Homework #4 (Covers Unit-11, Unit-12 and Unit-13)
CDA Computer Logic Design
Total Points: 100

Notes:
1. All homework should be done and submitted individually
2. Show all steps for each question to get full points (Use extra pages if required)
3. Submit electronically in canvas as a single pdf file
4. Follow instructions for each question
5. A' is the complement of A

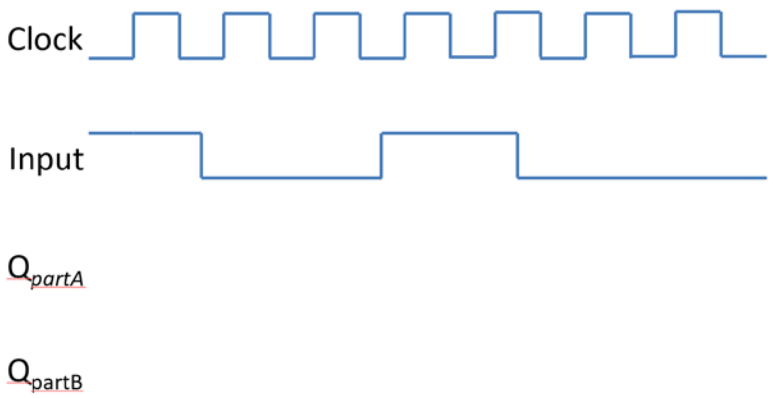
Name: _____ UID:_____

Q1. (3x5 points) A sequential circuit with two D flip-flops, X and Y; two inputs, A and B; and one output, Z, is specified by the following next-state and output equations:

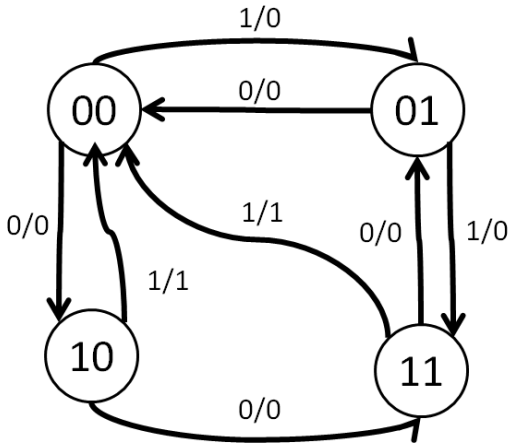
$$X(t+1) = (A + B)(A'X)$$
$$Y(t+1) = AB + AB'Y$$
$$Z = X'Y$$

(a) Draw the logic diagram of the circuit
(b) Derive the state table
(c) Draw the corresponding state diagram

Q2. (2x5 points) Given the input and clock transitions, indicate the output of a D flip flop assuming:
(a) It is negative-edge triggered
(b) It is positive-edge triggered

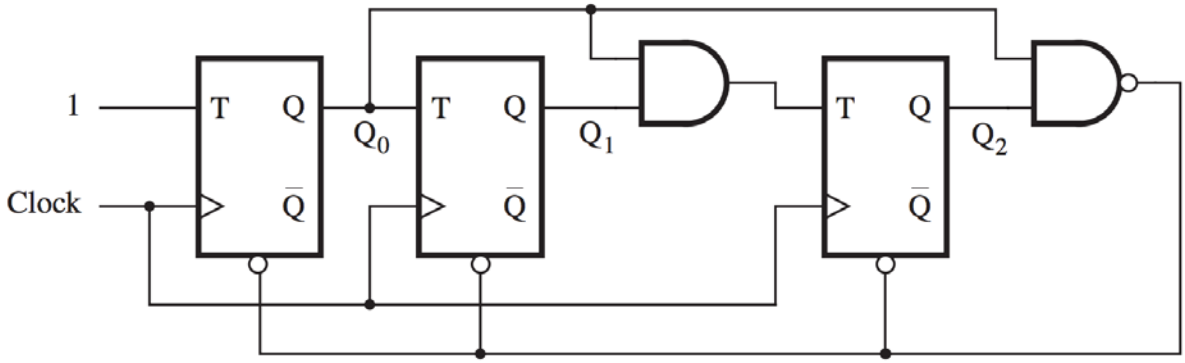


Q3. (2x10 points) Given the state diagram below, (for reference: 0/0 → Input / Output)
(a) create the state table
(b) create a sequential circuit design using only two D flip flops, and any additional simple logic gates (AND, OR, NOT, XOR, NAND, NOR)



Q4. (2x10 points) An A-B flip-flop behaves as follows:
If AB = 00, the flip-flop changes its current state,
If AB = 01, the flip-flop holds,
If AB = 10, the flip-flop is reset, i.e..Q=0
If AB = 11, the flip-flop changes its current state
(a) Give the characteristic (next-state) equation for this flip-flop.
(b) Create the state table

Q5. (15 points) For the following circuit complete the timing diagram.



Q_0

Q_1

Q_2

Q6. (2x10 points) Design a synchronous sequential circuit that will count through the sequence 0,1,3,5,7 when the control input, x=0; and through the sequence 7,5,3,1,0 when x=1. The circuit should return to state 0 if it falls into states 2, 4, or 6. Note: the sequence cycles – 0,1,3,5,7,0,1,3,…

(a) Draw a state diagram for the circuit

(b) Draw a state transition table for the circuit