1. $D_A = A\bar{Y} + XY\bar{A} + A\bar{X}$

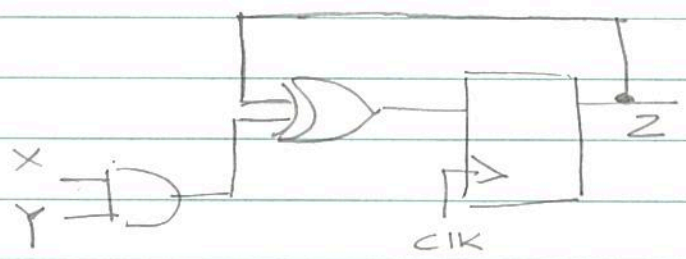
$= A(\bar{X} + \bar{Y}) + \bar{A}(XY)$

$= A(\overline{XY}) + \bar{A}(XY)$

$= A \oplus XY$

$Z = A$

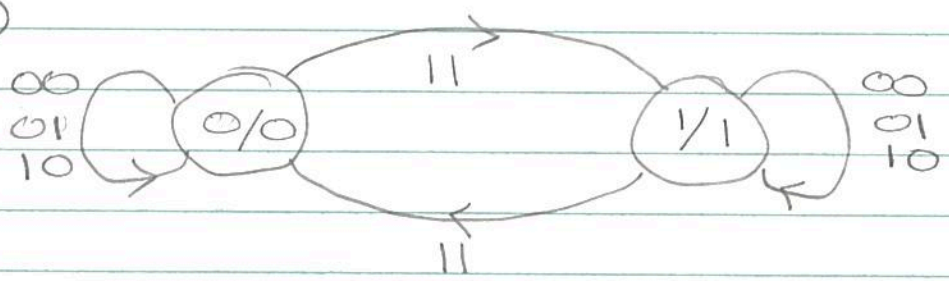
a)



b)

Present State A	Inputs X	Y	Next State A(t+1)	Output Z
0	0	0	0	0
0	0	1	0	0
0	1	0	0	0
0	1	1	1	0
1	0	0	1	1
1	0	1	1	1
1	1	0	1	1
1	1	1	0	1

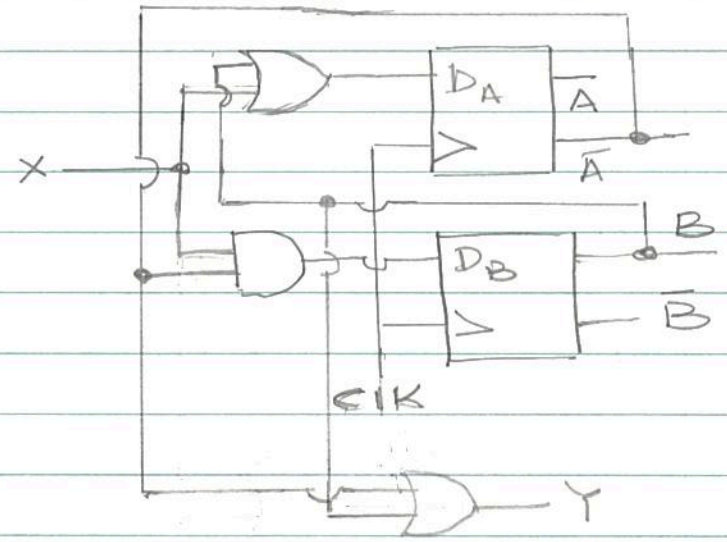
c)



d) Moore FSM as depends only on flipflop output

2. $Y = \bar{A} + B$ $\quad D_A = X + B$ $\quad D_B = X\bar{A}$

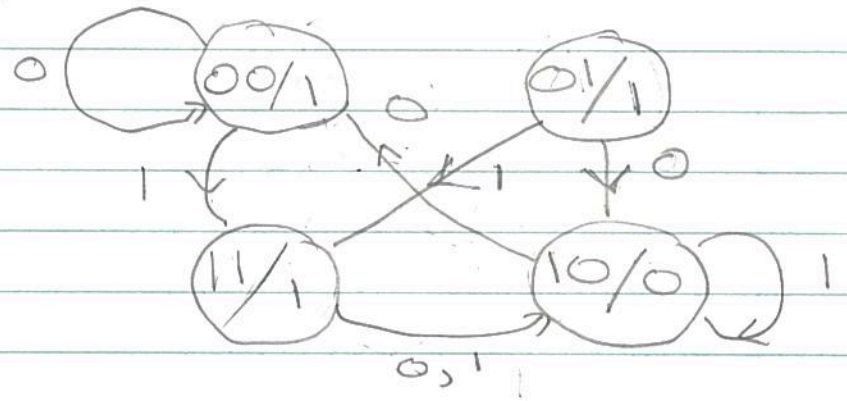
a)



b)

Present state A	Present state B	Input X	Next state A(t+1)	Next state B(t+1)	Output Y
0	0	0	0	0	1
0	0	1	1	1	1
0	1	0	1	0	1
0	1	1	1	1	1
1	0	0	0	0	0
1	0	1	1	0	0
1	1	0	1	0	1
1	1	1	1	0	1

c)



Note:
It is not possible to go to state 01 from any other state so can be removed

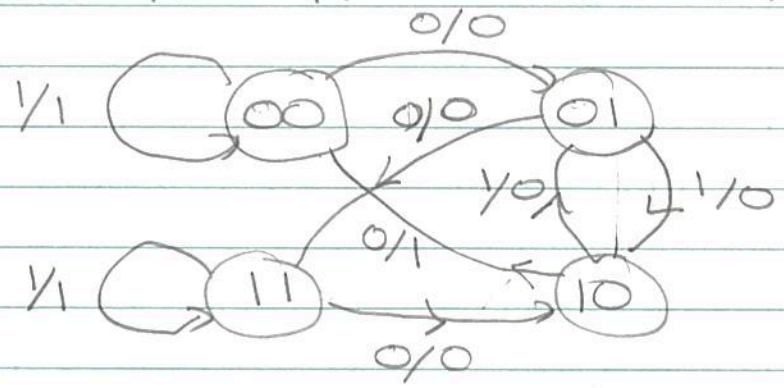
3.

Present state	00	01	00	00	01	11	00	01	11	10	10
Input	1	0	0	1	1	0	1	1	1	1	0
Output	0	1	0	0	0	1	0	0	0	0	1
Next state	01	00	00	01	11	00	01	11	10	10	00

4.

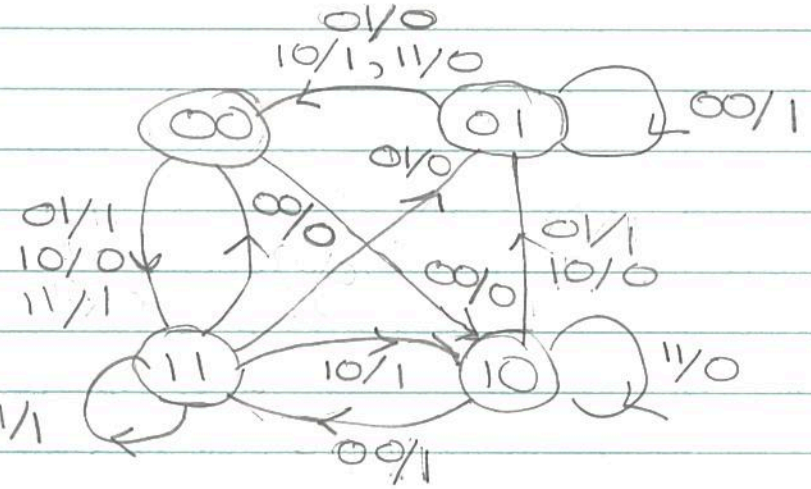
$D_A = B$, $D_B = \overline{X \oplus A}$, $Y = X \oplus A \oplus B$

Present state AB		Next state A(t+1)B(t+1)		Output Y	
X=0	X=1	X=0	X=1	X=0	X=1
00	00	01	00	0	1
01	01	11	10	1	0
10	10	00	01	1	0
11	11	10	11	0	1



Mealy FSM

5.



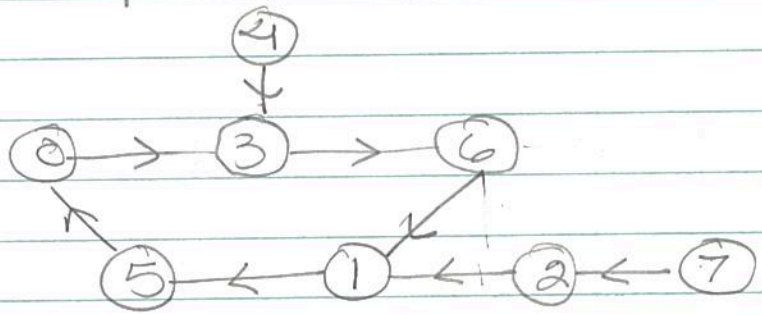
6.

$J_2 = q_0$ $\quad K_2 = 1$

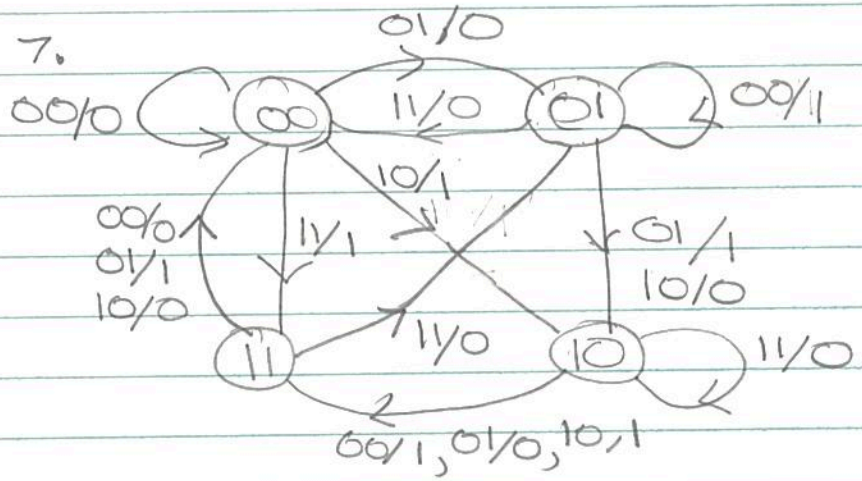
$J_1 = \overline{q_0}$ $\quad K_1 = \overline{q_0}$

$J_0 = 1$ $\quad K_0 = \overline{\overline{q_2}\,\overline{q_1}} = q_2 + q_1$

	Present State $q_2 q_1 q_0$	Flipflop inputs $J_2 K_2$ $J_1 K_1$ $J_0 K_0$	Next State $Q_2 Q_1 Q_0$	
0	0 0 0	0 1 1 1 1 0	0 1 1	3
1	0 0 1	1 1 0 0 1 0	1 0 1	5
2	0 1 0	0 1 1 1 1 1	0 0 1	1
3	0 1 1	1 1 0 0 1 1	1 1 0	6
4	1 0 0	0 1 1 1 1 1	0 1 1	3
5	1 0 1	1 1 0 0 1 1	0 0 0	0
6	1 1 0	0 1 1 1 1 1	0 0 1	1
7	1 1 1	1 1 0 0 1 1	0 1 0	2



7.



8. $J_A = x$ $K_A = \bar{B}$

$J_B = x$ $K_B = A$

a) From JK characteristic table

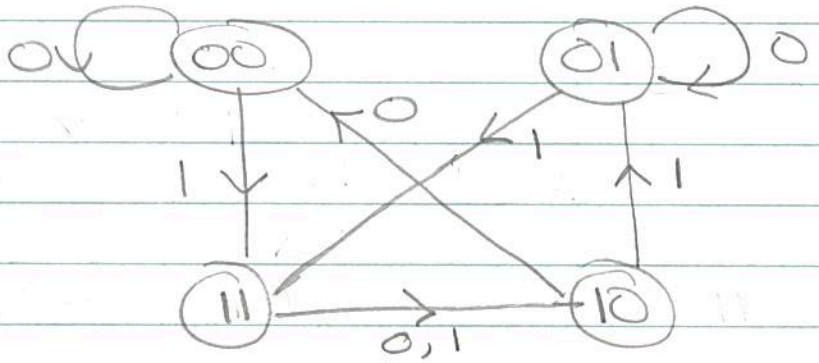
$$Q(t+1) = J\bar{Q} + \bar{K}Q$$

$$\Rightarrow A(t+1) = J_A\bar{A} + \bar{K}_A A = x\bar{A} + AB$$

$$B(t+1) = J_B\bar{B} + \bar{K}_B B = x\bar{B} + \bar{A}B$$

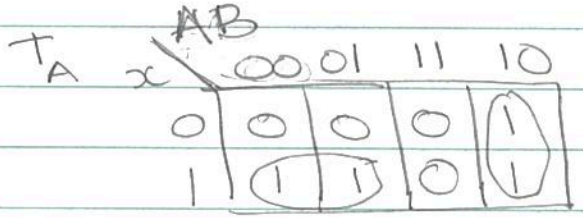
b)

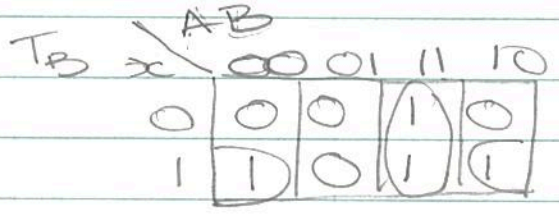
Present state A B	Input x	Next state A(t+1) B(t+1)
0 0	0	0 0
0 0	1	1 1
0 1	0	0 1
0 1	1	1 1
1 0	0	0 0
1 0	1	0 1
1 1	0	1 0
1 1	1	1 0



c) State table for T-flipflop

Present state	Input	Next state	Flip-flop inputs
AB	x	A(t+1) B(t+1)	T_A T_B
0 0	0	0 0	0 0
0 0	1	1 1	1 1
0 1	0	0 1	0 0
0 1	1	1 1	1 0
1 0	0	0 0	1 0
1 0	1	0 1	1 1
1 1	0	1 0	0 1
1 1	1	1 0	0 1





$T_A = \bar{A}x + A\bar{B}$

$T_B = \bar{B}x + AB$