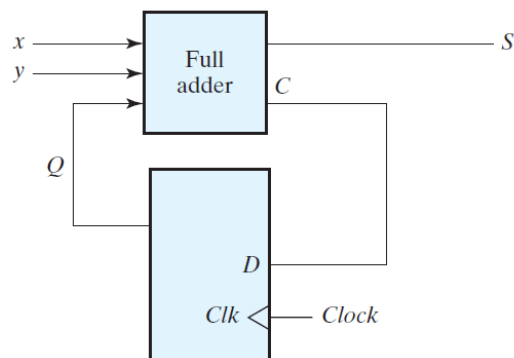# EC 2.101 - Digital Systems and Microcontrollers

Practice Sheet 3 (Sequential Circuits Pt. I)

Q1. A sequential circuit has one flip-flop Q, two inputs x and y, and one output S. It consists of a full-adder circuit connected to a D flip-flop, as shown in the figure below. Derive the state table and state diagram of the sequential circuit.
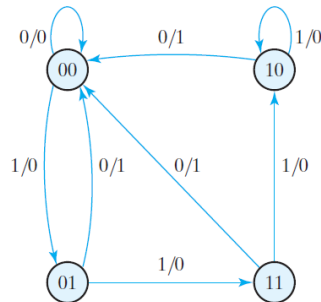

Q2. Derive the state table and the state diagram of the sequential circuit shown in the figure below. Explain the function that the circuit performs.
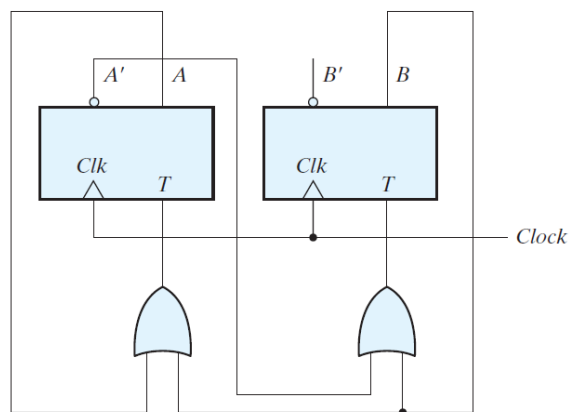
Q3.

a. Determine the state transitions and output sequence that will be generated when an input sequence of 010110111011110 is applied to the circuit below. It is initially in the state 00.

b. Design a sequential circuit with two D flip-flops A and B and one input x_{in}. When $x_{in} = 0$, the state of the circuit remains the same. When $x_{in} = 1$, the circuit goes through the state transitions from 00 to 01, to 11, to 10, back to 00, and repeats.

Q4. Design a sequential circuit with two JK flip-flops A and B and two inputs E and F. If E = 0, the circuit remains in the same state regardless of the value of F. When E = 1 and F = 1, the circuit goes through the state transitions from 00 to 01, to 10, to 11, back to 00, and repeats. When E = 1 and F = 0, the circuit goes through the state transitions from 00 to 11, to 10, to 01, back to 00, and repeats.

Q5. A sequential circuit has three flip-flops A, B, C; one input x_{in}; and one output y_{out}. The state diagram is shown in the figure below. The circuit is to be designed by treating the unused states as don't-care conditions. Analyse the circuit obtained from the design to determine the effect of the unused states.