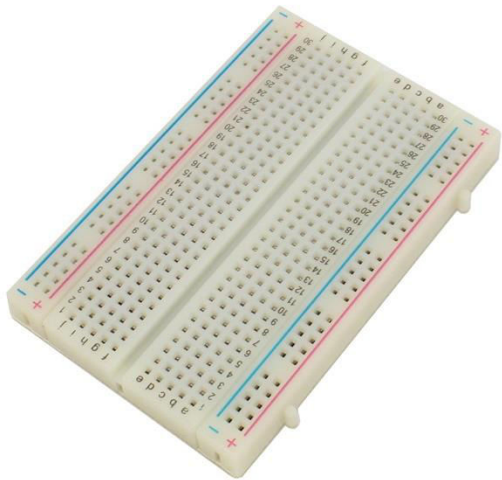


Basic Microcontroller Programming

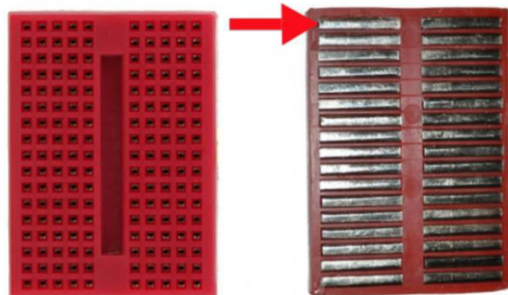
Breadboard



- Great for creating temporary circuits without any soldering
- Two sections of the Breadboard

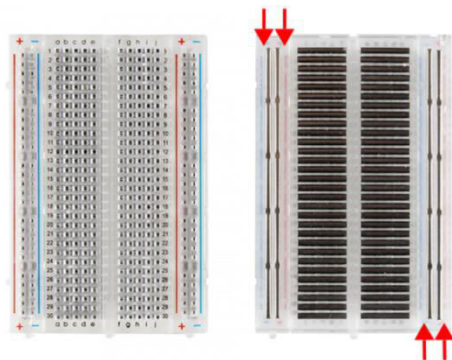
Middle section (labeled alphabetically)

Each nodes in a row is connected



Outer section (labeled +/-)

Each nodes in a column is connected



Simple Project 1

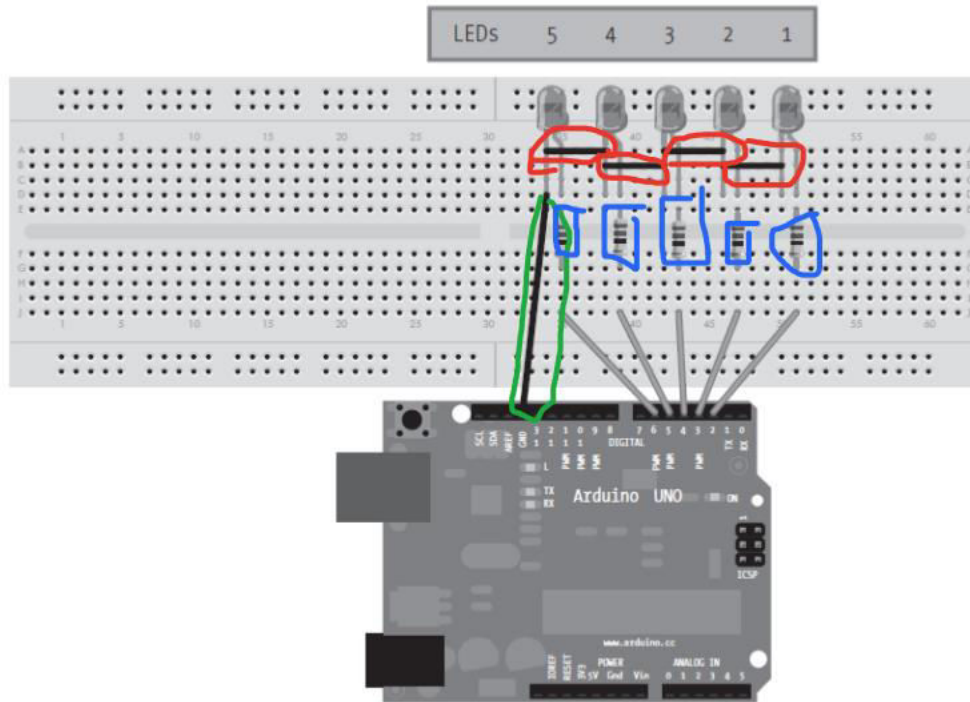


Figure 3-13: Circuit layout for Project 1

Green – Jumper wire connected to the ground port of the Arduino

To close electric circuits

Red – Jumper wire connecting all negative legs of the LED together

Blue – Resistor

Plugged into the positive legs of the LED

Resistors are useful as it limit the LED'S current. To find out what the resistor needs to do, utilize Ohm's Law.

Ohm's Law : V (Voltage) = I (Current) * R (Resistance)

What we know

Arduino outputs 5V : V_s

LED requires 1.7 V : V_f

Current : I : 10mA = 0.01A

Utilizing that, we can find the R

$$R = V / I$$

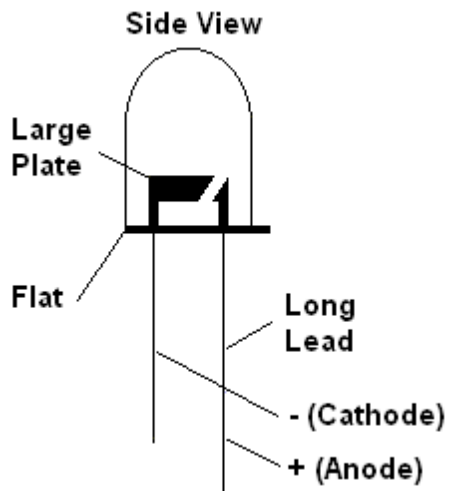
$$R = V_s - V_f / I$$

$$R = 5V - 1.7V / 0.01A$$

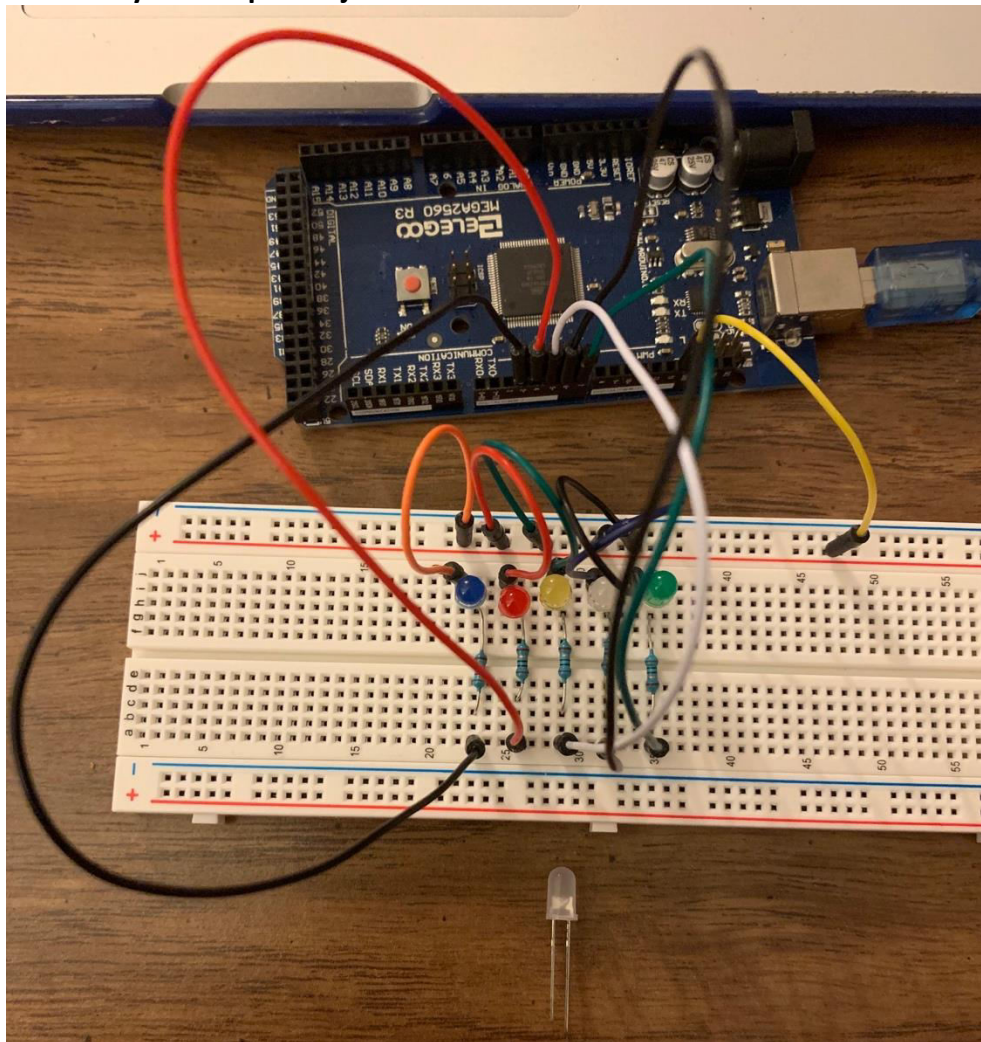
$$= 330 \Omega$$

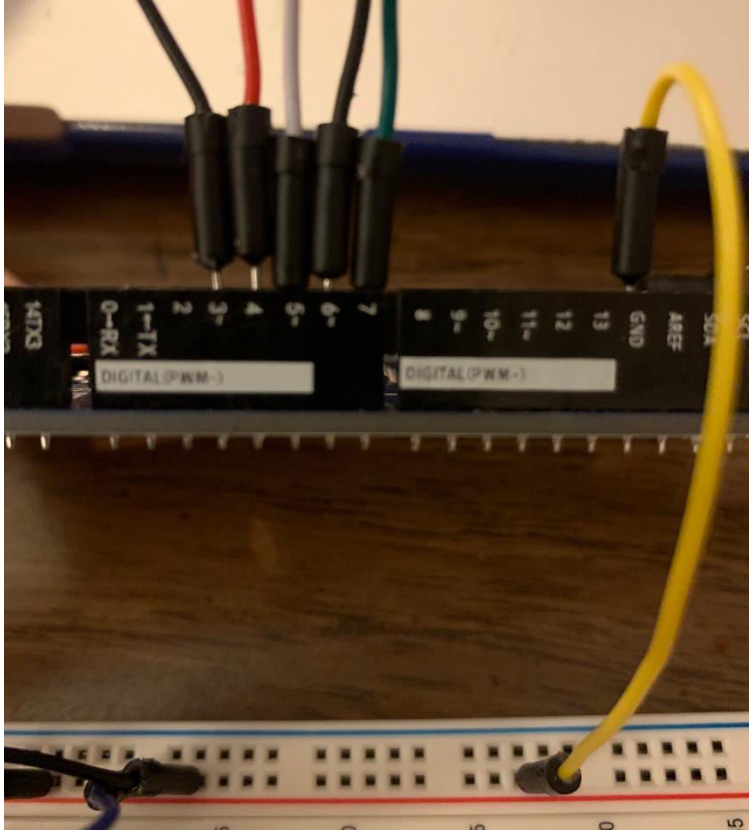
For now, we'll be using 1000 Ω Resistor

LED parts



Other way for Simple Project 1





Sketches

Sketches are C programs
So you can utilize C logic

Basic Sketch

```
// Five LEDs blink sequentially for 500 milliseconds
```

```
void setup() {  
  pinMode(3,OUTPUT);  
  pinMode(4,OUTPUT);  
  pinMode(5,OUTPUT);  
  pinMode(6,OUTPUT);  
  pinMode(7,OUTPUT);  
}
```

```
void loop() {  
  digitalWrite(3,HIGH);  
  delay(500);  
  digitalWrite(3,LOW);  
  
  digitalWrite(4,HIGH);  
  delay(500);  
  digitalWrite(4,LOW);  
  
  digitalWrite(5,HIGH);
```

```

    delay(500);
    digitalWrite(5,LOW);

    digitalWrite(6,HIGH);
    delay(500);
    digitalWrite(6,LOW);

    digitalWrite(7,HIGH);
    delay(500);
    digitalWrite(7,LOW);
}

```

Formatted Basic Sketch

```
int d = 500; // delay is 500 ms
```

```

void setup() {
    pinMode(3,OUTPUT);
    pinMode(4,OUTPUT);
    pinMode(5,OUTPUT);
    pinMode(6,OUTPUT);
    pinMode(7,OUTPUT);
}

void loop() {
    for(int a = 3; a < 8 ; ++a) {
        digitalWrite(a,HIGH);
        delay(d);
        digitalWrite(a,LOW);
    }
}

```

Another Basic Sketch W/ analogWrite()

```
// Each of the 5 LEDS blink slowly sequentially
```

```
int d = 5; // delay is 5ms
```

```

void setup() {
    pinMode(3,OUTPUT);
    pinMode(4,OUTPUT);
    pinMode(5,OUTPUT);
    pinMode(6,OUTPUT);
    pinMode(7,OUTPUT);
}

void loop() {
    for(int a = 3; a <= 7; a++) {
        for(int b = 0; b < 256; ++b) {
            analogWrite(a,b);

```

```
    delay(d);  
  }  
  for(int b = 256; b >= 0; --b) {  
    analogWrite(a,b);  
    delay(d);  
  }  
  delay(200);  
}  
  
}
```