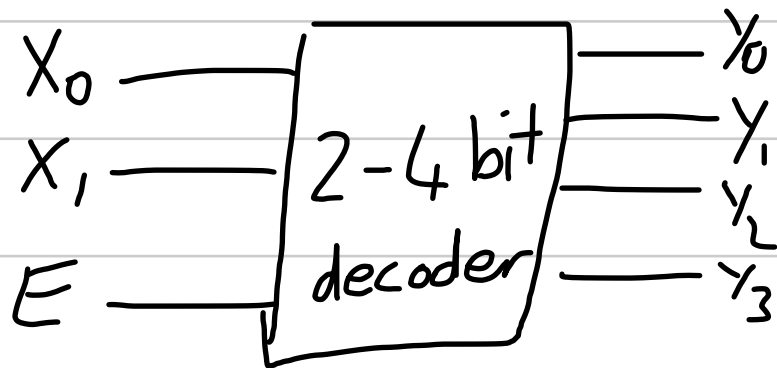


24 AUGUST 2011

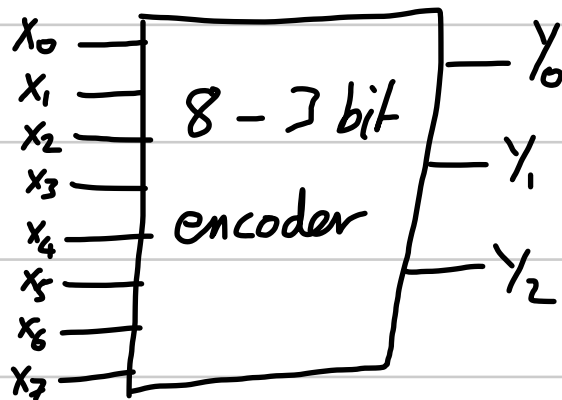
DECODER



Only 1 high

ENCODER

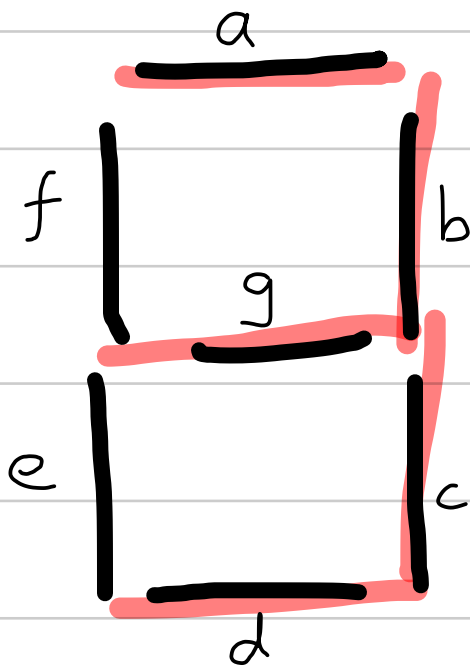
Only 1 high



PRIORITY.

BCD - BINARY CODED DECIMAL

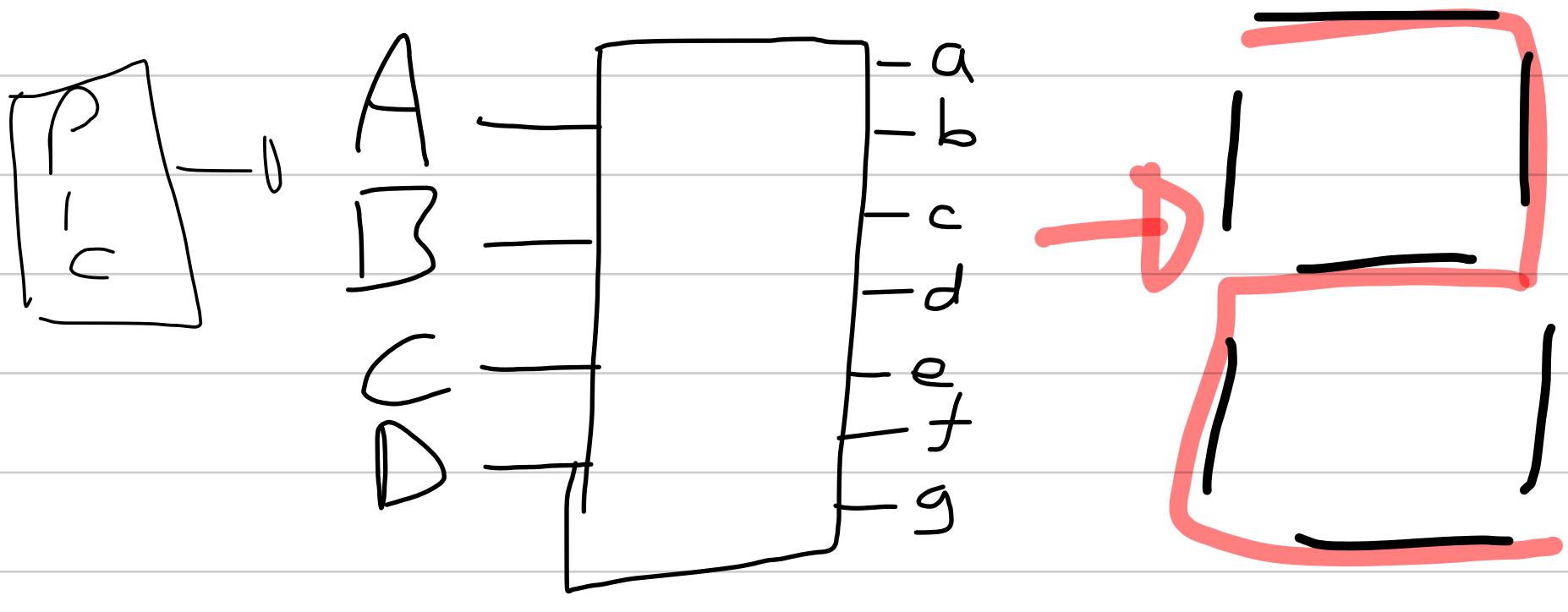
Driving LCD displays - 7 segment display



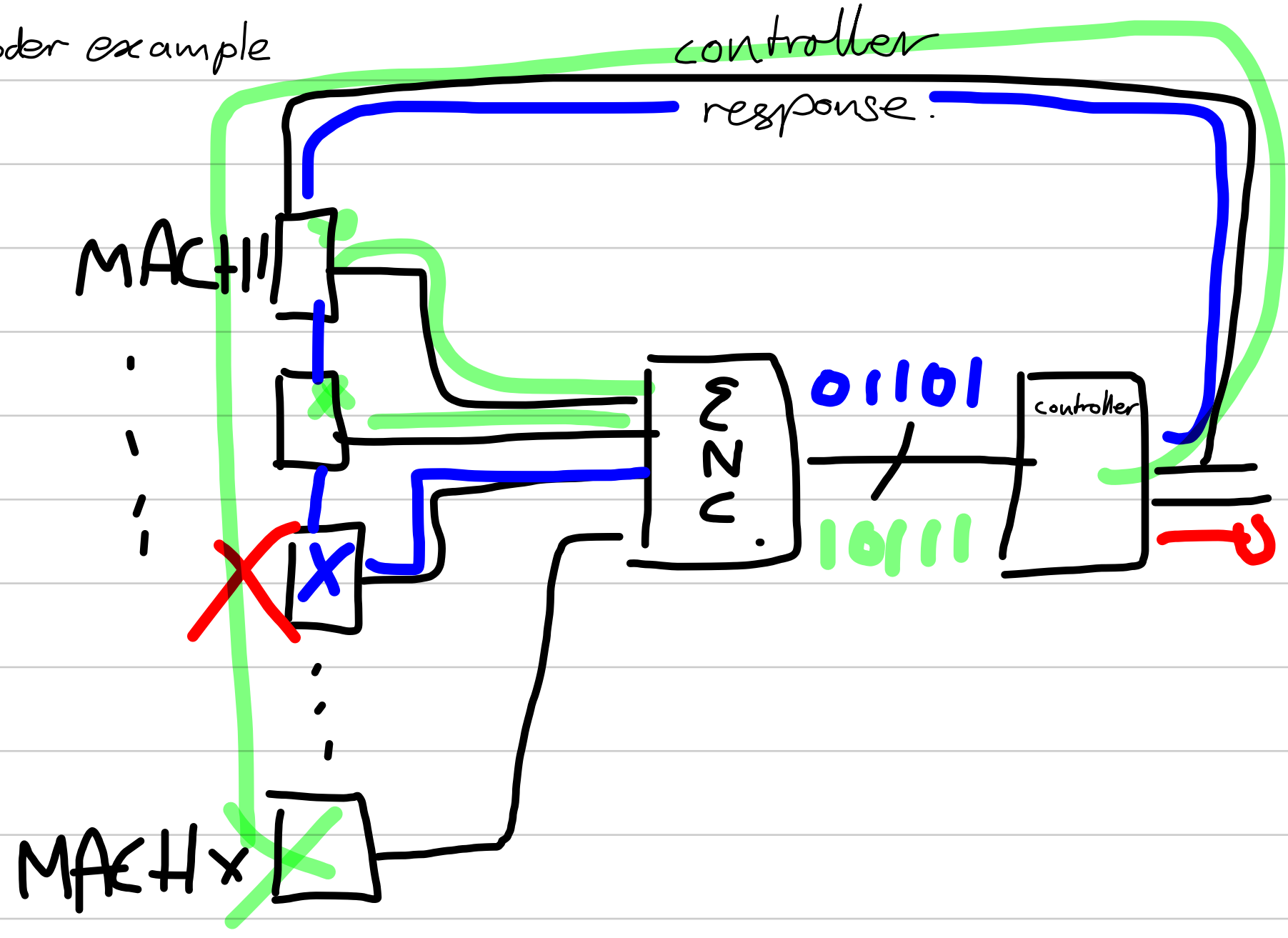
Dec	a	b	c	d	e	f	g
0	1	1	1	1	1	1	0
1	0	1	1	0	0	0	0
2	1	1	0	1	1	0	1
3	1	1	1	1	0	0	1
4	0	1	1	0	0	1	1
5	1	0	1	1	0	1	1

etc.

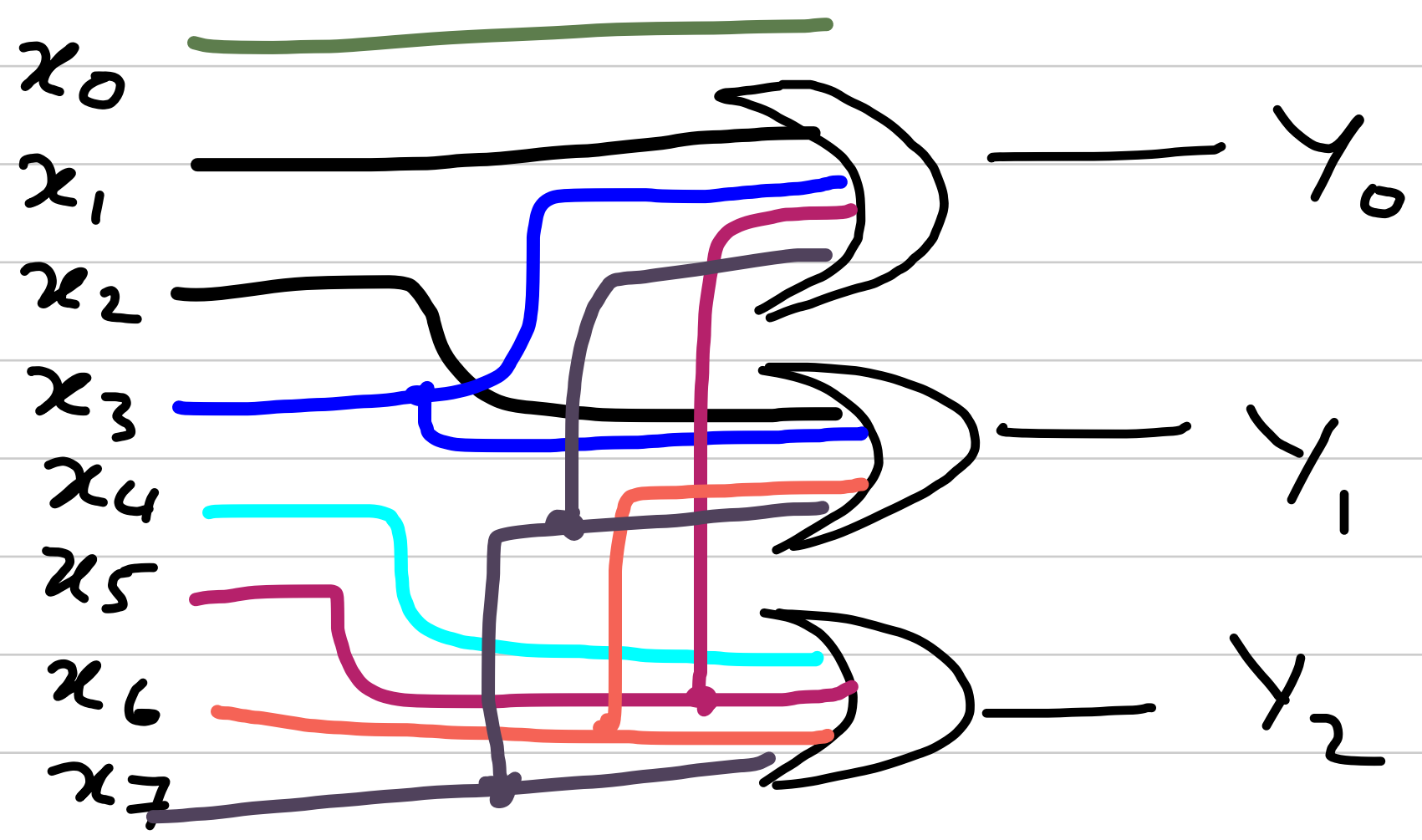
BCD - cont.



Encoder example

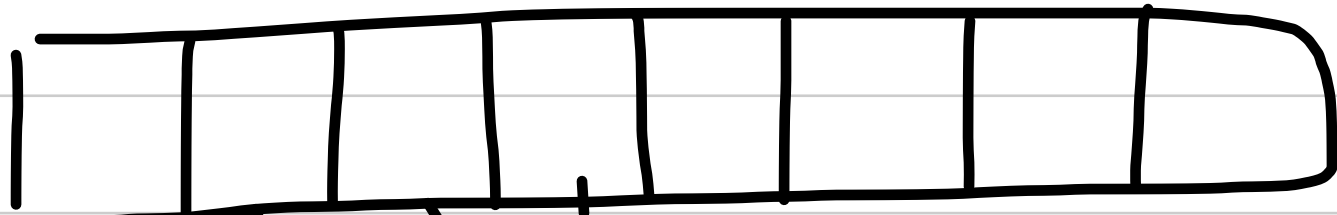


Gated circuit diagram of encoder

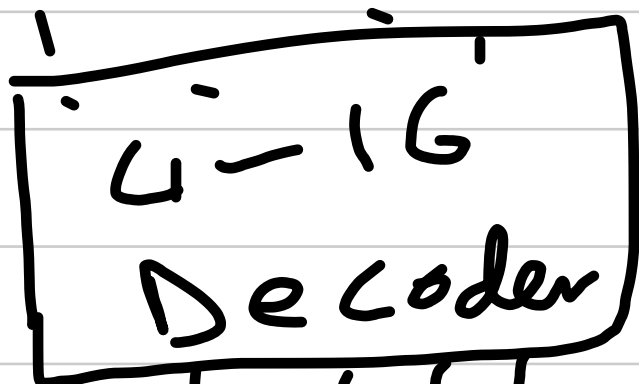


Decoder Example

INSTRUCTION

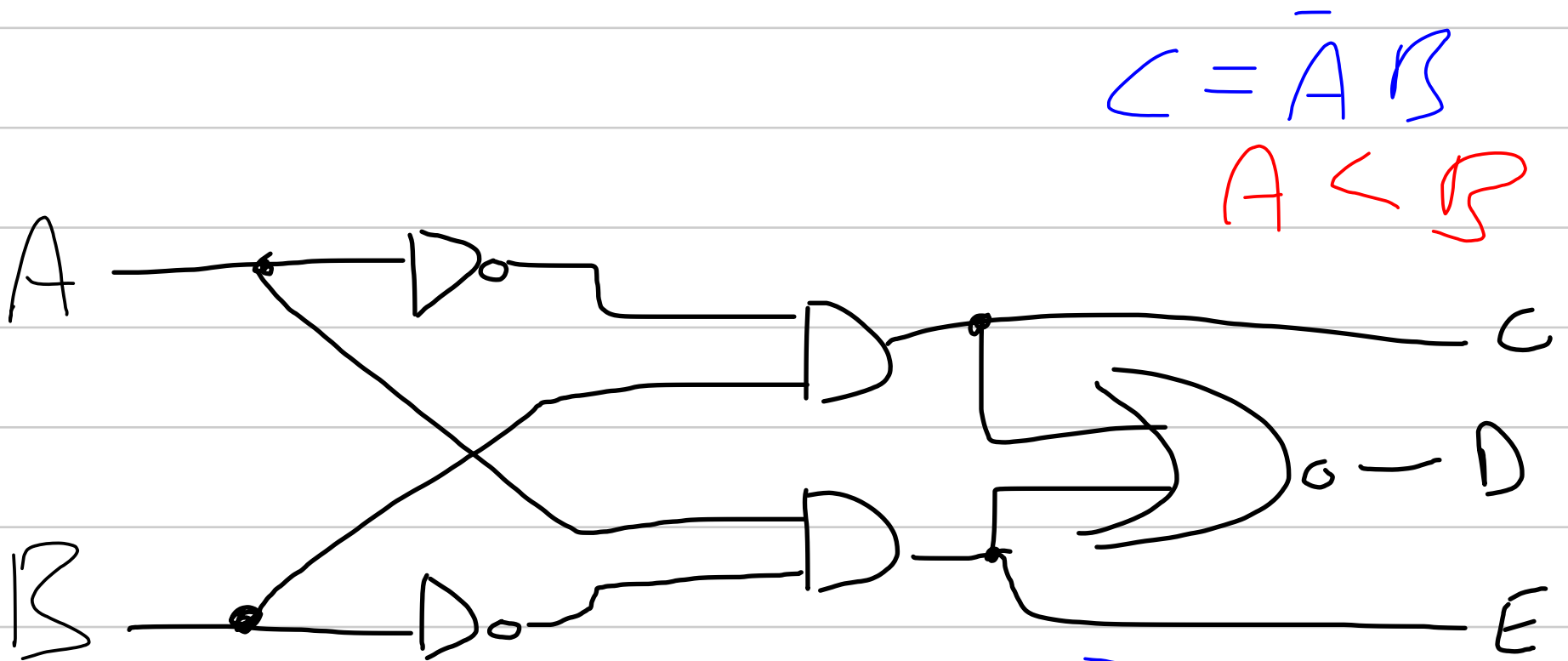


OPCODE



Load
jump
add.
store.

2 BIT - COMPARATOR



$$C = \bar{A}B$$
$$A < B$$

$$D = \bar{A}B + A\bar{B}$$
$$A = B$$

$$E = A\bar{B}$$
$$A > B$$

31 August 2011

→ Comparators

2 bit comparator → TRUTH TABLE

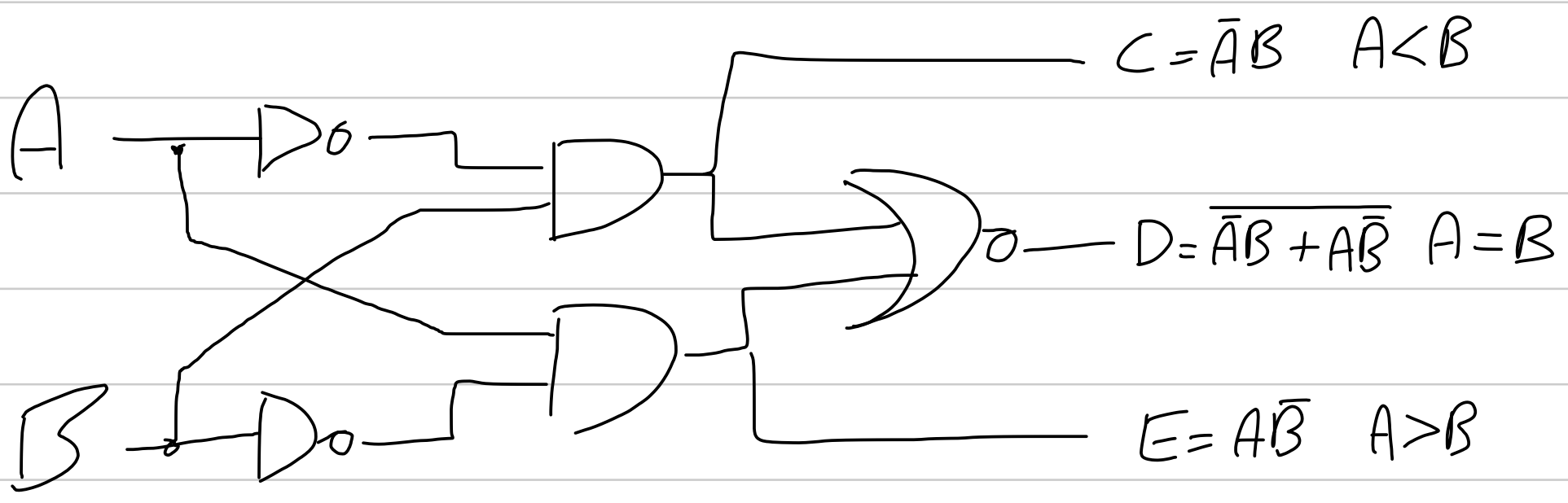
4 bit magnitude comparator

→ Adders

Half - Adder

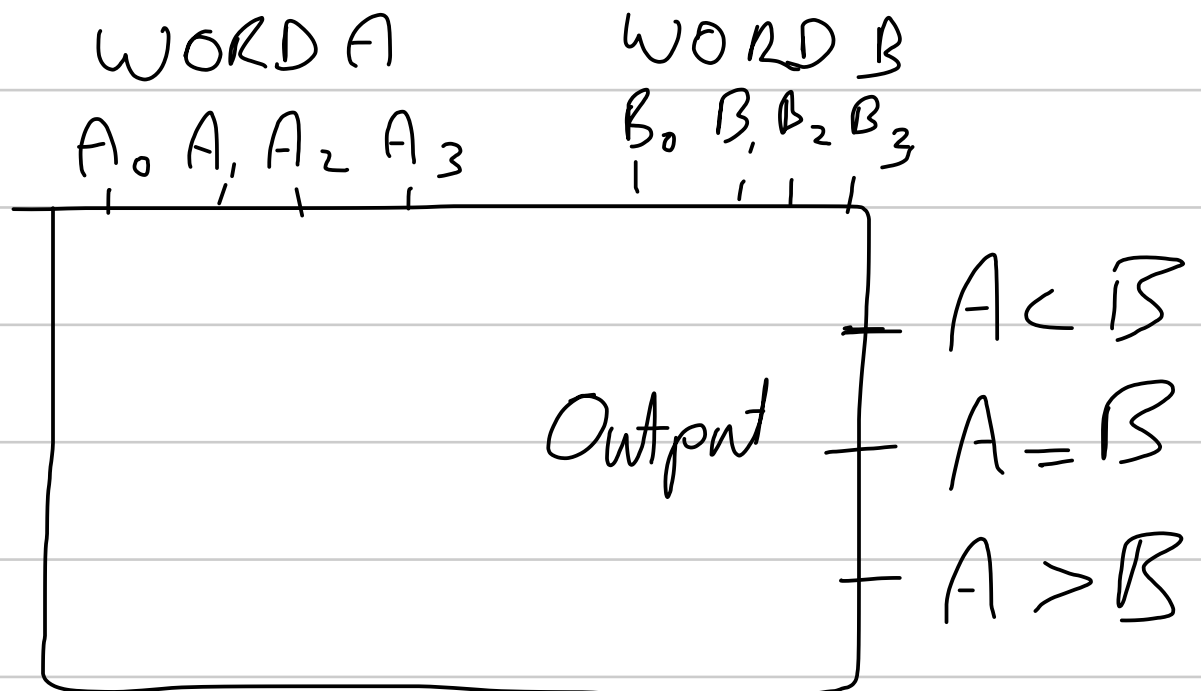
Full - adder

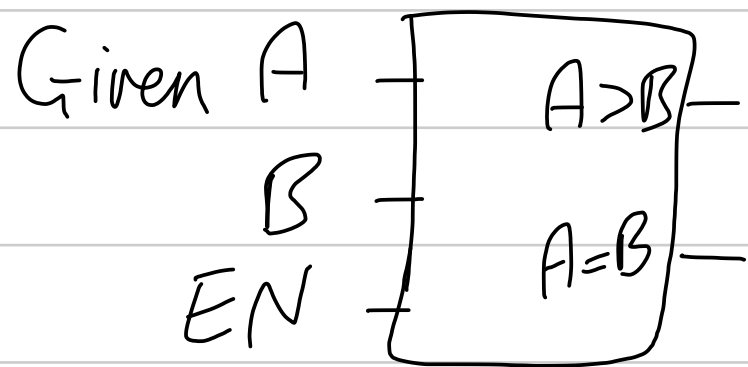
Comp-Recap.



B	A	$A > B$	$A = B$	$A < B$
0	0	0	1	0
0	1	1	0	0
1	0	0	0	1
1	1	0	1	0

4 bit - Magnitude comparator

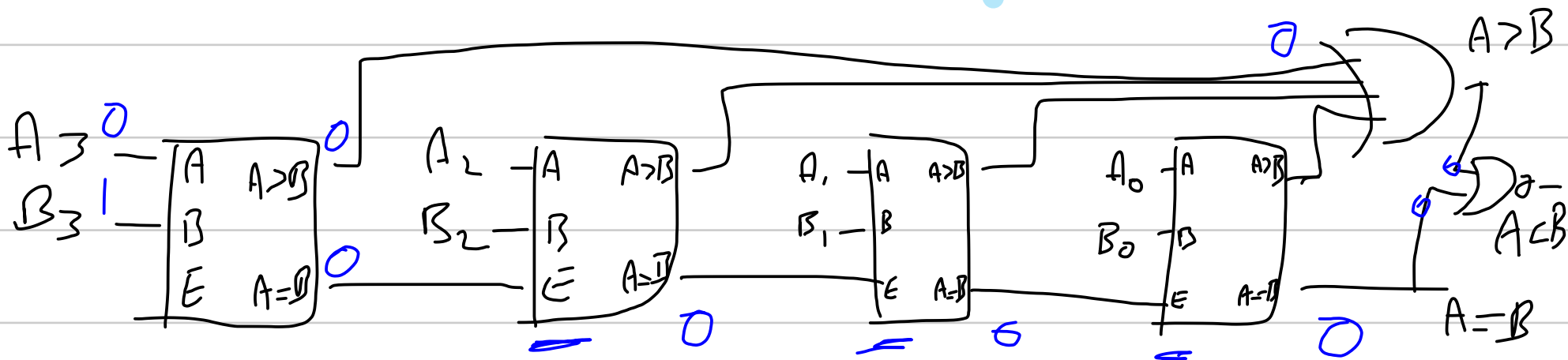




Build a 4 bit comparator

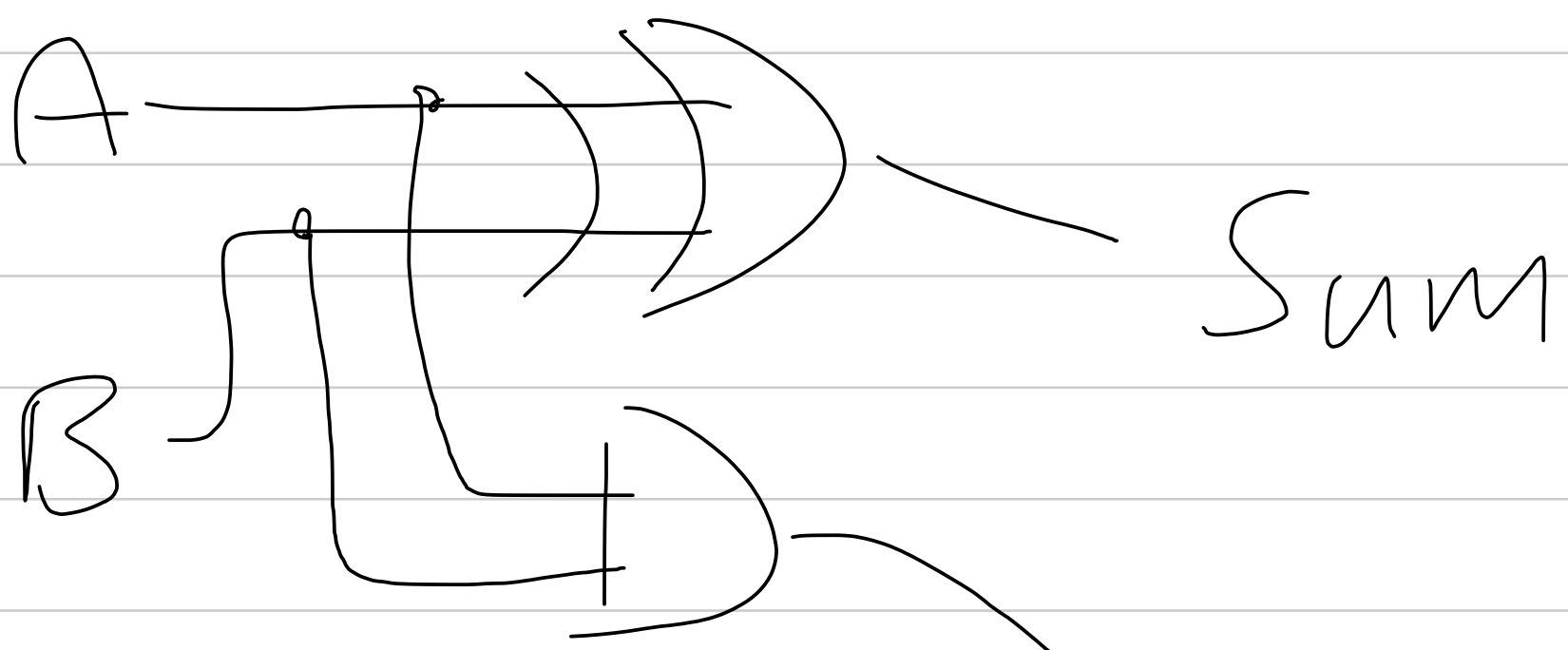
$$A = A_3 A_2 A_1 A_0$$

$$B = B_3 B_2 B_1 B_0$$



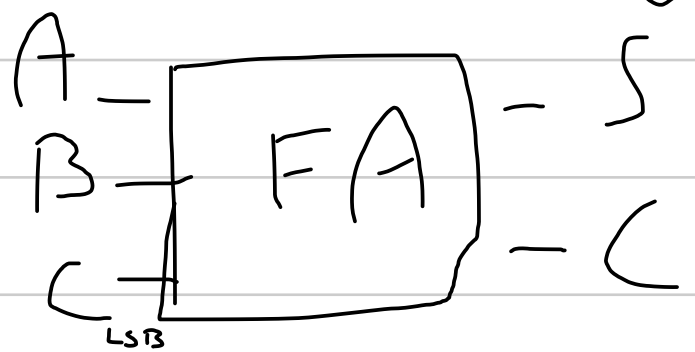
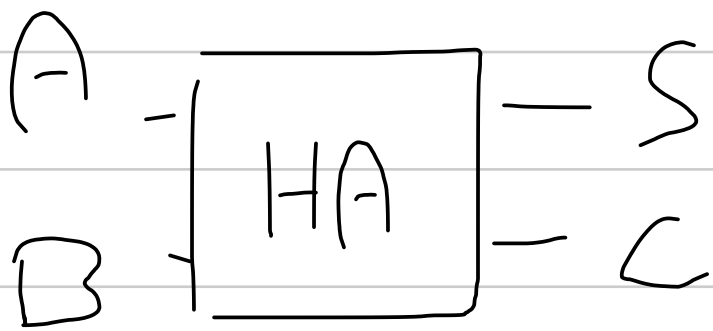
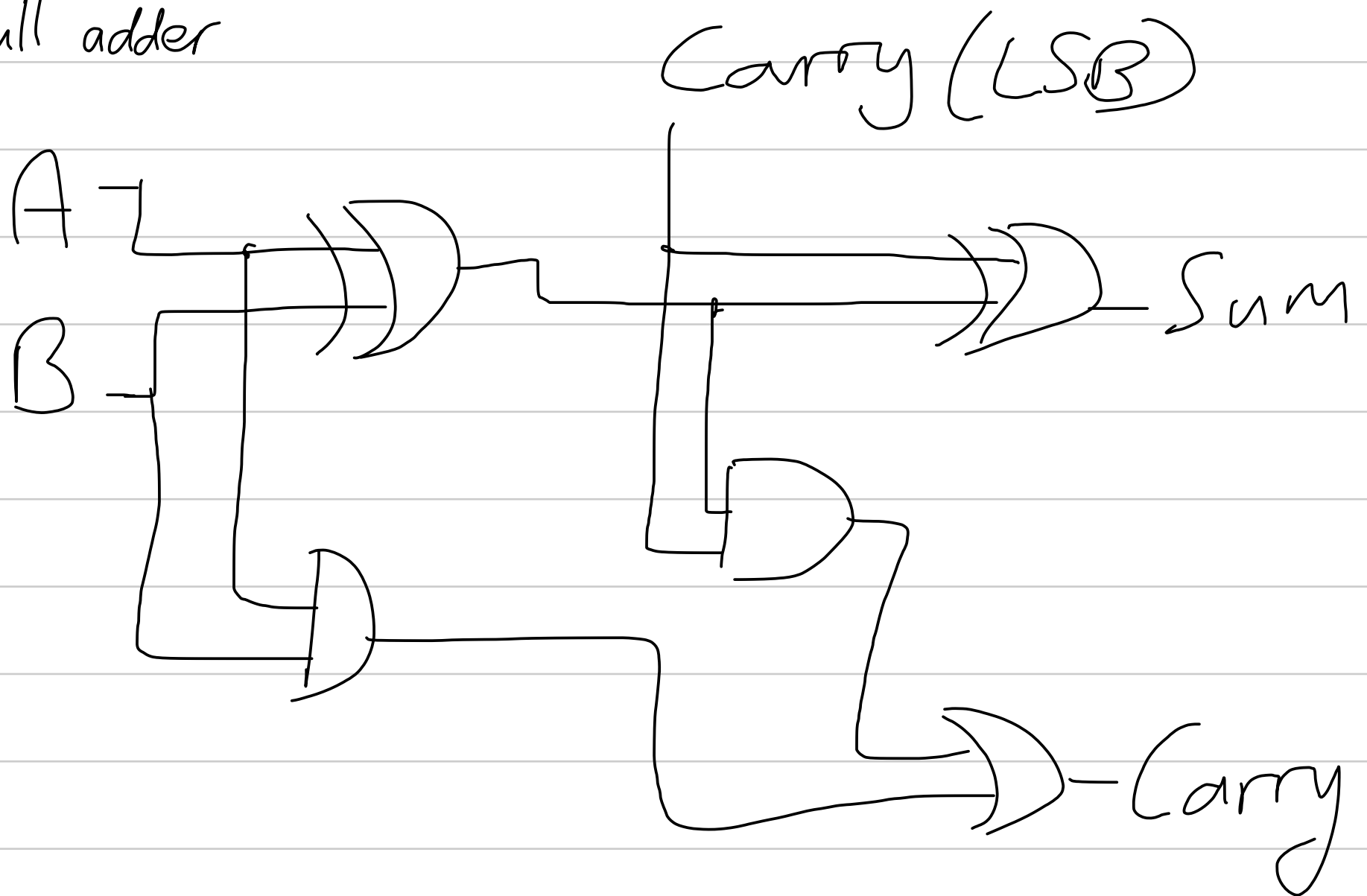
A	0	1	1	1
B	0	1	0	1

Half adder



A	B	S	C	Carry
0	0	0	0	
0	1	1	0	101
1	0	1	0	+ 011
1	1	0	1	<hr/>

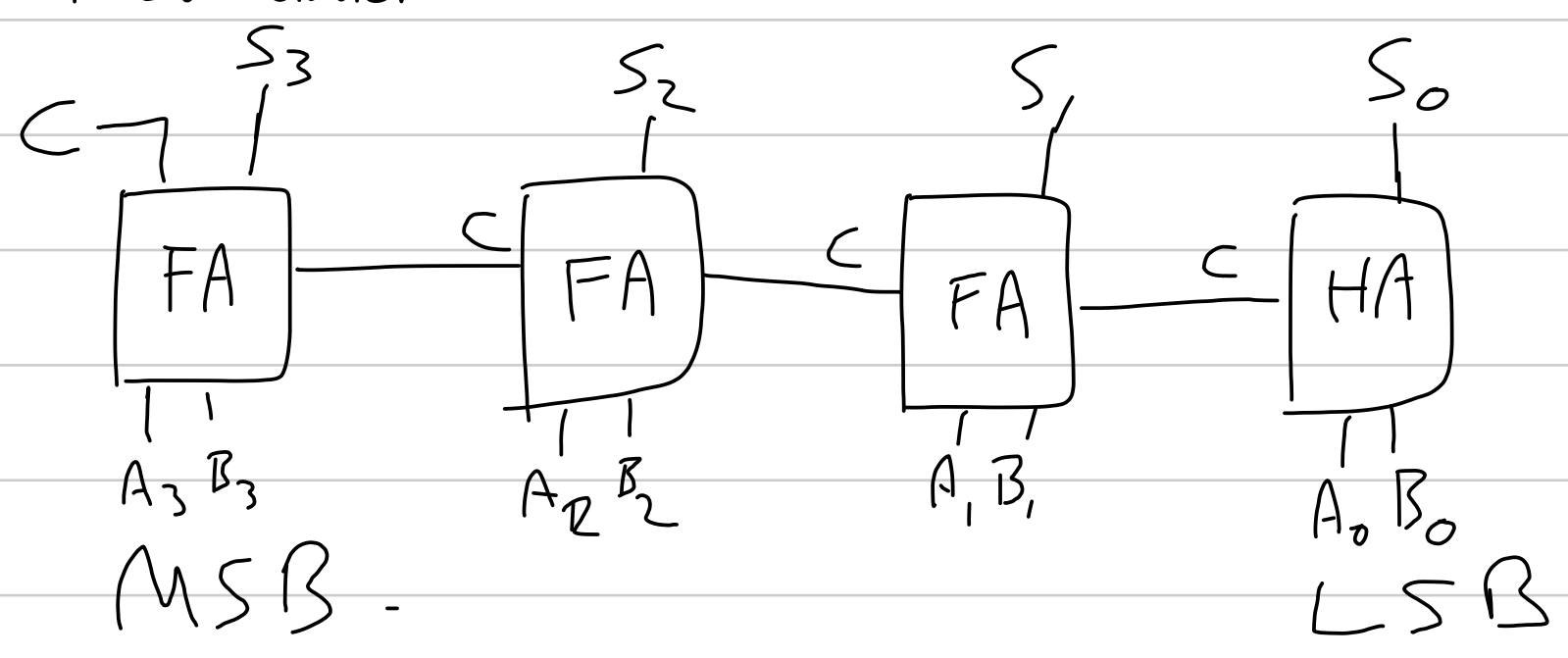
Full adder



Full adder



Create a 4-bit adder



7 September 2011

Recap:

half & full adder

4 bit \rightarrow 2 number adder

Multi-bit comparators.

NEW \rightarrow

Subtractor

Multipliers

Parity

$$\begin{array}{r}
 A = 0110 \\
 B = 0011 \\
 \hline
 A+B = 1001
 \end{array}$$

$$\begin{array}{r}
 0110 \\
 - 0011 \\
 \hline
 \rightarrow
 \end{array}$$

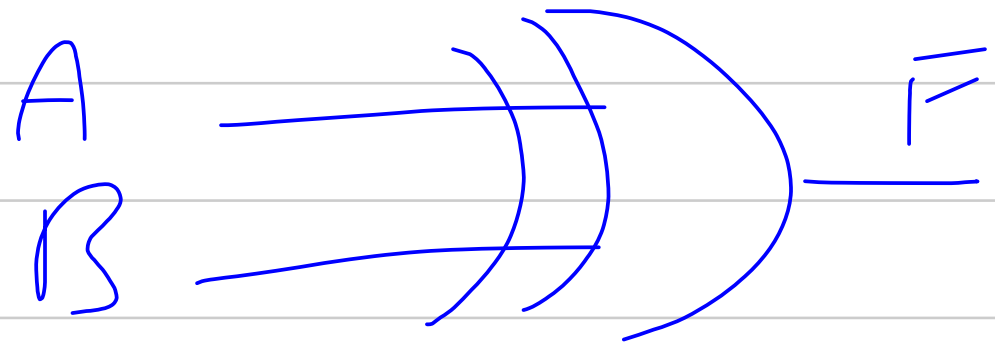
$$\begin{array}{r}
 0011 \\
 \hookrightarrow 1100 \\
 \hline
 1101
 \end{array}$$

$$\begin{array}{r}
 0110 \\
 1101 \\
 \hline
 10011
 \end{array}$$

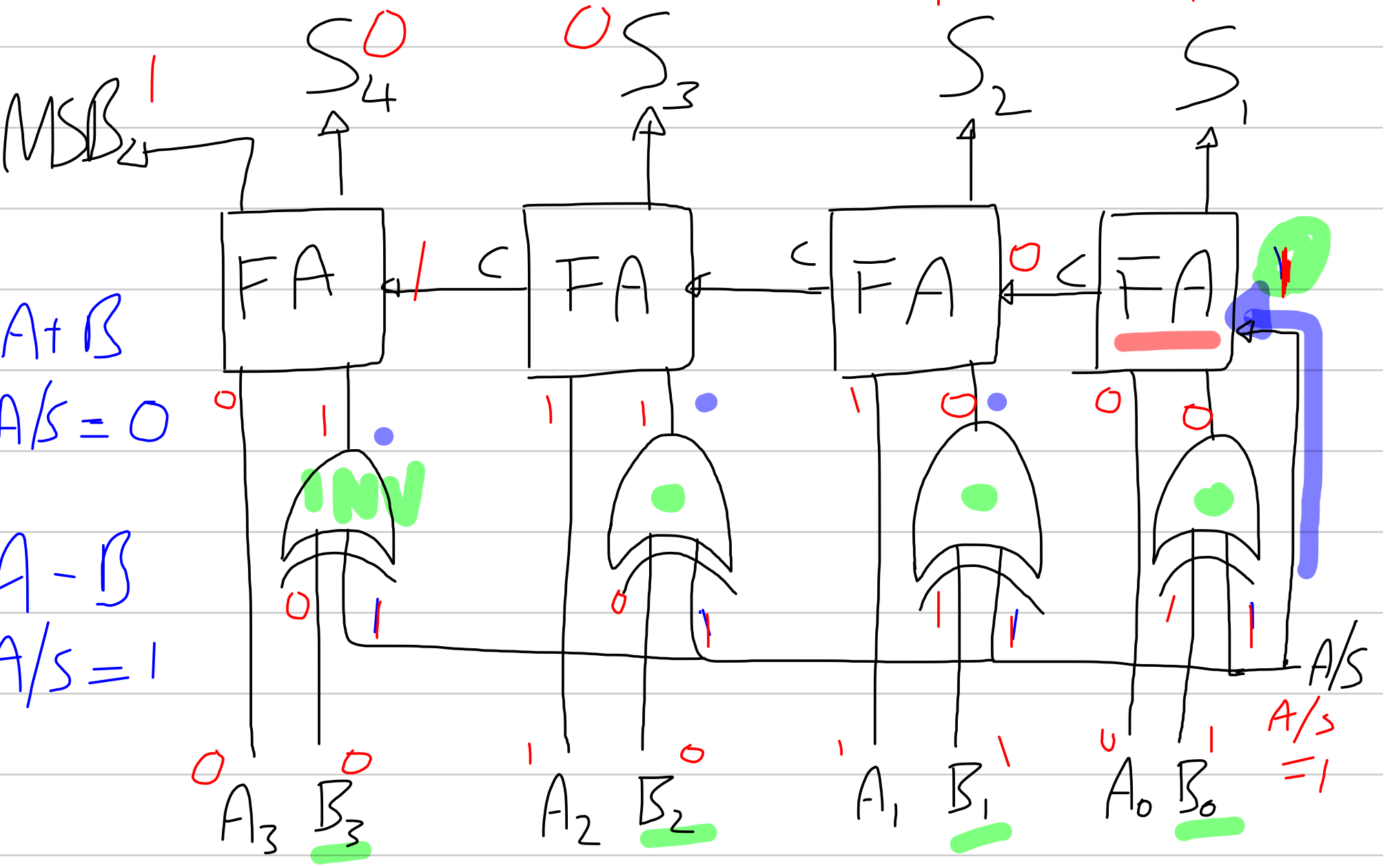
Subtractors!

2's compliment \rightarrow how?

What gate component can be used?



A	B	F
0	0	0
1	0	1
0	1	1
1	1	0



Multipliers

Multiply by 2?

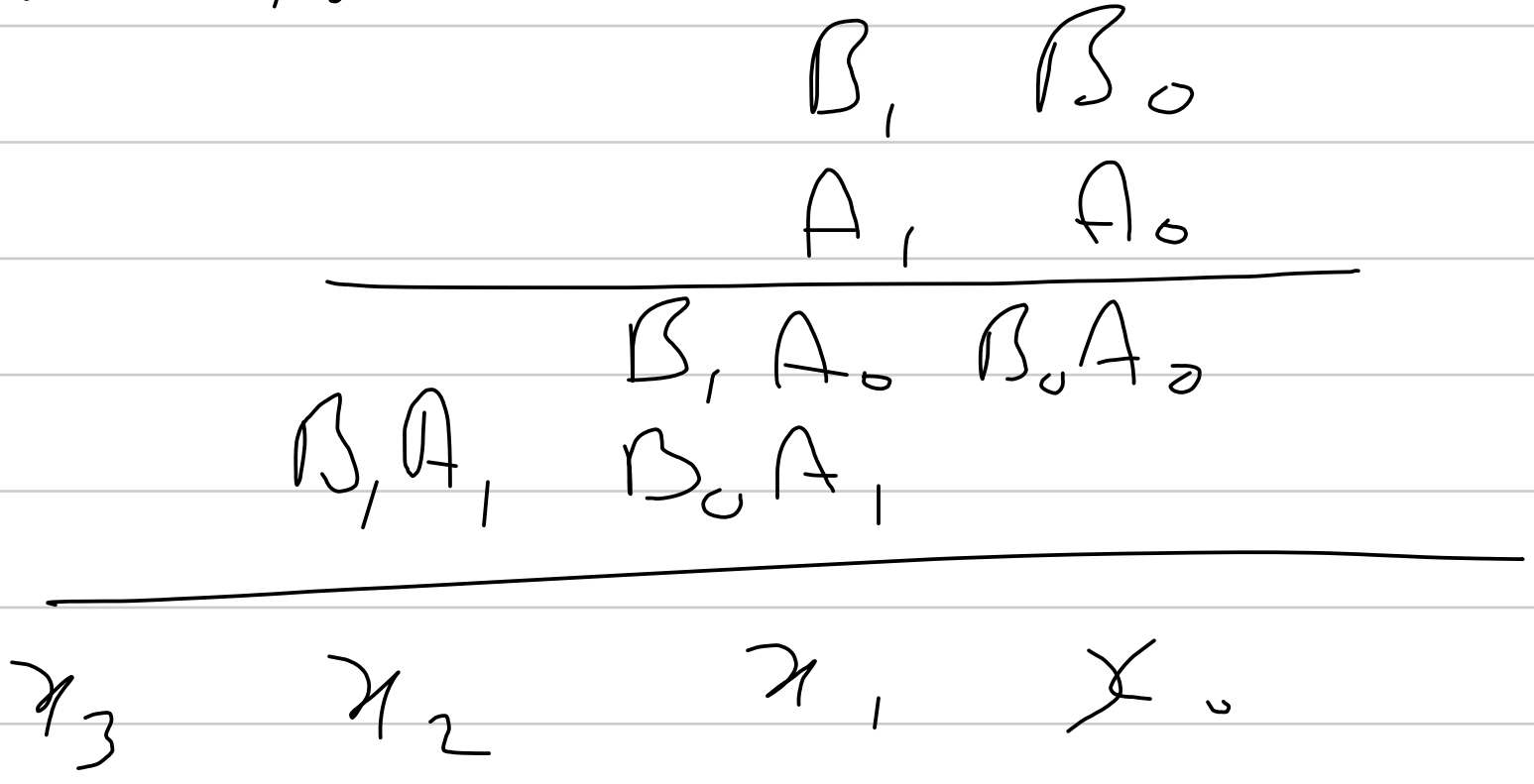
Repeated additions?

$$7 \times 7 = 49.$$

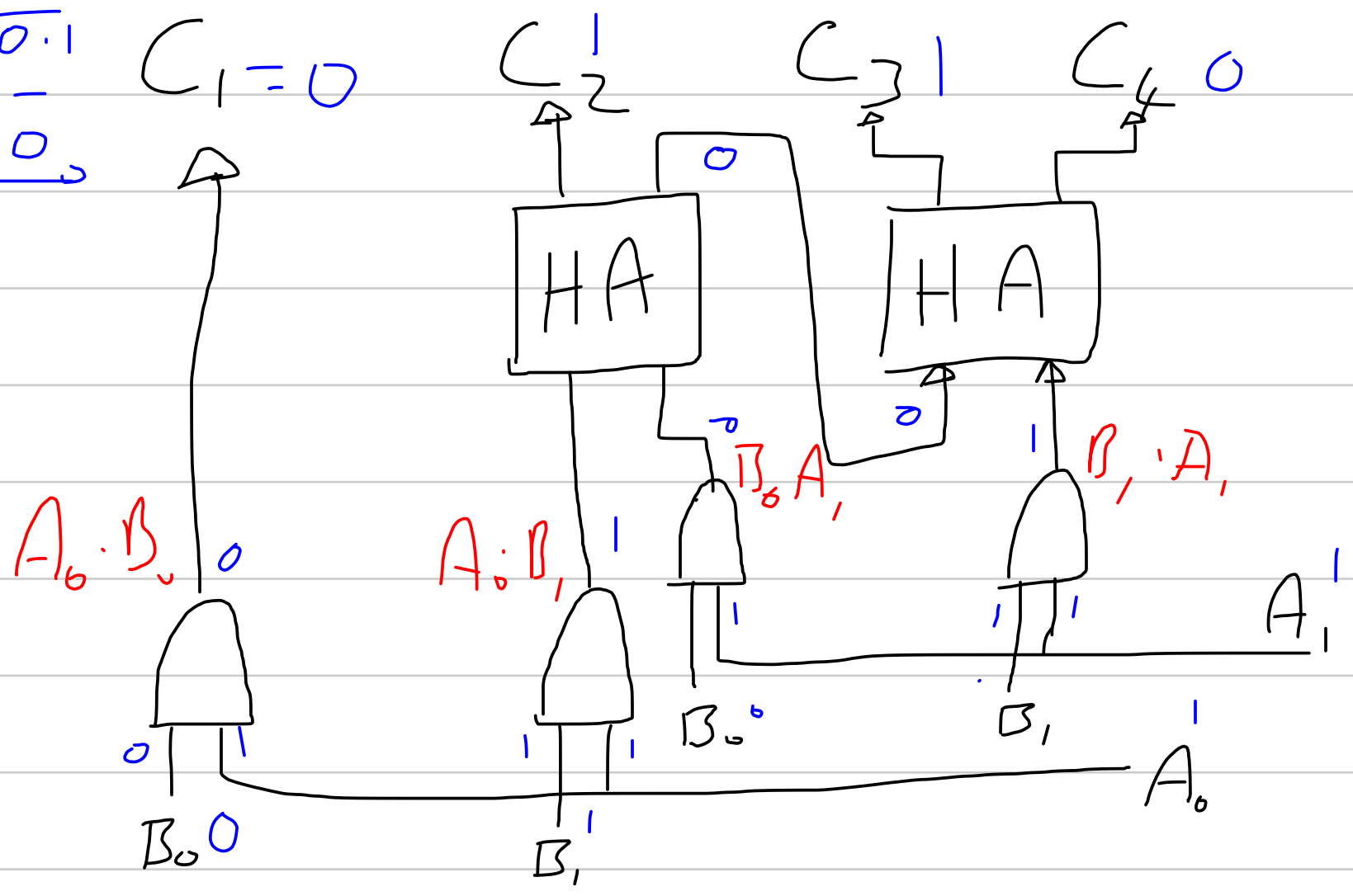
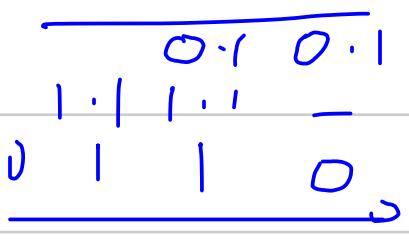
$$\begin{array}{r} 7 \\ + 7 \\ + 7 \\ \vdots \\ \hline 49. \end{array}$$

Numbers - A & B each two bits, how do we multiply them?

$A \Rightarrow A_1, A_0$ & $B \Rightarrow B_1, B_0$



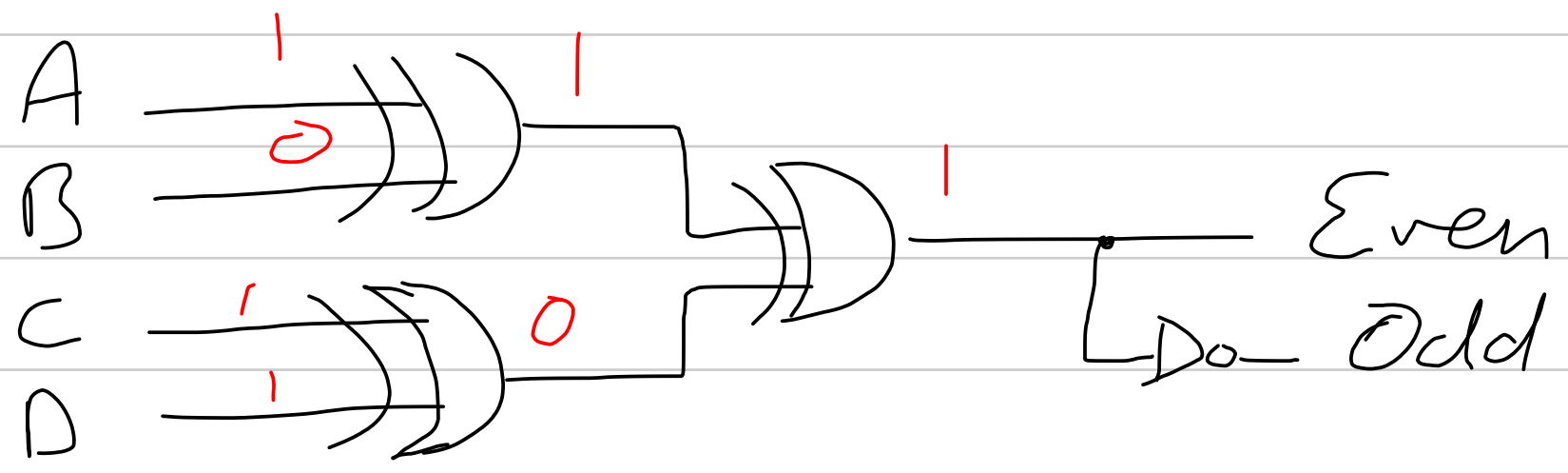
$A = 11$
 $B = 10$



Parity bits.
Even & Odd.

1 0 1 1
A B C D.

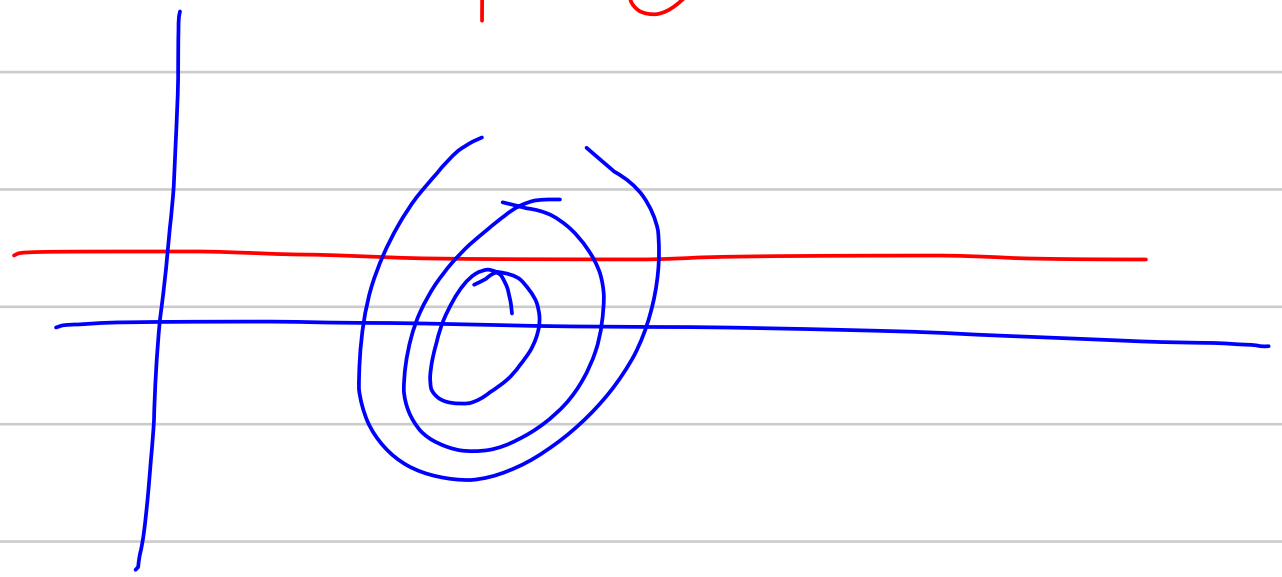
Even = 1
Odd = 0



1 0 1 1
1 1 0 1

1 0 1 1 0 1

1 1 0 1 1 1



Parity checker

