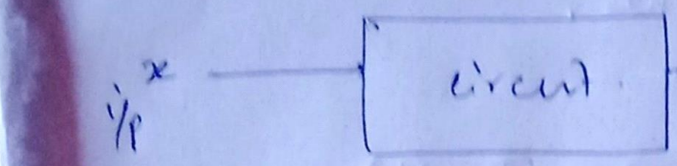
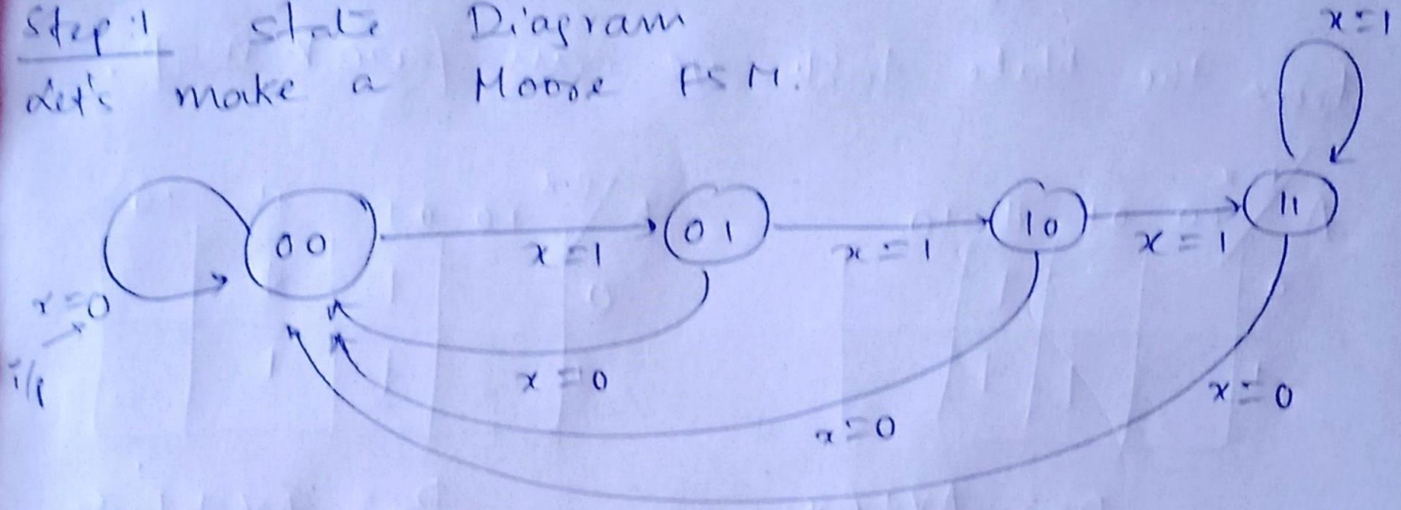
Design Example of Sequential Circuit (FSM)

Specification:
Design a circuit to detect three consecutive ones in a input bit stream.



Example
x → 0 0 0 1 0 1 1 0 1 1 1 0 0 1 1 1 1 0 1 1 0 ...
y → 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 1 1 0 0 0 0 ...

Step 1 State Diagram
Let's make a Moore FSM.



Step: 2 State transition table

4 states - need 2 bit → 2 FFs needed

Present State (PS) A	B	i/p x	Next state (NS) A(t+1)	B(t+1)	o/p y
0	0	0	0	0	0
0	0	1	0	1	0
0	1	0	0	0	0
0	1	1	1	0	0
1	0	0	0	0	0
1	0	1	1	1	1
1	1	0	0	0	0
1	1	1	1	1	1

Step 3 : Derive FF input equations.

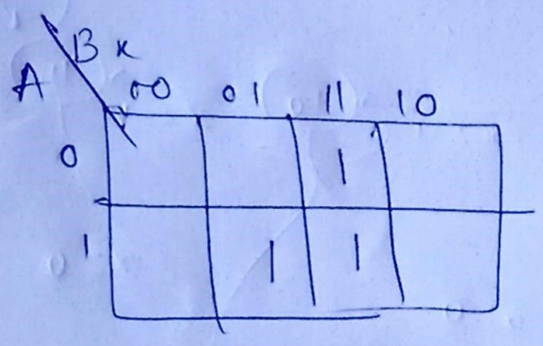
Recall that if you use D-FF, then the output of the flipflop A(t+1) and B(t+1) are same as the inputs.

So we need to synthesize

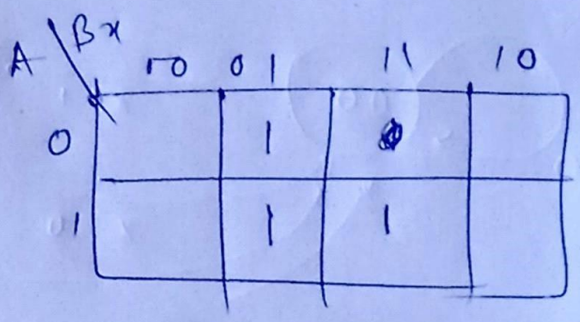
$A(t+1) = D_A(t)$ and $B(t+1) = D_B(t)$

↑
D-input of the FF

From the state table we can form k-map.

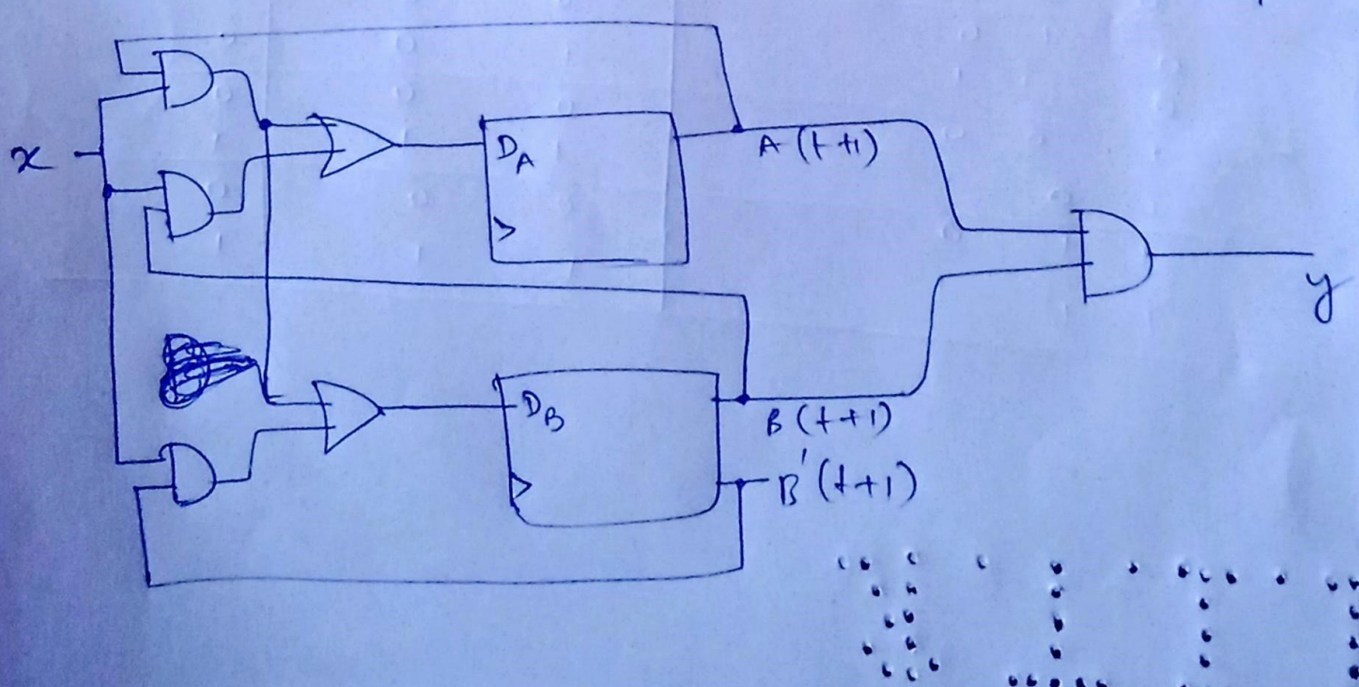


$D_A = Ax + Bx$



$D_B = Ax + B'x$

the o/p is simple function of A(t+1) and B(t+1)

$y(t+1) = A(t+1)\,B(t+1)$

Step-4 Draw the circuit following the equations