**Experiment 1: Introduction to Arduino – The LED Blink Program and Circuit**

The Arduino is a very popular[1] device with applications limited only by your own imagination. Today we'll get an introduction to the Arduino – you will get to see how we can control a simple circuit using one of these magical devices.

**Learning Objectives: After completing this experiment, the student should be able to:**

- Connect a series circuit composed of an LED and resistor to an Arduino.
- Connect an Arduino to a computer with a USB "printer" cable.
- Edit, compile and upload an Arduino sketch using the Arduino IDE.
- Articulate the function of the `void setup()` and `void loop()` in an Arduino sketch.
- Articulate the use of brackets `{ }` in an Arduino sketch.
- Recognize the need for the semicolon `;` at the end of program lines in an Arduino sketch.
- Apply the Arduino command `pinMode()`, `digitalWrite()` and `delay()` in an Arduino sketch.

**Procedures:**

***Background:*** Take a look at an Arduino…it has a `USB` connection so it can connect to a computer as well as a collection of input and output pins (you can connect wires from those pins to things on a breadboard). We'll get to most of this in due time, but realize that the Arduino has digital output (which we'll use today), analog outputs, analog inputs and digital inputs as well as a programmable microprocessor which we can boss around if we learn how to do some simple programming.

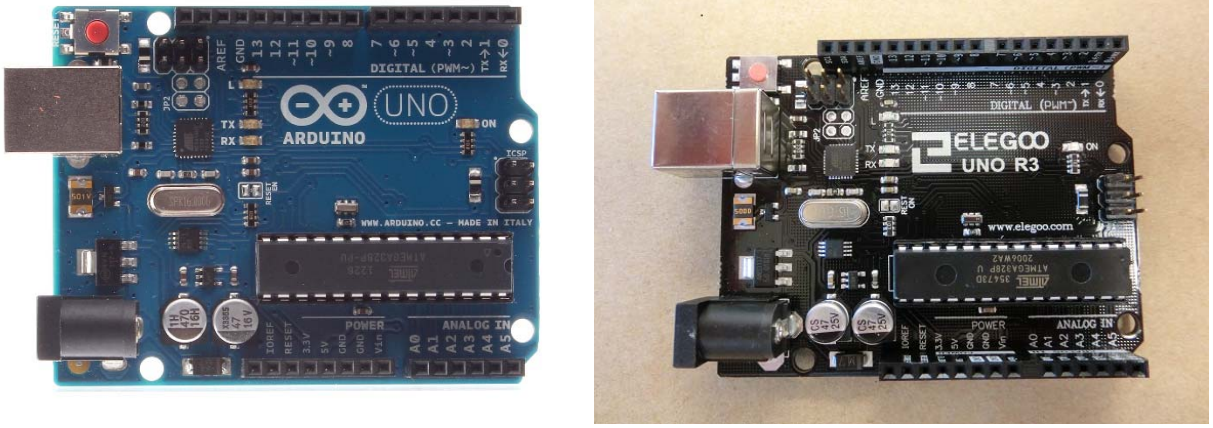



Figure 1: Two versions of the popular Arduino Uno.

***More Background:*** Our objective is to blink an LED on and off. We will use "`pin 8`" to do this. We'll tell the Arduino to turn that pin on (`HIGH` or +5Volts) and then off (`LOW, GND` or 0Volts). But if we connect it straight to the LED, it will push too much current and it's likely that either the LED or the Arduino will burn up. So we limit the current flow by putting a resistor in series with the LED. The resistor simply makes more "resistance" so less current flows and this keeps the LED safe from incineration. Easy.

[1] A quick Google search on "`Arduino`" reveals more than 144,000,000 links!

3. Connect the circuit as shown in the cartoon below. Make sure the "short leg" of the LED is on the lower "rail" (ground, `GND`) of the breadboard. (Notice the shorter leg is on the right of the LED in the figure.) Pay attention to how the breadboard is used to connect everything together.

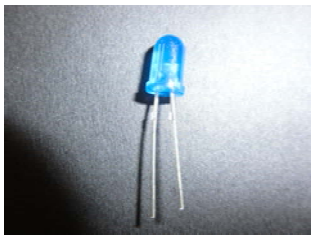
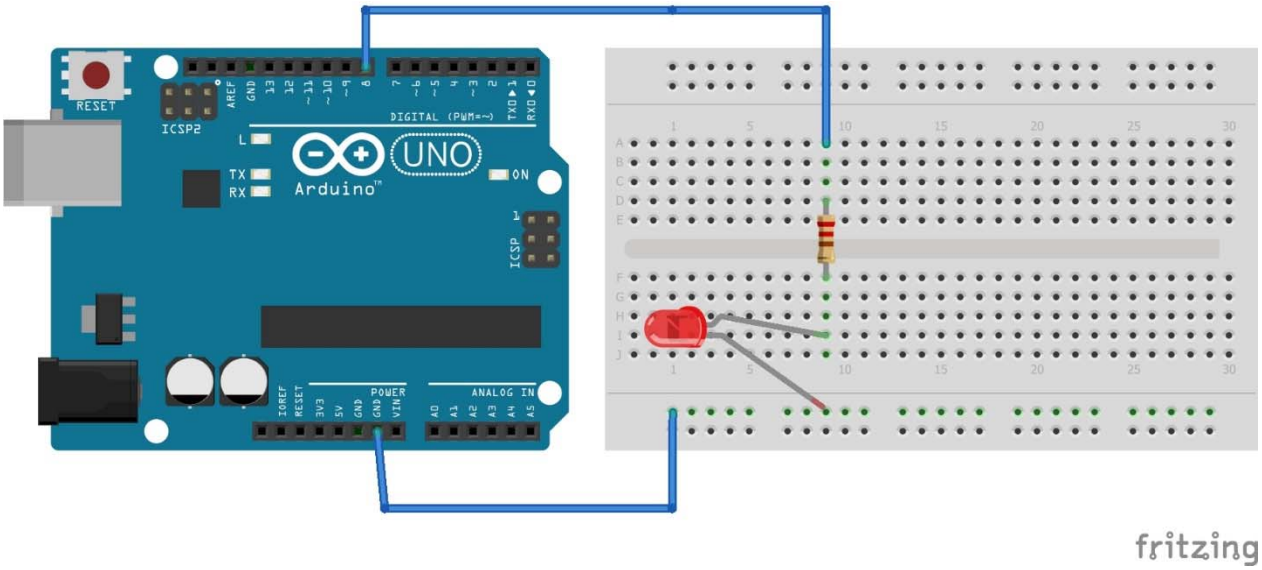


Figure 2: The short leg on the right is connected to `GND`.




**4.** Start up your `Arduino IDE`. A new window should open. This is called a "sketch" since it is waiting for you to enter your beautiful artwork known as a computer program. The lines you should enter are as shown below[2]:

```
void setup()
{
     pinMode(8, OUTPUT);
}

void loop()
{
     digitalWrite(8, HIGH);
     delay(1000);

     digitalWrite(8, LOW);
     delay(1000);
}
```

- Every Arduino sketch must have one and only one `void setup()` which runs once when turned on. You would add additional commands if you need to, say, use more output pins, ***hint hint***.
- Every Arduino sketch must have one and only one `void loop()` which it runs over and over forever (or until you unplug it!). You add additional commands to do other things. These commands must be in the correct order which is the fun part to think about.

[2] Enter is exactly as it's shown. ***Exactly***. Computers don't have any tolerance for monkey business and if it's not exactly right it will kick you right off the island.

5. Now go to the top of the sketch and click on the "play" arrow. ⇨ It should compile the program and eventually (if you have it right[3]) make the LED blink on and off.
6. How can you make it blink faster? Slower?

### ***Above and Beyond Options*:**

Option 1: Change your original "blink" program so that the LED makes a "heartbeat" pattern.

Option 2: What do you think this code does? Try it out[4]!

```
void setup() {
     pinMode(7, OUTPUT);
     pinMode(8, OUTPUT);
}

void loop()  {
     digitalWrite(7, LOW);
     digitalWrite(8, HIGH);
     delay(500);

     digitalWrite(7, HIGH);
     digitalWrite(8, LOW);
     delay(500);
}
```

Option 3. Can you add a third (or more!) LED/resistor combo and make them light one after the other in sequence?

Option 4. Do something else like making a "bouncing light rider"…

[3] If not…it will not be polite…you'll have to fix it…
[4] You'll need to add another resistor/LED combo of course!