**Sequential Circuit Design – Practice Problems**

**Question 1:** Design a sequential circuit with two D flip-flops A and B and one input X. When X = 0, the state of the circuit remains the same. When X = 1, the circuit goes through the state transitions from 00 to 10 to 11 to 01, back to 00, and then repeats.

**Question 2:** Implement sequential circuits (using JK Flip-flops) for state diagrams given below:

|  |  |
| --- | --- |
| **(a)** | **(b)** |

**Question 3:** Make state diagrams of recognizers for following sequences:

1. “0011”
2. “1001”

**Question 4:** There is a sequential machine that takes a binary sequence (one bit per cycle) as input and gives **Y** as output. Y= 1 if sequence of the input (received at any moment) forms a binary string with even no. of zeros **and** the last bit received is 1. Implement this machine.

***For example:***

If sequence of input is **100001,** output should be **1**. (No. of 0’s are even and last bit is 1)

If sequence of input is **1,** output should be **1**. (No. of 0’s are even and last bit is 1)

If sequence of input is **1111,** output should be **1**. (No. of 0’s are even and last bit is 1)

If sequence of input is **100,** output should be **0**. (Last bit is not 1)

If sequence of input is **000111,** output should be **0**. (No. of Zero’s are odd)

**Question 5:** Make a sequential machine that accepts inputs of pattern “10101010101010…” ( i.e. alternate high and low signal being received at input) and gives output 0 otherwise.

**For example:**

000 🡪 Output = 0

0100 🡪 Output = 0

1010101 🡪 Output = 1

010 🡪 Output = 1

0101 🡪 Output = 1

1101 🡪 Output = 0

**Question 6:** Make a state machine that gives output 1 if total number of 1s in input sequence is a multiple of 3.

**For example:**

101010000 🡪 Output = 1 (total number of 1s is 3)

1101101100 🡪 Output = 1 (total number of 1s is 2x3)

1001010101 🡪 Output = 0 (total number of 1s (5) is not a multiple of 3 )

**Question 7:** Make a state machine that serially takes a binary number (one bit per clock cycle) where last bit received is the least significant bit of the number. This number can be of infinite length. Machine gives output 1 if the number is divisible by 4.

**Question 8:** Make excitation tables for all the flip-flops you have seen so far. (SR, D, Toggle and few we did in latches/FF’s practice questions).