Fall 2014

BSM 203 Logic Circuits

Final

Name:
Student ID:
I. Education ☐ II. Education ☐

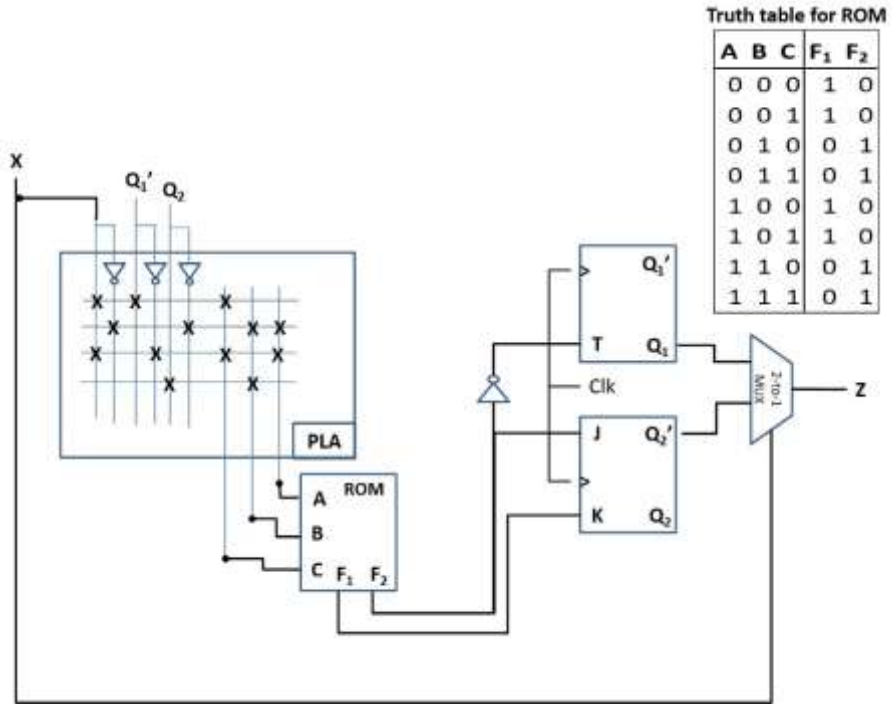
Signature:

Instructions:

- The duration of this exam is 90 mins.
- Note that there are 2 questions in this exam.
- Be clear in your answers. You can use as many answer sheets as you need.
- If you write in Turkish, there will be a penalty for each sentence/word that you wrote.
- Please put your name and your number, mark your class, and sign for both exam paper and answer sheets.

Questions:

1) [40 points] [Analysis of Clocked Sequential Circuits] Consider the circuit shown below.



Truth table for ROM

A	B	C	F_1	F_2
0	0	0	1	0
0	0	1	1	0
0	1	0	0	1
0	1	1	0	1
1	0	0	1	0
1	0	1	1	0
1	1	0	0	1
1	1	1	0	1

(a) Derive the FF input equations (J, K, T), FF next state equations (Q_1^+ and Q_2^+), and output equation (Z).

T = ...

J = ...

K = ...

Q_1^+ = ...

Q_2^+ = ...

Z = ...

(b) Is this a Mealy Machine or Moore Machine? Explain your answer in one sentence below.

(c) Construct a state table and graph below.

Transition Table

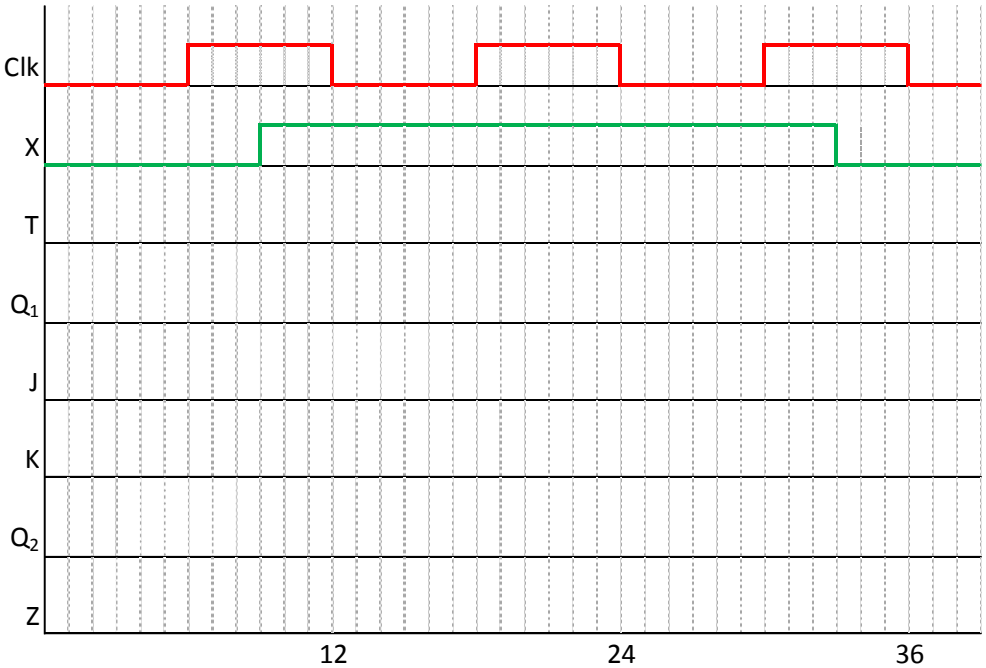
Q_1Q_2	$Q_1^+Q_2^+$ X = 0	$Q_1^+Q_2^+$ X =1	Z

Next State Table

Pesent State	Next State X = 0	Next State X =1	Output

State Graph

(d) Complete the timing chart shown below for the circuit for an input sequence X=010011 and the clock period 12ns. Assume that FF is falling-edge triggered, that initially Q1 = Q2 =0, and that X changes midway between the rising and falling clock edges. The delays in ROM, PLA, and MUX are 1 ns for each and delay in each FF is 2 ns. The delay in OR gate is negligible.



2) [60 points] [Design of Clocked Sequential Circuits] Design a sequence detector that detects the sequence 010 (You do not have to draw the actual design).

a) as a Moore Machine

b) as a Mealy Machine

You can use any type of FF, but the students who use T flip-flop will receive 5 extra points, and the students who use S-R or J-K flip-flop will receive 10 extra points.

Hint: You may want to first check how the detector works for a random input.

An example of how it works for a random input is given below for your convenience.

X = 000111101010011010100010001011110001010100010 10

Z = 000000000100000001010001000100000000101010001 01

Then you need to follow the following steps for each machine.

For Moore Machine:

Step 1: Derive the state graph and the state table.

Next State Table

Pesent State	Next State X = 0	Next State X =1	Output

State Graph

Step 2: Decide how many FFs you need and, based on your decision, derive the transition table.

Transition Table

	X = 0	X =1	Z

Step 3: Decide the type of FF you want to use and, derive FF input equations.

For Mealy Machine:

Step 1: Derive the state graph and the state table.

Next State Table

Pesent State	Next State X = 0	Next State X =1	Output

State Graph

Step 2: Decide how many FFs you need and, based on your decision, derive the transition table.

Transition Table

		Z
	X = 0 X =1	

Step 3: Decide the type of FF you want to use and, derive FF input equations.