**D Flip-Flop Experiment Report**

Name:   
  
Date:   
Course: CSCI 220 Computer Architecture I  
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# **Introduction**

The purpose of this lab is to understand the operation of a D Flip-Flop using the 74175 integrated circuit (IC). A D Flip-Flop is a fundamental component in digital electronics, used for storing a single bit of data. It is widely used in memory storage, data synchronization, and sequential logic circuits. In this experiment, we will verify the function table of the 74175 D Flip-Flop and observe its behavior under different input conditions. The results will help us understand how D Flip-Flops can be used in practical applications such as registers, counters, and shift registers.

# **Objective**

The objective of this lab is to:

1. Set up a circuit using the 74175 D Flip-Flop IC.
2. Verify the function table of the D Flip-Flop by observing its outputs for different inputs.
3. Understand the practical applications of D Flip-Flops in digital systems.

# **Procedure**

## **Components Used**

1. 74175 IC (contains 4 D Flip-Flops)
2. Breadboard
3. Power supply (+5V DC)
4. Function generator (1 Hz square wave)
5. LED indicators
6. Connecting wires

## **Circuit Setup**

1. **Power Connections**:
   * + - Connected Vcc (Pin 16) to +5V.
       - Connected GND (Pin 8) to ground.
       - Connected MR (Pin 1) to +5V to disable the reset function.
2. **Clock Signal**:
   * Set the function generator to produce a 1 Hz square wave.
   * Connected the TTL output of the function generator to CP (Pin 9).
3. **Data Input**:

Connected D₀ (Pin 4) to either ground (LOW) or +5V (HIGH) to set the input.

1. **Output Observation**:

Connected Q₀ (Pin 2) and  (Pin 3) to LED indicators to observe the output.

## **Verification of Function Table**

* The function table of the 74175 D Flip-Flop was verified by applying different combinations of inputs (MR, CP, and D) and observing the outputs ().
* The clock signal was set to 1 Hz to allow easy observation of the output changes.

# **Data and Discussion**

## **Function Table**

The following table shows the expected and observed results for the 74175 D Flip-Flop:

|  |  |  |
| --- | --- | --- |
| **Inputs** | **Outputs** | **Observed Results** |
| **MR** | **CP** | **D** | **Q** |  | **Q** | **​** |
| L | X | X | L | H | L | H |
| H | **↑** | H | H | L | H | L |
| H | **↑** | L | L | H | L | H |
| H | L | X | Previous Level | Previous Level | Previous Level |  |

## **Observations**

1. When MR (Master Reset) was set to LOW, the output Q₀ was always LOW, and  ​​ was always HIGH, regardless of the clock or data input. This confirmed the reset functionality of the D Flip-Flop.
2. When MR was set to HIGH, the output Q₀ followed the input D₀ on the rising edge of the clock signal (↑).

Example:

* + - When D₀ = HIGH, Q₀became HIGH, and   became LOW.
    - When D₀ = LOW, Q₀became LOW, and  became HIGH.

1. When the clock signal was LOW, the output remained at the previous level, demonstrating the memory function of the D Flip-Flop.

## **Discussion**

The experiment successfully verified the function table of the 74175 D Flip-Flop. The results matched the expected behavior, confirming that the D Flip-Flop stores the input data (D) and updates the output (Q) on the rising edge of the clock signal. The reset function (MR) worked as expected, overriding the clock and data inputs to force the output to a known state (LOW).

# **Conclusions**

The experiment demonstrated the fundamental operation of a D Flip-Flop using the 74175 IC. The key findings are:

1. The D Flip-Flop stores the input data (D) and updates the output (Q) on the rising edge of the clock signal.
2. The reset function (MR) overrides the clock and data inputs, forcing the output to LOW.
3. D Flip-Flops are essential components in digital systems, used for memory storage, data synchronization, and sequential logic.

# **References**

Petzold, M. (n.d.). *Lab Manual for CSCI 220 Computer Architecture I*. St. Cloud State University.

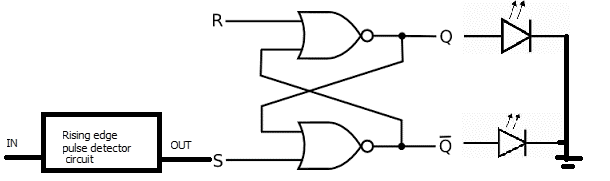
Texas Instruments. (n.d.). *74175 Quad D-Type Flip-Flop Datasheet*. Retrieved from [Texas Instruments website](https://www.ti.com/)

Floyd, T. L. (2015). *Digital Fundamentals* (11th ed.). Pearson.

# **Appendix**

## **Function 1. Logic function**

*Qnext* = (*MR*) ⋅ (*D*⋅*CP*rising edge)  *.0*



## ***Figure 1: Circuit diagram for the 74175 D Flip-Flop experiment.***

## ***Table 1: Function Table of 74175 D Flip-Flop***

|  |  |  |
| --- | --- | --- |
| **Inputs** | **Outputs** | **Observed Results** |
| **MR** | **CP** | **D** | **Q** | **Q‾*Q*​** | **Q** | **Q‾*Q*​** |
| L | X | X | L | H | L | H |
| H | **↑** | H | H | L | H | L |
| H | **↑** | L | L | H | L | H |
| H | L | X | Previous Level | Previous Level | Previous Level |  |