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Assignment 9: Design a 4-bit Ripple Up/Down counter (Asynchronous)

Ripple counter is a special type of Asynchronous Counter in which clock pulse ripples through the circuit.

Up counter counts the states in ascending order and down counter counts in descending order.

Up-Down counter is a bi-directional counter which counts in both direction (asc and desc).

We will use J-K flip-flops to implement the up-down counter.

As we will have to implement both up and down counter in same circuit we will have an input M. If M=0 we will take it as ~~(M=0)~~ up counter and if M=1 will act as down counter.

As here, the output of first flip-flop is given as clock to second flip-flop. Let's control using M ~~to~~ up or down.

- M=0 → Q is connected to next clock
- M=1 → $\bar{Q}$ is connected to next clock

- Now, the truth table for Y which will go to next clock.

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M	Q	$\bar{Q}$	Y
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

K-Map

M \ Q$\bar{Q}$	00	01	11	10
0	0	0	1	1
1	0	1	1	0

$$Y = \bar{M}Q + M\bar{Q} = M \oplus Q$$

- Now we, will implement the circuit, using J-K flip-flops and NAND gates.

- 4- Bit UP-down ripple counter circuit.

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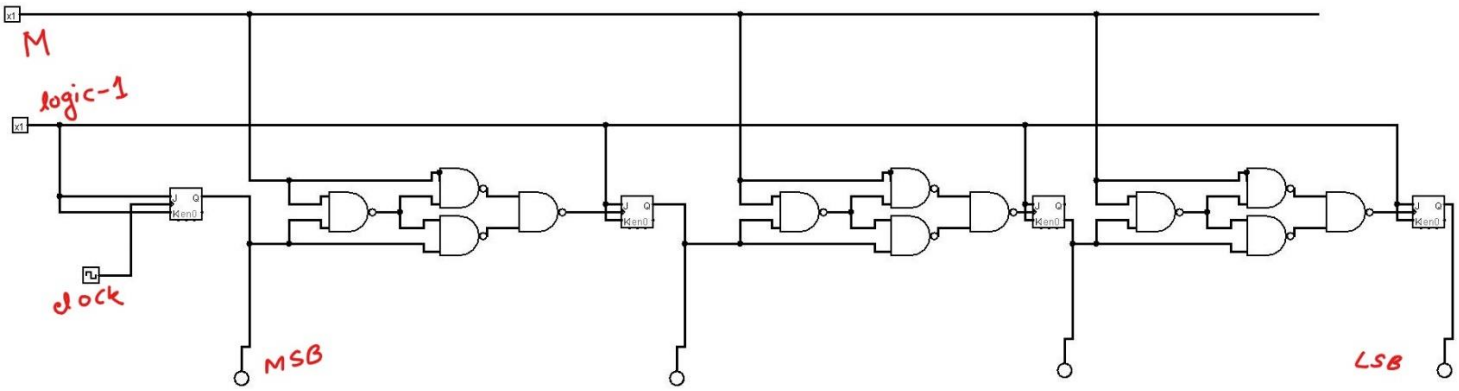
M
logic-1
clock
MSB
LSB