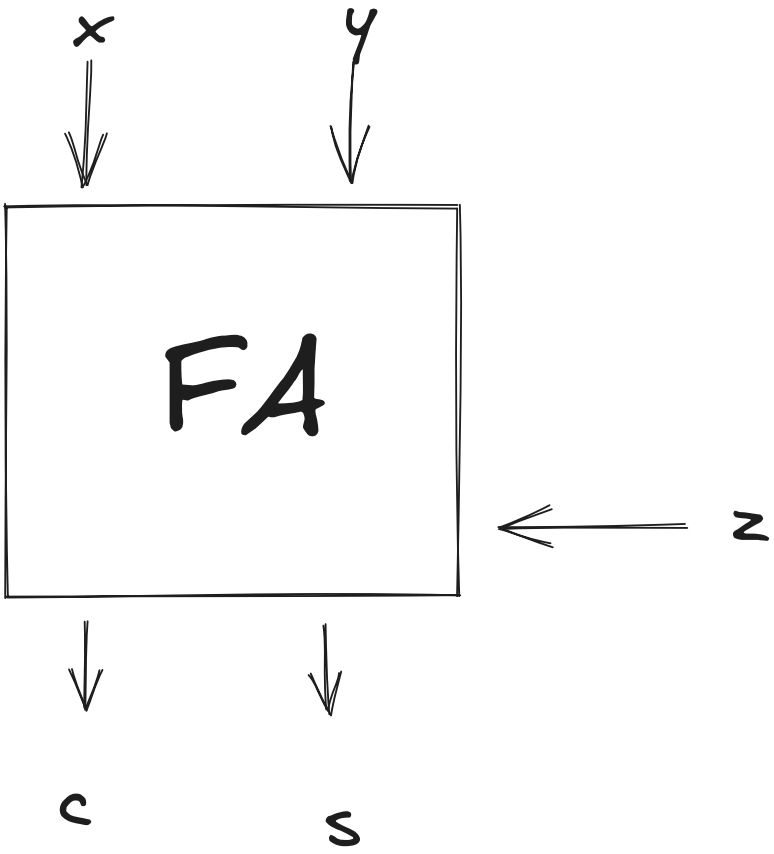
Combinational Circuits

Combinational Circuits

Full Adder



Truth table

x	y	z	c	s
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	1	1

s = x xor y xor z

c = xy+yz+xz

c = x(y+z)+yz

A \ BC	00	01	11	10
0	0	0	1	0
1	0	1	1	1

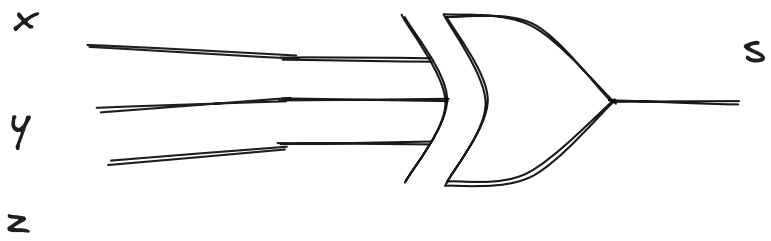
Sir method

c = xy + x'yz + xy'z

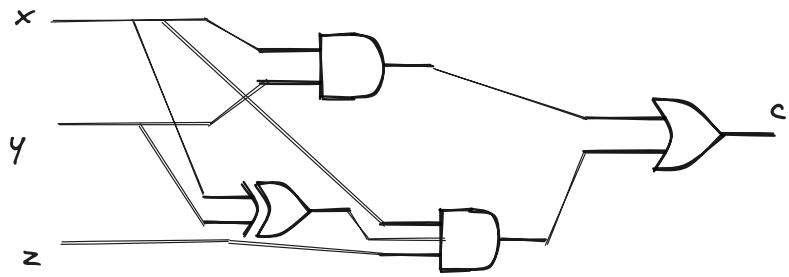
xy+z(x'y+y'x)

xy+z(x (**xor**) y)

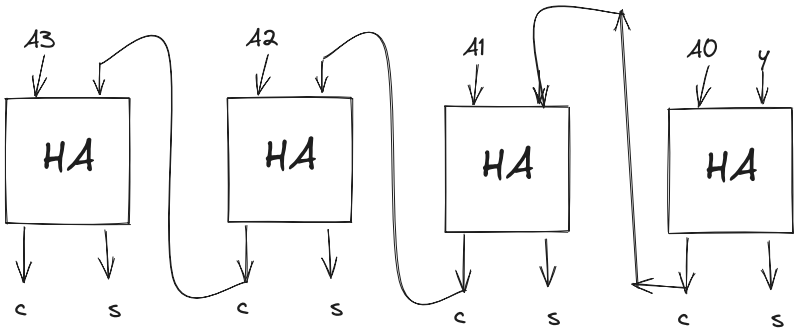
S



C

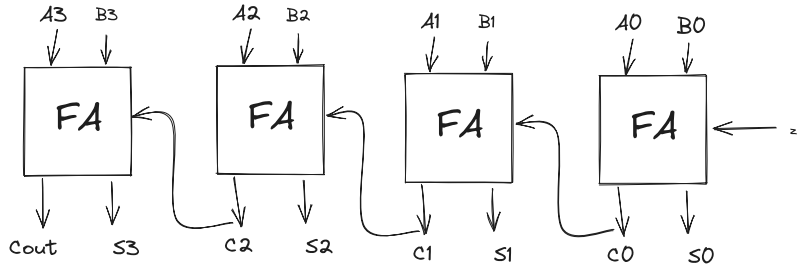


4 Bit half adder



Questions

1. Design a 4 bit binary adder using full adder



A = 1101

B = 0101

Addition: $A + B$

Subtraction:

$A - B$

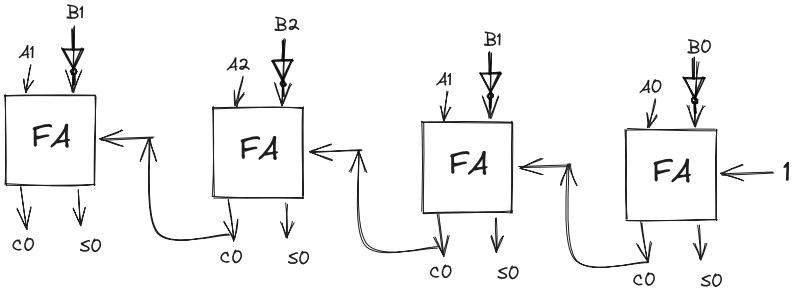
$A + (-B)$

$A + 2\text{'s comp}(B)$

$A + B' + 1$

HW

2. Draw a 4 bit subtractor circuit using full adder

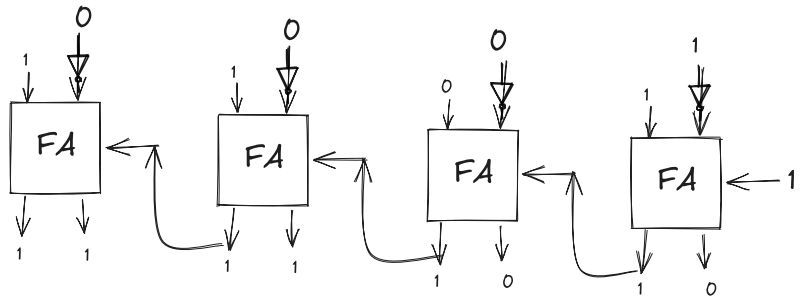


3. Design a 4 bit binary decrementer

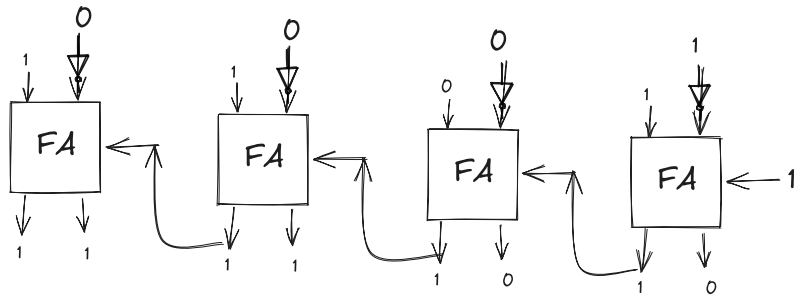
$A - 1$

$A_3A_2A_1A_0 + 1110 + 1$

$A_3A_2A_1A_0 + 1111$



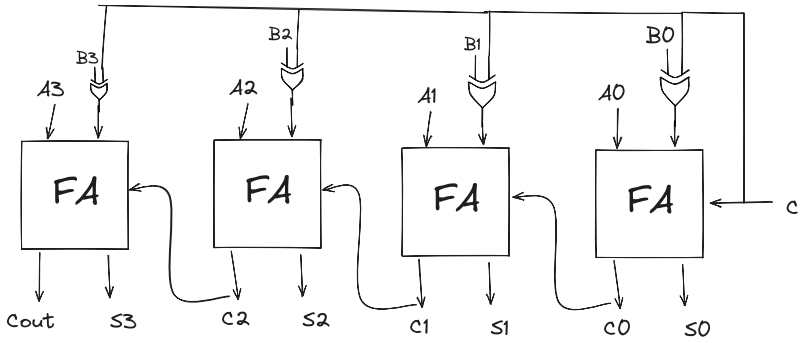
Ex - 1101



4. Design a circuit that can add and subtract two 4 bit binary numbers. Circuit uses a control signal C as per the following table:

C	Output
0	A+B
1	A-B

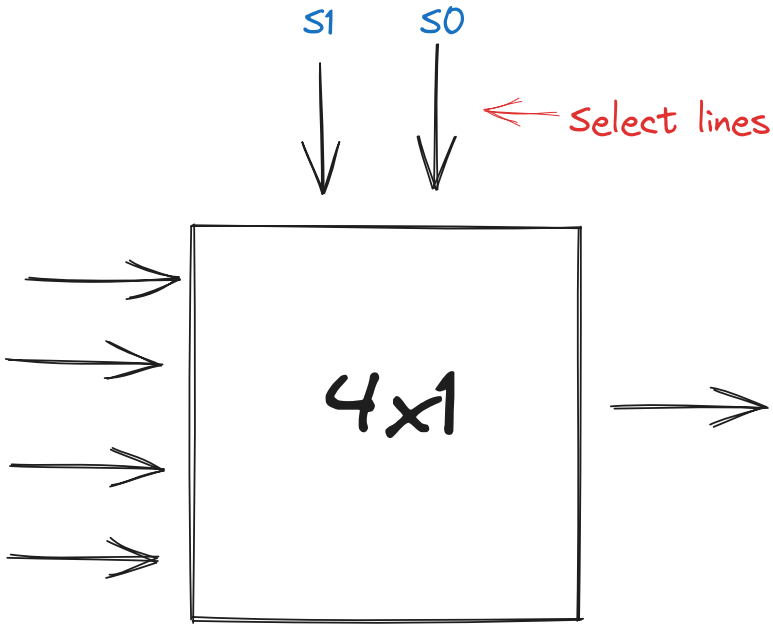
ans



If we want to flip bit when input is 1 and not flip when input is 0 we will use XOR

Multiplexer

Multiple inputs and single output



How will input be selected?

Through select lines

2 Variables

S1	S2	Y
0	0	I0
0	1	I1
1	0	I2

S1	S2	Y
1	1	I3

3 Variables

S1	S2	S3	Y
0	0	0	I0
0	0	1	I1
0	1	0	I2
0	1	1	I3
1	0	0	I4
1	0	1	I5
1	1	0	I6
1	1	1	I7

Logic Diagram