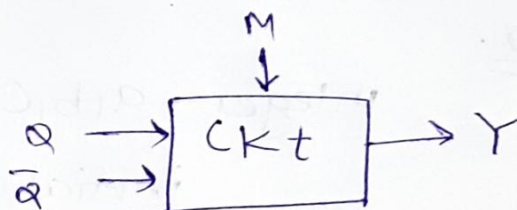


Here,  $M$  is the controlling element.

i.e. if  $M=0 \rightarrow$  Upcount. ( $Q$  as next CLK)  
 $M=1 \rightarrow$  Downcount. ( $\bar{Q}$  as next CLK)

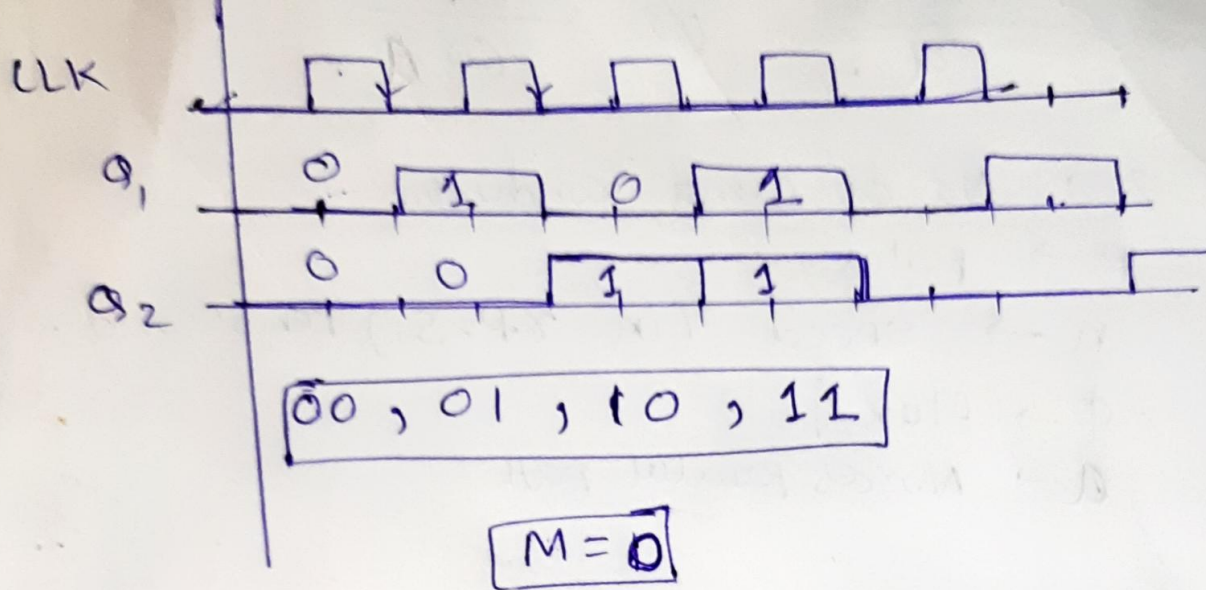
$M$	$Q$	$\bar{Q}$	$Y$
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

$Y \rightarrow$  To next flip flop



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

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



On every falling edge CLK gets high and J-K flip flop gets triggered.

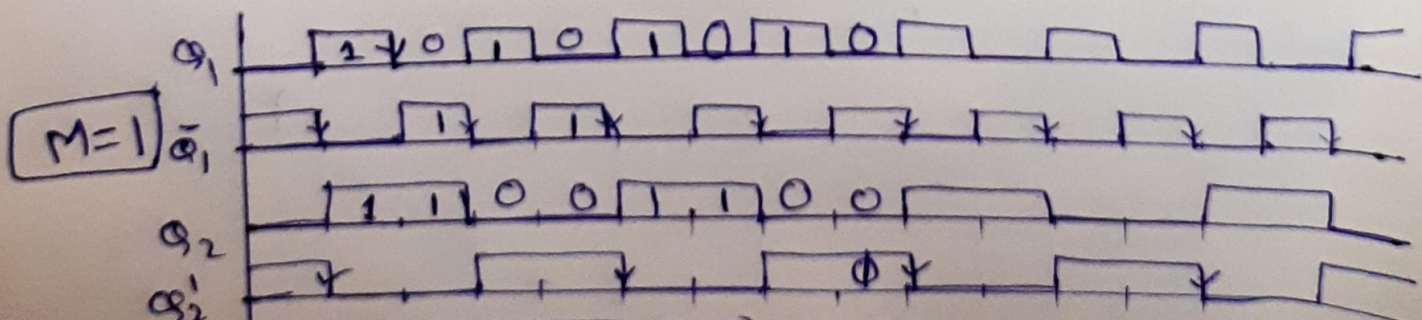
So, the inputs will be  $J=1$ ,  $K=1$ ,  $CLK=1$ .

So, toggling takes place.

at first falling edge  $Q_1$  goes high.

As  $Q_1$  is given as CLK of 2nd FF, falling edge at  $Q_1$  will trigger FF2 and FF2 goes high.

Similarly,  $Q_3$  changes state.





so, as mentioned earlier as  $M=1$ ,

$\bar{Q}$  is connected as next clock.

so, at the falling edge of  $\bar{Q}_1$ ,  $Q_2$  changes from 0  $\rightarrow$  1.

And in the next falling edge of  $\bar{Q}_1$ ,  $Q_2$  changes from 1  $\rightarrow$  0.

and similarly goes on.

$Q_2$	$Q_1$
1	1
1	0
0	1
0	0