The University of Texas at Dallas
Department of Computer Science
CS 4141: Digital Systems Lab

Experiment #4 – Familiarization with Sequential Logic Circuits (Flip-Flops)

CS 4141 Laboratory 4, PRE-LAB 4

Objective: The purpose of Experiment #4 is to familiarize students with the functionality of the D and J-K flip-flops, and with the construction of a clocked flip-flop (essentially a clocked D-type FF). We will build the RS and clocked D flip-flop circuits in the lab.

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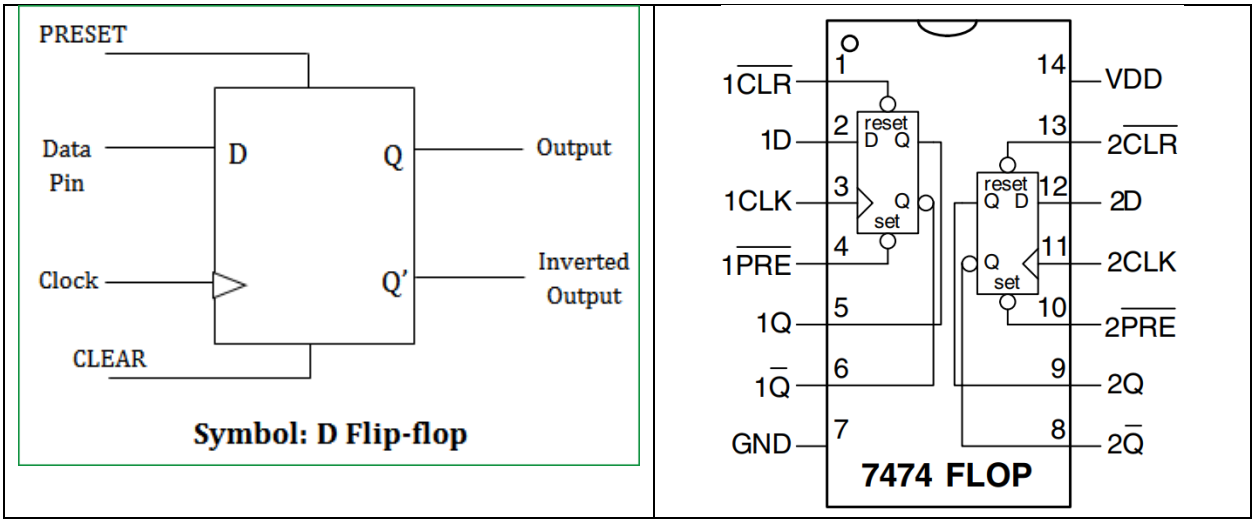
Turn-In Checklist

Make certain that your name, your lab section, the date, and "Pre-Lab 1" is at the top of your paper.

- Problem 1. DFF Flip Flop Truth Table (5 points)
- Problem 2. JK Flip Flop Truth Table (5 points)
- Problem 3. Logic Diagram of a tiny ALU with DFF Accumulator (10 points)

Problem 1. DFF Flip-Flop Truth Table (5 points)

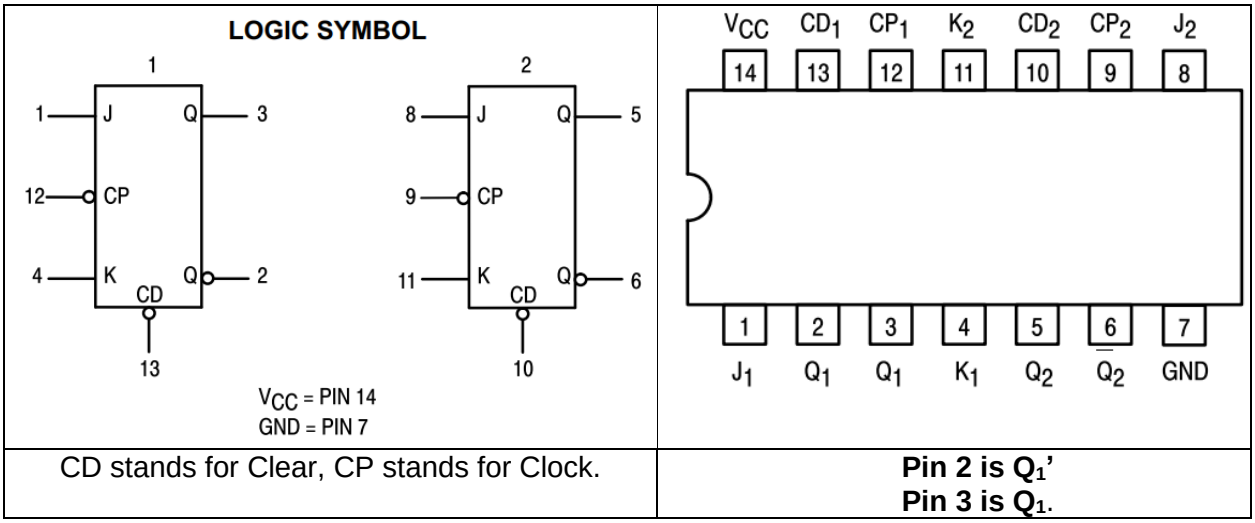
Below are the DFF logic symbol and circuit diagram (from ic_diagrams.pdf).



Learn about D Flip-Flop IC 7474. Draw truth table for the output Q and Q'. Consider all inputs including Clock, CLEAR (Reset), PRESET and data pin D.

Problem 2. JK Flip-Flop Truth Table (5 points)

Below are the logic symbol and IC diagram of the JK-FF.



CD stands for Clear, CP stands for Clock.	**Pin 2 is Q_1'** **Pin 3 is Q_1.**

Learn about JK Flip-Flop IC 74107. Draw truth table for the output Q and Q'. Consider all inputs including Clock, Clear, data pin J, and data pin K

Problem 3. Logic Diagram of a tiny ALU with DFF Accumulator (10 points)

This problem involves building a tiny ALU performing 4-bit addition and using two 74SL74 (4 DFF's) and a 4-bit adder.

Provide an implementation to perform the following ALU addition operation.

Add A,B – This operation adds register A and input B and stores the result in register A.

Create a 4-bit register using 4 D FFs which acts as an accumulator. This accumulator is connected with an adder and is performing the following task.

The initial value of the accumulator is 0 and every time a clock pulse is given, it adds the current value of the accumulator (let's call it A) and a given 4-bit input B. The B input is provided using 4 input switches. Thus, the accumulator stores the addition of multiple 4-bit values provided to the ALU.

Draw the Logic Diagram of a tiny ALU with DFF Accumulator. Use logical symbols, not IC chips. A logical diagram should contain block notations (such as Full Adder, D Flip-Flop, Decoder, Multiplexer) and gate symbols (such as AND, OR, and NOT).