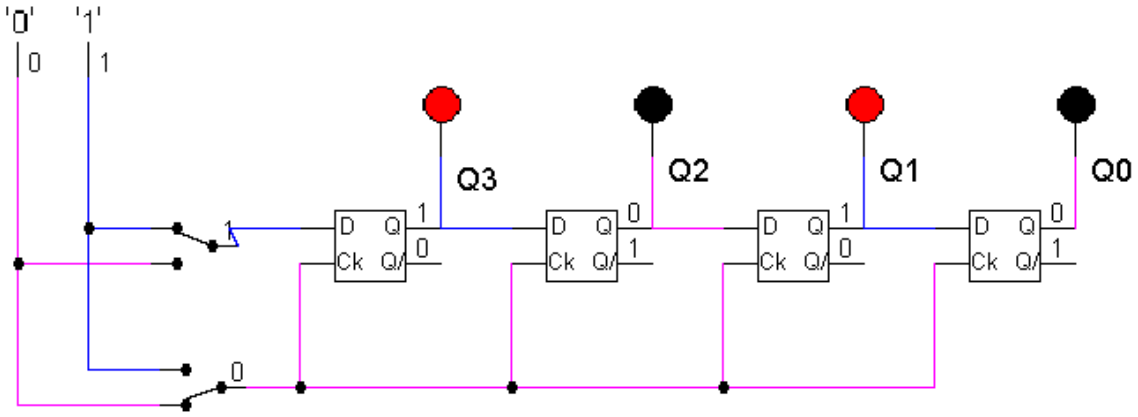
1. Construct 4 bit Serial In parallel Out shift register using D- flip flop. Explain the Working mechanism of the circuit taking Serial input 1010. Also draw the timing diagram according to the given input.
Ans:

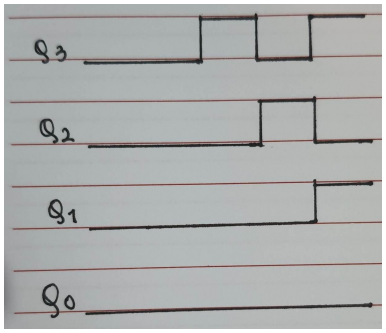


It consists of a group of flip-flops in parallel. Here, the serial input 1010 is passed to the circuit. The first input passed down is 0, it takes the first place. The next input passed down is 1 and it takes the position of 0 and 0 goes forward. The next new input 0 is passed down and takes place of previous value, and this process continues until the full input is passed down.

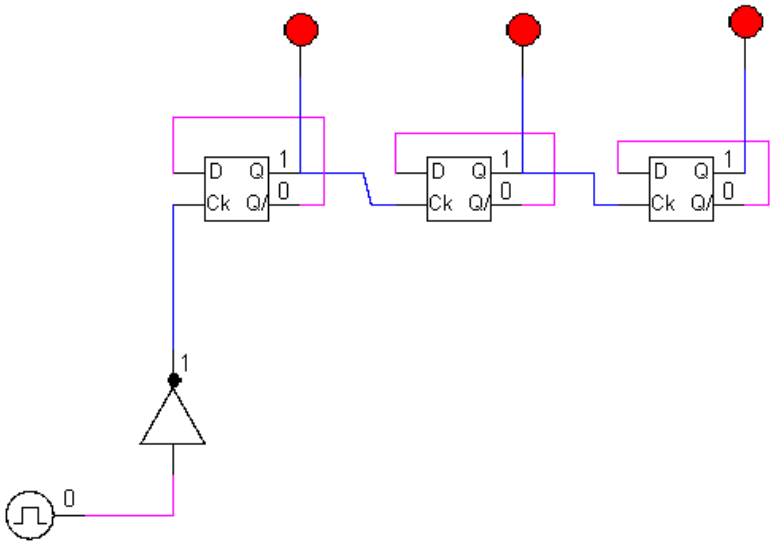
Truth Table:

CLOCK	INPUT	Q3	Q2	Q1	Q0
1	ORIGINAL	0	0	0	0
1	0	0	0	0	0
1	1	1	0	0	0
1	0	0	1	0	0
1	1	1	0	1	0

Timing diagram:



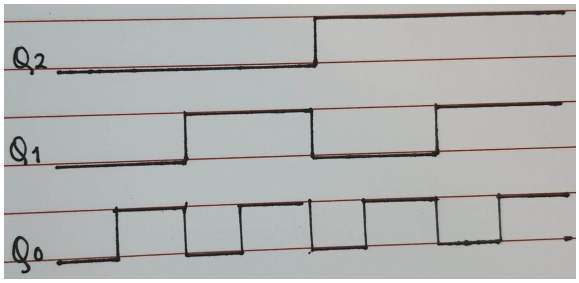
2. Design a 3 bit counter using Toggle D flip flop and draw the timing diagram.
Ans:



Truth table:

CLOCK	Q2	Q1	Q3
0	0	0	0
1	0	0	1
2	0	1	0
3	0	1	1
4	1	0	0
5	1	0	1
6	1	1	0
7	1	1	1

Timing diagram:



3. Load alu.cct file from the :logisim folder. The circuit should look like this
The circuit behaves like a simple arithmetic logic unit. The inputs A0-A3 represent a 4 bit binary number. Inputs B0-B3 represent another binary number. A0 and B0 are the least significant bits respectively. The following table details the functions supported by the chip. All other control lines = 0.
Function Add Subtract

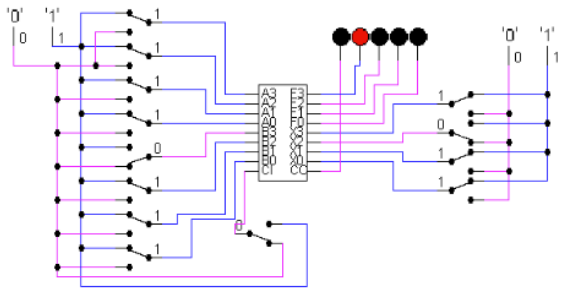
Function	Add	Subtract
X3-X0	1010	1011

i) Use A= 15 and B = 7
ii) Use A = 13 and B = 9
Write the corresponding result of the operations. Manually provide each operation has provided the correct result.

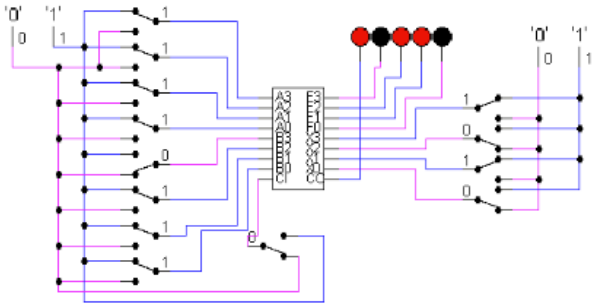
Ans:

i)

Ans: subtract = 01000

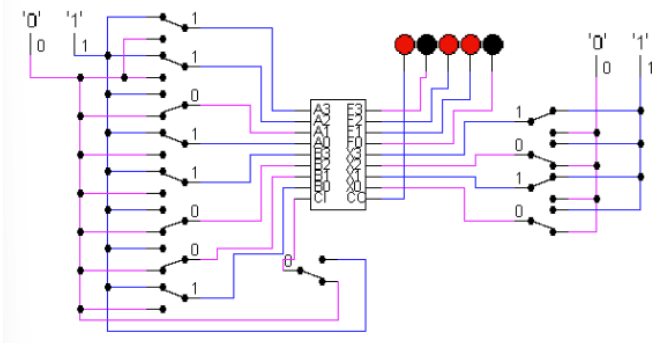


Add = 10110



ii)

Ans: add = 10110



Subtract = 00100