Jr. BME // BMES @ UCI

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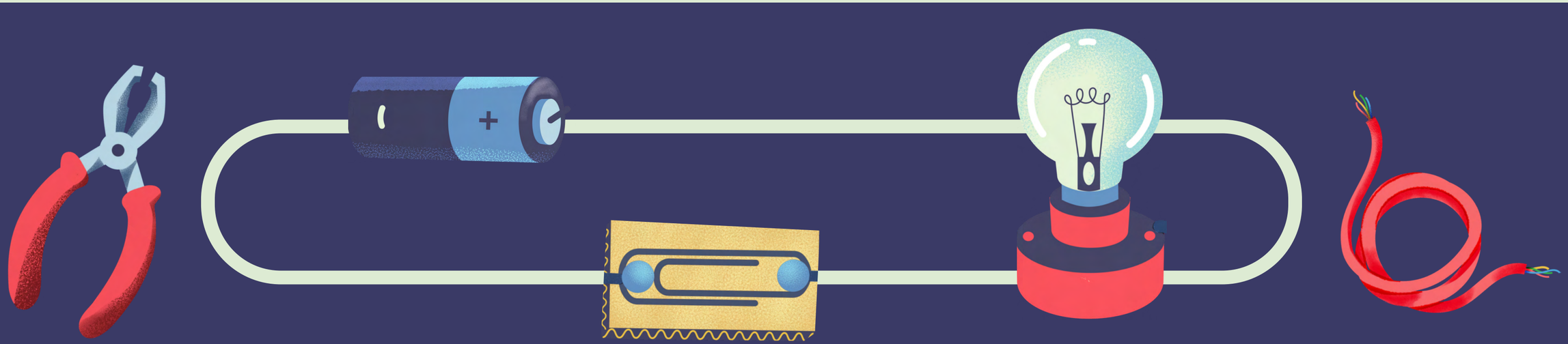
# ARDUINO 101

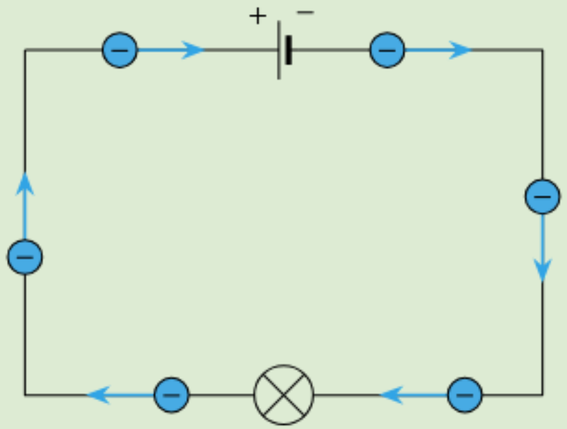
Presented by Varu Vummidi

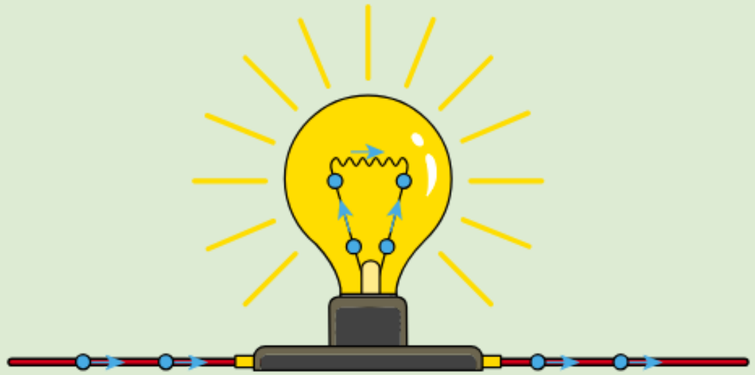



# Have you downloaded Arduino?

https://www.arduino.cc/en/software
Or Google “Arduino download”

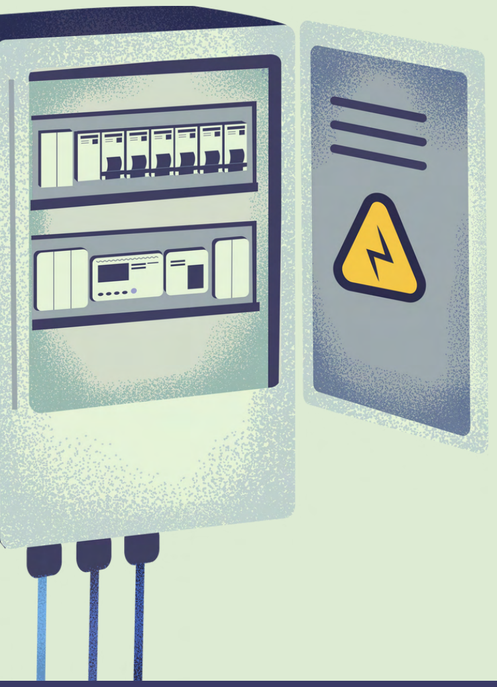
# Circuits

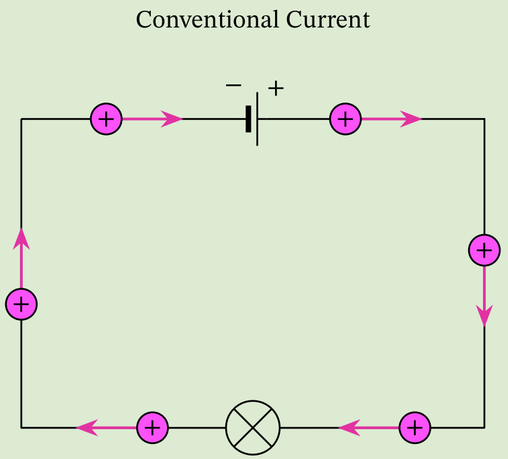


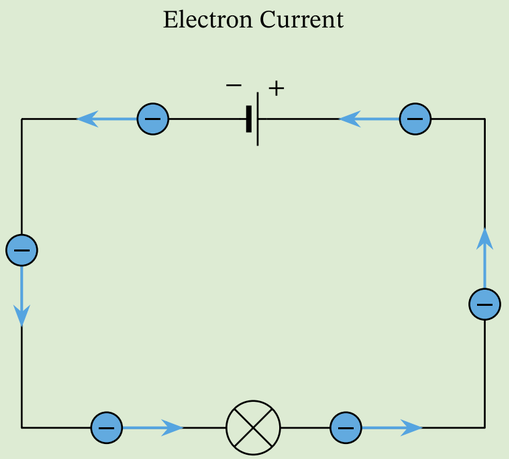



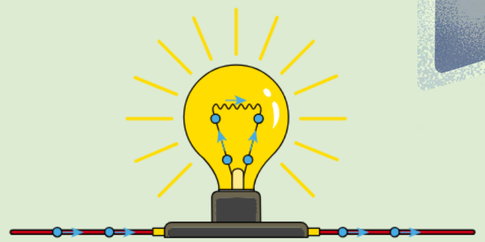
## What is a circuit?

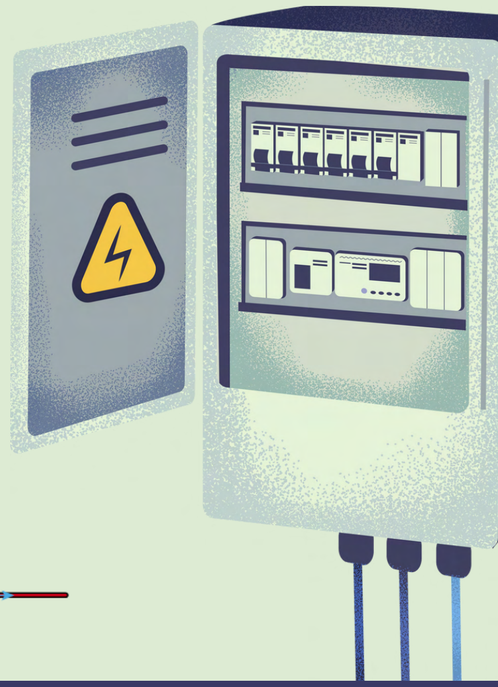
# Circuits





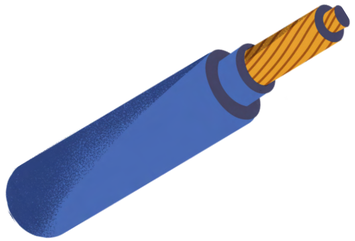


A circuit is a closed loop of moving charges.

# What makes a circuit?

**Electrical device**

converts electrical energy into another form



**Conductor**

material that allows current to flow

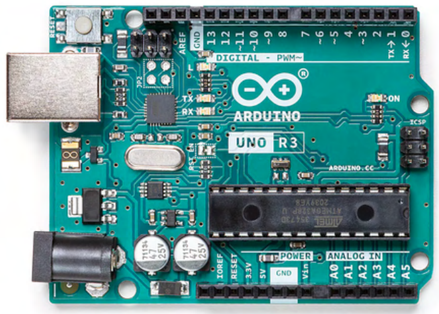
**Voltage source**

source of electricity, such as batteries or electric outlets

**Resistor**

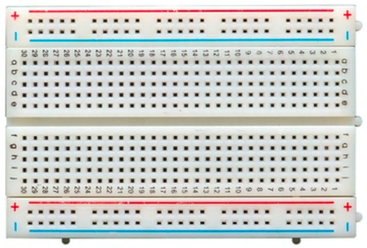
limits the current flow

# What makes a circuit?




**Electrical device**

converts electrical energy into another form



**Conductor**

material that allows current to flow

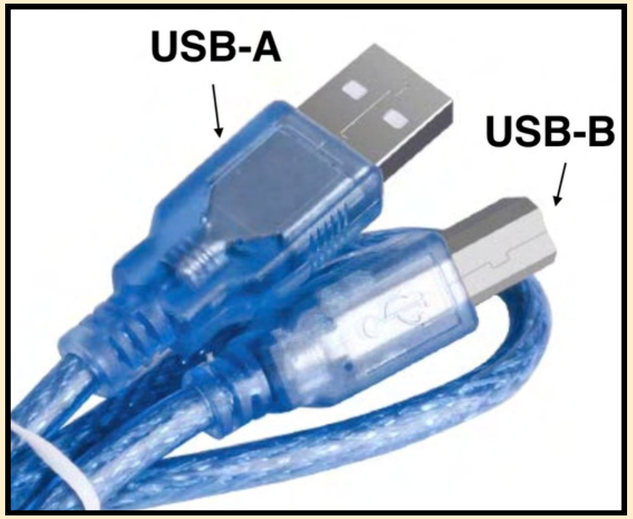
**Voltage source**

source of electricity, such as batteries or electric outlets

**Resistor**

limits the current flow

# Make your circuit!



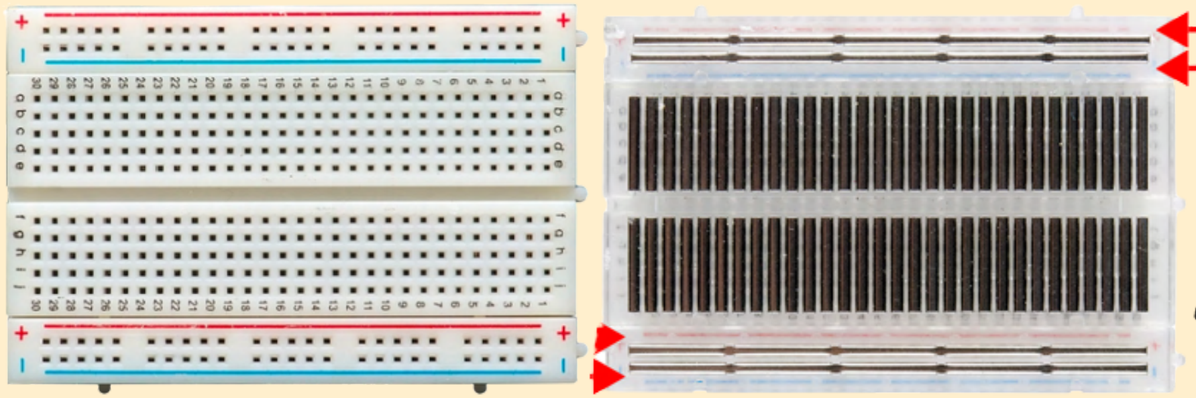

1. Connect the USB-B end into your Arduino.
2. Connect the USB-A end into your computer.

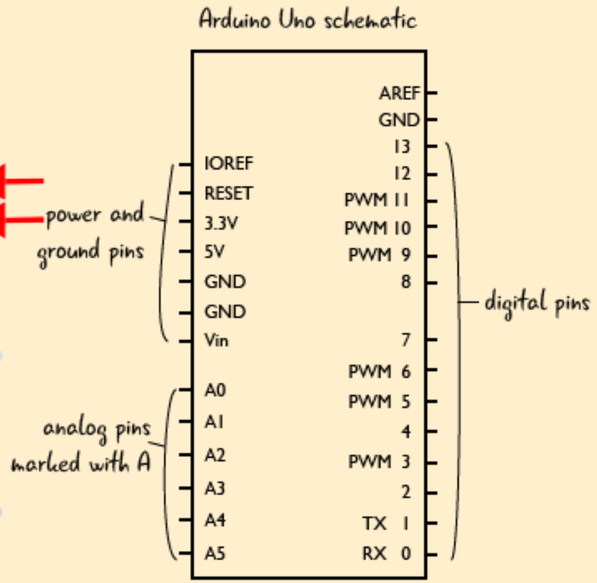
   Mac user? Connect the USB-A end into a USB to USB-C adapter.

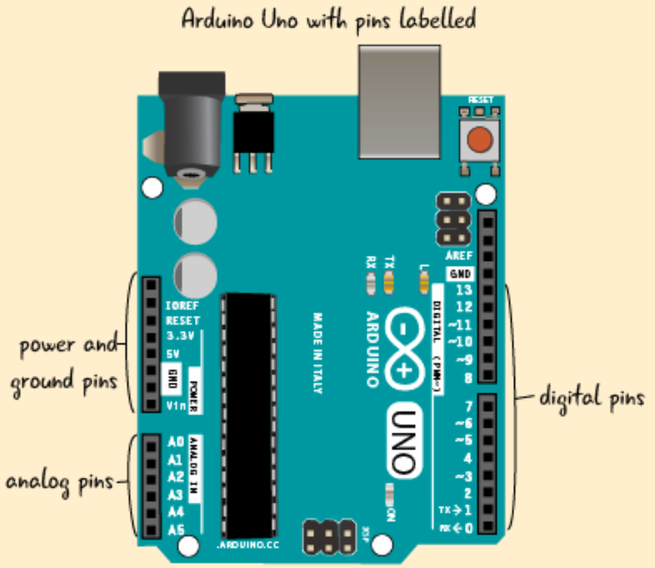
   Don’t have an adapter? Raise your hand for a volunteer.

3. Connect wire from 5V to + channel on breadboard
4. Connect wire from GND to - channel on breadboard

## breadboard



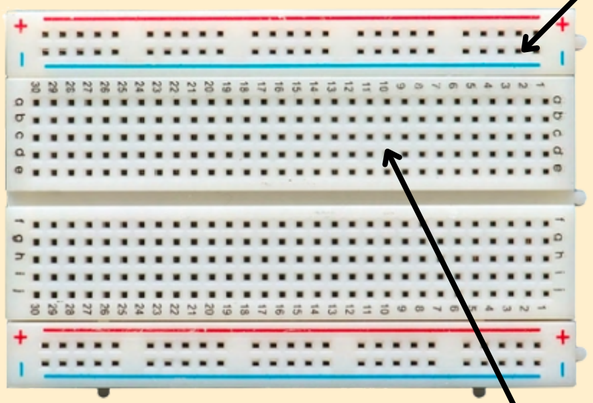


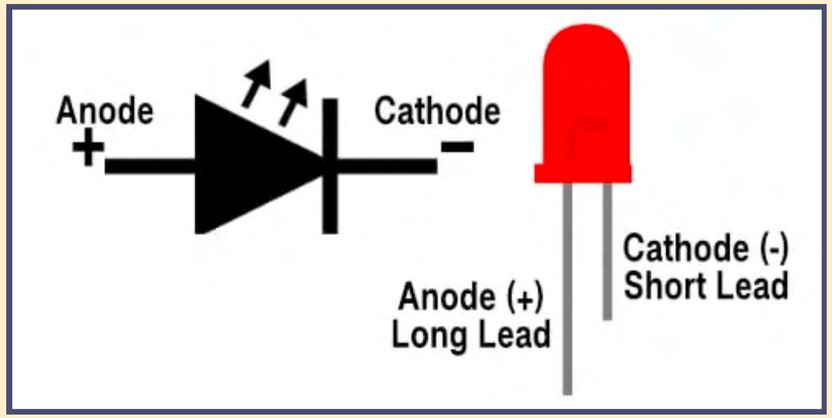

# Try to complete the circuit with the LED!

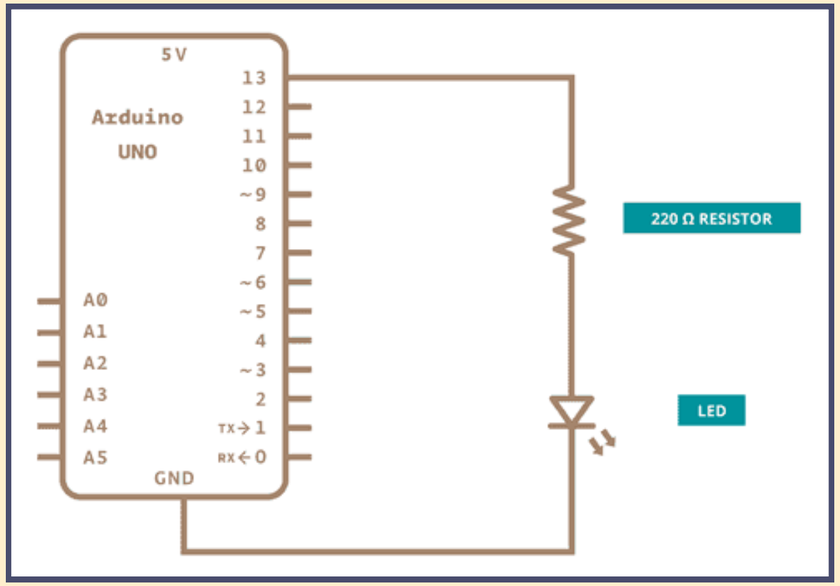
power has been supplied to board from here

## breadboard



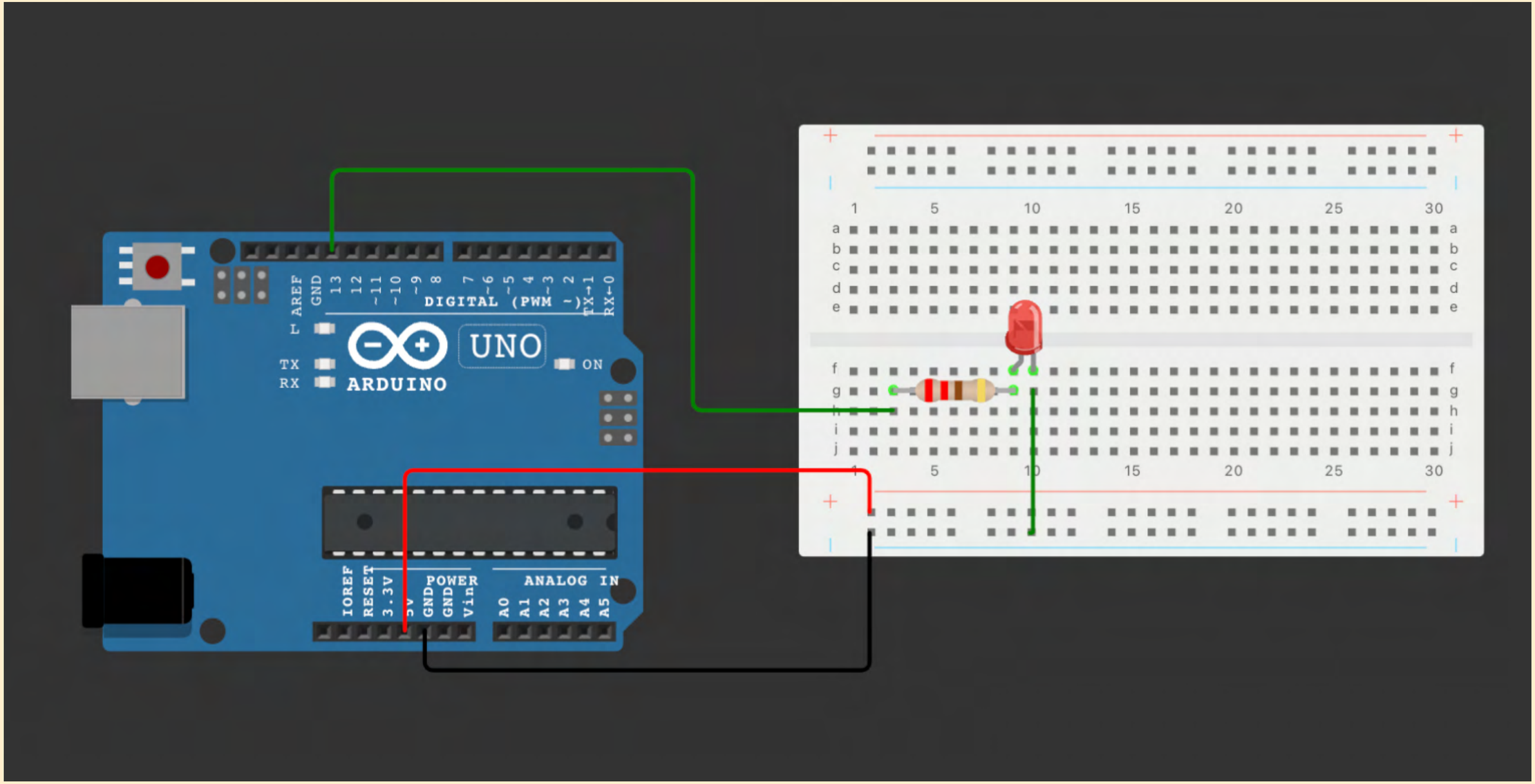
build circuit here



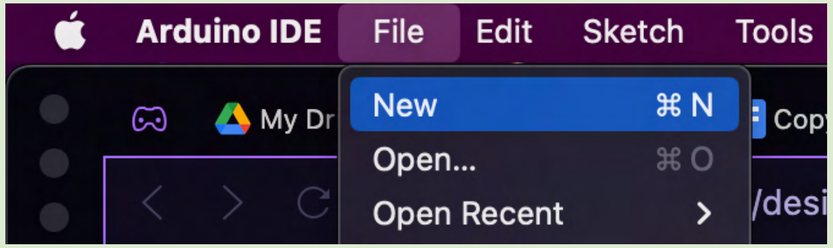

## Things to remember:

- Current flows from + to -
- Resistor controls how much power **reaches** the LED
- Add 2 wires: 1 to send signal to Pin 13, 1 to connect back to common ground

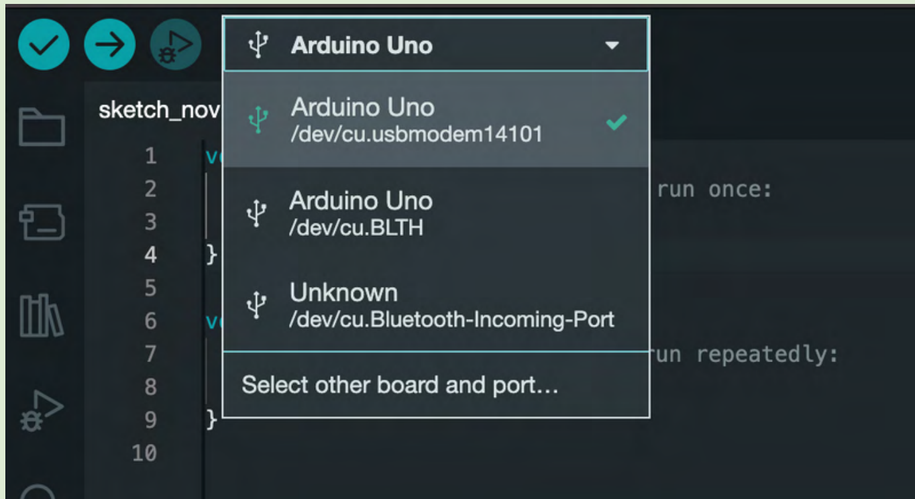

AREF
GND
13
12
~11
~10
~9
8
7
~6
~5
4
~3
2
TX→1
RX←0
DIGITAL (PWM ~)
UNO
ARDUINO
TX
RX
ON
IOREF
RESET
3.3V
5V
GND
GND
Vin
POWER
A0
A1
A2
A3
A4
A5
ANALOG IN
1
5
10
15
20
25
30
a
b
c
d
e
f
g
h
i
j

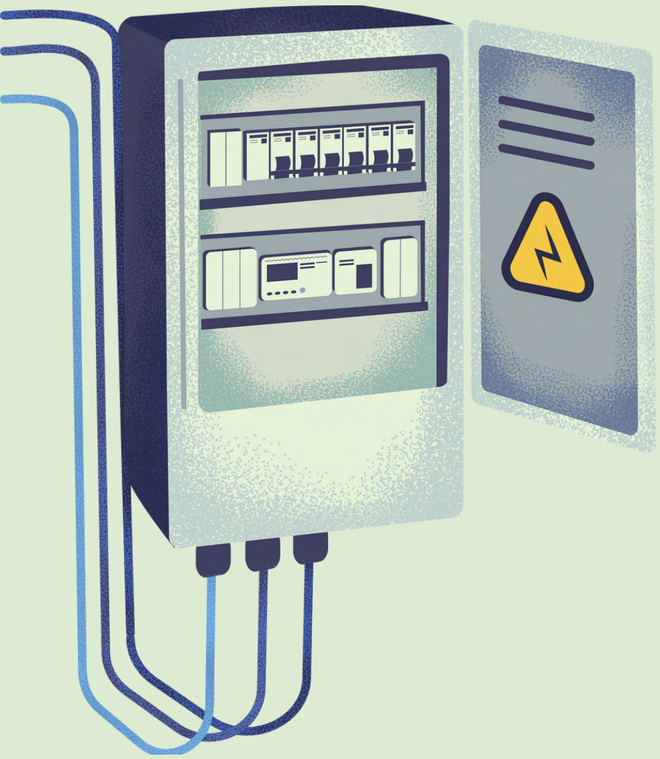
# OKAY, HOW DO WE LIGHT IT UP?

Open new sketch




Set up port





## Define Pin 13

Should you do this in
void setup or void loop?

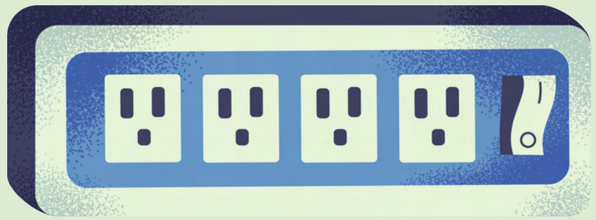
**Syntax**

```
pinMode(pin, value);
```

**Parameters**

`pin: Arduino pin number`

`value: OUTPUT or INPUT`



## Turn on Pin 13

Should you do this in
void setup or void loop?

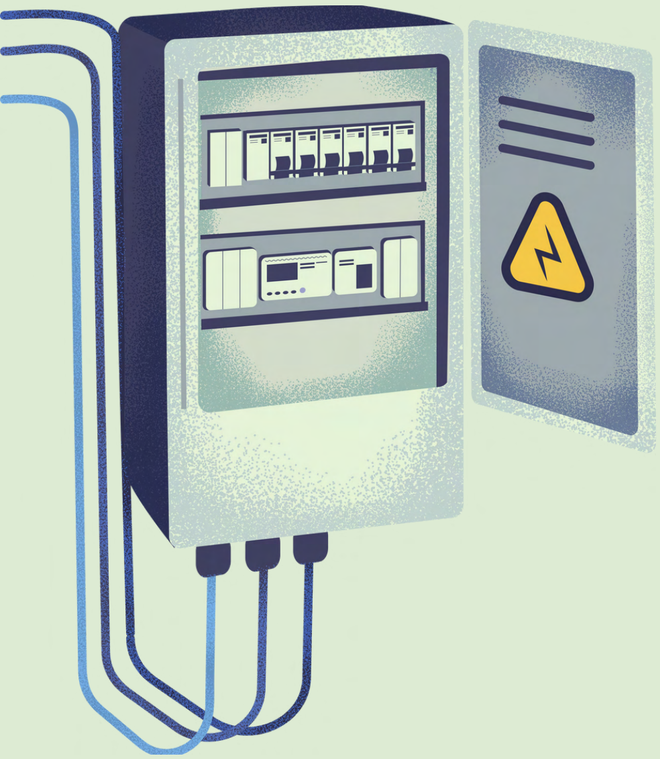
**Syntax**

```
digitalWrite(pin, value);
```

**Parameters**

`pin: Arduino pin number`

`value: HIGH or LOW`



## Delay

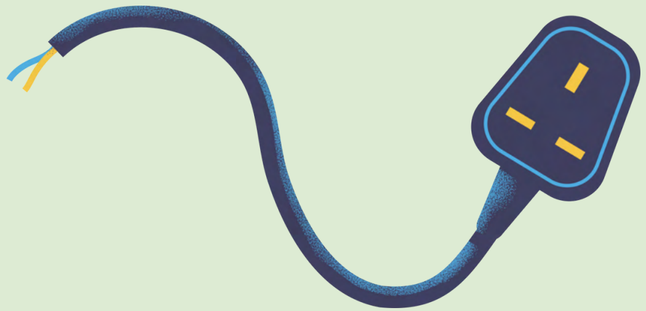
1 second = ? milliseconds

**Syntax**

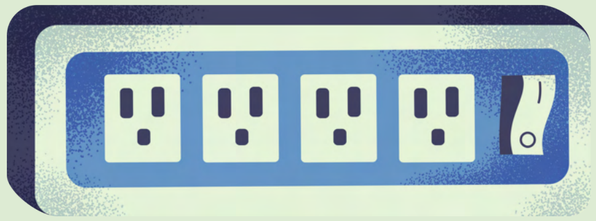
```
delay(value);
```

**Parameters**

`value: time in ms`



## Turn off Pin 13



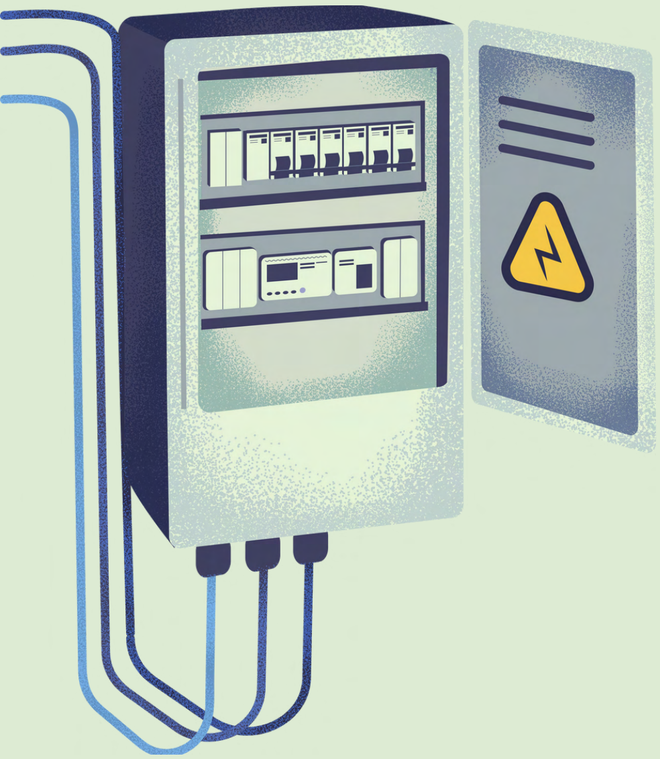
**Syntax**

```
digitalWrite(pin, value);
```

**Parameters**

`pin: Arduino pin number`

`value: HIGH or LOW`



## Delay

1 second = 1000 ms

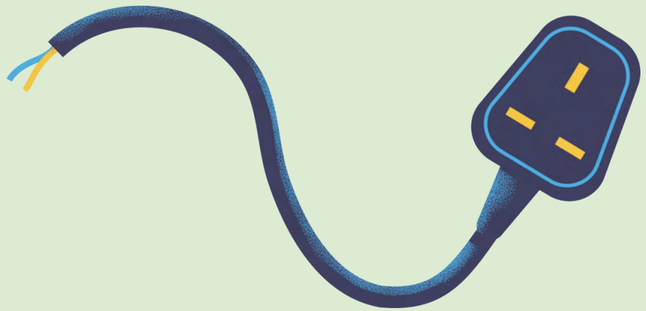
**Syntax**

```
delay(value);
```

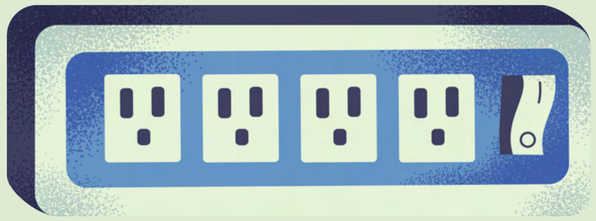
**Parameters**

`value: time in ms`

Where should the delay be?



## Turn off Pin 13



**Syntax**

```
digitalWrite(pin, value);
```

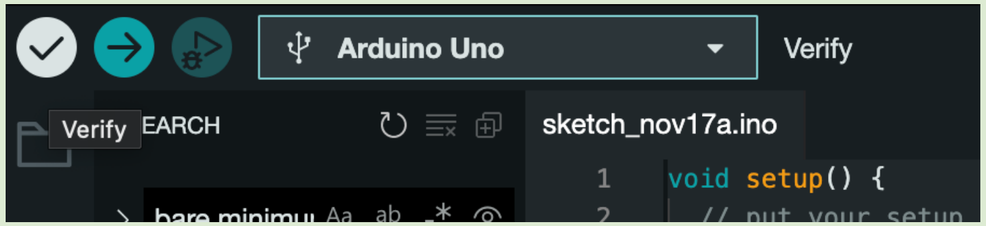
**Parameters**

`pin: Arduino pin number`

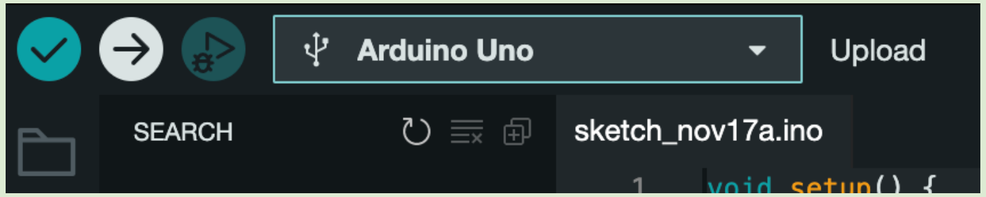
`value: HIGH or LOW`

# LET’S RUN IT!

Verify sketch

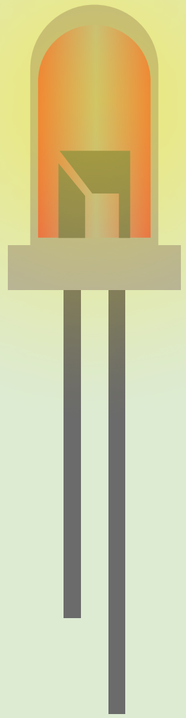


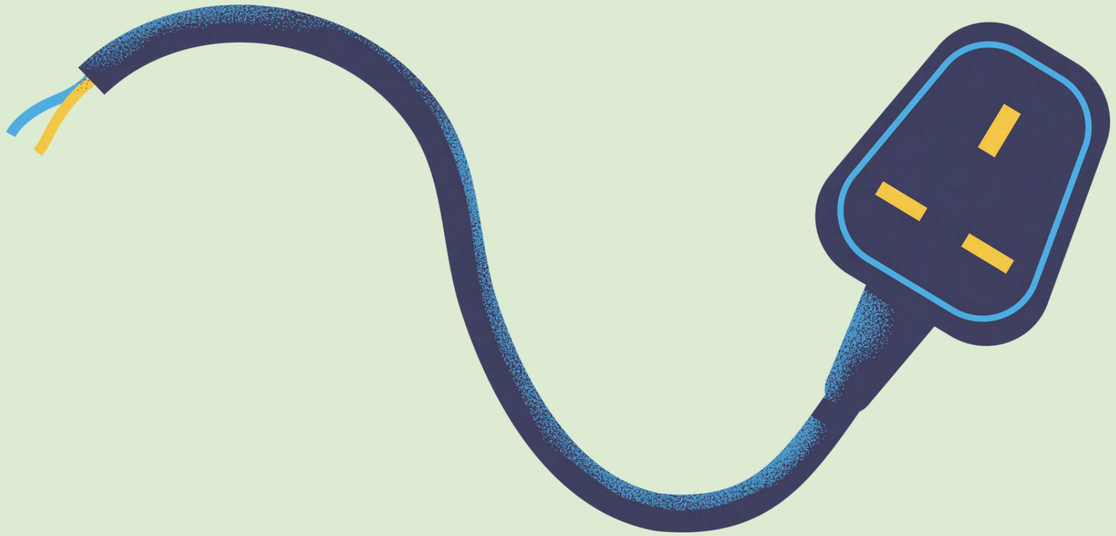

Upload



```
1   void setup() {
2     // put your setup code here, to run once:
3     pinMode(13,OUTPUT);
4
5   }
6
7   void loop() {
8     // put your main code here, to run repeatedly:
9   digitalWrite(13,HIGH);
10  delay(1000);
11  digitalWrite(13,LOW);
12  delay(1000);
13  }
14
```

# Congratulations!



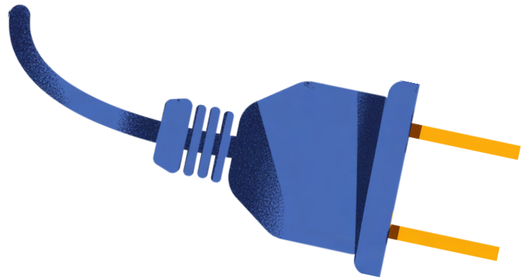


## Let’s take a break to RECHARGE :)

You’re an R&D Engineer at Southern California Edison. You want to design a fully functional traffic light, but to do so, you need a protoype.

Create a “stop light” using Arduino with 3 LEDs that turn on and off, **one after the other**. Each light should stay on for **3 seconds**. Your code should make it clear which pin is lighting up which LED.

https://www.arduino.cc/reference/en/



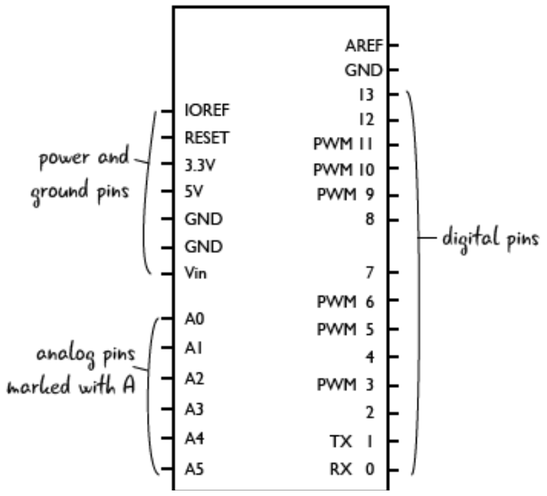
# Extra Challenge

Adjust your design so that instead of turning off, the other lights become dimmer.

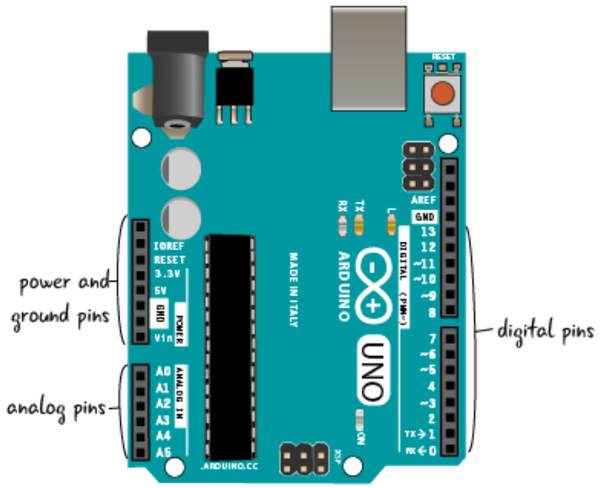
# Extra Challenge Tips

- Arduino has digital pins and analog pins
- digitalWrite only has 2 modes of brightness: 5V and 0V
- What is PWM (Pulse Width Modulation) in Arduino?
- Stuck?
  - Google is your friend :)
  - Ask for help!

Arduino Uno schematic

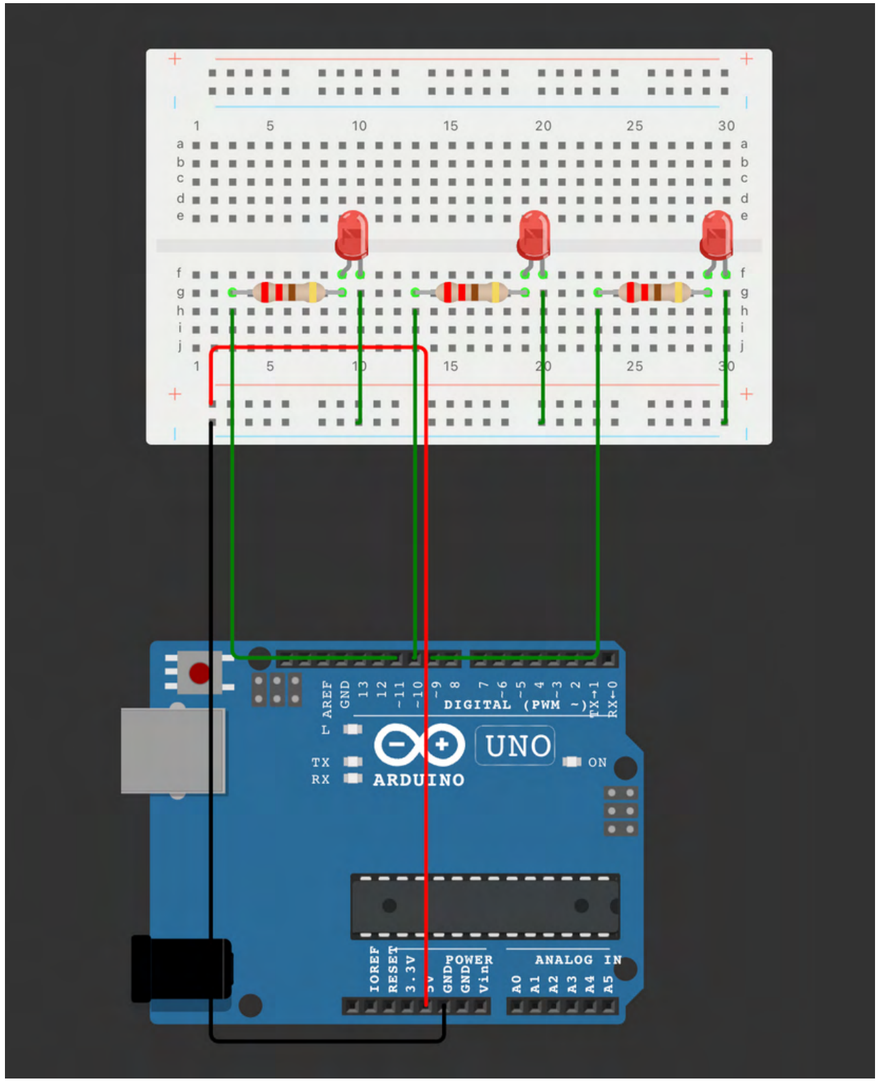



Arduino Uno with pins labelled



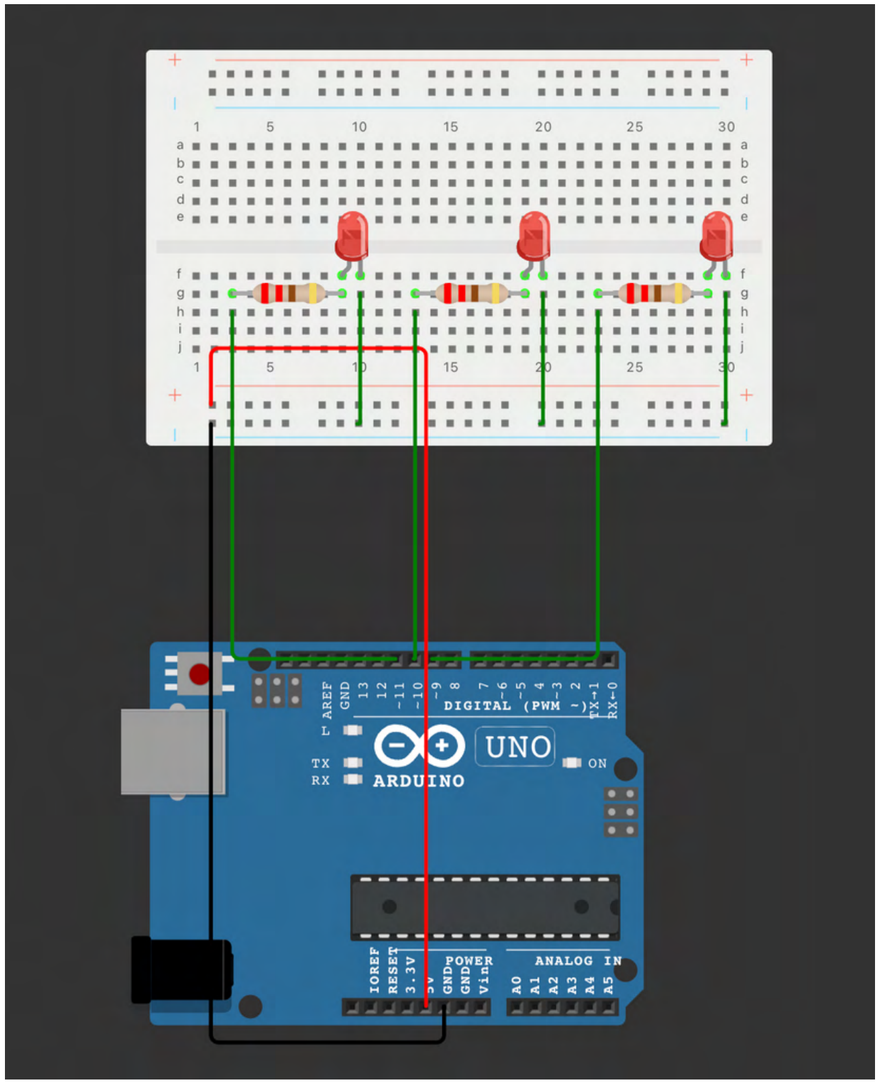

https://www.arduino.cc/reference/en/

# Challenge Solution



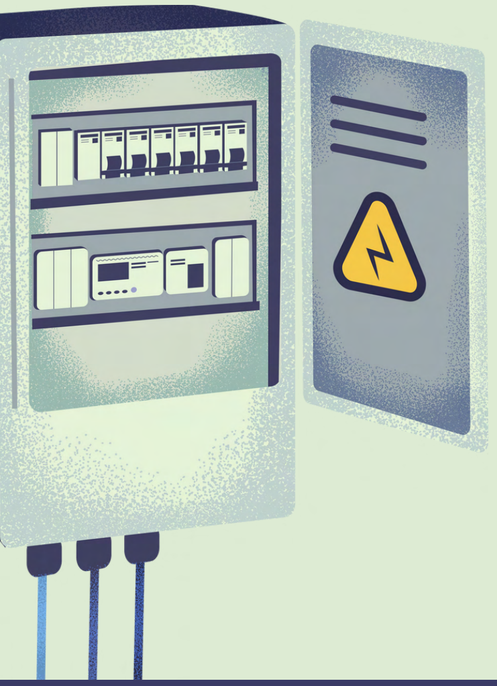

```
// assign variables to pins
int red = 11;
int yellow = 10;
int green = 9;


void setup() {
  // initialize pins as outputs
  pinMode(red, OUTPUT);
  pinMode(yellow, OUTPUT);
  pinMode(green, OUTPUT);
}

void loop() {
  // turn on each light, one at a time for 3 seconds

  digitalWrite(red, HIGH);
  digitalWrite(yellow, LOW);
  digitalWrite(green, LOW);
  delay(3000);

  digitalWrite(red, LOW);
  digitalWrite(yellow, HIGH);
  digitalWrite(green, LOW);
  delay(3000);

  digitalWrite(red, LOW);
  digitalWrite(yellow, LOW);
  digitalWrite(green, HIGH);
  delay(3000);
}
```

# Extra Challenge Solution

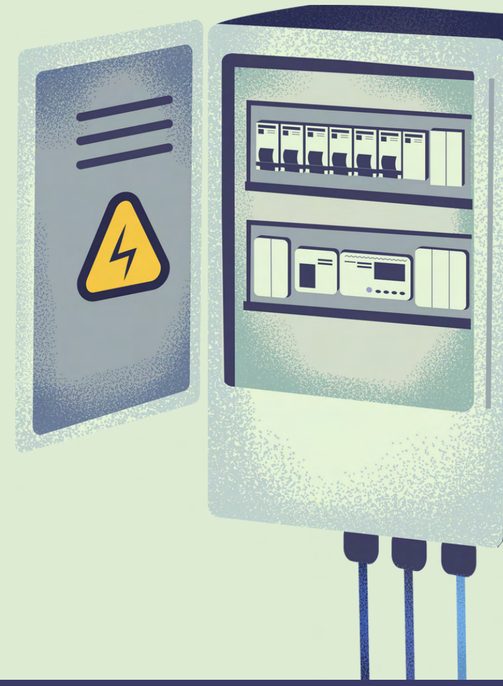


```ino
int red = 11;
int yellow = 10;
int green = 9;

void setup() {
  // put your setup code here, to run once:
 pinMode(red,OUTPUT);
 pinMode(yellow,OUTPUT);
 pinMode(green,OUTPUT);

}

void loop() {
analogWrite(red,255);
analogWrite(yellow,10);
analogWrite(green,10);
delay(3000);

//

analogWrite(red,10);
analogWrite(yellow,255);
analogWrite(green,10);
delay(3000);

//

analogWrite(red,10);
analogWrite(yellow,10);
analogWrite(green,255);
delay(3000);

// note: pin number is arbitrary - I just chose 11, 10, and 9 as an example :^)
}
```

*wiring doesn’t change



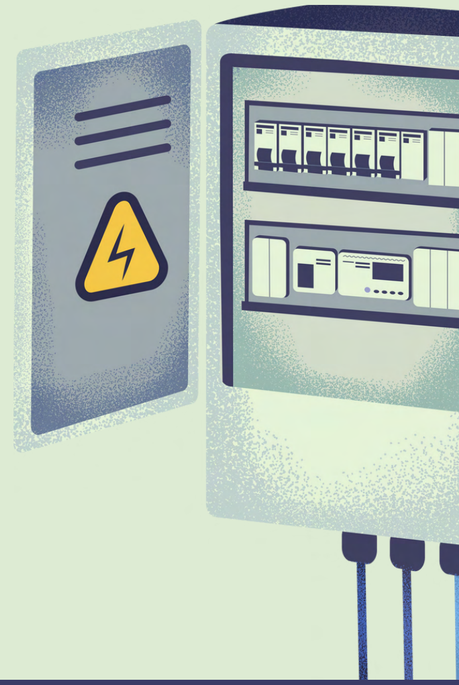
# Wrap-Up



- Why would an engineer want to protoype their idea first?
- Are there other, more efficient ways to complete the prompts?
- If you want to test other ways at home: https://wokwi.com/projects/new/arduino-uno

# Thanks for coming!

Please fill out our anonymous feedback form :)



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