AKTU

GATEWAY CLASSES

Digital System Design

B.Tech. 3rd Sem

EC & Allied



Exam/Result Oriented Content

- ✓ Recorded Video Lectures
- ✓ Pdf Notes
- ✓ PYQs

UNIT 3 : Sequential logic design

Lec 9

Today's Target

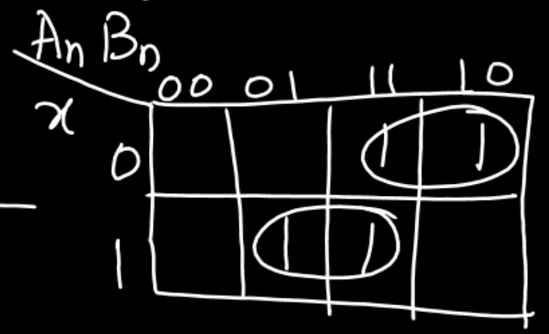
- Numerical on Sequential Circuit
- Numerical on State Diagram
- Numerical on Asynchronous Circuit

Design a sequential circuit with two Flip Flops, A & B and one input x. When x=0, the State of the circuit remains the same when x=1 the circuit passes through the state transitions from 00 to 01 to 11 to 10 back to 00 & repeat. (22-23, 20-21,19-20)

State Table

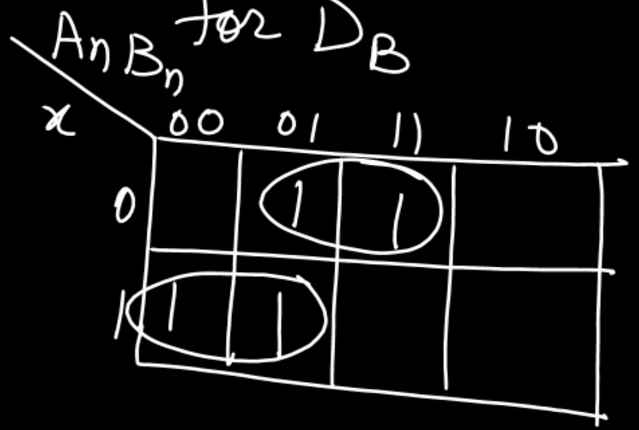
Previous state A_n	Previous state B_n	I/P x	Next state A_{n+1}	Next state B_{n+1}	D_A	D_B
0	0	0	0	0	0	0
0	0	1	0	1	0	1
0	1	0	0	1	0	1
0	1	1	1	1	1	1
1	0	0	1	0	1	0
1	0	1	0	0	0	0
1	1	0	1	1	1	1
1	1	1	1	0	1	0

for D_A



$D_A = A_n \bar{x} + B_n x$

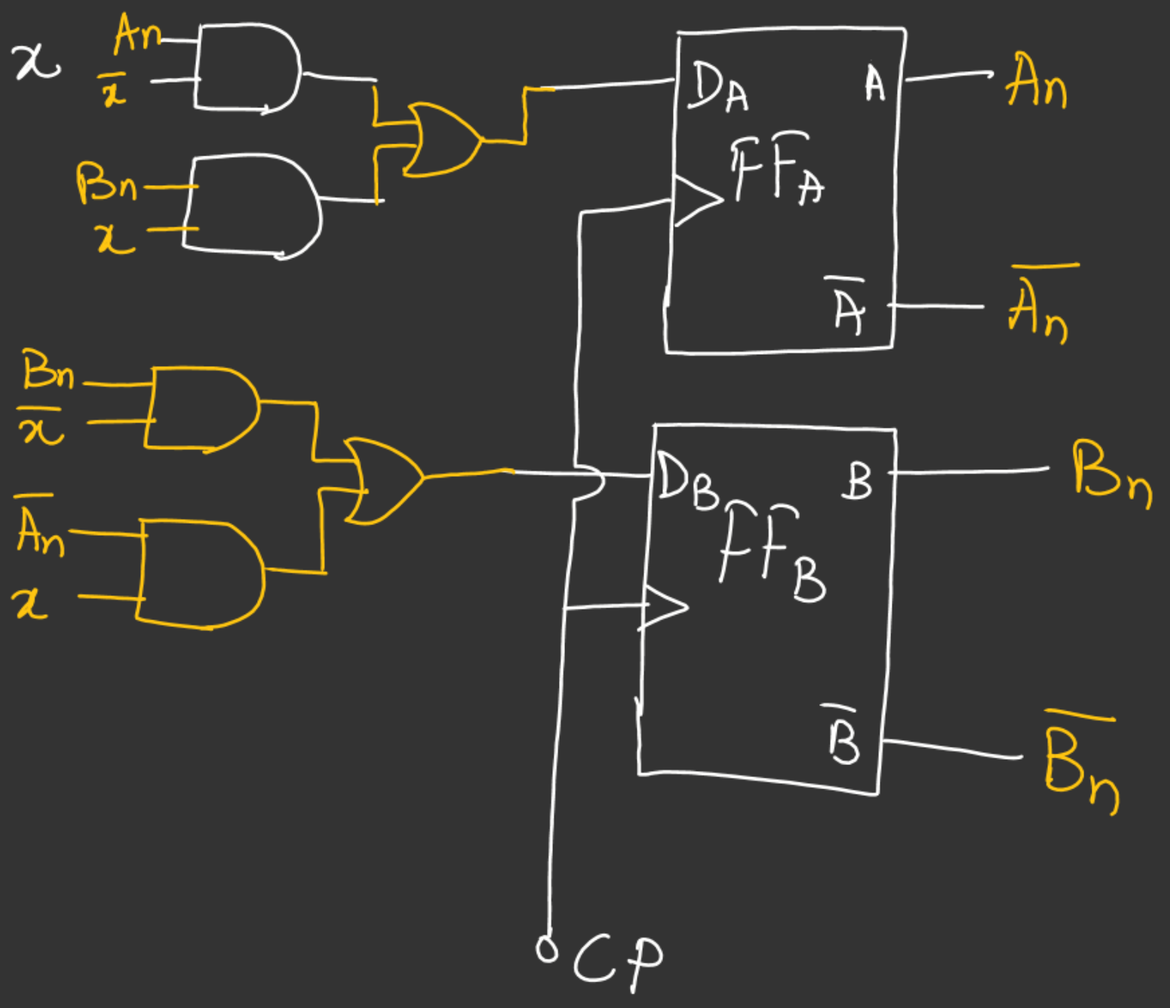
for D_B



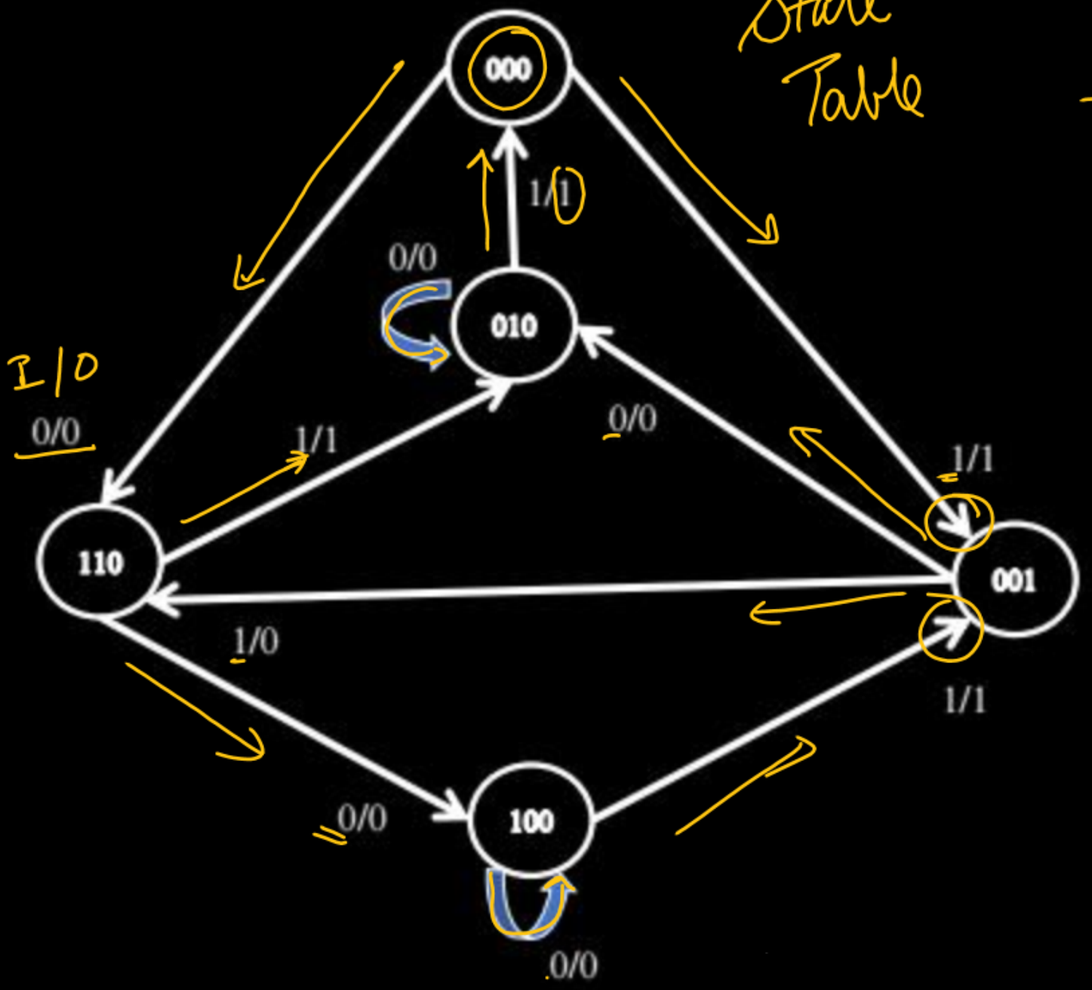
$D_B = B_n \bar{x} + \bar{A}_n x$

$$D_A = A_n \bar{x} + B_n x$$

$$D_B = B_n \bar{x} + \bar{A}_n x$$



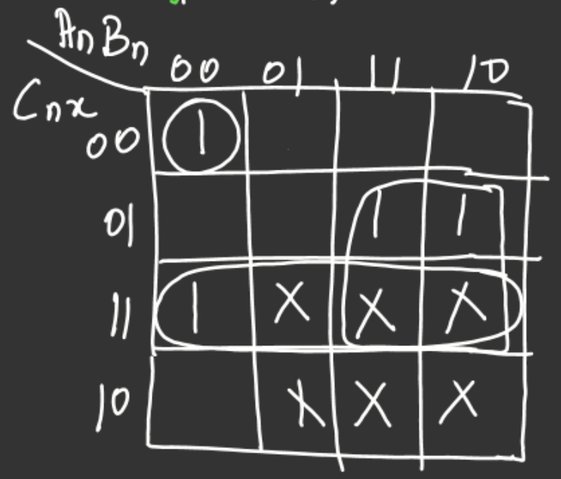
For the given state diagram, design the circuit using T Flip Flop (19-20)



State Table

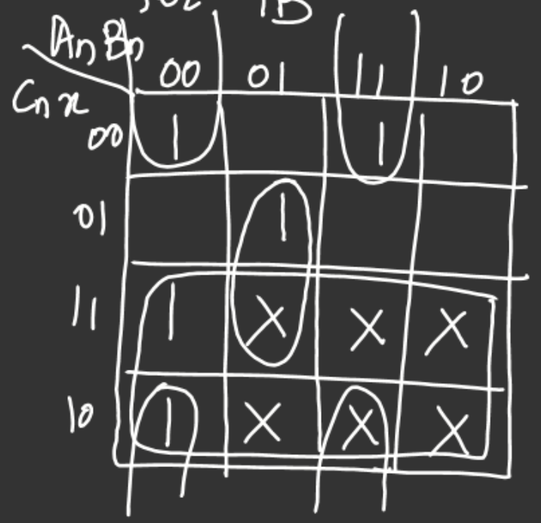
Present State A_n B_n C_n	I/P x	Next State A_{n+1} B_{n+1} C_{n+1}	O/P y	T_A	T_B	T_C
0 0 0	0	1 1 0	0	1	1	0
0 0 0	1	0 0 1	1	0	0	1
0 0 1	0	0 1 0	0	0	1	1
0 0 1	1	1 1 0	0	1	1	0
0 1 0	0	0 1 0	0	0	0	0
0 1 0	1	0 0 1	1	0	1	1
0 1 1	0	0 1 0	0	0	0	0
0 1 1	1	0 0 0	0	0	1	1
1 0 0	0	1 0 0	0	1	0	0
1 0 0	1	0 0 1	1	1	0	1
1 0 1	0	X X X	X	X	X	X
1 0 1	1	X X X	X	X	X	X
1 1 0	0	1 0 0	0	0	1	0
1 1 0	1	0 0 1	1	1	0	0
1 1 1	0	X X X	X	X	X	X
1 1 1	1	X X X	X	X	X	X

for T_A



$$T_A = C_n x + A_n x + \bar{A}_n \bar{B}_n \bar{C}_n \bar{x}$$

for T_B

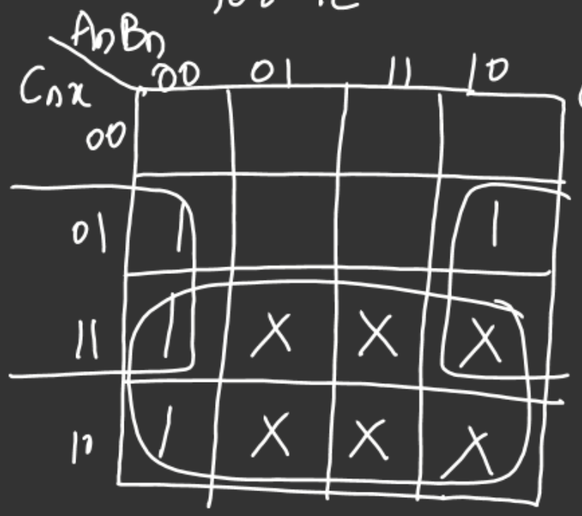


$$T_B = C_n + \bar{A}_n B_n + \bar{A}_n \bar{B}_n + A_n B_n$$

$$= C_n + \bar{A}_n \left[B_n + \bar{B}_n \right] + A_n B_n$$

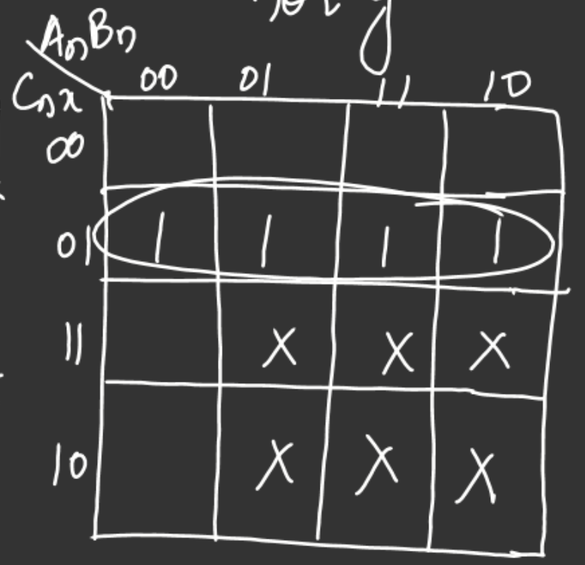
$$= C_n + \bar{A}_n + A_n B_n$$

for T_C



$$T_C = C_n + \bar{B}_n x$$

for y



$$y = \bar{C}_n x$$

State Equations

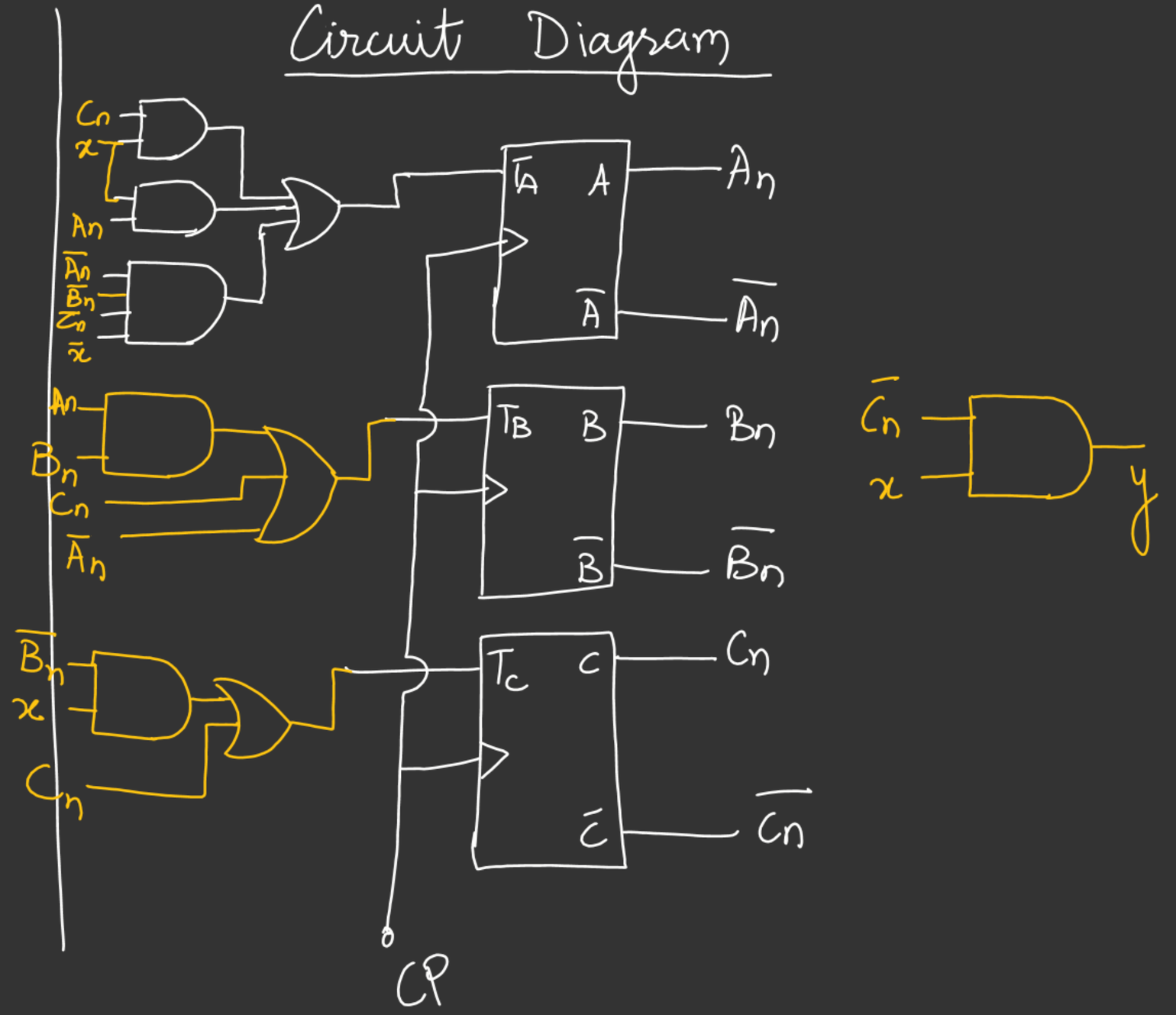
$$T_A = C_n x + A_n x + \bar{A}_n \bar{B}_n \bar{C}_n \bar{x}$$

$$T_B = C_n + \bar{A}_n + A_n B_n$$

$$T_C = C_n + \bar{B}_n x$$

$$y = \bar{C}_n x$$

Circuit Diagram



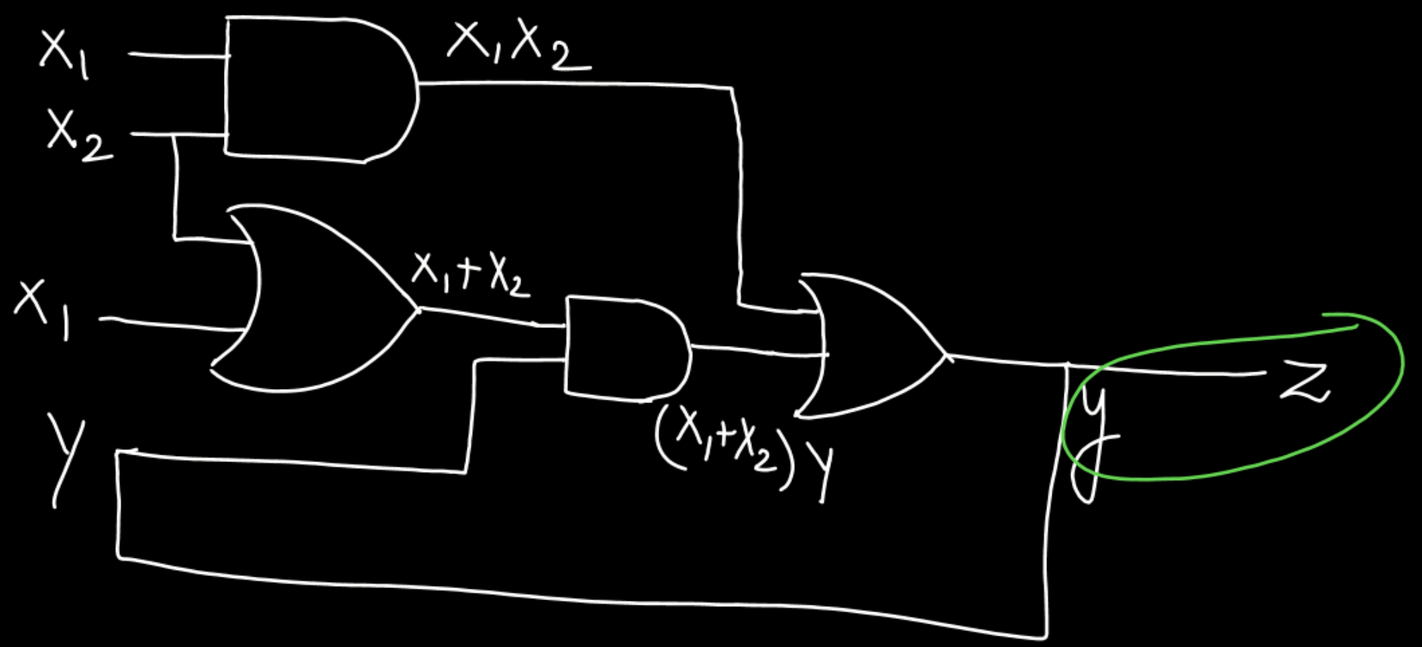
An asynchronous sequential logic circuit is described by the following excitation and output function y = XIX2 + (X1 + X2) Y and output Z = y

(i) Draw the logic diagram of the circuit.

(ii) Derive the transition table and output map

(iii) Describe the behavior of the circuit. (18-19)

Logic Diagram:

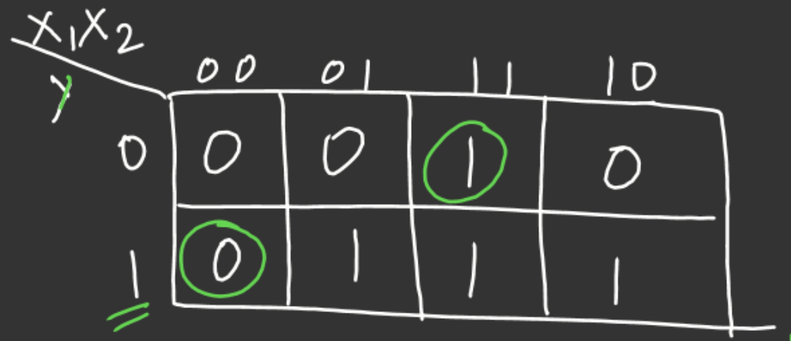


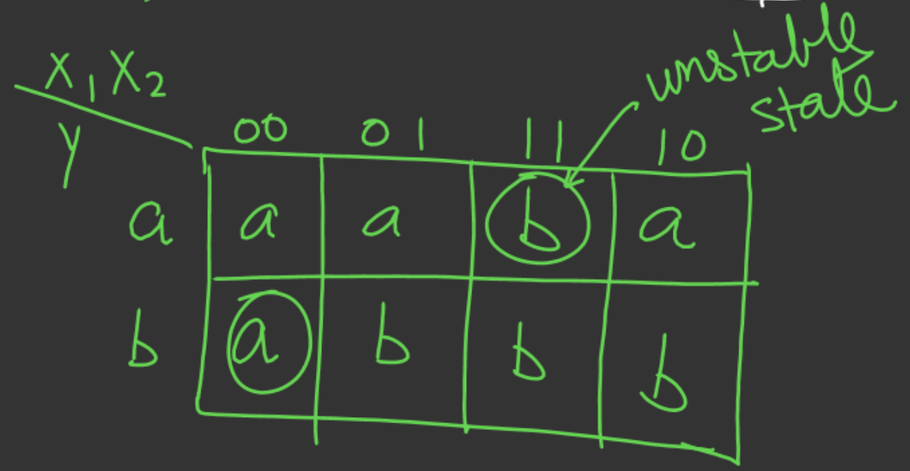
Transition Table

y	x_1	x_2	y
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

$$y = x_1 x_2 + (x_1 + x_2)\, y$$

Output Map





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Thank You