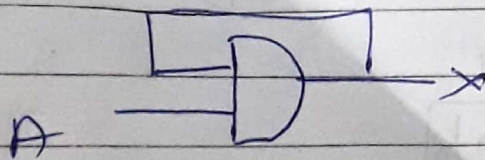


11.8

Analysis of Asynchronous Sequential Circuit-

Asynchronous Sequential circuit is also called event driven circuit does not have any clock to trigger change of state. State changes are triggered by change in input signal. Here the output change depends on change in input level is discussed which is called as "fundamental mode of operation".

Consider two input AND gate with output feedback as shown below

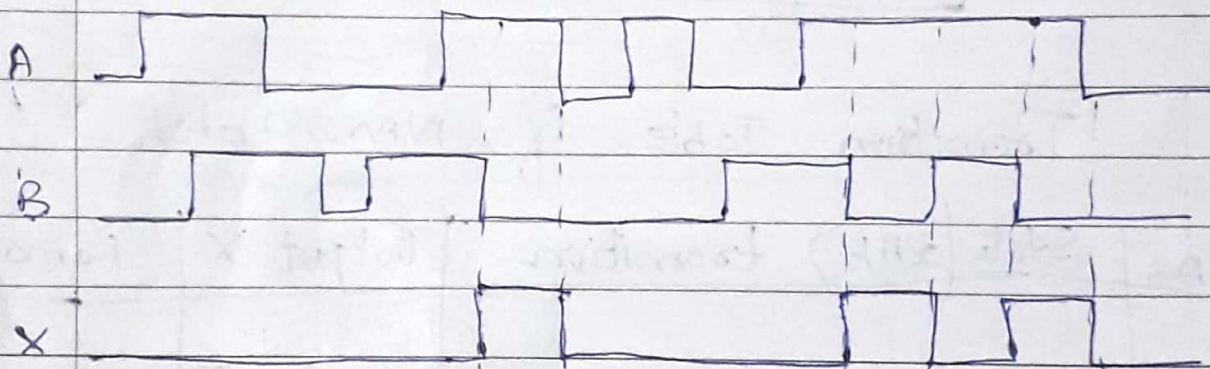


The gate input reacts after a finite time which is referred to as propagation delay (τ).

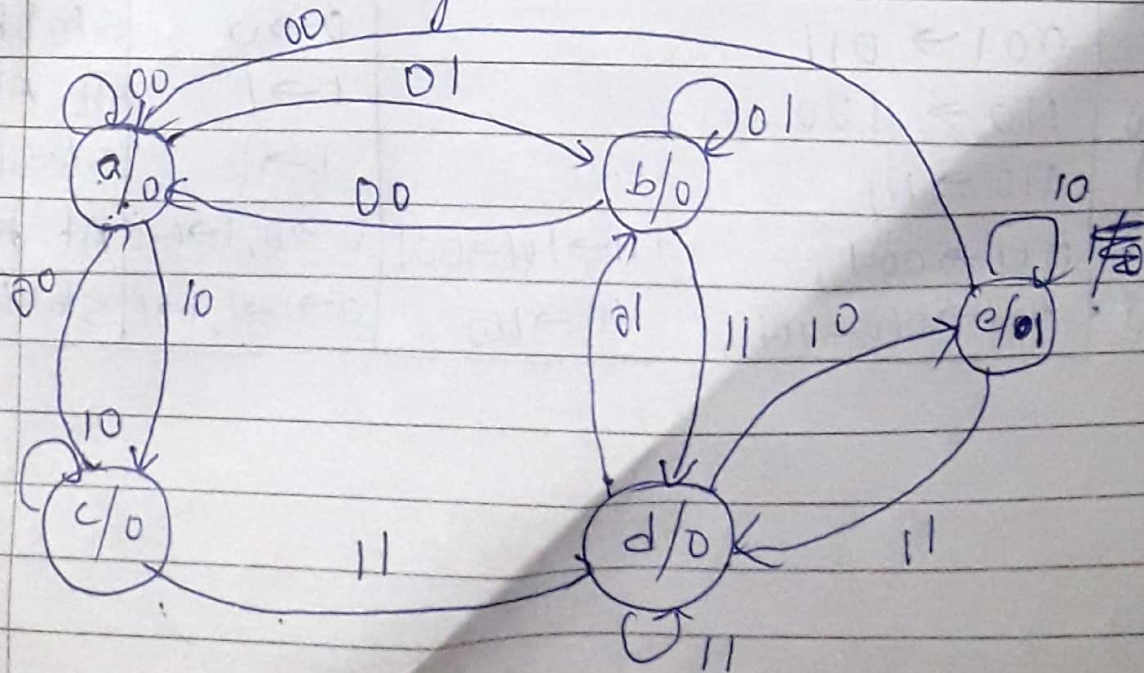
11.10 Design of Asynchronous Sequential Circuit

The Problem :- A digital logic circuit has two inputs A, B & one output X.

X goes high if at $A=1$, B makes a transition $1 \rightarrow 0$. X remains high as long as this $A=1, B=0$ are maintained.



State Transition Diagram



Primitive Table / Primitive flow table AB (Next state)

PS

	00	01	11	10	X
a	(a)	b	x ₁	c	0
b	a	(b)	d	x ₂	0
c	a	x ₃	d	(c)	0
d	x ₄	b	(d)	e	0
e	a	x ₅	d	(e)	1

Here don't care 'x' are represented as x₁, x₂, x₃, x₄ & x₅ for simplification in state reduction

State Reduction

b	d, x ₁			
	c, x ₂			
c	d, x ₁	b, x ₃		
	b, x ₃	c, x ₂		
d	d, x ₁	a, x ₄	a, x ₄	
	a, x ₄	e, x ₂	b, x ₃	
	e		c, e	
e				
	a	b	c	d

$$x_1 \equiv d$$

$$x_2 \equiv c$$

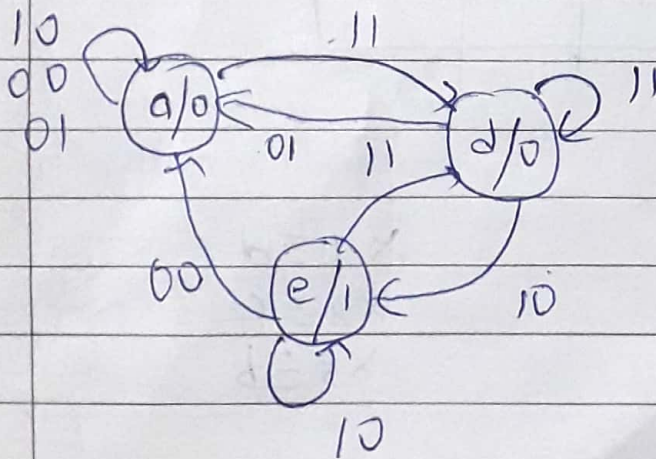
$$x_3 \equiv b$$

$$P: (abc)(d)(e)$$

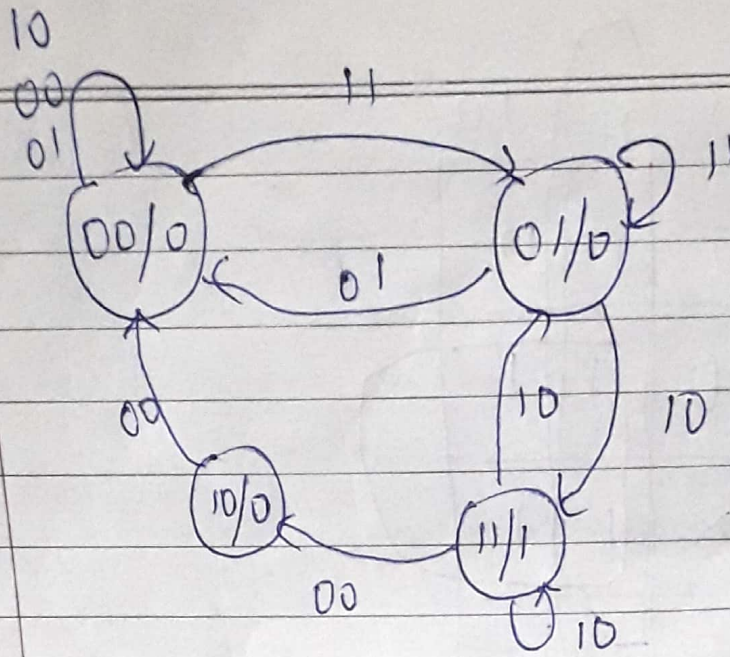
State Assignment

	AB				
	00	01	11	10	X
a	(a)	(a)	d	(a)	0
d	x ₄	a	(d)	e	0
e	a	x ₅	d	(e)	1

a, d, e = 00, 01, 11 \Rightarrow This combination requires only one bit change.



To ensure only "00 \rightarrow 01 \rightarrow 11" states are used validate state, if '10' occurs we need to restart again from '00'. \therefore introduce this after '11' & connect it to '00'.



K-map & Design equations

AB \ pq	00	01	11	10
00	00	00	01	00
01	X	00	01	11
11	10	X	01	11
10	00	X	X	X

AB \ pq	00	01	11	10
00	0	0	0	0
01	X	0	0	1
11	1	X	0	1
10	0	X	X	X

$$P = q\bar{B}$$

AB	00	01	11	10
00	0	0	1	0
01	x	0	1	1
11	0	x	1	1
10	0	x	x	x

$$Q = \bar{A}B + AB$$

P	0	1
0	0	0
1	0	1

$$X = PQ$$

Circuit diagram

