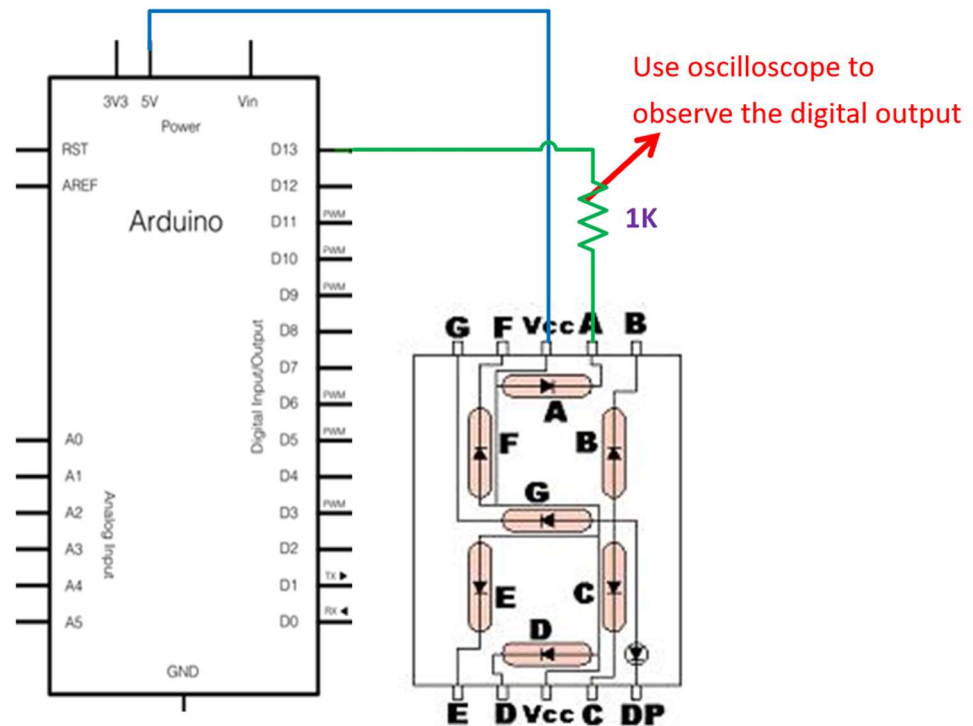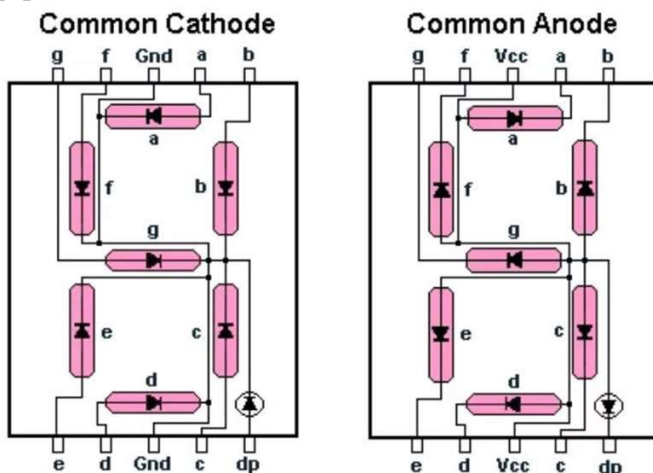# REPORT

Experiment 1: LED Blink.

NOTE: use DC coupling to observe the waveforms, and use cursor/measure to mark V_{high} and V_{low}.

What is a seven-segment display?

Basically, they are 7(line segments) + 1(dot) LEDs with a commonly connected end. There are 2 types of 7-segment display, common cathode, and common anode.
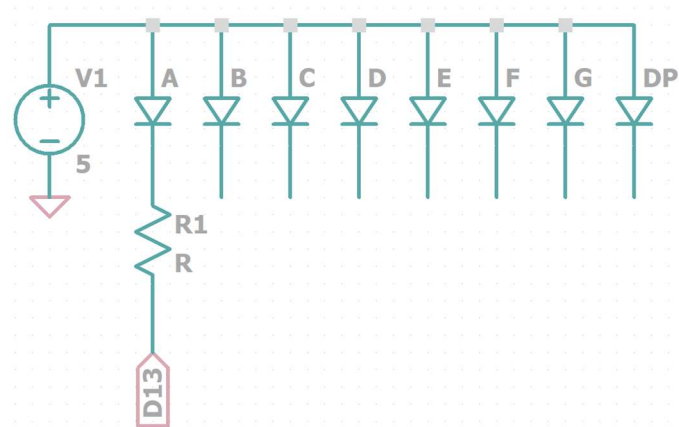
[1]

Common cathode:

The cathodes of LEDs are connected together, so if the input signal of an LED is **HIGH**, the corresponding LED would be turned on.

Common anode:

In contrast, the LED of the common anode type would be turned on if the input signal is **LOW**.
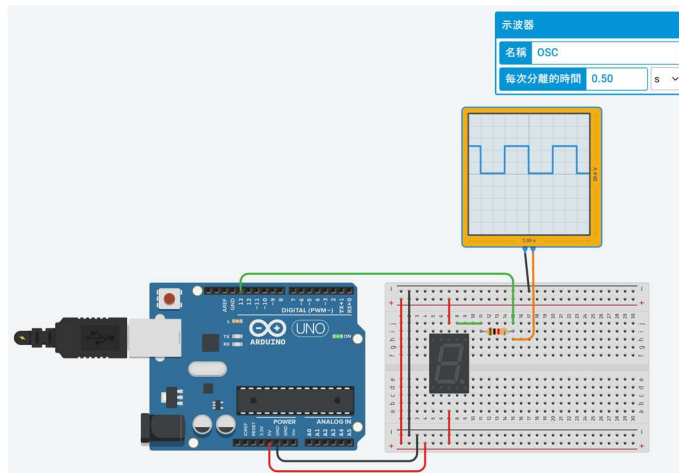
Circuit Analysis

D13 is an input signal of the 7-segment display, if D13 is LOW(0V), the voltage drop of LED A would be 5V, and LED A would be turned on. On the contrary, if D13 is HIGH, the voltage drop of LED A would be 0V, LED A would be turned off.

D13	LED A
HIGH	Off
LOW	On

Simulation

0.5Hz


```
1   int led = 13;
2   int hT = 1000;
3
4   void setup()
5   {
6      pinMode(led, OUTPUT);
7   }
8
9   void loop()
10  {
11     digitalWrite(led, LOW);
12     delay(hT);
13     digitalWrite(led, HIGH);
14     delay(hT);
15  }
```
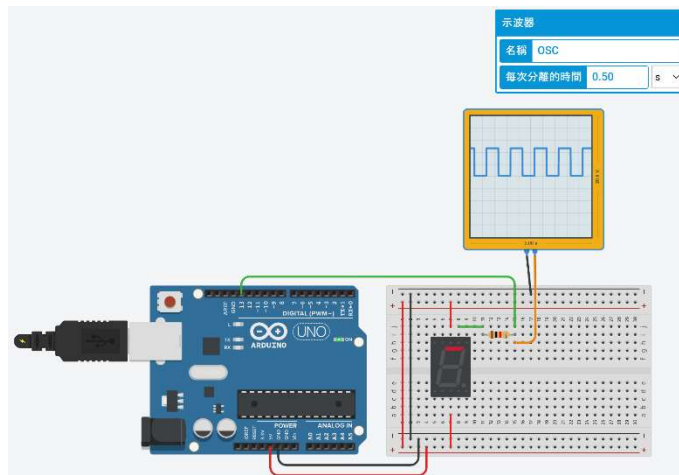
1Hz


```
1   int led = 13;
2   int hT = 500;
3
4   void setup()
5   {
6      pinMode(led, OUTPUT);
7   }
8
9   void loop()
10  {
11     digitalWrite(led, LOW);
12     delay(hT);
13     digitalWrite(led, HIGH);
14     delay(hT);
15  }
```

2Hz


```
1  int led = 13;
2  int hT = 250;
3
4  void setup()
5  {
6    pinMode(led, OUTPUT);
7  }
8
9  void loop()
10 {
11   digitalWrite(led, LOW);
12   delay(hT);
13   digitalWrite(led, HIGH);
14   delay(hT);
15 }
```
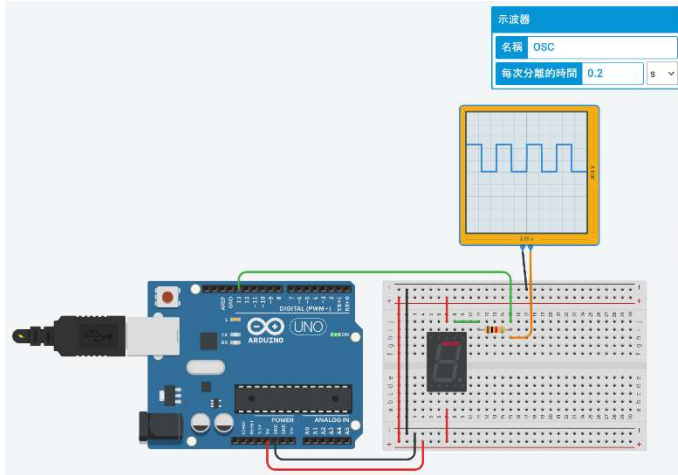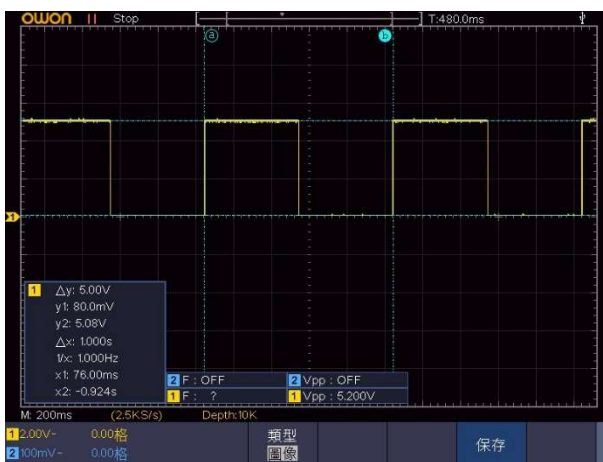
Data

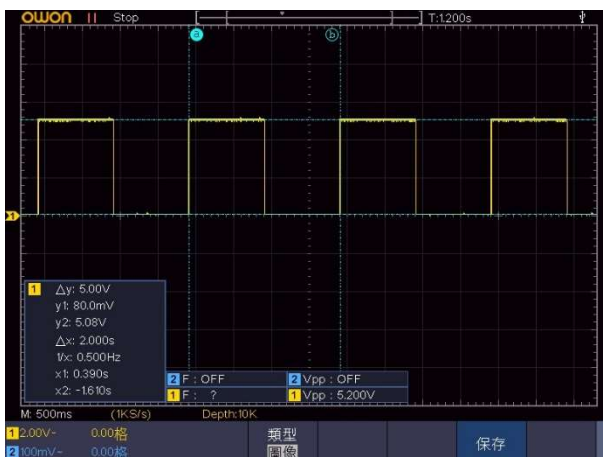1.

Arduino D13 ouput waveform with frequency 1Hz.

2.

Arduino D4 ouput waveform with frequency 0.5Hz.

3.

Arduino D4 ouput waveform with frequency 2Hz.
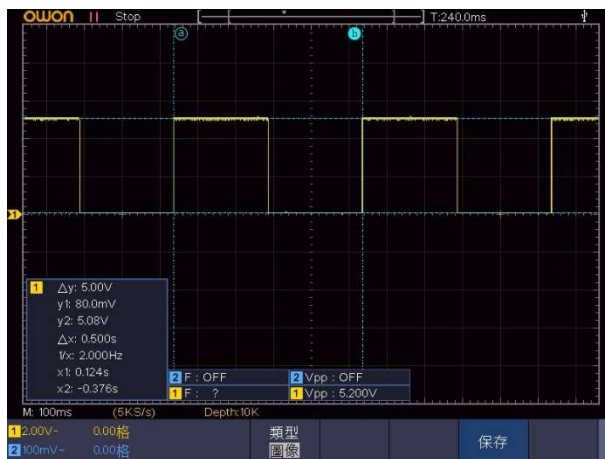
Question:

What output level (high/low) will make LED turn light or dark? Why?

LOW (0V). Because the 7-segment display we use is a common anode 7-segment display.

Demo

EXP1

https://youtu.be/ottNDeb2jJo

Experiment 2: LED Blink with push button.
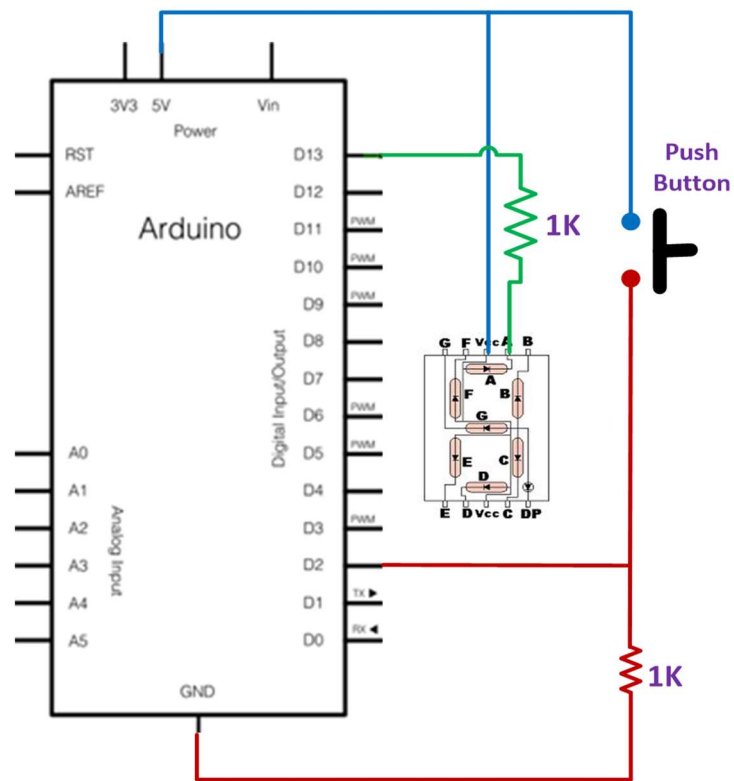
What is pull-high/pull-low circuit?
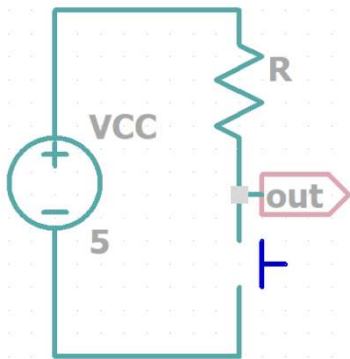
Pull-High	Pull-Low
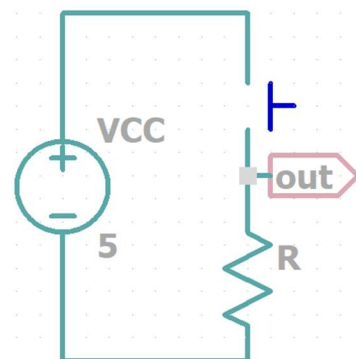
Button	Output
Release	HIGH
Press	LOW

Button	Output
Release	LOW
Press	HIGH

Circuit Analysis
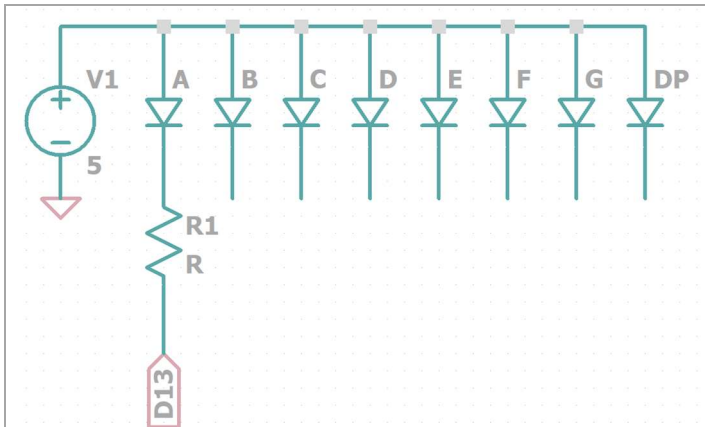
The same as the previous experiment.	It's a pull-low circuit, and it's output would be the input signal of Arduino (connected to PIN2).
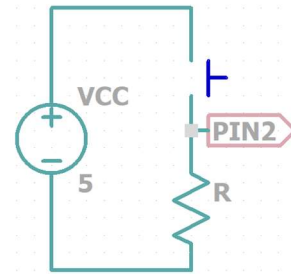
Simulation

Pull-Low
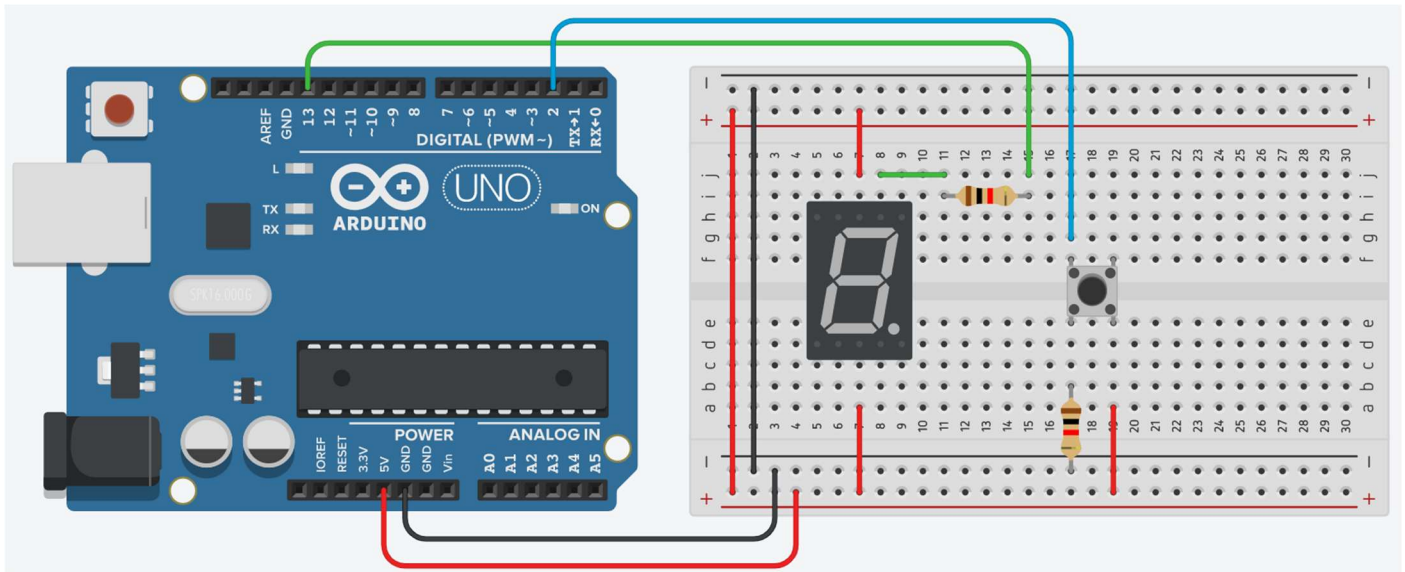

```
int pushButton = 8;
int led = 13;
void setup()
{
  // initialize serial communication at 9600 bits per second:
  Serial.begin(9600);

  pinMode(pushButton, INPUT);
  pinMode(led, OUTPUT);
}
```

```
void loop()
{
  // read the input pin:
  int buttonState = digitalRead(pushButton);
  if (buttonState == LOW)
  {
    digitalWrite(led, LOW);
    delay(1000);
    digitalWrite(led, HIGH);
    delay(1000);
    Serial.println(buttonState);
  }
  else
  {
    digitalWrite(led, LOW);
    Serial.println(buttonState);
  }
}
```

Pull-High
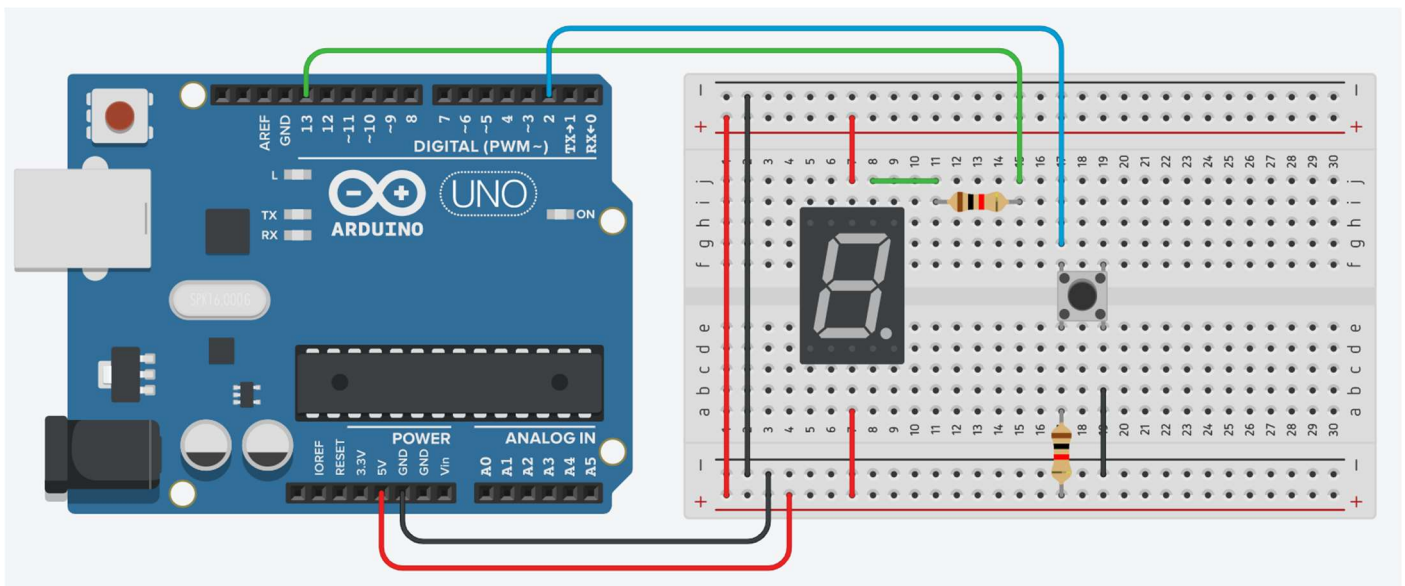

```
int pushButton = 8;
int led = 13;
void setup()
{
  Serial.begin(9600);
  pinMode(pushButton, INPUT);
  pinMode(led, OUTPUT);
}
```

```
void loop()
{
 int buttonState = digitalRead(pushButton);
 if (buttonState == HIGH)
 {
  digitalWrite(led, LOW);
  delay(1000);
  digitalWrite(led, HIGH);
  delay(1000);
  Serial.println(buttonState);
 }
 else
 {
  digitalWrite(led, LOW);
  Serial.println(buttonState);
 }
}
```

Data

1.

Is this circuit a pull-high or pull-low type? __pull-low__.

2.

Measure pin D2 voltage using voltage meter:

Behavior	DC Voltage (V)
Pushbutton pressed	**5**
Pushbutton released	**0**

3.

Change your circuit to another type and modify your circuit and sketch to achieve the same requirement.
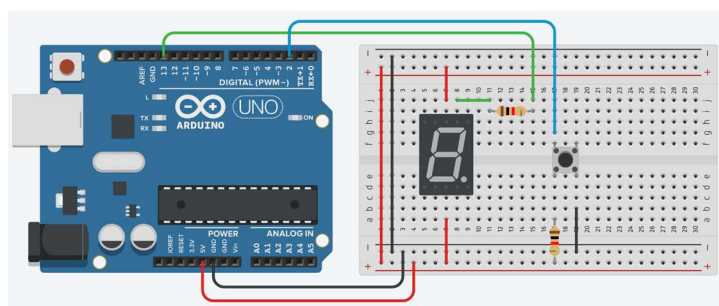
Modified circuit:

Modified sketch:

```
int pushButton = 2;
int led = 13;
void setup()
{
  // initialize serial communication at 9600 bits per second:
  Serial.begin(9600);
  // make the pushbutton's pin an input and led's pin an output:
  pinMode(pushButton, INPUT);
  pinMode(led, OUTPUT);
}
void loop()
{
  // read the input pin:
  int buttonState = digitalRead(pushButton);

  // make LED blink and output buttonState.
  if (buttonState == HIGH)
  {
    digitalWrite(led, LOW); // turn the LED on (HIGH is the voltage level)
    delay(1000); // wait for a second
    digitalWrite(led, HIGH); // turn the LED off by making the voltage LOW
    delay(1000);
    Serial.println(buttonState);
  }
  else
  { // turn LED on and output buttonState.
    digitalWrite(led, LOW);
    Serial.println(buttonState);
  }
}
```

4.

Measure pin D2 voltage using voltage meter after step 3:

Behavior	DC Voltage (V)
Pushbutton pressed	0
Pushbutton released	5

5.

Attach your serial monitor screenshot

Release → Press

Pull - High	Pull-Low
Serial Monitor ✕ Message (Ctrl + Enter to send message to 'Arduino Uno' on 'COM3' 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0	Serial Monitor ✕ Message (Ctrl + Enter to send message to 'Arduino Uno' on 'COM3' 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1

Demo

EXP2

https://youtu.be/5OBm8n2hb1c

Experiment 3: LED Marquee.

Attach your sketch and result pictures:

```
byte pinA=1, pinB=2, pinC=3, pinD=4, pinE=5, pinF=6, pinG=7, pinP=8;
byte pushButton = 13;
int buttonState;

void setup() {
  pinMode(pinA, OUTPUT); pinMode(pinB, OUTPUT); pinMode(pinC, OUTPUT);
  pinMode(pinD, OUTPUT); pinMode(pinE, OUTPUT); pinMode(pinF, OUTPUT);
  pinMode(pinG, OUTPUT); pinMode(pinP, OUTPUT);
  pinMode(pushButton, INPUT);
}

// show the specified LEDs of 7-segment
void showSevenSeg(byte A, byte B, byte C, byte D, byte E, byte F, byte G, byte P) {
  digitalWrite(pinA, A); digitalWrite(pinB, B); digitalWrite(pinC, C);
  digitalWrite(pinD, D); digitalWrite(pinE, E); digitalWrite(pinF, F);
  digitalWrite(pinG, G); digitalWrite(pinP, P);
}
```

```
void check()
{
 while(1)
 {
  buttonState = digitalRead(pushButton);
  if(!buttonState)
  {showSevenSeg(0,0,0,0,0,0,0,0);}
  else{break;}
 }
}


void loop() {
 showSevenSeg(0,1,1,1,1,1,1,1); // turn LED A of 7-segment on.
 delay(500);
 check();
 showSevenSeg(1,0,1,1,1,1,1,1); // turn LED A of 7-segment on.
 delay(500);
 check();
 showSevenSeg(1,1,0,1,1,1,1,1); // turn LED A of 7-segment on.
 delay(500);
 check();
 showSevenSeg(1,1,1,0,1,1,1,1); // turn LED A of 7-segment on.
 delay(500);
 check();
 showSevenSeg(1,1,1,1,0,1,1,1); // turn LED A of 7-segment on.
 delay(500);
 check();
 showSevenSeg(1,1,1,1,1,0,1,1); // turn LED A of 7-segment on.
 delay(500);
 check();
}
```
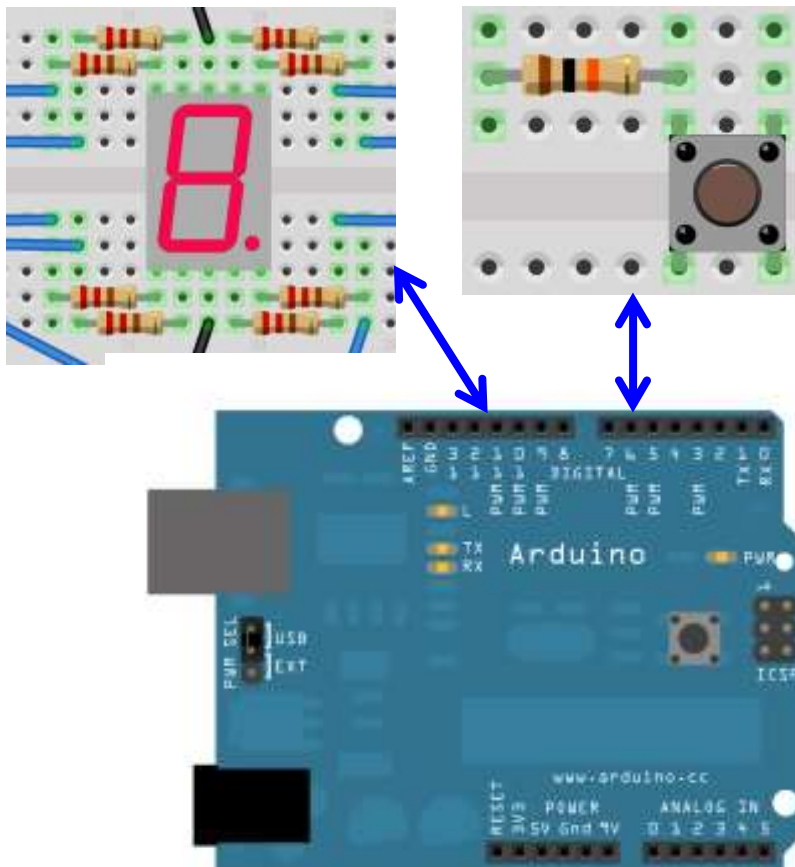
Demo

EXP3

https://youtu.be/cjjXVWf9tNQ

Experiment 4: student ID Marquee.

Attach your sketch and result pictures:

```
byte pinA=1, pinB=2, pinC=3, pinD=4, pinE=5, pinF=6, pinG=7, pinP=8;
byte pushButton = 13;
int buttonState;

void setup() {
 pinMode(pinA, OUTPUT); pinMode(pinB, OUTPUT); pinMode(pinC, OUTPUT);
 pinMode(pinD, OUTPUT); pinMode(pinE, OUTPUT); pinMode(pinF, OUTPUT);
 pinMode(pinG, OUTPUT); pinMode(pinP, OUTPUT);
 pinMode(pushButton, INPUT);
}

// show the specified LEDs of 7-segment
void showSevenSeg(byte A, byte B, byte C, byte D, byte E, byte F, byte G, byte P) {
 digitalWrite(pinA, A); digitalWrite(pinB, B); digitalWrite(pinC, C);
 digitalWrite(pinD, D); digitalWrite(pinE, E); digitalWrite(pinF, F);
 digitalWrite(pinG, G); digitalWrite(pinP, P);
}

void num(int n)
```

```
{
 switch(n)
 {
  case 0:
   showSevenSeg(0,0,0,0,0,0,1,1);
   delay(500);
   break;
  case 1:
   showSevenSeg(1,0,0,1,1,1,1,1);
   delay(500);
   break;
  case 2:
   showSevenSeg(0,0,1,0,0,1,0,1);
   delay(500);
   break;
  case 3:
   showSevenSeg(0,0,0,0,1,1,0,1);
   delay(500);
   break;
  case 4:
   showSevenSeg(1,0,0,1,1,0,0,1);
   delay(500);
   break;
  case 5:
   showSevenSeg(0,1,0,0,1,0,0,1);
   delay(500);
   break;
  case 6:
   showSevenSeg(0,1,0,0,0,0,0,1);
   delay(500);
   break;
  case 7:
   showSevenSeg(0,0,0,1,1,1,1,1);
   delay(500);
   break;
  case 8:
   showSevenSeg(0,0,0,0,0,0,0,1);
   delay(500);
   break;
  case 9:
   showSevenSeg(0,0,0,0,1,0,0,1);
```

```
      delay(500);
      break;
    case 10:
      showSevenSeg(1,1,1,1,1,1,1,1);
      delay(200);
      break;
  }
  showSevenSeg(1,1,1,1,1,1,1,1);
    delay(100);
}

void ID()
{
  int stuID[10]={10,1,0,9,5,1,1,2,0,8};
  for (int i=0;i<10;i++)
  {
    num(stuID[i]);
  }
}

void check()
{
  while(1)
  {
    buttonState = digitalRead(pushButton);
    if(!buttonState){ID();}
    else{break;}
  }
}

void loop() {
  showSevenSeg(0,1,1,1,1,1,1,1); // turn LED A of 7-segment on.
  delay(500);
  check();
  showSevenSeg(1,0,1,1,1,1,1,1); // turn LED A of 7-segment on.
  delay(500);
  check();
  showSevenSeg(1,1,0,1,1,1,1,1); // turn LED A of 7-segment on.
  delay(500);
  check();
  showSevenSeg(1,1,1,0,1,1,1,1); // turn LED A of 7-segment on.
```

```
delay(500);

check();

showSevenSeg(1,1,1,1,0,1,1,1); // turn LED A of 7-segment on.

delay(500);

check();

showSevenSeg(1,1,1,1,1,0,1,1); // turn LED A of 7-segment on.

delay(500);

check();

}
```

Demo

EXP4

https://youtu.be/rzM0r-gSWo8

Reference

[1]   How to Interface a Seven-Segment Display with an Arduino

https://www.digikey.tw/en/maker/projects/how-to-interface-a-seven-segment-display-with-an-arduino/9c05f147618c4fe3b8bb79acce5c60e3

[2]   Pull-up resistor, Wikipedia.

https://en.wikipedia.org/wiki/Pull-up_resistor

心得

還沒寫好 QQ