

# Assignment I

## Sequence Detector Using D Flip Flop

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**Abstract**—This manual shows how to use the 7474 D-Flip Flop IC to detect the sequence 1001.

### I. COMPONENTS

| Components            | Value   | Quantity |
|-----------------------|---------|----------|
| Resistor              | 220 Ohm | 1        |
| Arduino               | UNO     | 1        |
| Seven Segment Display |         | 1        |
| Decoder               | 7447    | 1        |
| Flip Flop             | 7474    | 1        |
| Bread Board           |         | 1        |
| Jumper Wires          |         | 20       |

### II. HARDWARE

- 1) Make connections between the seven segment display in Fig 1 and the 7447 IC in Fig 2 as shown in Table I
- 2) Connect the Arduino, 7447 IC and the 7474 IC according to Table 2 and Fig 3.
- 3) Input is given from Arduino D8.

|         |    |    |    |    |    |    |    |
|---------|----|----|----|----|----|----|----|
| 7447    | a' | b' | c' | d' | e' | f' | g' |
| Display | a  | b  | c  | d  | e  | f  | g  |

Table I: Connection Table

### III. FINITE STATE MACHINE

- 1) A sequential detector is a sequential state machine that takes an input string of bits

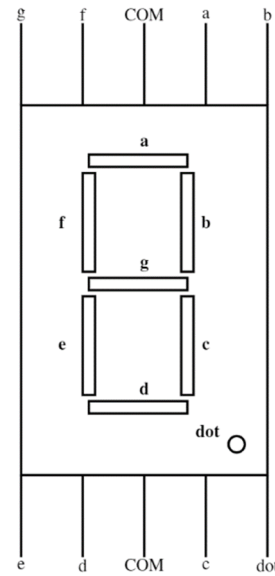


Figure 1: Seven Segment Display

and generates an output 1 whenever the target sequence has been detected.

- 2) The Input is changed to 0 and 1 to display the Next state.
- 3) The LED glows when the sequence 1001 is detected.



Figure 2: Pin Diagram of 7447 IC

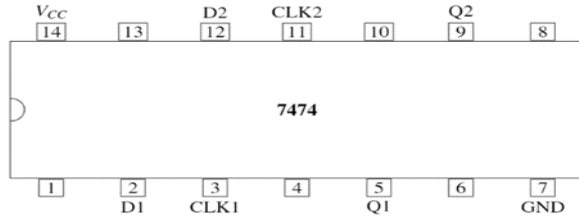


Figure 3: Pin Diagram of 7474 IC

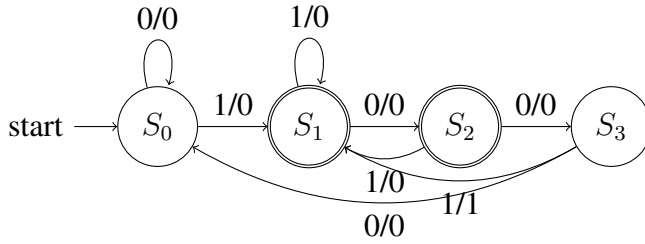


Figure 4: State Diagram

|         | INPUT |    | OUTPUT |    |    |    | CLOCK |      | 5V |   |    |    |
|---------|-------|----|--------|----|----|----|-------|------|----|---|----|----|
|         | P     | Q  | D      | C  | B  | A  |       |      |    |   |    |    |
| Arduino | D6    | D7 | D2     | D3 | D4 | D5 | D13   |      |    |   |    |    |
| 7474    | 2     | 12 |        |    | 9  | 5  | CLK1  | CLK2 | 1  | 4 | 10 | 13 |
| 7447    |       |    |        |    | 1  | 7  |       |      | 16 |   |    |    |

Table II: Connection Table

| Present State |   | Input | Next State |   | Output |
|---------------|---|-------|------------|---|--------|
| A             | B | X     | P          | Q | Y      |
| 0             | 0 | 0     | 0          | 0 | 0      |
| 0             | 0 | 1     | 0          | 1 | 0      |
| 0             | 1 | 0     | 0          | 1 | 0      |
| 0             | 1 | 1     | 0          | 1 | 0      |
| 1             | 0 | 0     | 1          | 1 | 0      |
| 1             | 0 | 1     | 0          | 1 | 0      |
| 1             | 1 | 0     | 0          | 0 | 0      |
| 1             | 1 | 1     | 0          | 1 | 1      |

Table III: State Table

| X | AB |    |    |    |
|---|----|----|----|----|
|   | 00 | 01 | 11 | 10 |
| 0 | 0  | 1  | 0  | 1  |
| 1 | 0  | 0  | 0  | 0  |

$$P = A'BX' + AB'X' \quad (1)$$

| X | AB |    |    |    |
|---|----|----|----|----|
|   | 00 | 01 | 11 | 10 |
| 0 | 0  | 0  | 0  | 1  |
| 1 | 1  | 1  | 1  | 1  |

$$Q = AB' + X \quad (2)$$

| X | AB |    |    |    |
|---|----|----|----|----|
|   | 00 | 01 | 11 | 10 |
| 0 | 0  | 0  | 0  | 0  |
| 1 | 0  | 0  | 1  | 0  |

$$Y = ABX \quad (3)$$

## CONCLUSION

The detection of 1001 sequence using D-Flip flop is implemented using

<https://github.com/SinkonaChinthamalla/fwc/blob/main/Assignment1/code.cpp>