

## **Lab Manual 12**

### **Counters and Registers**

#### **Objectives:**

To familiarize with registers and counters

#### **Counters**

A counter is a register that goes through a predetermined sequence of states upon the application of clock pulses. In a ripple counter, the flip-flop output transition serves as a source for triggering other flip flops. In a synchronous counter, the clock inputs of all of the flip flops receive the common clock pulse, and the change of state is determined from the present state of the counter.

#### **Register**

The ideas in combinational circuits and sequential methods, when brought together as one system gives sequential building blocks, usually in the form of registers and counters. A register is a set of flip-flops with combinational logic to implement state transitions that allow information to be stored and retrieved from them. In the simplest form, a flip-flop is a one-bit register.

#### **Note:**

For LogicWorks Implementation use a Binary Switch as a Clock input.

For BreadBoard Implementation use a Clock Generator as a Clock input.

### Problem 1:

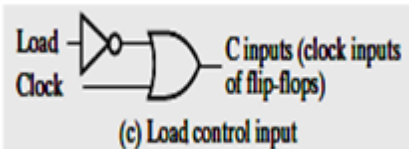
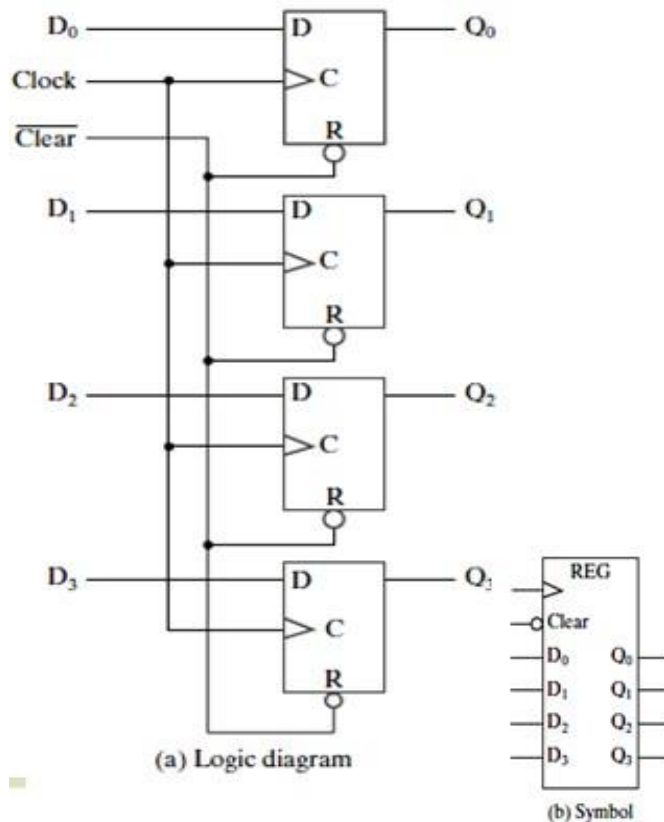
Design and implement the counter exhibiting the following behavior on Breadboard and Logic Works using JK Flip-Flop. Use the Hex Display in LogicWorks and Trainer to show the output of the circuit.

000, 011, 110, 000, 011,.....

### Problem 2:

Logic diagram of a 4-bit register is shown below (D Flip-Flops are being controlled by Clock). Implement it on trainer.

- Implement the circuit on Logic Works and Bread Board.
- Implement register with clock gating and test it.



When the **Load signal is 1**, **C inputs= Clock**, so the register is clocked normally, and new **information is transferred** into the register on the positive transitions of the clock.

When the **Load signal is 0**, **C inputs= 1**. With this constant input applied, there are no positive transitions on C inputs, so the contents of the register remain unchanged.

**Problem 3:**

Construct a 16-bit serial-parallel counter, using four 4-bit parallel counters. Suppose that all added logic is AND gates and that serial connections are employed between the four counters. What is the maximum number of AND gates in a chain that a signal must propagate through in the 16-bit counter