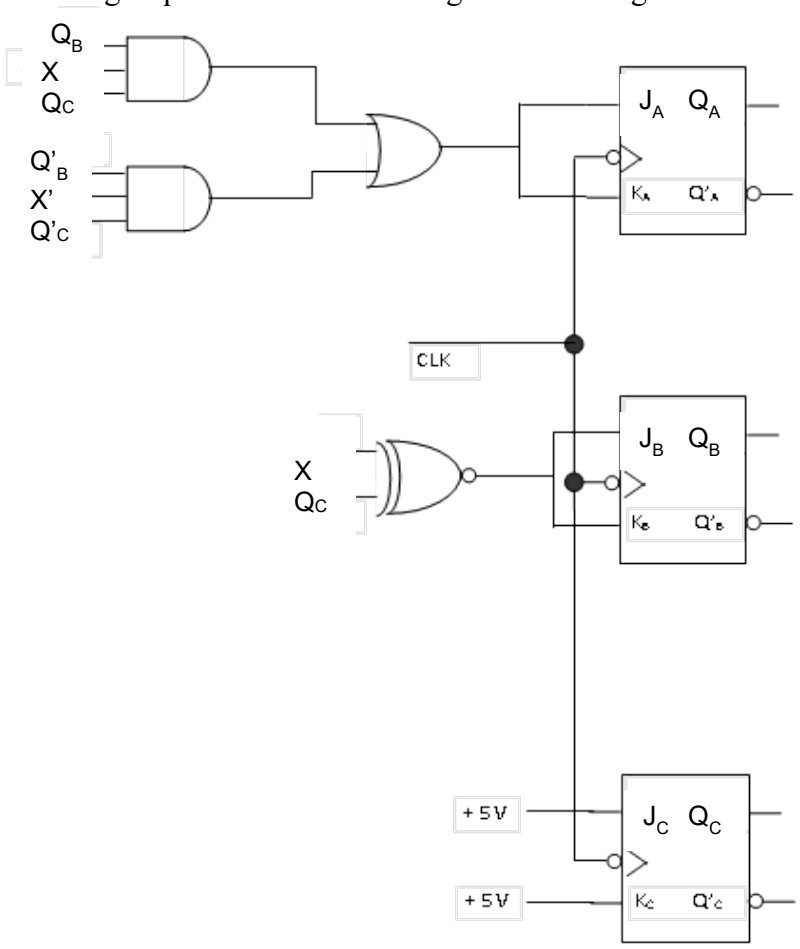
EGC220 HW #6 Dr. Izadi

First Name:_____ Last Name: _____

20 Points

Problem 1

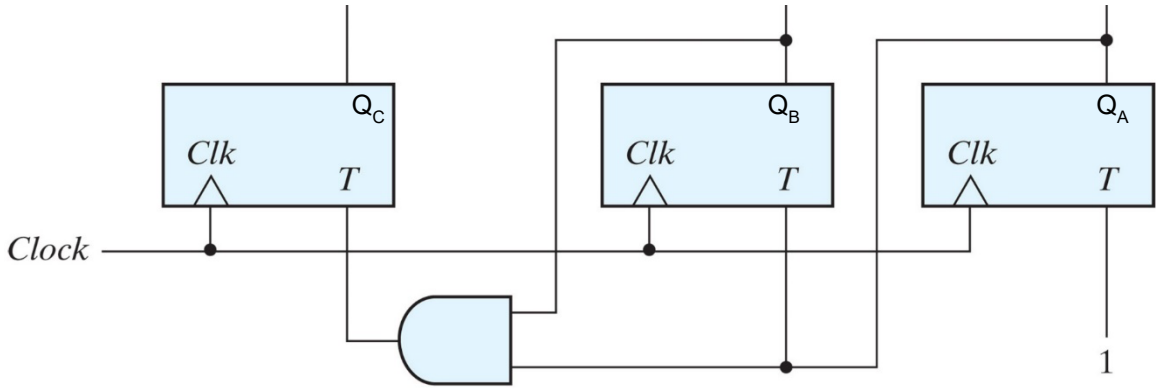
Analyze the following sequential circuits leading to a state diagram.



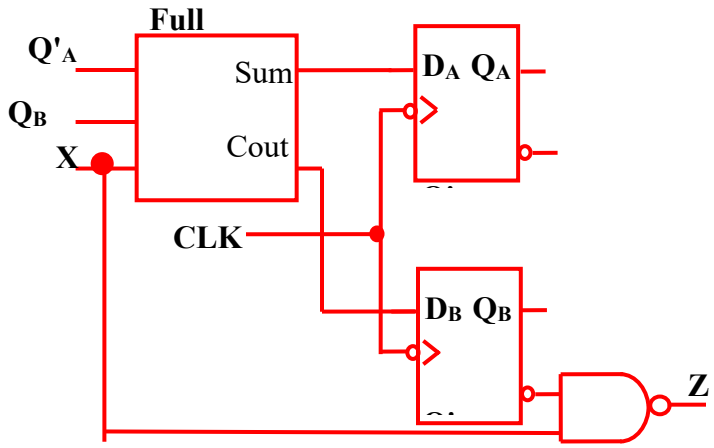
20 Points

Problem 2

Analyze the following sequential circuits leading to a state diagram.

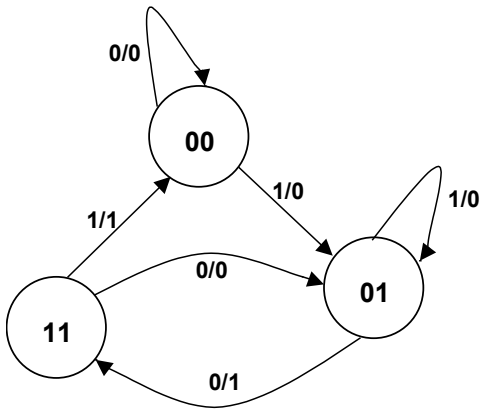


20 Points
Problem 3
Analyze the following circuit leading to its state diagram.

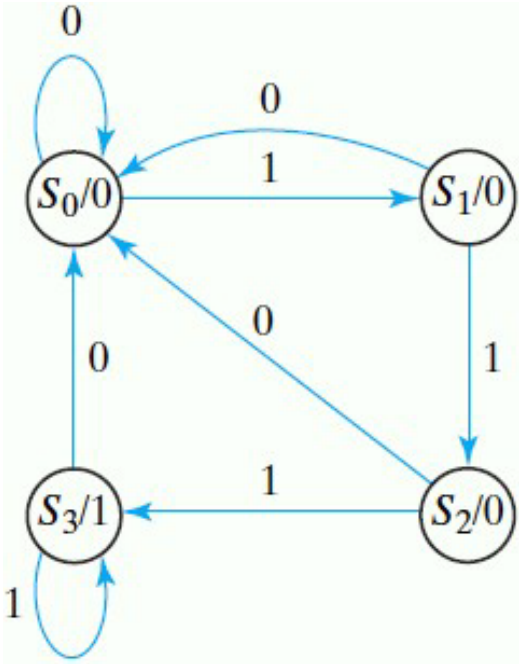


20 Points
Problem 4
Using JK flip flops, design an up/down synchronous counter that counts from 3 to 6.

20 Points
Problem 5
Using JK flip-flops, design a circuit for the following state diagram.



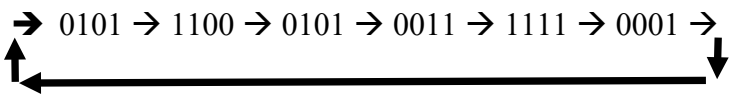
20 Points
Problem 6
Using T flip-flops, design a circuit for the following state diagram. You may make the following state assignments: S0 = 00, S1 = 10, S2 = 11, S3 = 01



25 Points
Problem 7
Using JK flip-flops, design a Moore based sequence detector with one input and one output, which would generate an output of 1 only when the input sequence is 101. Assume no overlapping, namely 10101 generates output 00100.

25 Points
Problem 8
Using JK flip-flops, design a Moore based sequence detector with one input and one output, which would generate an output of 1 only when the input sequence is 101. Assume overlapping of sequence is allowed, namely 10101 generates output 00101.

25 Points
Problem 9
Using D flip flops, design a circuit to generate the following sequence.



Your design should be race free.

Due 5/2/2023

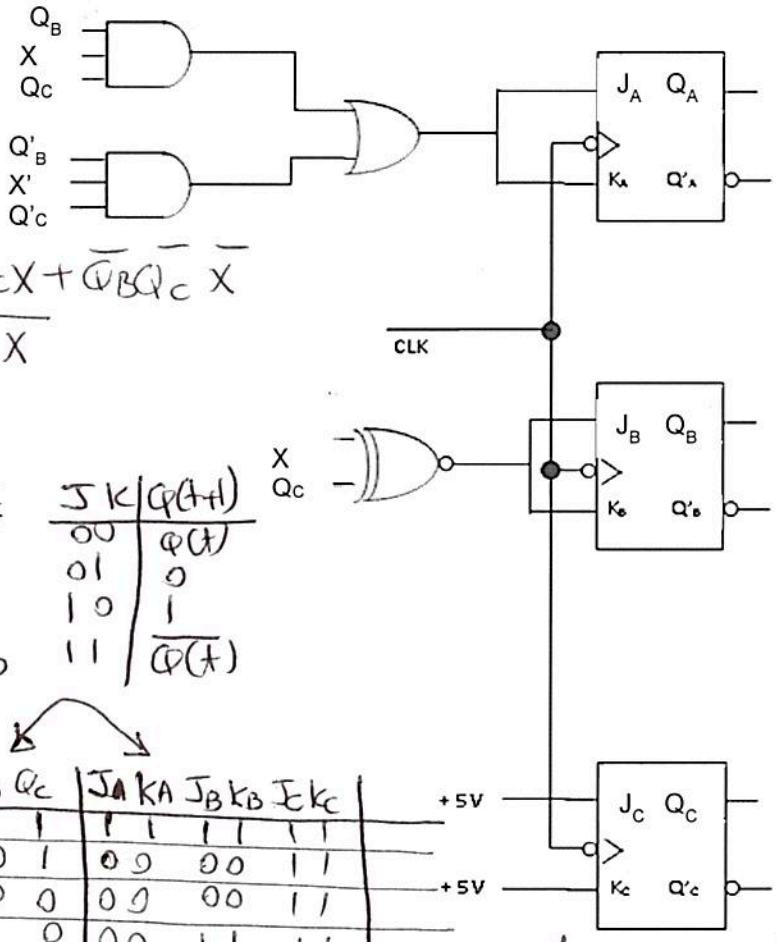
EGC220 Dr. Izadi

First Name: Key Last Name: _____

20 Points

Problem 1

Analyze the following sequential circuits leading to a state diagram.



1) $J_A = K_A = Q_B Q_C X + \bar{Q}_B Q_C \bar{X}$

$J_B = K_B = \overline{Q_C \oplus X}$

$J_C = K_C = 1$

2.

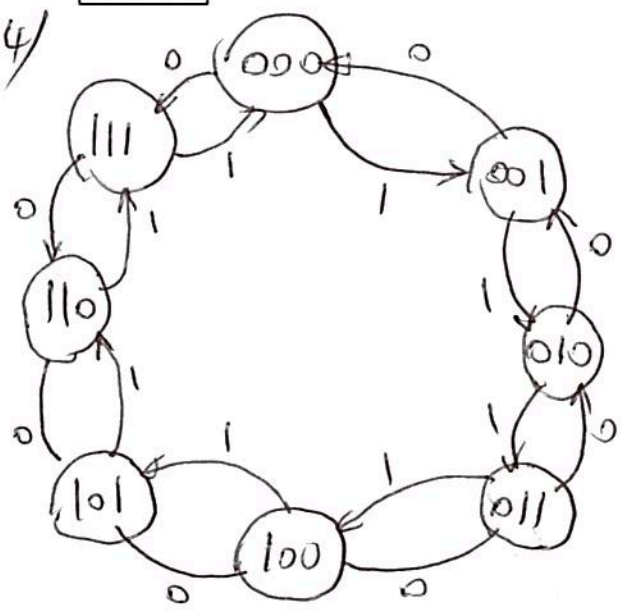
Q(t)	Q(t+1)	J K
0	0	0 X
0	1	1 X
1	0	X 1
1	1	X 0

J K	Q(t+1)
0 0	Q(t)
0 1	0
1 0	1
1 1	$\overline{Q(t)}$

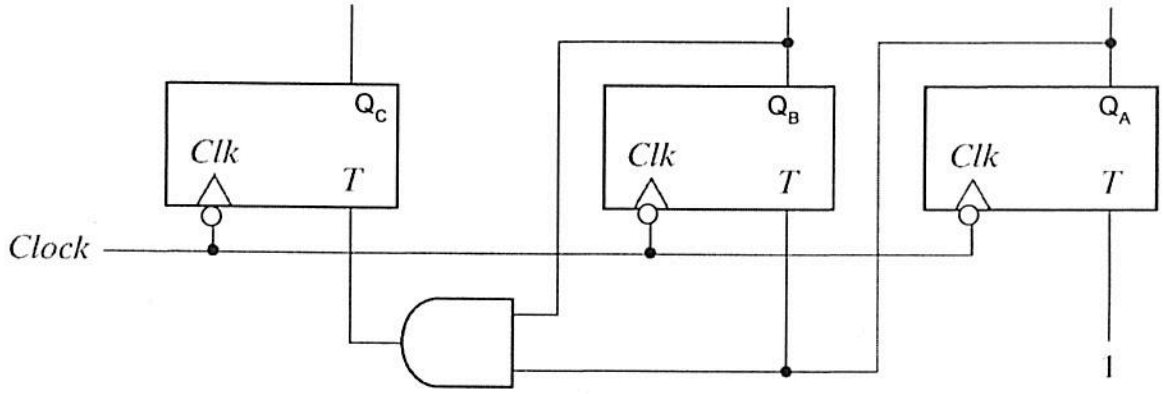
3/

PS				NS			J_A K_A	J_B K_B	J_C K_C
Q_A	Q_B	Q_C	X	Q_A	Q_B	Q_C			
0	0	0	0	1	1	1	1 1	1 1	1 1
0	0	0	1	0	0	1	0 0	0 0	1 1
0	0	1	0	0	0	0	0 0	0 0	1 1
0	0	1	1	0	1	0	0 0	1 1	1 1
0	1	0	0	0	0	1	0 0	1 1	1 1
0	1	0	1	0	1	1	0 0	0 0	1 1
0	1	1	0	0	1	0	0 0	0 0	1 1
0	1	1	1	1	0	0	1 1	1 1	1 1
1	0	0	0	0	1	1	1 1	1 1	1 1
1	0	0	1	1	0	1	0 0	0 0	1 1
1	0	1	0	1	0	0	0 0	0 1	1 1
1	0	1	1	1	1	0	0 0	1 1	1 1
1	1	0	0	1	0	1	0 0	1 1	1 1
1	1	0	1	1	1	1	0 0	0 0	1 1
1	1	1	0	1	1	0	0 0	0 0	1 1
1	1	1	1	0	0	0	1 1	1 1	1 1

4/



20 Points
Problem 2
Analyze the following sequential circuits leading to a state diagram.



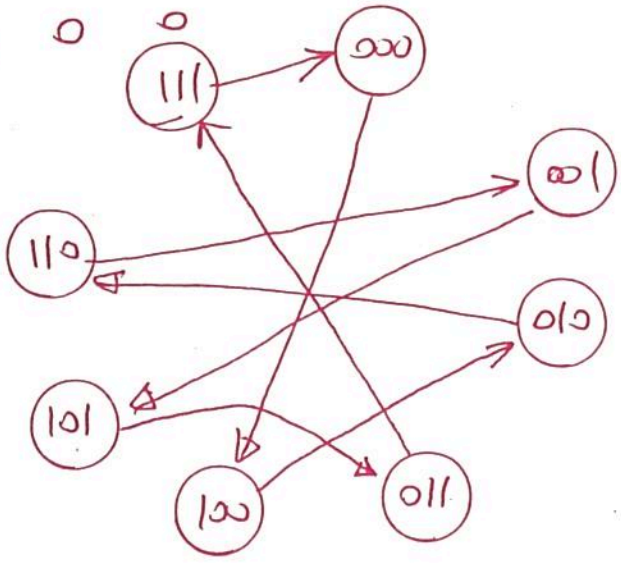
1. $T_A = 1$
   $T_B = Q_A$
   $T_C = Q_A Q_B$

2.

T	Q(t+1)
0	Q(t)
1	$\overline{Q(t)}$

PS / NS

Q_A	Q_B	Q_C	T_A	T_B	T_C	Q_A	Q_B	Q_C
0	0	0	1	0	0	1	0	0
0	0	1	1	0	0	1	0	1
0	1	0	1	0	0	1	1	0
0	1	1	1	0	0	1	1	1
1	0	0	1	1	0	0	1	0
1	0	1	1	1	0	0	1	1
1	1	0	1	1	1	0	0	1
1	1	1	1	1	1	0	0	0



20 Points

Problem 3

Analyze the following circuit leading to its state diagram.

1) $D_A = \text{Sum} = \overline{Q_A} \oplus Q_B \oplus X$

$D_B = C_{out} = \overline{Q_A} Q_B + \overline{Q_A} X + Q_B X$

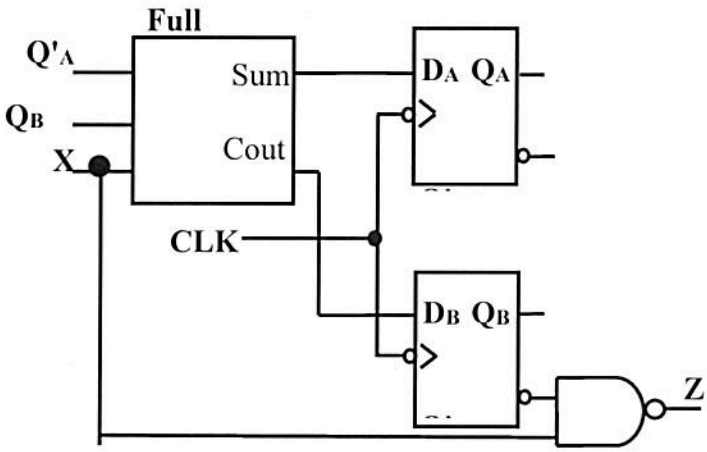
2)

Q(t)	Q(t+1)	D
0	0	0
0	1	1
1	0	0
1	1	1

$Z = \overline{Q_B} X$

$= \overline{Q_B + X}$

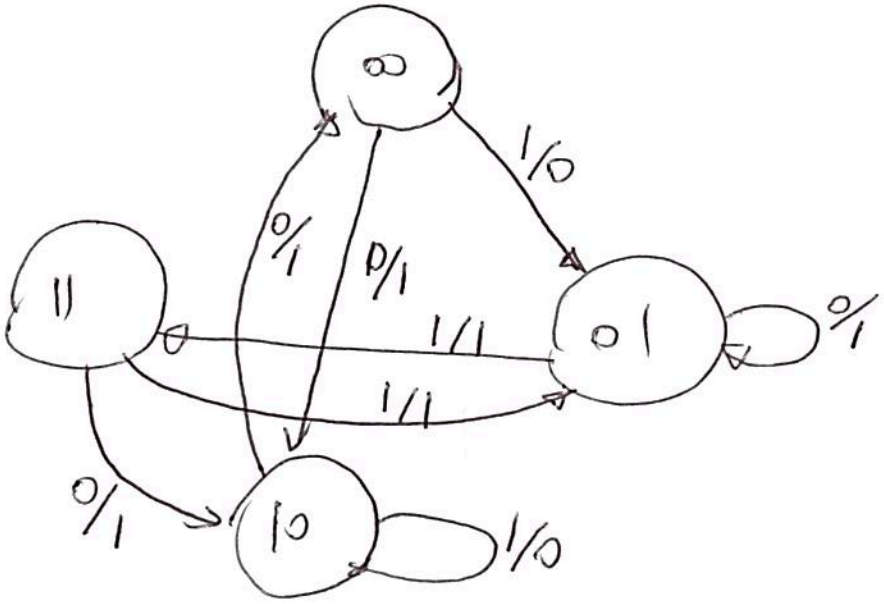
D	Q(t+1)
0	0
1	1



3)

PS			FF input		NS		output
Q_A	Q_B	X	DA	DB	Q_A	Q_B	Z
0	0	0	1	0	1	0	1
0	0	1	0	1	0	1	0
0	1	0	0	1	0	1	1
0	1	1	1	1	1	1	1
1	0	0	0	0	0	0	1
1	0	1	1	0	1	0	0
1	1	0	1	0	1	0	1
1	1	1	0	1	0	1	1

4.



EGC220 HW Dr. Izadi

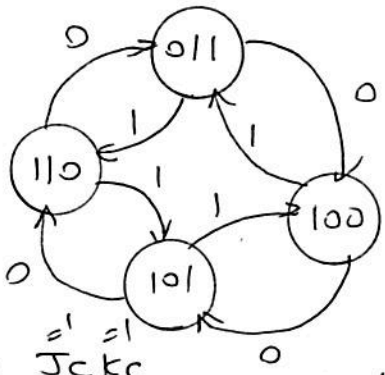
First Name: Key Last Name: key Sec:

20 Points

Problem 4

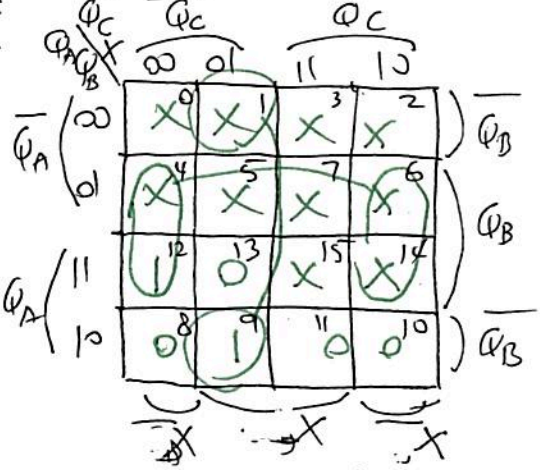
Using JK flip flops, design an up/down synchronous counter that counts from 3 to 6.

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



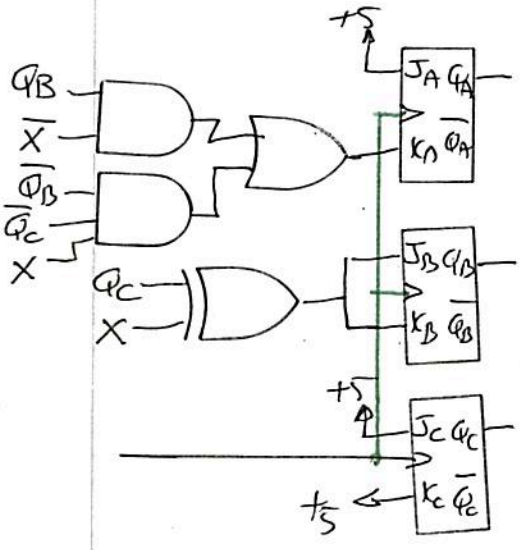
PS			input	NS									
Q_A	Q_B	Q_C	X	Q_A	Q_B	Q_C	J_A	K_A	J_B	K_B	J_C	K_C
0	0	0	0	X	X	X	X	X	X	X	X	X
0	0	0	1	X	X	X	X	X	X	X	X	X
0	0	1	0	X	X	X	X	X	X	X	X	X
0	0	1	1	X	X	X	X	X	X	X	X	X
0	1	0	0	X	X	X	X	X	X	X	X	X
0	1	0	1	X	X	X	X	X	X	X	X	X
0	1	1	0	1	0	0	1	X	X	1	X	1
0	1	1	1	1	1	0	1	X	X	0	X	1
1	0	0	0	1	0	1	X	0	0	X	1	X
1	0	0	1	0	1	1	X	1	1	X	1	X
1	0	1	0	1	1	0	X	0	1	X	X	1
1	0	1	1	1	0	0	X	0	0	X	X	1
1	1	0	0	0	1	1	X	1	X	0	1	X
1	1	0	1	1	0	1	X	0	X	1	1	X
1	1	1	0	X	X	X	X	X	X	X	X	X
1	1	1	1	X	X	X	X	X	X	X	X	X

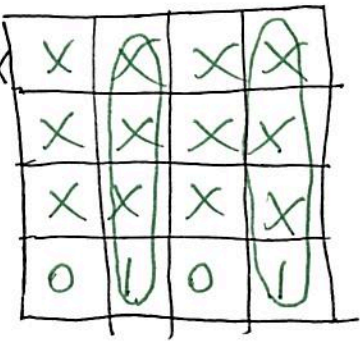
$J_A = J_C = K_C = 1$

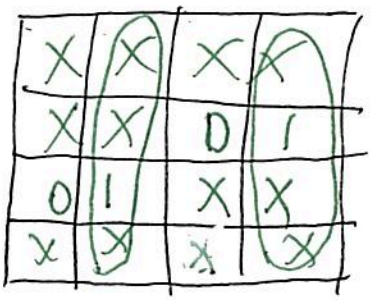


$K_A = Q_B \overline{X} + \overline{Q_B}\,\overline{Q_C}\,X$

$J_B = K_B = Q_C \oplus X$

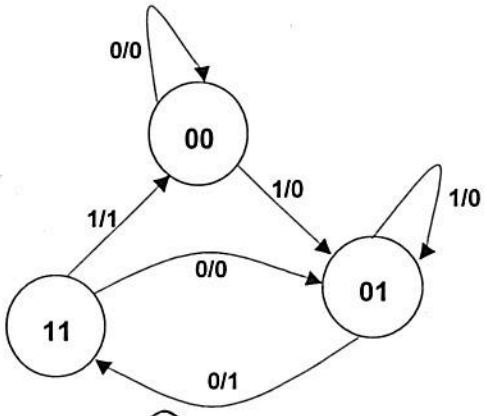






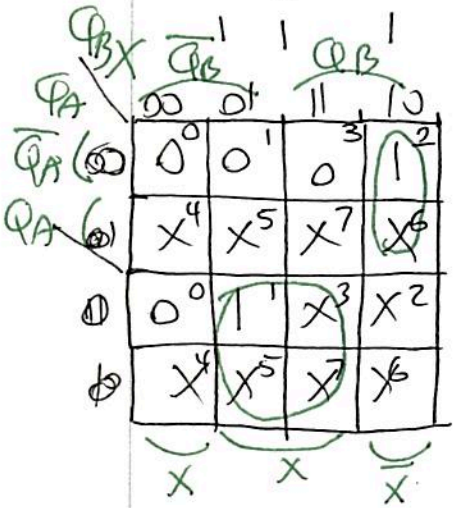
20 Points
Problem 5
Using JK flip-flops, design a circuit for the following state diagram.

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



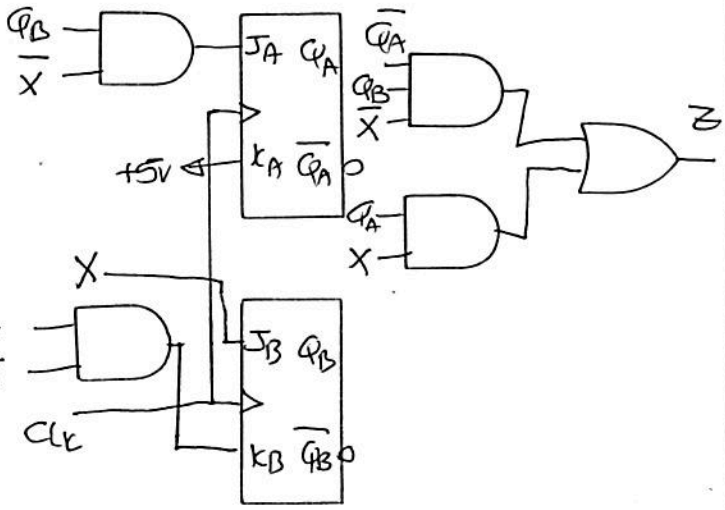
Q_A	Q_B	X	Q_A	Q_B	J_A	K_A	J_B	K_B	Z
0	0	0	0	0	0	X	0	X	0
0	0	1	0	1	0	X	1	X	0
0	1	0	1	1	1	X	X	0	1
0	1	1	0	1	0	X	X	0	0
1	0	0	X	X	X	X	X	X	X
1	0	1	X	X	X	X	X	X	X
1	1	0	0	1	X	1	X	0	0
1	1	1	0	0	X	1	X	1	1

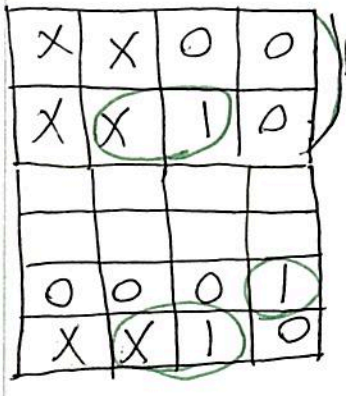
$K_A = 1$



$J_A = Q_B \bar{X}$

$J_B = X$

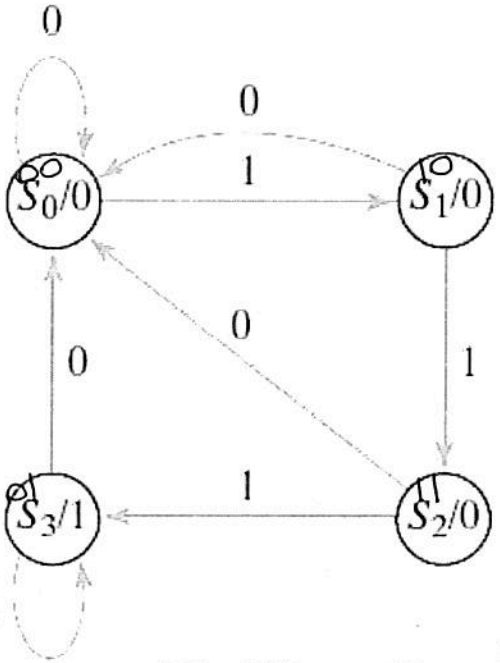




$K_B = Q_A X$

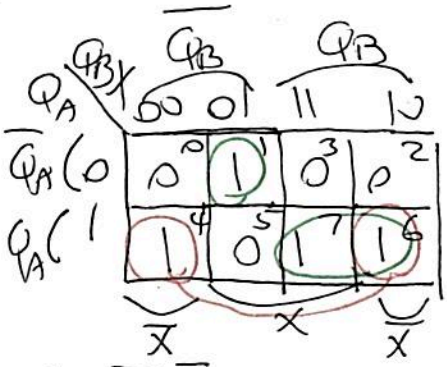
$Z = \bar{Q}_A Q_B \bar{X} + Q_A X$

20 Points
Problem 6
Using T flip-flops, design a circuit for the following state diagram. You may make the following state assignments: S0 = 00, S1 = 10, S2 = 11, S3 = 01

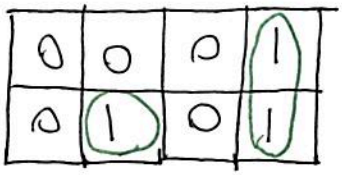


PS

Q_A	Q_B	X	Q_A	Q_B	T_A	T_B	Z
0	0	0	0	0	0	0	0
0	0	1	1	0	1	0	0
0	1	0	0	0	0	1	1
0	1	1	0	1	0	0	1
1	0	0	0	0	1	0	0
1	0	1	1	1	0	1	0
1	1	0	0	0	1	1	0
1	1	1	0	1	1	0	0

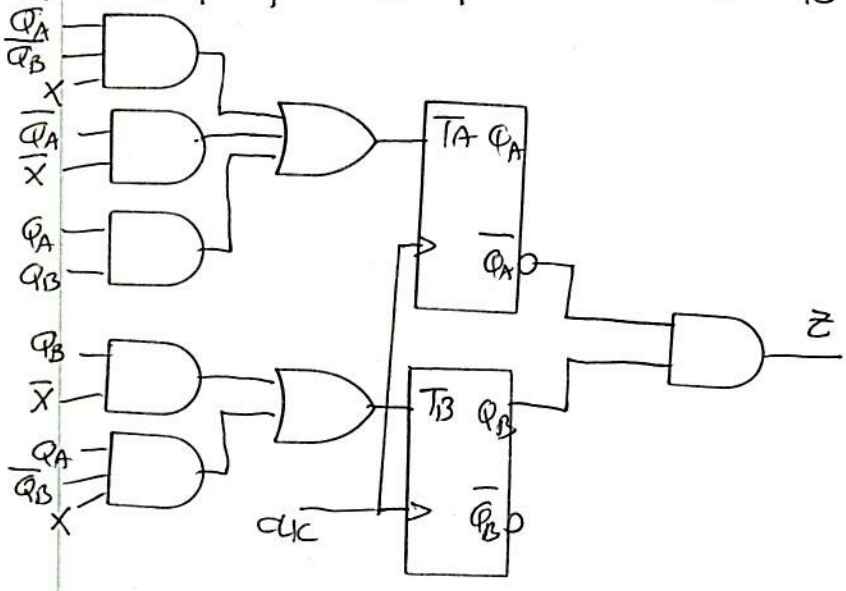


$T_A = \bar{Q}_A \bar{Q}_B X + Q_A \bar{X} + Q_A Q_B$



$T_B = Q_B \bar{X} + Q_A \bar{Q}_B X$

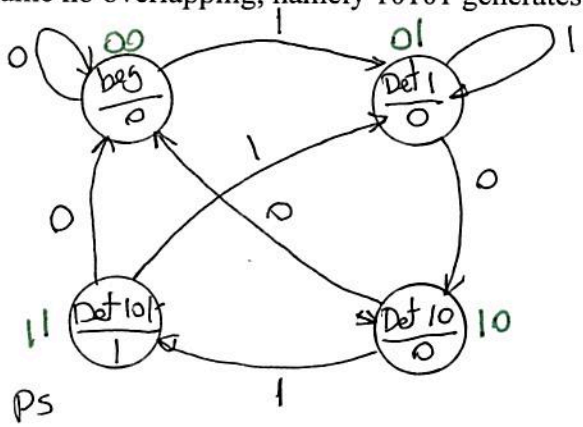
$Z = \bar{Q}_A Q_B$



25 pt.

Problem 7

Using JK flip-flops, design a Moore based sequence detector with one input and one output, which would generate an output of 1 only when the input sequence is 101. Assume no overlapping, namely 10101 generates output 00100.



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

Q_A	Q_B	X	Q_A	Q_B	J_A	K_A	J_B	K_B	Z
0	0	0	0	0	0	X	0	X	0
0	0	1	0	1	0	X	1	X	0
0	1	0	1	0	1	X	X	1	0
0	1	1	0	1	0	X	X	0	0
1	0	0	0	0	X	1	0	y	0
1	0	1	1	1	X	0	1	X	0
1	1	0	0	0	X	1	X	1	1
1	1	1	0	1	X	1	X	0	1

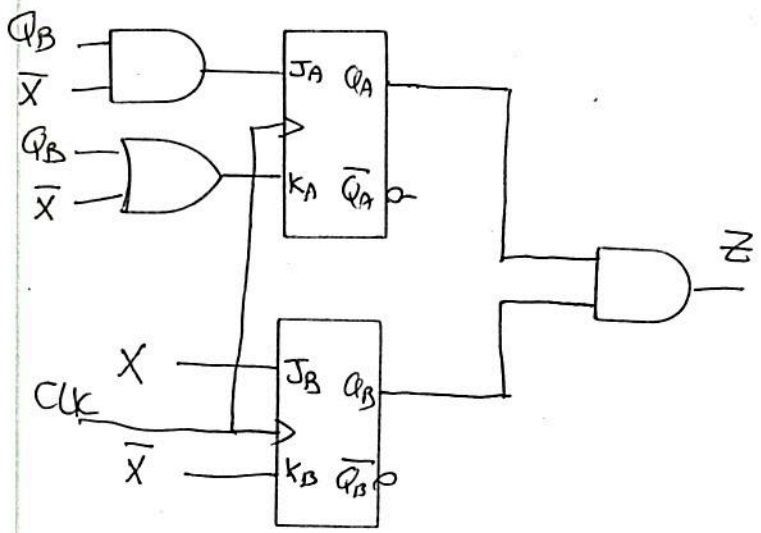
$Q_A Q_B$ \ X

	00	01	11	10
0	0 (0)	0 (1)	0 (3)	1 (2)
1	X (4)	X (5)	X (7)	X (6)

$J_A = Q_B \bar{X}$

X	X	X	X	
1	0	1	1	

$K_A = \bar{X} + Q_B$



0	1	X	X
0	1	X	X

$J_B = X$

X	X	0	1
X	X	0	1

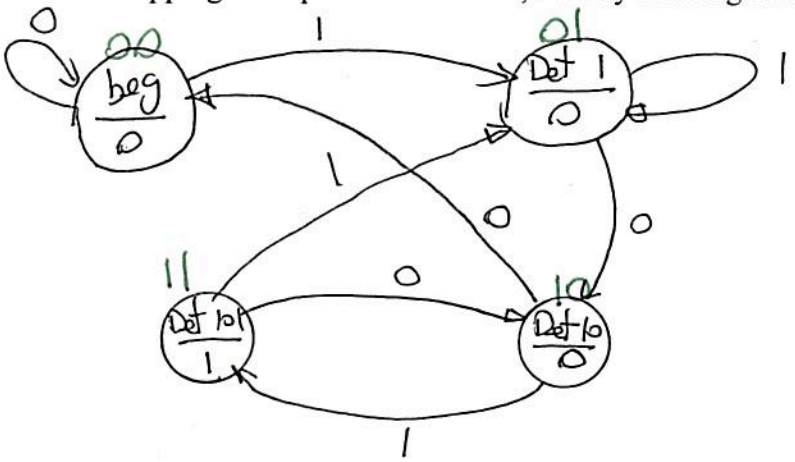
$K_B = \bar{X}$

$Z = Q_A Q_B$

25 pt.

Problem 8

Using JK flip-flops, design a Moore based sequence detector with one input and one output, which would generate an output of 1 only when the input sequence is 101. Assume overlapping of sequence is allowed, namely 10101 generates output 00101.



	0	1
0	beg	Det 1
1	Det 10	Det 101

Q_A	Q_B	X	Q_A	Q_B	J_A	K_A	J_B	K_B	Z
0	0	0	0	0	0	X	0	X	0
0	0	1	0	1	0	X	1	X	0
0	1	0	1	0	1	X	X	1	0
0	1	1	0	1	0	X	X	0	0
1	0	0	0	0	X	1	0	X	0
1	0	1	1	1	X	0	1	X	0
1	1	0	1	0	X	0	X	1	1
1	1	1	0	1	X	1	X	0	1

Q_A \ $Q_B X$	00	01	11	10
0	0	0	0	1
1	X	X	X	X

$J_A = Q_B \bar{X}$

X	X	X	X
1	0	1	0

$K_A = Q_B \odot X$

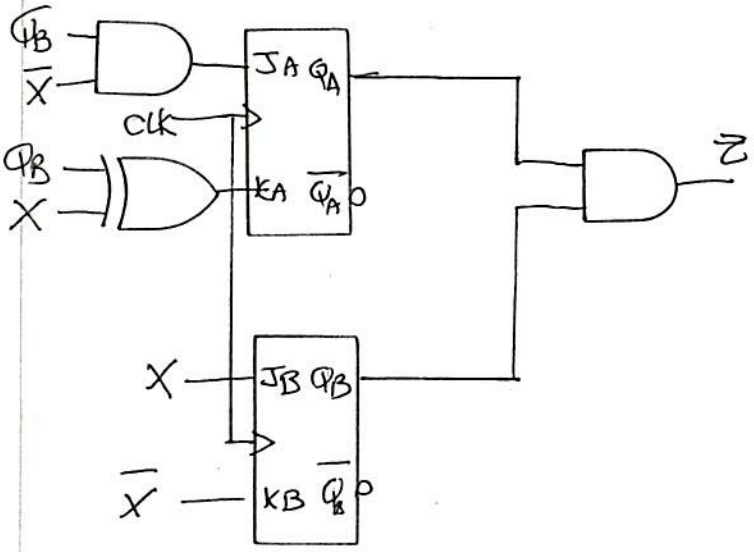
0	1	X	X
0	1	X	X

$J_B = X$

X	X	0	1
X	X	0	1

$K_B = \bar{X}$

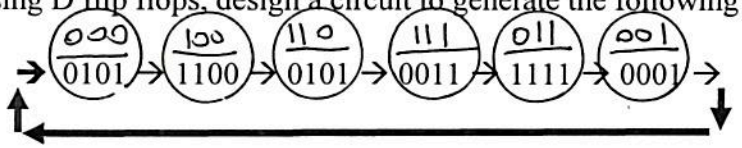
$Z = Q_A Q_B$



25 pt.

Problem 9

Using D flip flops, design a circuit to generate the following sequence.



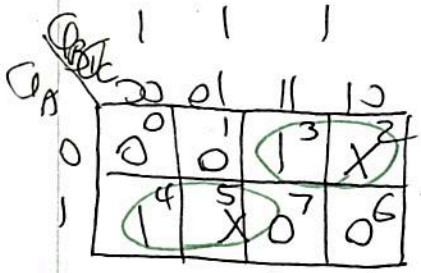
Your design should be race free.

PS			NS						
Q_A	Q_B	Q_C	D_A	D_B	D_C	z_3	z_2	z_1	z_0
0	0	0	1	0	0	0	1	0	1
0	0	1	0	0	0	0	0	0	1
0	1	0	X	X	X	X	X	X	X
0	1	1	0	0	1	1	1	1	1
1	0	0	1	1	0	1	1	0	0
1	0	1	X	X	X	X	X	X	X
1	1	0	1	1	1	0	1	0	1
1	1	1	0	1	1	0	0	1	1

$D_A = \overline{Q_C}$

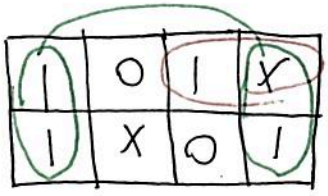
$D_B = Q_A$

$D_C = Q_B$

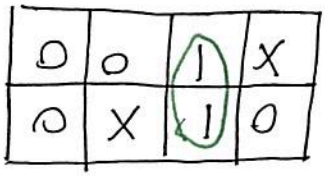


$z_3 = Q_A \overline{Q_B} + \overline{Q_A} Q_B$

$= Q_A \oplus Q_B$



$z_2 = \overline{Q_C} + \overline{Q_A} Q_B$



$z_1 = Q_B Q_C$

$z_0 = \overline{Q_A} + Q_B$