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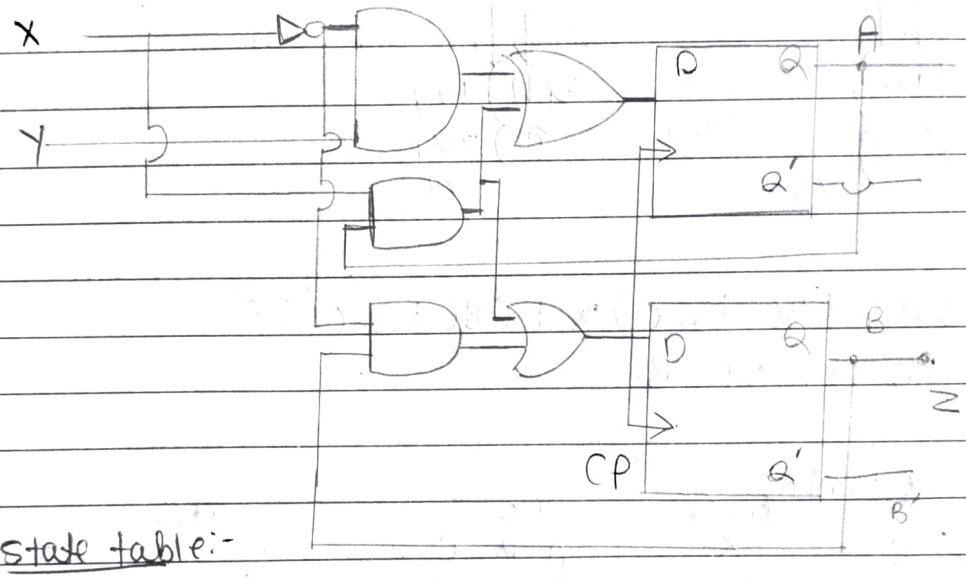
DE Assignment (1)

Q-1 $A(t+1) = x'y + xA$ | $z = B$

$B(t+1) = x'B + xA$

=> (a) Logic Diagram:-



* State table:-

P.S		Inputs		N.S.		Output
A	B	X	Y	A	B	Z
0	0	0	0	0	0	0
0	0	0	1	1	0	0
0	0	1	0	0	0	0
0	0	1	1	0	0	0
0	1	0	0	0	1	1
0	1	0	1	1	1	1
0	1	1	0	0	0	1
0	1	1	1	0	0	0
1	0	0	0	0	0	0
1	0	0	1	1	0	0
1	0	1	0	1	1	0
1	0	1	1	1	1	1
1	1	0	0	0	1	1
1	1	0	1	1	1	1
1	1	1	0	1	1	1
1	1	1	1	1	1	1

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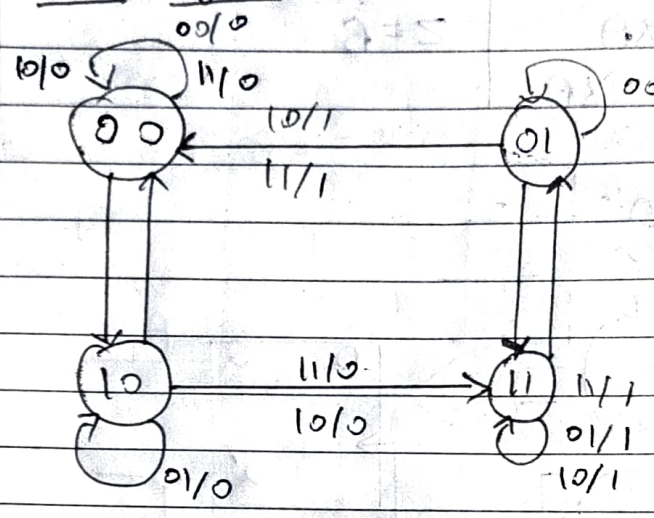
(c) State Diagram :-



Q-2 $DA = CBC' + B'C)x + CBC + B'C')x'$

$DB = A, \quad DC = B$

(a) State table :

PS			Inputs	N.S.			Output		
A	B	C	X	A	B	C	DA	DB	DC
0	0	0	0	1	0	0	1	0	0
0	0	0	1	0	0	0	0	0	0
0	0	1	0	0	0	0	0	0	0
0	0	1	1	1	0	0	1	0	0
0	1	0	0	0	0	1	0	0	1
0	1	0	1	1	0	1	1	0	1
0	1	1	0	1	0	1	1	0	1
0	1	1	1	0	0	1	0	0	1
1	0	0	0	1	1	0	1	1	0
1	0	0	1	0	1	0	0	1	0
1	0	1	0	0	1	0	0	1	0
1	0	1	1	1	1	0	1	1	0
1	1	0	1	0	1	1	0	1	1
1	1	0	0	1	1	1	1	1	1
1	1	1	0	1	1	1	1	1	1
1	1	1	1	0	1	1	0	1	1

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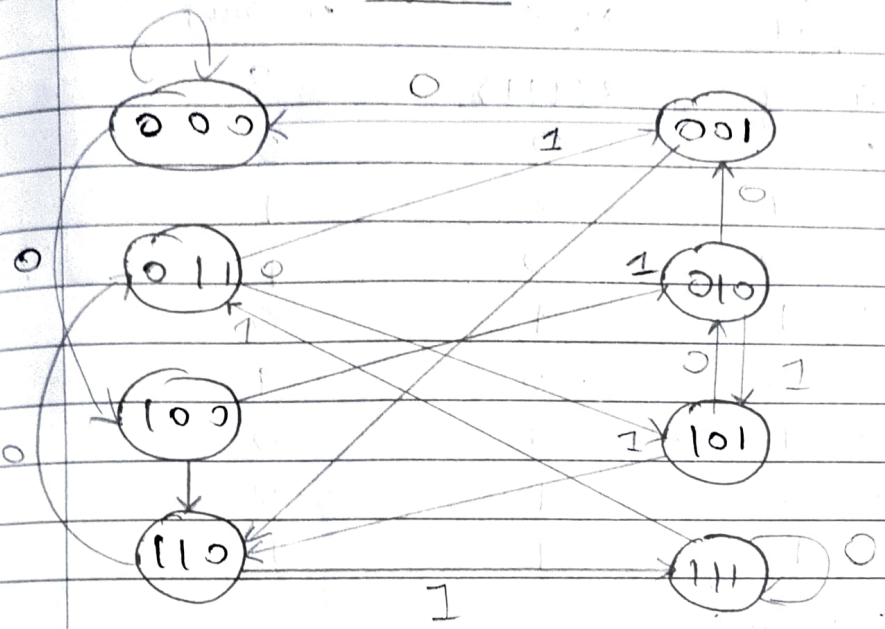
(b) State Diagram



Q-3 Full Adder Circuit's equations are:-

$S = x \oplus y \oplus Q$

$C = xy + xQ + yQ$

⇒ Output ⇒ $S = x \oplus y \oplus Q$

Input equation:-

$D_Q = C$

$= xy + xQ + yQ$

Characteristic equation

$Q(t+1) = D = xy + xQ + yQ$

State eqⁿ: $Q(t+1) = C$

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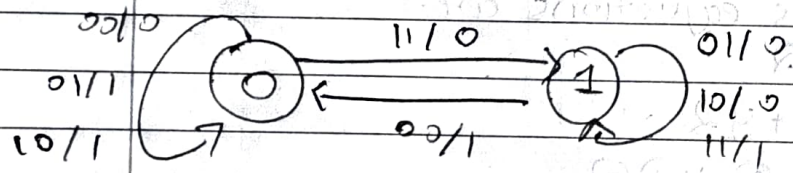
(a) State equation:-

P.S.	Input		N.S.	Output
Q(t)	x	y	Q(t+1)	S
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	1	1

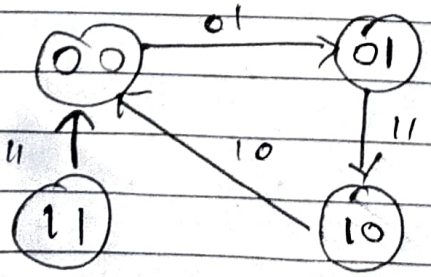
* (b) State Diagram :-



Q-4 $TA = A + B$; $TB = A' + B$

P.S.		Input		N.S.	
A	B	TA	TB	A	B
0	0	0	1	0	1
0	1	1	1	1	0
1	0	1	0	0	0
1	1	1	1	0	0

(b) State Diagram:-



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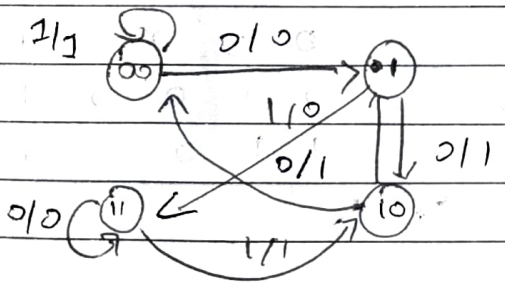
Q-5 $JA = B$, $JB = (A \oplus X')$ $Y = A \oplus X \oplus B$

$KA = B'$, $KB = (A \oplus X)'$

* State table :-

P. S.		Input	N. S.		F. F.				O/P
A	B	X	A(t+1)	B(t+1)	JA	KA	JB	KB	Y
0	0	0	0	1	0	1	1	1	0
0	0	1	0	0	0	1	0	0	1
0	1	0	1	0	1	0	1	1	1
0	1	1	1	1	1	0	0	0	0
1	0	0	0	0	0	1	0	0	1
1	0	1	0	1	0	1	1	1	0
1	1	0	1	1	1	0	0	0	0
1	1	1	1	0	1	0	1	1	1

* State Diagram :-



Q-6 $JA = BX + B'Y'$

$KA = B'XY$

$Z = AXY + BX'Y'$

$JB = A'X$

$K_B = A + XY'$

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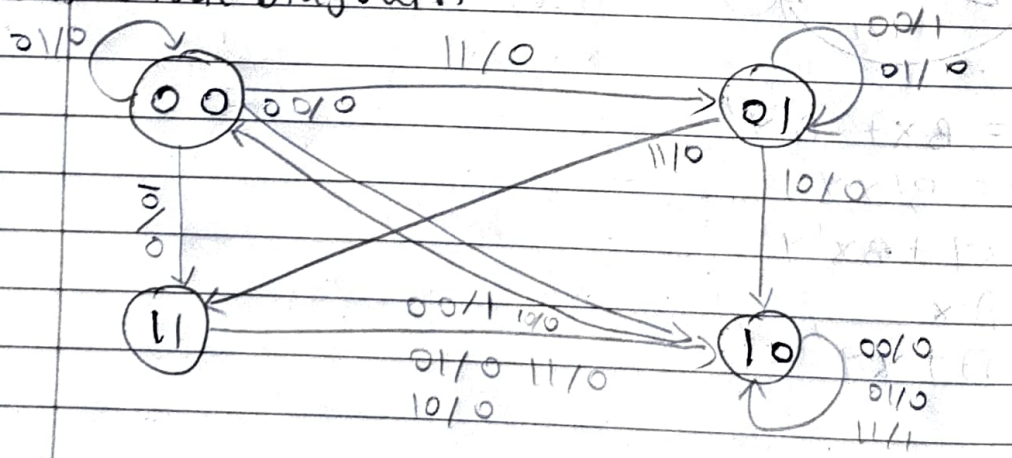
P.S		Input		N.S.		O/P				
A	B	X	Y	A	B	Z	J_A	K_A	J_B	K_B
0	0	0	0	1	0	0	1	0	0	0
0	0	0	1	0	0	0	0	0	0	0
0	0	1	0	1	1	0	1	1	1	1
0	0	1	1	0	1	0	0	0	1	0
0	1	0	0	0	1	1	0	0	0	0
0	1	0	1	0	1	0	0	0	0	0
0	1	1	0	1	0	0	1	0	1	1
0	1	1	1	1	1	0	1	0	1	0
1	0	0	0	1	0	0	1	0	0	1
1	0	0	1	1	0	0	0	0	0	1
1	0	1	0	0	0	0	1	1	0	1
1	0	1	1	1	0	1	0	0	0	1
1	1	0	0	1	0	1	0	0	0	1
1	1	0	1	1	0	0	0	0	0	1
1	1	1	0	1	0	0	1	0	0	1
1	1	1	1	1	0	1	1	0	0	1

(b) State Diagram



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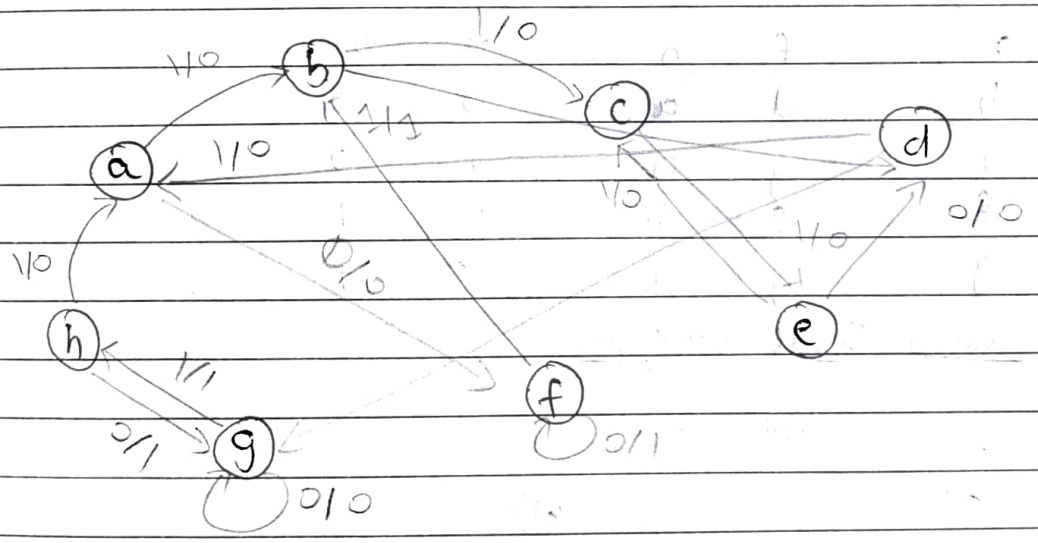
Q-7

P.S	N.S		Output	
	x=0	x=1	x=0	x=1
a	f	b	0	0
b	d	c	0	0
c	f	e	0	0
d	g	a	1	0
e	d	c	0	0
f	f	b	1	1
g	g	h	0	1
h	g	a	1	0

* State Diagram:-



* Reduced State table:-

→ State d & h both go to same states g & a have same outputs

→ So, out of d & h, one can be removed.

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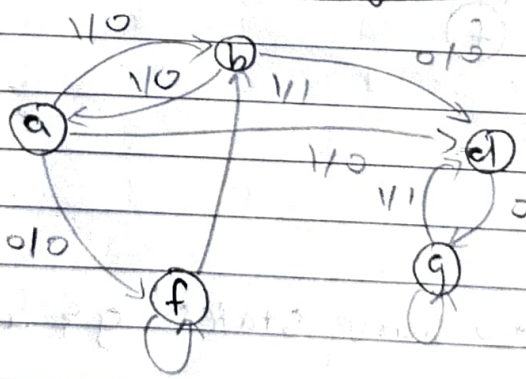
P.S.	N.S.		O/P	
	x=0	x=1	x=0	x=1
a	f	b	0	0
b	d	c	0	0
c	f	b	0	0
d	g	a	1	0
f	f	b	1	1
g	g	d	0	1

→ Here, states a, c & f go to same sides & f & b also, a & c have same output of 0 for x=0 & x=1.

→ a, c are equivalent.

P.S	N.S		O/P	
	x=0	x=1	x=0	x=1
a	f	b	0	0
b	d	a	0	0
d	g	a	1	0
f	f	b	1	1
g	g	d	0	1

* Reduced State Diagram: -



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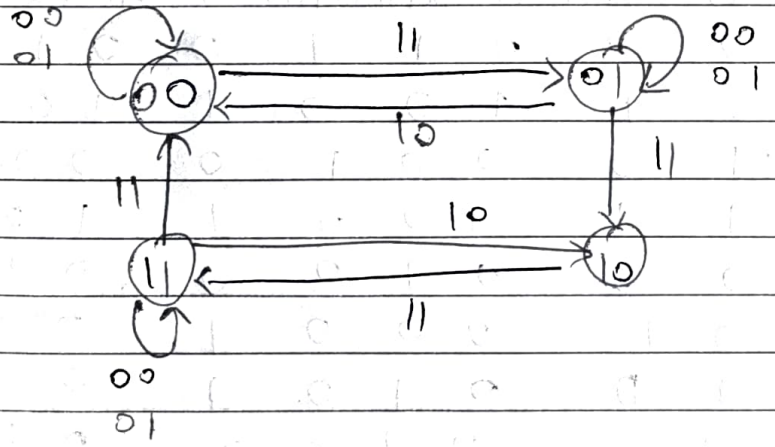
Q-3 Equation Derived from Figure:-

$D = T \oplus Q$

P.S.	Input	N.S.	F.F I/P
Q(t)	T	Q(t+1)	D
0	0	0	0
0	1	1	1
1	0	1	1
1	1	0	0

→ Here, if input is 0, next state will be same as present state (memory).
→ If input 1 then next state will be complement of present state.
→ Hence, it is equivalent to T flip flop

Q-4 State Diagrams:-



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* JA:-

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

KA:-

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

K_B

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

Q-10

A(t)	B(t)	C(t)	X	A(t+1)	B(t+1)	C(t+1)	Y	D_A	D_B	D_C
0	0	0	0	0	1	1	0	0	1	1
0	0	0	1	1	0	0	1	1	0	0
0	0	1	0	0	0	1	0	0	0	1
0	0	1	1	1	0	0	1	1	0	0
0	1	0	0	0	1	0	0	0	1	0
0	1	0	1	0	0	0	1	0	0	0
0	1	1	0	0	1	0	1	0	0	1
0	1	1	1	0	1	0	0	0	1	0
1	0	0	0	~~0~~	~~0~~	~~0~~	~~0~~	X	X	X
1	0	0	1	-	-	-	X	X	X	X
1	1	0	0	-	-	-	X	X	X	X
1	1	0	1	-	-	-	X	X	X	X
1	1	1	0	-	-	-	X	X	X	X
1	1	1	1	-	-	-	X	X	X	X

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* K-maps :-

D_A:

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

$D_A = A'B'x$

D_B

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

$D_B = A + C'x' + BCx$

D_C

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

$D_C = Ax + Cx' + A'B'x'$

Y:

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

$y = A'x$

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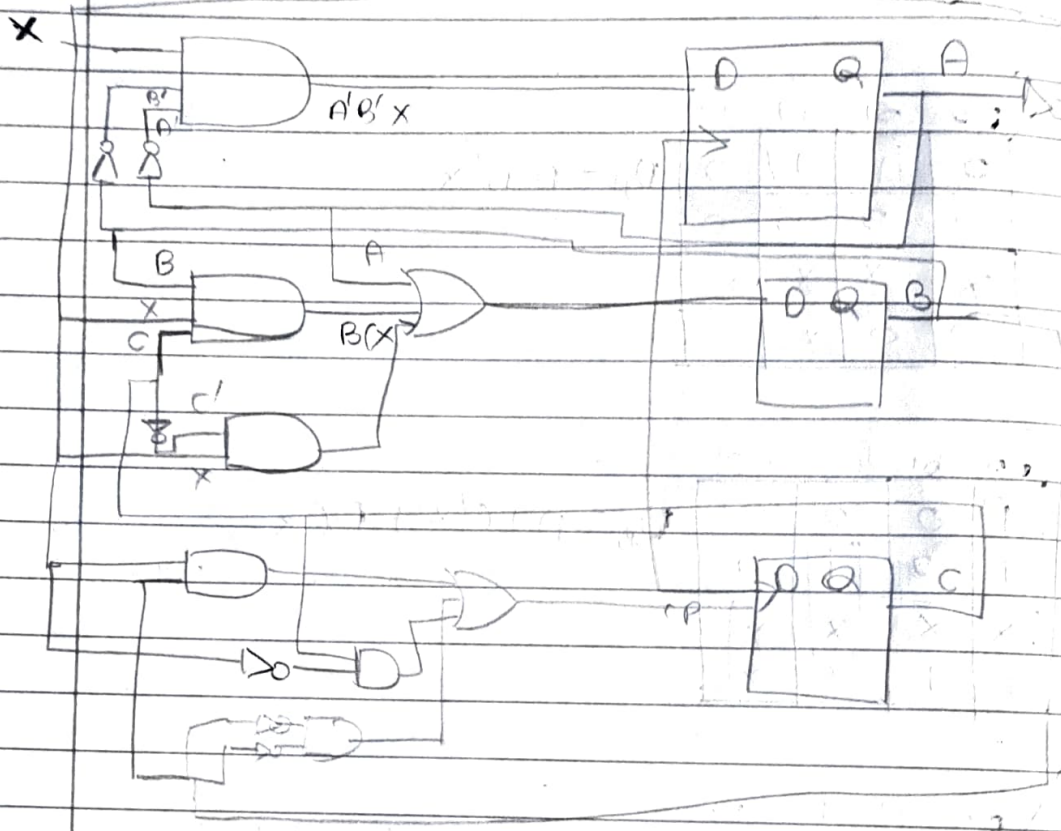

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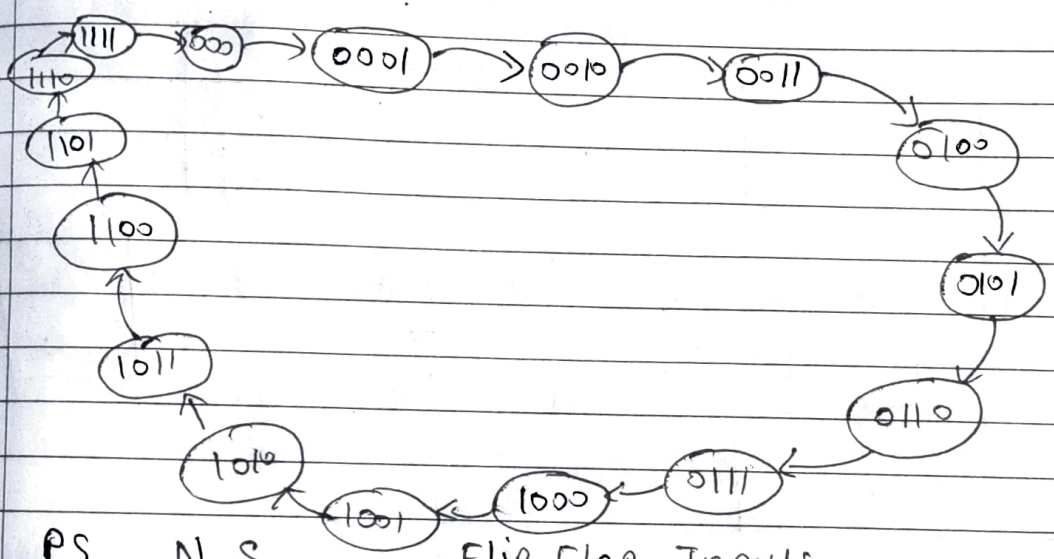
Q-11 State Diagram :-



PS	N.S.	Flip Flop Inputs
A B C D	A B C D	J_A K_A J_B K_B J_C K_C J_D K_D
0 0 0 0	0 0 0 1	0 x 0 x 0 x 1 x
0 0 0 1	0 0 1 0	0 x 0 x 1 x x 1
0 0 1 0	0 0 1 1	0 x 0 x x 0 1 x
0 0 1 1	0 1 0 0	0 x 1 x x 1 x 1
0 1 0 0	0 1 0 1	0 x x 0 0 x 1 x
0 1 0 1	0 1 1 0	0 x x 0 1 x x 1
0 1 1 0	0 1 1 1	0 x x 0 x 0 1 x
0 1 1 1	1 0 0 0	1 x x 1 x 1 x x 1
1 0 0 0	1 0 0 1	x 0 0 x 0 x x x 1
1 0 0 1	1 0 1 0	x 0 1 x x 1 x 1 0
1 0 1 0	1 0 1 1	x 0 x 0 0 x 1 x
1 0 1 1	1 1 0 0	x 0 x 0 1 x x 1
1 1 0 0	1 1 0 1	x 0 x 0 0 x 1 x
1 1 0 1	1 1 1 0	x 0 x 0 1 x x 1
1 1 1 0	1 1 1 1	x 0 x 0 x 0 1 x
1 1 1 1	0 0 0 0	x 1 x 1 x 1 x 1

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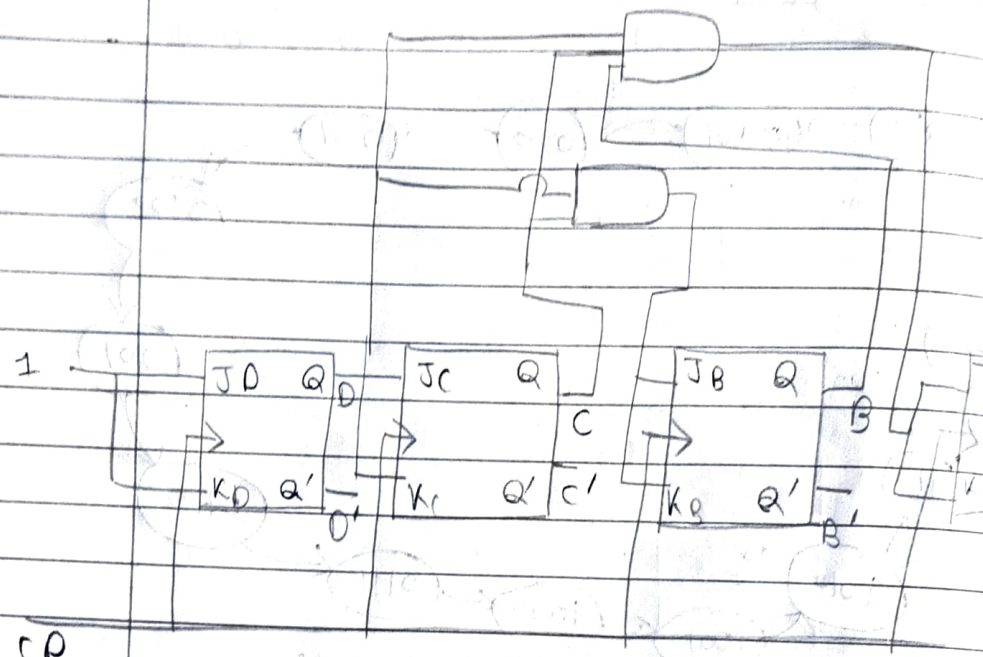
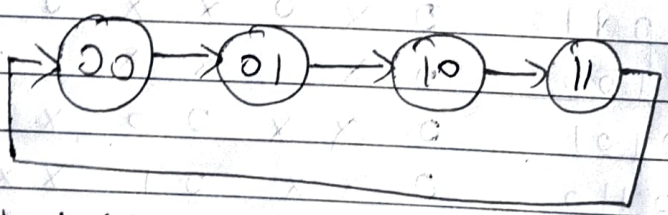


Q-13 State Diagram



* State table:-

Present state		Next state		Flip Flop input	
A	B	A	B	T_A	T_B
0	0	0	1	0	1
0	1	1	0	1	1
1	0	1	1	0	1
1	1	0	0	1	1

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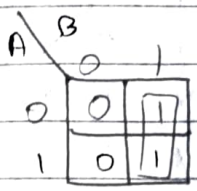
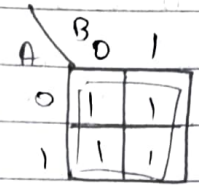
* K-Maps:-

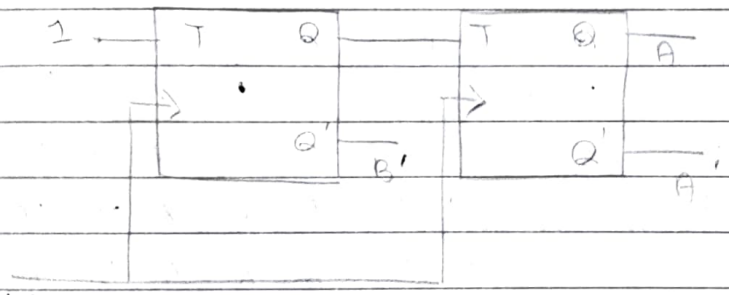


$T_A = B$



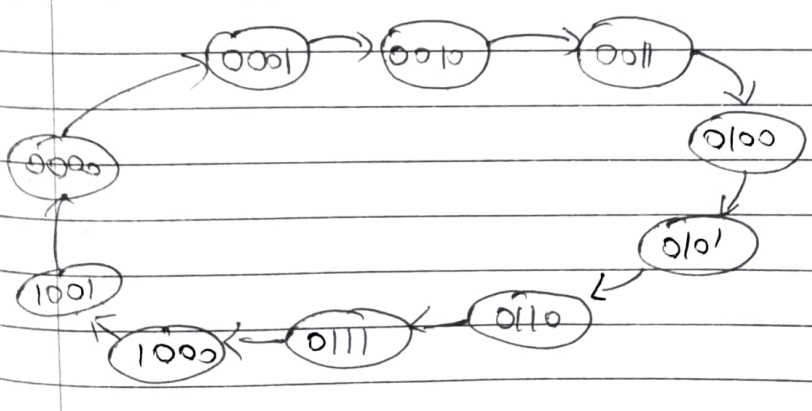
$T_B = 1$

* Sequential circuit



Q-14 State Diagram

=



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* State table:-

P.S.				N.S.				FF Inputs							
A	B	C	D	A	B	C	D	S_A	R_A	S_B	R_B	S_C	R_C	S_D	R_D
0	0	0	0	0	0	0	1	0	X	0	X	0	X	1	0
0	0	0	1	0	0	1	0	0	X	0	X	1	0	0	1
0	0	1	0	0	0	1	1	0	X	0	X	X	0	1	0
0	0	1	1	0	1	0	0	0	X	1	0	0	1	0	1
0	1	0	0	0	1	0	1	0	X	X	0	0	X	1	0
0	1	0	1	0	1	1	0	0	X	X	0	1	0	0	1
0	1	1	0	0	1	1	1	0	X	X	0	X	0	1	0
0	1	1	1	1	0	0	0	1	0	0	1	0	1	0	1
1	0	0	0	1	0	0	1	X	0	0	X	0	X	1	0
1	0	0	1	0	0	0	0	0	1	0	X	0	X	0	1
1	0	1	0	-	-	-	-	X	X	X	X	X	X	X	X
1	0	1	1	-	-	-	-	X	X	X	X	X	X	X	X
1	1	0	0	-	-	-	-	X	X	X	X	X	X	X	X
1	1	0	1	-	-	-	-	X	X	X	X	X	X	X	X
1	1	1	0	-	-	-	-	X	X	X	X	X	X	X	X
1	1	1	1	-	-	-	-	X	X	X	X	X	X	X	X

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* S_A

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

$S_A = BCD$

R_A

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

$R_A = C'D$

S_B

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

R_B

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

S_C

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

$S_C = A'C'D$

R_C

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

$R_C = CD$

S_D

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

$S_D = D'$

R_D

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

$R_D = D$

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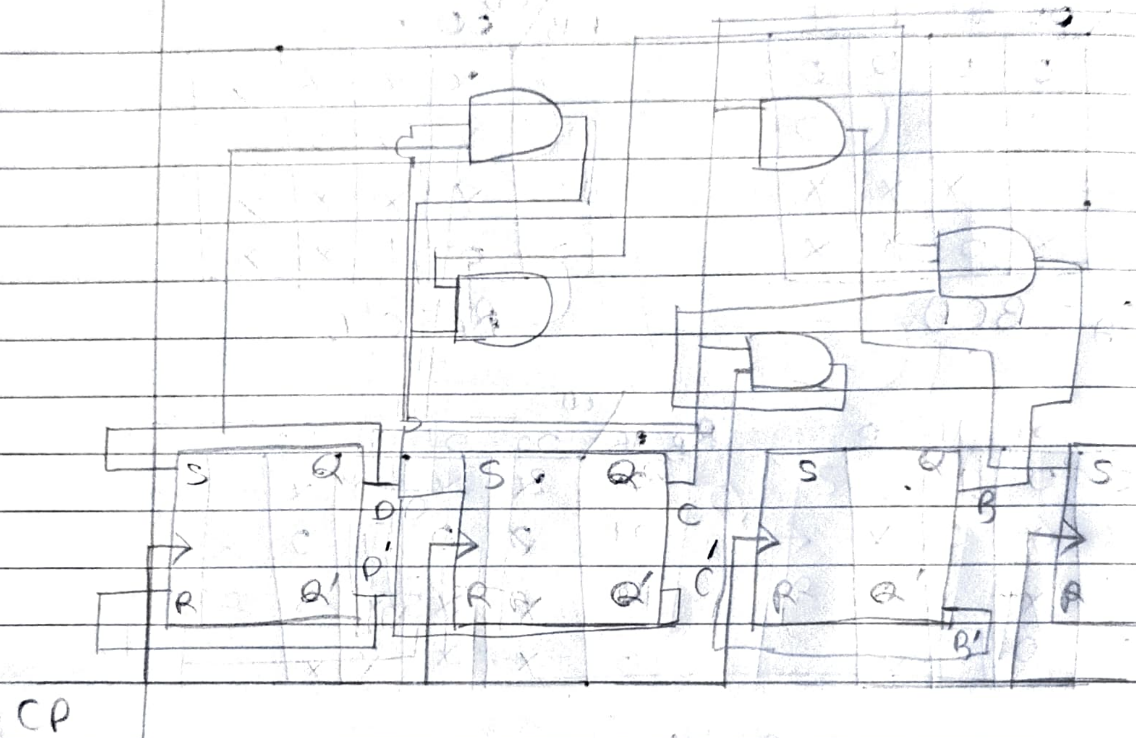

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