**Lecture 03 Assignments**

**Sequential Logic Circuits**

1) Describe the difference between *combinational logic circuits* and *sequential logic circuits*.

2) Is the circuit in the following figure combinational logic or sequential logic? Explain its relationship between inputs and outputs using a truth table. What would you call this circuit?



3) Design an S-R latch, and show its truth table. Show how to convert the S-R latch into a D latch. Indicate the advantage(s) of the D-latch over the S-R latch.

4) Design a D flip-flop using the D latch(s). Show how to construct a 4-bit **parallel-in-parallel-out** register from the D flip-flops. Describe the importance of registers in a computer system.

5) Describe how the designers eliminate the forbidden state of S-R latches, and show the structure of the resulted latch with its truth table.

6) Design a J-K flip-flop from J-K latches. Show the circuit schematics of a **mod-13** ripple counter using the J-K flip-flops, and show the output sequence of the counter using a truth table.

7) Describe the term “toggling” in J-K latches. Show how to construct a J-K flip-flop out of J-K latches.

8) Draw the circuit schematics of a **mod-13** ripple counter using J-K flip-flops and show the output sequence of the counter using a truth table.

9) Draw the circuit schematics of a **mod-6** ripple counterusing ***toggling*** flip-flops and show the output sequence of the counter using a truth table.

10) [4 Points] Draw the circuit schematics of a **mod-11** ripple counter using the J-K flip-flops and show the output sequence of the counter using a truth table.