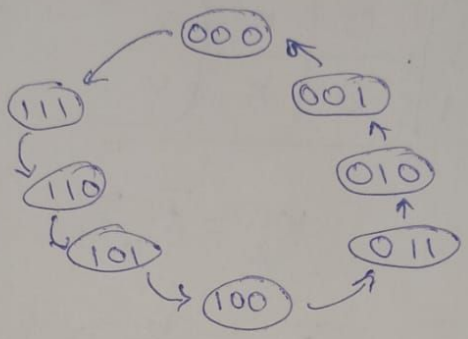
Exercise - 3

3-Bit Synchronous down Counter Using JK-Flipflop

Numbers of required flipflops : $2^3 = 8 = 3^2$

State Diagram :



Exitation Table :

Q_n	Q_{n+1}	J	K
0	0	0	x
0	1	1	x
1	0	x	1
1	1	x	0

CLK	Q_2	Q_1	Q_0	Q_2	Q_1	Q_0	J_2	K_2	J_1	K_1	J_0	K_0
1	0	0	0	1	1	1	1	x	1	x	1	x
2	1	1	1	1	1	0	x	0	x	0	x	1
3	1	1	0	1	0	1	x	0	x	1	1	x
4	1	0	1	1	0	0	x	0	0	x	x	1
5	1	0	0	0	1	1	x	1	1	x	1	x
6	0	1	1	0	1	0	0	x	x	0	x	1
7	0	1	0	0	0	1	0	x	x	1	1	x
8	0	0	1	0	0	0	0	x	0	x	x	1

J_2

Q_2 \ Q_1Q_0	00	01	11	10
0	1	0	0	0
1	x	x	x	x

K_2

Q_2 \ Q_1Q_0	00	01	11	10
0	x	x	x	x
1	1	0	0	0

J_1

Q_2 \ Q_1Q_0	00	01	11	10
0	1	0	x	x
1	1	0	x	x

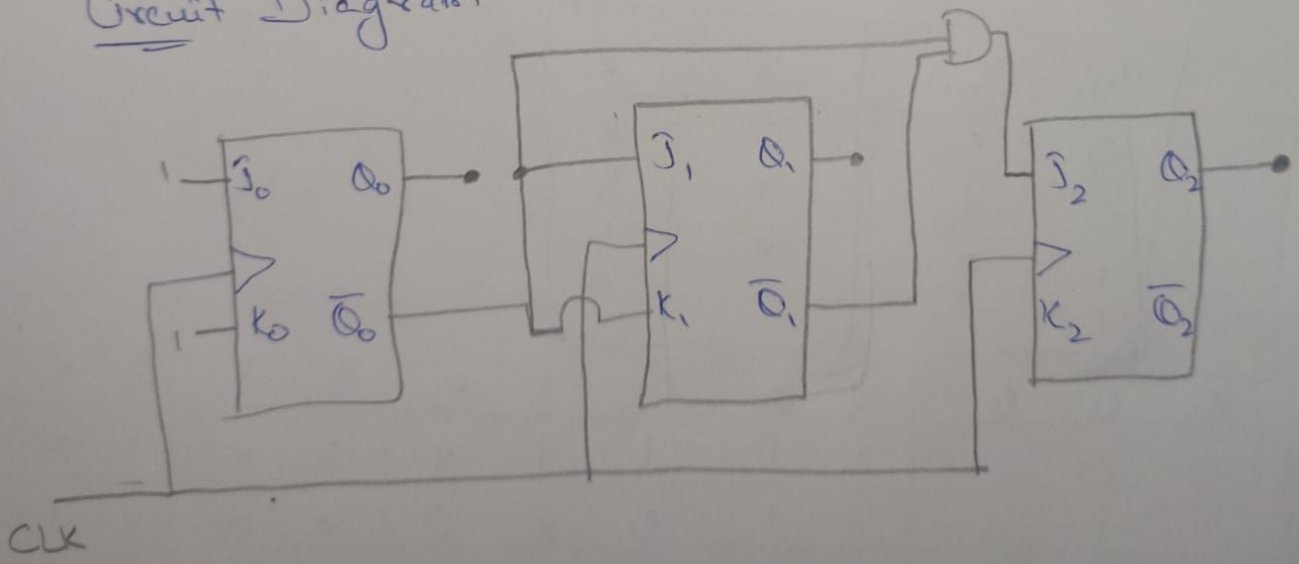
K_1

Q_2 \ Q_1Q_0	00	01	11	10
0	x	x	0	1
1	x	x	0	1

$J_2 = \bar{Q}_1\bar{Q}_0$ $\quad K_2 = \bar{Q}_0\bar{Q}_1$ $\quad J_1 = \bar{Q}_0$

$J_0 = K_0 = 1$

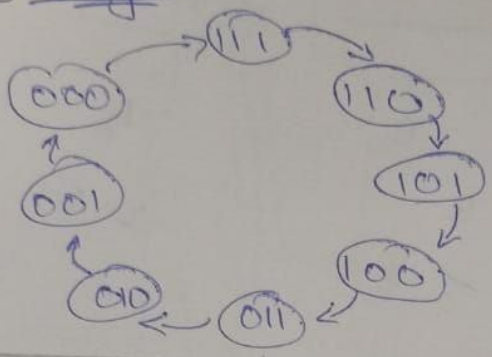
Circuit Diagram



3-Bit Synchronous Down Counter Using D-flipflop

7 → 0 : 7 → 111 = 3 flipflops

State Diagram



Excitation Table

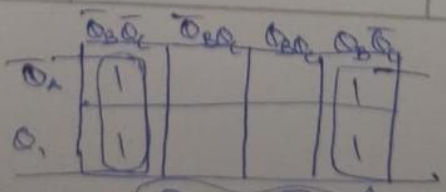
Q_n	Q_{n+1}	D
0	0	0
0	1	1
1	0	0
1	1	1

	Q_A	Q_B	Q_C	Q_{A+1}	Q_{B+1}	Q_{C+1}	D_A	D_B	D_C
7	1	1	1	1	1	0	1	1	0
6	1	1	0	1	0	1	1	0	1
5	1	0	1	1	0	0	1	0	0
4	1	0	0	0	1	1	0	1	1
3	0	1	1	0	1	0	0	1	0
2	0	1	0	0	0	1	0	0	1
1	0	0	1	0	0	0	0	0	0
0	0	0	0	1	1	1	1	1	1

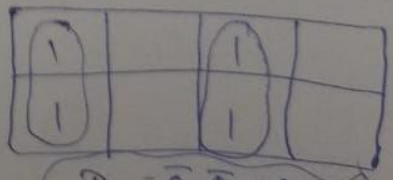
$D_A \rightarrow 0, 5, 6, 7$

$D_B \rightarrow 0, 3, 4, 7$

$D_C \rightarrow 0, 2, 4, 6$

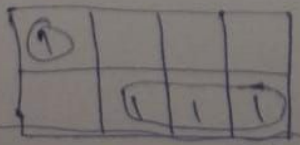


$D_C = \bar{Q}_C$



$D_B = \bar{Q}_B\bar{Q}_C + Q_B Q_C$

$= Q_B \odot Q_C$



$D_A = Q_A Q_C + Q_A Q_B + \bar{Q}_A\bar{Q}_B\bar{Q}_C$

Circuit