

## C O M P L E M E N T A N D C A D D

APRIL - MAY 1979

No. 2

### NEWS

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## USING BOOLEAN ALGEBRA

A quick glance through the SC/MP instruction set will describe such goodies as 'Exclusive or' (not used in rowing)

'Rotate right' (not a dance step)

This page will help you decide when you need to use any particular instruction within your program.

Instructions come under two main types :- single byte and double byte. The only difference really is that the double byte instruction needs an extra operand, that is to say that the first byte cannot supply all the information.

Take an add instruction; If you want to add 20 to your accumulator or you would code F4 (load imm.) and then follow it with the second byte - 20.

### AND

The and instruction appears in both single and double byte formats, but this just means for single byte instructions the op-code on its own is enough.

The and function compares the accumulator with the contents of a memory location, or the extension register.

Where corresponding bits are set to 1, a 1 is left in the accumulator. That is, both bits must be 1 for the result to be 1.

E.g. 53 (0101 0011) and 29 (0010 1001) is 01 (0000 0001)

So already we've covered 10 possible op-codes!

One is AND IMMEDIATE which 'and's the acc. with the second byte of the instruction. Another is AND EXTENSION which AND's the accumulator with the extension register.

The remaining 7 cover the possibility of wanting the operand to be contained someplace in memory.

If for instance you want to and with the contents of OB66 you could do it by setting up register P2 to contain OB66 (Load OB XPAH Load 00 XPAL) then all you do is add the pointer no. to D0-the base code, arriving at D2, and follow it by the 'displacement' - 66.

If you used P3 (there is no law against it), then code D3.

### OR

The OR instruction appears in all the formats of the 'and'. It compares the accumulator with a second operand (extension reg. or contents of some address or an actual number) and leaves a 1 in the accumulator wherever at least one corresponding bit was set. E.g. 47 (0100 0111) OR 21 (0010 0001) gives: 67 (0110 0111)

### EXCLUSIVE-OR

As above for OR except that each corresponding pair of bits must be different for a 1 to be set in the result.

E.g. 37 (0011 0111) XOR A5 (1010 0101) gives 92 (1001 0010)

### USING BOOLEAN ALGEBRA CONTD

So what use are these weird logic functions?

Well, for a start don't forget that the SC/MP works on 8 bits at a time. It will quite happily add together lots of 8 bits, or store/load a byte.

But how do you breakdown a byte? Well the method is to use our new-found knowledge in Boolean Algebra.

To isolate a bit/bits we have the and function to mask out the bits we want. So if we just want the least significant bit of the accumulator, e.g. as an odd or even test, we can and immediate with 01. This leaves us with either 0 or 1 in the accumulator, the other bits have been wiped out.

To force a bit to appear we must use the OR facility e.g. to make sure the flags are set we must or the status register with 07 - leaving the other bits as unchanged.

To invert a bit within a byte, use EXCLUSIVE-OR, leaving the corresponding bits-to-be-changed as 1.

Another major use of EX-OR is the comparison of 1 byte with another.

If we want to find out if the accumulator contains, say 28, all we must do is ex-or with 28 and test for 00 (00 when 28).

If some of these are not clear, then experiment with the machine or on paper.

Programs are usually littered with operations of this kind (can you see why D4 OF is useful), and the lack of them in Higher level languages (e.g. Basic, Cobol) provides at least one reason for their less efficiency.

A later article will be concerned with rotating/shifting and the various addressing modes available.  
You can never get away from using AND/OR/etc, after all, the SC/MP is really one large TTL package!!

### TWONKY CONVERSIONS FOR MK14

The hardware does not need to change, though I just used a NE555 oscillator connected to Sense B.

Luckily the program has been written inefficiently, and we can gain an extra two bytes.

The program occupies OBOO-FF and uses OF00-FF as the tune playing store. An earphone or amplifier should be connected to Flag0.

OBO1 C4 OF , OB09 CA 00 (mistake) OBOB C4 OB , OB19 C4 OF,  
OB50 E4 07 , 98 05 , E4 07 32 90 B8 C4 EF 32 C4 OB 35  
OB5F C4 OF , OBB2 C4 OB , OBEE 08.  
Exec. OBOO.

### ENOUGH POWER?

I used to have power supply problems - transformer or regulator over-heating, but since have invested in an ex-equipment 5V supply. The ad claims to the supply provides 5V or  $7\frac{1}{2}$ V at 10A, though I doubt I've exceeded 3A.

The advert was still in the last ETI - the cost? £5.50 postage £1.25., which seems quite reasonable. The firm is Canon Components, 322,324 whitehorse Rd, Croydon, Surrey, CRO 2LF. 'phone 01-684 9872.

### QUICK INPUT ROUTINE

The following routine saves time by allowing you to enter programs without the tedious Mems-Terms.

It can be loaded into any part of memory, and lets you enter a program into 0?12-FF. The first 12<sub>16</sub> bytes are used by the monitor. It does not show the address being incremented but just a slight flicker for half a byte and a longer flicker for a whole byte. ABORT pressed at any time will terminate the program and give you the last location used. So to start at 0F12, this value will be 11.

Start B00 nn First loc'n - 1. i.e. last loc'n used.

B01	half-byte	
B02	C4 0F 36	P2 high gives program area, change as
B05	C4 00 32	needed.
B08	C4 01 37	
BOB	C4 3F 33	P3 points to monitor routine.
BOE	3F	Jump to monitor to await number.
BOF	90 FD	Ignore command keys!
B11	8F 66	Small delay.
B13	40 C8 EC	Put number pressed into half-byte.
B16	3F	Get low part of number.
B17	90 FD	Ignore if not no.
B19	C0 E7	Get half-byte.
B1B	1E 1E 1E 1E	Turn it round the right way.
B1F	58	(classic example of <u>OR</u> ) or extn.
B20	01	Remember the complete no. in extn.
B21	A8 DE	Get nn - next location in this block.
B23	32	Set up P2 to this loc'n.
B24	40 CA 00	Put number input into next loc'n
B27	8F FF 8F 77	Longer delay - indicates whole byte.
B2B	90 D5	Back for next byte!

Obviously its easier to miss out a byte using this method, so to insert a byte use the routine:

C6 01 01 CA FF E4 88 9c F7 where OFFB,C points to the loc'n and the program is terminated by 88.

To remove a byte : C6 01 cA FE E4 88 9c F8 3F , where as above OFFB,C points to the right place and the prog. ends with 88. Note 3F should have been put after the first routine (sorry).

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I.e. step 1 shows 'OFxx xx'

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See you next newsletter!

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[OCR version with checked hex code]

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