CSC 137 MOCK MIDTERM 2

Show your work clearly to earn points. Work not shown will not earn any points.
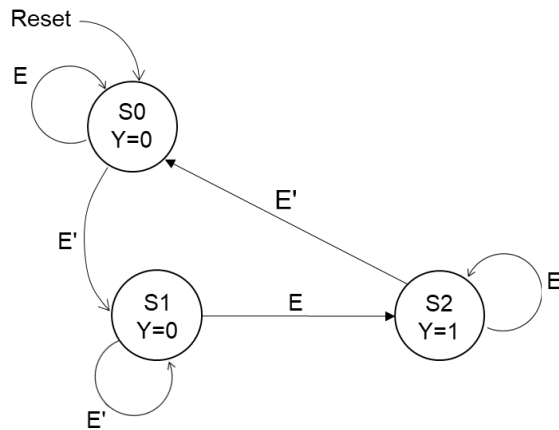Date: Instructor: Dr. Ilkan Çokgör   Total: 20 points

Student Name: Student Number:

1) Given the state transition diagram below:

a)   Construct the state transition table. (2 points)
b)   Use K-maps to derive the <u>simplest</u> Boolean equations for the state variables. Take don't care
     cases into account. (2 points)
c)   Construct the Output table. (1 point)
d)   Derive the <u>simplest</u> Boolean equation for the output. (1 point)
e)   Draw the Moore machine circuit. (2 points)

2) You are tasked with designing a control unit that loads a value to a 4-bit register and decrements the value in the register. When the register value reaches 0, the execution is complete. The register transfer language (RTL) description for each micro-operation is given below:

Start: Reg <- inbus
Loop: Reg = Reg -1
         If Reg ≠ 0, goto Loop
End: goto End

The register hardware and its function table are given as follows:
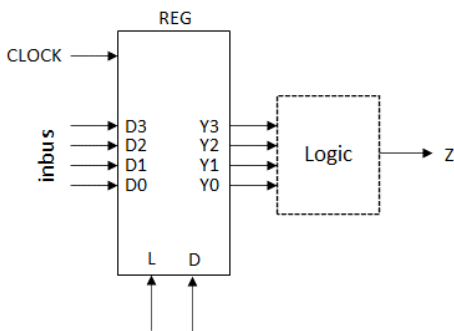
a) Design and show the logic at the register output to generate the necessary Z signal so that when the register reaches 0, Z is Logic 0, otherwise Z is Logic 1. (1 point)
b) Establish the control signals that are necessary for each micro-operation. Clearly show where those control signals would be connected in the counter hardware circuit. Hint: Think about how many control signals you need. <u>Show in a table which control signal will be generated at each RTL step.</u> (2 points)
c) Construct the state transition diagram of the control unit. <u>Show which state corresponds to which micro-operation (i.e. RTL step) in a table.</u> (2 points)
d) Construct the state transition table for the control unit. (2 points)
e) Derive the <u>simplest</u> Boolean equations for the state variables. (2 points)
f) Construct the output table for the control unit. (1 point)
g) Derive the <u>simplest</u> Boolean equations for the outputs. (2 points)