,00,70,00,70,04,40,00,00,04,40,40,70,00
270 DATA 0,70,00,40,67,C7
280 DATA 0,00,00,00,20,70,00,C0,F1,70,13,C0,FE,30,0F,83,10
290 DATA 0,00,00,30,30,04,40,00,00,04,40,40,70,00
300 DATA 0,70,00,00,00,70,00,00,00,00,00,00,00,00,00,00,00
307 END
308 END # 4 PAGE 10
309 END
1800 FOR I=VECTOR READ# DOSUB10000 FOR E5040+1,8 NEXT I
1810 I=0717
1810 READ# IFA="END" THEN 1200
1820 GOTO 1800 FOR E1,8 I=I+1 GOTO 1110
1830 I=0001
1840 READ# IFA="END" THEN 1200
1850 GOTO 1800 FOR E1,8 I=I+1 GOTO 1210
1860 FOR I=0001 TO 255 PERIODS DOSUB10000 FOR E1,8 NEXT I GOTO 1800
18800 A=0: B=1: C=2: D=3: E=4: F=5: G=6: H=7: I=8: J=9: K=10: L=11: M=12: N=13: O=14: P=15: Q=16: R=17: S=18: T=19: U=20: V=21: W=22: X=23: Y=24: Z=25: RETURN
20000 PRINT # "ROM LOG: THE END PART"
```



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# 6809 DRAGON EXPRESS

John Nash explains more machine-code for Dragons.



Now you that has come to look at more detail at how machine code is put together. First, you will need to understand the concepts of addresses and numbers. For example, we have a number 30, and five people live there, so you could say the contents of address 30 is five. Basic does not use addresses, except for special values, but calls variables by name, like V1, V2. You cannot do this in machine code, but you can use the address or pair of addresses as a variable.

Another concept you will require, especially if working without an assembler, is hexadecimal numbers. This works in a similar way to decimal, except that the first column contains numbers up to 15 (FF), the second, numbers up to 255 (FF), the third, numbers up to 65535 (FFFF) and the fourth, numbers up to 4294967295 (FFFFFFFF), which is the largest number our chip can handle directly.

If you place the number into two parts, and name the high byte — first two hexadecimal digits — in the first address, and the low byte — second two hexadecimal digits — in the second address of a pair. Now that this is different from chips such as the 286, if you have used those. Our instruction set also has two types of instructions, those using one byte of memory — 8-bit — and those using two bytes — 16-bit — more of these later.

The low way to learn machine code programming is to look at programs, and as you do this, you will need to understand them. If you have an assembler now, there is no problem, but if you do not, you will need to get a book such as *The MC6809 Clubbook* by C. D. Warren, TAB Books, distributed by W.

Frederick and Co. You will then need to look up the codes, some of which are one byte, some of which are two, and work out from the instruction's meaning how many address or number bytes you would expect to follow it. Yes, it is easier with a monitor program, which does all this automatically. There is a considerable amount of published 8-bit code at large, and of course you could always look in the RAM. Try

First 16 (hex)Packed:

for the range 0200 to 0215, using a loop to do this in Basic. This will show you just ROM's opening system, which is, of course, a large machine-code program.

All computers usually do it in more numbers from one place to another, so methods of moving numbers are one of the most important facets of programming in machine code, you have three options: chip registers, RAM addresses and the stack. There are sometimes differing uses and limitations, so I shall describe them separately.

■**Chip registers** — These consist of the following: two eight-bit registers, A and B, which can be used as a single 16-bit register, D. These registers are the most versatile and have the most instructions available, so they get used most. Then there is a pair of index registers, each of 16-bits, called X and Y. These are of particular use in indexed addressing, but can also store numbers and perform some arithmetic operations.

Next, there is a pair stack register, U, which is also 16-bit. This is primarily for holding the user stack pointer but can also store a number, and perform arithmetic and controlling operations. There is a similar register, eight-

which is the hardware stack pointer. Finally, there are three special eight-bit registers, CC, which handle control codes or flags, DP, the direct addressing, and PC, the program counter register, which shows where the program has reached. We shall not be using eight CC, DP or PC as the relatively simple level of machine code under discussion.

When do you use the chip registers? The answer is the most operations — it is quite surprising how few operations need more than four or five registers. The chief thing to remember is that all the chip registers values are lost when you reset or Basic, so, if you need their values, you will have to store them in RAM addresses before starting.

■**RAM addresses** — these are slower and thus, cumbersome than chip registers, but also more permanent, as they are into three return back to Basic. Use RAM storage when you run out of chip registers, and when you need to take values back with you, or pass them from Basic to a machine-code routine in the other direction. One register stores eight bits, — like a pair stores 16-bits, High byte first.

■**The stack** — usually there are two stacks, but since the hardware one is used for return addresses, we shall create it as the user. The user stack is normally a user defined and works as follows:

It starts from the address in the U register 1, and grows downwards in memory as you push numbers onto it. An often used and good analogy is a spring loaded glass stack in a cabinet, where you push plates in the top, and they push them aside or there farther down. When you pull them out, the top one is gone. (continued on next page)



content of a register. It can appear as follows:  
Form MFA STR STD STX STR STU  
and, the arithmetic functions. There are 16 for use with the accumulator registers, A, B and C.

**ADD** This has eight bits — **ADDA**, **ADDB** — and **ADD** — **ADDG** — registers, and sets a carry flag on a two memory registers and A, B or C. **ADD**, **INDA**, **EXT**, **INDA**.

**STB** This is the complementary pair of **ADD** and all the same remarks apply. It advances the contents of C or two memory addresses from the A, B or C register.

Form MADA MADB MAB

**MUL** This is an unusual but useful instruction. It multiplies the contents of A and B together and leaves the result in C. **AM**, **INDA**.

Form MAI

**MAX** This came in the big multiprocessor instructions, which function on individual bits in the registers. You might use these to set the carry bit on, for arithmetic operations — **MO** — for example. You need those instructions for converting high resolution graphics into printer instructions. All the group of instructions have the same address modes: **INDA**, **EXT**, **INDIA**. All are eight-bit only.

**AND** performs a logical and between the contents of A or B and a memory register, and leaves the result in A or B. This is different from a basic **AND**, and checks each bit in turn.

**IF** Both the memory and the accumulator — A or B — has a 1 in bit N, then a 1 is left, otherwise a 0. For example: **AND1111** and **AND11111** give **AND1111**.

Form ANDA ANDB

**OR** is in some ways the counterpart of **AND**, because it gives a 1 on the accumulation of either or both of the bits being compared was a 1. To repeat the example: **OR1111** or **OR11111** gives **OR11111**. Note the difference from the basic **OR**.

Form ORA ORB

**ORC** completes that trio. It stands for exclusive or, meaning that the bits are compared as before, but if both are 1 or both

are 0, a 0 will result. You will only get a 1 if one bit is 1 and the other 0. In our example, **OR11111** and **OR1111** = **OR11111**.

Form ORCA ORCB

The rotate and shift instructions are conventionally taken together because their operations are similar. Again, there are eight bits, but the addressing modes are not quite the same as above: rotate and shift use **INDA**, **EXT**, and **INDIA**.

**LSR** moves all the bits left by one, effectively multiplying by two. Bit 0 becomes 1, and bit 7 goes into the carry bit, where you could direct it with an **ORCC** — **OR** contains code equate — for example. Thus, if we get **0001011** in A, and then do **LSR A**, we get **0010111**.

Form LSLA LSLB

**LSR** is analogous except that the bits are shifted one to the right. Bit 0 goes into bit 7 — bit 8 — and the 8th bit of the next one the carry bit. **LSR** effectively divides by 2.

Form LSLA LSLB

**RCL** This instruction is a little different from **LSL**. Again, the bits are all moved one to the left, and the carry goes to bit 0, while bit 7 goes into the carry. This is a true "rotation" through one bit — right — carry. Again, the bits are the following address modes: **INDA**, **EXT**, **INDIA**.

Form ROLA ROLB

**RCR** As you might expect, this rotates to the right, again passing through the carry bit. Each of these **RCR** or **RCL** instructions moves the bits by one place.

Form ROLA ROLB

**ROR**, **ROL**, **LSR** and **LSL** can all also be used on memory registers, in exactly the same way. This is what the extended and indexed addressing refers to.

The branch instructions all work in a similar way, in an conventionally listed register. All use relative addressing, that is, are followed by a number to indicate the size of the forward or backwards branch. All also have a long branch form signaled by a prefix 1. For example, **LBRQ**, **LBRB** and so on.

All the branch instructions rely on setting flags, which are usually set up by an

immediately preceding **ORP** instruction. Taking them in alphabetical order, and including the most useful ones only:  
**BRQ** — Branch on equal, branches if the two values are equal.

**BRH** — Branch if greater than or equal.  
**BGT** — Branch if greater.  
**BLE** — Branch if less than or equal to zero — **C=0**.

**BLA** — Branch if lower or the same.  
**BLT** — Branch if less than 0 — **C=0**.  
**BNZ** — Branch if unequal.  
**BEZ** — Branch always.  
**LBRQ**, **LBRB**, **LBRG**, **LBRH**, **LBRL**, **LBR7**, **LBR8** and **LBRB** are of the bit self explanatory, and again these are a selection from the set.

Form BRQ BRH BRG BRB BRH BRG BRB

**CMF** This instruction goes here logically. This means compare memory with register, and has eight bit and 16-bit forms. Its addressing modes are:  
**INDA** **EXT** **INDIA**

As indicated above, at least one of it is set up the condition for a branch.

Form CMFA CMFB CMFG CMFH CMFB CMFD CMFV

There are some miscellaneous but useful instructions which I have grouped together — **DEC** increments an eight bit register, A or B or C on the address mode, or a memory register on the extended or indirect mode. It subtracts one from the value in the register.

**INC** is the corresponding alternative, and increments by adding one to an accumulator or memory register.

Address for both: **INDA** **EXT** **INDIA**  
Form: **INCA INCB INC C** **INCH INCH INCH INCH**  
The usual ones, or both, can be 8-bit or both 16-bit. The address mode is **INDA**.

Form: **INCA INCB INCH INCH**

**TRN** is similar, but transfers the value from Register 1 to Register 2, leaving Register 1 with an original value. This is a kind of copy instruction. The address mode is **INDA**.

Form: **TRN D L TRN R B**

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| 0001 00  | 0001 00 | 0001 00 | 0001 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 0010 00  | 0010 00 | 0010 00 | 0010 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 0011 00  | 0011 00 | 0011 00 | 0011 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 0100 00  | 0100 00 | 0100 00 | 0100 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 0101 00  | 0101 00 | 0101 00 | 0101 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 0110 00  | 0110 00 | 0110 00 | 0110 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 0111 00  | 0111 00 | 0111 00 | 0111 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 1000 00  | 1000 00 | 1000 00 | 1000 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 1001 00  | 1001 00 | 1001 00 | 1001 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 1010 00  | 1010 00 | 1010 00 | 1010 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 1011 00  | 1011 00 | 1011 00 | 1011 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 1100 00  | 1100 00 | 1100 00 | 1100 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 1101 00  | 1101 00 | 1101 00 | 1101 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 1110 00  | 1110 00 | 1110 00 | 1110 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 1111 00  | 1111 00 | 1111 00 | 1111 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 0000 00  | 0000 00 | 0000 00 | 0000 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 0001 00  | 0001 00 | 0001 00 | 0001 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 0010 00  | 0010 00 | 0010 00 | 0010 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 0011 00  | 0011 00 | 0011 00 | 0011 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 0100 00  | 0100 00 | 0100 00 | 0100 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 0101 00  | 0101 00 | 0101 00 | 0101 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 0110 00  | 0110 00 | 0110 00 | 0110 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 0111 00  | 0111 00 | 0111 00 | 0111 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 1000 00  | 1000 00 | 1000 00 | 1000 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 1001 00  | 1001 00 | 1001 00 | 1001 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 1010 00  | 1010 00 | 1010 00 | 1010 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 1011 00  | 1011 00 | 1011 00 | 1011 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 1100 00  | 1100 00 | 1100 00 | 1100 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 1101 00  | 1101 00 | 1101 00 | 1101 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 1110 00  | 1110 00 | 1110 00 | 1110 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 1111 00  | 1111 00 | 1111 00 | 1111 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 0000 00  | 0000 00 | 0000 00 | 0000 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 0001 00  | 0001 00 | 0001 00 | 0001 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 0010 00  | 0010 00 | 0010 00 | 0010 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 0011 00  | 0011 00 | 0011 00 | 0011 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 0100 00  | 0100 00 | 0100 00 | 0100 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 0101 00  | 0101 00 | 0101 00 | 0101 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 0110 00  | 0110 00 | 0110 00 | 0110 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 0111 00  | 0111 00 | 0111 00 | 0111 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 1000 00  | 1000 00 | 1000 00 | 1000 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 1001 00  | 1001 00 | 1001 00 | 1001 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 1010 00  | 1010 00 | 1010 00 | 1010 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 1011 00  | 1011 00 | 1011 00 | 1011 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 1100 00  | 1100 00 | 1100 00 | 1100 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 1101 00  | 1101 00 | 1101 00 | 1101 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 1110 00  | 1110 00 | 1110 00 | 1110 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 1111 00  | 1111 00 | 1111 00 | 1111 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 0000 00  | 0000 00 | 0000 00 | 0000 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 0001 00  | 0001 00 | 0001 00 | 0001 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 0010 00  | 0010 00 | 0010 00 | 0010 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 0011 00  | 0011 00 | 0011 00 | 0011 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 0100 00  | 0100 00 | 0100 00 | 0100 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 0101 00  | 0101 00 | 0101 00 | 0101 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 0110 00  | 0110 00 | 0110 00 | 0110 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 0111 00  | 0111 00 | 0111 00 | 0111 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 1000 00  | 1000 00 | 1000 00 | 1000 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 1001 00  | 1001 00 | 1001 00 | 1001 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 1010 00  | 1010 00 | 1010 00 | 1010 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 1011 00  | 1011 00 | 1011 00 | 1011 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 1100 00  | 1100 00 | 1100 00 | 1100 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 1101 00  | 1101 00 | 1101 00 | 1101 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 1110 00  | 1110 00 | 1110 00 | 1110 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 1111 00  | 1111 00 | 1111 00 | 1111 00 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |  |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |

continued from previous page

Note that upon the register must be the same bit.

**BR** or jump to subroutine transfers control to a subroutine. The address must be

**EXT ADDR**

**BR** or branch to subroutine is similar except that it uses relative addressing.

**RTS** or return from subroutine is the instruction that takes you back at the end of a subroutine, either to the same address after the subroutine call, or, if there was not one, back to base. What this instruction actually does is pull the first return address from the hardware stack and jump to it.

**SWI** or software interrupt is the corresponding instruction to cause control to be conveyed to another system, when running a program from the knowledge to debug and test it, for example. An **RTS** in this instance will really start things up, because there will not be a return address to go to.

**NOP** or no operation is a useful instruction, principally when you want to leave an address blank, or temporarily remove an instruction when debugging. Surprise, surprise — a does nothing.

**NEG** or negate — this command is right to use, and replaces the contents of an accumulator or memory register with the two's complement — see article #1 — of the process contents.

See also: **EXT ADDR**, **INSTR**, **INSTR ADDR**

**LEA** or load effective address is used to add a value to a register which would not normally allow this, such as X, Y, U, D. For example **LEAR**, Y, X, with 5 to the value in X, while **LEAR**, X, Y, loads Y with the value in X + 10. Note that three other values are allowed: **AM**, **INDEX**, **INDEX**.

See: **LEAR**, **INDEX**, **LEAR**, **INDEX**

Note: **LEAR**, **LEAR** are not allowed.

Finally, we come to the Push and Pull instructions. These are stack operations.

**PUSH** pushes registers onto including U' onto the user stack, which grows downwards from U. I'll mentioned earlier the addressing mode is immediate, and is form is **PHLL**.

**PULL** is the converse, and pulls values of the user stack, placing them into the register specified in the register. **PULL**, X, pulls the top value and puts it in X.

We now have the complete of addressing and instructions, and can now write simple routines to do useful operations at high speed. I've not using an assembler, you will have lots of problems, and the instructions can be revised as shown. You will need constants to control your loops, and it is best to use up the X, Y, U and registers, the possible use of the accumulators, before you start using RAM addresses for storage.

It is quite surprising how few programs need more than three registers going simultaneously. You can assemble your program to a suitable address, near the top of memory, then delay it from the monitor. The best way to do this is to insert lots of triplets and do this to speed the chip registers (regards), so as if they weren't what they should. Do not be discouraged by errors — all programmers make them.

Once it runs, change the final **RST** to an

**RTS** and save the program on tape. Then try running it with the basic calling routine. It shall be using the in more detail next issue, but for the moment, try an **EXEC**, **NONNON** instruction, where **NONNON** is the first address of your program.

Finally, let me mention memory program. I get an outline of how this works.

Line 170 loads Y with the starting address of the storage area.

Line 180 loads X with 4000 which is the address of the right hand side of the screen half way down.

Lines 185-190 are a loop which takes the value at the address in X and stores it in the table pointed to by Y. It then adds 32 to X to get the end of the current table. It then gets the next table pointer and stores. It repeats until the bottom of the screen is reached (line 190 checks that).

Line 195 stores the end of the screen address in X.

Lines 200-210 are a loop which gets the row screen address contents and stores it in the table to the right — **LIAY** is X. This produces a scroll right, and line 210 checks for half the screen completed. Lines 205-210 set up the pointers for reversing the values from our storage table.

Lines 215-220 are a loop that reads from back into the left hand end of the screen.

Lines 220 checks for job finished.

The method of storing the last screen column and putting a blank at the left hand side ensures the wrap around necessary for the final of scroll.

Those of you who have an assembler can save time, but those who do not will find the page tables below. It is not possible to list all possible combinations, as there are more than 1400 of them. However I have given the codes mentioned in the article in the form of a hexadecimal assembly listing. To use them, you need to take the hexadecimal digits into your chosen

address using a hex loader such as the one published as my first article.

You will see the term Postbyte in the table — this is a byte that comes after the instruction proper and allows to flaggate and indexed addressing. The method for working this out is given in Table 3 for indexed addressing and Table 2 for indexed addressing. These Postbytes come after the instruction and before the operand, that is, second. You have to build them up from a series of bits, these are at the binary end of bits. This is a bother, but it all done automatically by an assembler. If you plan any serious machine-code work, an assembler will be essential, definitely not a luxury. It will also make debugging far easier.

Table 3 Postbytes for **EXT**, **YPR** and **Push**, **Pull** instructions.

**1 110 AND 100 POSTBYTES** are the same. They are arranged as two sets of four bits, 7 to 4 representing the source register, bits 3 to 0 the destination.

As an example: 0 to U would be 00000011. For **Push** and **Pull** (**PHLL** or **PL**), on the **Push** order a Y, X, B, R, so this gives into the stack in that order, and the **Pull** order is the reverse so they come out in the order X, B, R, Y. The codes are shown below. Note that there is no code for D, you get **Push**/**Pull** both A, U, B.

**BIT 0** = Y  
**BIT 1** = X  
**BIT 2** = B  
**BIT 3** = R

The complements for **PC** for B, U (not allowed), 0 to D (not for B, CC). The Postbyte specifies which register to use as shown in the table. Does again, you can take as synthesis the Postbyte from the list.

Table 2 Postbytes for indexed addressing. Four bit offset addressing, where the offset is 2-15 or less is quite different from the one.

**BIT 15 TO 0**  
**BITS 8 & 9 INDICATE THE REGISTERS**  
**BIT 10 FOLLOW**  
**BIT 11 INDICATES THE SIGN** — **SET** IF **NEGATIVE**  
**BITS 12 TO 13 CONTAIN THE ACTUAL OFFSET**

The remainder of the codes work as follows — only those discussed are included.

**BIT 12 ALWAYS 1**  
**BITS 8 & 9 SHOW THE REGISTER AS FOLLOWS**

00 X  
01 Y  
10 U  
11 B, if required

**BIT 11 INDICATES INDIRECT ADDRESSING**, which is not allowed for simple addressing operations (X, Y, B) functions.

Bits 2 to 0 are as follows, using X to indicate or register register could be X, Y, U or B.

3 1 0000  
2 0 0001  
1 0 0010  
0 0 0011  
1 0 0100  
0 1 0101  
0 0 0110  
0 0 0111  
1 0 1000  
1 0 1001  
1 0 1010  
1 0 1011  
1 0 1100  
1 0 1101  
1 0 1110  
1 0 1111  
1 1 0000  
1 1 0001  
1 1 0010  
1 1 0011  
1 1 0100  
1 1 0101  
1 1 0110  
1 1 0111  
1 1 1000  
1 1 1001  
1 1 1010  
1 1 1011  
1 1 1100  
1 1 1101  
1 1 1110  
1 1 1111

The 7 and 10 bit offsets are in two's complement notation, so can take plus or be taken as minus.

You will need to use other bits, such as set from the table, that constitute a binary number. This results the one decimal as follows:

if **BIT 7 SET** ADD 128  
if **BIT 6 SET** ADD 64  
if **BIT 5 SET** ADD 32  
if **BIT 4 SET** ADD 16  
if **BIT 3 SET** ADD 8  
if **BIT 2 SET** ADD 4  
if **BIT 1 SET** ADD 2  
if **BIT 0 SET** ADD 1

Note convert the resulting decimal number to hex, either from tables or with the computer. For **PHLL** or **PL** doing it is your best if it is possible, but then for **push** or **pull**.

# CHOOSING A HOME MICRO

**WARNING**

Choosing a home micro can be a daunting task to the newcomer, and with an ever increasing number of micros emerging on the market, even up-grading, say, from a ZX81 can be a risky and expensive exercise if the wrong decision is made. It is important to look at the real facts and specifications, and check exactly what you get for your money before choosing your micro-computer system.

## THE PITFALLS

### "DON'T LET THE ADD-ONS ADD UP"

A number of large companies are offering packages that seem to be good value and low cost. These offers usually have a hidden pitfall, namely that the essential accessories such as monitor, leads, peripherals and software often carry very high cost premiums in addition to the cost of the hardware itself. Consider how much software usually costs before you set out for a ROM/ROM package!

### CHECK THE QUALITY OF THE PRODUCT.

Buy materials and tools on one where you can be sure, and avoid cheaply made, and probably worse, made to order, building sets offered by the up-start. If you can't afford to build it out for an unreliable edge construction, compare and contrast quality PC/Bs. Low quality components and/or design will affect the reliability of the end-product, and can lead to false economy.

### DON'T BUY A GAMES MACHINE

Games you won't just games and nothing else! With a games computer you are limited. Some computers, however, take the advantage of built-in game facilities by the whole world of computing to equate to your interests and skills. Aerial computer systems will allow you to expand your knowledge of the TV technology world and help you to play with all added uses in the field of education, communications and home automation use.

### SOFTWARE

Make sure the system you choose has a growing library of support software to enable you to make the full potential of your machine.

### KEY POINTS TO LOOK FOR

#### ● High Resolution Colour

In general most home computers have a poor graphics resolution (for details). Check up the various and personal envelopes in graphic mode and multiply the line numbers together. If the result is less than 20480 then the graphics capability is considered high resolution. Without high resolution graphics displays such as those used in games can be. Check up in appearance.

#### ● High Quality Sound

Some computers produce a sound channel when in reality there is no sound channel inside the computer is a small speaker controlled by electronic pulses. At the very least, a sound facility should provide more than one channel and/or stereo channel so we'll get the best effects in games for example. The best system also provide analogue control of the sound channels to produce very realistic and effects very important for generating music. Also look for the ability to connect external amplifiers.

#### ● Keyboard

For an ample array of programs and data into a computer it is important that the keyboard has a good standard in operation. Coupled with a quality keyboard the user is fully aware whether computer has accepted his/her orders. Also of importance is a keyboard layout. A standard QWERTY keyboard layout will minimize the user with the advantage of computers used in the world of business and professional applications very important if the purpose of your buying a computer is educational.

#### ● RAM

One of the most important features of a computer is the amount of RAM or memory included. In general the more powerful and exciting a computer program is the more RAM it requires. But there are all computers are advertised quoting the maximum used in the system. Computers can use a great deal of their own RAM for posting extended data and particularly in supporting the graphics display and the CPU. It is less than 256K then you are in a struggle!

#### ● Computer Language

It is too difficult to program a Computer in its own binary language so high level languages are used. The most popular being BASIC. However there are a number of BASICs, some being very different from others. A list has been compiled in the computer industry is Personal BASIC. Learn the one and you will be able to program in the majority of computer BASICs such as independent ports to home computers as it is used to educate your children in the technology of the future.

#### ● Expansion

As you extend your knowledge of computing you will need to



Choosing the right software will go a long way to making your home micro a money saving CPU. It will give you the ability to play the role and reduce prices before you buy. Probably choose either for your system that you expect to make your money.

colleague system that will give you the ability to communicate. Printers, Disk drive, Modems, Communications Modem and Local Modem as well as software (I'll sound effects).

#### ● Software

The computer you choose should have a growing educational ability

software to make the most of its capability. Remember computing is learning. You can't learn to compute at a rate of a device which does not perform like a micro-computer. It isn't, but out for a computer which offers all the points above and you will be sure of getting the best value for money.

## To find out which company offers you the right choice, with:-

- Good value, high specification, quality micros.
- A quality, 4 colour, plain paper printer/plotter.
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- Micro Disk Drives.
- Comprehensive and growing range of software

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It's time to move beyond - to Granada micro Handbooks.



I MADE MYSELF, the Maple, Modem and it has worked well, giving me access to a number of amateur and commercial databases around the country. The Modem has proved reliable and useful. It has worked successfully on both a BBC Micro and an Apple II fitted with a Compaq Digimodem serial card.

The Maple Modem connects directly to British Telecom's telephone lines and the receiver has been signal possible in the UK and, consequently, low error rates. The alternative method for putting a signal on to the telephone line is to use a small headpiece near the microphone and a microphone close to the speaker to read and receive the tones that carry a message.

There is no electrical connection in the telephone lines in the type of Modem, instead it is electronically coupled — the computer produces a digital signal which is turned into analogue tones for the Modem and these are fed to the headpiece which vibrates and chirps and sends the information down the line.

Unlike many amateur couplers which are referred to as rotary calls, the Maple Modem can both originate and answer calls. That means that the receive and transmit flows at the Modem can be reached between incoming and outgoing messages. This is important because not originate only electronically coupled modems will be unable to communicate with each other — one Modem must answer the other's incoming call.

The Maple Modem relies on the operator to switch the Modem into the telephone circuit, it is not an auto-answer device. Using the Modem is quite straightforward, you dial the number you wish to communicate with and listen on your telephone and the call connects. A steady tone indicates that the computer is on the line and is waiting for the outgoing tone from your Modem.

You switch the Maple line switch on and register your telephone number on its ring. The remote computer will send a welcome message and then you can start to view messages. At the end of the exchange of

# MODEM



Paragon's Modem for the Apple II/IIx

# MAPLIN ON LINE

information you wish the Maple has much to offer.

Whatever I have used the Modem with either a BBC micro or an Apple II computer the number of corrupted characters has been very low. In other terms the best way to describe the results is solid copy. All the computers I have connected — some of which are listed in Figure 1 — use full duplex which means that a character typed onto the BBC micro does not appear directly on the VDU but is sent, instead, to the Modem and the remote computer.

(Continued on page 170)

John Dawson found the thought of putting together and using a Modem quite daunting until he actually went ahead and did it. Now he finds it reliable and useful. Here he looks at operating procedures for the unit with particular reference to the Maplin Modem.

Figure 1 Computer database

|                         |                 |  |
|-------------------------|-----------------|--|
| Event                   | 01 475 1488     | Douglas                                      |
| Modem                   | 0302 602941     | Electronic<br>Maplin                         |
| Serial                  | 0377 286528     | Electronic<br>Radio 8<br>Barnesway<br>Widley |
| Forum 80                | 0405460 858 881 | Electronic and<br>History                    |
| TEBS London 01 248 9800 |                 | Localised                                    |
| Maplin 80               | 081 628 8528    | Electronic, and<br>History                   |

Figure 2

```

10 NUMBER = 01770
20 NAME = 02000
30 1st NAME = 03000
40 2nd NAME = 03000
50 CLS
60 PRINT 10010, 101 BBC
terminal operation
70 PRINT 10015, 1015 "PARSONS"
80 REM 10015 01 03000
90 PRINT 10015, 1015 "PARSONS"
100 2nd NAME = 01 10015 100
110 2nd NAME = 01 10015 100
120 0200 10
130
140 0200 10015 20
150 010 020010015 20
160 010 020010015 20
170 010 020010015 20
180 020010015 = 02000
190 020010015 = 02000
200 020010015 = 02000
210 020010015 = 02000
220 020010015 = 02000
230 020010015 = 02000
240 020010015 = 02000
250 020010015 = 02000
260 020010015 = 02000
270 020010015 = 02000

```

```

280 10015 0
290 10015 0
300 010 020010015
310 10015 02000
320 010 020010015
330 10015 02000
340 010 020010015
350 010 020010015
360 010 020010015
370 010 020010015
380 010 020010015
390 010 020010015
400 010 020010015
410 010 020010015
420 010 020010015
430 010 020010015
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890 010 020010015
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970 010 020010015
980 010 020010015
990 010 020010015

```

```

990 010 020010015
1000 010 020010015
1010 010 020010015
1020 010 020010015
1030 010 020010015
1040 010 020010015
1050 010 020010015
1060 010 020010015
1070 010 020010015
1080 010 020010015
1090 010 020010015
1100 010 020010015
1110 010 020010015
1120 010 020010015
1130 010 020010015
1140 010 020010015
1150 010 020010015
1160 010 020010015
1170 010 020010015
1180 010 020010015
1190 010 020010015
1200 010 020010015
1210 010 020010015
1220 010 020010015
1230 010 020010015
1240 010 020010015
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1260 010 020010015
1270 010 020010015
1280 010 020010015
1290 010 020010015
1300 010 020010015
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1870 010 020010015
1880 010 020010015
1890 010 020010015
1900 010 020010015
1910 010 020010015
1920 010 020010015
1930 010 020010015
1940 010 020010015
1950 010 020010015
1960 010 020010015
1970 010 020010015
1980 010 020010015
1990 010 020010015

```

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continued from page 100

The remote machine then offers the user back down the line, through the Modem and into the BBC macro, where it is displayed on the VDU. Full duplex allows the simultaneous transmission and reception of data.

Mail duplex, also available on the Magics Modem, means that the terminal — the BBC macro plus Modem — transmits and receives data consecutively, and transmitted data is displayed locally before it is sent to the remote machine.

Many of the telephone numbers printed on our computers magazine or another journal are to be answered. Some of the computers are only connected to the Bulletin Board service between certain hours. You also, quite reasonably, have to be prepared for human error on the other end of the line — "Sorry love, he's on holiday for two weeks". The numbers listed in figure 1 were correct at the time of writing.

The hardware is only part of the story because the Modem and computer on their own are just pieces of apparatus with no function. In common with all peripherals you need some software to make the computer recognise and use the equipment you have connected. The BBC machine is particularly clear in this respect. The machine operating system, or MOS, allows you to work at a high level of ease simply with a control line of data out of the machine and the built-in assembler makes the development of a terminal package quite easy.

Figure 2 lists a basic program which will set up the BBC macro either as a terminal or to transfer a file of information held on the machine to another computer. The terminal section of the program — lines 140 to 360 — is taken largely from Mike James' excellent book, *The BBC Macro* — an expert guide. The book is worth buying and the expansion of the program is explained in considerable detail. The additional part of the terminal program does a much interesting character at the address pointed to by the variable "xxx".

When you have completed the exchange of data with the remote computer you can return to the main menu by pressing the Escape key. The program is very credit user for too many

# MODEM



Gene entered me and could be carried into a number of cost-effective running procedures. It was developed in a hurry, it does work, but it needs a long — it is not an example of good programming.

Lines 190 to 300 send the data stored between "A:2000" and "xxxxxx" to the serial printer port in the name RS-423 output as was used by the terminal program. The data is sent at 100 baud — line 820 — and the file is created by sending a Control Z character — line 830. The purpose of this expansion is to streamline the transfer of information to a CP/M file using the Personal Knowledge Program or PIP.

Someone will tell you that the Magics Modem is over-engineered. That may be true, it certainly works reliably and, despite the over-availability of single chip Modems, a respectable good value for money. The adding transceiver is essential for any Modem that is to be connected to HF lines — careful construction is necessary to ensure that the most plied equipment is electrically safe.

I expect to use the Modem and the BBC macro together to access an Amec data database Colleague by going through the public switched network for most purposes. The different frequency some times used in the US are not a problem because all you are doing is to make a local phone call to the public switched network.

The RS-150 interface for the Sanyo ZX-61 computer is made by Cable Technology,

Limited and a comes with software on a tape to turn the ZX-61 into a console terminal. The terminal software uses the SanyoMail protocol to control the flow of data into the computer and can change the ZX-61 screen to the ZX screen.

One option at the start of the program will set up the system to look like a Teletext Gold terminal. Unfortunately I was unable to borrow a ZX-61 to run the Cable interface with the Magics Modem but as theory, there should be no problems.

The Microdrive are now on sale for the Sanyo Spectrum. Probably the most interesting part of the new hardware is the interface between the Spectrum and the Microdrive. The interface has an RS-232C mode and also works to set up a local area network or LAN. It supports up to 64 Spectrum computers. The manual does not say how long the links can be between computers on the net but if the same distances are used for both the RS-232C and the LAN then you might expect to be able to run up to 50 metres of cable from one computer to the next.

You can direct the output from your computer to another specified computer on the network or you can broadcast a message of data for everybody to receive. The manual says that the output from your computer is coded for the recipient and if this is not working for the message your computer will wait for ever, attempting to get the message through.

Although you must not use high level calls since it appears from the manual that more than one pair of systems may use the net at the same time. Low level addresses are apparently needed. More programs need cover to be a problem area although one expert suggests that the network operates at 110 Kbaud.

Learning about computing happens at a series of steps. Moving information from one computer to another was quite a big step and I still think it was not. The BBC machine is ideal for experimenting at this field. Connecting the Magics Modem was remarkable simple and extending Mike James' original program was not difficult given the BBC user guide as a reference book. ■

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# RESPONSE FRAME

**Do you have a problem? Your manual is incomprehensible or you just cannot get the hang of that programming trick you tried — whatever it is, Tim Hartnell will do his best to answer your queries. Please include only one question per letter and mark them "Response Frame"**

## GETTING LOADED

I am intending to market my own software, but I want to ensure that the cassette will load on any Sinclair Spectrum through any tape recorder. I have read that recordings made on some recorders will not load through other recorders. Could you please recommend a low-priced cassette recorder which I can use to produce recordings which will load on any Spectrum?

D G Brown,  
Rugby, Warwick.

THEORY SAYS THAT you are approaching the problem from the wrong end. Rather than try to find a cheap recorder which will work with all Spectrums, you should ensure in the first instance cassette records you use offer the standard of recording, better than the make of cassette player used to load the program files onto the cassette. In the most important thing to ensure when choosing a recorder is that you can choose duplicated by one of the commercial tape operators or recording company software. This will only be a sensible path to follow if you will be making large quantities of your program.

## TAPE CONTROL

Is your February issue you reviewed Spectrum hardware. Could you please tell me where I could obtain an Adams tape controller?

Erica Duff,  
Barnfield, Middlesbrough.

THE ITEM IS AVAILABLE from Douglas Adams, 1 Leazes Road, Leeds, N.E. 7 7NL.

## STAR GAZER

I am interested in amateur astronomy and particularly in the observational side. I have a Dragon 32 and would like to know if there is software available which gives astronomical figures such as positions, distances, magnitudes of stars and planets for any given day. Could you help?

John Holmes,  
Aylesford.

I MUST SAY there still is a lack of support of such software in the U.K. However, Creative Computing magazine in America publishes a list of computer programs related to navigation using the stars, and the way used prior to arrival.

You could contact, among other bodies, Star Observers, Plymouth.

I Buy New Read, Penworth, Manchester, M20 9LZ, has a copy of its extensive catalogue of Dragon products in use if there is anything available which might be adapted to your needs. Baffle Micro-Day 328 Microbeam, High Road, London, SW21 9BB, also provides a catalogue of Dragon products, although you must specify what is in the Dragon and a compatible model is suggested. Finally, if you cannot get time to play around with the stars, Skyline Services, 65 The Vale, Luton, LU2 7EF offers an exciting program called Solar 2 for the 32.

## TALK TALK

I have seen advertisements for programs for the Spectrum and Dragon which enable the computer to speak without the need for extra hardware. How do they do it? Surely it should be able to do it on any BBC Micro without having to buy the special Avance speech controller.

Alan James,  
Merton.

THE SPEECH IS produced on the Spectrum and Dragon by using voice manipulation of the computer's digital output. It is perfectly possible to do so on the BBC Micro for the results are, in general, quite similar to those produced by a custom-made speech unit.

I have found some Spectrum "speech" that has had to be "learned" by the programmer before I could understand what it was supposed to be saying.

As well as being of much better quality, speech produced by a custom unit is much, much superior to material such as hardware speech.

## LEADING ZERO

I have a problem relating to the Maths and Cass program in the book *Introducing Basic*. My computer, an Atari, accepts an input of 120, but it won't add 120. It ignores the leading zero. I have played with the relevant lines of the program, but to no avail. Your help in this matter would be most appreciated.

J Shaw,  
Petersham.

LEADING ZEROES are ignored by all computers and nearly all calculating devices. Even my own program of the Mathematical program you refer to, I think the problem is simply that the program does not allow zero to be part of the operand code. There is no need to include a zero at the

beginning of the operand if the operand is your number. This may be incorrect, but it appears so from the part of the program you sent.

In general, it is often easier to treat numbers as strings — using ASCII or change them to the string, and ASCII, unless you are to get them back into number form — if they require extensive manipulation. Strings are much easier to cut up, and play with, than are numbers.

## IN FUNCTION

I have devised a 100-Spectrum game which allows two players to meet in individual circumstances about the screen. Each player has his own battery of pieces. Of course, if two boys are present at the same time, Intely II becomes an empty shell, and that is no argument. How can I get the computer to only look at one set of boys at a time?

C Bradley,  
Barnet Way, Bishops Cleeve.

THE ANSWER IS to use the In function, which allows them to see only one to be used at a time. Use a low like 80 IN 0000 — THEN to get the other you want. You can set up a simple routine to get the effect you want. You can set up a simple routine to get the computer to return the result of the In actually set by including a Print to test a program. To use the following numbers 8000, 0000, 0000, 0100, 0100, 0100, 0100, 0100 and 1000. The use of In is explained in the book *Using Doper* — see *28 Spectrums* by Douglas Jones.

## MEMORY LOSS

Was my 2000 lost its memory? When I typed in some long programs which are better to be for the unscrupulous 2000, I often get an "out of memory" error. Sometimes a program which fits the first time I use it gives an "out of memory" error when loaded back in from the cassette. What is going on?

M Pratt,  
Peters.

AS HAS BEEN discovered, the 20 is very badly when the memory is nearly full. When the 20 has a free memory as you have, a reserve space to memory for each address required. I suggest you use CLR to get rid of all values assigned to variables, and keep your eyes down to the absolute minimum.

## DISABLING

I have been writing programs on my BBC Spectrum. I have that you cannot break out of a machine code program. Is there any way of disabling the break key when using Basic?

Robert Allen,  
Alley Day, Newport.

THESE RECENTLY came it so way that can be done on Basic 2.

However, you want to know about this so you can prevent most such programs, you can add lines to the listing — changing the copyright, for example, to you — which cannot be removed from the listing by anyone.

If you were your name and every right claim to be the rightful owner, which you may not deserve, make this the first line from your program: I GET A + BBC 2000 + 200000000 (BBC 2000 A + 2000 A + 2) STOP

I MUST SAY that, then, you will see how easy where you can use to be. All you have to do is use a video line 1, and your name and copyright will be locked in the listing file too.

## SPRITELY SPRITE

I am a Commodore 64. Could you please explain how I can move a sprite across the screen using keys or a joystick?

John Clark,  
Leek.

WANTS TO MOVE an I am sure you have gathered, the exact shape in the world to use, but the record of many shows even that computers for the effect required in understanding them. A sprite is a character which you define. It will look just as you specify, in terms of shape and colour, and can be placed anywhere on the screen and moved under your control.

The Commodore 64 Programmer's Reference Guide explains how to position and move sprites on page 242. Contains the address table with a routine to load the sprite's position on page 246 of the same book or a standard Intely II submission to use the keyboard, and you can view your sprite around. The guide is extremely valuable, but a demands much careful reading.

## VIC FORT

I see a Vic-64 and am very pleased with its performance. However, I would be pleased if you could tell me how to get the command PLOT 000,000 — which sets a report function on all keys — to stay permanently in memory?

G Adams,  
St Johns,  
Middlesbrough.

THE ONLY way really if it is possible to change the contents of the VIC ROM. Although, as you know, ROM can not be changed except by your entry something into the computer, ROM is fixed when you buy the machine. Therefore, there is no way, short of reprogramming the ROM, to change the area of a particular address — P0, in this case. You will just have to continue to type the command into the machine in the case of each programming session, and possibly lose it in the saving process of New Year's resolution of the editors. ■

# SNOWBALL

of £9.99 is the ultimate adventure for

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*Snowball is a massive adventure with over 7000 footprints. It took nine months to perfect and marks a new leap forward in adventure games - it has a detailed, planned background and is set aboard a huge starship that would really work. Snowball could be a glimpse of the future!*

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*Thus when your frozen-coffin wakes you with the Snowball still in flight, you know that something must be very wrong. You're awakened and disorientated by lengthy information, but the fate of the 5 mile long space-ship is in your hands!*

*Snowball is our new fourth adventure. Here's what the reviewers said about the last three:*

*The descriptions are so good that few players could fail to be impressed by the realism of the mythical worlds where they are the hero or heroine. The booklet supplied with each program is very helpful. Extensive information is supplied about the game scenario. The Level 9 programs are great fun to play (and plenty happens to keep you bemused and amazed for hours on end.*

*- Which Micro & Software Review August*

*A major miracle of programming. & An impressive suite of adventures. They are always a pleasure to play.*

*Popular Computing Weekly 12 May & 23 June*

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High Wycombe, Bucks HP12 3DP.

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# BBC

continued from page 28

screen which were saved before the crash.

The interface between the Forth operating system and the existing store is essential for an efficient Forth system. Forth definitions are stored within the machine in a compact form and the source code stored externally on a screen.

Screens are swapped in and out of the machine as required - automatically by the host system interface with the tapes. The Forth operating system can become confused about which screen is in memory and which has been saved.

The Forth stack is a standard 20 Forth system with extensions to allow effective use of some of the BBC's facilities. These are primarily the word 2VDU for the VDU drivers and Plot which apart from the use of pins for screen as observed in the Room Plot command. The manual gives some guidelines concerning implementation of other facilities notably the operations of the Sound and Drawpage commands in Basic.

No guidance is given as to how to implement the system code of the A to D converters. The machine code addresses for these are not difficult to write if you are familiar with the MOS BBC machine code and Forth stack it would have been useful for the host user to have had these included in the dictionary somewhere or being that explicit is given in the manual.

I managed to implement these in machine code but did not use the assembler supplied on the tape. For modifying small parts of machine code there is a simple way to include the routines to routine operators within definitions it is within the philosophy of Forth to leave definitions short and simple. If I wanted to include longer pieces of machine code then the assembler looks a useful tool.

The screen editor is used to edit and add screen prior to their being compiled into a Forth dictionary. I did not find a default screen being used to buffer typed editors on other machines. I imagine that people when only editing operations has been screen based as on the BBC itself used that it difficult to produce a default input using both the Forth and screen editors in tandem possibly the best of both methods. The only thing specially missing from the editor is a search and replace command. The extensive nature of Forth makes this very easy to implement.

Also supplied by Acornsoft is a manual. This is one of the best and one of the most books on Forth I have read. The most useful feature is a dictionary which correctly and succinctly explains the meaning of almost every word included in the dictionary.

After a very gentle start in the few chapters it then launches into the low and very high level systems in an extremely and frightening manner. As an experienced programmer it has some disturbing revelations and the apparent errors does not help in finding information. It shows signs of a hasty rewrite and has erasures on a number of levels which will surely indicate I would suggest a national edition with the original author's manual expanded and separated from the advanced in conclusion I would recommend Acornsoft Forth to anybody who has a BBC Micro.

Steve Cohen

Continued from page 28

advantages of Basic, as being well suited for use on microcomputers with their relatively limited memory. It was originally designed for controlling radio telescopes by Charles Moore at Ka Paul National Observatory in Arizona in the early 1970's.

Forth's advantages are that it is compact, taking up much less of a system's memory than the typical Basic, and that it contains very few. To the programmer it is very different to working in Basic, because Forth is an extensible language. It comes with a standard set of commands, the Dictionary, which you then add to, to build up your program.

New commands, which are called Words at Forth, are created out of combinations of the old ones, or by writing machine code routines. Eventually you end up with a single word which when you type it in causes the whole program to Run.

Another distinctive feature of Forth is the stack, a sort of heap on which you store numbers which you are about to use.

In Forth each programmer ends up creating virtually their own language. But the core Dictionary, when you go when you buy a Forth language system and all you have before you set to work, has to be signed otherwise Forth would fragment into a thousand idiosyncratic quads.

Forth represents a new development in the dictionary definition of Forth was arrived at not by a committee or consensus or consensus but by the community of Forth users themselves meeting at Forth limited group meetings. Forth is the standard Forth, arrived at in 1975.

There are still problems with Forth. Although it is fast and efficient, it is incredibly



difficult to teach other people Forth programs. Gary Kildall, creator of CP/M, who is particularly a C and Logo enthusiast, describes Forth as a near-ideal language for the micro.

Forth, designed in 1971 by Allan Forth, a Texas University Professor, is, on the other hand, very concerned with the human programmer's thinking. The language is named after Alan Forth who, in an 18-year-old, attended the first commercial calculating machine in France in 1830. Forth is designed to be easy for programmers to learn and reuse.

To be frank, I do not like Forth - it faces out to Basic in a particular way which might be good for you but which I would like to be opposed. Allan Forth had strong ideas about structuring programs - that is writing them in separate chunks, or modules, with each program module containing a complete logical thought. The modules are then

continued on page 28

## ZX-81 FORTH

ZX-81 Forth from Spectra limited has one selling an inhibitor plus a further four minutes at least the editor which is written in Forth also based on a Forth for 8080 the editor limited there is about 70 kb for the application documents.

The most surprising part of the system was the facility to save the Forth definitions as Forth files. Using the editor a screen can be opened, saved and loaded normally in a Forth file. There is no indication of the screen number as the screen is loaded or unopened to be loaded, which makes loading the file on the tape a little difficult.

Only one screen can be held in memory at one time. Once the screen has been written it can be saved to tape with the word Save and loaded for printing with List or for execution with Load. A heap screen is prepared with a Char which is the screen number on the top of the stack.

The editor is very different from the Basic editor. The user to save a screen initially will be able to using a number of words for moving a pointer around the screen. When the pointer has been positioned there are words to delete and insert one line into the screen.

Spectra Forth is very close to standard implementation. All the control loops -

initials letters and List are printed as is all the expected stack memory and dictionary manipulation words. It even supports recursion.

The character set has been transferred to ASCII which would be a moderate screen but a simple program to be written on the ZX-81 in high level Forth using the standard words for implementation user code routines.

The speed advantage of Forth on the ZX-81 is pronounced. The slow mode of operation has disappeared. The screen is printed at all times. A sample 1 to 1000 Forth loop for example executes in about 4 seconds in Forth compared with over 20 seconds in Basic.

Also supplied with the tape are two printed books. The Problem of there is a confusion guide. It includes details of the operation as well as a brief introduction to ZX Forth and a glossary containing a definition of every word included in the Forth dictionary. An appendix also includes the machine code provided for getting on the screen. The other booklet is a useful and comprehensive guide to the editor.

Spectra Forth for the ZX-81 supports the Forth philosophy by entering the machine, or possibly beyond its limits.

Spectra Forth for the 48K Spectrum is almost identical to the ZX-81 version. Obviously some new problems have been introduced to make use of the Spectrum's graph-ic and sound capabilities.

It also provides the Spectrum with a full screen editor as on the BBC.

Steve Cohen

# SOFTWARE FILE

Continued from page 170

```

0000  PRINT "NOW MANY BYTES REMAIN"
0010  GOTO 100
0020  INPUT N
0030  LET L=PEEK 16011+800+PERR
0040  LET L=L-1
0050  LET L=L-PEEK (L3+10010)+800
0060  LET L=L-1
0070  LET L=L-1
0080  LET L=L-1
0090  LET L=L-1
0100  LET L=L-1
0110  LET L=L-1
0120  LET L=L-1
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0990  LET L=L-1

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0000  PRINT "NOW MANY BYTES REMAIN"
0010  GOTO 100
0020  INPUT N
0030  LET L=PEEK 16011+800+PERR
0040  LET L=L-1
0050  LET L=L-PEEK (L3+10010)+800
0060  LET L=L-1
0070  LET L=L-1
0080  LET L=L-1
0090  LET L=L-1
0100  LET L=L-1
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0970  LET L=L-1
0980  LET L=L-1
0990  LET L=L-1

```



## Rotating display

Alan Knowles,  
Gillingham,  
Kent



THIS PROGRAM FOR THE ZX 81 with a level 1&K will show pages of information to be entered, which will be fitted onto the screen whenever and wherever with a machine-code routine will rotate through the display, printing to the screen with the speed of machine code. Entering the program is divided into three main parts:

- Entering the data statements
- Entering and running the test loader
- Entering and running the screen display loader

The total program will be roughly a machine code with a couple of lines of Basic to run it.

**Stage 1** — entering the Basic statements — on a ZX machine up to 19 pages can be displayed if all 79 pages are entered the data list is roughly 15,000 bytes long. An easy way of entering this is to Load a program from tape the user manual of the ZX81 then use the Programmer Book published in Your Computer Software File, September 1982 by R Young to change it to a machine Basic.

When this is done enter 16000 to the prompt. Once this has been entered as a data command enter:

POKE 16000:

to make the first line of the program. If you have any trouble with line 1 reentering to the screen then:

POKE 1610:LIST 10

to clear statements.

**Stage 2** — entering and running the test loader — **Figure 2**. When this is run enter the hexadecimal numbers missing out the spaces for example:

HEX DUMP FOR THE ABOVE LOADER

or: When completed press **Newline** and the program will stop with an error message. Delete the loader — line by line.

**Stage 3** — entering and running the screen display loader — **Figure 3**. Enter the loader, before running it, save it on tape. Although the program is in Basic a Pokes are values BASIC and the program may crash if incorrectly entered.

When run on screen 'Y' will be displayed at the top left corner of the screen. If a key is pressed the appropriate character will take on place and it will move on to the next print position. If a space is wanted press **Newline** as the normal space key will break out of the program. To rub out a character press shift 0 as an normal Basic. If a key is pressed for a short time one character is printed. If a key is held down the characters will be printed repeatedly.

**Graphic Character Mode** — to print screen characters press shift 0, screen 'Y' will become screen 'Y'.

To screen to screen 'Y' press shift 0 again.

**Graphic Character Mode** — to print graphics press shift 0. The screen 'Y' will become screen 'G'. The keys 1 to 0 represent the first 10 characters of the character set — see appendix A of the ZX81 manual. Press shift 'Y' to return you to screen 'Y'.

When each screen is completed there is a short pause — lines 1040 and 1100. This can be used if you have finished. If you have then press 'Y' and the program will stop. Pressing 0 and the program will continue to the next page.

If you answered 'Y' then the program has been completed. Add these lines:

```

0000  GOTO 16000
0010  GOTO 16000
0020  GOTO 16000

```

To break out of the display press the break key at the end of the top of page.

If you wish to use the two lines at the bottom of the screen — lines 25 and 31 — before running the screen display loader change line 210 to:

POKE 16000:GOTO 16000

And before running the final program add:

0000 POKE 16000:

To run the program with the extended screen use **Run 1997**.

To alter the time each page is on the screen PoKE 16120 where 0 is any number from 1 to 255 — 0 is just under a second, 255 is approximately 1 minute 45 seconds.

To run through the display once, restore line 9999.

Figure 1: Automatic Run

```

0000  PRINT "NOW MANY BYTES REMAIN"
0010  GOTO 100
0020  INPUT N
0030  LET L=PEEK 16011+800+PERR
0040  LET L=L-1
0050  LET L=L-PEEK (L3+10010)+800
0060  LET L=L-1
0070  LET L=L-1
0080  LET L=L-1
0090  LET L=L-1
0100  LET L=L-1
0110  LET L=L-1
0120  LET L=L-1
0130  LET L=L-1
0140  LET L=L-1
0150  LET L=L-1
0160  LET L=L-1
0170  LET L=L-1
0180  LET L=L-1
0190  LET L=L-1
0200  LET L=L-1
0210  LET L=L-1
0220  LET L=L-1
0230  LET L=L-1
0240  LET L=L-1
0250  LET L=L-1
0260  LET L=L-1
0270  LET L=L-1
0280  LET L=L-1
0290  LET L=L-1
0300  LET L=L-1
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0330  LET L=L-1
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0370  LET L=L-1
0380  LET L=L-1
0390  LET L=L-1
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0940  LET L=L-1
0950  LET L=L-1
0960  LET L=L-1
0970  LET L=L-1
0980  LET L=L-1
0990  LET L=L-1

```

Figure 2: The Test Loader

```

0000  PRINT "NOW MANY BYTES REMAIN"
0010  GOTO 100
0020  INPUT N
0030  LET L=PEEK 16011+800+PERR
0040  LET L=L-1
0050  LET L=L-PEEK (L3+10010)+800
0060  LET L=L-1
0070  LET L=L-1
0080  LET L=L-1
0090  LET L=L-1
0100  LET L=L-1
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0240  LET L=L-1
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0950  LET L=L-1
0960  LET L=L-1
0970  LET L=L-1
0980  LET L=L-1
0990  LET L=L-1

```

```

00 IF G=0 THEN INPUT G
01 POKE R,16+CODE G:CODE G:G
02 GOTO 10
03 SCROLL
04 PRINT R,G:G TO 1
05 LET H=0:G TO 0
06 LET H=H+1
07 GOTO 00

```

HEX DUMP FOR THE ABOVE LOADER

| ADDRESS | HEXADecimal             |
|---------|-------------------------|
| 16014   | 70 76 E1 7E 99 C6 FE FF |
| 16020   | 0B 0B 80 80 10 F4 80 80 |
| 16026   | 11 FF FF 01 32 37 10 80 |
| 16030   | FD 10 FD 00             |

Figure 3: Screen display loader

```

0000  PRINT "NOW MANY BYTES REMAIN"
0010  GOTO 100
0020  INPUT N
0030  LET L=PEEK 16011+800+PERR
0040  LET L=L-1
0050  LET L=L-PEEK (L3+10010)+800
0060  LET L=L-1
0070  LET L=L-1
0080  LET L=L-1
0090  LET L=L-1
0100  LET L=L-1
0110  LET L=L-1
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0230  LET L=L-1
0240  LET L=L-1
0250  LET L=L-1
0260  LET L=L-1
0270  LET L=L-1
0280  LET L=L-1
0290  LET L=L-1
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0990  LET L=L-1

```

Continued on page 185

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938, 940, 942, 944, 946, 948, 950, 952, 954, 956, 958, 960, 962, 964, 966,
968, 970, 972, 974, 976, 978, 980, 982, 984, 986, 988, 990, 992, 994, 996,
998, 1000.

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10000000, 10000001, 10000002, 10000003, 10000004, 10000005, 10000006, 10000007, 10000008, 10000009,
10000010, 10000011, 10000012, 10000013, 10000014, 10000015, 10000016, 10000017, 10000018, 10000019,
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10000180, 10000181, 10000182, 10000183, 10000184, 10000185, 10000186, 10000187, 10000188, 10000189,
10000190, 10000191, 10000192, 10000193, 10000194, 10000195, 10000196, 10000197, 10000198, 10000199,
10000200.

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## Alien flashers

Commodore 128, 128C, 128D, 128SE, 128SXL

**128-36**

**NOT READY YET!** *Martians II* is almost here, but you can't play it yet. This program uses recursive and user-defined graphics to good effect, as well as a machine-code routine to advance a picture.

Instructions are included in the program and are quite straightforward. To score a high score requires a few games to work out the strategy. On destroying a score of six aliens, the usual number of which is eight at the start — up to 30 — the player is then confronted with a new kind of alien, which will have increased in number by five — maximum 35. For each wave destroyed without losing a laser beam, the bonus is doubled, but is zero if any alien damage is done your defenses and no delay your laser beam. You start with three laser beams.

Some variables can be altered in the program to vary the game.

- L.B. — number of laser beams
- DE — bonus at start
- BC — score — starts at base 100
- G — top left of screen & after for
- G+1 — start of laser motion (expanded) /

## User-defined keys

John Burton  
Anglia  
Wimborne

**SPR500M**

**THIS PROGRAM** for the IBM Spectrum provides 50 user-defined function keys which are used in a number way to those on the BBC Model.

Instead there are no analog keys on the Spectrum keyboard, a new shift key is used to score shots. The Space key is used in the same way in the new example shift keys. It, and any other key pressed together will produce the required line on the side/screen area in the bottom of the screen. For example, if the H

Continued on page 102

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# MEMOTECH

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Fifteen months ago Memotech developed the first 64K Memopak, designed to maximise the capabilities of the Sinclair ZX81. Since then, using the ZX81 as a starting point, we've gone on to produce a comprehensive range of Memopaks, adding 16K and 32K memory expansions, address packages comprising a Word Processor, Z80 Assembler and Spreadsheet Analysis, plus Communication Interfaces, High Resolution Graphics and a professional quality Keyboard. To complete our range of ZX81 add-ons, we are now introducing the MEMOPAK RS232 Serial Interface.

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The RS232 is an all-purpose interface which allows the ZX81 not only to connect to compatible serial printers, but can link up with numerous types of peripheral or even other processors. The Interface has two main modes of operation. BASIC mode allows you to use the range of functions supplied by the BASIC EPROM within an ordinary BASIC program, and TERMINAL mode allows you to use your ZX81 as a terminal to another processor. The EPROM functions offered permit the user to send, receive and compare bytes between ZX81 code and ASCII, as well as check the status of numerous control flags. Received or transmitted data can appear instantaneously on the screen, and received data may be printed immediately.

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This pack breaks down the commands required by operating in the ZX81 character level and allows high definition displays to be generated. All 256 x 128 individual pixels can be controlled using simple commands, and the built-in software enables the user to work interactively at the character, line, column, block and page levels.

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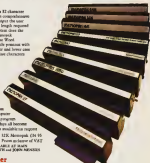
## Memopak Memory Extensions

For those who writing fast on the road to and comparing, these packs transform the ZX81 from a toy to a powerful computer. Data storage, extended programs, long and complex displays all become feasible. Further details available on request. 16K Memopak £24.95 32K Memopak £24.95 64K Memopak £29.95. From enquiries to VAT REGISTRARS AND APPROVALS OF TRADE DEALERSHIP OF MEMOTECH Ltd (John HARRISON)

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The Assembler allows you first to code and then to assemble programs in the Z80 language, and then translate a program machine code. You can save your files and assemble programs. The Editor mode allows you to edit directly on the eight lines, complete underlined lines and control the user's placing of braces and machine code. Brackets may be changed or listed from a conventional printer using our Connection Interface. The assembler mode handles all standard Z80 instructions, numbers in hex or decimal, constants and character labels.

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To Order: Send your Name, Address, Memopaks required, plus a Cheque/Postal Order/Access/Bankcard number (please state which) to: Memotech Limited, Station Lane Industrial Estate, Witney, Oxon. OX29 6EX. Telephone Witney 2977.

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HP3300-1225 HP3300-1225 Keyboard and mouse set for use with HP3300-1225. Keyboard and mouse are designed and made in Taiwan, China.

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# sional



## The All-Purpose System

The MTX Series is a new departure in micro-computer technology. Whether your needs are a user one for personal programming, games playing, scientific or process control, educational or business use the MTX Series is already capable or very easily adaptable to almost every application. Glance through the standard features below - you'll see what we mean.

### Software

The MTX's 24K ROM contains several languages and routines which enable the novice or the experienced programmer to make full use of the machine. Standard languages are MTX BASIC, MTX LOGO commands, WOODY. ROM routines include an ASSEMBLER/DISASSEMBLER with screen display of the 240 CPU registers, memory and program, which can be manipulated from the keyboard. Machine code programs can be stepped through one instruction at a time, and easily called from within BASIC programs. A further feature is the Virtual Screen facility which enables the programmer to split the screen into a maximum of eight sections to work independently whilst maintaining all full screen facilities. Pascal is available as an option ROM pack.

### Hardware - 32K RAM on the MTX300, 64K on the MTX512.

The MTX300 has 32K of user RAM as standard (64K on the 512), expandable to 512K plus 16K of video RAM, controlled by a separate Video Processor. Sixteen colours, 40 column text, 256 x 182 high resolution graphics with all sixteen colours available, and 32 easily redefinable user defined graphics characters (Sprites) combine to make effective screen displays quick and simple to achieve. Standard outputs are reameters printer port, two joystick ports, an uncommitted I/O port, 2400 Baud Cassette port separate TV and Video Monitor ports, 4 channel sound with full output plus a dedicated cartridge port. Other standard features include the 280A processor running at 4MHz, real time clock, full moving key keyboard with 78 keys including eight 2-function keys and separate numeric pad.

### The Disc Based Computers from Memotech

Designed to use the full power of the MTX computers the FDX and HDX make perfect business systems of prices which make perfect business sense. Both feature the CP/M operating system giving instant access to a wide range of proven application software. Available in October these feature:

- Full Western Digital floppy disc controller set with SAS interface for 4 drives, CP/M types 8-12
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### FDX - Floppy Disc System

For 2 5 1/4" Quad drives 500K unformatted, 34K formatted.

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2 1/4" Quad drives, 500K unformatted, 34K formatted, 2 1/4" Winchester which may be 5, 10, or 20 MB.

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## MEMOTECH

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The individually tailored foam insert securely protects your

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All components remain fully operational within the case via inter-connections routed between the

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This is the first case designed for easy use with each component positioned for convenient operation. The overall dimensions are 103mm x 790mm x 363mm.

### Value Corner

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32K Gam Pando including Module  
711 45 (p+p 75p)



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# SOFTWARE FILE

(Continued from page 184)

Key was programmed with

**BORDER 7 PAPER 7 BANK 0LS**

Pressing Space and B together will produce characters when the next key is pressed.

Programming the keys is usually only done when the program is set up to machine code in raw, but could be done using Poite also.

After program I is entered, key definitions should be entered from line 3000 onwards. This should have the code for each keyboard or letter or symbol with the line data being zero. For example the line above should be:  
3000 DATA 205, 55, 55, 210, 55, 55, 217, 55, 0  
where 211 is the code for leader, 15 the code for 5, and 16 the code for and so on.

The line data line of 3000 will default key H, the second will default Y and the third E. The sequence is:

**H Y E POSITIONING JUSTIFIED CODE**

and so on.

The letters in brackets cannot be programmed but must still be given the code 0 in the Data line.

The codes are put in the area of memory from 3032 on with each key having 32 bytes. The machine code line overruns and it cannot be used with vector program that does to also. Examples of key definitions

Key H **LOAD 0**      **PLN**  
Key Y **FLOP 0,0** **DRAW 200 0** **DRAW**  
         **0 170** **DRAW -260 0** **DRAW 0**  
         **-170**

Key E      **-800** **LOAD**  
Key 5      **PRINT 0**  
Key T      **PLN 50, 20** **DRAW 50 0** **150 70**  
Key G      **RANDOMISE 0**

The data lines for these are:

3000 DATA 205, 55, 55, 210, 55, 55, 217, 55, 0  
3001 DATA 205, 55, 55, 55, 210, 55, 55, 217, 55, 0  
3002 DATA 205, 55, 55, 55, 210, 55, 55, 217, 55, 0  
3003 DATA 205, 55, 55, 55, 210, 55, 55, 217, 55, 0

10 DATA 10,17,127,71,237,90,94,100,100,100  
20 DATA 210,177,190,200,100,1,140,10,100  
30 DATA 190,100,200,100,1,1,1,1,1,1,1,1,1,1,1  
40 DATA 11,17,74,210,20,110,100,1,40,0  
50 DATA 20,100,100,100,1,1,1,10,10,10,10  
60 DATA 200,100,1,1,1,1,1,1,1,1,1,1,1,1,1  
70 DATA 100,100,100,1,1,1,1,1,1,1,1,1,1,1,1  
80 DATA 0  
90 DATA 0  
999 DATA 00000000

1000 LET T=POKE P:FOR S=1000 TO 10000  
1010 PRINT S:IF S LET S=POKE S:P:GOTO 1000  
1020 PRINT S:GOTO 1000  
1030 PRINT S:GOTO 1000  
1040 IF S=10000 THEN PRINT "PROGRAM COMPLETE"  
1050 GOTO 1000  
1060 PRINT S:GOTO 1000  
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1980 PRINT S:GOTO 1000  
1990 PRINT S:GOTO 1000  
2000 PRINT S:GOTO 1000

## Sea-Fox

Jason Bell  
Preston  
Buckinghamshire



**TRY PLAY THE ROLE of a submarine looking through the surface of the water. In the shipping lanes in the Atlantic, Pacific, Indian, and other oceans, you'll find a variety of ships, submarines, and other vessels, each moving at a different speed. You can point by rotating those ships with your keyboard, and you can launch torpedoes depending on the ship's speed and distance from the submarine.**

Use the joystick — at the left-hand corner — to move your sub left and right. Press the trigger buttons to launch a torpedo. Usually, you have one minute to score in every point in you run. If you manage to score 1,000 points in the first minute, then you get 30 seconds of extra playing time. From that on, you have to score another 500 points to win more time — 30 seconds. When the time counts' machine runs, the game is over.

If you get one of the top five scores, you then have the chance to enter your name into the high-score table. You can set up to seven lanes, but the computer will only accept:

upper case, normal value letters, so do not press the Atari keys and lower-case keys.

All movement in Sea-Fox is achieved by a vertical blank interrupt, VBI, because in conjunction with player-matrix graphics. The vertical blank period occurs every 1/60th of a second after the screen has been drawn. Therefore, whatever happens in a VBI routine, it occurs every 1/60th of a second, regardless of user operation. This is often known as multi-positioning.

In Sea-Fox, a VBI routine gives fast, smooth movement. The routine performs three main functions: it moves the ships, submarines and torpedoes. The routine uses page 6 — locations 3000-3100 hex, 1530-1710 decimal — to be VBI variables which the routine uses:

- 1530 to 1538 Horizontal position of player 0 - 0 - zero
- 1540 to 1542 Speed of player 0-0
- 1544 to 1546 Direction of player 0-1
- 1548 Horizontal position submarine player 1
- 1550 Missile vectoring flag 1 - yes, 0 - no
- 1552 Vertical position missile 0 - torpedoes
- 1554 Missile speed

The ship speeds vary from 0 to 3 — 0 only when the ship is being exploded. The speed is simply the number of lanes a torpedoes

penetrated in the VBI routine. Your submarine travels at speed 3. The direction are 0 for right and 255 for left. In the routine, these values are added to the horizontal position values, which give the desired result. The missile speed is usually set at 1, although this can be changed by altering the 1554 Data value at line 340.

The data line for the VBI routine is held in VBI0, a vector routine, which enables the VBI to be held in memory. The routine changes the desired vertical blank vector — locations 3110 and 3112 hex — so as to point to my routine. This can only be done at machine language, and is performed by jumping to an operating system routine SET VBI, which sets a register VBI000 — 3400 hex.

Before jumping to the OS routine, the X register is loaded with the high byte of the address of the VBI routine, and the Y register is loaded with the low byte. The accumulator is then loaded with 0 for the correction vector, or 1 for the deferred vector. I used the deferred vector.

The VBI is enabled by executing  
**0 = LOAD VBI000, VBI0**

By changing the two values loaded by the X and Y registers — to 128 and 95 respectively, and executing the same command, the VBI can be disabled.

80 DATA 10,17,127,71,237,90,94,100,100,100  
90 DATA 210,177,190,200,100,1,140,10,100  
100 DATA 190,100,200,100,1,1,1,1,1,1,1,1,1,1,1  
110 DATA 11,17,74,210,20,110,100,1,40,0  
120 DATA 20,100,100,100,1,1,1,10,10,10,10  
130 DATA 200,100,1,1,1,1,1,1,1,1,1,1,1,1,1  
140 DATA 100,100,100,1,1,1,1,1,1,1,1,1,1,1,1  
150 DATA 0  
160 DATA 0  
1699 DATA 0  
1700 DATA 00000000

1530 LET X=POKE P:FOR S=1000 TO 10000  
1540 PRINT S:IF S LET S=POKE S:P:GOTO 1530  
1550 PRINT S:GOTO 1530  
1560 PRINT S:GOTO 1530  
1570 IF S=10000 THEN PRINT "PROGRAM COMPLETE"  
1580 GOTO 1530  
1590 PRINT S:GOTO 1530  
1600 PRINT S:GOTO 1530  
1610 PRINT S:GOTO 1530  
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1100 LET T=POKE P:FOR S=1000 TO 10000  
1110 PRINT S:IF S LET S=POKE S:P:GOTO 1100  
1120 PRINT S:GOTO 1100  
1130 PRINT S:GOTO 1100  
1140 IF S=10000 THEN PRINT "PROGRAM COMPLETE"  
1150 GOTO 1100  
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(Continued on page 187)

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• There is no need to worry about the system. You can enjoy the system. There is no need to worry about the system. You can enjoy the system.

• There is no need to worry about the system. You can enjoy the system. There is no need to worry about the system. You can enjoy the system.



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 This is an arcade game played only by video, and only by video. You have a choice of course and can experience something that you'll find in the game. The game is available in 16 bit MSX Spectrum, and is available in 16 bit MSX Spectrum. The game is available in 16 bit MSX Spectrum. The game is available in 16 bit MSX Spectrum. £4.99



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Yes, I can happily power up my computer!



# SOFTWARE FILE

(Continued from page 104)

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040 8 BC0L8 0101,200,00,0,0,0,0,0,0,0,0
050 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
060 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
070 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
080 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
090 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
100 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
110 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
120 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
130 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
140 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
150 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
160 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
170 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
180 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
190 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
200 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
210 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
220 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
230 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
240 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
250 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
260 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
270 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
280 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
290 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
300 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
310 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
320 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
330 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
340 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
350 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
360 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
370 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
380 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
390 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
400 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
410 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
420 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
430 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
440 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
450 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
460 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
470 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
480 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
490 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
500 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0

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510 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
520 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
530 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
540 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
550 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
560 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
570 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
580 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
590 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
600 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
610 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
620 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
630 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
640 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
650 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
660 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
670 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
680 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
690 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
700 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
710 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
720 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
730 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
740 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
750 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
760 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
770 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
780 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
790 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
800 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
810 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
820 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
830 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
840 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
850 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
860 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
870 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
880 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
890 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
900 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
910 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
920 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
930 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
940 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
950 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
960 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
970 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
980 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0
990 8 BC0L8 0101,200,0,0,0,0,0,0,0,0,0

```

## Vduex

Adrian Demers,  
Nascom, Inc.,  
Cumbria, Greater



**VDUEX** IS A PROGRAM I have written for a BBC Model B computer to allow a range of new features to the VDU driver. Adrian's will work on IRE, macra, it controls the use of graphics mode to alter the memory used by VDUEx, too much will be told for your own program.

**VDUEX** comes in two parts. The first part, when loaded, changes Page 0 main menu for the machine code that will be controlled by part 2 I have replaced it like the program that many people will wish to change the program or power on. It would describe in detail to an user to control the VDUEx for convenience at the end of a screen.

Type **VDUEX** at to use a position. Press Break and type in part 1. Same as in the beginning of the screen. Press Break screen and type Page=0100, then type in part two and Run it. If you have typed in the program, obviously you should use the assembly language followed by a Press any key to control VDUEx program. Doing this will result in an screen identical to pressing the Break key if everything is OK, you will see

**BBC Computer**  
**VDUEX - A Screen**  
**BASIC**

with the usual prompt and cursor. If that does not happen, you will need to make a hard reset — CTRL break, or reset break, break on (ON 0 1 — and type Page=01000 and Q/C. Check the program — you will probably have made a minor mistake in typing at the assembly language. You should now have the program on the screen following part 1. You are now ready to test out the functions of VDUEx.

An increased cursor, **VDUEX** should be used to replace screen. This is done to an use of vertical display, and the necessity for vertical movement — set prompt on mode 2 or 6 — in VDUEx can increase double height characters so before on any type Mode 6 I should now perhaps will see what **VDUEX** screen does. Well, **VDUEX** press function to the currently screen code 0Y so that it now screen the line.

### VDUEX.C

where P is the function to be applied to character C. Function available include double height, underline and underline of double underline. All of these may be cancelled. P spaces in a list follows follows on the words of the last significant Run but normally a function, in 00000  
 SET 0 0 — normal height 1 — double height  
 SET 0 0 — did not mean 1 — changed  
 SET 0 0 — do not mean 1 — cancelled  
 SET 0 0 — continue underline 1 — started

underlining — each apply only if underlining is on.

For those who do not understand the following explanation will hopefully make things clearer. Setting work, P=0, add 1 to make C double height, 2 to make C underlined, 4 to make C underlined and 8 to make the underline faded. Remember that C is only the ASCII code of the character to be generated. Here are some examples to try out

```

VDUEX(ASSC 1)
VDUEX(0Y)
VDUEX(0Y)
VDUEX(0Y)

```

If any of the characters do not look right, test you can not use, check against the screen dump of Demos. If you are sure they are performed, add part 2 — do not Run it — do not check though, being the corrected version before you Run a screen, do a hard reset and type Page=01000 then Q/C. This is because during the last part of assembly underlining machine-code program is stored and when search screen VDUEx — if it was correct — it would find a strange version and crash.

Now that you have a correct version of **VDUEX** on tape, ready to use with your own programs, we can see just that. Demo shows the new VDU code it states VDUEx will probably be quite useful to you as, for example, graph programs and educational applications. The program was in this column with large characters for classrooms on mail — try double height to mode 3

**YOUR COMPUTER PRESENTS!**

# VDUEX: THE BBC SCREEN PACKAGE

ABCDEFGHIJKLMN OPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz

opqrstuvwxyz ABCDEFGHIJKLMN OPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz

ABCDEFGHIJKLMN OPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz

opqrstuvwxyz ABCDEFGHIJKLMN OPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz

ABCDEFGHIJKLMN OPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz

opqrstuvwxyz ABCDEFGHIJKLMN OPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz

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| Model B Plus 2  | Model B Plus 3  | Model B Plus 4  | Model B Plus 5   |
| Model B Plus 3  | Model B Plus 4  | Model B Plus 5  | Model B Plus 6   |
| Model B Plus 4  | Model B Plus 5  | Model B Plus 6  | Model B Plus 7   |
| Model B Plus 5  | Model B Plus 6  | Model B Plus 7  | Model B Plus 8   |
| Model B Plus 6  | Model B Plus 7  | Model B Plus 8  | Model B Plus 9   |
| Model B Plus 7  | Model B Plus 8  | Model B Plus 9  | Model B Plus 10  |
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| Model B Plus 97 | Model B Plus 98 | Model B Plus 99 | Model B Plus 100 |

**VDUEX: PART 1**  
 00 B00 B000000000000000000000000000000000000  
 01 B01 B  
 02 B02 B  
 03 B03 B VDUEX - A. Demers B  
 04 B04 B PART 1 B  
 05 B05 B  
 06 B06 B000000000000000000000000000000000000  
 07 B07 B000000000000000000000000000000000000  
 08 B08 B000000000000000000000000000000000000  
 09 B09 B000000000000000000000000000000000000  
 10 B10 B000000000000000000000000000000000000

Continued on page 105

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Continued from page 100

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1000  REM *****
1010  REM *****
1020  REM *****
1030  REM *****
1040  REM *****
1050  REM *****
1060  REM *****
1070  REM *****
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1180  REM *****
1190  REM *****
1200  REM *****
1210  REM *****
1220  REM *****
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## Self-writing

Jeremy H. Lee,  
Northbrook,  
Illinois

**MS-DOS**

Macros (DOS PROGRAMS) writes with the mouse cursor into a loop that it translates into. One advantage for us is that it has a basic program of your own. Also, chapters list steps created using programs that let you make the character without looking with the mouse and keyboard-based conversion and may be required to use our Data conversion.

Here is a program that will take memory locations within a specified range, print out a copy of Data conversion with a specified line number and usually enter it to add without user intervention. It makes use of the fact that if any number is left on the keyboard buffer, or you have deliberately set the keyboard buffer pointer to an area, then those numbers will be taken as valid ASCII, including carriage return. Location 190 is the keyboard buffer pointer, location 1 is the first location of the keyboard buffer, and 0 is the last.

When the program is done, it will ask for a start line number. This requires that you enter the value of the line number that you would like the program to start entering lines. Once the line number is left in location 0, you may only have lines from 0 to 190. This should be as much of a limitation unless you already have a program there. If that is the case, however, it is simple to add an offset by changing line 0010 to

```
0010 G = 19000 + 1
```

where 1 is an offset, for example 1-600 and you change line 0010 to 1, then the Data conversion will start at 600 and go on increments of one. If you do not want data to go in increments of one, then change line 0010 to

```
0010 G = 19000 + 5
```

where 5 is a scaling factor. Thus, if 5-10 then the line numbers will go in increments of 10. Obviously the two can be combined, giving an offset as well as an increment

```
0010 G = 19000 + 5 + 1
```

The listing of the program, written for a Turbo, should pose no problems to other users of their computers have a similar type of keyboard buffer system and know the appropriate locations. The cursor control keys

are in brackets in the listing to ease interpretation. For example (down) means home for cursor, left) means clear screen, (down) means move the cursor down three lines.

There is just one other point about using the program. When an offset is specified

and it is not a factor of 10 away from the start location, the data contained in the last location, plus the consecutive increments up to 10, will be processed in the last line entered. This is so potential errors that it may not be five extra bytes of memory. In any case it is not much work to delete the unwanted values

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1000  REM *****
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## Mean machine

Garret B. Woodhead,  
Brooklyn,  
West Yorkshire

**FASTBALL**

THIS GAME IS TO challenge your Mean Machine around the race track — grinding the walls. If your car suddenly drives over an oil slick, then you may slide and therefore lose the car.

After using your three cars, press key Y or key N to run or stop the game. The game can control cursor keys.

- 01 Graphic A
- 02 Graphic B
- 03 Graphic C
- 04 Graphic A and B
- 05 Graphic 1
- 06 Graphic 2
- 07 Graphic 3
- 08 Graphic 4
- 09 Graphic 5
- 10 Graphic Shifted 3

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Continued on page 100

# BBC MICRO™ MANCHESTER

All prices include VAT unless otherwise stated

|  |         |
|--|---------|
| BBC Model B Computer                     | £399    |
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| BBC Model B with Disc Interface and VIEW | £529.90 |
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| Disc Upgrade (including fitting)         | £36     |
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| ACORN Speech Synthesiser                 | £15.00  |

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|--------------------|---------|
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Prices for the best  
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Micro  
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Osc Interface..... £35

£204

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NAME

ADDRESS



# COMPETITION CORNER

A £75 book token will be awarded to the first correct solution drawn from the competition bag. All entries must be at the Your Computer offices by the last working day in October. The name of the winner, the solution, and a competition report will be published in the December, 1983 issue of Your Computer.

If you want to set a competition for Competition Corner, remember that the simplest solution should be calculable by a short program rather than by any other form of reckoning.

## COMPETITION RESULTS

All club members (1000) and 1000 of our readers all complete the crossword. A Copy 35 would make my summer holiday costs also because — it means that some computer buffs refer to the sea and would rather trade the joys of sea and sand for the pleasure of the

keyboard. "Poking and poking are more for their own thinking" was the way P. Winthrop put it. A poem which was echoed by S. Skelton: "I would byte back on the bugs and bonnets".

On the same theme was J. Knight's "A daily fix of Copy 35 will last longer than holiday pay" and Iain M. Hayes — we are used to these long, busy, hard-working days of summer.

After all the holiday games the winning entry A. Caslew, 51 Parson Street, Swindon, Wiltshire came as a relief. Poking was definitely his word. "A Copy is steady, and I'll have a brain with it".

Competitors who created the isomorphic code in the Savings Investment problem found that the alien beings were equipped with 2x4 limbs, two arms and three legs — or as one entry argued two-legs and a post-hole tail. An artist's impression of the alien is shown here.

The £15 book token goes to the first correct solution picked at random which came from J. Pevay, 16 Oakham Grove, Ashby de la Zouche, Leicestershire.

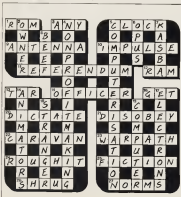


## WOODWORM

BY ANTHONY ROBERTS



With the Woodworm in his eye, a little ball showing his way through the somewhat circular cluster of wooden balls shows how. What is, especially hard is variety and beauty, each ball is made out of wood, some from wood — see it below, 13 in all, in our diagram. Why will show his way through eight of the balls before reaching midway and being off. If you want the difference between the distance of each consecutive ball on his route, you will see that he covered the maximum possible variety — what is that word? Of course, there is no way to return to a ball after it has been visited once — it has all been chewed over!



# SPECTRUM

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from SPECTRUM

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Now a powerful business micro with enormous memory for the price of a games machine. The-

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For further details please refer to the description. The 96K system can be expanded up to 1MB (additional £40 per MB).

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MY NAME IS  
DIAMOND, DAN DIAMOND  
I'M A PRIVATE COP. I  
WORK THE BIG APPLE  
A SEETHING METROPOLIS  
FILLED WITH HUMAN  
MISERY AND CHINESE  
TAKEAWAYS.

NORMALLY I  
ONLY DO ROUTINE  
DIVORCE CASES BUT  
WHEN SHE WALKED  
INTO MY OFFICE I  
FOUND MYSELF  
INVOLVED IN A CASE  
SO STRANGE THAT

IT MADE THE  
BIG SLEEP  
LOOK LIKE A  
CAT NAP.



NEWS

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### HUNT WINS GRAND PRIZE

At yesterday's Monaco Grand Prix, a hunting party scoured onto the track as the driver of the race Car was lured in the fountains wrapped around the car. "The whole place has gone to the dogs," one driver was reported as saying. The race was restarted, but only around the corner before the Hunt disappeared from the finishing line to enter the abandoned flag (at least) from each race.

### PLAYER WINS OPEN

Eagle-eyed operators who...



# Salamander SOFTWARE



## PRIVATE DETECTIVE DISAPPEARS

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### BANANA DICTATOR WINS UP

### IDEAS IN EVEREST TRAGEDY

The Everest Expedition ended in tragedy yesterday as Clive and Frank plunged down a cliff to a grisly death. The expedition is now spent as the Yukon continues.

### COLD WAR NARG ESCAL

Thousands of... in the States... Machine the...



# A.G.F.

## PROGRAMMABLE JOYSTICK INTERFACE

### for Spectrum or ZX81



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\*Self test



## SHINWACTI CP80

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\*80 cps

\*Bi-directional logic seeking

\*True descenders

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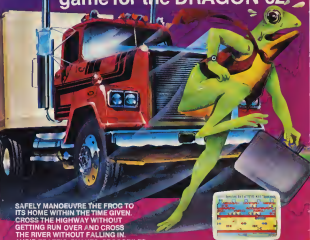
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ORIG APPROVED VERSION (5/88)  
SPECTRUM VERSION (2/88)

**Navfighter**

ORIG 1 (3/87) ORIG

You are in command of a galactic defence vessel travelling through interstellar space to attack and destroy invading aliens. As long range this is controlled by your keyboard. Enemies which fly above stars in the local quadrant, with passing planets, space stations, ice-jets and all kinds of aliens which may strike in packs or singly, attacking and making moves around your ship. They may counter attack the space with your photon torpedoes or if you move in close enough switch over to manual and visual control to chase the flying and fire deal with your photon star. The star torpedoes return to your ship a few seconds. Out-manned in the start of the shooting part. This will need to conserve energy resources to get back to the starting point and then the time-jets to the other quadrant. Missions, score and energy status are all monitored throughout the game machine code game which may be seen whenever you wish.

ORIG APPROVED VERSION (5/88)

**GALAXY 8**

ORIG

One of the Galaxy 8 combine three parts made to take arcade type space games. They consist of Galaxy which is a 3-dimensional game with 15 angled stars including them. It looks a slight variation to the standard in groups of one, two or three. Next Aster War is an arcade now game with a superb score showing instantly across the screen. Finally, your ship which has right left up and down controls plus power fire to chase the aliens along with any items that may be being dropped them. The last game on the side is Space Chase which gives a view from your cockpit of a flying ship. You fire at aliens and be hit back, so you must get a good eye for quickly before hit through your force shields. Last but not the least is a game of two player space games but the end is BASIC which can easily be seen from being short, simple and clearly written with every one of the BASIC explained in an English Manual document.

ORIG VERSION (2/88)

**Assembler/Disassembler** ORIG

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ORIG VERSION (2/88)

**Durell Software**

Dept. YCO - Durell Software  
Castle Lodge - Castle Green  
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ENGLAND



**Jungle Trouble**

SPECTRUM

Five machine code with super cartoon graphics. The original and witty game is set in the depths of the Amazon jungle. First you must drop your man to collect an egg and then a nearby river is rapidly falling. The ground has been a falling river. There is most items a ladder to the next level where he has to hit a button of traps in the path. As he does this a measuring tape appears from the left of the screen and reads his score. So back to the start for another egg and more problems with the river. And the last thing he has to do is to get a path through the forest to trap ORIG another ladder to level three where he has to get a jet of water by grabbing a swinging rope. He is over space back to the city? Can he jump the stream that suddenly opens before him and enters in about 10 seconds? It helps programming with original graphics added to all members of the family – but very fast-moving and addictive.

SPECTRUM VERSION (2/88)

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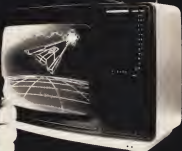
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### ATARI® JOYSTICK OWNERS!!

Atari has announced that they will be releasing a new joystick for the Atari 2600. This joystick is designed to be more comfortable and easier to use than the standard Atari joystick. It features a new design with a more ergonomic shape and a new button layout. Atari is committed to providing the best quality products for its customers, and this new joystick is a testament to that commitment.

Software, the software is available for the Atari 2600. It includes a variety of games and utilities that can be used to enhance your Atari experience. The software is available in both cassette and diskette formats, and is priced to provide excellent value for money.

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A collection of crossword puzzles for the BBC micro. The puzzles are designed to be challenging and fun, and are suitable for users of all ages. The collection includes a variety of puzzles, including word searches and cryptograms, and is available for purchase from Bromley Press House.

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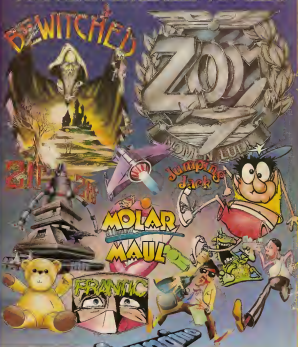
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