BITS Pilani
Hyderabad Campus
Department of Electrical Engineering

Digital Design
First Semester 2020-21
Tutorial : 08

Sequential Circuit Design

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1 . Design a Modulo 5 Counter

State table

C B A	C+1	B+1	A+1	J_C	K_C	J_B	K_B	J_A	K_B
0 0 0	0	0	1	0	×	0	×	1	×
0 0 1	0	1	0	0	×	1	×	×	1
0 1 0	0	1	1	0	×	×	0	1	×
0 1 1	1	0	0	1	×	×	1	×	1
1 0 0	0	0	0	×	1	0	×	0	×

Q(t)	Q(t+1)	J	K	
0	0	0	X	(0 0) (0 1)
0	1	1	X	(1 0) (1 1)
1	0	X	1	(1 1) (0 1)
1	1	X	0	(1 0) (0 0)

Excitation Table

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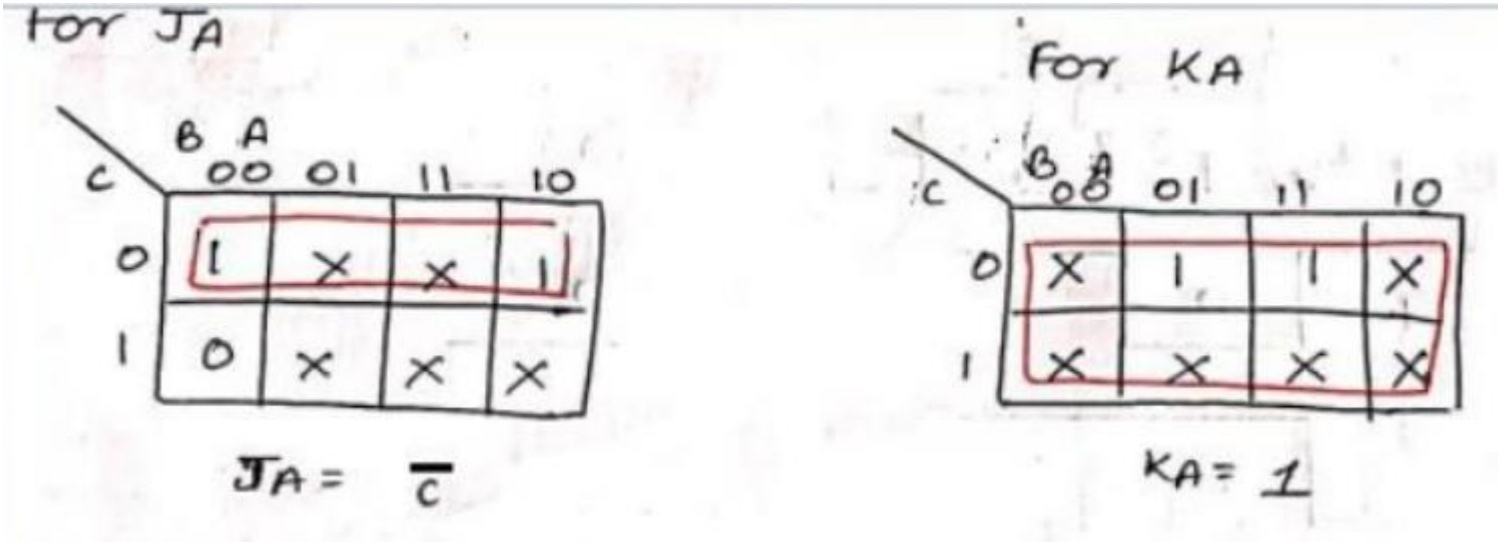
1 . Design a Modulo 5 Counter



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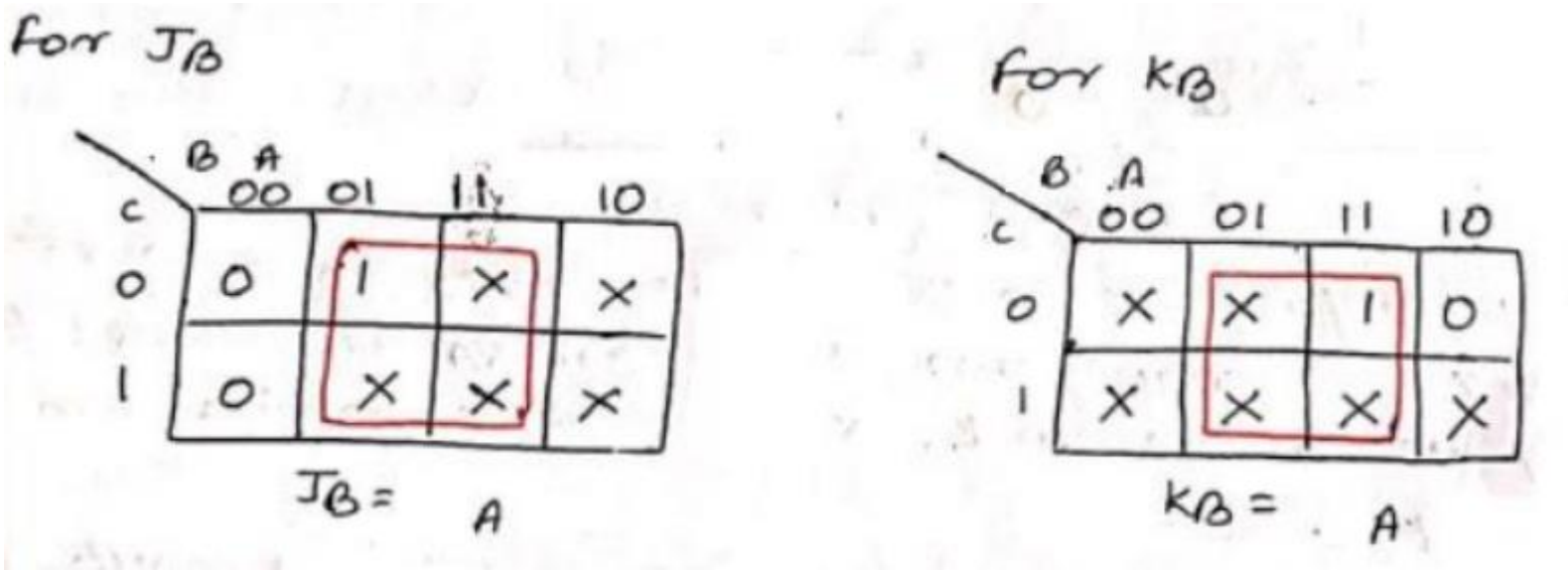
1 . Design a Modulo 5 Counter



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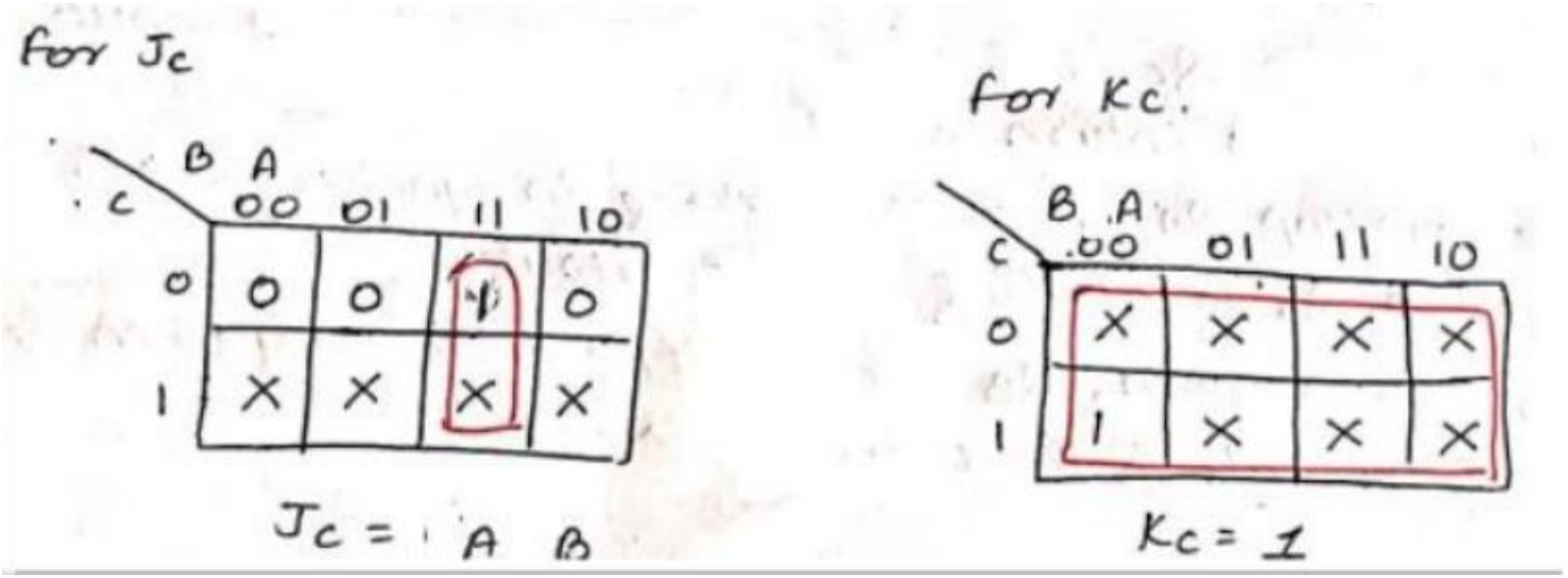
1 . Design a Modulo 5 Counter



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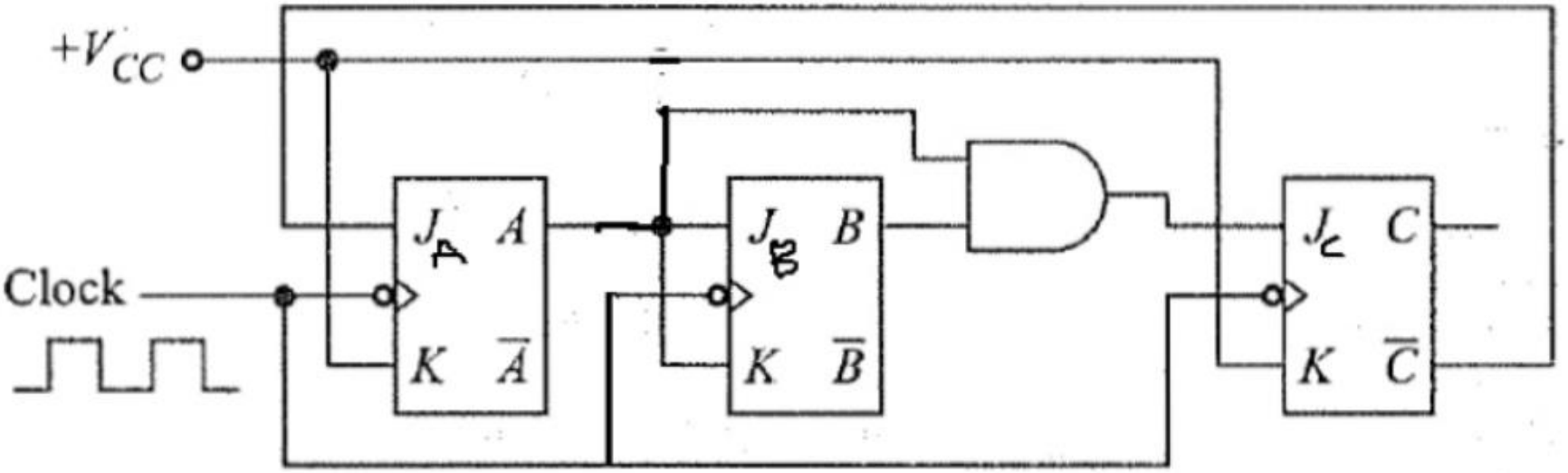

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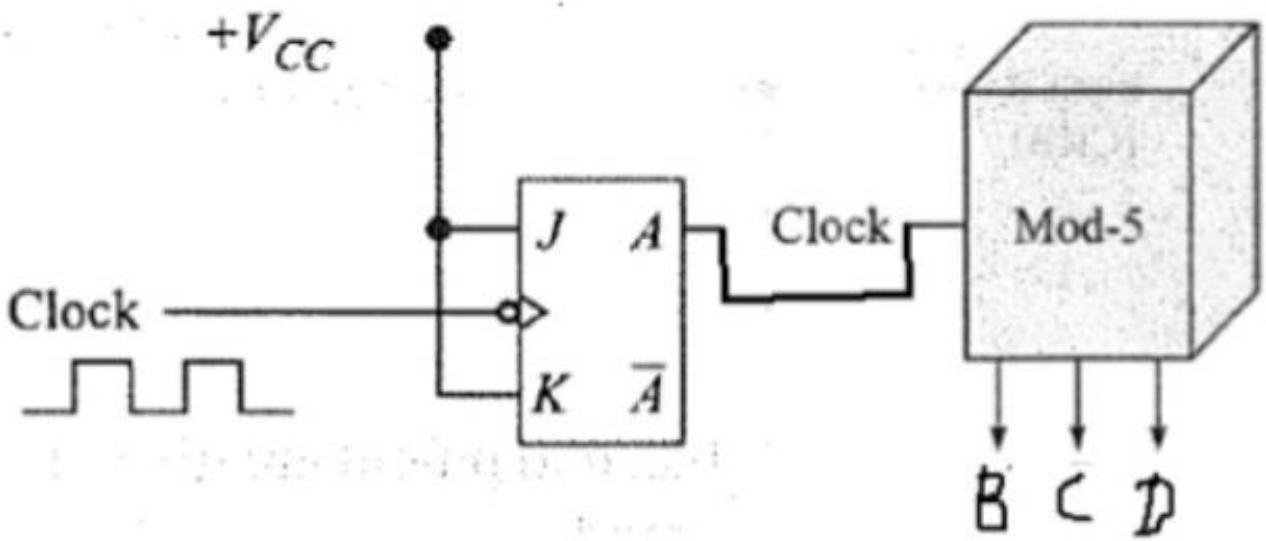
2 . Design a Modulo 10 Counter



0000
0001
0010
0011
0100
0101
0110
0111
1000
1001

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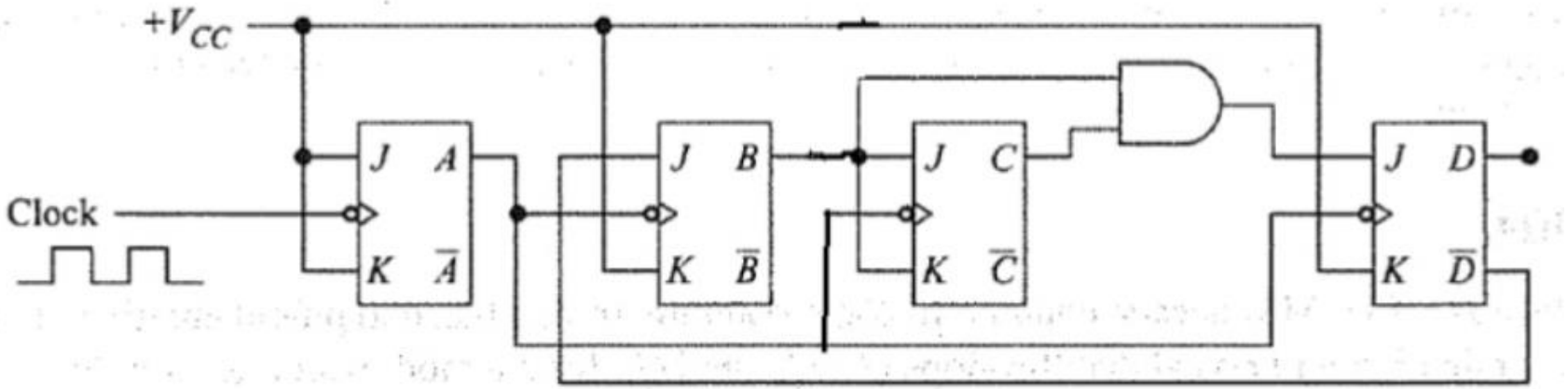
2 . Design a Modulo 10 Counter



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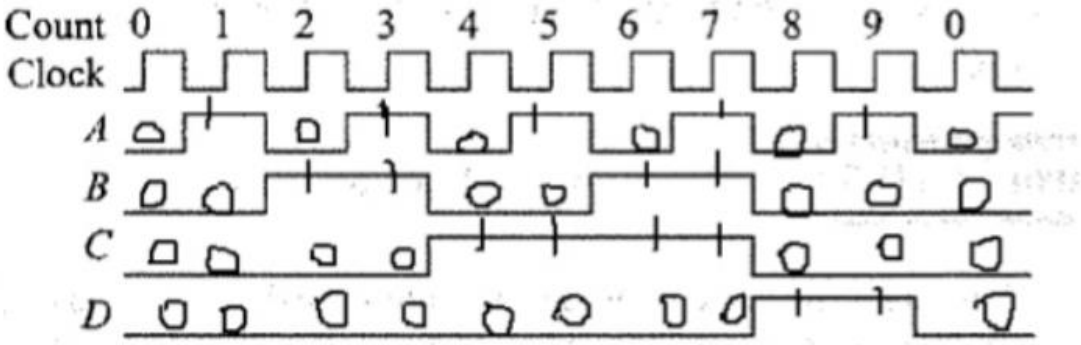
2 . Design a Modulo 10 Counter

Truth Table:

D	C	B	A	Count
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9

Timing Waveforms:



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3 .

Problem: Design self-correcting MOD-6 counter in which all the unused states leads to state CBA=000

State Table:

C_n	B_n	A_n	C_{n+1}	B_{n+1}	A_{n+1}	J_C	K_C	J_B	K_B	J_A	K_A
0	0	0	0	0	1	0	×	0	×	1	×
0	0	1	0	1	0	0	×	1	×	×	1
0	1	0	0	1	1	0	×	×	0	1	×
0	1	1	1	0	0	1	×	×	1	×	1
1	0	0	1	0	1	×	0	0	×	1	×
1	0	1	0	0	0	×	1	0	×	×	1
1	1	0	0	0	0	×	1	×	1	0	×
1	1	1	0	0	0	×	1	×	1	×	1

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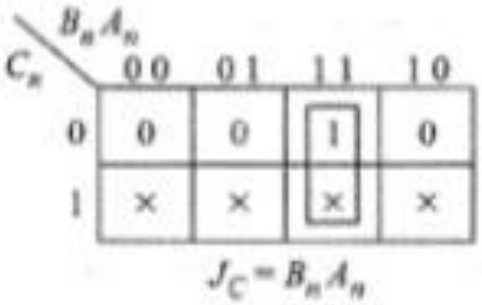
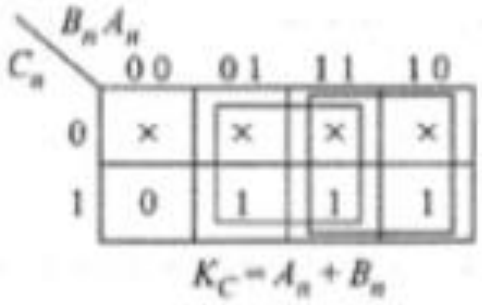
3 .

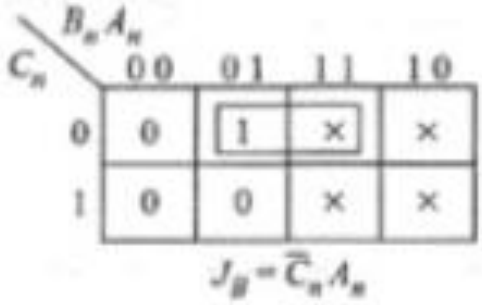
Problem: Design self-correcting MOD-6 counter in which all the unused states leads to state CBA=000



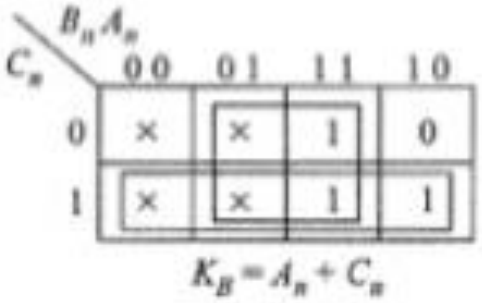
$J_C = B_nA_n$



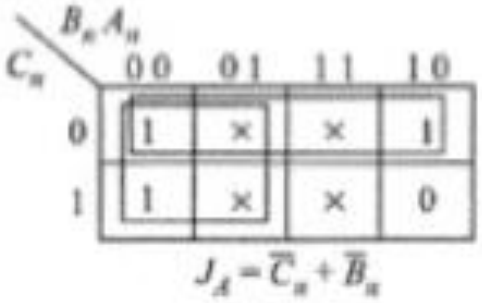
$K_C = A_n + B_n$



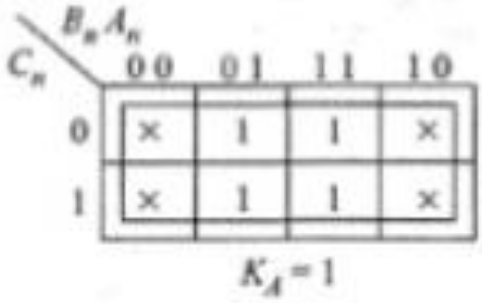
$J_B = \overline{C}_nA_n$



$K_B = A_n + C_n$



$J_A = \overline{C}_n + \overline{B}_n$



$K_A = 1$

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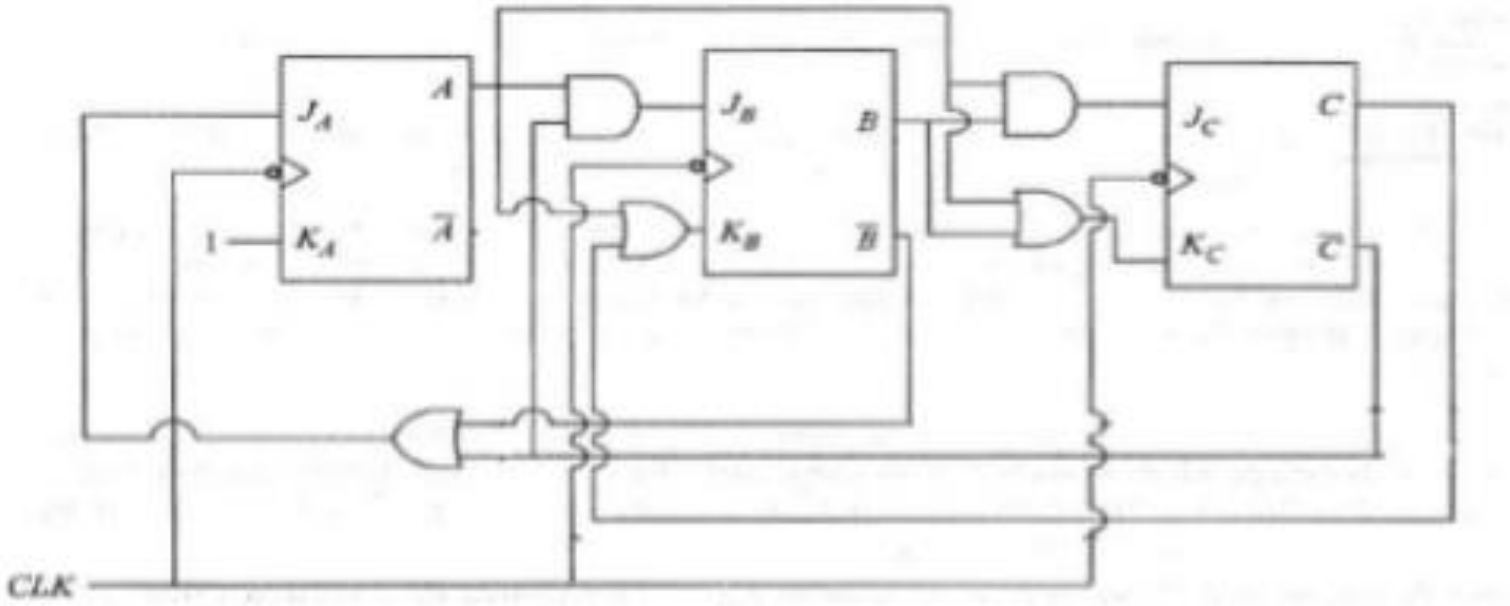
3 .

Problem: Design self-correcting MOD-6 counter in which all the unused states leads to state CBA=000

Mod-6 self-correcting circuit:



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4. **Presettable Counter:**

In Presettable counter, user can set initial state of the counter, after initial state, counter can be made to count either UP or Down.

MOD-8 Presettable counter with initial state =101 (5):

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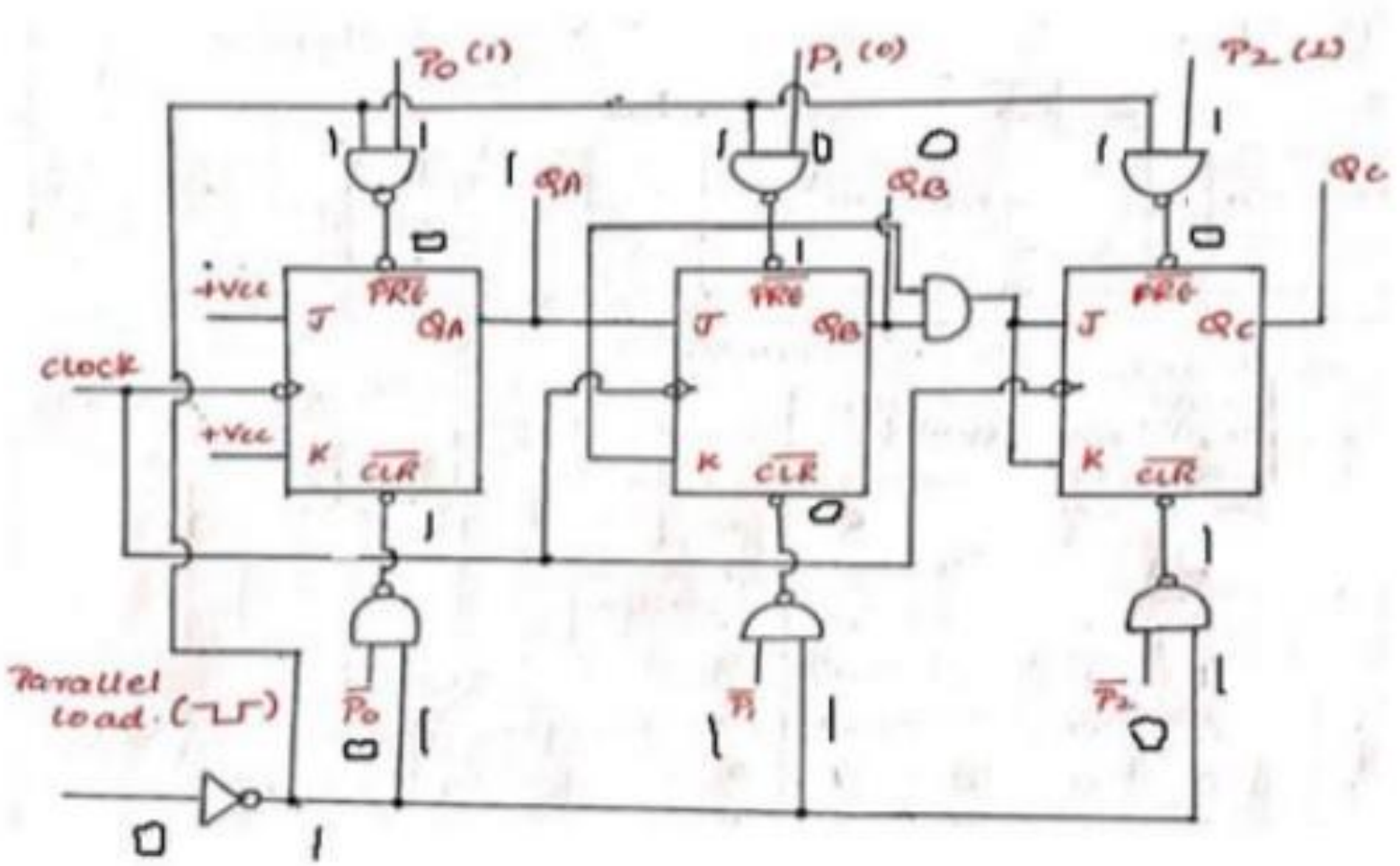
4.



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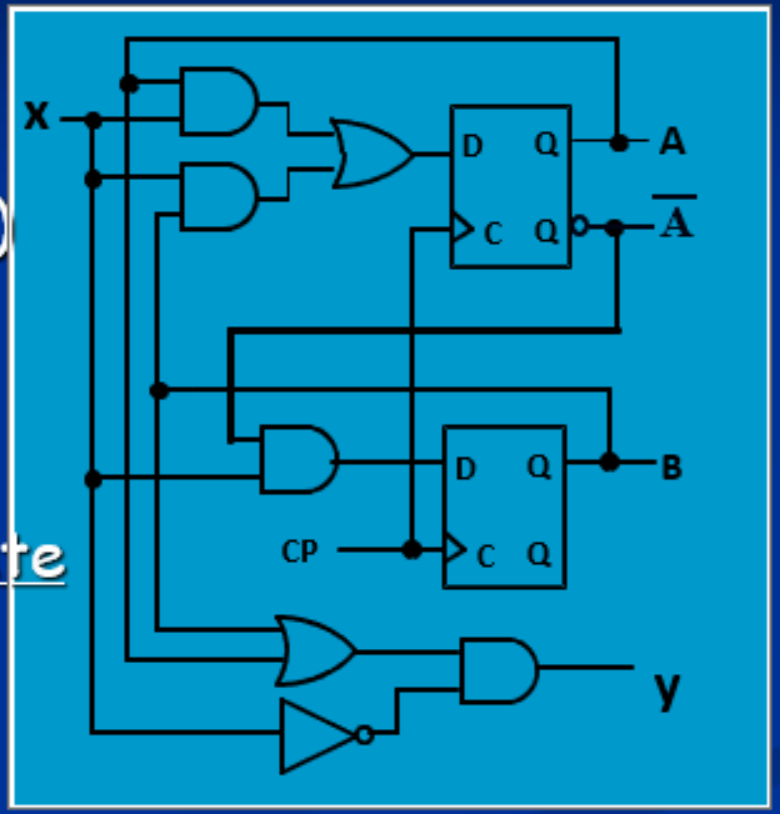
5 .

- Input: x(t)
- Output: y(t)
- State: (A(t), B(t))
- What is the Output Function?
- What is the Next State Function?



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5 .

- Boolean equations for the functions:
  - $A(t+1) = A(t)x(t) + B(t)x(t)$
  - $B(t+1) = A'(t)x(t)$
  - $y(t) = x'(t)(B(t) + A(t))$