CMR INSTITUTE OF TECHNOLOGY

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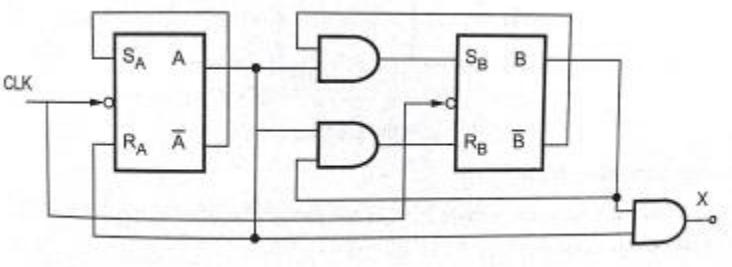
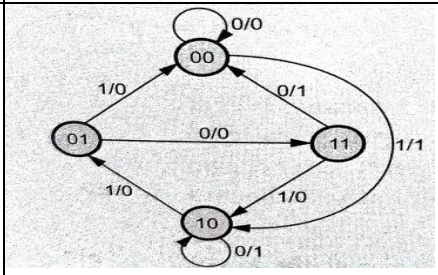
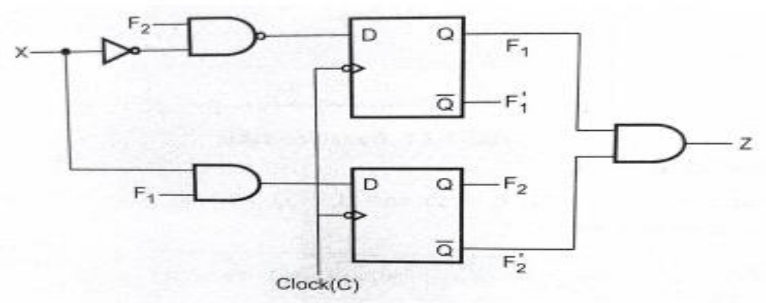
Internal Assesment Test - III

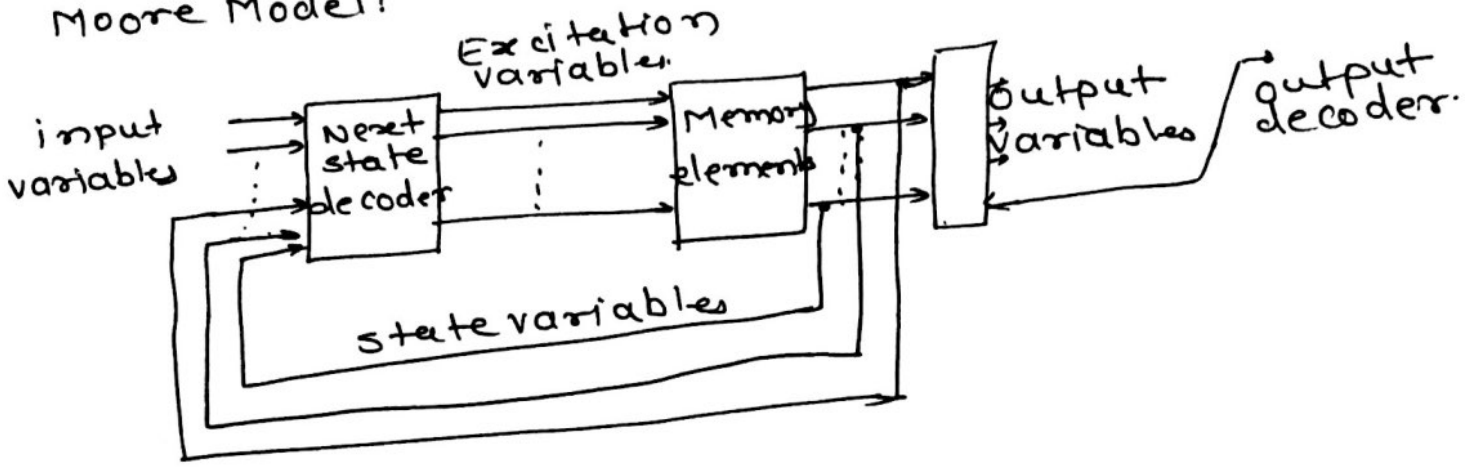
Sub:	DIGITAL SYSTEM DESIGN							Code:	17EE35	
Date:	22/11/2018	Duration:	90 mins	Max Marks:	50	Sem:	3rd (A)	Branch:	EEE	
Answer any FIFTY marks.										
								Marks	OBE	
									CO	RBT
1.	Define state variables, excitation variables and write a note on Moore and Mealy sequential model.							10	CO4	L1
2.	 Give output function, transition table and state diagram by analyzing the sequential circuit shown above.							10	CO4	L3
3.	Realize a 3 bit synchronous up counter using JK flip flop. Write excitation table, transition table and logic diagram.							10	CO4	L4
4.	 Design the sequential logic circuit for system shown above using D flip flop.							10	CO4	L3
5.	 For the logic diagram given in fig.) Derive the excitation and output equations ii) write the next equation iii)construct a transition table iv)draw the state diagram.							10	CO4	L4
6.	Design a sequence detector to detect sequence 110 using JK flip flop.(Use Moore Machine model)							10	CO4	L3

1.

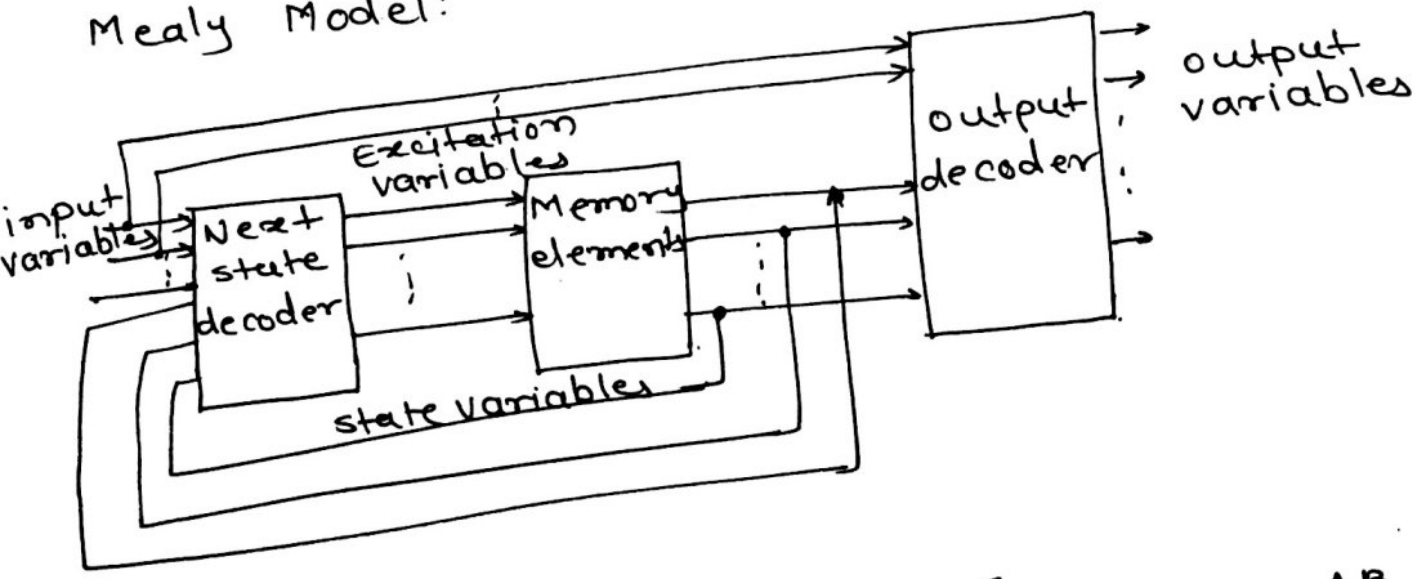
State variable: The output of flipflops (memory) defines the state of a sequential machine. Therefore state variables are the flip-flop outputs.

Excitation variable: Excitation variables are the inputs to the flip-flops. Excitation variables are generated by the input combinational logic operating on the state variables and input variables.

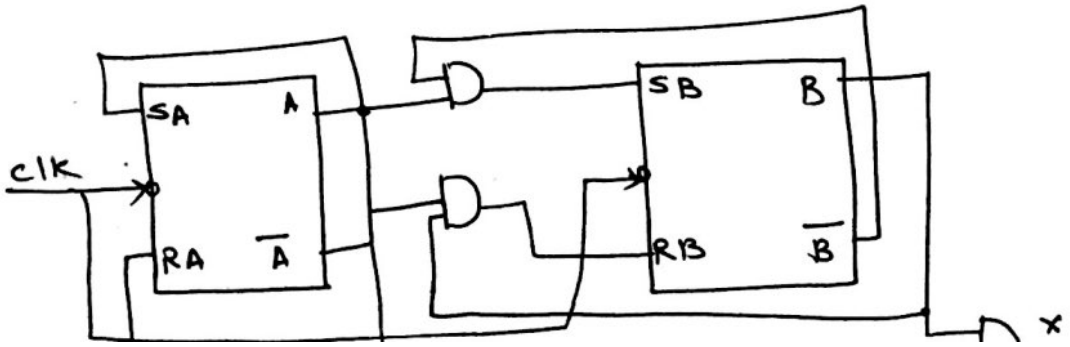
Moore Model:



Mealy Model:



2.



$x = AB$

$SA = \overline{A}$ $RA = A$

$SB = A\overline{B}$ $RB = AB$

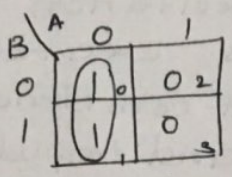
$A^+ = QA^+ = SA + \overline{RA}\,QA = \overline{A} + \overline{A}\,QA = \overline{A}(1+QA) = \overline{A}$

$B^+ = QB^+ = SB + \overline{RB}\,QB = A\overline{B} + \overline{AB}\,QB = A\overline{B} + (\overline{A}+\overline{B})B$

$= A\overline{B} + \overline{A}B = A \oplus B$

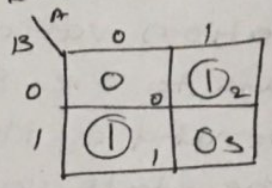
present state Q_A	Q_B	Next state Q_A^+	Q_B^+
0	0	1	0
0	1	1	1
1	0	0	1
1	1	0	0

K-MAP for A^+



$A^+ = \overline{A}$

K-MAP for B^+



$B^+ = A \oplus B$

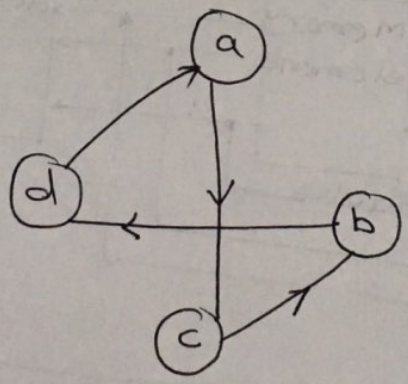
Transition Table:

present state A	B	Next state A^+	B^+	output X
0	0	1	0	0
0	1	1	1	0
1	0	0	1	0
1	1	0	0	1

state assignment

a = 00
b = 01
c = 10
d = 11

state diagram:



Q.4. state table:

present state A	B	Next state x=0	x=1	output x=0	x=1
0	0	00	10	0	1
0	1	11	00	0	0
1	0	10	01	1	0
1	1	00	10	1	0

For D flip flops next states are nothing but the new present states. For k-map we use next states directly.

K-Map

For flip-flop A

AB \ X	0	1
00	0	(1)
01	(1)	0
11	0	(1)
10	(1)	0

For flip-flop B

AB \ X	0	1
00	0	0
01	(1)	0
11	0	0
10	0	(1)

For output

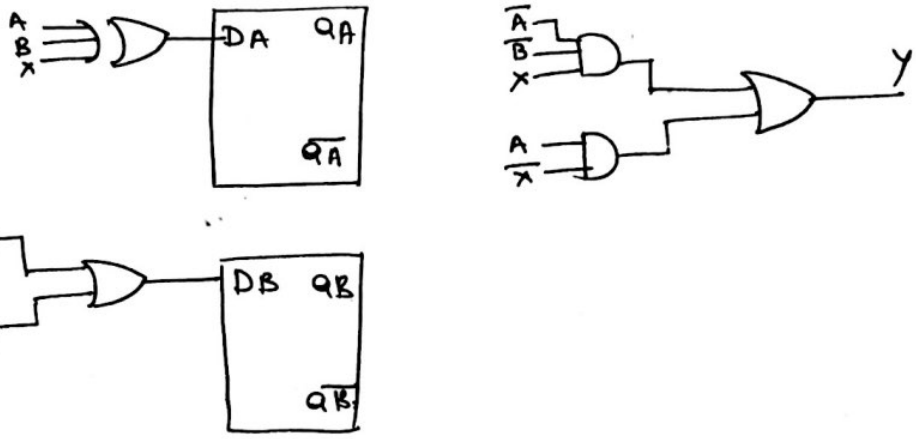
AB \ X	0	1
00	0	(1)
01	0	0
11	(1)	0
10	(1)	0

$DA = \bar{A}B\bar{X} + \bar{A}B\bar{X} + ABX + A\bar{B}\bar{X} = A \oplus B \oplus X$

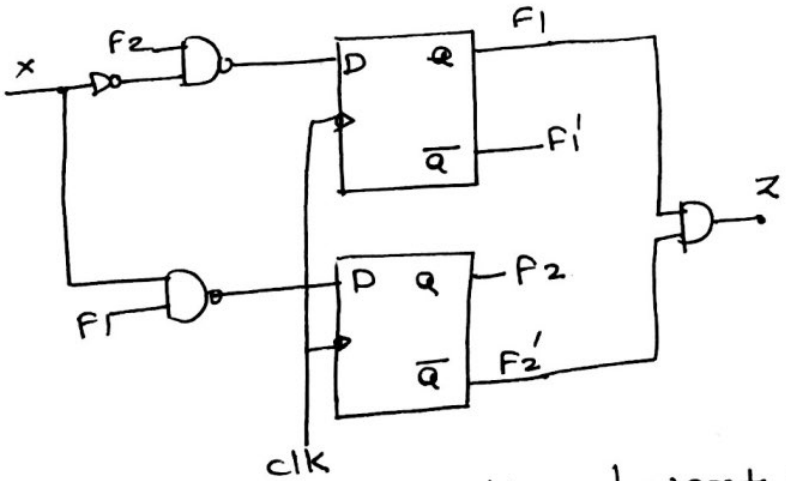
$DB = \bar{A}B\bar{X} + A\bar{B}X$

$Y = \bar{A}\bar{B}X + A\bar{X}$

logic diagram



Q.5



Excitation & output equations

$Z = F_1\bar{F_2}$

$P_1 = \overline{F_2\bar{X}} = F_2 + X$

$P_2 = XF_1$

Transition equations

$Q^+ = P$

$F_1^+ = F_2 + X$

$F_2^+ = XF_1$

Next state map for each flip flop

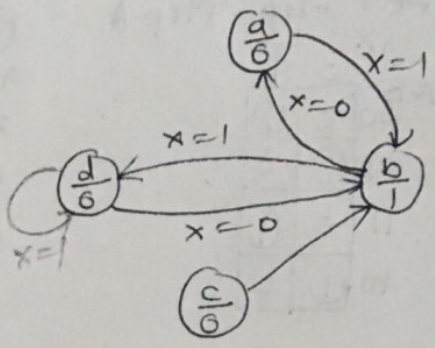
For F_1^+

F_2F_1 \ X	0	0
00	0	1
01	0	1
11	1	1
10	1	1

For F_2^+

F_2F_1 \ X	0	1
00	0	0
01	0	1
11	0	0
10	0	1

state diagram:
a=00, b=01, c=10, d=11

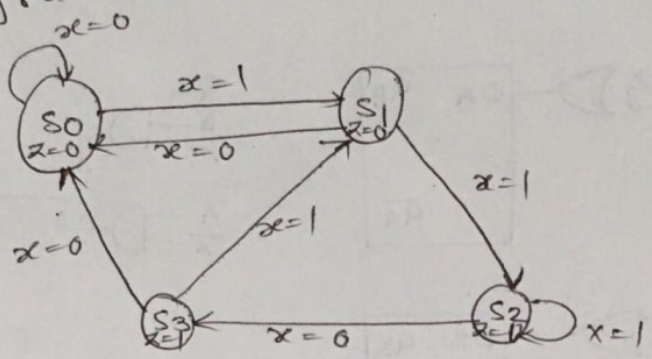


Transition Table

present state		Next state x=0		x=1		output
F_2	F_1	F_2^+	F_1^+	F_2^+	F_1^+	
0	0	0	0	0	1	0
0	1	0	0	1	1	1
1	0	0	1	0	1	0
1	1	0	1	1	1	0

Q. 6

state diagram



state transition table:

present state	input x	Next state	output (z)
S0	0	S0	0
S0	1	S1	0
S1	0	S0	0
S1	1	S2	0
S2	0	S3	0
S2	1	S2	0
S3	0	S0	1
S3	1	S1	1

Need two flip flops.

S0 - 00, S1 = 01, S2 = 10, S3 = 11

state transition table:

Present state	Inputs: input		input	outputs: Next state			JK input variable	
Name	q_1	q_0	x	state name	q_1^+	q_0^+	z	J_1 K_1	J_0 K_0
S0	0	0	0	S0	0	0	0	0 X	0 X
S0	0	0	1	S1	0	1	0	0 X	1 X
S1	0	1	0	S0	0	0	0	0 X	X 1
S1	0	1	1	S2	1	0	0	1 X	X 1
S2	1	0	0	S2	1	0	0	X 0	1 X
S2	1	0	1	S0	0	0	1	X 0	0 X
S3	1	1	0	S1	0	1	1	X 1	X 1
S3	1	1	1	S1	0	1	1	X 1	X 0

K-MAP for J_A, J_B, K_A, K_B

$J_1 = q_0\bar{x}$

$K_1 = q_1 q_0$

$J_0 = q_1\bar{x} + \bar{q}_1 x$

$K_0 = q_0\bar{x} + \bar{q}_1 x$

a. 3

Present state $Q_2\ Q_1\ Q_0$	Next state $Q_2^+\ Q_1^+\ Q_0^+$	J_0	K_0	J_1	K_1	J_2	K_2
0 0 0	0 0 1	1	X	0	X	0	X
0 0 1	0 1 0	X	1	1	X	0	X
0 1 0	0 1 1	1	X	X	0	0	X
0 1 1	1 0 0	X	1	X	1	1	X
1 0 0	1 0 1	1	X	0	X	X	0
1 0 1	1 1 0	X	1	1	X	X	0
1 1 0	1 1 1	1	X	X	0	X	0
1 1 1	0 0 0	X	1	X	1	X	1

K-MAP for $J_0, K_0, J_1, K_1, J_2, K_2$

$J_0 = 1$ $\quad J_1 = Q_0 \quad J_2 = Q_1 Q_0$

$K_0 = 1$ $\quad K_1 = Q_0 \quad K_2 = Q_1 Q_0$