PROBLEM: **<u>Designing a traffic light using a D f/f</u>**

state 0 (R/R) → state 1 (G/R) → state 2 (Y/R) → state 3 (R/R) → state 4 (R/G) → state 5 (R/Y); 6 states (000 – 101)

Current State Q(t) ABC	**Next State Q(t+1) $D_AD_BD_C$**
000	0 0 1
001	0 1 0
010	0 1 1
011	1 0 0
100	1 0 1
101	0 0 0

	00	01	11	10
0 |				1
1 |	1		x	x

$D_A = BC + AC'$

	00	01	11	10
0 |		1		1
1 |			x	x

$D_B = BC' + A'B'C$

	00	01	11	10
0|	1			1
1|	1		x	x

$D_C = C'$

<u>WHAT IS NEXT ? COMPLETE THE CIRCUIT FOR THE TRAFFIC LIGHT</u>

PROBLEM:

Add an Emergency State:

RY blink: for x = 1 go into emergency state
for x = 0 go into next state;

I will consider the emergency state to be 110. We have 6 states now and 4 variable table, for ABC and X. From emergency for x=1 stays in emergency for x=0 reset to 000. Since it was not clearly mentioned, you can also consider that by 0/1 stays in emergency state. In that case you will get different expressions for the f/f inputs.

Current Q(t) ABC	**Input X**	**Next Q(t+1) $D_AD_BD_C$**
000	0	001
000	1	110
001	0	010
001	1	110
010	0	011
010	1	110
011	0	100
011	1	110
100	0	101
100	1	110
101	0	000
101	1	110
110	0	000
110	1	110

PROBLEM:
A sequential circuit with two D f/f, A and B; two inputs , x and y and one output, z is specified by the following next-state and output functions:

A(t+1) = x'y + xA
B(t+1) = x'B + xA
Z = B

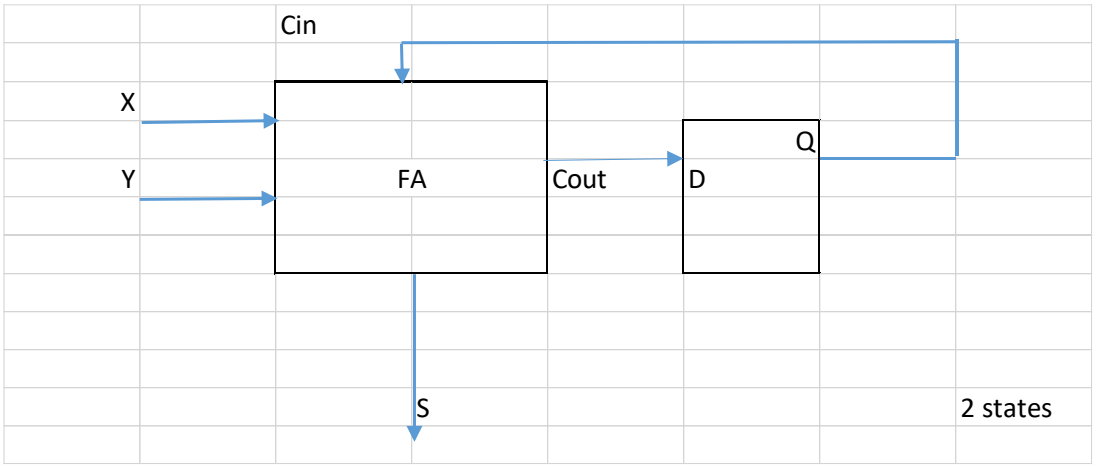
Derive the state table
Derive the state diagram
Draw the circuit

				DA	DB		
A	B	X	Y	A(t+1)	B(t+1)	Z	16 combinations

Take it from here ……

PROBLEM:
A sequential circuit has one f/f Q; two inputs, x and y; and one output S. It consists of a full adder circuit connected to a D f/f. Derive the state table and state diagram of the sequential circuit.

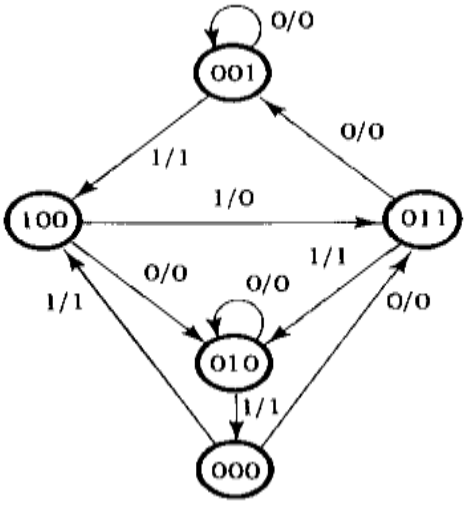
You already have the hint in the Timing Relationship



Cin: present state Cout: next state

		Q(t)	D/Q(t+1)
X	**Y**	**Cin**	**Cout**

PROBLEM: A sequential circuit had three f/f A,B,C; one input x; one output y. The circuit is to be designed by treating the unused states as don't care conditions. Analyze if the circuit is self-correcting. Use D f/f in the design.



Present State Q(t) ABC	Input X	Next State Q(t+1) $D_AD_BD_C$	Output Y
000	0	011	0
000	1	100	1
001	0	001	0
001	1	100	1
010	0	010	0
010	1	000	1
011	0	001	0
011	1	010	1
100	0	010	0
100	1	011	0

Unused states 101, 110 and 111

	00	01	11	10
00		1	1	
01				
11	x	x	x	x
10			x	x

	00	01	11	10
00	1			
01	1		1	
11	x	x	x	x
10	1	1	x	x

	00	01	11	10
00	1			1
01				1
11	x	x	x	x
10		1	x	x

$D_A = A'B'X$ $D_B = A + C'X' + BCX$ $Dc = Cx' + AX + A'B'X'$

$Y = A'x$ Db: A=1 B=0 C=1 X = 0

Unused states: 101, 110, 111

State X

101 0 $D_B = 1, D_C = 1$ Next State = 111

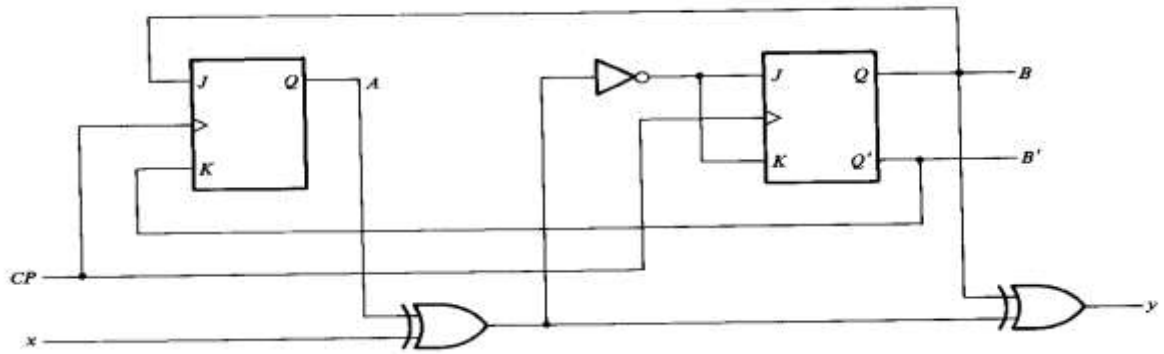
101 1 $D_B = 1, D_C = 1$ Next State = 111

Continue……

Conclusion:

Problem:

A sequential circuit has 2 JK f/f, one input x, and one output y. The logic diagram is shown below. Derive the state table and state diagram.

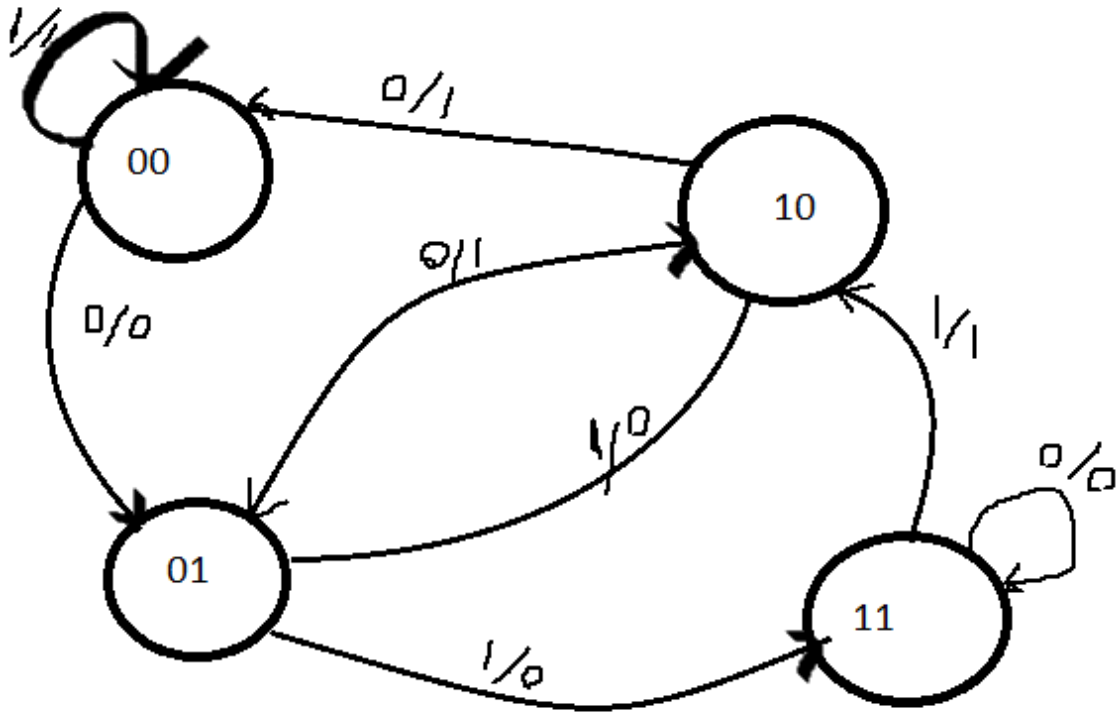


Get the expression of the f/f inputs (based on present states and external input)
Based on present state and f/f inputs get the next state

JA = B KA = B' JB = (A $_{XOR}$ X)' KB = (A $_{XOR}$ X)'

Y = X xor A xor B (the odd function)

AB	**X**	**J_A**	**K_A**	**J_B**	**K_B**	**Next**	**Y**
00	**0**						
00	1						
01	0						
01	1						
10	0						
10	1						
11	0						
11	1						


1/1
0/1
00
10
0/1
0/0
1/1
1/0
0/0
01
11
1/0