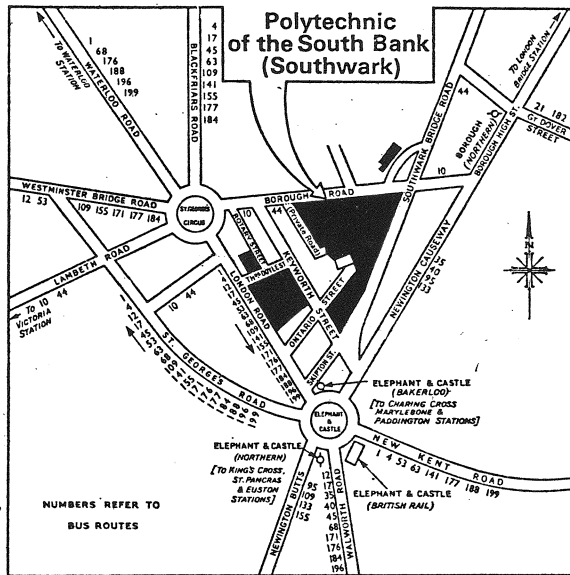


ANNUAL GENERAL MEETING

Thursday March 31st
7.0pm
South Bank Poly.

AGENDA

- Retiring Officers' reports and statement of the club's accounts.
- Election of officers and committee members for 1977/8.
- Discussion of special projects.
- Visit and lecture programme.
- A.O.B.



In This Issue

- * BIT STRETCHER
- * 8080/Z80 LIBRARY
- * 6800 LIBRARY ADDITIONS
- * ETI MOD MODS
- * WBI PLUS

D-I-Y COMP CONF

Online Conferences Ltd. are organising a one-day symposium for those interested in building their own computer.

Date: provisionally Saturday 14 May 1977
Time: 10.30 - 17.00 (90 mins lunch)
Venue: IEE Savoy Hill ; main theatre and common room.

Audience: broadly anybody with an interest in building a working computer system in their own home and of sufficient technical bent to grasp the fundamentals. Sixth form school students and upwards. Numbers limited to 500 maximum.

Provisional programme;

- introduction
- basic components, viability of home construction.
- ingredients; basic bits & pieces, how much they cost, memory, I/O, power supplies, PC boards.
- microprocessor kits
- I/O; lamps & switches, keyboards, TTY's, VDU's, making use of domestic TV, cassette recorders.
- programming; binary, hex, assemblers, loaders.
- 'I did it my way'; two case studies.
- effects of micro-electronics on consumer products (cars, washing machines etc.)
- applications; games, supercalculator, electric train control etc.
- question & answer session.

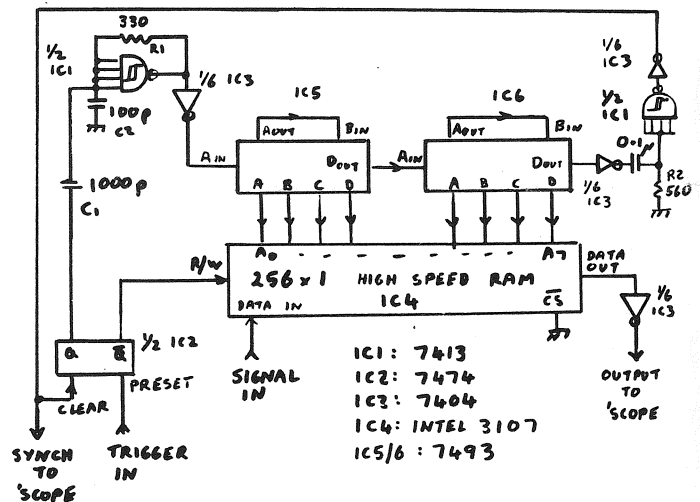
Industry participation display in common room; manufacturers and suppliers of components & kits (and ACC - has anyone a working, transportable, WB they would be prepared to show ?)

The charge is not settled yet but will probably be in the range £8 to £10 for pre-payment, more if you pay at the door. But - we have negotiated a specially reduced price for 1977/8 ACC members - . To take advantage of this send

£6.50 (payable to Online Conferences Ltd.)
Your 1977/8 ACC membership number

to; Roger J N Barnes
Online Conferences Ltd.
Cleveland Road
Uxbridge UB8 2DD
(tel; Uxbridge 39262)
before the end of April.

BIT STRETCHER



This circuit was designed with the intention of trouble-shooting microprocessor systems (8080). A 'scope of suitable speed with storage facilities (for examining single machine cycles) costs in the region of £1500 to £2000. The high speed memory used in this circuit costs in the order of £10, not cheap but cheaper than the alternative.

The output and synch are connected to the 'scope and the input is attached to the point to be monitored, possibly via an attenuator. The 'trigger in' is connected to the source of a suitable trigger pulse. This pulse, when the unit is in operation, sets FF1 which the 7413 clock to 10MHz and sets R/W to logic 0 for writing. After 256 pulses FF1 is reset by the monostable (C3 & R2) from the output of IC6. This sets the memory to read and the clock back to 100kHz.

The timing is not very accurate for the first 10 or so pulses at either frequency, after which rough comparisons can be made. The display readout speed can be adjusted by means of C1. The quoted frequencies are only approximate so some experimentation may be needed. The memory must be a high speed one like the Intel 3107 (60ns). The circuit has not been tested as a whole but each individual part has been tested with a 2102A memory. As a final warning, don't try using equivalent CMOS logic, it is too slow.

Michael Reynolds

CHEAP MOSTEKS

Response to date has been slow but encouraging.

I would be interested in hearing from members as to which components they would like to see added to the list. From the letters I have received it would seem that there is a demand for a 4k static RAM and a 2708 type EPROM, also for tri-state buffers.

Mostek are in the process of making a 4k static RAM and a 2708 EPROM and as soon as these are available I will negotiate a suitable price and let you know. I have been able to include HEX TRI-STATE CMOS BUFFERS 80C95 and 80C97, made by HARRIS.

I regret that there is a price increase for most of the components as shown below.

effective from 4 Feb, however, they still compare favourably with memories from Intel and AMD and F8 parts from Fairchild.

I have been able to negotiate an improvement in the price of the Z80 MPU due to the fact that ZILOG have reduced their prices to £48.50 for the ceramic package and £42.40 for the plastic package, however as there is some doubt as to the availability of the plastic package devices, my supplier is only prepared to meet me part way on the ceramic package.

I would ask members who send me orders for components, who wish to receive an acknowledgement, to please enclose a stamped SAE. Also, there is no need to add VAT to the handling charge as it is pre-paid and therefore not liable to VAT.

First deliveries of the VDU are expected in early April.

Scientific Calc Chip set MK50075/50108/50109 are in short supply and there are delays in delivery.

PRICES TO ACC MEMBERS - 15 February 1977

MOSTEK

		£
MK3880P	Z-80 CPU 40 pin DIP ceramic	39.00
MK3880N	Z-80 CPU 40 pin DIP Plastic	N/A
MK3881P	Z-80 PIO 40 pin DIP Ceramic	14.53
MK3882P	Z-80 CTC 28 pin DIP Ceramic	14.53
MK3850N-1	F8 CPU - R/C Control	11.25
MK3850N-3	F8 CPU - Crystal Control	11.25
MK3851N	F8 PSU 1K Monitor Programmed ROM + 2 x 8 bit I/O	25.50
MK3852N	F8 DMI Dynamic Memory Interface	8.00
MK3853N	F8 SMI Static Memory Interface	8.00
MK3854N	F8 DMA Direct Memory Access	5.75
MK3861N	F8 PIO	8.00
MK3820N	F8 PIA	6.55
MK6820N-1	PIA direct replacement for Motorola M6820	5.60
MK6820N-3	PIA	6.50
MK3702T-3	1us EPROM direct replacement for Intel 1702A	9.70
MK3702T-2	750ns EPROM	11.25
MK3702T-1	550ns EPROM	13.95
MK4102N-1	450ns 1024 x 1 bit Static RAM - type 2102	2.05
MK4102N-6	275ns 1024 x 1 bit Static RAM	2.55
MK4104P-20	200ns 4096 x 1 bit Static RAM	23.30
	cycle time 340ns; standby power 50mW	
	To get the price down on the MK4104P-20 I would need to batch up orders, 100 off = £14.50	
MK4096N-6	250ns 4096 x 1 bit Dynamic RAM	11.50
MK4096N-11	350ns 4096 x 1 bit Dynamic RAM	9.00
MK4096N-16	300ns 4096 x 1 bit Dynamic RAM	10.25
MK4027P-3	200ns 4096 x 1 bit Dynamic RAM	18.45
MK4027P-4	250ns 4096 x 1 bit Dynamic RAM	17.80
MK4200N-11	350ns 4096 x 1 bit Dynamic RAM standby power 0.6mW	9.00
MK4200N-16	300ns 4096 x 1 bit Dynamic RAM	10.25
MK5002N	4 digit Counter/display Decoder - 7 segment & BCD	10.10
MK5005N	4 digit Counter/display Decoder - 7 segment output	10.50
MK5007N	4 digit Counter/display Decoder - BCD output	7.50
MK50395N	6 decade Counter/display Decoder	12.00
MK50396N	6 decade Counter/display Decoder = 99hr/59min/59sec	12.00
MK50396N	6 decade Counter/display Decoder = 59min/59sec/99/100	12.00
MK50240N	Top Octave Frequency Generator -50% Output duty cycle	10.00 +
MK50241N	Top Octave Frequency Generator -30% Output duty cycle	10.00 +
MK50242N	Top Octave Frequency Generator -50% Output duty cycle	10.00 +
MK5009N	Counter Time Base Circuit	7.50
MK50250	series of digital alarm clocks	6.90
MK50362N	Clock Radio Circuit	7.25

HARRIS - CMOS

80C95	Hex Tristate Buffers = same pin out as 8T95	0.57
80C97	Hex Tristate Buffers = same pin out as 8T97	0.57

MOSTEK

Expandable Calculator set.		
MK50075/50101/50102	Business set	21.40
MK50075/50107/50108	Scientific set	21.40
MK50109	1 to 50step programmable ROM for above sets	6.45
MK50110	51 to 100 step programmable ROM use with MK50109	6.45

MOS Technology

MPS 7529-103	Scientific Calculator	13.00
--------------	-----------------------	-------

MOSTEK	F8 MPU Card 1K RAM/1K ROM monitor/4 x 8 bit I/O Ports	123.00
--------	---	--------

Please add VAT @ 8% on all items except for those marked +, add 12½%
Please add Postage & Packing of 50 pence per order. F8 card add £2.00 p&p

W. J. Whitehouse, Flat 2, Hean Castle, Saundersfoot, Dyfed, SA69 9AL.

I would remind all members requesting the short form data sheet to ensure their SAE's are stamped with a 9p stamp, and those requesting Z80 data to put on a 14p stamp. I regret I am unable to supply detailed data sheets but I have arranged for data sheets on the appropriate components to be included with each order.

I would like to thank members for replying to my previous letter. I am sending in the orders as I get them and would be interested in hearing from any member who is experiencing any delays in receiving their components.

However, I would be obliged if members could indicate on their orders the degree of urgency, as I will have to batch up orders to gain the 100 off price. This particularly applies to orders for the MK4102N-1 static RAM, members who cannot wait will have to pay the full members' price of £2.05

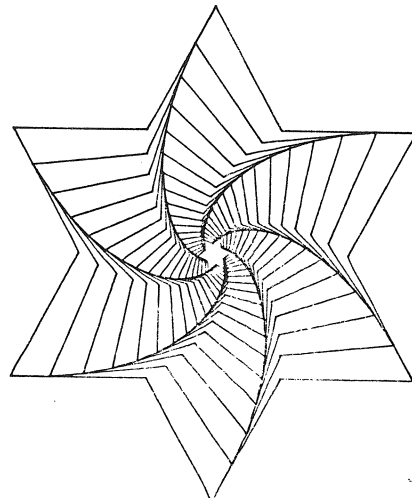
I can get the MOS Technology Calc Chip as detailed in the Hardware Maths Unit in Byte. £13.00.

I would like to hear from any member who is interested in the Z80 or F-8 MPU. Z80 Technical Manuals are available at £3.25 post paid.

W J Whitehouse

WINNER OF THE COMPUTER ARTWORK COMPETITION

R J BAKER



MOS TECHNOLOGY COMPONENTS & KIM-1 COMPUTER

Are sold in the UK by;

Aardalect Electronics Ltd.
Suite E, Georgian House
Trinity St.
Dorchester, Dorset
tel: 0305 67141

FORTRAN

One interesting software possibility that has occurred to me is an interpretive version of FORTRAN. I have specially translated an earlier LIFE program of mine into this interpretive version. Most people will be able to see the differences between my FORTRAN and batch FORTRAN by reading the listing, but I will explain a few of the differences.

1) File set up. This will be handled by a header statement of similar form to the one used in CDC FORTRAN, namely, PROG XYZ(F1=c1, ... Fn=Cn). XYZ= a program name, f1 ... fn = file names, c1 .. cn = corresponding channel numbers. Default PROG statement is PROG MAIN(INPUT=5,OUTPUT=6) where INPUT and OUTPUT are virtual file names giving access to the user's terminal. The system may have other virtual file names giving access (direct or queued) to other peripherals (PRINTER,PLOTTER etc.).

2) Routine names, variable names, line labels etc. may be longer than 6 characters, but the excess will be ignored.

3) Print conventions; to improve compatibility the first character of each line of output will be translated as follows;

Char	Translated to
blank	CR,LF
Ø	CR,LF,LF
1	CR,5*LF
+	CR
-	none

other unchanged, but CR,LF appended to start of string. The string is then output and the typehead left where it is. e.g. the three strings 'THIS IS AN EXAMPLE', '-OF PRINTOUT';'+____' output in that order would produce
THIS IS AN EXAMPLE OF PRINTOUT

Formatting; FORTRAN normally types results right-justified i.e. with any filler spaces going to the left of the field. To send spaces to the right, the field is prefixed with a minus sign; to centre justify with extra spaces going to the left the character '!' is used; to centre justify with right hand fill '?' is used. For unformatted I/O (to and from the terminal or sequential text files) the formats NUMBER or STRING are used.

Notes on free format string input; unless a string is the only item to be input on its line, it must either be enclosed in quotes or apostrophes or have no imbedded commas, quotes, apostrophes or blanks.

4) Character set; all 128 ASCII characters, including lower case. Of course only characters 32-95 will be meaningful outside strings. The following control characters will have special meaning;

CTRL	Meaning
@	(and Rubout) ignored
A	Translate next character, if 64-95, to the corresponding CTRL character. If comma, to '.'. If anything else, to rubout.
C	(as data input) Terminate program.
D	Delete last line, echoed as backarrow.
M(CR)	End of line, echoed as CR LF.
J(LF)	As above.
ESC	(or Break) If solicited, delete life. If unsolicited, as CTRL C.

5) There will be three ways of ending a program; a STOP statement will print out the string of characters immediately following the STOP statement, plus the line number and stop. e.g. 241 STOP ERROR 12 would print ERROR 12 AT LINE 241. The default message is, naturally, STOP. An END statement is the same except that the default is END. A pseudo-subroutine-call CALL EXIT would simply stop, without printing.

Anyone got any further ideas ?

R J Baker

```
1Ø IMP INT (A-Z)
2Ø DIM COLONY(1ØØ,1ØØ),NEWCOL(1ØØ,1ØØ),LINE(1ØØ)
3Ø DATA COLONY/1ØØØØ*Ø/
4Ø READ(5,"IN")MAXGEN
5Ø "IN" FORMAT(4ØI2)
6Ø WRITE(6,"MAX")MAXGEN
7Ø "MAX" FORMAT('MAXGEN=',I2)
```

```
8Ø GEN=POP=Ø;MINX=MINY=1Ø1;MAXX=MAXY=Ø;*NOTE
    MULTIPLE STATEMENT FEATURE
9Ø WRITE(6,"LIVE")
1ØØ "LIVE" FORMAT (' LIVE LIST')
11Ø "READY" READ(5,"IN",END="NOMORE")X,Y
12Ø X=X+1;Y=Y+1;WRITE(6,"OUT")X,Y
13Ø "OUT"FORMAT(2(I,X,I2))
14Ø COLONY(X,Y)=1;MINX=MINØ(MINX,X);MAXX=MAXØ(MAXX,X)
145 MINY=MINØ(MINY,Y);MAXY=MAXØ(MAXY,Y)
15Ø POP=POP+1;GOTO "READY"
16Ø "NOMORE" IF(POP>Ø)GOTO "PRINT";WRITE(6,"RIP");
    STOP DEAD
17Ø "RIP" FORMAT (' THIS COLONY IS ALREADY DEAD')
18Ø "PRINT" WRITE(6,"HEADER")GEN,POP
19Ø "HEADER" FORMAT('1GENERATION',-I3,' POPULATION',
    -I5)*N.B. NOTE THE '1'
2ØØ DO"TYPE"X=MINX,MAXX;DO "ASSIGN" Y=MINY,MAXY
21Ø Z='?';IF(COLONY(X,Y)=Ø)Z=' ';IF(COLONY(X,Y)=1)
    Z='*'
22Ø "ASSIGN" LINE(Y)=Z;"TYPE" WRITE(6,"GROWTH)(LINE
    (SWIT),SWIT=MINY,MAXY)
23Ø "GROWTH" FORMAT(1X,1ØØA1)
24Ø GEN=GEN+1;IF(GEN.GT.MAXGEN)GOTO "ENDGEN"
25Ø POP=Ø;MINX=1Ø1;MAXX=Ø;MINY=1Ø1;MAXY=Ø;DO "SACN"
    X=1,1ØØ
26Ø XM1=X-1;IF(X=1)XM1=1ØØ;XP1=X+1;IF(X.EQ.1ØØ)XP1=1
27Ø DO"SCAN" Y=1,1ØØ;YM1=Y-1;IF(Y=1)YM1=1ØØ;
    YP1=Y+1;IF(Y=1ØØ)YP1=1
28Ø LOCPOP=COLONY(XM1,YM1)+COLONY(X,YM1)+COLONY(XP1,
    YM1)+COLONY(XM1,Y)+COLONY(XP1,Y)+
29Ø+COLONY(XM1,YP1)+COLONY(X,YP1)+COLONY(XP1,YP1)
    ;*NOTE CONTINUATION (+) FEATURE
3ØØ NEWCOL(X,Y)+Ø;IF(LOCPop.EQ.2)NEWCOL(X,Y)=
    COLONY(X,Y);IF(LOCPop.EQ.3)NEWCOL(X,Y)=1
31Ø IF(NEWCOL(X,Y).NE.1)GOTO"SCAN"
32Ø MINX=MINØ(MINX,X);MAXX=MAXØ(MAXX,X);MINY=MINØ(
    MINY,Y);MAXY=MAXØ(MAXY,Y);POP=POP+1
33Ø "SCAN"CONT;IF(POP=Ø)GOTO"KILLED"
34Ø SWIT=Ø;DO "CHECK" X=1,1ØØ;DO "CHECK" Y=1,1ØØ;
    IF(COLONY(X,Y).NE.NEWCOL(X,Y))SWIT=1
35Ø "CHECK" COLONY(X,Y)=NEWCOL(X,Y);IF(SWIT.EQ.1)
    GOTO "PRINT";WRITE(6,"STABLE")
36Ø "STABLE" FORMAT('THIS POPULATION HAS STABILISED')
    ;WRITE(6,"END");"END" FORMAT(' *** END OF
37Ø+LIFE ***');STOP STABLE
38Ø "ENDGEN"WRITE(6,"GENS");"GENS"FORMAT(' LIMIT GEN
    ERATION REACHED');WRITE(6,"END")
39Ø STOP MAXGEN
4ØØ "KILLED"WRITE(6,"DEADED")GEN;"DEADED"FORMAT(' THE
    POPULATION DIED OUT AT GENERATION',-I2)
41Ø WRITE(6,"END";STOP DEATH;* ON THE ROADS: DRIVE ON
    THE PAVEMENTS!
42Ø END LIFE
```

ed's note; where the original text used lines longer than the 50 or so characters in the ACCN column width, I've carried on the next (un-numbered) line.

8080/Z80 LIBRARY

Inspired by Tim Moore's 6800 Software Pool, a similar collection of software and information is being assembled for 8080/Z80 users.

A start has been made with a number of articles and manuals listed below. Members wishing to use the library should send an A4 stamped addressed envelope to the address below. Applications will be dealt with in strict rotation so there may be some delay for popular items.

I would like to hear from anyone using or intending to use 8008,8080,8085 or Z80 micros, so that a list of interested members can be compiled.

The library needs as many contributions as it can get if it is to be of any real use, so please send something in however small or specialised.

Items marked 'L' are for loan only.

Neil Harrison

15 Hill Rd.,Watchfield,Swindon,Wilts SN6 8SB

SOFTWARE

L S1 How to do a number of conversions (Brown/Byte) All routines in 8080 code;
ASCII 1's & 0's to 8 bit binary and back.
ASCII octal to 8 bit binary & back.
ASCII HEX to 16 bit binary & back.
ASCII sign & decimal to signed 16 bit number and back.

- L S2 AMSAT 8080 Standard Debug Monitor (Allen-Kasser/Byte). A comprehensive 8080 monitor program, allows the user to;
- Examine & alter memory & registers
 - Dump memory, load & punch paper tapes
 - Start executing at any address
- from a suitable terminal. It is written in a modular way so mods are fairly simple. Many useful subroutines. 600H bytes ROM + a few bytes of RAM
- S3 BCD addition & subtraction up to 16 digits(ACC) 8080 code

HARDWARE & GENERAL INFORMATION

- L H1 8080 System User's manual (Intel)
Full details of the 8080, instruction set, circuits and supporting chips.
- L H2 Z80 CPU Technical Manual (Zilog)
Instruction set, hardware & software examples.
- L H3 Microprocessor Update;Z80 (Hashizume/Byte 12)
Comparison of 8080 & Z80.
- L H4 The Circuit for Z80's (Suding / Byte 13)
Complete circuit description of a Z80 CPU board.
- L H5 Interfacing Dynamic RAM to the Z80 (Zilog application note)
- L H6 How To Stop A Microprocessor (8080)(Morrow)
..and see what's in the registers.
- H7 TMS 5501 in 8080A systems (TI/New Electronics)
Versatile I/O controller from TI made for 8080

SHOP

FOR SALE

19" rack 5' 6" high on castors.
J Florentin (229 0859)
17A Campden Hill Gdns. London W8 7AX

NOTE

Proops are selling faulty calculators; 9 digits 23 keys c595 chips @ £1.25. I bought 3 and they work !

J Cunningham (G8LDH)

FOR SALE / GIFTS

- 1) NCR Card Reader/Verifier ? marked Class 382-1. It needs pick up fingers but is in fair condition. This is for free.
 - 2) Creed 7B teleprinter/page. Complete with keyboard but no cover. £10 ono
 - 3) Creed 92 tape reader. 5-8 level. Solenoid operated 25 characters per second. Free.
 - 4) Remex 8 hole optical reader with associated boards. The power supply is 19 inch rack mtg; +5V, -24V,+24V, +150V. The motors on this unit are 115 volt but I have a transformer 250/115V which is 10" x 10" approx. This machine is spool or loop. £8
 - 5) Remex 8 hole optical reader. Loop only. No PSU or boards. £3.
 - 6) AT&E TTY tuning scope. I think EHT chain is O/C otherwise it is in very good condition. £8
- I REQUIRE a mag tape reader 8 - 10 track
- G Youd 38 Middlebere Cresc.,Turlim Moor, Poole, Dorset

COMPUTER ARTWORK T SHIRTS

SAE + 6p stamps for details to R J Baker
54 Brixton Rd., London SW9 6BS

FOR FREE

Friden Flexowriter - 5 bit code - all wiring and relays have been removed.
Creed 7TR/3 5 hole paper tape punch.
Solenoid operated 5 hole paper tape reader.
Mike Lord; 7 Dordells, Basildon, Essex
tel; 0268 411125 (evenings)

FOR SALE

Wireless World teletext decoder with upper/lower case character generator. As new. £125 o.n.o , or will part exchange for a VDU.
Andy Barton
1 Kidwells Park Drive, Maidenhead, Berks.
tel; 01 432 2313 (day)
0628 35246 (evenings)

HELP

I am looking for a 5VDC and a 12VDC version of the clock IC AY-5-1202. Also, a miniature rotary switch, 2 pole 6 way.

L Chanter
19 Lodge Place, Inkersall, Staveley, Derbyshire S43 3DU

I have a Potter keyboard from key to disc or key to tape equipment. The typewriter sized unit has data selector switches and an 8 bit lamp display. Circuit is a diode matrix and DTL. Unit is KDR3300/KB3100A model 14 serial 470091. Anyone have data on this ? It seems a pity to strip it down if I can use the existing logic.

Len Warner
62 Beech Rd St Albans Herts AL3 5AT

PUZZLE BITS

P Rutherford

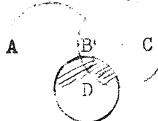
ANSWERS TO PREVIOUS QUESTIONS (Vol 4 Iss 5 p 2)

1) Neither. Since their perimeters are the same length the circle will revolve through the same number of degrees in going round their sides. The only extra degrees will be needed at the corners. In the case of the square this will be $360^\circ (90 \times 4)$. In the case of the triangle this will also be $360^\circ (120 \times 3)$.

2) This is best solved using a Venn diagram.

Chemistry

Physics



Neither

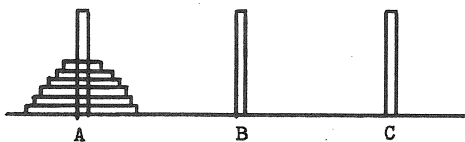
D = 10 (given in question)
∴ A + B + C = 90 (1)
A + B = 75 (given in question)
and substituting for this in (1);
75 + C = 90 ∴ C = 15
We are told in the question that
B + C = 83
∴ B = 83 - C = 83 - 15 = 68

NEW QUESTION (Sample answer next newsletter)

3) The Towers of Hanoi.

This well known puzzle specifies 3 vertical rods A, B & C on which are stacked a number of discs all of different diameters. No disc is placed on top of a smaller one. It is required to move all of the discs to rod B, moving only one disc at a time and maintaining a rule forbidding a larger disc to be placed on top of a smaller disc.

E.g initial situation with six discs;



Write a program which will move N discs from rod A to rod B. This can be done fairly easily by means of a recursive procedure definition. Printout the position after every move. In order to save space, print the discs stacked on one rod along one line, i.e. horizontally, hence only using three lines for each position.

HELP

Does anyone know if there is an IC to convert from ordinary punched card code (12 bit) to 8 bit binary ?

A MacPherson

28 Baberton Mains Row, Edinburgh 14

I'm having difficulty in finding detailed info on and specifications for the standard types of line driving/receiving circuits e.g. RS232 .

I'm still finding my way in the world of computing therefore any information or the details of where I might obtain it will be gratefully received.

Graham Bond

85 Barrowfield Rd, Farmhill, Stroud, Glos GL5 4DG

*** can I persuade anyone to write an article on this subject ? ed. ****

DEAF-FAX

DEAF-FAX is a research and development group which aims to research and manufacture communication aids for the deaf and hard of hearing. It was formed in May 76 by Derek Southern (Apprentice Training Instructor of Electronics of Instrumentation) and Ken Carter (lecturer in Deaf Education) at their local electronics club in Willingford, Oxon. DEAF-FAX is composed entirely of volunteers, has links with other organisations for the deaf, and is currently seeking charitable status as a company. The main activities at the moment are the building of Teletext and Videowriter units for hire by the deaf. It is hoped that the volunteer labour force will keep costs down so that a unit may be hired for £1 a week. The Videowriters are destined to link into an existing teleprinter network for the deaf (there are about 100 TTY stations at the moment, which will be converted to ASCII).

DEAF-FAX is important to us because it is a group of electronics enthusiasts like ACC, who are doing things we are trying now or may want to do in a year or two (eg, they have PO approval for an acoustic coupler, and are trying to reduce the cost of the model they use). I think DEAF-FAX and ACC should get together to further their mutual interests, and of course DEAF-FAX would be glad of volunteers to construct and commission equipment, or of ideas for new communication aids. I have a few copies of press cuttings giving background information, borrowable for a 6p stamp. All feedback is welcome, please get in touch if you have any thoughts on ACC/DEAF-FAX activities or want to volunteer as a constructor. Please send a stamp if you require a reply.

Len Warner

62 Beech Rd., St Albans, Herts AL3 5AT

LOCAL GROUPS

MIDLANDS MEETING

Following my notice in the newsletter, two local members contacted me, and together with several interested parties from the Electronic Organ Constructors Society - some of whom are already ACC members - we had an interesting session discussing various aspects of amateur computers. Some members were more knowledgeable about hardware, & some software. Most were fairly new to the subject, but between us there was a fair pool of knowledge.

Three of those present indicated their intention to build the ETI 'System 68' or variants of it, and there was a wide ranging discussion on input devices. The various different levels of programming language were also discussed.

Altogether an enjoyable and informative session.

A further meeting is planned for April 17th. anyone interested is very welcome, and if you contact me first I'll send details of how to find us.

Roy Diamond

27 Loweswater Rd., Binley, Coventry (tel Cov 454061)

ACC 6800 LIBRARY

By 6th February the Library had sent out a total of 58 items within 7 days of each request. All appears to be going well. Two comments;

- 1) It appears to be a better idea to make all items loan only - extended loan if necessary.
- 2) Could you please put 32p postage with your SAE. If the stamps are loose any unused ones will be returned with the items requested. Mark SAE (A4) 'ACC' please.

All the items Mick Reeve held have now been moved to this address.

The usual request; if you have any hardware tips or natty bits of software send them in for inclusion in the Library.

Tim Moore

24 College Rd., Maidenhead, Berks

ADDITIONS TO HARDWARE LIBRARY

- B29 AN EXTRA INSTRUCTION FOR EARLY 6800 (Electronics Dec 27 '76 p 62) See what '9D' does for you !
- B30 DESIGNING WITH THE 6280 PIA (Electronics Dec 27 1976 p 85) Useful short cut when speed is important.
- B31 HOW TO EXPAND A MICROCOMPUTER'S MEMORY (Electronics Dec 23 1976 p 67) Is 64K enough ?
- B32 PRIORITY ENCODER SIMPLIFIES CLOCK TO COMPUTER INTERFACE (Electronics Dec 23 1976 p 70)
- B33 CONTROL THE DATA RATE OF A uP WITH SOFTWARE INSTRUCTION (Electronics Design Nov/Dec 1976 p172) Alter baud rate of your TTY or VDU with software.
- B34 USE TTY OR VDU INTERCHANGEABLY ON A uP SYSTEM (Electronic Design Nov 1976 p174) Detects if device is 110 baud or 300 baud automatically.
- B35 TWO-PHASE CLOCK FEATURES NON OVERLAPPING O/P's (Electronics Jan 20 1977 p 99) Very neat TTL 7402 generator of 6800 master clock.
- B36 BAUD RATE GENERATOR FOR MC6850 ACIA (ACC) Cheaper than Motorola recommended chip.
- B37 THE 6800 MICROPROCESSOR FAMILY (Motorola) 36 pages plus two cassettes. Very good elementary introduction. Some crunch points still not fully explored. Recommended.
- B38 MICROPROCESSOR INTERFACE PIA (Electron Nov '75 p 22) 1 page discussing PIA interfacing.
- B39 MICROPROCESSOR TOGETHER WITH A CALCULATOR CHIP (Advert) 1 page - idea - use calculator chip not software.
- B40 EVALUATION MODULE 2 USER'S GUIDE (Motorola) 42 pages. Describes the latest MEK6800D2 kit, which costs £188.
- B41 M6800 RESIDENT MACRO ASSEMBLER AND LINKAGE EDITOR (Motorola) 1 page. Advance broad-sheet on software.
- B42 DETAILS OF MOTOROLA USER GROUP LIBRARY (Motorola) 5 pages. Early version, only 32 entries of rather poor standard as far as we can gather.
- B43 MEK6800D2 KIT SUMMARY (MPU Marketing) 4 pages. Easy to understand summary.
- B44 DISPLAY LETTERS & SYMBOLS ON A 7 SEGMENT NUMERICAL DISPLAY (Electronic Design Dec 6 1976) 1 page hardware tip - nothing to do with 6800.
- B45 FAST WAY OF LOADING A PROGRAM INTO MEK6800D1 KIT BY HAND. (ACC) Using a variation of tape format. 1 page.
- B46 HIGH LEVEL 6800 LANGUAGE (Atkins) 1 page publicity handout.
- B47 ASSEMBLER (AMI Microsystems) 1 page, alternative assembler - costs £50.
- B48 AMI 6800 KIT (AMI Microsystems) 4 pages 6800 Prototyping Board (news).
- B49 AMI 6800 FAMILY (Quarndon) 64 pages, recommended.
- B50 S6800 FAMILY PRICE LIST (Quarndon) 1 page.
- B51 SWTPC 6800 COMPUTER NEWSLETTER (SWTPC) 7 pages. A fantastic breakthrough from the 'States.

ADDITIONS TO SOFTWARE LIBRARY

- S18 STRING INPUT/OUTPUT PROGRAM (ACC) Inputs any length character string, next 'G' lists the string. 18 bytes. Uses Mikbug.
- S19 EDITOR VERSION A (ACC) Enables a machine code program to be altered. Very useful if an assembler is not available. BB hex bytes.
- S20 EDITOR VERSION B (ACC) Similar to Version A, the difference is a matter of taste.
- S21 ADDITION OF TWO NUMBERS, SUM NOT EXCEEDING 99 (ACC) 33 hex, useful demonstration program.
- S22 SWTPC 6800 BLACKJACK PROGRAM BLKJAK-1 (SWTPC) Game; 5F7 hex bytes. Real software from USA !!
- S23 SWTPC 6800 MEMORY DUMP PROGRAM MEMDMP-1 (SWTPC) Displays part of memory on TTY or VDU. 30hex bytes plus Mikbug RAM.
- S24 EDITOR (SWTPC) 543 hex bytes. Untested (any offers ?)
- S25 MICROBASIC INTERPRETER (SWTPC) CA4 hex bytes. Untested - any offers ?

LETTERS

MORE LANGUAGES

R J Baker continues his occasional reports on his LIFE (ACCN Vol 4 Iss 5) Does anyone know whether a mathematical theory has been developed for LIFE which would be able to determine the a priori stability of a pattern ?

While the program is being written in Manchester Auto Code (MAC) (and NOT Mercury Autocode as stated) this is certainly not the only high level language available at Galdor.

The Galdor ICT 1301 will run MPL assembler, MAC (which is not much better than assembler), Rapidwrite (non-verbose Cobol). Additionally Galdor has built up a 1900 installation from scrap market auctions, briefly this is an ICL 1903 (32K) with tapes, discs, all basic peripherals and plans for time sharing. This can run PLAN (1900 assembler), COBOL, BASIC, Algol and FORTRAN all at nominal cost. Andy Keene (ACC committee) & Stuart Fyfe Galdor Centre Surbiton 01 399 1300

ACCESS

I have access to a Sigma 9 computer via my school. Languages available include FORTRAN, BASIC, Algol, SOL, APL, SNOBOL etc. etc.

If anybody has some small programs they would like tested, I would be willing to do so, in exchange for a few bob to cover postage etc.

I'm writing a cross-assembler and simulator for Z80. I'd like anybody interested in this MPU to drop me a line sometime. I may well be able to assemble programs for the Z80 in the summer.
R P Steele 17 Lawrie Park Cresc., London SE26

STATES MAGS & CUTS

There are now quite a number of Hobby computer mags on the US market, so I'll list the more important ones here with the subscription rates;

BYTE Peterborough NH 03458 \$15 / year
KILOBAUD Peterborough NH 03458 \$17 / year
INTERFACE AGE 6515 Sunset Blvd. Suite 202, Hollywood, Calif 90028 \$18 / year
CREATIVE COMPUTING P.O. box 789-M Morristown, NJ 07960 \$10 / year
Dr. DOBB'S JOURNAL Box 310 Menlo Park, CA 94025 \$14
PERSONAL COMPUTING 167 Corey Rd., Brookline, MA 02146 \$26 / year (air mail)

All except the last are by surface mail and are accurate as far as I know. There are a number of other publications which I haven't included because they seem a bit unstable or because I don't have all the information for subscriptions.

BYTE, KILOBAUD & INTERFACE AGE are general hard/soft ware mags. CREATIVE COMPUTING & Dr. DOBB'S JOURNAL are general with a software bias. PERSONAL COMPUTING

is merging with a magazine called MIKRO-TREK at the moment so its a bit difficult to say where it is going.

Moving on to something different, you mentioned in the last issue of ACCN that it would be nice to see a cassette interface which met the CUTS standard. Well, the one you printed from my article can be used for both high speed operation and also CUTS (Kansas City) standard. If the write monostable Z14 is set for 2400 baud instead of 3300 baud i.e. 200uS instead of 150uS, and the read monostable adjusted accordingly. The operation is still high speed and conforms to the new proposed American standard PE2400 (Phase Encoded). If by software you record for a '1' bit not a single '1' but 8 'ones', and for a '0' not a single zero but 8 zeroes, on the tape you get 8 cycles of 2400Hz and 4 cycles of 1200Hz respectively at 300 baud which is Kansas City standard and can be read by anyone else's system without problem. Similarly you can read KC standard by using software to read 8 ones for every '1' bit and 8 zeroes for every '0' bit. And, of course it only requires software to change from 2400baud to 300baud, not hardware.

Ian Spencer.

6800 FUNNY

I am writing to raise a point which may have puzzled other 6800 users as much as it did me.

There are several 'funnies' in the 6800 interrupt system mentioned in the Applications Manual, but the following one isn't;

Execution of the SEI instruction when the interrupt mask is already set causes a spurious software interrupt. You can prevent this happening by always placing a NO-OP (01) before the SEI.

Martin Allard

SC/MP FUNNY

I have finally taken the plunge by purchasing an SC/MP Introkit and Keyboard Kit. At present I am working my way through the instruction set in an attempt to evaluate the processor's capabilities.

Concerning this kit, I would like to mention a point - The Introkit uses a standard 7442 4 to 10 line decoder to drive both the digit lines in the display and the keyboard lines. I have noticed that it is sometimes difficult to type in a character in the range 0 to 7 after the digit 8.

By 'scoping' around the circuit, the cause became evident. The output of the 7442 is low when driving the display, but when it is required to supply current to all seven segments (digit = 8) the output voltage of the 7442 rises to a value above the maximum logic 0 voltage permissible in TTL. Pressing a key subsequently causes this indeterminate voltage to be applied to a gate input, resulting in the erratic operation described above.

A cure which I have adopted is to reduce the +5V supply to +4.85. This has overcome the problem without affecting operation or the memories or CPU.

E R Tippelt

SIG ANYONE ?

Recently I have seen and heard calls for a bigger newsletter, more often, every member should contribute something ... I don't think ACCN is far from the mark now; it holds the club together with its (almost) regular collection of articles and newsy bits, and it would be a strain on Mike and club finances if it increased much in scale.

Looking back over almost 4 years of ACCN, it has been a good forum for ideas and excellent for the WB project, but perhaps ACC is large enough now to have special interest groups, each holding its own discussions by meeting, phone, cassette or letter, with a volunteer to co-ordinate the group. SIG topics would be listed in ACCN with the co-ordinators summary of recent activity, and occasional SIG articles would be published. SIG activities would be a mixture of practical and theoretical, with no sharp divisions. Thus SIG members are in day to day touch with their own interests, while ACCN readers get a regular supply of good articles. Let's have a SIG on SIGs; send comments on the SIG

idea and suggested topics to me and I will report in the next ACCN.

My OU courses this year are;

M251 An Algorithmic Approach to Computing

TM221 The Digital Computer

T321 Telecommunication Systems

T321 has not been mentioned in ACCN before; it is a 3rd level course based on two case studies, of the telephone system and of television broadcasting. The set book 'Telecommunications; A Systems Approach' looks a very interesting 270 pages, half phone, half TV with nitty-gritty detail of traffic levels and colour systems etc. Drop me a line if you would like to join in a cassette tapespondence on these courses. Len Warner

62 Beech Rd St Albans Herts AL3 5AT

Walker (Allyn & Bacon) about £6.50

THE M+E COMPUTER PROGRAMMING SERIES ELEMENTARY

ALGOL by Alan Brundritt ISBN 0 7121 0549 2

about £1.25

If there are any members interested in programming in BASIC or Algol I would very much like to correspond with them. At the moment I am working on some games programs.

Also, does any other member know of a cheap way of punching computer cards. I would consider buying a keypunch but my budget is severely restricted as I am still at school. At the moment I use mark-sense programs run at a local Polytechnic, but this is very tedious for long programs.

Nicholas Wright

WHICH WAY TO GO ?

I have a suggestion to make regarding the future direction of the club.

I think it may be worthwhile the club making a name for itself and doing the computer industry a service at the same time by taking up and researching some of the things that the major computer companies are for the moment ignoring.

For example, there is a form of parallelism where the processor is executing different parts of different instructions at the same time; e.g. when it finishes one instruction it may be three-quarters of the way through the next instruction, half-way through the next, one quarter of the way through the one after that and just starting the one after that. The great problem with this technique is dealing with conditional branches, as where to get the next instruction from is not known until the condition can be tested. The solution is to have 2 chains of instructions leading from a conditional branch; one assumes the condition to be true, the other that it is false. Later, one of the chains can be discarded.

To cater for the case where one conditional branch is followed by another there would have to be provision for more than two chains and, of course, the larger the number of instructions executed in parallel (4 in the above example) the larger the number of possible chains.

Manufacturers have left the question of multiple chains for the time being and I think the club could do the industry a service by investigating the practical possibilities.

I think the club has all the talent and experts required for such a project, and I believe that the research should go beyond a theoretical level and should be tested on a practical processor designed to implement the techniques. The processor would either have to be completely designed from scratch like WB or perhaps a bitslice processor could be used (however I do not know how adaptable they are).

Perhaps there are other projects other members can suggest, however I think it would be a good idea for the club to pursue some sort of practical research project.

Graham R Cobb

THIS WAY ?

Thank you very much for the volume 4 newsletters which I received yesterday together with my membership. After reading them I would like to make several points;

- 1) I agree with many people who have written in supporting the development of the WB2. I enjoy the construction of my projects (regardless of complexity) as well as putting the result to good use. The construction of a small computer over a long period (not just getting a MPU kit through the post to be built up over a few days) helps to spread the cost and allows scope for development.
- 2) The articles on MPUs were very interesting, however some short programs showing the instructions being used would be helpful.
- 3) I have found the following books very useful during the course of learning two high level languages;

FUNDAMENTALS OF BASIC PROGRAMMING by Terry M

TREKING

Herewith a progress report on STAR TREK;

So far I have had two letters, which is about 1½ more than I expected. Keep the ideas coming, all are appreciated.

Peter Mabey sent me a listing of 'Super STAR TREK' by Robert Leedom and David Ahl (of '101 BASIC Computer Games fame). He also told me that he and a friend are engaged in translating a dice version for use on their programmable calculators.

Neil Pearce sent in the idea that the prog should be real time - an excellent suggestion. He also suggested a 3D universe, and have the display represent the Enterprise viewing screen. Perhaps this last idea might be difficult (or impossible) to implement without sacrificing some hardware/software/terminal compatibility - but a good one all the same, and I shall consider it, for an advanced version at least. I foresee little difficulty (from the compatibility viewpoint) in implementing the first two ideas.

The actual program will be divided into a series of individual routines and subroutines, each being in one (or more) program files and linked by CHAIN statements. It will be written in BASIC+, with perhaps one or two other features added to shorten the program. I might translate it into some other language (FORTRAN ?) at a later date.

Previous versions have used objects with random (as to sector) positions. This is deplorable as it detracts from the realism (and hence enjoyment) of the game. However, to store the contents of each sector would require far too much memory, which defeats one of the objects of using structured programming. So I have used an idea which was originally put forward in the ACCN (D.J.Andrews, V1 I5 Feb '74) as a means of solving this problem in LIFE programs, namely to store a list of object co-ordinates, stored according to object type. According to my calculations, I should be able to get by with about 500 (or 750 at a pinch) list elements - as opposed to 262,144 (256k) sectors for a 64x64x64 galaxy! The only computers I know of with anywhere near this amount of memory (and don't forget I have to get the program in as well!) are the enormous CDC 6600/7600 machines, and these are meant for running 100 or so programs simultaneously.

To make the game as realistic as possible, I am basing it upon actual episodes. This involves 'research' in the books by James Blish and Alan Dean Foster. Perhaps when (and if !) I finish the project I might serialise it in the ACCN.

R.J.Baker 54 Brixton Rd., London SW9 6BS

Wanted for future generations!

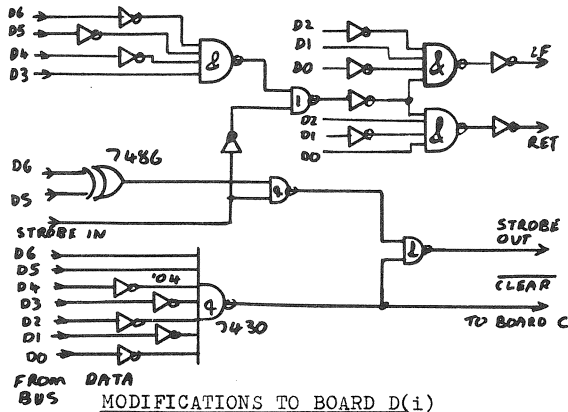
We are desperately looking for computer equipment to be used in Technical Colleges to help in the education of the next generation of computer designers and users. With little or no budget for buying new equipment we are appealing on their behalf to the affluent industry for any unwanted teletypes (working or not), peripherals, paper tape equipment, circuit boards etc that can be put to good use by enthusiastic students.

If you can help please contact Bill Gledhill, Editor, Systems International, 106 Church Road, London SE19 2UB.
Tel: 01-771 3614.

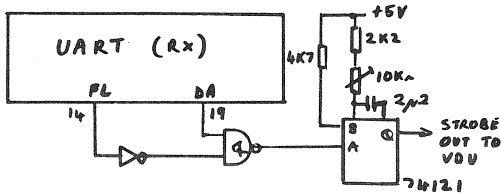
ETI VDU PLUS²

Here are two modifications to the ETI VDU MODS printed in Iss 5. The mod to board D(i) (Fig 3) is very useful;

- 1) To prevent control characters being printed
- 2) To prevent other codes starting 11xxxx from clearing the screen



The 7486 and the 7430 and additional inverters are included to prevent control characters from being written onto the VDU screen.



ALTERNATIVE FOR UART RECEIVER

The 10K preset is adjusted so that all characters are correctly received and none are missed.

Dave Howland

BOOKS UP

Just a short note to tell you that the books I recommended have almost doubled in price in the short time since I bought them, (approx 15 months) Mathematical Puzzles and Diversions now costs 60p and More Mathematical Puzzles and Diversions now costs 70p. My apologies to anyone who was inconvenienced.

P Rutherford

SOME NOTES FOR VEROBOARD USERS

The most important thing about using Veroboard is to throw away the tool Vero recommend for cutting the Cu tracks. The problem with this method is that it wastes space, is slow, and isn't reliable.

A better method is to use a Stanley knife and to cut a narrow gap between a pair of holes. This saves space and time and produces a cleaner cut than the other method.

It is useful to arrange chips of similar length and to use the nearest whole track at either end for the power supply rails.

Usually the most convenient number of holes to be left between chips is 6 and is never less than 4. If a row of chips has a large number of signals in common it is a good idea to leave a whole track for each signal (i.e. function bus on a bit slice system).

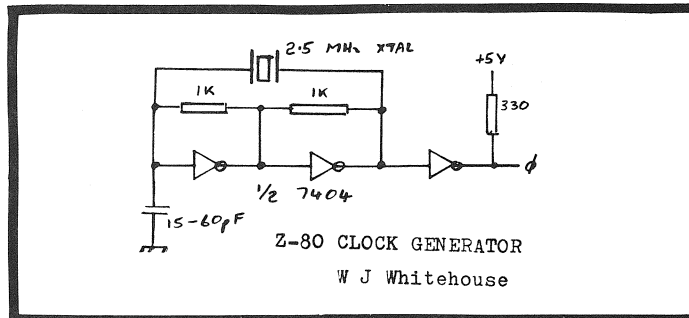
For short connections, i.e. power or even from one row to an adjacent row, uninsulated tinned copper wire can be used. It can be straightened by just

slightly stretching it. Very short lengths can be bent using a pair of pointed nose pliers marked to give spacing of 0.1, 0.2 inches etc.

28 gauge is a convenient thickness, it is also the thickest gauge you can get two wires into one hole. A piece of silicon rubber tubing is useful for holding the wires in place whilst soldering them in.

For other connections the best wire I have come across is the Kymar covered silver plated solid wire as sold by RS Components.

J S Florentin (G8AVQ)



EDS BIT

Have had a couple of queries from members about Byte subscriptions. It seems that if you subscribe directly to Byte USA, they can take 2 - 3 months to reply, although after that the magazines come through regularly. Also, a couple of members have said that they have had some difficulty in trying to subscribe via the UK agent (J.Remizo), although I do know of some people who have successfully gone through him. Could we have some feedback from members please, and if there does appear to be a real problem then perhaps the ACC can raise the matter with Byte.

Having run out of back copies of Vols 1, 2 & 3, we are now loaning out the library copies - drop me 15p stamps per Vol to cover postage & I'll put your name onto the queue (UK members only please).

As reported elsewhere in this issue, the extraordinary general meeting decided to raise the membership fee for the year 1977/8, in part to cover the effect of inflation on the cost of producing the newsletter, mainly to give the club a financial base for activities such as participation in the RSGB exhibition, possibly hiring premises for a 'junk' sale, etc. These extra activities will be discussed further at the AGM, so please do come along, or if you can't then drop us a note. (And - don't forget to renew your membership ASAP !)

Mike Lord

BOOKLIST

MICROPROCESSORS & MINICOMPUTERS

B.Soucek J Wiley & Sons New York 1976

INTRODUCTION TO MICROCOMPUTERS & MICROPROCESSORS

A.Barna & D.I.Porat J Wiley & Sons N York 1976

DIGITAL COMPUTER USERS HANDBOOK

ed; M.Klerer & G.Korn McGraw-Hill 1967

COMPUTER HANDBOOK

ed; H.Huskey, G.Korn McGraw-Hill

ON-LINE COMPUTING

ed; W.Karplus McGraw-Hill

WB CORNER

SEQUENTIAL UP/DOWN LIGHT FLASHER

Steps DATA lights sequentially either;

- Left to right repeated
- Right to left repeated
- Left to right / right to left alternately

Step interval about 1/2 sec.

Entry 005

Start - lights step left to right repeated.
 At any time, setting the MSB switch will cause the direction of stepping to alternate.
 Unsetting the MSB switch will cause the direction of stepping occurring at that time to continue.
 G D Hayes

LOC	CODE	SOURCE STATEMENT
003	000	GT HLT
004	076	ADDR DEF 076
005	150 104 004	L1 MOV 104, @ADDR
010	041 004	INC ADDR
012	037 005	GCC L1
014	050 030 376	MOV 030,376
017	050 024 377	MOV (L2),377
022	110 001	MOV 001,A

024	041 003	L2	INC CT
026	033 075		GNZ L3
030	107	SHL	SHL A
031	037 024		GCC L2
033	210 001 004		MOV 001,ADDR
036	053 200 004		AND 200,ADDR
041	056 200 004		BIT 200,ADDR
044	033 061		GNZ MOV
046	057 106 030		CMP 106,SHL
051	032 065		GIZ MOV+
053	050 106 030		MOV 106,SHL
056	050 200 062		MOV 200,MOV+001
061	110 001	MOV	MOV 001,A
063	030 024		GTO L2
065	050 107 030	MOVX	MOV 107,SHL
070	050 001 062		MOV 001,MOV+001
073	030 061		GTO MOV
075	104	L3	TST A

WB +

I built WB1 last Summer/Autumn. I soon wanted to extend it, but it seemed that there would be no WB2. So, I had to design my own modifications.

My first aim was to increase the addressable, useable store. I am now trying to add 1 or 2 'accumulators' which are not destroyed by subsequent ops.

8 bits can only address 256 words. I did not want the expense of making WB1 16 bits, so I decided to widen the PC in effect. The most significant 8 bits were in fact just a register as a data port. This register was readable and writeable, and effectively (using 2101's) selected which 256 word block was addressed.

This obviously gives a 64k address space, and any part of it could run programs just the same as any other (if there was that much store, which there isn't!). This register is called the Permanent Memory Select (PMS) reg. By writing to this register a program could jump to another memory block, but it would enter it at (PC + 1). Thus the Address (A) reg was added, readable and writeable.

Now, when PMS is written to (changing the memory block) the contents of the A reg are loaded into the PC. Now a program can jump anywhere in the 64k space to any address.

One more problem; how about reading/writing a "not-in-this-memory-block" address? Need another register, Operand Pass Memory (OPM) and a dummy reg. (D).

Now, when address D is detected, and for the duration that the D address is on, we cut off the PMS reg., and allow the OPM reg to select the memory block, and we cut off the D address, and put the A register contents onto the A bus. Thus store line (Areg) in memory block (OPMreg) is accessed. When the store access cycle finishes, then the OPM reg. and A reg. are taken off, PMS selects the memory, and PC selects the address as usual.

So now we can;

- 1) Jump to and from any location in 64k
- 2) Read from and write to any location in 64k
- 3) Run programs from any location in 64k

n.b. the A reg is used for new memory entry address and operand passing.

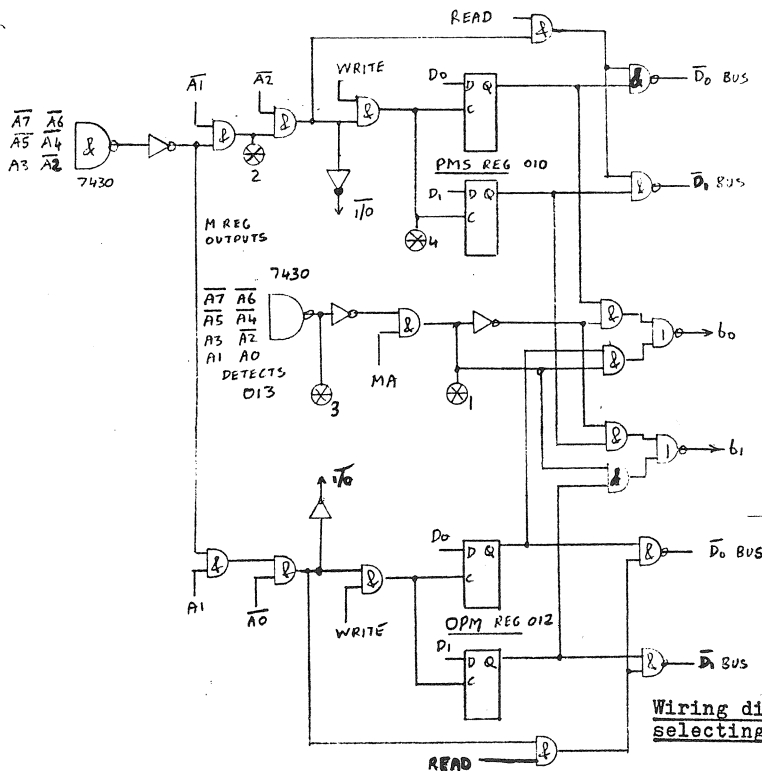
I have made PMS reg @ 010
 A @ 011
 OPM @ 012
 D @ 013

CODE EXAMPLES

To change from M_0 to M_2 , and to enter M_2 at location 200

M_0

```
MOV #200 Areg
MOV #002 PMSreg
the next instruction read comes from (200) $M_2$  etc.
```



These selects would be present for each bit of the registers, easily expandable.
 Do a decode on these two bits to select between $M_0 - M_3$

Wiring diagram of the loading, reading and selecting between registers PMS and OPM

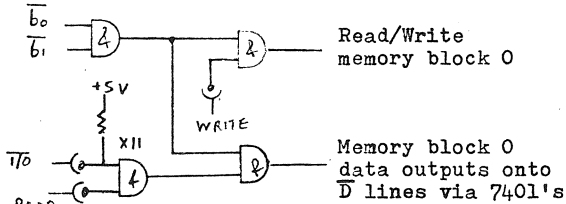
To read/write at store line 200 in M_0 from M_2

```

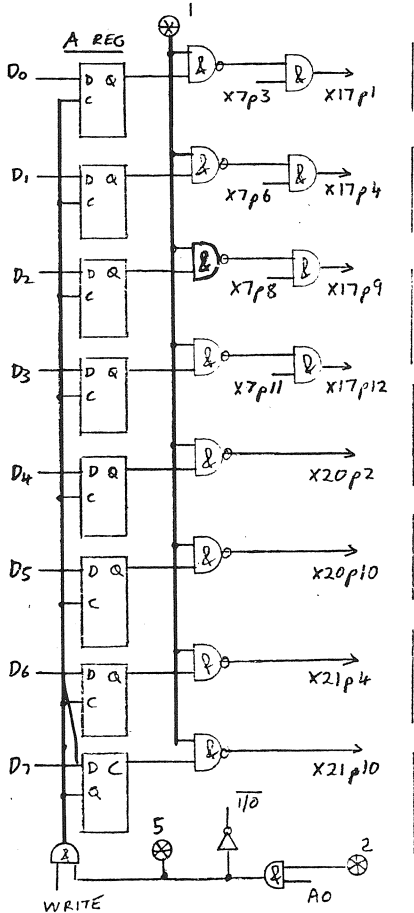
M2
MOV #200 Areg
MOV #000 OPMreg
MOV Dreg A (or MOV A Dreg)
  
```

It is worth noting the following points;

- 1) It is often not necessary to write to the OPM reg, as the non-local accesses are often to the same non-local block, e.g. planting compiled code.
- 2) The readability of all registers is important as this enables the INC X instruction to be used, e.g. on the Areg, again for planting compiled code, or accumulating data read from a cassette.
- 3) I have only done the two least significant bits of the PMS and OPM reg as this is more economical (1 7475) and gives a 1 out of 4 select for 4 pairs of 2101's = 1k. It is very simple to expand (up to 64k!).



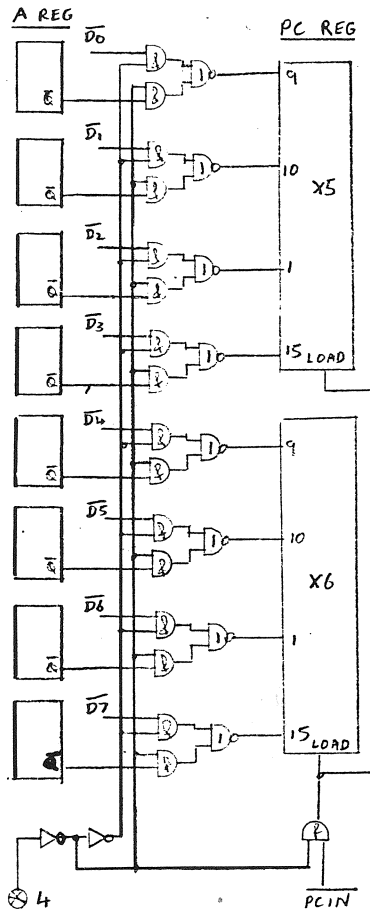
Wiring diagram - example of use of b_0, b_1 to select M_0



Wiring diagram of A reg (011)

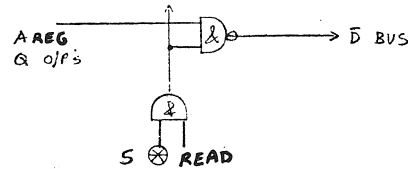
This is a bit tricky because;

- 1) The Areg outputs sometimes go out to the A bus instead of the M reg outputs.
- 2) The Areg outputs sometimes are loaded into the PC therefore selects are needed on the PC inputs.
- 3) In the diagram above there is spare capacity in X20 and X21, so selects are only needed for the 4 least significant bits.



Wiring diagram of loading Areg into the PC

I think that is about it, except that the Q O/P's of the Areg are fed to 7401's as below to make the Areg readable;



WIRING

All this was planned and done over a period of about 8 weeks. It certainly wasn't all planned before hand, so sort of grew as I did it! Because of this I make no claims as to the efficiency of the wiring. I am sure it can be improved to some extent because I work naturally using AND/OR gates, and WB 1 was done in the main using NANDs etc. Because of this I found myself using a lot of NOTs.

I would like to thank all who designed WBL. It is easier to modify someone else's hard work than to do the hard work in the first place. Lastly, it is all working well with my WB, and I am now pressing on to a keyboard (Sperry Gyroscope) and a tape store.

R H Stopford

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