CprE 281 HW8

ELECTRICAL AND COMPUTER ENGINEERING
IOWA STATE UNIVERSITY

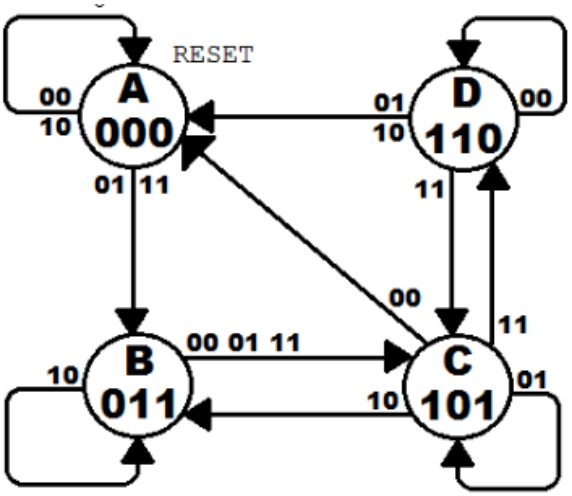
Basic Design Steps, State-Assignment Problems, Moore & Mealy Machines

Assigned Date: Eleventh Week

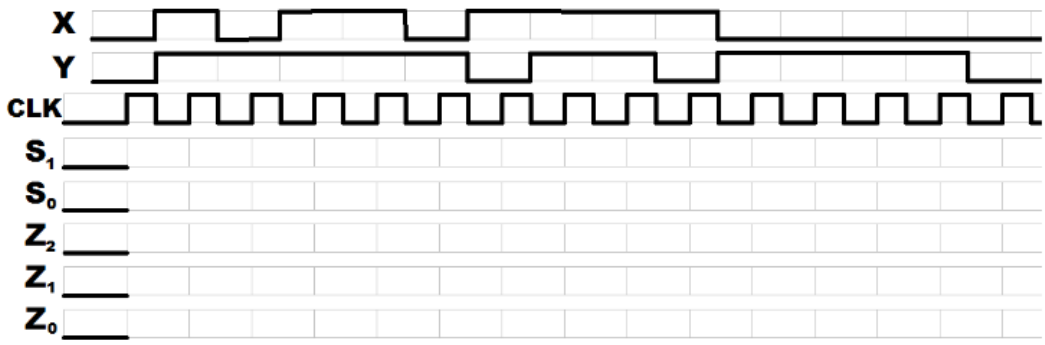
Finish by Nov. 15, 2021

P1 (20 points): Design and implement a Moore machine that detects the pattern 011 in its 1-bit serial input stream. Explain the logic behind your solution. Show your work for all steps discussed during the lectures: graph, state table, state-assigned table, truth tables, k-maps, expressions, circuit diagram.

P2 (15 points): Look at the state diagram below. The input variables are X and Y. The state variables are S1 and S0. The state encodings are as follows: A=00, B=01, C=10, and D=11. The output variables are Z_2, Z_1, and Z_0.



a. Fill in the timing diagram below given the state diagram for a circuit that implements this state diagram using Positive-Edge-Triggered DFFs.



b. Fill in the state table with state assignments

	X=0, Y=0	X=0, Y=1	X=1, Y=0	X=1, Y=1	$Z_2\,Z_1\,Z_0$
A					
B					
C					
D					

c. Draw the truth table and show that the next-state expressions can be expressed as follows:

$$S_0^{new} = \bar{S}_1\bar{S}_0(Y) + \bar{S}_1 S_0(X\bar{Y}) + S_1\bar{S}_0(X) + S_1 S_0(\bar{X}\bar{Y})$$
$$S_1^{new} = \bar{S}_1\bar{S}_0(0) + \bar{S}_1 S_0(\bar{X} + Y) + S_1\bar{S}_0(Y) + S_1 S_0(XY + \bar{X}\bar{Y})$$

d. Derive expressions for the output variables Z_2, Z_1, and Z_0 in terms of S_1 and S_0

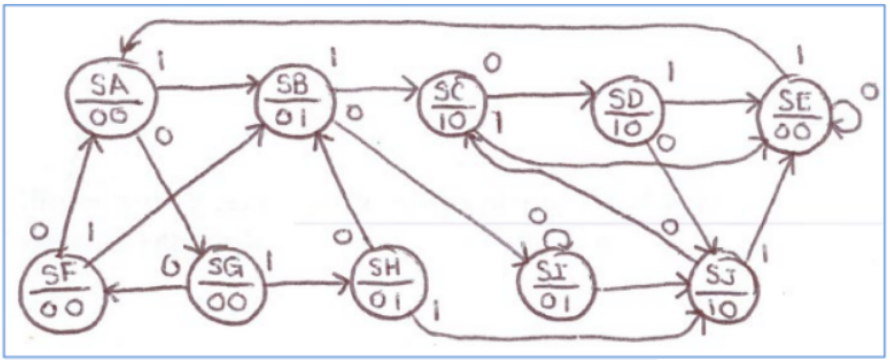
P3 (15 points): Draw a state diagram for a state machine that reads in a sequence of bits, one bit at a time, and stops when it has read in five 1s. (The five 1s can be non-consecutive.) The machine outputs a 1 when it has read at least five 1's. It outputs a 0 otherwise.

P4 (20 points): Draw a state diagram for a state machine that reads in a sequence of bits, one bit at a time, and outputs a 1 whenever the sequence 1110 is detected. It outputs a 0 otherwise. The machine keeps detecting the sequence and never stops.

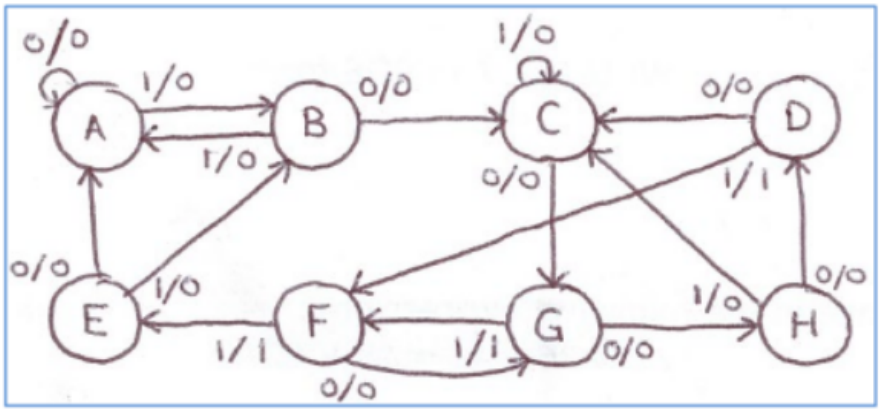
a. Using a Moore machine
b. Using a Mealy machine

P5 (15 points): perform state minimization on the following state diagrams:

a.



b.



P6 (15 points): Reduce the state diagram below to use only 5 states: