Midterm 2

ECE 275

Nov 12th, 2021

(1) Your name: Student ID:

About the exam

1. There are total 4 problems.

2. Problem 1 and Problem 2 are mandatory. You have the option of doing any one of Problem 3 and Problem 4. If you do both, you will receive the best of the two.

Problem description

Design a Mealy sequential circuit which investigates an input sequence X and which will produce an output of Z = 1 for any input sequence ending in 0101 provided that the sequence 110 has never occurred.
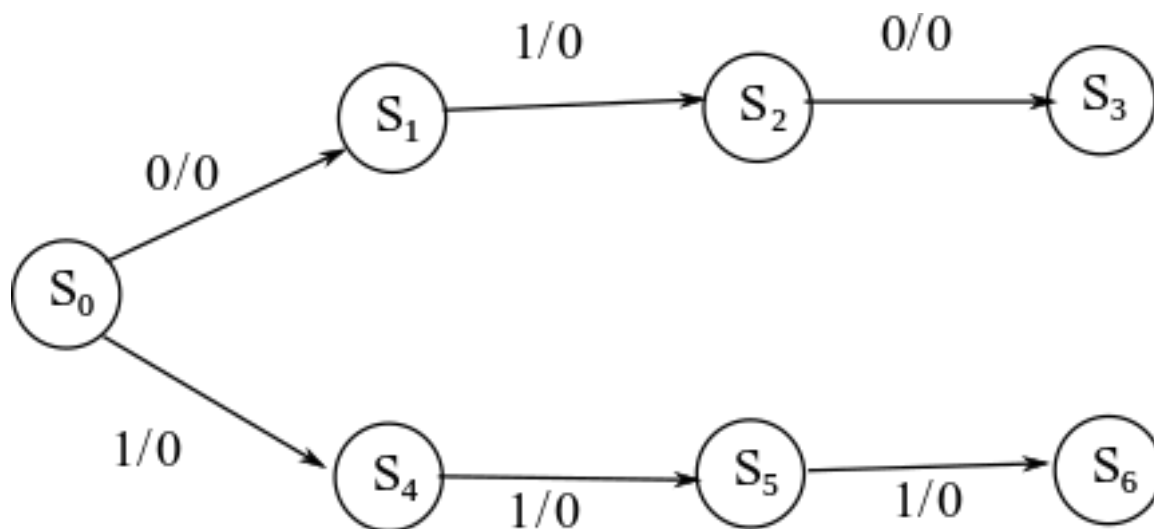
Example:

$$X = 0\,1\,0\,1\,0\,1\,1\,0\,1\,0\,1$$
$$Z = 0\,0\,0\,1\,0\,1\,0\,0\,0\,0\,0$$

Notice that the circuit does not reset to the start state when an output of Z = 1 occurs.

State	Meaning
S_0	xxx
S_1	xx0
S_2	x01
S_3	"010"
S_4	xx1
S_5	x11
S_6	"110"

Present State		Next State		Output	
	X=0	X=1		X=0	X=1
S_0	S_1	S_4		0	0
S_1		S_2			0
S_2	S_3			0	
S_3					
S_4		S_5			0
S_5	S_6			0	
S_6	S_6	S_6		0	0

Problem 2. Can the above state table be reduced? Find out the equivalent states. Only specify which states are equivalent to each other. You do not need to write the state table again. (10 marks)

Problem 3. (State assignment).
Using the guideline method find the groups of states that should be grouped together.
Draw the state assignment map. Assign a 3-bit state encoding to the states in the
reduced state table derived in Problem 2. (20 marks).

Problem 4. The following state-assigned table is given. Find the boolean expressions for inputs J_1 and K_1 to a J-K flip flop that implments the transition from Present state y_1 to Next state Y_1. Express the inputs J_1 and K_1 in terms of input X and present state y_2, y_1 and y_0 (20 marks).

Present state			Next State						Output	
			X=0			X=1			X=0	X=1
y_2	y_1	y_0	Y_2	Y_1	Y_0	Y_2	Y_1	Y_0		
0	0	0	0	1	0	0	0	0	0	0
0	0	1	1	1	0	1	1	1	1	0
0	1	0	0	1	1	0	0	0	0	0
0	1	1	0	1	1	1	1	1	0	0
1	0	0	d	d	d	d	d	d	d	d
1	0	1	1	0	1	1	1	1	0	0
1	1	0	1	0	1	0	0	1	0	0
1	1	1	1	1	0	1	1	1	0	0