DIGITAL SYSTEMS AND MICROCONTROLLERS - LAB REPORT 6
10/10/25

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Experiment 1

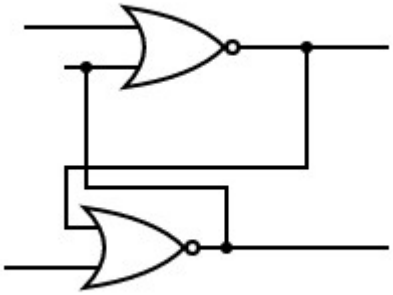
Objective:

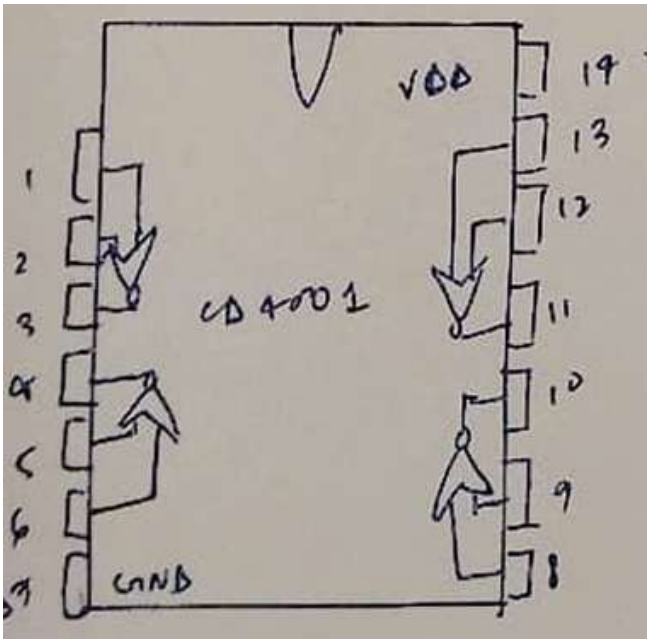
To assemble SR Latch using NOR implementation.

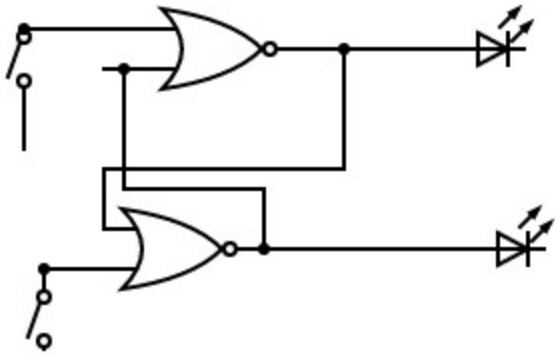
Electronic components used:

1. Digital Test Kit
2. Connecting Wires
3. ICs: CD4001

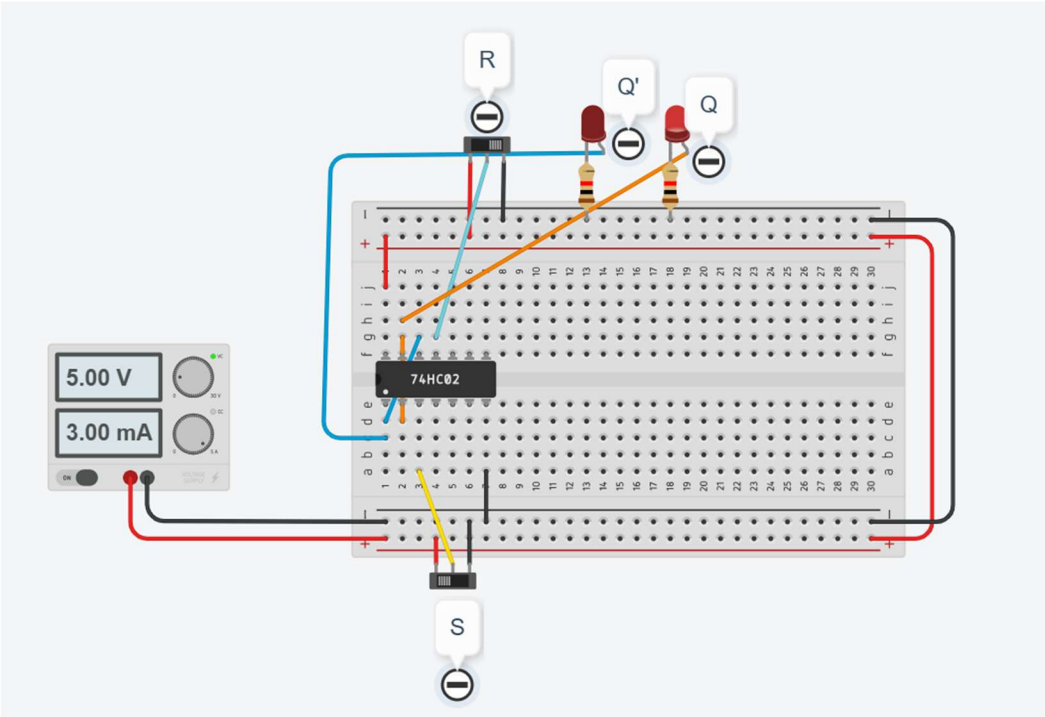
Reference circuit:







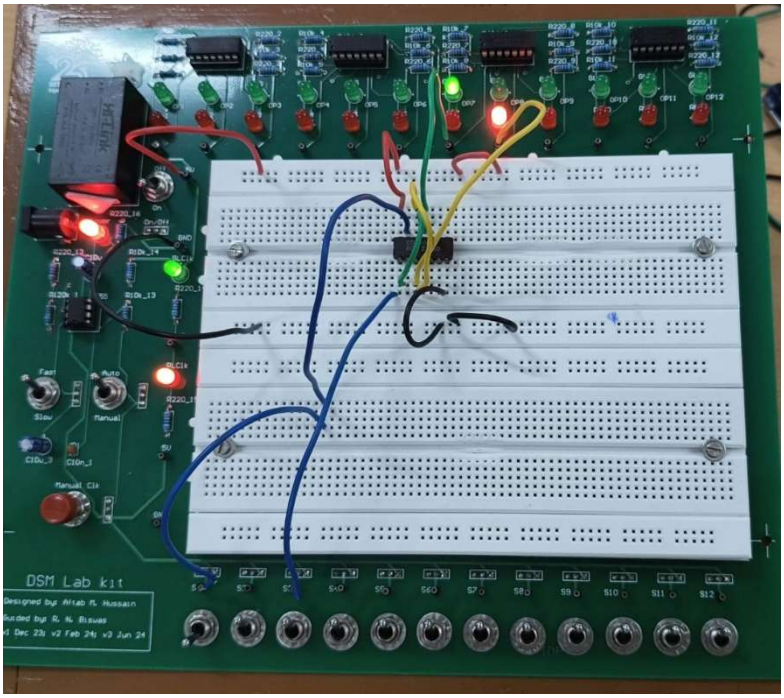
Tinkercad Reference circuit:



Procedure:

1. Connect the VCC (14) and GND (7) pins of the ICs to the VCC and GND lines of the Digital Test Kit respectively.
2. Make the connections as shown in the reference circuit.

Observation:



Conclusion:

S	R	Q	Q'	Action
0	0	Previous output	Previous output	LATCH
0	1	0	1	Reset
1	0	1	0	Set
1	1	0	0	Forbidden

Link to TinkerCAD simulation:
https://www.tinkercad.com/things/kW6UXFWYl2Q-lab6exp1?sharecode=undefined

****The TinkerCAD link does not work properly sometimes. If there's an issue with the same, please tell me and I can send you the login details of my Tinkercad Account.

Experiment 2

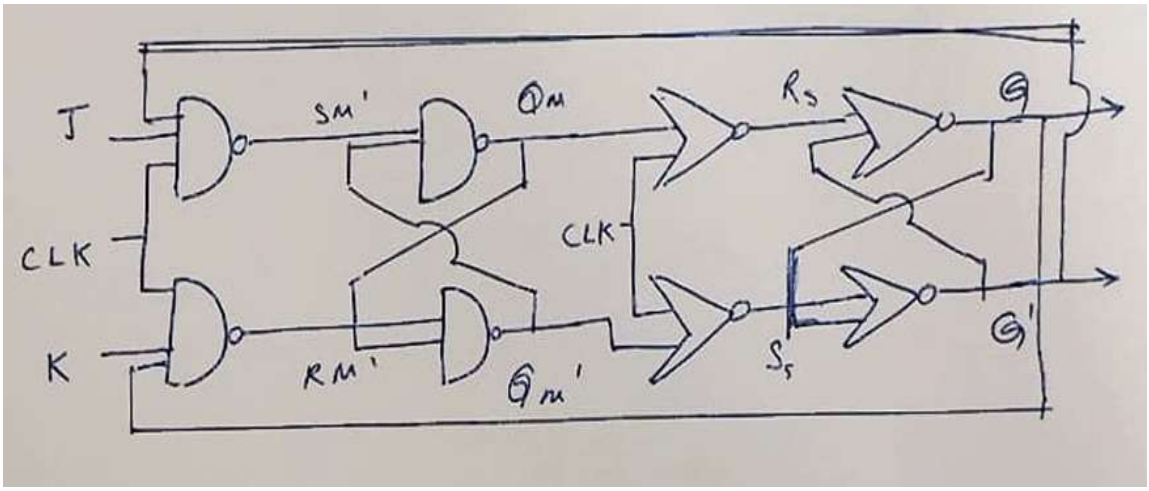
Objective:

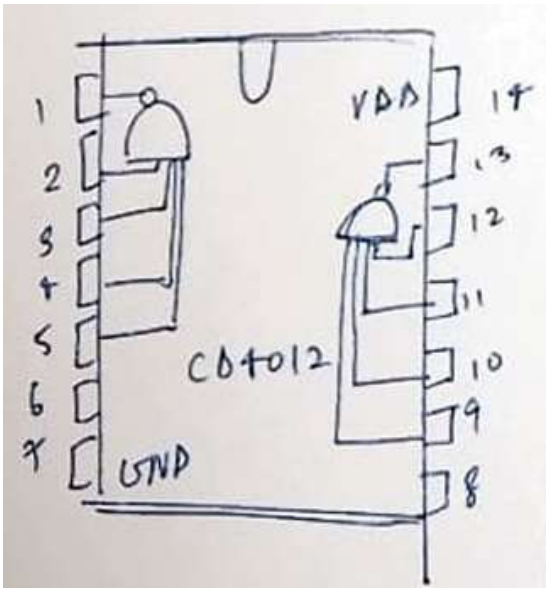
To assemble and test a JK Master Slave Flip Flop.

Electronic components used:

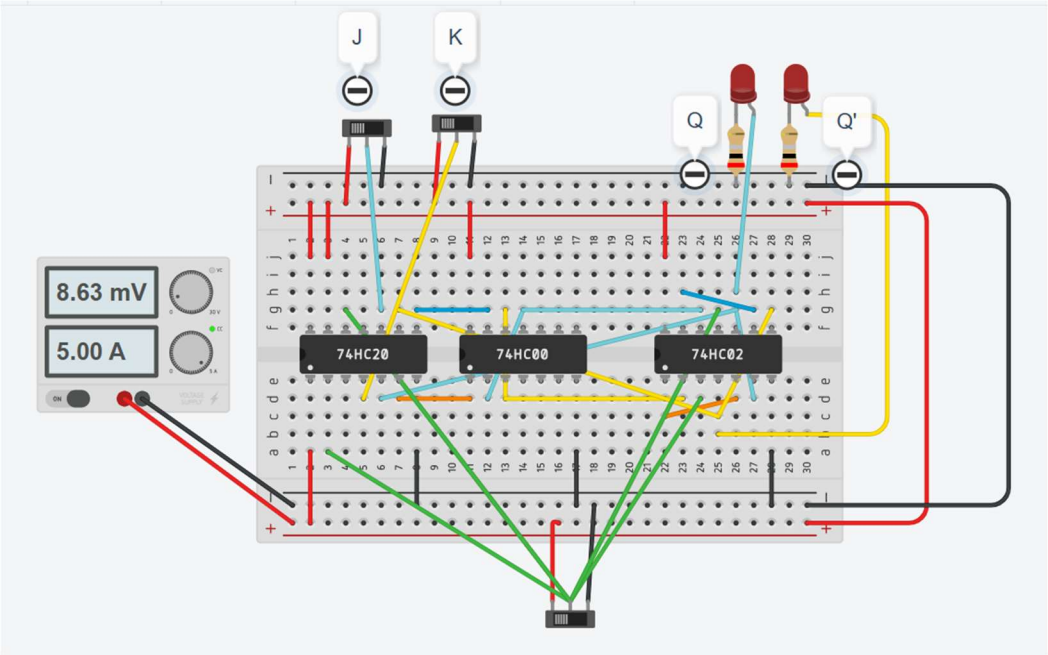
1. Digital Test Kit
2. Connecting Wires
3. ICs: CD4012, CD4001

Reference circuit:





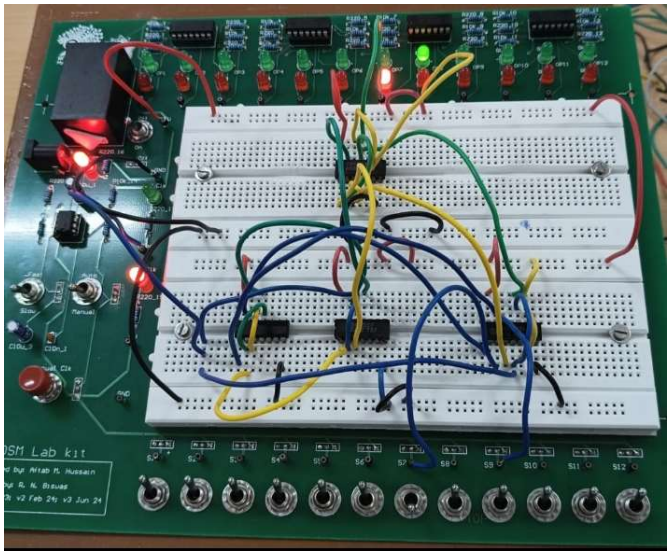
Tinkercad Reference circuit:



Procedure:

1. Connect the VCC (14) and GND (7) pins of the ICs to the VCC and GND lines of the Digital Test Kit respectively.
2. Make the connections as shown in the reference circuit.

Observation:



Conclusion:

J	K	Action	Qn+1
0	0	Hold	Qn
0	1	Clear	0
1	0	Set	1
1	1	Toggle	Qn’

Link to TinkerCAD simulation:

https://www.tinkercad.com/things/e15BUOikLtO-lab6exp2?sharecode=undefined

**Site used to make circuit reference diagrams: https://www.circuit-diagram.org/editor/

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Experiment 3

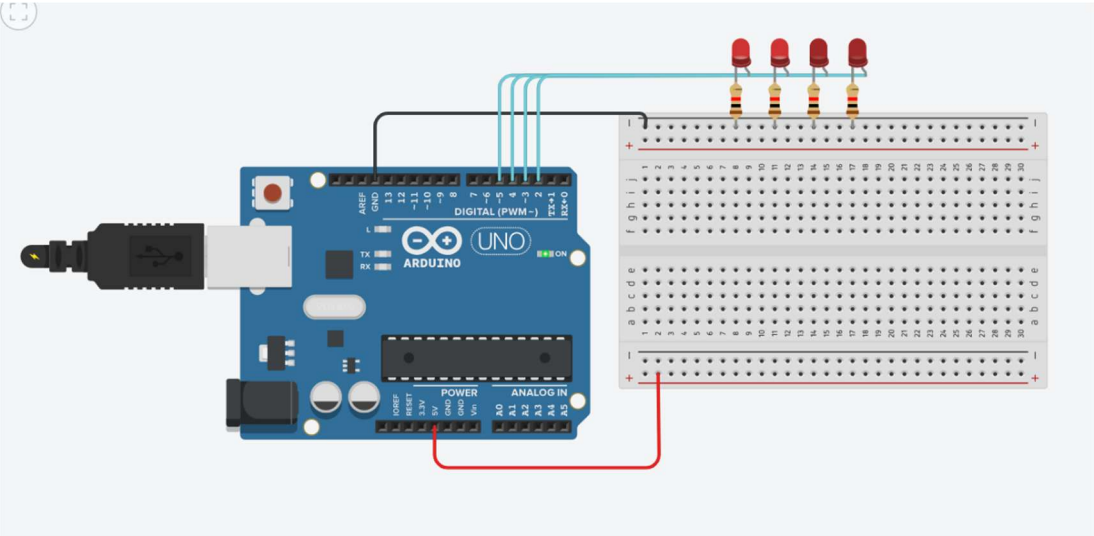
Objective:

Use Arduino to implement 4 bit up-down ripple counter.

Electronic components used:

1. Digital Test Kit
2. Connecting Wires
3. Arduino UNO Board

Tinkercad Reference circuit:



Procedure:

1. Connect the VCC and GND pins of the Arduino to the VCC and GND lines of the Digital Test Kit respectively.
2. Connect the output pins of the Arduino to the LEDs of the Digital Test Kit.
3. Write the below code.

```
// LED pins (from least to most significant bit)
int ledPins[] = {2, 3, 4, 5};  // Connect 4 LEDs to these pins

int counter = 0;              // Current counter value (0-15)
bool countingUp = true;       // Direction of counting (true = up, false = down)

void setup() {
  // Set all LED pins as OUTPUT
  for (int i = 0; i < 4; i++) {
    pinMode(ledPins[i], OUTPUT);
  }
}

void loop() {
  // Show the binary value of counter on LEDs
  for (int i = 0; i < 4; i++) {
    int bitValue = (counter >> i) & 1;       // Extract bit i
    digitalWrite(ledPins[i], bitValue);      // Set LED ON or OFF
  }

  delay(500);  // Wait 500ms before next update

  // Update counter value
  if (countingUp) {
    counter++;
    if (counter > 15) {
      counter = 15;       // Prevent going over 4-bit max
```

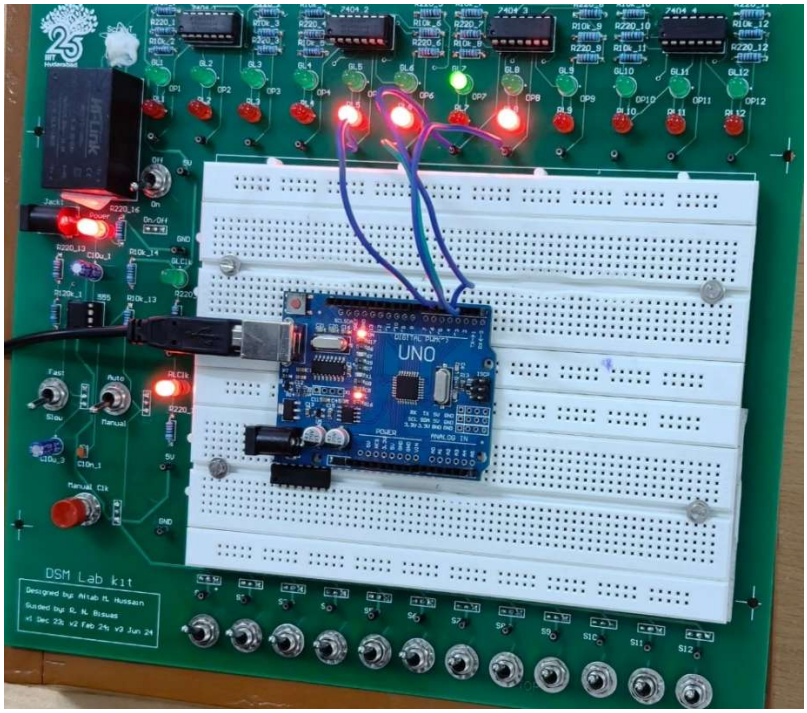
```
void loop() {
  // Show the binary value of counter on LEDs
  for (int i = 0; i < 4; i++) {
    int bitValue = (counter >> i) & 1;       // Extract bit i
    digitalWrite(ledPins[i], bitValue);      // Set LED ON or OFF
  }

  delay(500);  // Wait 500ms before next update

  // Update counter value
  if (countingUp) {
    counter++;
    if (counter > 15) {
      counter = 15;       // Prevent going over 4-bit max
      countingUp = false; // Switch to down counting
    }
  } else {
    counter--;
    if (counter < 0) {
      counter = 0;        // Prevent going below 0
      countingUp = true;  // Switch to up counting
    }
  }
}
```

Output

Observation:



Conclusion:

4 bit up-down ripple counter successfully implemented using Arduino.

Link to TinkerCAD simulation:
https://www.tinkercad.com/things/l6ZRxxOIQRX-lab6exp3?sharecode=lzADMZIREDdd2UlSFsRIP3oU_vq6tWP-31vJmRgjO6c

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