Tutorial _2

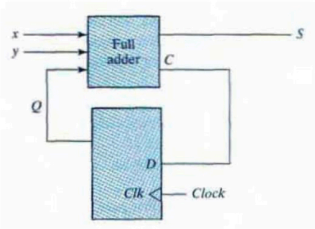
1. Construct a *JK* flip-flop. using a *D* flip-flop, a two-to-one-line multiplexer. and an inverter.

2. A sequential circuit with two D flip-flops A and B. two inputs x and y, and one output z is specified by the following next-state and output equations>

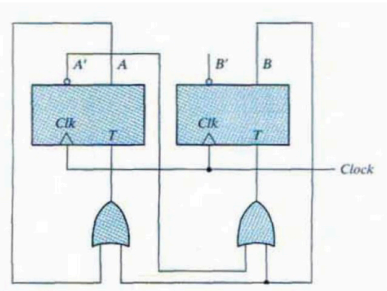
$$A(t+1) = x'y + xB$$
$$B(t+1) = x'A + xB$$
$$z = A$$

   a. Draw the logic diagram of the circuit.
   b. List the stale table for the sequential circuit.
   c. Draw the corresponding state diagram.

3. 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 following. Derive the stale table and state diagram of the sequential circuit.



4. Derive the state table and the state diagram of the sequential circuit shown in the following Figure. Explain the function that the circuit performs.



5. A sequential circuit has two JK flip-flops A and B and one input x. The cicuit is described by the following flip- flop input equation.

$$J_A = x \quad K_A = B'$$
$$J_B = x \quad K_B = A$$

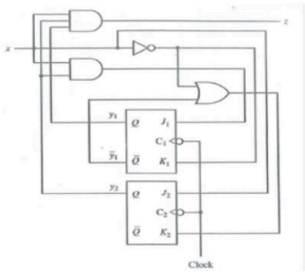
   a. Derive the state equations A (t + 1) and B(t + 1) by Substituting the input equations for the J and K variables,
   b. Draw the state diagram of the circuit.

6. A sequential circuit has two JK flip-flops A and B. two inputs x and y and one output z. The flipflop input equations and circuit outpour equation are

$$J_A = Bx + B'y' \qquad K_A = B'xy'$$
$$J_B = A'x \qquad K_B = A + xy'$$
$$z = Ax'y' + Bx'y'$$

   a. Draw the logic diagram of the circuit.
   b. Tabulate the state table.
   c. Derive the state equations for A and B.

7. Analyze the synchronous sequential circuit below. Assume the inputs levels. Use K-map to find:
    a. The State table.
    b. The State diagram.



8. 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.

9. Design a one input, one output serial 2's complementer. The circuit accepts a string of bits from the input and generates the 2's complement at the output.

    Hint: - 2's complement of a number can be obtained by keeping the least significant bits as such until the first 1, and then complementing all bits
    eg: 001010 → 110110

10. A sequential circuit has three flip-flop s A. B. and C: one input x_in: and one output y_out. The stale diagram is shown in the following Figure. The circuit is to be designed by treating me unused states as don't-care conditions. (a)· Use D flip-flops in the design.
    a. Use D flip-flops in the design.
    b. Use JK flip- flops in the design.

11. Design a counter that counts in the sequence: 000, 010, 001, 100, 011, 110, 000, ... Use clocked T flip-flops. Design your counter to go to state 000 from all invalid states. There is no need to draw a circuit diagram