

DRAGON USER



The independent Dragon magazine

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Clever Code

DIY Expert

Micro Vision Compo Communication



DRAGON USER



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How to submit articles

The quality of the material we can publish in
Dragon User each month will, to a very great
extent, depend on the quality of the
articles that you can make with your
Dragon. The Dragon computer was launched
on to the market with a powerful version of
Basic, but with very poor documentation.

Articles which are submitted to Dragon
User for publication should not be more than
3000 words long. All submissions should be
typed. Please leave wide margins and a
double space between each line. Programs
should, wherever possible, be computer
printed on plain white paper and be accom-
panied by a tape of the program.

We cannot guarantee to return every
submitted article or program, so please keep
a copy. If you want to have your program
returned, you should include a stamped,
addressed envelope.

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Have you got a problem... then we want to hear about it. Send all your Dragon-related queries to us and get results fast! Or maybe this is your chance to help someone out!		Masses Jason Orban and Geoffrey Campbell continue our exploration into the world of machine code — this month discussing chip architecture and flow- charting.	
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Your chance to express your views to thousands of other Dragon Users. This month (amongst others) — more bulletin board numbers — update on OS-8 users group — the very last word on totalcolour — plus your letter (reprints ... that's next month, isn't it?)		Jason Orban's selection for this month — the good, the bad, the supremely inefficient — can you afford not to read this?	
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This is it, the results of the first People's Chart, compiled by you, the Dragon User — plus your chance to vote in Chart Number Three. Vote! Vote! Vote!		Numerous technical ... and non-technical readers' technical ... and non-technical questions ... from the keyboard of the seasonally knowledgeable Brian Cadge.	
Expert System	8	Adventure Trail	29
They say everyone's an expert at some- thing — so why not try creating your own expert system, using this program by Peter Whitaker.		Mike Gerrard collects the usual assortment of wails and waxes of the adventure world and puts them back on the straight and narrow. Tips galore ...	
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The new MKT controller, from Com- putronics, opens up vast new applications for your Dragon — from budget alarm to telemail. Was Roy Coates impressed? Read on for details.		All good things come to an end ... and judging by the mail bag, this one has been particularly popular. The final instalment of the Dragon Firmware guide.	
		Competition	34
		Gordon Lee ponders the improbables this month and sets his usual brain teaser — which presents you with a chance to win a copy of Micro Vision's Beersalver.	

Editorial

ORDERING goods by mail has always been a bit of a strange business. For a start, apart from the massive glossy household catalogues, the range of goods available via this strange transaction always seem to be — well — a bit out of the ordinary. Take a look at the classified ads in your Sunday newspaper. Wholesale cereals, Toxopneus and X-Ray specs ... hardly run of the mill. Plus, if you think about it, the actual act of faith in sending some money off to a strange address and hoping something will come back seems on a par with expecting trains to run on time, or England to beat the West Indies. And when it does arrive — is it really what you wanted in the first place?

Luckily for us, actual crooks are very few and far between in the computer market, but as recent events have shown, delays that drag on for weeks and months cause unnecessary worry, are downright frustrating and (worse of all) cause a lack of confidence in the system that hits every company — good and bad. So what can the consumer do?

You can always read the reviews in Dragon User of course, but this is the area where shows come into their own. At a show, you can meet the people behind the companies. Look at the goods and form your own opinions, chat to other users. Even if you can't make it to a show physically, you can bet that if someone is exhibiting regularly, then they are run by enthusiastic, active Dragon supporters.

So, if there's a show near you, why not pay it a visit. In fact, you'd be deft not to. As the lawyers say, 'Let the buyer beware'.

South Wales success

THE 'Dragon comes home to Wales' show, held on 15th February in Cardiff, was by all accounts quite a success — with a total attendance of around 700. Trade supporters included Blats, Compasmas, Computers, Datasets, Gwynnors, John Penn, Pen-comms and Peacock. "Everyone that came seemed happy," said organiser John Penn, "and we've already had quite a few nice letters." The event generated a great deal of interest — with people coming from as far away as Birmingham — and coverage from GWR Radio and the Western Mail.

So much so, in fact, that a repeat performance is already in the advanced planning

stage — this time to be held in the Leeds area, in the middle of May.

But in addition to the usual trade exhibitors, John is hoping to encourage users to come along and actually show the public what various users they can put to. "Radio communications, Model train controllers, that kind of thing," explained John. "We're trying to show people what can be done with their computers." He added, "We're continuing to support the Dragon in every way we can — trying to bring all aspects of Dragon use — not just a showcase."

Anyone who feels they have a project that might be of interest, contact John Penn on Boston (04202) 9070.

Eclipsed

FOLLOWING coverage of delays in the game Total Eclipse (Dragon User March 1988), West Midlands Consumer services were inundated with calls from disgruntled readers

Although at the time of going to press, Eclipse was unavailable for comment, reports were coming in of the arrival of the game from all over the country. As soon as our copy arrives, expect a full review. Watch this (empty) space.



Extra!

NEWS that will interest potential purchasers of Quickbeam's Shaolin Master — the game now has an extra bonus, a "Challenge Screen" between bouts — but don't worry if you've already bought it. Quickbeam's Dave Hitchman is offering the upgrade to ex-

isting owners just for the postage. Send your tape back to them with the appropriate number of stamps and you'll get your upgrade, for no extra charge.

For first time purchasers, the price remains at £7.95 plus 50p P&P. Contact Quickbeam Software, 67 Old Nazareth Road, Brockmore, Wrens BN10 6RN.

Hold the Bus!

ANDTEK Data Design are now offering a BUS Expansion available to the Dragon or Tandy colour computer user. Called Autabus it consists of a buffer cartridge, and a compact, six bit, Expansion Unit. Cartridges can be mixed with Disk Interfaces, or used simply as a peripheral I/O Expansion Bus. The user is offered the choice of cartridge selection, from a digital switch, or under software control, either from cartridge or local program. Additionally an 8-bit/2-parallel Port configured as a Centronic

Printer Interface is standard in-built feature.

Autabus's future plans include the release of an 80 column card, ROM Disk Card, and RAM Expansion, all with the enthusiastic upgrade in mind.

Autabus is offered as a set of P.C.B.'s, cartridge case, and construction/operation manual, at £38.00. Also available fully built, and tested. For full details, please write to: Andtek Data Design, 41 Peabworth Road, Harrow, Middlesex HA1 3UD.

Now Showing

SEE more show news, this time from Microsoft, who are holding two 6800-Conventions, one in London in November, and one at CMIST in Manchester, to be held over the weekend of April 26th and 27th. Apart from trade exhibitors (already 18 in number) a major feature of the convention will be a series of lectures (three per day) covering various aspects of 6800 computing,

supported by a panel of experts to service extended question and answer sessions after each lecture. Microsoft are also throwing open the doors to any user groups or adventure clubs that want to use the facilities. Entrance is expected to be £1.75 for adults, 75p for children. Said spokeswoman Jennifer Pope, "We're expecting to take Manchester by storm!"

For further details about accommodation, venue and availability of club spaces contact Jennifer on (07700) 89020, or write to Box 68, St Asaph, Cornwall PL25 4YD.

Weekend away in Wales

IF YOU'RE still thinking about going to the Dragon 'Weekend in Wales' (see Dragon User Feb 1988) at the end of this month, you'd better make your mind up soon! Says event organiser Bob Morgan, "Bookings are going very well, but some places may still be available. We're looking forward to an exciting weekend." Bob is particularly looking for a few more experienced DB-trustees, so if that's your cup of tea, why not give it a try?

The event is to be held at the Trevelyan Hotel, Aberystwyth in Gwynedd over the weekend of 21-23rd, with a variety of talks and demonstrations planned — including an appearance by our very own Brian Cadge on the Saturday.

The cost, fully inclusive of accommodation and board will

be £45 per person. Interested parties contact Bob at the Mid Wales Tourism Council on 0854 2654.

Black Box

UNTIL recently, the major problem with converting joystick for the Dragon has been that the actual conversion, no matter how careful, automatically invalidated the manufacturer's warranty. However, these clever Peacock people have come up with a remedy, in the shape of a little black box, called the Dragonbox. The box just plugs in between the unconverted 9-pin Atari-type joystick and your computer — it's as simple as that . . .

Initially, Peacock will be supplying the Dragonbox only with the Quickbeam II Autolife joystick — at an inclusive price of £14.95.

Contact Peacock at 46 Queen Street, Bideford, Devon, Ex36. Tel (0636) 703220.

OS-9 Update

I WAS rather surprised at the reply by Paul Grate to my original letter about forming an OS-9 User Group, as I had actually written to Paul, explaining to him that I did not intend to set up a rival group to the DMOG. Our group are purely concerned with OS-9; we are not trying to compete with any other group, but rather to fill a void for OS-9 users.

Since my letter in October, we have successfully set up the group and we now produce a newsletter on Disk. The Newsletter supports a Public Domain Software library as well as the usual letters, articles, news and other items you would expect in a newsletter.

Our members are of all ages and come from many walks of life, with quite a number who are professionally involved in computing and are able to offer assistance to others. Our membership is mainly in the UK but we have two members in Belgium and three in Germany. We are hoping to affiliate with the US User Group in the States and thus involving both Group's software libraries.

Our Public Domain Software Library currently has one volume (disk) completed, with another half completed. Because we distribute the PDL programs on the Newsletter every month, our members are able to keep up to date with the PDL programs and, of course, it is very much more affable for contributions coming in. We have some excellent routines which range from diagnostics to communications, file maintenance to utilities and we also have a patch to customize Splograph and use it with an 80 (or any size) column terminal.

Our membership fees will be £10 per year which will include the price of the first disk. These members are asked to send in the disk by the 20th of the month for the next issue. We currently have three newsletters (2 disk issues) and the 3rd Newsletter will be due end of February. If anyone is interested in joining us, then they only have to send me some blank disks for copies of the Newsletter which will tell them

more about us than a single letter can (return postage would be appreciated).

I would like to thank Dragon User, the Systems Engineers Dept of Motorola in Scotland, Ted Oprechal of Compusense, Drew Crane of Microvare, Visually, Teachmaster and all the members who have helped me in various ways, whilst I was starting the group.

Maile Vernon
4 Roseberry Court
Llandudno
Gwynedd

Transform

THERE SEEM to be thousands of Dragon users transformed into ex-Dragon users by their transformers burning out. It is this happens that is what you should do:

- 1 Take your faulty transformer into a radio repair shop.
- 2 Tell them to open it up by drilling out the rivets. (This is usually where the repair people get reluctant, but remember: what have you got to lose?)
- 3 Let them replace the fuse that has blown, most often the 10V one; usually, the actual transformer is in a bearing state!
- 4 Let them close the box with screws; the next repair will be so much easier!

DON'T try this yourself unless you're a professional. 240 volts is a killer. The whole job should take about half an hour and not cost more than £10.

PS: If anyone is looking for Swedish-Finnish word processing software or software to access and download from electronic mailboxes, contact me!

Maile Vernon
Punahillside 4 B 14
2F — 06620
Helsinki
Finland

THANKS for all the letters on the subject of transformers — the moral is that they can be repaired BY PROFESSIONAL, COMPETENT PEOPLE. The mailing strongly advised against amateur meddling — a point that cannot be made strongly enough.

Of course, new or reconditioned transformers are now available from a number of sources — Betsy and Pookah to name but two.

Wordproc Pokes

I HAVE had a couple of letters from people wishing to use my "Wordproc" program with a printer other than my Seikosa GP130A. The alterations are remarkably simple. Double = code for double width print. Single + = code for double width cancel or single width standard text.

POKE \$H198,DOUBLE
POKE \$H199,SINGLE
POKE \$H19C,SINGLE
POKE \$H19D,SINGLE
POKE \$H19E,DOUBLE
POKE \$H19F,DOUBLE
POKE \$H198,SINGLE

The codes for double and normal text can be entered using the "special characters" key as described in the article. Double spaced lines can be obtained by first loading the program, and then entering: POKE \$H1A2,POKE \$H1A6,13:POKE \$H14C,13. This will send an extra line feed to the printer each time.

Peter Wobeser
Cambridge

Tip Time

THIS IS the first letter that I have written to Dragon User so let me say what a great job you're doing keeping the Dragon 32-64 alive.

Dragon to Dragon

BELLOW ARE some good IDEAS that cater for us Dragon users with modems. I'll let them with what I think are the best at the top and then in descending order.

Ring back (RIB) means that you dial the number and after R's ring once, you replace the receiver and dial again. When you get the carrier tone, turn your modem on and replace the receiver.

Name	Number	Details
WARRS (300) 88509 (300)	0603 520711 0705 736625	FIRST BACK, 24 HRS. FRI, WED & SAT 11-10PM SUN, 10AM-10PM
DAIR CRYSTAL TLJ (300)	01 954 9647 021 444 1484	DRAGON 800 OS-9 24 HRS. (300 & 1200) 9AM-10PM, FRI, 10PM-9AM, NORMAL, 24 HRS.
SANCTUARY (300)		

I have come across a routine of Pike's from Dragon World that might be of some use to the Dragon owners who have (or have access to) a printer. POKE \$H198,\$H90 (enter) POKE \$H199,\$H9C (enter) POKE \$H197,\$H7E (enter). To cancel the routine type POKE \$H197,\$H98 (enter). To re-start type POKE \$H197,\$H7E (enter). What this routine does is that everything that is typed to the screen is sent to the printer, (rather like a typewriter).

Also I am looking for a computer (see item) who would be interested in programming and also exchanging hints, pokes, programs, etc.

John Scullard
12 The Mount
Taigemouth

More Tips

MY TIP is, if you are like me and messing with machine code sometimes the program goes wild and usually its DragonDoc that gets the word end of the stick. To get it back just run the little program.

10 CLEAR 500
20 FOR A=1 TO 10
30 READ 1, 10, A, AS, BS
40 SWRITE 20, A, AS, BS
50 NEXT

Dr R. Bailey (244999)
22 Potocase St
Chase Terrace
Sault
WOT SAN

You must ensure that your modem is set in Originate Mode or else you'll get garbage on the screen.

All of the above numbers require your software to be set on "7 Bits No Parity 1 Stop Bit".

Ray Thomas
40 Bro Daves'
Solve
Haverlowe
Dorset
2452 272

Dragon User People's Chart

This is what the Dragon world has been holding its breath for — the results of the first Dragon User People's Chart. The entries flooded in and the administrative minions were kept working long and hard until the results appeared were obtained.

Generally, the program attempts were of an amazingly high standard, but in the end we plumped for the solid but sincere, 'The Dragon is just great', from D. J. Post of Chislehampton, North Devon. Many congratulations to him, and his prize will be slipping its way westward very soon. And so to next month....

Each month we will be asking you to vote for your top five favourite programs on your Dragon (games, applications or utilities) and write them down in order of excellence on the form opposite (or today if you don't want to damage your return). And just for an extra incentive (as if you needed it), if you like you can construct a phrase or sentence using letters from the titles in your own log three — you don't have to use them all, just as many as you can. We will pick out our favourites, and he or she will be the recipient of £25-worth of software, donated by Microdeal. You can vote in the chart without making up an anagram, but you won't be in with a chance of winning a prize.

Send off your entry to: People's Chart, Dragon User, 10-13 Little Newport Street, London WC2H 9PP. Enter the People's Chart!

Results February 1986

- 1 Shocktrooper..... (Microdeal)
- 2 Juxtaposition..... (Wintersoft)
- 3 Speed Racer..... (Microdeal)
- 4 Eddie Steady Go..... (Incentive)
- 5 Jet Set Willy..... (Software Projects)

Chart Three

Voting for Chart No. 3 closes at 11pm on Friday 18th April 1986. Entries received after that time will not be eligible for inclusion in that month's voting. The editor's decision is final. Only one entry per individual per month will be allowed.

My top 5: Voting Month 3

- Name:
- Address:
1.
2.
3.
4.
5.

My phrase is:

WINTERSOFT PRESENT THEIR FIRST ADVENTURE WITH PANORAMIC GRAPHICS



THE BARONS OF CETI V are the most fabulous, exciting adventure of the century. You can't miss it because there's nothing else out there that could all be yours. Buy it now for the best price ever.

THE ADVENTURE BEGINS IN THE

morning quiet of a beautiful island. You'll be amazed at the amount of things you can do with this game.

AN EPIC TALE OF ADVENTURE AND DISCOVERY. You'll be amazed at the amount of things you can do with this game.

For a full version, a complete guide to the game, and a complete guide to the game, see the back of the box.

ADVENTURE BEGINS IN THE morning quiet of a beautiful island. You'll be amazed at the amount of things you can do with this game.

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NAME:

ADDRESS:

POSTCODE:

TELEPHONE:

ORDER NO:

NAME:

ADDRESS:

POSTCODE:

TELEPHONE:

ORDER NO:

Any Questions?

Construct your own personal expert system with this program from the keyboard of Peter Wittaker

IN THE Syllago Expert program (Dragon User, March 1986) I demonstrated how the Dragon could be made to appear to understand English, and to draw conclusions from what it was told. However, interesting though that may be, it is not of much practical use in the real world. The program here presented is different, in that it has great potential use, the extent of which is only limited by the imagination of the user. For example, if your car broke down, it would be possible for the non-expert car mechanic to diagnose the fault in a matter of minutes using this program. The program would ask a series of questions, and depending on the answers given would be able to work out the fault. Similarly this program could help to diagnose an illness or to categorise an unrecognised animal.

Binary

Start by entering and running Listing 1 'Detectout'. This is a short expert system which will illustrate some of the principles and weaknesses of such systems. When run, it asks you to choose one of four possible causes for a car breakdown. Then it asks three relevant questions, and depending upon the answers makes its diagnosis. The program works by treating the series of answers given as a binary number ($2^3 = 16 - 1 = 15$), so that if the end of the sequence of questions we have a three bit binary value. This value is compared with the values required for the four known solutions to the problem. If a match is found it is printed out, and the program returns to the start again.

This works quite well, and although the program does not have any insight ability to learn new solutions to the breakdown problem, it can be easily altered, if the questions are all answered 'Yes', the program will reply that it does not know what the problem is. Edit Line 230 to add "spotted driving", and change the loop in Line 180 from 4 to 5. The program will now come up with a solution to the situation. However, this is a very unsatisfactory solution, because it is difficult to expand the program's knowledge database. With three questions it can distinguish between eight different situations, but if we wish to add a ninth situation we must include an extra question. Doing this will change the answer values for all the other eight answers (from three bit values to four bits) and the database values will need to be recalculated.

This might not be too much trouble with three questions and eight situations, but by the time you have reached 10 questions

```
10 CLS:PRINT#7,"ANIMAL EXPERT":PRINT
11:PRINT
20 PRINT:PRINT"PLEASE CHOOSE A BREAK
DOWN FROM ONE OF THE FOLLOWING
CATEGORIES:PRINT#10,"FLAT BATTERY
":PRINT#10,"EMPTY PETROL TANK":P
RINT#10,"BROKEN HEADLIGHT":PRINT
#10,"BLOWN FUSE":PRINT
30 RESTORE
40 *****ASK QUESTIONS *****
50 POWER=0:SUM=0
60 FOR A=1 TO 3
70 POWER=POWER*2
80 READ QUESTION:PRINTQUESTION:CH
ARACTER
90 RE[AK]EY=10:RE[AK] THEN 50
100 IF RE[AK]="" THEN PRINT"YES":SUM=SU
M+POWER:GOTO130
110 IF RE[AK]="" THEN PRINT"NO":GOTO130
120 GOTO 90
130 NEXT A
140 *****FIND ANSWER *****
150 FOR A=1 TO 4
160 READ ANSWER:ANSWER
170 IF SUM=ANSWER THEN PRINT"THE AN
SWER IS ",ANSWER:FOR A=1 TO 50
0:NEXTA:GOTO20
180 NEXT A
190 PRINT#10,"DO NOT KNOW WHAT THAT I
S":FOR A=1 TO 500:NEXT A:GOTO2
0
200 *****QUESTION*****
210 DATA "DO THE LIGHTS WORK?","DOES
THE ENGINE RUN?","DOES THE HORN
WORK"
220 *****ANSWER*****
230 DATA "FLAT BATTERY",0,"EMPTY PET
ROL TANK",5,"BROKEN HEADLIGHT",
5,"BLOWN FUSE",2
240 (C) 1985 PETER WHITTAKER.
```

Listing 1

and over a thousand different situations the job gets out of hand. A second problem is that to find a solution, the program needs to ask all of the questions it knows, even if some of them are totally irrelevant. Added to this many of the possible answer combinations will never occur, so 10 questions might only distinguish between 20 actual solutions, and not the thousand possibilities. All of this makes the program very rigid, uninteresting to use, and removes all

chances of a short cut to the solution.

Listing #2, the 'Expert Learning System' overcomes these problems. Instead of relying upon rulesets for all the questions asked, it generates a tree of related questions and answers. This means that it will ask only the minimum of possible questions to arrive at a solution, and that it can very easily learn and expand its knowledge database. The program makes use of three data tables. The first,

6809 CONVENTION

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UMIST, SACKVILLE ST.,
MANCHESTER

Show Sat 10.00 a.m. — 6.00 p.m.
Times: Sun 10.30 a.m. — 5.00 p.m.

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BLABY MICRODEAL
DESIGN DESIGN SALAMANDER
SHARDS
POCKETMONEY SOFTWARE
MODEM HOUSE
INCENTIVE
TANDY CORPORATION
COMPUSENCE

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+ OUR PANEL OF EXPERTS
AND YOUR QUESTION TIME

USER ASSOCIATIONS, ADVENTURE CLUBS, PEN-PAL
GROUPS WILL ALL BE THERE

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Please send me adult tickets @ £1.50
. child (under 16) @ 75p

I understand these tickets will entitle me to entrance on either one or both days

Name

Address

Post Code

I enclose a cheque *please debit my credit card no* *(delete as applicable)

RETURN TO THE ORGANISER, 6809 CONVENTION,
P.O. BOX 68 St. AUSTELL CORNWALL PL25 4YB TEL 0726 68020

```

38 CLEAR ANSWER ANSWERS( QNO ), QUEST
  ( QNO ), CORRECT ANSWER( QNO, 1 )
39 ANSWERS( :QUEST( QNO ) ANSWERS( : ) ) =
  FLAT BATTERY ANSWER( QNO ) - ( 1 )
  THE QUESTIONS PLEASE THINK OF
  A ONE WORD ANSWER
40 CLEAR PRINTED, CORRECT SYSTEM 1, 1
  PRINTED( "BY FACTOR LIMITTED")
  PRINTED( " " ) PRINTED( " " ) PRINTED( " " )
  PRINT( QNO, QUEST( QNO ) ANSWERS( : ) )
41 ANSWERS( : ) ANSWERS( : )
42 IF ANSWER THEN QNO
43 IF ANSWER THEN QNO
44 IF ANSWER THEN QNO
45 *****QUESTIONS*****
46 PRINT( "IT IS A QUESTION")
47 IF QUEST( QNO ) = " THEN YES/NO?
  CORRECT ROUTINE
48 FLAG( : )
49 PRINT( "QUESTIONS FLAG( : ) CORRECT")
50 ANSWERS( : ) ANSWERS( : )
51 IF ANSWER THEN YES/NO? PRINT( "YES")
  QNO
52 IF ANSWER THEN YES/NO? PRINT( "NO")
  QNO
53 GOTO 38
54 IF ANSWER FLAG( : ) ANSWER FLAG( : )
  ANSWER FLAG( : ) GOTO 38
55 IF ANSWER FLAG( : ) THEN QNO
56 ***** BLANK ROUTINE *****
57 INPUT "OK, I GIVE UP, WANT TO
  TRY? " : OK
58 IF OK
59 GOTO 38
60 IF ANSWER = "OK" THEN PRINT( "YES")
  OK YOU, " ANSWER FLAG( : ) = " GOTO
  38
61 IF ANSWER = "OK" THEN QNO
62 ANSWER = "OK" : ANSWER ANSWER : OK
63
64 ANSWER FLAG( : ) = ANSWER
65 GOTO 38
66 ***** ANSWER ROUTINE *****
67 PRINT( " ) THINK IT IS A?"
68 IF LEFT( ANSWER( : ) ANSWER FLAG( : )

```

```

  ) , 1
69 IF LEFT( ANSWER( : ) ANSWER( : )
  ANSWER( : ) ANSWER FLAG( : ) )
  = " " ELSE PRINT( "ANSWERS( : )
  ANSWER FLAG( : ) ) )
70 PRINT( "YES") CORRECT SOLUTION
  FOUND
71 ANSWERS( : ) ANSWERS( : )
72 IF ANSWER THEN PRINT( "YES") PRINT(
  "NO") CORRECT SOLUTION
73 IF ANSWER THEN QNO
74 PRINT( "NO" )
75 INPUT "PLEASE ENTER THE CORRECT
  ANSWER : "
76 IF STORE FOR NEW ANSWER, STORE
  CHECKING FOR ANSWER CORRECT, OK
  OK
77 OK
78 OK
79 IF ANSWER = "OK" THEN QNO
80 IF ANSWER = "OK" THEN QNO
81 ANSWER = "OK"
82 ANSWER ANSWER FLAG( : ) STORE LOCK
  TIME OF OLD ANSWER
83 ANSWER ANSWER( : ) OLD ANSWER
84 ANSWER FLAG( : ) ANSWER FLAG( : ) CORRECT
  SOLUTION( : ) ANSWER FLAG( : )
  OR CORRECT TO THE NEW QUESTION
85 PRINT( "PLEASE ENTER A QUESTION TO
  TELL ME")
86 IF LEFT( QNO, 1 ) = "0" OR LEFT( QNO,
  1 ) = "1" OR LEFT( QNO, 1 ) = "2" OR LE
  FT( QNO, 1 ) = "3" OR LEFT( QNO, 1 ) = "4
  " THEN PRINT( " : " ) ELSE PRINT
  " : "
87 PRINT( "FROM Q" : IF LEFT( QNO, 1 ) =
  "0" OR LEFT( QNO, 1 ) = "1" OR LEFT(
  QNO, 1 ) = "2" OR LEFT( QNO, 1 ) = "3" O
  R LEFT( QNO, 1 ) = "4" THEN PRINT( " :
  : " ) ELSE PRINT( " : " )
88 INPUT "QUESTION(QUESTION)
  HAVE NEW QUESTION"
89 PRINT( "FOR THE OUTCOME OF : " : IF
  PRINT( "HOW WOULD YOU ANSWER" : CORRE

```

Listing 2

QUESTIONS contains a list of all the questions the program knows, and these are numbered in ascending order as they are learned. The second ANSWERS contains a list of all the possible answers known to the program, and these too are numbered in ascending order as they are learned. The first table ANSWERS(1,0) is the heart of the system, and contains the knowledge base itself. This is used to link the questions and answers together. The left column of this array contains the data for a 'Yes' answer, whilst the right column contains that for a 'No'. If the number in the array is a positive number, then it is referring to another question, but if it is a negative number, then it refers to an answer.

First of all you will then be told to think of a car breakdown, and the computer will guess that it is a flat battery. If this is so, press <Y> and repeat the process. If the flat was not a flat battery, then press <N> and type in what the problem was (eg. 'empty petrol tank'). Then you will need to enter a question to tell a flat battery from an

empty petrol tank, and then to enter the answer to that question for each of the two outcomes. Once the question has been accepted, the program returns to the options display. The next time the database is questioned the program will start with your question and produce its answer depending on whether you answer 'Yes' or 'No'. Each time it gets the answer wrong, the program will ask for the correct answer, and a question to tell it from the wrong answer. In this way it slowly builds up a quite extensive knowledge database.

Once a database has been created it can be saved or loaded by pressing the <S/L> keys from the options screen. (This is currently set up for use with a disk system, but can easily be changed for use with cassette tapes.) The first thing the program saves (Line 70) is the initial question used as a prompt. This will ensure that the correct starting phrase will be used whenever the database is reloaded. To modify the program for use on a different subject, simply change the initial question and answer proved in Line 20 the first time

this new database is used. These modified values will be loaded back in whenever the database is reloaded.

The value of the expert system is not to be found in using it to help yourself, but in using it to help other people. If you knew nothing about auto tests, then you will not easily be able to set up a database about them. However, once you have set up a database on a subject with which you are well acquainted, this can very easily be accessed by a total novice to the field. The program will ask the questions you have entered, and will reach the verdict you would have reached, and if a new solution is found, the program will add it to its knowledge database.

The program is set up to distinguish between up to five-hundred different solutions, and can be modified to handle more. If you run out of string space try PC-DRAWT and increase the CL-DRAW command in Line 10. Once set up with a good database, the program should seem quite impressive to someone who does not know how it works.

```

1000 <C>
500 QWERTYUIOP [P] QWERTYUIOP 500
540 IF QWERTYUIOP THEN PRINT"YES" :GOTO5
90
500 IF QWERTYUIOP THEN PRINT"NO" :GOTO57
0
540 QWERTYUIO
570 PRINT"FOR THE OUTCOME OF THIS P
RINT" HOW WOULD YOU ANSWER" :GOTO
1000
500 QWERTYUIOP [P] QWERTYUIOP 500
540 IF QWERTYUIOP THEN PRINT"YES" :GOTO5
90
500 IF QWERTYUIOP THEN PRINT"NO" :GOTO52
0
510 QWERTYUIO
540 IF QWERTYUIOP THEN SOUND 1, 10 :GOTO490
500 IF QWERTYUIOP THEN PRINT"QUESTION 1, 0
WERTYUIOP" :QUESTION 1, 1 :GOTO 1000
570 QUESTION 1 TO ANSWER 490999
540 IF QWERTYUIOP THEN PRINT"QUESTION 1, 1
WERTYUIOP" :QUESTION 1, 1 :GOTO
500 QWERTYUIO
500 "SEEK DRIVE DATABASE SEEK
570 OPEN PRINTING "NAME DATABASE"
540 PRINT"PC: INSERT DISC IN DRIVE.
... " :GOTO41194
500 IF FILE$="" THEN 700 ELSE KILLF
ILE$+" :GOTO 500 :CLOSE :GOTO710
700 PRINT"123, "" :PRINT"FILE NAME" :
FILE$
710 RND
720 PRINT"FILES: INITIAL QUESTIONS
730 RND
740 IF ANSWER$="" THEN PRINT"ANSWER$
ANSWER$ THEN 500
750 PRINT"FILES: ARRAY A, 0
760 PRINT"FILES: ARRAY B, 1
770 PRINT"FILES: QUESTION A
780 PRINT"FILES: ANSWER A
790 QWERTYUIO
500 PRINT"123, "FILE $AVED, " :GOTO999
0 :GOTO700
510 "SEEK DRIVE DATABASE SEEK
540 PRINT"ENTER FILE NAME" :FILE$
540 RND
500 PRINT"FILES: INITIAL QUESTIONS
510 RND
500 PRINT"FILES: ARRAY A, 0
540 PRINT"FILES: ARRAY B, 1
570 PRINT"FILES: QUESTION A
580 PRINT"FILES: ANSWER A
590 IF QWERTYUIOP="" THEN RND :GOTO
500
590 CLOSE
510 QUESTION$
520 RND
530 RND+1 :IF ANSWER$="" THEN 530
ELSE ANSWER$+1
540 QWERTYUIO
550 FOR RND TO 2000 :NEXT R :RETURN
560 <C> [END BY PETER WHITTAKER.

```

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The game for 2 to 4 players, the object being to form words on the board and thereby score points. The computer automatically calculates all scores including bonus and interest values, 50 bonus etc. The game features colourful graphics with facilities for connecting mistaken spelling or exchanging difficult letters from the rack.

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Dear Computerware,
I have this morning received
my copy of Blockbuster Quiz
and am very pleased with it. I
must praise your very prompt
service... well done.
Paul Gardner
Hemel

Dear Computerware,
May I say how successful your
Linkword program is. It has
given our family hours of fun
and interest — and I hope
increased our vocabulary!
Peter James
Ryde

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SAME DAY DESPATCH!

TRADE ENQUIRIES WELCOME

Getting in control

The new MXT controller opens up a new range of applications for your Dragon — Roy Coates checks it out

THE LATEST addition to CompuSense's armoury of hardware for the Dragon is the MXT controller cartridge from Beam Electronics. The cartridge fits snugly into the Dragon's cartridge port and has integral legs to support the weight of the unit which is heavier than most cartridges owing to the weight of the relays that are enclosed within it.

The facilities offered by the cartridge include the ability to control up to four external devices (the controller is available in both 2 and 4 relay configurations) and to detect the condition of four input channels. A real-time clock is included in the package which enables the unit to be programmed to operate at set times which makes it suitable for many domestic applications such as heating control and lighting etc.

When the unit is plugged into the Dragon and the Dragon switched on, the program held on an EPROM within the cartridge automatically loads seven new commands to BASIC to enable the unit to be controlled

easily from a BASIC program. The new commands allow you to set the real-time clock, access the clock (for timing purposes), switch each of the relays either ON or OFF and determine the status of each of the four input channels. The commands are:

CLOCKSET — Which allows the real-time clock to be set to the current time.

CLOCKONK — Which displays the current setting held by the real-time clock.

CLOCK — Which allows a BASIC variable to assume the value held by the clock.

SWITCHON — Which allows one of the relays to be energised.

SWITCHOFF — Which will de-energise an active relay.

SWITCHIN — Which will return the status of a selected input port.

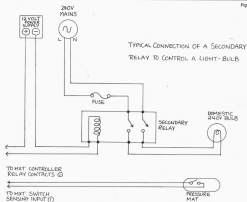
MON — Which activates the monitor program built into the cartridge.

The machine code monitor built into the MXT controller allows the assembler programmer to execute and de-bug his program

while the controller is present. The monitor is capable of examining and changing both the 6809's internal registers and user-specified memory locations, setting break-points to allow machine code program execution to be monitored at selected stores, execution of a machine code program itself, and finally a warm-start back to BASIC.

As with the added BASIC functions, the monitor commands are simple to use and easy to remember. The documentation supplied with the unit gives sufficient information on each of the new commands and some useful ideas and examples on how to implement them.

Care has obviously been taken in designing this unit for although the makers suggest that the clock should be accurate to within about two seconds a day, they give information on fine tuning the counters that control the clock itself. These counters are employed and the most sensitive of these will alter the clock rate by a mere 0.1



seconds a day!! (Apparently Dragon Data changed the main Crystal frequency in some of the earlier Dragons from 14.215MHz to 14.31815MHz, details for adjusting the clock to compensate for this are also given.)

Connections to the MXT unit are made by means of some very neat screwless terminals, these simply require a screwdriver to depress the spring-loaded assembly under the wire is inserted and this provides a secure connection to the cable.

Relays

The relays used in this controller are rated up to a maximum of 3 Amps at 24 Volts DC and a maximum of 2 Amps at 240 Volts AC and it is worth mentioning that the manufacturers strongly recommend that mains voltages should not be switched by

the relays in the unit but by secondary external relays driven by passing a lower voltage through the relays of the MXT unit.

The MXT controller unit may be used for all sorts of applications from a simple burglar alarm system to the control of a model railway. A useful application would be the automatic switching on of a house light at a set time in the evening. (See Fig 1). The following program will switch a light on at 6pm (1800 hrs) and switch it off at 11pm (2300 hrs). The switching on of the lamp may be overridden by a pressure mat connected to input switch 1.

A burglar alarm circuit may be made up in such a way that all trigger switches are connected in series to one of the input sensors and the alarm bell triggered by a secondary relay driven from one of the MXT relays.

The uses to which this unit may be put are so varied that it would be impossible to list them all. It is well made and the price compares fairly with other such products on the micro-market. The software is simple to use and the unit appears to be quite reliable. The only reservation that I would have personally is that the power to drive a multiple relay operator may, in the long term, be too much for the Dragon's already weak power switch.

Product MXT controller
Model Dragon 32

Price 2-relay £29.95, 4-relay £36.95

Supplier Compuserve Ltd, PO Box 169, 288-3 Green Lanes, London NW3 5XA, Tel: 01-862 0881.

```

10 REM PROGRAM TO SWITCH LIGHT ON AT 6PM AND OFF AT 11PM.
20 REM
30 REM
40 T=CLOCK(H)           : 'CHECK FOR 6PM.
50 IF T = 18 THEN 40     : 'IF NOT 6PM THEN TRY AGAIN.
60 IF SWITCHIN 1 = 0 THEN 40 : 'PRESSURE MAT OPERATED ??
60 SWITCHON 1           : 'ACTIVATE RELAY ONE.
70 REM NOW CHECK FOR 11PM TO TURN THE LIGHT OFF.
80 T=CLOCK(H)
90 IF T <> 23 THEN 90    : 'NOT 11PM SO TRY AGAIN.
100 SWITCHOFF 1         : '11PM SO SWITCH RELAY ONE OFF.
110 END

```

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Countdown

Only ninety seconds to save the Earth — are you up to the challenge of this machine code game by Steve Gatharcole?

THE INTERGALACTIC Federation has informed us that Earth is to be blown up to make way for a new Milky Way. Three bombs have been placed within the depths of the Earth, you have approximately one and a half minutes to destruction. Thank you for your attention.

To destroy the bombs you must first jump as you jet sled as it passes underneath you — use the right joystick fire button for this. Now you have complete control over the jet sled, so using the right joystick manoeuvre down to the right-hand side of the screen and using the fire button blast away at the walls with your ion range laser. Now get it at the bombs and destroy them. Unfortunately you must not bump into anything or you will lose one of your lives; this also applies if you get too close to the bombs.

Your score will depend on the bombs left at the end, which is calculated on the time left. This is then displayed in the Hall of Fame. A useful tip... press the fire button and move at the same time.

Instructions

To load the game proceed as follows. First type in LISTING 1; the Basic "runner" for the game. Check all looks OK and save to tape as normal, but do not run this yet as it contains machine code not yet in memory.

Next type in LISTING 2; the screen display (the machine code adds the rest). If all looks OK, save to tape directly after LISTING 1 using CSAYEM "SCRN".

1000 0579,0 144.

Now switch off and then on (to clear memory) and type in LISTING 3. This is a hex loader for the machine code and is the same as used for Claydroid and Topdog, so if you already have this on tape you can use it again. When you run LISTING 3 you will be asked for the start address. Type in 20000 then press Enter — you will now be asked for the finish address. Type in 20900 then press Enter. Now you must type in the codes of hex digits up to and including the "—" sign, (LISTING 4), then press Enter.

You must now type in the checksum (the number after the "—" sign). Press Enter, and if all is well the next address will be displayed. Carry on as before, until the end. When finished, save this to tape using CSAYEM "COUNT", 20000,20900,20000, saving this directly behind SCRN. Reread the tape and you are ready to go — type CLD=0 then RUN.

If you want to type in (LISTING 4) in small amounts, do this by typing in the first address you want to finish at and save to

```

10 CLS
20 REM HDLOADER - ENTER THE
30 REM STRING OF HEX DIGITS FIRST
40 REM AND THEN THE CHECKSUM
50 CLEAR2000,17770
60 PRINT"ENTER START ADDRESS":(INPUT START
70 PRINT"ENTER FINISH ADDRESS":(INPUT FINISH
80 FOR N=START TO FINISH STEP 11
90 PRINT;(N);
100 TT=0:INPUT "A,B,C,D"
110 FOR S=1 TO LEN(N)*4
120 P=VAL("0"9+HEX$(MID$(N,S,1)
130 TT=TT+P*1600#256#256
140 Z=Z+1:NEXT S
150 PRINT"TT"
160 INPUT "A"
170 IF T=0:DO:TT=TTOR$00#256
200 PRINT"ERROR - ENTER LINE AGAIN"
2000 GOTO
2100 NEXT

```

Listing 3

```

10 GOSUBS
20 CLEAR2000,17770
30 CLD=PRINT$(CLD+0);
40 PRINT$(0,"9 8 7 6 5 4 3 2 1 0")
50 FOR M=0 TO 0
60 PUT$(CONV$(15,10),00000000)
70 NEXT M
80 FOR M=0 TO 20000-20900
90 CLD=PRINT$(CLD+0);
100 CLEAR$(CONV$(M,10),HEX$(M));
110 M=M+1
120 PUT$(CONV$(M,10),00000000)
130 NEXT M
140 FOR M=0 TO 20900-20000
150 CLD="COUNT";CONV$(M,10)+"0000"
160 M=M+1
170 NEXT M
180 PRINT$(CONV$(20900,10),0000)
190 PRINT$(CONV$(20000,10),0000)
200 PRINT$(CONV$(20000,10),0000)
210 PRINT$(CONV$(20000,10),0000)
220 PRINT$(CONV$(20000,10),0000)
230 PRINT$(CONV$(20000,10),0000)
240 PRINT$(CONV$(20000,10),0000)
250 PRINT$(CONV$(20000,10),0000)
260 PRINT$(CONV$(20000,10),0000)
270 PRINT$(CONV$(20000,10),0000)
280 PRINT$(CONV$(20000,10),0000)
290 PRINT$(CONV$(20000,10),0000)
300 PRINT$(CONV$(20000,10),0000)
310 PRINT$(CONV$(20000,10),0000)
320 PRINT$(CONV$(20000,10),0000)
330 PRINT$(CONV$(20000,10),0000)
340 PRINT$(CONV$(20000,10),0000)
350 PRINT$(CONV$(20000,10),0000)
360 PRINT$(CONV$(20000,10),0000)
370 PRINT$(CONV$(20000,10),0000)
380 PRINT$(CONV$(20000,10),0000)
390 PRINT$(CONV$(20000,10),0000)
400 PRINT$(CONV$(20000,10),0000)
410 PRINT$(CONV$(20000,10),0000)
420 PRINT$(CONV$(20000,10),0000)
430 PRINT$(CONV$(20000,10),0000)
440 PRINT$(CONV$(20000,10),0000)
450 PRINT$(CONV$(20000,10),0000)
460 PRINT$(CONV$(20000,10),0000)
470 PRINT$(CONV$(20000,10),0000)
480 PRINT$(CONV$(20000,10),0000)
490 PRINT$(CONV$(20000,10),0000)
500 PRINT$(CONV$(20000,10),0000)
510 PRINT$(CONV$(20000,10),0000)
520 PRINT$(CONV$(20000,10),0000)
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690 PRINT$(CONV$(20000,10),0000)
700 PRINT$(CONV$(20000,10),0000)
710 PRINT$(CONV$(20000,10),0000)
720 PRINT$(CONV$(20000,10),0000)
730 PRINT$(CONV$(20000,10),0000)
740 PRINT$(CONV$(20000,10),0000)
750 PRINT$(CONV$(20000,10),0000)
760 PRINT$(CONV$(20000,10),0000)
770 PRINT$(CONV$(20000,10),0000)
780 PRINT$(CONV$(20000,10),0000)
790 PRINT$(CONV$(20000,10),0000)
800 PRINT$(CONV$(20000,10),0000)
810 PRINT$(CONV$(20000,10),0000)
820 PRINT$(CONV$(20000,10),0000)
830 PRINT$(CONV$(20000,10),0000)
840 PRINT$(CONV$(20000,10),0000)
850 PRINT$(CONV$(20000,10),0000)
860 PRINT$(CONV$(20000,10),0000)
870 PRINT$(CONV$(20000,10),0000)
880 PRINT$(CONV$(20000,10),0000)
890 PRINT$(CONV$(20000,10),0000)
900 PRINT$(CONV$(20000,10),0000)
910 PRINT$(CONV$(20000,10),0000)
920 PRINT$(CONV$(20000,10),0000)
930 PRINT$(CONV$(20000,10),0000)
940 PRINT$(CONV$(20000,10),0000)
950 PRINT$(CONV$(20000,10),0000)
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970 PRINT$(CONV$(20000,10),0000)
980 PRINT$(CONV$(20000,10),0000)
990 PRINT$(CONV$(20000,10),0000)
1000 PRINT$(CONV$(20000,10),0000)
1010 PRINT$(CONV$(20000,10),0000)
1020 PRINT$(CONV$(20000,10),0000)
1030 PRINT$(CONV$(20000,10),0000)
1040 PRINT$(CONV$(20000,10),0000)
1050 PRINT$(CONV$(20000,10),0000)
1060 PRINT$(CONV$(20000,10),0000)
1070 PRINT$(CONV$(20000,10),0000)
1080 PRINT$(CONV$(20000,10),0000)
1090 PRINT$(CONV$(20000,10),0000)
1100 PRINT$(CONV$(20000,10),0000)
1110 PRINT$(CONV$(20000,10),0000)
1120 PRINT$(CONV$(20000,10),0000)
1130 PRINT$(CONV$(20000,10),0000)
1140 PRINT$(CONV$(20000,10),0000)
1150 PRINT$(CONV$(20000,10),0000)
1160 PRINT$(CONV$(20000,10),0000)
1170 PRINT$(CONV$(20000,10),0000)
1180 PRINT$(CONV$(20000,10),0000)
1190 PRINT$(CONV$(20000,10),0000)
1200 PRINT$(CONV$(20000,10),0000)
1210 PRINT$(CONV$(20000,10),0000)
1220 PRINT$(CONV$(20000,10),0000)
1230 PRINT$(CONV$(20000,10),0000)
1240 PRINT$(CONV$(20000,10),0000)
1250 PRINT$(CONV$(20000,10),0000)
1260 PRINT$(CONV$(20000,10),0000)
1270 PRINT$(CONV$(20000,10),0000)
1280 PRINT$(CONV$(20000,10),0000)
1290 PRINT$(CONV$(20000,10),0000)
1300 PRINT$(CONV$(20000,10),0000)
1310 PRINT$(CONV$(20000,10),0000)
1320 PRINT$(CONV$(20000,10),0000)
1330 PRINT$(CONV$(20000,10),0000)
1340 PRINT$(CONV$(20000,10),0000)
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1400 PRINT$(CONV$(20000,10),0000)
1410 PRINT$(CONV$(20000,10),0000)
1420 PRINT$(CONV$(20000,10),0000)
1430 PRINT$(CONV$(20000,10),0000)
1440 PRINT$(CONV$(20000,10),0000)
1450 PRINT$(CONV$(20000,10),0000)
1460 PRINT$(CONV$(20000,10),0000)
1470 PRINT$(CONV$(20000,10),0000)
1480 PRINT$(CONV$(20000,10),0000)
1490 PRINT$(CONV$(20000,10),0000)
1500 PRINT$(CONV$(20000,10),0000)
1510 PRINT$(CONV$(20000,10),0000)
1520 PRINT$(CONV$(20000,10),0000)
1530 PRINT$(CONV$(20000,10),0000)
1540 PRINT$(CONV$(20000,10),0000)
1550 PRINT$(CONV$(20000,10),0000)
1560 PRINT$(CONV$(20000,10),0000)
1570 PRINT$(CONV$(20000,10),0000)
1580 PRINT$(CONV$(20000,10),0000)
1590 PRINT$(CONV$(20000,10),0000)
1600 PRINT$(CONV$(20000,10),0000)
1610 PRINT$(CONV$(20000,10),0000)
1620 PRINT$(CONV$(20000,10),0000)
1630 PRINT$(CONV$(20000,10),0000)
1640 PRINT$(CONV$(20000,10),0000)
1650 PRINT$(CONV$(20000,10),0000)
1660 PRINT$(CONV$(20000,10),0000)
1670 PRINT$(CONV$(20000,10),0000)
1680 PRINT$(CONV$(20000,10),0000)
1690 PRINT$(CONV$(20000,10),0000)
1700 PRINT$(CONV$(20000,10),0000)
1710 PRINT$(CONV$(20000,10),0000)
1720 PRINT$(CONV$(20000,10),0000)
1730 PRINT$(CONV$(20000,10),0000)
1740 PRINT$(CONV$(20000,10),0000)
1750 PRINT$(CONV$(20000,10),0000)
1760 PRINT$(CONV$(20000,10),0000)
1770 PRINT$(CONV$(20000,10),0000)
1780 PRINT$(CONV$(20000,10),0000)
1790 PRINT$(CONV$(20000,10),0000)
1800 PRINT$(CONV$(20000,10),0000)
1810 PRINT$(CONV$(20000,10),0000)
1820 PRINT$(CONV$(20000,10),0000)
1830 PRINT$(CONV$(20000,10),0000)
1840 PRINT$(CONV$(20000,10),0000)
1850 PRINT$(CONV$(20000,10),0000)
1860 PRINT$(CONV$(20000,10),0000)
1870 PRINT$(CONV$(20000,10),0000)
1880 PRINT$(CONV$(20000,10),0000)
1890 PRINT$(CONV$(20000,10),0000)
1900 PRINT$(CONV$(20000,10),0000)
1910 PRINT$(CONV$(20000,10),0000)
1920 PRINT$(CONV$(20000,10),0000)
1930 PRINT$(CONV$(20000,10),0000)
1940 PRINT$(CONV$(20000,10),0000)
1950 PRINT$(CONV$(20000,10),0000)
1960 PRINT$(CONV$(20000,10),0000)
1970 PRINT$(CONV$(20000,10),0000)
1980 PRINT$(CONV$(20000,10),0000)
1990 PRINT$(CONV$(20000,10),0000)
2000 PRINT$(CONV$(20000,10),0000)

```

Listing 4

tape using CSAYEM "COUNT",20000,20900, where "0" is your finish address. Remember to CLD=0 this before starting up next time and use "0" as your start address. Or if you find the prospect of all this typing too much then send me £1.50 at the following address and I will gladly send you a copy. Steve Gatharcole, 16 Hanksford House, Walspole St Andrew, Wilsleash, Cambridgeshire PE14 9SA.

```

10 PMODE 3,1:SCREEN 1,0
20 DIM S(0),00
30 A=1536
40 FOR M=1 TO 8
50 READ S:POKE A,S
60 A=A+32
70 NEXT M
80 IF A=1537 THEN 120
90 A=1537
100 GOTO 40
110 DATA 255,255,00,255,00,00,255,
00,255,00,00,00,00,00,255
120 GET @,@: - @,@: .S,@
130 PCLS
140 COLOR2
150 LINE @,140 - @256,140,PSET
160 FOR Y=57 TO 57 STEP 8
170 FOR X=2 TO 190 STEP 8
180 GOSUB 490
190 NEXT X
200 NEXT Y
210 FOR Y=62 TO 78 STEP 8
220 FOR X=2 TO 190 STEP 8
230 GOSUB 490
240 NEXT X
250 NEXT Y
260 FOR Y=84 TO 100 STEP 8
270 FOR X=2 TO 190 STEP 8
280 GOSUB 490
290 NEXT X:NEXT Y
300 FOR Y=110 TO 127 STEP 8
310 FOR X=2 TO 66 STEP 8
320 GOSUB 490
330 NEXT X:NEXT Y
340 FOR Y=134 TO 143 STEP 8
350 FOR X=2 TO 190 STEP 8
360 GOSUB 490
370 NEXT X:NEXT Y
380 FOR Y=170 TO 194 STEP8
390 FOR X=2 TO 190 STEP 8
400 GOSUB 490
410 NEXT X:NEXT Y
420 X=67:FOR Y=150 TO 174 STEP 8
430 GOSUB 490:NEXT Y
440 COLOR0
450 LINE @,150 - @256,194,PSET,B
460 LINE @,161 - @253,193,PSET,B
470 COLOR4:LINE @,57 - @206,194),
PSET,BF
480 GOTO 480
490 PUT @,Y1 - @+8,Y+@,8,PSET
500 RETURN
510 GOTO 510

```

Listing 2

```

20000 1400700000200C0000000000 = 10F
20011 00000000000004000401010 = 0E
20022 1010101010101010101000 = 05
20033 40054001000000001000100 = 0D
20044 0100010001000100010005 = 0
20055 4001000440101000100040 = F3
20066 0100004001000100010000 = 8F
20077 40101010100010001001400 = 112
20088 00101010101000540100010 = 85
20099 0010001100110011001100 = 40
20110 01000100010001000100010 = 99
20121 0010001000100010000100010 = 6A
20132 00101000004010001001010 = 12F
20143 0010001000101010101000 = 15F
20154 00001000100000000000000 = 160
20165 400100000000000000000000 = 6F
20176 00000000101010100004005 = 114
20187 40101010100000000000500 = 14F
20198 00001010101000000000000 = 12F
20209 100010004000000000000000 = 144
20220 100010000054000500001000 = 0A
20231 101040004000400000001010 = 164
20242 10001000100010001010005 = 65
20253 00054000400040010101010 = 15F
20264 101010101010101010005400 = 0A
20275 40054000401010101010005 = 15F
20286 10001000100010001000000 = 130
20297 00000010001000100010001 = 14F
20308 10001000005000500000000 = 10A
20319 000000000000000000000000 = 200
20330 002000000000002000000000 = 3F2
20341 000000000000000000000000 = 32
20352 040024000000000000000000 = 24C
20363 202040000000000000000000 = 206
20374 0200000000000000000000000 = 406
20385 000000000000000000000000 = 506
20396 200020000000000000000000 = 390
20407 000020002000000000000000 = 304
20418 000000000000000000000000 = 54
20429 001000000000000000000000 = F0
20440 400000000000000000000000 = 114
20451 000000000000000000000000 = 60
20462 000000000000000000000000 = 160
20473 000000000000000000000000 = 54
20484 540044004400000000000000 = 0C
20495 000000000000000000000000 = 54
20506 100010001000100000000000 = 40
20517 1000007000007400001000 = 100
20528 00000001000007F0000740 = 254
20539 0001020000000000100020 = 250
20550 00000000000000000000000 = 40C
20561 0004000010000010000000 = 42
20572 00000100000700007F0002 = 170

```

Listing 4 - cont on p70

287583 810000004582010000000000 = 325
 287594 000000000000000000000000 = 48E
 287605 000000000000000000000000 = 00
 287616 0000000000000000000000000 = 0
 287627 0000000000200000000000000 = 1FC
 287638 0020000000000000000000000 = 496
 287649 000004000000400001500000 = 147
 287660 15000020000020000020000 = 93
 287671 0020000000000000200000000 = 106
 287682 000002000000000000000000 = 262
 287693 000000000000000000000000 = 30
 287704 0000000000000000000000000 = 428
 287715 0000000000000000000000000 = 18C
 287726 0000000200000000000000000 = 34C
 287737 000000000400001500000000 = 90
 287748 0000040000150000000000000 = 99
 287759 510000000000015000001500 = 150
 287770 0000000004000004000000000 = C
 287781 0000000000001000007000 = 04
 287792 0070000007000001000000000 = 130
 287803 0001000002F0000700000000 = 219
 287814 000000000001000000010000 = 50
 287825 400400100000000000000000 = 58
 287836 00100000100000000000019 = 57
 287847 0000150000190000190000 = 97
 287858 150000040000000000000000 = 21
 287869 000400000500000000000000 = 9
 287880 000000000000000000000000 = 0
 287891 000000000000000000000000 = 0
 287902 000000000000000000000000 = 0
 287913 000000000000000000000000 = 0
 287924 0000000470007000700070000 = 532
 287935 000007000000000000000000 = 501
 287946 35F00470007000010F0130 = 697
 287957 60E020F7000120F017000E2 = 522
 287968 0000200000000000000000000 = 409
 287979 0003000000000000000000000 = 527
 287990 0F17000000000000000000000 = 307
 21001 000000000000000000000000 = 569
 21002 0000000000000000000000000 = 386
 21003 0000000000000000000000000 = 332
 21004 10F0000000000000000000000 = 407
 21005 3001000000000000000000000 = 336
 21006 0000000000000000000000000 = 300
 21007 0000000000000000000000000 = 554
 21008 50F7000000000000000000000 = 435
 21009 0000000000000000000000000 = 305
 21010 0000000000000000000000000 = 406
 21011 0000000000000000000000000 = 350
 21012 0000000000000000000000000 = 4FF
 21013 0000000000000000000000000 = 4E3
 21014 0000000000000000000000000 = 563
 21015 0000000000000000000000000 = 500
 21016 0000000000000000000000000 = 400
 21017 0000000000000000000000000 = 636
 21018 12010F220F00000000000000 = 010

21019 0000000000000000000000000 = 505
 21020 0000000000000000000000000 = 440
 21021 30F0000000000000000000000 = 50F
 21022 0000000000000000000000000 = 557
 21023 2F00000001000000000000000 = 430
 21024 1017F000010010000210000 = 300
 21025 0000000000000000000000000 = 30F
 21026 0000000000000000000000000 = 93
 21027 0000000000000000000000000 = 300
 21028 0000000000000000000000000 = 430
 21029 0000000000000000000000000 = 409
 21030 0000000000000000000000000 = 321
 21031 0000000000000000000000000 = 406
 21032 0000000000000000000000000 = 514
 21033 7010000000000000000000000 = 4C5
 21034 0000000000000000000000000 = 403
 21035 0000000000000000000000000 = 409
 21036 0000000000000000000000000 = 46E
 21037 0000000000000000000000000 = 514
 21038 0000000000000000000000000 = 90
 21039 0000000000000000000000000 = 99
 21040 0000000000000000000000000 = 150
 21041 0000000000000000000000000 = C
 21042 0000000000000000000000000 = 04
 21043 0070000007000001000000000 = 130
 21044 0001000002F00007000000000 = 219
 21045 0000000000010000000100000 = 50
 21046 4004001000000000000000000 = 58
 21047 0010000010000000000000019 = 57
 21048 0000150000190000190000000 = 97
 21049 1500000400000000000000000 = 21
 21050 0004000005000000000000000 = 9
 21051 0000000000000000000000000 = 0
 21052 0000000000000000000000000 = 0
 21053 0000000000000000000000000 = 0
 21054 0000000470007000700070000 = 532
 21055 0000070000000000000000000 = 501
 21056 35F00470007000010F0130 = 697
 21057 60E020F7000120F017000E2 = 522
 21058 0000200000000000000000000 = 409
 21059 0003000000000000000000000 = 527
 21060 0F1700000000000000000000000 = 307
 21061 0000000000000000000000000 = 569
 21062 0000000000000000000000000 = 386
 21063 0000000000000000000000000 = 332
 21064 10F0000000000000000000000 = 407
 21065 3001000000000000000000000 = 336
 21066 0000000000000000000000000 = 300
 21067 0000000000000000000000000 = 554
 21068 50F7000000000000000000000 = 435
 21069 0000000000000000000000000 = 305
 21070 0000000000000000000000000 = 406
 21071 0000000000000000000000000 = 350
 21072 0000000000000000000000000 = 4FF
 21073 0000000000000000000000000 = 4E3
 21074 0000000000000000000000000 = 563
 21075 0000000000000000000000000 = 500
 21076 0000000000000000000000000 = 400
 21077 0000000000000000000000000 = 636
 21078 12010F220F000000000000000 = 010

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21937	3121391E9C864926C73F86	=	350	22387	16FF13188C592426C3D655	=	343
21948	3436138D4E26188E518F86	=	380	22398	4881812611864E24018427	=	298
21959	8FC61D8D518FB6681548128	=	471	22409	868D52239426FA4FB75598	=	485
21979	258C188C5924298A188E59	=	24F	22420	177DF716FEDF86559660101	=	561
21991	51866F3688268D518F5FF7	=	461	22431	2611866E29818927968D52	=	327
21992	5584F755838F4E262586434	=	3FA	22442	684926FA4FB7559617FD63	=	562
21993	3613884E26188E518F864F	=	388	22453	16FF18655978181361186	=	666
21914	C6188D518FB668154811832	=	482	22464	4E26818927968D52E84A26	=	380
21925	66188E59512689188E5924	=	278	22475	FA4FB7558717FD8816FEB3	=	5F2
21936	664F3688E88D518F5FF758	=	540	22486	34368E4E26368978289A688	=	370
21947	64F755838F4E26258644FB7	=	477	22497	81882633A6888188262846	=	374
21958	4E268755878648874E2E8E	=	389	22508	9481882627884E26368988	=	410
21969	4E2D4FA798A798A798A755	=	540	22519	4688818826186668818826	=	385
21989	6C16FC853A368D881213C6	=	385	22530	15868481882688F8E4E2638	=	357
21991	8F86821CFE8E4E26268828	=	382	22541	8F8684F8A94858826823586	=	444
22002	3A881F8836881F8833381F	=	269	22552	864E288188272948874E2E	=	388
22013	8D2D4A34C3884E26348828	=	410	22563	C61430C34E391F8388868E	=	388
22024	8F4E265A268A3889F8388F	=	523	22574	86488C1E88018A17882A17	=	38E
22035	4E268F4E2638F74E382648	=	388	22585	882717882A178821864E2E	=	100
22046	C688F74E26884E26381F8F	=	479	22596	81882648C841F74E23884E	=	3E7
22057	4E2638863A368E88978E78	=	487	22607	26188E518F868FC61D8D51	=	424
22068	38868884C317FED18E8A2C	=	5CF	22618	8F868187558935863A36F8	=	446
22079	868FC61D188E518FB8D518F	=	403	22629	4E26C184271786815A8183	=	318
22090	F84E2AC18427988852238A	=	380	22640	23688558E8A26FA813C35	=	474
22101	26FA8E4E263688288F4E26	=	450	22651	848D52235A26FA884E2618	=	3F4
22112	868FC61D188E59248D518F	=	457	22662	8E888C688F68893A78A38	=	628
22123	4FB75589864E26C61430C3	=	478	22673	88288A26F38889FC21313F	=	465
22134	4E2681F828E4E26888A8C41E	=	385	22684	188C888826E71773F94588	=	498
22145	8D518486FF8F7F88178144	=	57F	22695	34368E4E26868154812822	=	378
22156	86558C8183187782C88641	=	326	22706	2C3A18C889888FFC689A68A	=	410
22167	84FF8826483178288864E23	=	324	22717	818827828D7586FFA78A38	=	480
22178	81811827FF1C8858898181	=	36A	22728	1F3A268F17881235183889	=	285
22189	268316FC8884E112818F18	=	38F	22739	88F8C6844FA78A281F5A26	=	412
22200	27FF88888128681588132	=	443	22750	FF85863A3688FF258A8887	=	56F
22211	18228888818C1822888988	=	20E	22761	FF338C888188FD87F288D	=	597
22222	8158181325A2813E238314	=	23E	22772	167FFF288D1138818C888F	=	34E
22233	FF8888812F75882F458A4	=	59A	22783	288888FF2388F787F2338	=	673
22244	C1812788F64E26C1842786	=	369	22794	841F12313F26FC89188E51	=	381
22255	8D558E8A26FA188E58248E	=	530	22805	85868FC61D8D518F8D52CA	=	523
22266	4E26888FC61D8D518FC641	=	488	22816	188E518F8D518FC68A178B	=	520
22277	F755848E52238881875589	=	41A	22827	E15A26FA866588C48B7588	=	406
22288	87588816FF738D8812F458	=	536	22838	28263A26A6888188261E8C	=	348
22299	88C18127248FF75589F64E	=	483	22849	18842285888E7228C88C16	=	323
22310	28C18427988852238A26FA	=	308	22860	2C328888144A28888C19C1	=	383
22321	8E4E26188E59518649FC61D	=	382	22871	25888819C1288A25864F87	=	457
22332	8D518FC641F755838D558E	=	505	22882	528C884E268A788A788A78	=	461
22343	C681F75886F75587168F87	=	488	22893	8648874E2E3F38888874E	=	380
22354	188C8A2626A286558858181	=	38A	22904	2E3F78787878888888FF8F	=	499

Heart of the matter

This month Messrs Orbaum and Campbell reveal the joys of chip architecture and flowcharting in part two of our series on machine code.

LAST MONTH we showed you a small glimpse of the world of assembler programming. Before we start programming, however, there are a few more things that form the basis of the programmer's world. Two in particular are processor architecture and flowcharting — in that order.

Processor architecture has nothing at all to do with Sir Christopher Wren, but then again it has very little to do with programming. It is, however, hard to keep in mind the way the processor deals with the instructions that it is obeying, so this way more efficient code can be written.

Registers

The diagram in Figure One shows the internal structure of the 68000, giving the relationships of all the registers and buses. The easiest way to think of a register is as another memory location. The same difference is that of speed — to access the contents of a register, the processor does not need to go outside the immediate environment. The registers all have different uses, as listed below:

PC — Program Counter. Used to point to the next instruction to be executed, and stores 18 bits wide. Very rarely is it used by programmers. Although it is possible to change the contents, the results are likely to control, and the desired result can usually be achieved in simpler and easier ways.

S — System Stack Pointer. A stack is a list of bytes, used for many purposes. The analogy of a stack of plates has been quoted in many other places, and is not strictly true, as the stack pointer can be changed to access bytes out of sequence. The pointer contains the address of the next free byte on the stack, and is updated whenever something is pushed to or popped from the stack. The system stack is used, as its name suggests, to store return addresses for subroutine calls. As the stack can be placed anywhere in memory, this register is sixteen bits wide.

U — User Stack Pointer. The 68000 is unusual amongst processors in that it has two stacks. The user stack is not used by the processor, and as it is safest to use the user stack for all your data, then if anything is left on the stack by a subroutine — normally fatal when it comes to time to retrieve the return address — the program runs all right. On the other hand, if the process is followed, the first indication that something is wrong comes when the stack has grown far enough to overwrite something important. On the whole we generally

ignore the user stack, but it can be useful on occasion.

X and Y — Index Registers. Like all processors, the 68000 has several index registers, for use in accessing memory. Unlike most, both indices on the 68000 can access the entire range of addressable memory — all 655,360, if that. This is because they are 18-bit registers. They are used as an offset for accessing, for example, tables of data, but they have many other uses, as we shall cover later.

DP — The Direct Page Register. Memory is divided, nominally, into pages of 256 bytes. For speed, it is possible to specify which page operations are going to occur in, and then to have the address as an eight-bit offset within the page. This is only really useful if there are going to be a large number of memory operations within a 256

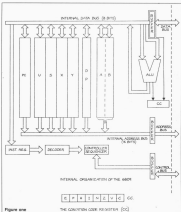
byte area — for example sorting a small data table.

D — The Accumulator. The 68000 is also unusual in that it has a 16-bit accumulator. This is the register that is used for most of the arithmetic functions. It can also be used as two eight-bit registers, A and B, for functions not exceeding 255.

CC — The Condition Code Register. This is best thought of as eight separate bits, as they are rarely accessed as a byte. Each bit serves a different function, and is used as a flag to show whether or not an event has occurred. We will deal with these separately as we come to them.

Many of these explanations will only become clear after addressing modes are covered at a later date.

The ALU is the Arithmetic Logic Unit, and executes arithmetic functions such as add-



ion, subtraction, and, surprisingly, multiplication, a function that normally needs implanting in software.

The data and address buses are both used for communication between various parts of the chip, and, through a buffer, with devices such as memory chips.

The controller sequencer is the bit that controls all the registers and the ALU, with help from the instruction register and the decoder.

Now on to a subject that has made govern men crazed, and is widely ignored by

programmers, analysts, consultants, and bus-drivers, despite its relative importance. Yes, its flowcharting! Many people think this is only of use for very large programs, but with a language like assembly, where there are a large number of lines of code, it is often very easy to lose track of the overall direction of the program, when concentrating on a few lines at a time. Thus a flowchart comes in handy. There are a multitude of symbols, courtesy of the boys at the IEC, but of these, only three are of any use — Process, Decision, and Start/Stop.

The basic principles of flowcharting are very simple. The most important thing is to be able to look at whatever is being coded as a whole, then break it down into manageable chunks in logical sequence. What a manageable size is depends on many things, including the size of the whole task, the programmer, the size of the finished flowchart.

The only guide it is possible to give is to say that the flowchart itself should not get out of hand.

The symbols are as follows:

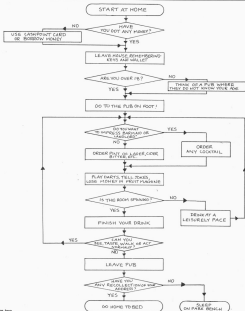
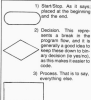


Figure two



Figures Two and Three are two flowcharts we chose up as an example. The first, not totally serious, has nothing at all to do with programming (except in that it represents a process not totally unfamiliar to most programmers), but should serve as a general example. The second is a flowchart for a program we will publish next month, to clear the screen in a slightly different way. More on that later after a closer look at Figure Two.

Flowcharting

The first thing you will notice about the flowchart is that it is very easy to follow. This is one of the fundamental advantages to flowcharting a program. It is very difficult to get lost in the programming provided you have an adequate flowchart next to you.

We say adequate because we have seen someone try to write a *Defender* program from a flowchart with six boxes, which were "Show Instructions", "Install", "Play Game", "Isn Dead? (Y/N)", "Print Game Over", and "Another Game? (Y/N)". This flowchart, as one can imagine, is of little use to anyone.

The thinking flowchart contains six decisions, ten processes, a start, and two alternative endings. All lines are arrowed (some more than once), all junctions have arrows on all lines entering/joining as near to the junction as possible without causing confusion. All decision boxes have their exits clearly marked Yes and No.

All these things should be present on every flowchart, although on a code flowchart the start and end boxes should contain the words START and END respectively and exclusively. Study the first flowchart, understand it and its use, then go on to Figure Three. Look at it and try to understand it before reading on for the explanation.

Right, all those who didn't even glance at the diagram go back and do it again. Come that? Good. Now, the flowchart is very simple, having two loops, but it may add understanding to realize that the Dragon text screen starts at location 1024 and ends at location 1828. All the routine does is to point to a position along each line (initially at the right hand end), store the address of that position in X (in this case the X register) and then use that as an offset to store a given square on screen. The pointer is then

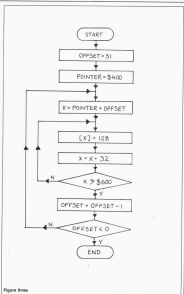


Figure three

moved onto the next line, by adding 32, and the register is checked to ensure we have not reached the end of the screen. If we have, the position is reduced by one, and if we have not reached the end of the line, the process is repeated.

Glossary

Try to extend the flowchart so that it covers the screen in black that way, and then does the same in the opposite direction, in green. We will present a program next month that does so.

For now here are this month's additions to the Glossary of machine code terms.

Accumulator — A register within which most of the mathematical functions are performed within a machine code program.

FILE — First In Last Out.

Flowchart — A diagram designed to ease programming of part or all of a program. The flowchart consists of a series of standard symbols combined in a manner that makes them easily understood.

LIFO — Last In Last Out.

Register — In crude terms, a faster "variable" within the computer. A set of eight or 16 bits (defining a register as a one or two byte register) used for the manipulation of data within memory.

Stack — A pile of numbers! A stack works on a LIFO principle, ie, the top number on the stack will be the one put there most recently.

Join us next month for the first piece of actual code.

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Cop it!

Program: *Cops n Snatch*.
Blazy Software, Crossways
House, Luttenhove Road,
Blazy, Leicester.
Price: £3.99

A few days ago I sat at my keyboard and said "Right, it's time to write this month's reviews. Perhaps before I do it though, I'll have a quick game of *Cops n Snatch*, just to wake me up!" By about one in the morning, into my millionth game of *Cops n Snatch* for that evening I was in no state to write my name, let alone a review of this superb game.

Strangely enough, the something happened the day before yesterday. I sat down, decided to have a quick go at this game, which, incidentally involves

flying a helicopter "Sensable" like for to be more accurate, "Super Cobra" flies over a terrain defended by guns, laser turrets, force fields, etc. in an effort to reach the enemy's plane, and suddenly found it was some ungodly hour near dawn. The reviews still remained unwritten.

Yesterday, I sat down, loaded up the game with the best of intentions, played its Mode 24 flicker free graphics for several hours and completely forgot all my cares and my deadline, being carried away as I was in the crystal sound and smooth movement, and speed.

Disappointing, therefore, that after so much play, it should only have been tonight, after two and a half hours of teaming on the keyboard instead of using my joystick because, you see, the sheer



speed of the game makes joystick control very difficult, I eventually got past the first force field and into the next stage of the game — a cave rather than just a landscape with no defenses, into which I managed to probe about three milliseconds!

It's now five to eleven at

night, the deadline is the day after tomorrow, I'd better get someone to hide *Cops n Snatch* now, thinking of which, I don't half fancy a game. No, no, I mustn't! ... Oh heck! What's a deadline anyway?

Jason Orsbaum



Rock steady

Program: *Dragonair*. Microbot, 41 Tuxo Road, St Austen, Cornwall, AT 25 5JE.
Price: £5.70 (inc P&P)

FOR MY second ride this month I have picked an Microsoft's *Dragonair* which is a brilliant, inspired cross between *Smiler*, *Tale-A-Ride*, and *Time Pilot* that flourishes as an original and addictive game in its own right.

The game puts you in charge of a space ship which remains centre screen as the play field moves around it in the opposite direction to that in which you are pointing (a la *Traffic-Jam* and *Time Pilot* and *Smiler*). The idea is to fire all humans within the galaxy. Each is held within an enemy base shown on the radar. A base consists of three or more force-fields enclosing one or more space people. The force fields are linked by generators and it is these which must be destroyed to remove the base.

Also in the galaxy, just to make things harder, are space mines, which, once shot, explode for a couple of seconds making it very easy to fly into their explosions which are as fatal to your ship as the mines themselves. The mines are accompanied by space rocks

which are really pretty feeble and easy to destroy — this makes it even more annoying when one is flown into!

Also in the galaxy, just to make things even harder, are *Dragons*, which chase you and attempt to kill you in the traditional Japanese style (karate-kick). It only takes one shot to cause a *Dragon* to fly out but they return with all due haste.

The last enemy is the *Dragonair* himself, so big, and so terrifying that he even shows up on the radar! He doesn't appear until quite late, at which point it's a good idea to get off the screen, providing you've rescued all the space people that is! When he does appear on the screen though, (and radar) claims that his wing span is about ten of your ship ... and that's one wing, and he's inebriated, most people just drop the joystick and their bottom jaw simultaneously and watch their ship vaporise on his full leaping not a scratch.

What can I say, the graphics are stunning, the game plays at a comfortable speed which I initially thought was too slow, but is in fact just right, and the title page is almost worth the money for the game anyway!

I have yet to finish section three (by which point the generators are shooting back) but I will ... I will ...

Jason Orsbaum



Freaky Fables

Program: *Zak's Son*. Cable (via Computer), 27 Coombe Road, Southminster, Essex, DM0 7AH.
Price: £2.99

ONCE upon a time, there was a happy, happy land, where *Dragon Dais* did exist, where all the people were friendly and full of goodness and smiled even when it was raining and when the people were so primitive they still thought that *Pinnae* was a good game. And all day long these happy, happy folk, sang jolly songs about life, love, and the legend of the *Dragon*.

But also there dwelt in the land of *Evil Wizard* and he began to spread rumors that there was a land far away across the water where there was a machine with really good games called the *Spectrum*. For it, there were no *Spectrums* in this happy, happy land. And then, the *Evil Wizard* turned his wicked hands and *Dragon Dais* were banished, and all the people did panic and scream and try to sell their *Dragons* through the pages of the wool known as "Freaky Computing Weekly".

But all was not lost in the land for there also existed the *Good Witch Cabette* who had

heard that one of these games for the *Spectrum* was a version of the arcade game mentioned in the legends of the *dragons* called *Zaxxon* and so, she said "Let there be *Zak's Son* so that all the little folk of the land can once more dance and sing and do all these happy sorts of things."

Word of her goodness had, however, reached the *Evil Wizard* and so he was filled with wrath and he decided not to stop his spell of good, but to alter it, for lo, he was as cunning as he was evil, and that's pretty cunning, and so he did speak these words ... "Yes, let there be *Zak's Son*, but let it be boring, slow, and generally disappointing."

And so, throughout the land adventures did appear on trees for *Zak's Son* and once more the people did dance and sing and sort of for their coppers and behold, on the day after they had given up getting up early to meet the post it did arrive on their doorsteps (for *God's Law* was still present in the happy happy land even if *Smiler* were not). And so, the people did lead the game into their *Dragons*, and so, and it was not good.

And you verify the moral is ... Those who bring out really unimpressive arcade copies deserve to receive critical reviews.

Jason Orsbaum





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Over Loading

PLEASE could you tell me if it is possible to load a graphics screen into another graphics screen leaving the first screen graphics on, but enter the second screen, if you could help I would be most grateful.

Simon Chambers
30 Park Avenue
South Shields
Type 4 star

THE SIMPLEST method of loading one screen 'over' another, without resorting to machine code, is to use a program such as the one shown below. Basically, this loads one picture into the first four graphics pages, and the second into the next four pages. The 'SET' command is used to take a section of the picture from the second screen and store it in the array 'A'.

The 'PUT' command is then used to overlay this on to the picture on the first screen.

This method works fine in the two colour modes, but for four colour modes change the 'AND' in line 70 to 'OR'. The areas where colours overlap will give interesting effects.

```
10 PCLAMP 0
20 PWORD 4,1:CONSOLE 1,1:
  COLOR 0,1:POLE
30 CLOADM "PICTURE1",80M
  Load picture 1 -- saved by the
  COMEM "PICTURE1",100,
  70:R,0 command
40 PWORD 4,1:
50 CLOADM "PICTURE2",8144:
  80M Load an offset
60 ORM A(12000:81713,0)-(200,
  10),0,0
70 PWORD 4,1:PUT(0,0)-(250,
  10),1,AND
80 GOTO 80
```

Remote Control

I AM trying to write a machine code program to enable my Dragon 32 to be run entirely from a ROM terminal. The terminal has a 60 x 24 display and I would like to take advantage of this.

I have a Mitron RC202 port and have run a small program from BASIC to check that the terminal will communicate with my Dra-



gon. I need to know where to place the code of the received character so that the Dragon thinks it is an input from its own keyboard, and also how to copy the output to the screen to the terminal. Hope you can help.

D. Pondator
103 Marry Street
West
Chester WA9 3DT

IT SHOULD certainly be possible to use a Dragon from a remote terminal (for text I'd only of course). One method is to patch the outputs at 302 and 303 which are the lines for character input and output respectively. These are normally initialised to 815 instructions. See the Firmware page in 88 1185 and 1386 for details of how to patch these routines.

Multi Channel

FOR A while now I have been struggling with multi-channel sound output, (eg, Composer), via my Dragon's S&S converter. Although I can quite easily produce sound through one channel, I can find no way of outputting through more than this. Could you please help me with this problem?

Adam Lee
24 Fernington Road
Berthol
Cheltenham
Gloucestershire GL51 6AF

A POINT made by my Dragon-brothers is the mixer's sound capabilities for lack of a better word. The Dragon has only two hardware based channels (not counting single bit sound) which is achieved via the S&S converter. Programs such as Mi-

crosoft's 'Composer' use a software technique involving producing mixed waveforms from the DA -- each 'channel' has a different waveform. The sound still only comes from one channel but appears to be in more than one voice.

The techniques involved are quite complex and the simplest solution is to buy a copy of 'Composer' which, after all, will produce stand-alone machine code.

Type Writing

PLEASE could you tell me if there is a way of getting whatever is produced on the screen, also produced on the printer, without having to use a -T in every print command. For example, the simple program below:

```
10 PRINT "DRAGON 32"
20 GOTO 10
```

I am asking this because at school I am taking a computer studies course, where I have to produce five programs written in BASIC, in the period of two years. But the program has to be produced as a listing and also as a ROM copy on the printer.

Please could you let me know whether there is a solution to my problem.

Bill Peet
17 Newton Close
Leighton
Lancs. PR9 3TG

THE FOLLOWING short listing can be run prior to loading your programs, or added to the start of any program. It causes a character sent to the screen to be echoed to the printer as well as to the screen. You can still send characters to the printer only, by using PRINT

-2 as normal. The program can be obtained by typing POKE 200,57

```
10 CLEAR 200,32750
20 FOR I=0 TO 7:READ A:POKE 32750+I,A:NEXT
30 DATA 10,111,20,1,27,170,100,0
40 POKE 200,220:PRINT 300,127:POKE 201,254
```

Making Contact

I OWN two Dragon 84s which I have linked together via the CG 232 ports in the following way: Pin 1 to 1, Pin 2 to 6, Pin 3 to 3, Pin 4 to 5, Pin 5 to 4, Pin 6 to 2, and Pin 7 to 7.

Firstly could you let me know if these are correct, and secondly could you please tell me how to send programs and data from one computer to the other as the DLOAD command only sets one computer to receive. I have tried the small programs given in the Dragon 84 supplement with no success.

Mr. P. C. Simpson
4 Marrow Road
George Green
Sheff
S12 6SD

A SATISFABLE lead for connecting two 84s together can be made by connecting the pins in the following way: Pin 1 to 5, Pin 2 to 6, Pin 3 to 4, Pin 4 to 3, Pin 5 to 2.

The problem with the DLOAD command is, as you have noted, there is no equivalent COMEM command. The format required is not simple and is general it is best to avoid trying to use it. With a lead made up as suggested above, the example programs in the supplement should work and can form the basis of a more sophisticated communications program.

Whoops!

FINALLY, I have received a number of letters regarding my answer to John Booth in 86 Jan '86. Many of you noticed my gaffe in using the variable P% to hold the disc filename, this should have course read P\$ as P% is a reserved word in Dragon BASIC and so its use as part of a variable name will cause a syntax error -- sorry!



MIKE GERRARD'S ADVENTURE TRAIL

LET'S DEAL with some readers' letters first, before going on to some news which I know will interest lots of people who have written in to me in the past.

First out of the lucky dip is D Degree of 11 Stary Street, London E14 6DB, who offers help to anyone stuck in *Trektoise* and *Juxtaposition*, but in return needs a favour himself... or possibly herself. DD has bought one of the Phoenix twin-pack games, where you have to discover a code from playing an arcade game before being allowed to play the adventure on the second tape. I never liked this approach, and DD has been unable to get through the arcade game, leaving an unsatisfactory adventure. The pack was called *The Emperor Must Die*, so can any of you code-crackers or arcade addicts out there come to the rescue?

Operation Safraz

Plenty of you have completed *Petigrew's Diary*, but as yet no one has claimed to have got through the second part, *Operation Safraz*. "After answering all the questions on the note given to you by Rhythms," says Justin Field, "what is the code you have to enter to proceed?" Any help to me or to Justin at 2 Barnet Green, Hatfield, Doncaster, South Yorks DN9 4HL.

Help of a slightly different kind is needed by S J Garfiole, 38 Plascoe Avenue, Hedge Hill, Birmingham B29 5HQ. It may well be psychiatric help, as the Garfiole household thinks the Adventure Trail should be five pages long every month, but their real problem lies with Franklin's Tomb. The SAVE facility on their copy causes the program to crash, which I haven't heard anyone mention before. Has any reader encountered the same problem and found a way round it? Or maybe you've finished the game and would like to pass a copy on. The Garfioles will manage to amuse themselves in the meantime as they're stuck in all Clabbers, but who isn't? How to get to the cave in the east, and how to get the feather from the eagle they ask. Well, to rewrite my favourite Everly Brothers song: MAER DBO DOTE VAKUD YLLA.

To prove that adventure playing can definitely be a family activity, just consider the Higgins home in Boodle, Merseyside. Philip is asking about *Petigrew*, Franklin and all Clabbers, while his brother is stuck in *Wings of War* and Dad has shown who's in

charge by just completing *Return of the King*. He found a bug in the program, so after managing to kill Orin, the program crashed whenever he tried to enter a village. Could be Gron's message, I suppose, being dealt out by his brother, Gron. Anyway, Higgins senior's advice is to forget Gron and take your gear to the Chamber of Time to get into the final stages which is a mini-adventure with "brilliant graphics."

Juxtaposition is the adventure that's dominating the postbag at the moment, not surprisingly, with detailed customers' letters — both those who've solved it and those who are struggling but still enjoying it. You'll probably know already from *Dragon User's News* pages that the sequel might be ready by Easter. Maybe Dean Douglas of Blackburn will have crossed the Blue Mountains by then. The way through it is the Brown Lands: TRAH SAKW GDRH with ANB. A hint on the game from Frederick Jaxxon at Burnley, who's solved that and *Trektoise*, both of which he thought were excellent, though he says *Trektoise* didn't have as much behind it as he expected. Anyway, in *Juxtaposition* Frederick says that while you're outside the White City (I thought that was a dog track), you should enter any building you can as you might find something interesting.

Franklin

Carl Trust is trying to find something interesting, and that's a copy of *Planet in Microland*. You may recall that Salamander released a version of his without play and instructions for a river, but now it seems to have disappeared from the market, as indeed does Salamander. Microland are selling some of the former Salamander titles but not this one. Anyone with a spare, contact Carl at 11 Hayden Road, Puchton, Norfolk NR10 0HX.

Stephen Cogan at 674 King Lane, Alcester, Leeds LS17 3RN is keen on hearing from Dragon owners in the Leeds area, particularly adventure players, to see about setting up a club of some kind, so contact Stephen if you're interested.

I'd like to remind readers to enclose their address when writing, which M D Water didn't, so his offer of help to people on several adventures is rather difficult to pass on! So was the answer to his question (a common one this) about getting past the

Highways Droid in *Juxtaposition*. You need a flash of inspiration on that one.

Help on *Juxtaposition* is available from Gareth and Gemma Edwards, and you don't need to be an adventurer to work out where they live. The address is 10 Harehale Court, Henshingly, Caerphilly, Mid Glamorgan CF8 2TR. The brothers Edward say they've advanced saved games to a desired position if you like, or just help on any particular problem, provided you enclose one, which of course applies when writing to anyone who's kind enough to offer help to other readers. Gareth and Gemma completed the game in 18 days, and two of those were spent trying to solve the puzzle of the caretaker, which I would have thought was one of the easiest of the lot, so it goes to show how different puzzles do for different people.

If you're fazed in *Ring of Darkness* then some hints from Garrick Acker. He says that if you're thinking of buying a raft to get to the island, wait till you can afford to buy two, then put one on each shore in case you die and are reincarnated on the opposite side from where you left the raft. That's if you can't afford a fireworks. Garrick also recommends the coward's way out in trying to deal with the monsters in the dungeons — break into the program and edit their strength to zero! Have my readers no shame?

More honest advice on *Return of the King* comes from Jonathan Harrop of Warrage, who says that at the start you must continually kill monsters to gain experience and raise your *Genial Level*, which causes the shops to sell more equipment, including the passes that you need. Also try trading with the monsters in the Forest Moon, as some of them give crystals away for nothing.

A couple of months ago I reviewed an adventure called *Castle Blackstar* and used it very highly indeed. A little gemini trap into the review, what publishers SCR Adventures have asked me to mention, and that's that the disc version is only available for the 64K Dragon, and not its little brother. It's good to know that at least one reader shares my enthusiasm for *Castle Blackstar*, and that's Pauline Hampton of 10 Cherry Lane, Leeton Heath, Alagger, Stoke-on-Trent ST17 3QZ. Pauline's completed lots of adventures, so know what she's talking about, and she says the SCR effort "really

is incredibly good." So good that she's stuck and needs help. . . can the reader who told me about the adventure, and whose letter I can't find, help Pauline in any way? Or anyone else, for that matter.

How far does that go (I mentioned, which should please all those readers who have written in over the months asking if there is any hope of a tape version of Colossal Cave Adventure for the Dragon. Well at last there is, although inevitably it has had to be abbreviated just a little in order to cram it all in. Still, at least you'll be able to discover for yourself what everyone on virtually every other mine has known for ages — that Colossal Cave Adventure is the grandaddy of all adventures.

The storyline remains the same — can you enter the genuinely colossal underground cave network and retrieve the various treasures that are hidden in there? Getting into the caves isn't much of a problem, but map-making is essential if you're to find your way round (and also get out again — that's where you've got past the first major obstacle, which is a giant green snake that rears up and hisses at you in the Hall of the Mountain Kings. Don't try and deal with it yourself, it's my only advice on that one. The dragon is a different kettle of monster, though. You'll also meet a bear, a troll that demands a toll, a pixie who insists on pinching your hard-earned treasures, and hiding it in the most devious of places, a damped-out stam, hostile dwarves that pop up out of nowhere and

throw things at you, and a host of other problems.

It's a pity that the lengthy location decisions, which were one of the attractions of the original, have had to go, but with the Dragon's bulky text display (not reduced) it's maybe just as well as some of them would take up several screens. However at least you do get a look at the most famous of all adventures, and it maybe a few of the problems and their solutions seem familiar (like the bear and our old friend the burning torch) then remember that these were the originals. There's a scorecard to save routine, which also acts as it was in the original mainframe version.

One practical tip — I find loading trouble

with the game till I eventually turned the cassette volume down very low indeed. The only other tip is to give the game a try by sending \$5 to Crown Software Ltd, 30 Bristol Avenue, Lutterbarn, Monksheep MK15 2NU. And that's the end of the colossal adventure column for another month, except to say that I've recently been given a sneak preview of a line of arcade-adventure game written by one of our readers and which Microcad will be publishing in the near future. I'm sworn to secrecy about it, but I will say that it's brilliant, with more packed into the program than I would have ever thought possible. I'm dying to write about it, but you'll have to wait till my lips have been unsealed.

Adventure Contact

To help puzzled adventurers further, we are instituting an Adventure Helpline — simply fill in the coupon below, stating the name of the adventure, your problem and your name and address, and send it to Dragon User Adventure Help-

line, 1213 Little Newport Street, London WC2H 7PP. As soon as enough entries have arrived, we will start printing them in the magazine.

Don't worry — you'll still have Adventure Trial to write to as well!

Adventure _____

Problem _____

Name _____

Address _____

Mar 88

Adventure Contact

Adventure Syzygy Problem I have all the co-ordinates, but how do you use them at the transporter? Also, how do you get to the planet? **Name** Clayton Poole **Address** 66 Castle Drive, Northborough, Peterborough, Cambs, PE5 8D.

Adventure Black Sanctum Problem Please could anyone supply me with a list of the commands? Also, how do I get out of the rugged mountain? **Name** John Suggard **Address** 12 The Mount, Tengenworth, South Devon, TQ14 8NE

Adventure The Kat Trilogy! Final Mission Problem How do you get past the second door after passing the airlock? **Name** Gillian Llewellyn **Address** Massygrove, Park Road, Wymondley, Welwyn, SG4 5AP

Adventure Juxtaposition Problem How do you kill the right-ops droid? Is there a hint sheet? **Name** Steven Slade **Address** 37 Waterloo Road, Barmst, Stockport, Cheshire, SK7 2ND

Adventure Barons of Cell V Problem I can't get away from the JRL assassin droid, or past

it. **Name** Philip Dew **Address** Reaslow, Winchester Road, Walsman Chase, Southampton, Hants.

Adventure Ring of Darkness Problem Any help please **Name** Karl Cavner **Address** 54 West Ham Close, Basingstoke, Hants, RG22 6PH

Adventure Jerusalem Adventure 2 Problem How do you be religious at Wollaton Wall? What are the magic words? What do you use them? **Name** John Haining **Address** Armarine, Somerville Street, Carline, Ayrshire, Scotland, KA6 9DQ

Adventure Juxtaposition Problem I cannot get past seemingly multiplying JRL assassination droid. Please tell me how I can do this — if possible send hint sheet. **Name** Simon Cochrane **Address** 15 St Stephen Rd, Penketh, Warrington, Cheshire.

Adventure Sea Quest Problem Getting Scuba gear from the Clerk Name Gareth Ashworth **Address** 49 Fossway, Syston, Leicester, LE17 8AF

Adventure Syzygy Problem Don't know how to beat Vobor.

Can't set co-ordinates right. Can anyone help? **Name** Stuart Gilchrist **Address** 65 Yewtree Close, Milton Kirby, Leicestershire, LE13 5LH

Adventure G Diablos Problem Where to dip the bag **Name** Gavin Griffin **Address** 58 Doo Basin, Tallaght, Co Dublin, Eire.

Adventure Madness and the Mirror Problem Everything **Name** Gavin Griffin **Address** 58 Doo Basin, Tallaght, Co Dublin, Eire.

Adventure Juxtaposition Problem Cannot get the white key out of the canister and cannot find the magic. **Name** Mark Coons **Address** 18 Willow Drive, Main Heath, Stockport-Trent, ST5 7LZ

Adventure Juxtaposition Problem Have wonder unit and deeds of Brava, but always die from Broken Flag. Can someone send a map? Also what use is crystal and Transmat receiver? **Name** David Eggelton **Address** 9 Time Road, Chatteris, Cambs, PE16 6GL

Adventure Return of the Ring Problem How to get the grain out of the human village. **Name**

Steven Atkins **Address** 305 Barcroft, Haxloy, Essex, CH18 7SH

Adventure Juxtaposition Problem How do you get out of the first building without being shot by the first droid? **Name** Richard Tyler **Address** 11 Stables Park, Turndridge Hills, Kent, TN2 5JX

Adventure Return of the Ring Problem We can't get the blue pass to get out of the maze at the beginning. **Name** Emma Brooker **Address** 21 Welbeck Road, Yeovil, Somerset.

Adventure Juxtaposition Problem How do I get out of the Emerald Tower with the Emerald? What use is the girl in the isomorphous? **Name** D J M Thompson **Address** Field View, Brits Roman, Oxon, OX9 3PU

Adventure Ring of Darkness Problem How do I get the key off the Jester? What do I do when I have the four rings? **Name** Paul Gibbons **Address** 85 Crossroads, Gaddington, Luton, Beds, LU1 4DQ

Adventure Trillion Problem Cannot pass the bronze field. **Name** J Wright **Address** 31 Oak Way, Cleethropes, South Humberston, DN15 0PL

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DragonDOS Firmware Memory Map

The Firmware data locations detailed below may be used for other purposes by the Basic ROM when DragonDOS is not installed, for example the USR routines listed. DragonDOS also uses RAM from 1000 to 3071, moving graphics page one to address 3072.

- 204 Floppy Disk Controller Macro Command Byte. This is the byte sent to the hardware to specify what operation is to be performed. See Manufacturers data sheet for details.
- 220 Disk Drive number (1-4). The drive to be used in a sector read/write operation.
- 228 Disk Read/Write TRACK.
- 232 Disk Read/Write SECTOR.
- 238-239 Disk Read/Write sector Buffer address. This is a 256 byte area of memory from where the sector is to be written, or to where the sector is to be loaded.
- 248 Floppy Disk Controller Hardware Error Status Byte. This is the error number returned by the hardware to be converted into a DragonDOS error code.
- 261 Current File Number. The number of file (1-10) most recently accessed.
- 244 Number of disk drive sides and tracks for current drive. Coding is as follows:
 00 = 1 side, 40 tracks
 01 = 2 sides, 40 tracks
 02 = 1 side, 80 tracks
 03 = 2 sides, 80 tracks
 The format of a disk is taken from the directory track on the first access to a disk after switch on or reset.
- 265 File Read/Write Flag. A zero value specifies a file read operation, non-zero specifies file write.
- 268 Disk I/O in progress flag. A non-zero value signals that disk I/O is continuing and that the motor should not be turned off by the IRQ routine.
- 261 Interrupt countdown to disk motor off. The DragonDOS IRQ routine is used to decrement this location if it is not already zero. When it reaches zero the disk motor is switched off.
- 2644 Disk Auto-Verify on/off flag. A non-zero value causes the disk to be read after a write to verify that the data has been saved correctly. A zero value disables this feature. The default setting is ON.
- 2646 Current default disk drive number (DEFD). This is the drive to be used by operations which do not specify a particular drive number. It is set from basic by

- 1548-50 the DRIVE command. AUTO command line number. The current line number being used by the AUTO command.
- 1551-52 AUTO command increment value.
- 1553 Program LOAD/RUN flag. A zero value indicates that the program is to be loaded, a non-zero value indicates that the program is to be loaded and RUN.
- 1600 AUTO command on/off flag. A non-zero value indicates that the AUTO command is being used.
- 1555 ERROR command on/off flag. A non-zero value indicates that the ERROR GOTO trap is active and errors will not cause the program to stop.
- 1627-28 ERROR trap line number. The Basic line number of the error routine.
- 1600-08 Line number of last error (EPL).
- 1681 Error code of last Basic error (EPR).
- 1616-18 Start address of program loaded.
- 1626-27 Length of program loaded.
- 1622-23 Entry address of program loaded (for machine code programs).
- 1687-88 USR routines address table. The addresses for the 10 USR routines are stored here when DragonDOS is installed.
- 1687-1790 Drive table: 4 bytes per parameter — 1 per drive.
- 1687-88 Online flag. A non-zero value indicates that the drive is online and has been accessed.
- 1691-94 Drive Current Track. If the drive is online, this byte specifies which track the head is currently over.
- 1695-98 Head stepping rate. This should only be changed if slower drives are used.
- 1783-88 Disk sectors per track. The number of sectors per track on the disk in the drive.
- 1785 File IDCB's. 10 (one per open file) each 31 bytes long. 1024 bytes of Disk File Sector Buffers — 256 bytes each.

DragonDOS Hardware Locations

The Floppy Disk Controller used in the DragonDOS interface is a WD 2707. The following index locations are used by the 2707:

- FF46 Macro command/Drive status Register.
- FF41 Track Register.
- FF42 Sector Register.
- FF43 Data Register.
- The disk motors are controlled by location FF48. A zero value turns off the motors. A non-zero value switches on the motors and selects the particular drive.

DragonDOS Firmware Routines

The following ROM routines may be used by the machine code programmer. All addresses are in decimal and obviously apply only when DragonDOS is installed.

- Write Sector** DragonDOS-0800
 Writes a sector (256 bytes) out to disk. The locations 235 to 238 must be set up correctly as detailed above on entry. The Z condition code will be clear (ZRE) if an error has occurred and the B register will contain the error code.
- Read Sector** DragonDOS-0812
 Reads a sector (256 bytes) from disk. The locations 235 to 238 must be set up correctly as detailed above on entry. Again the Z code will be clear if an error has occurred with the B register containing the code.
- Drive Init** DragonDOS-0808
 Initializes the DCS hardware. On return the status register at 8FF40 will have the following meaning: Bit 1 = Index Input; Bit 5 = Write Protect status.
- Hardware I/O** DragonDOS-4810
 Vector at 48175
 This is a very low-level routine used by DragonDOS to send commands to the hardware. This routine is used by the sector read/write routines. A knowledge of the hardware is required to use this routine. The command byte must be set up in location 234.
- Format Disk** DragonDOS-50108
 Formats the disk in DEFD drive. All data on this disk will be lost, an empty directory will also be set up on the newly formatted disk.
- Get Free Space** DragonDOS-5381
 Vector at 49184
 Returns the amount of free space (in bytes) on the current drive (DEFD) in the Floating Point Accumulator.
- Convert Sector** DragonDOS-54003
 On entry the Y register should contain the logical sector number which is to be converted into a physical track and sector number in locations 295/297. Logical Sectors start at number 0 at track 0, sector 1.
- Directory Disk** DragonDOS-55888
 Produces a directory of the disk in DEFD to the device number in DE'WH (location 111), including protection status and free bytes.
- Beep** DragonDOS-6229
 On entry the B register should contain the number of 'beeps' to be output. The Beep sound is that produced by the Basic BEEP command.
- Boot Disk** DragonDOS-68206
 Boots an OS of the disk in DEFD. If the disk is not a valid operating system disk (see below) then a BT error is produced, otherwise the OS boot up program is loaded and entered at location 9730. In either case this routine does not return.
- Wait Time** DragonDOS-68267
 On entry the X register should contain the number of milliseconds for the routine to wait before returning. The Break Key is also scanned by.

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Taking chances

IT HAS been said that in no other branch of mathematics is it so easy to blunder as in probability theory, a statement which latter experience often bears out.

In fact, the probability that a certain event will occur is the number of favourable cases, divided by Total number of equally likely cases. Similarly, the probability that the event will not occur will be the number of unfavourable cases divided by Total number of equally likely cases.

For example, the probability of drawing at random, say, a diamond from a fullpack will be $\frac{13}{52}$, or 0.25, and the probability against will be $\frac{39}{52}$, or 0.75. Note that the sum of these two probabilities is 1, so from the definition a probability of 1 means certainty and a probability of 0 means impossibility.

Difficulty in calculating probability often occurs when a number of factors are combined, and these fall into two main groups: (i) The probability of either this or that occurring, or (ii) The probability of both this and that occurring. To take the first instance, we have seen how the probability of drawing a diamond is assessed at .25. Suppose that we wish to calculate the probability of drawing either a diamond or a picture card. The temptation is to add the odds for drawing a diamond ($\frac{13}{52}$) to the odds for drawing a picture ($\frac{14}{52}$). This would give the total probability of $\frac{27}{52}$, which would be incorrect! How we have counted twice those cards that are both diamonds and pictures. What we need to find is the probability of drawing either a diamond, a club picture, a heart picture, and a spade picture. This is given by $\frac{13}{52} + \frac{13}{52} + \frac{13}{52} + \frac{13}{52} = \frac{52}{52} = 1$. To find the probability against simply subtract this value from 1.

The second of our main groups relates to cases where we wish to assess the probability that both this and that will occur. To take our card-drawing example we might

wish to calculate the probability of drawing a card which is both a diamond and a picture. In this case we simply multiply the probability of picking a diamond ($\frac{13}{52}$) by the probability of picking a picture ($\frac{14}{52}$). The product, $\frac{13}{188}$, gives the answer that we would expect as there are three diamond picture cards in the pack of fifty-two cards. Once again, to find the probability against, simply subtract from 1.

In some problems it is easier to calculate the probability against an event, and subtract this from 1 to find the probability for the event. For example, if I throw six ordinary dice, what is the probability that I will throw at least one six? Since the probability against throwing a six with one die is $\frac{5}{6}$, the probability against throwing a single six with six dice will be: $\frac{5}{6} \times \frac{5}{6} \times \frac{5}{6} \times \frac{5}{6} \times \frac{5}{6} \times \frac{5}{6} = \frac{15625}{46656}$. This value to 2 decimal places works out at 0.334, and so the probability for throwing at least one six would be 1 minus 0.334, that is 0.666.

Before turning to this month's competition question, here is a little problem whose solution I shall give next month. It is a problem which is set in such a way as to mislead the solver in assessing the probabilities involved. You are invited to attend to participate in a small bet. He shows you three boxes of identical appearance. In the first box are two red marbles, in the second box two white marbles, and in the third are one of each colour. The boxes are closed and are mixed up. You are then invited to choose one of the boxes, and without looking inside, remove one of the marbles. Suppose that it is red, your friend might say "Obviously, the box that you have chosen is not the one containing the two white marbles so therefore it must be either the red/red or the red/white box. The remaining marble has an equal chance of being red or white. I propose to guess which colour it is, and offer you an even money bet on the



outcome. If I am correct, I win. If answering 'I guess'! Would you be able to accept the bet?

For this month's competition, as a demonstration in probabilities, I assembled a number of volunteers into a room and handed to each one of them a slip of paper. They were then asked to write down any year in the range 1 to 1986 inclusive. This was to be done secretly without consultation with the others present. The papers were then collected. I knew from the number of volunteers present that there was a slight bias that every chance of any two numbers being the same, but that if I also write down a date and added it to the pile the probability would rise to a better than even chance. In other words, the addition of one extra number would increase the probability of at least two dates coinciding from just under 0.5 to just over this value.

Can you say how many volunteers there were? As a Club, there are fewer than you might at first sight, but!

Prize

For this month, we are offering 15 prizes of the newest game for the Dragon... from the newest software house: Bean-stalker from Micro Vision. In this 80 screen arcade adventure, you must collect treasure in Giantland, avoiding such hazards as giant caterpillars, giant insects and man-sized birds. You've seen the pantomime, now play the game!

Rules

To win your own copy of Bean Stalker, all you have to do is put your brain into gear and work out the answer to this month's puzzle — showing how you solved it. But please don't send us cassettes containing your program — hard copies only.

Make sure that your name and address

is clearly printed on your entry, and mark your envelope "April Competition" ... or you might risk disqualification.

As a tie breaker, complete the following sentence in 10 words or less: "I want to visit Giantland because...". As usual, preference will be given to entries that make the editorial staff giggle.

January winners

The 26 lucky winners of the Melbourne House 'Enter the Dragon' cassettes are as follows: Mark Liber of Lymington, West Yorkshire; R. G. Woods of Ilford, Essex; Charles Daly of Windsor Hill, Co. Cork; Simon Aubrey of Swanton, Wills, Q. B.; Barbara of Sutton Coldfield, West Midlands; P. D. Mellis of Tepton, Berks; M. Clarkson of Chesham, Essex.

Chris Jolly of Grove Park, London, K.; Lightowler of Halifax, G. R.; Sharples of Macclesfield; Luis Martinez of San Sebastian, Spain; Stephen Hunter of Highfield, Southampton; B. A. Newman of Addlestone, Surrey; J. Taylor of Aylesham, Wiltshire; P. L. Bates of St Albans; Cayana Simon of Blois, France; D. C. Faulstich of Maryland; Mid Glaswegian; Geoffrey Marshall of Selzer, Derby; and J. J. Randall of Plumstead, London. Congratulations one and all.

Entries for the tie break ("1986 is the Year of the Dragon because...") included many references to St George — English and otherwise, but generally our favourite was E. A. Newman's, "because it will be a roaring year."

I hope to be returning to the hot summer we are all praying for!

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