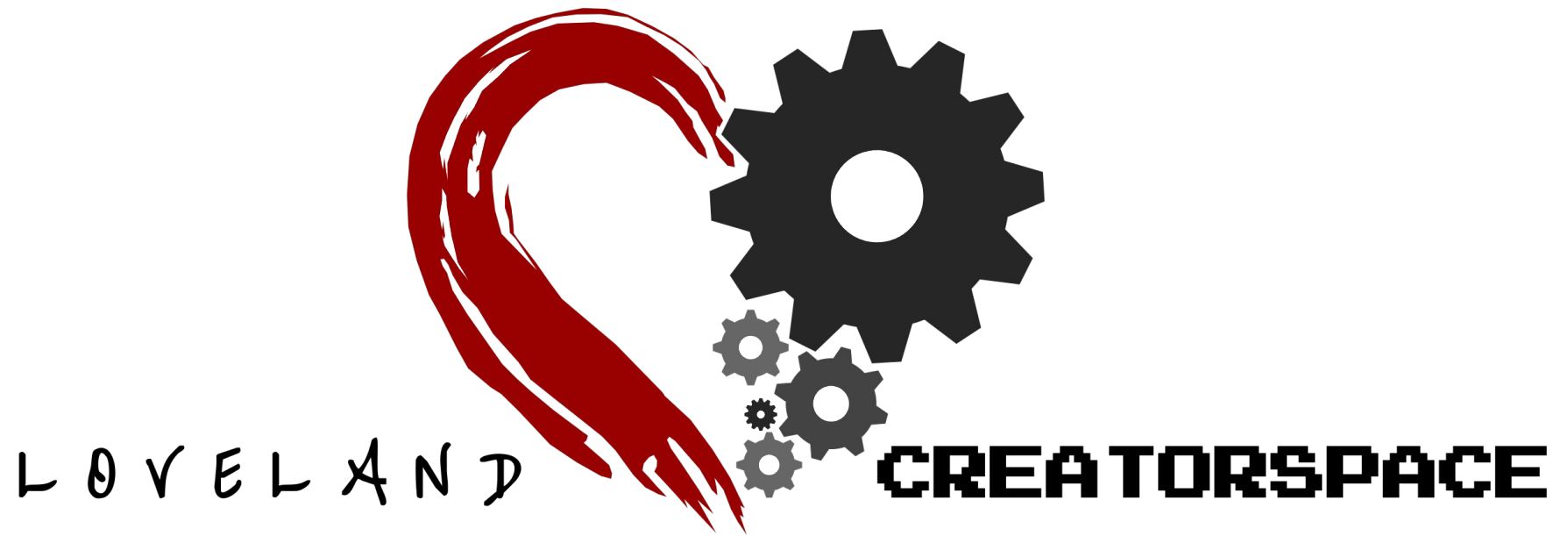


Arduino 101

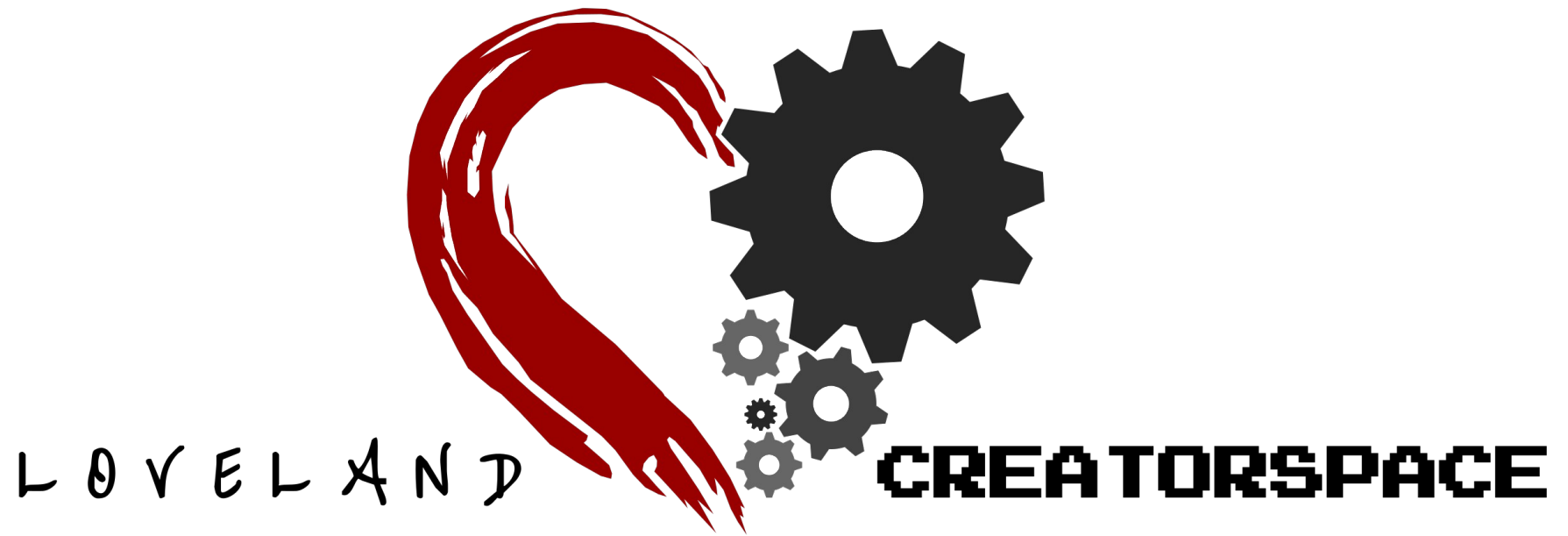
Creative Commons



Presented by Daniel Packard - 2013/12/14
With Maurice Woods III, Casey Kuhns, and Stephen Warren



A Maker Space for Loveland.



A Maker Space for Loveland.

Special thanks to SparkFun, Ferguson Highschool, and E3 Learning



Arduino

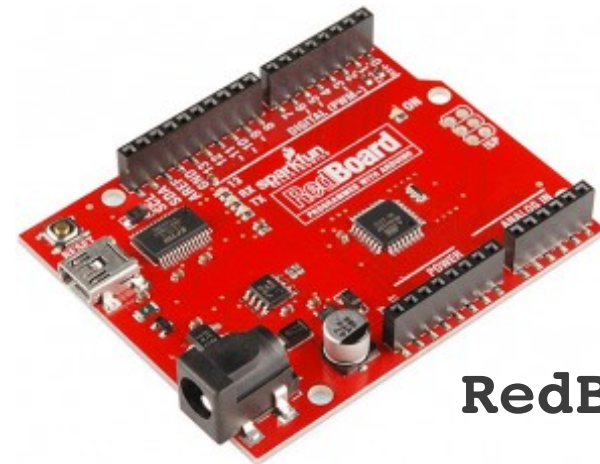
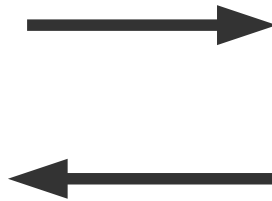


Arduino

*You've been **lied** to!*



Arduino



RedBoard

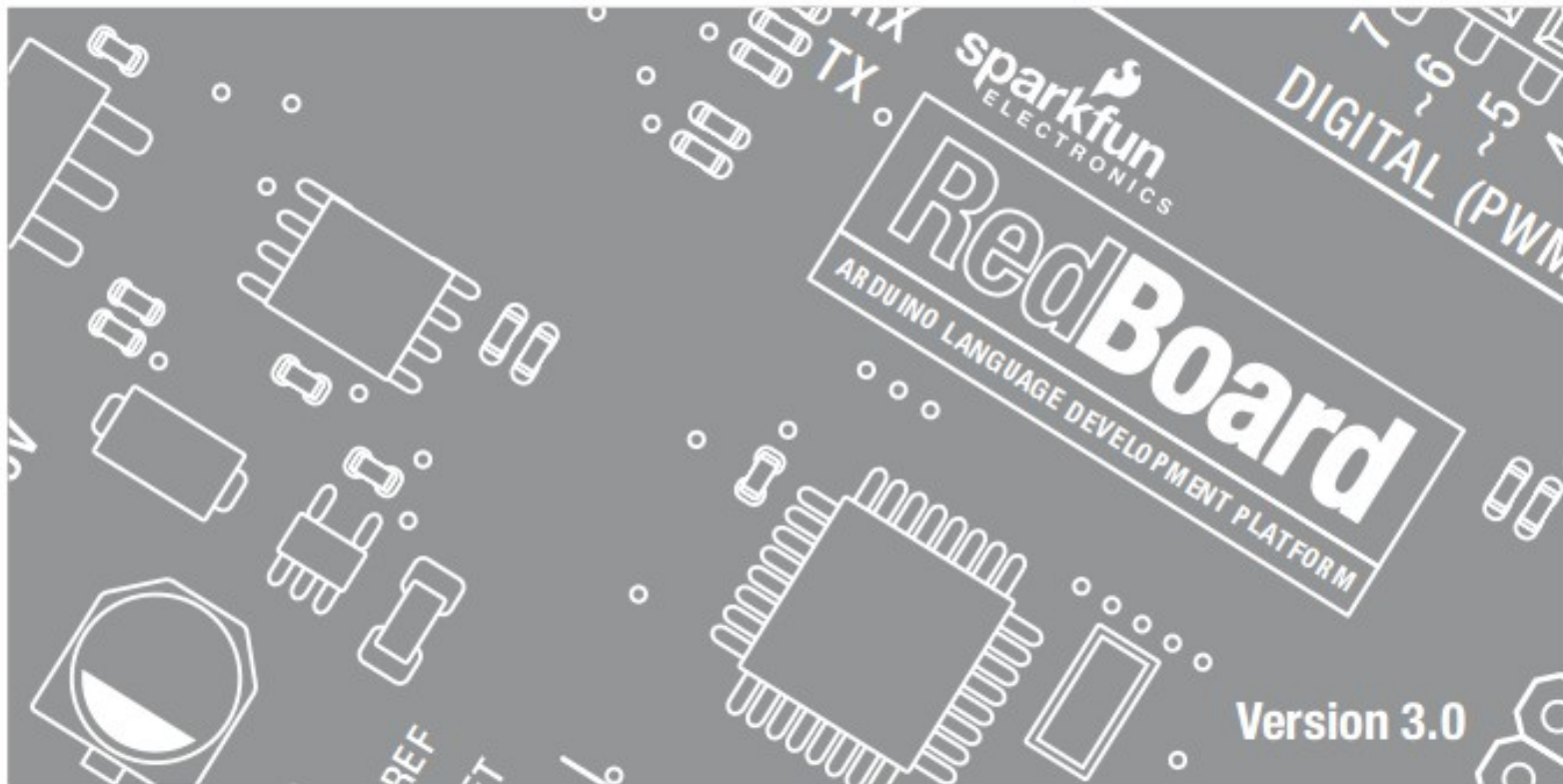
*You've been **lied** to!*

This class will use the **RedBoard** platform from



SIK GUIDE

Your guide to the SparkFun Inventor's Kit for the SparkFun RedBoard



<http://dlnmh9ip6v2uc.cloudfront.net/datasheets/Kits/SFE-SIK-RedBoard-Guide-Version3.0-Online.pdf>

Arduino (Redboard) is...



Arduino (Redboard) is...



A programmable micro-controller.

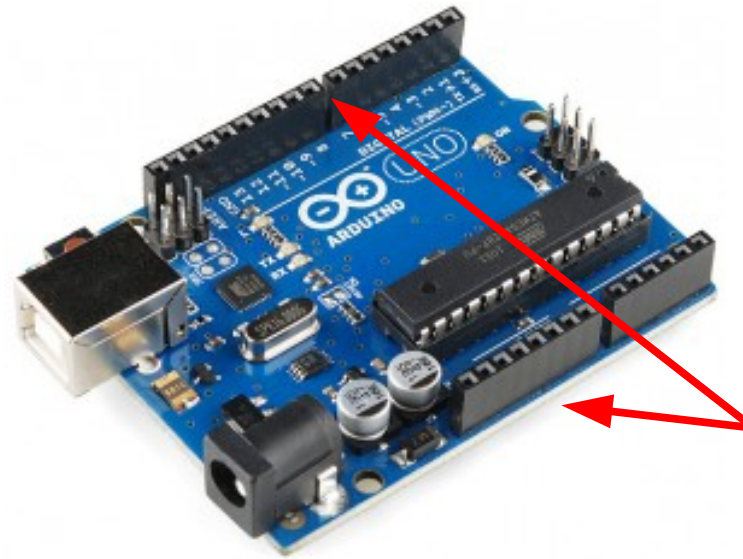
Arduino (Redboard) is...



Atmega Processor

A programmable micro-controller.

Arduino (Redboard) is...

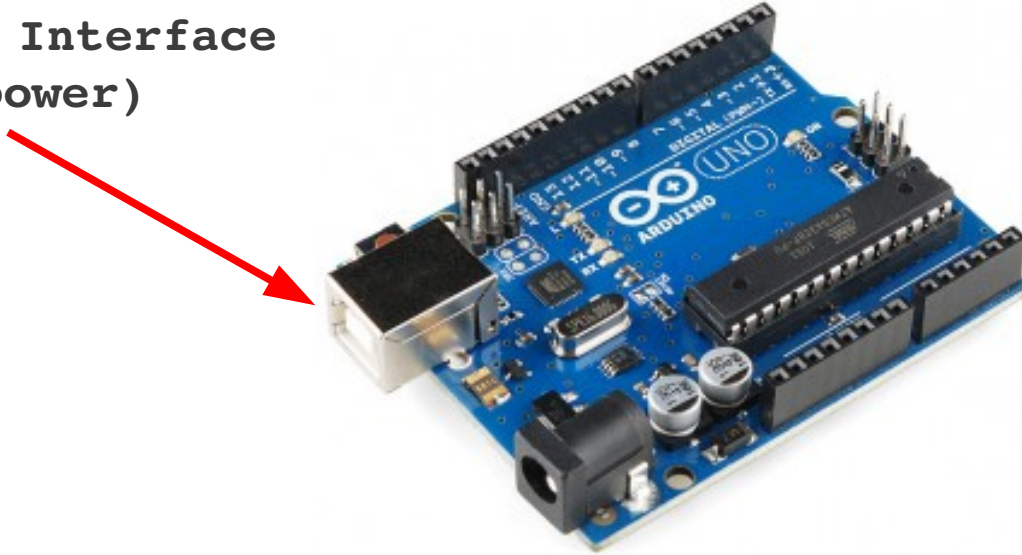


Input/Output pins
(power)

A programmable micro-controller.

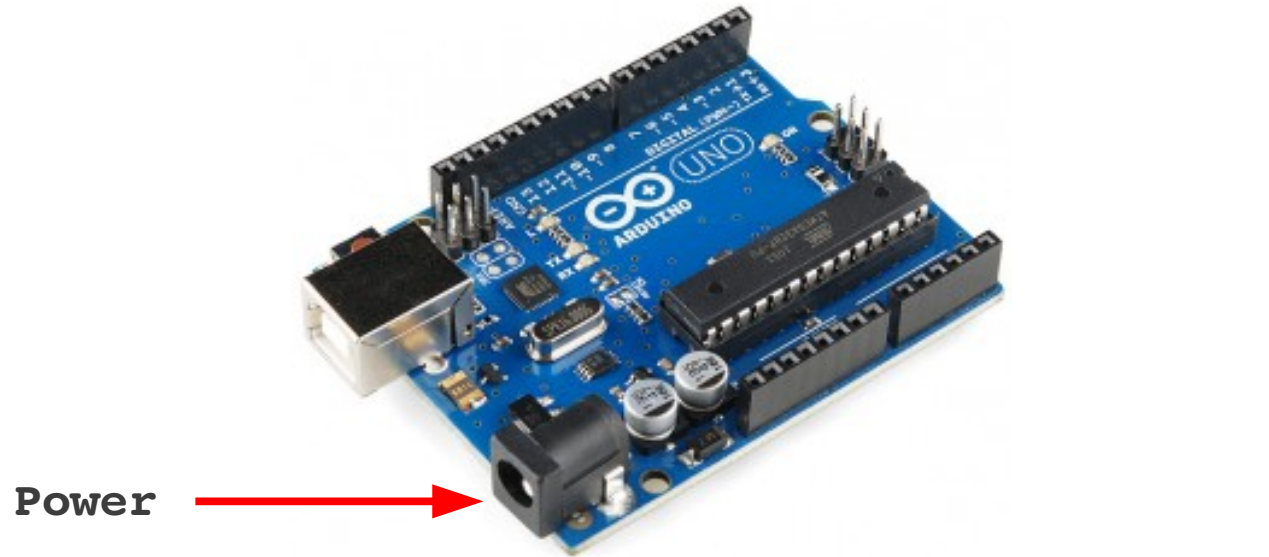
Arduino (Redboard) is...

USB Serial Interface
(and power)



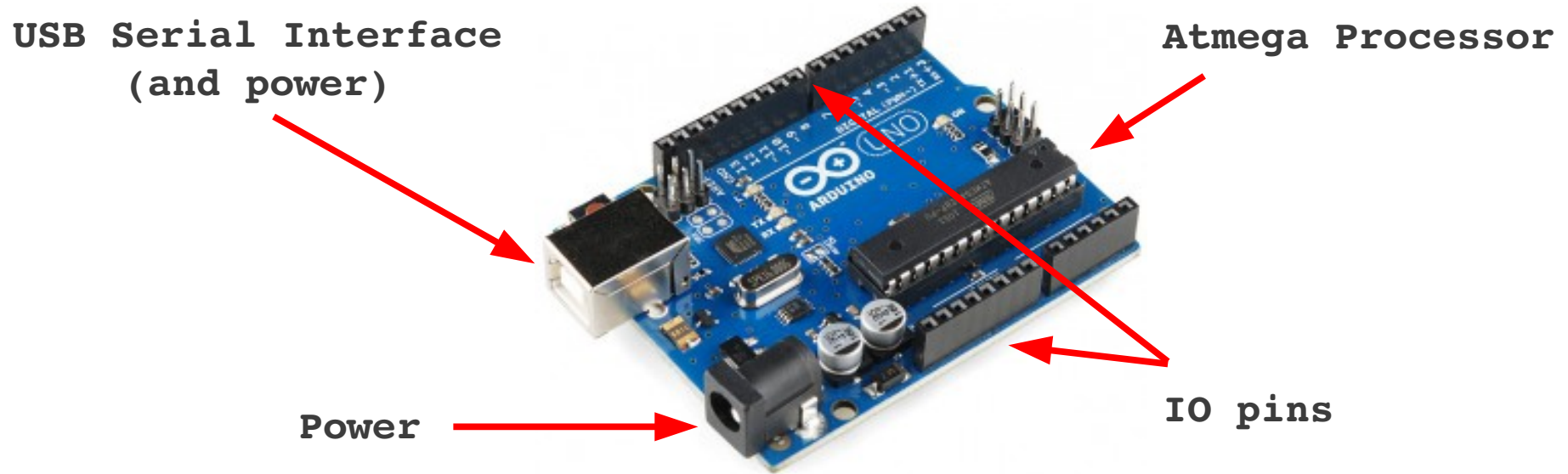
A programmable micro-controller.

Arduino (Redboard) is...



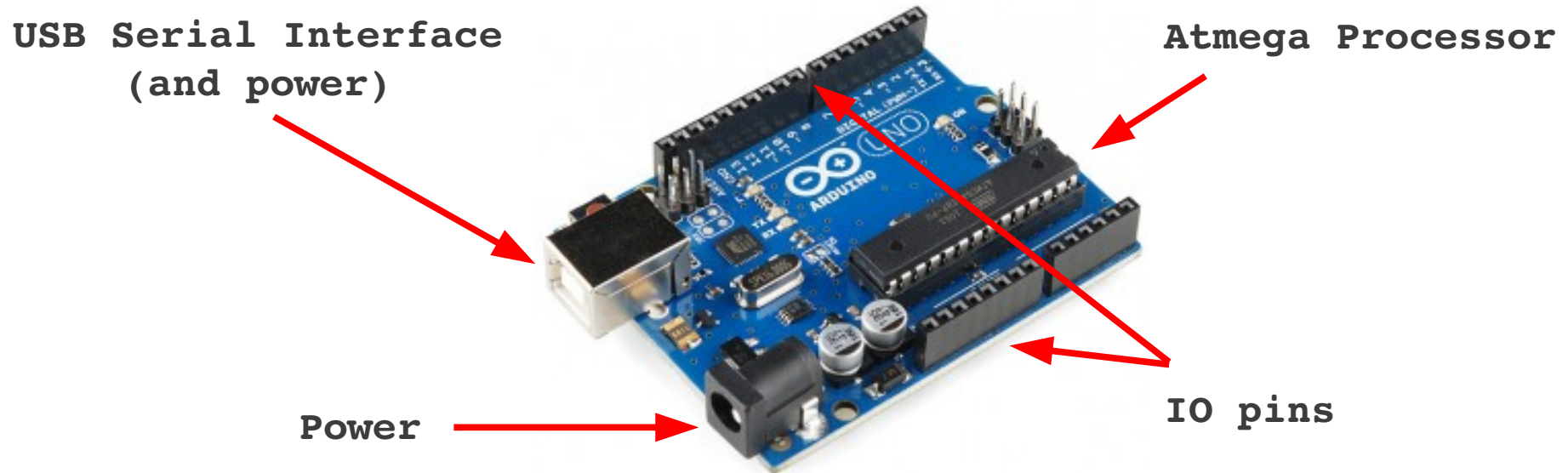
A programmable micro-controller.

Arduino (Redboard) is...



A programmable micro-controller.

Arduino (Redboard) is...



A programmable micro-controller.

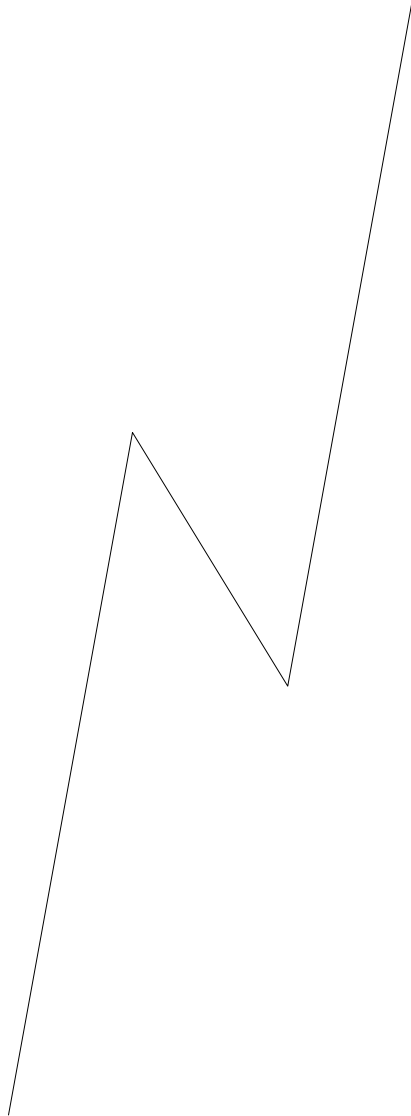
But the best way to explain the Arduino is with some examples:

<https://www.youtube.com/watch?v=6mXM-oGggrM>

<http://www.youtube.com/watch?v=yuKcLG1tqks>

<http://www.instructables.com/id/20-Unbelievable-Arduino-Projects/>

Programmable Circuits



Programmable Circuits

Build a simple circuit
(electronics)

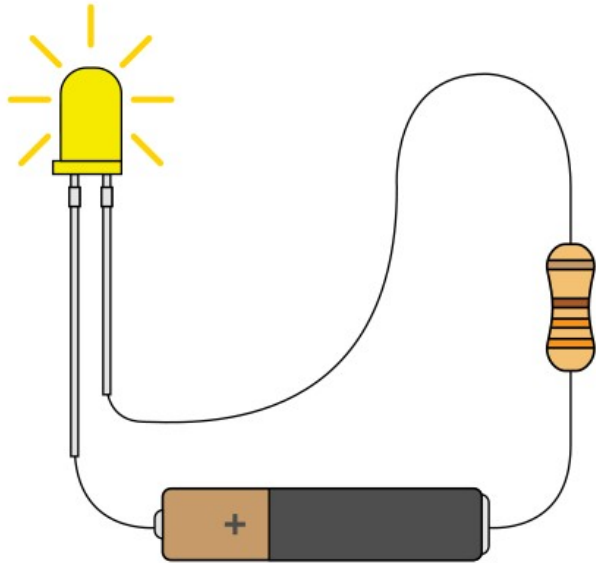


Image attributed to SparkFun Electronics

Programmable Circuits

Build a simple circuit
(electronics)

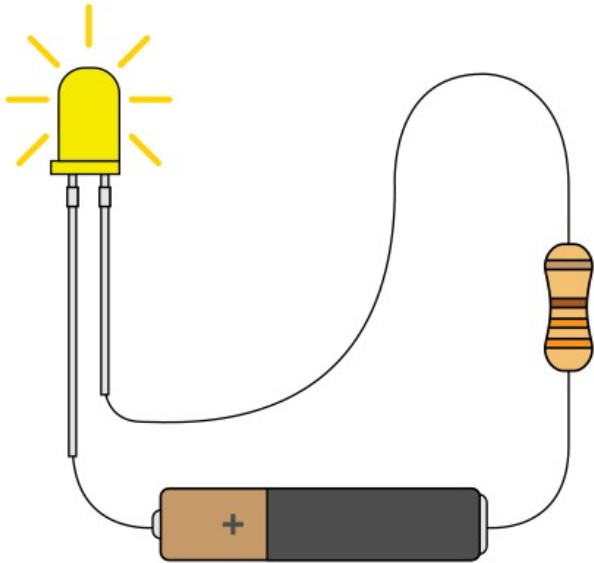


Image attributed to SparkFun Electronics

A screenshot of the Arduino IDE interface. The title bar reads "Blink | Arduino 1.0". The menu bar includes "File", "Edit", "Sketch", "Tools", and "Help". Below the menu bar is a toolbar with icons for opening, saving, and running. The main text area shows the "Blink" sketch. The code is as follows:

```
/*  
 * Blink  
 * Turns on an LED on for one second, then off for one second, repeats.  
 *  
 * This example code is in the public domain.  
 */  
  
void setup() {  
  // initialize the digital pin as an output.  
  // Pin 13 has an LED connected on most Arduino boards.  
  pinMode(13, OUTPUT);  
}  
  
void loop() {  
  digitalWrite(13, HIGH); // turn the LED on (HIGH is the positive voltage)  
  delay(1000);             // wait for a second  
  digitalWrite(13, LOW);  // turn the LED off by making the pin LOW (no voltage)  
  delay(1000);             // wait for a second  
}
```

Write a control program
(software)

Arduino 101

Installation:

Windows and Mac users:

Download the installer from:

- <http://arduino.cc>

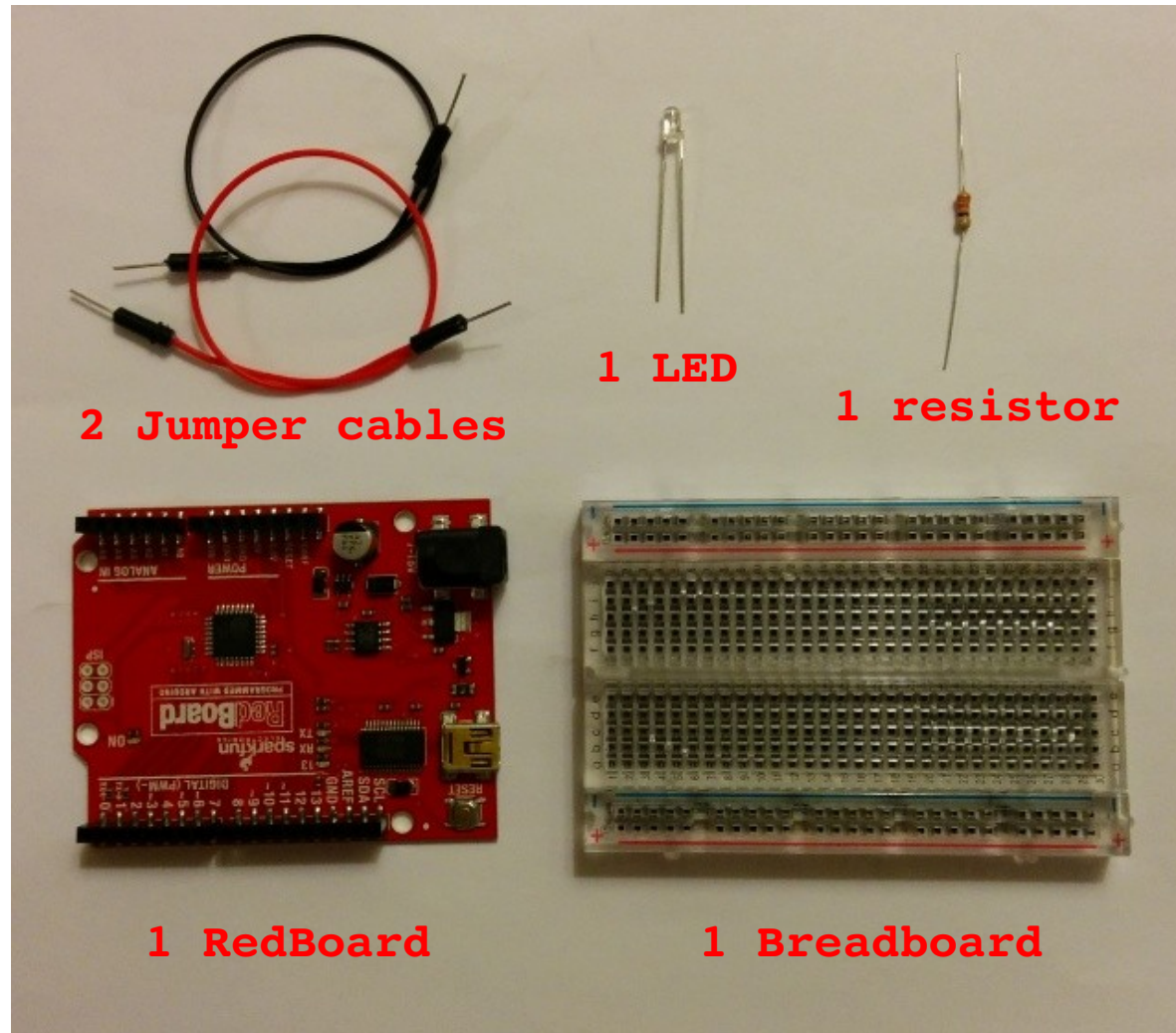
Linux users (specifically Debian) :

In a terminal:

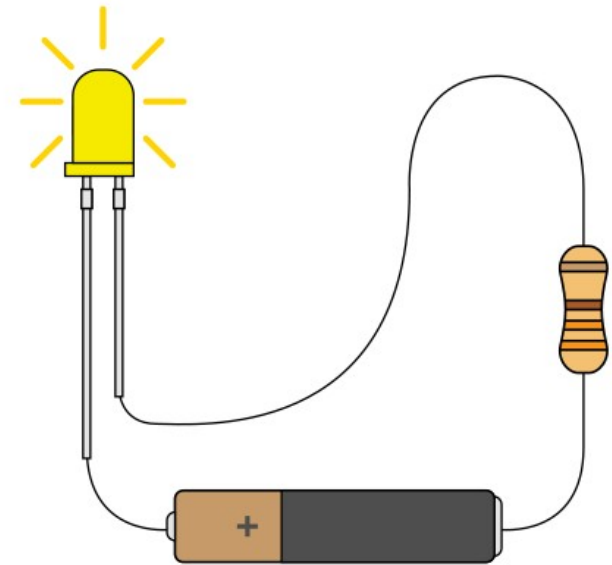
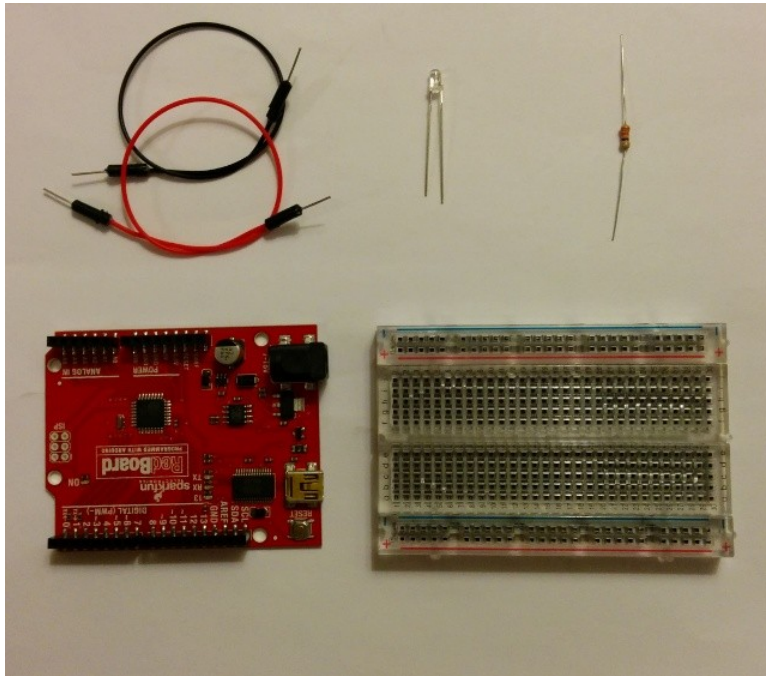
- `sudo apt-get install arduino`
- `sudo usermod -aG dialout <user>`
- Logout, and log back in for changes to take effect.

Building the Circuit

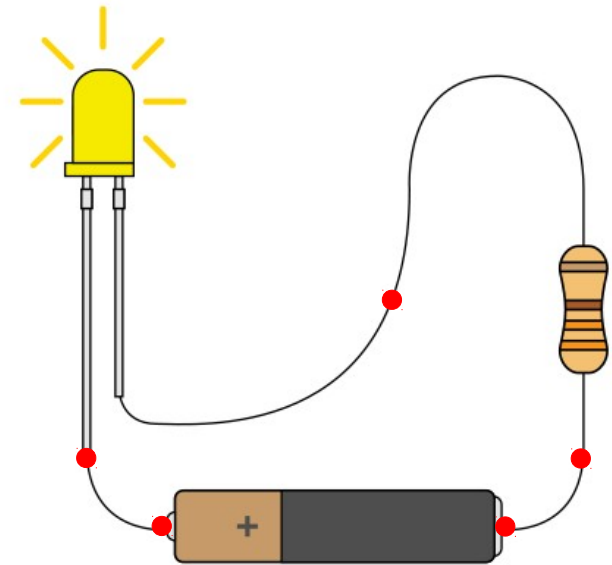
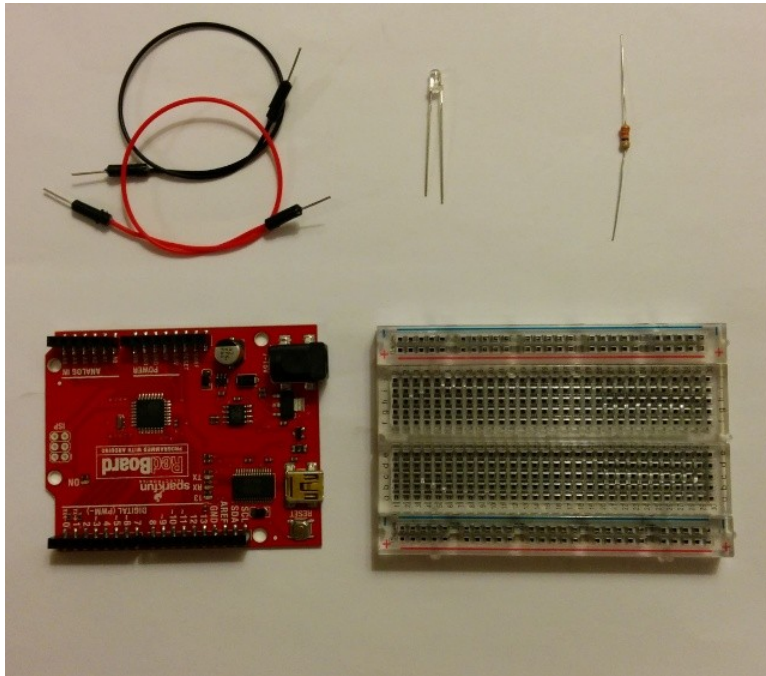
Inside your kit, you'll find:



Building the Circuit

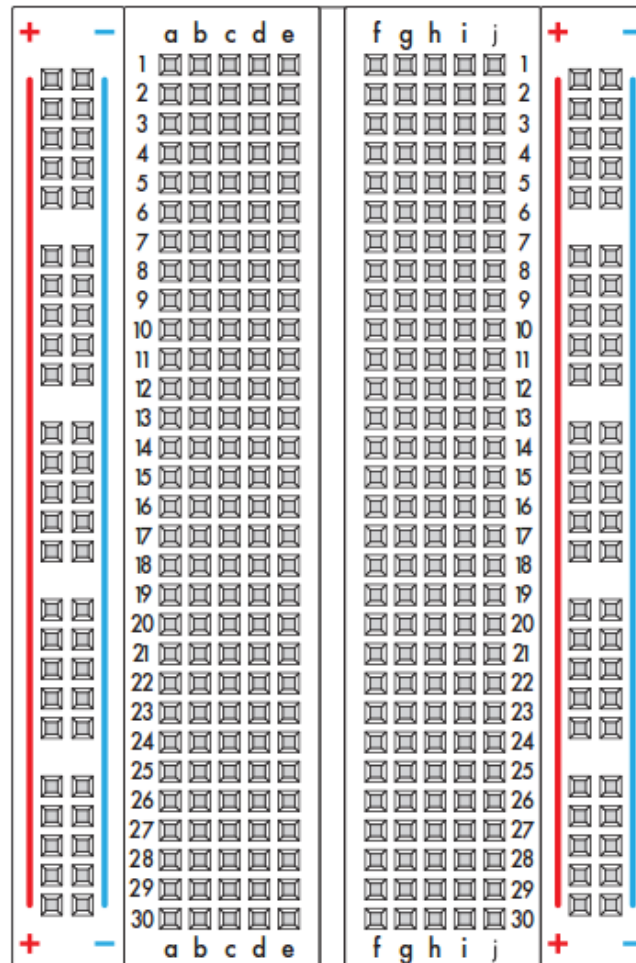


Building the Circuit

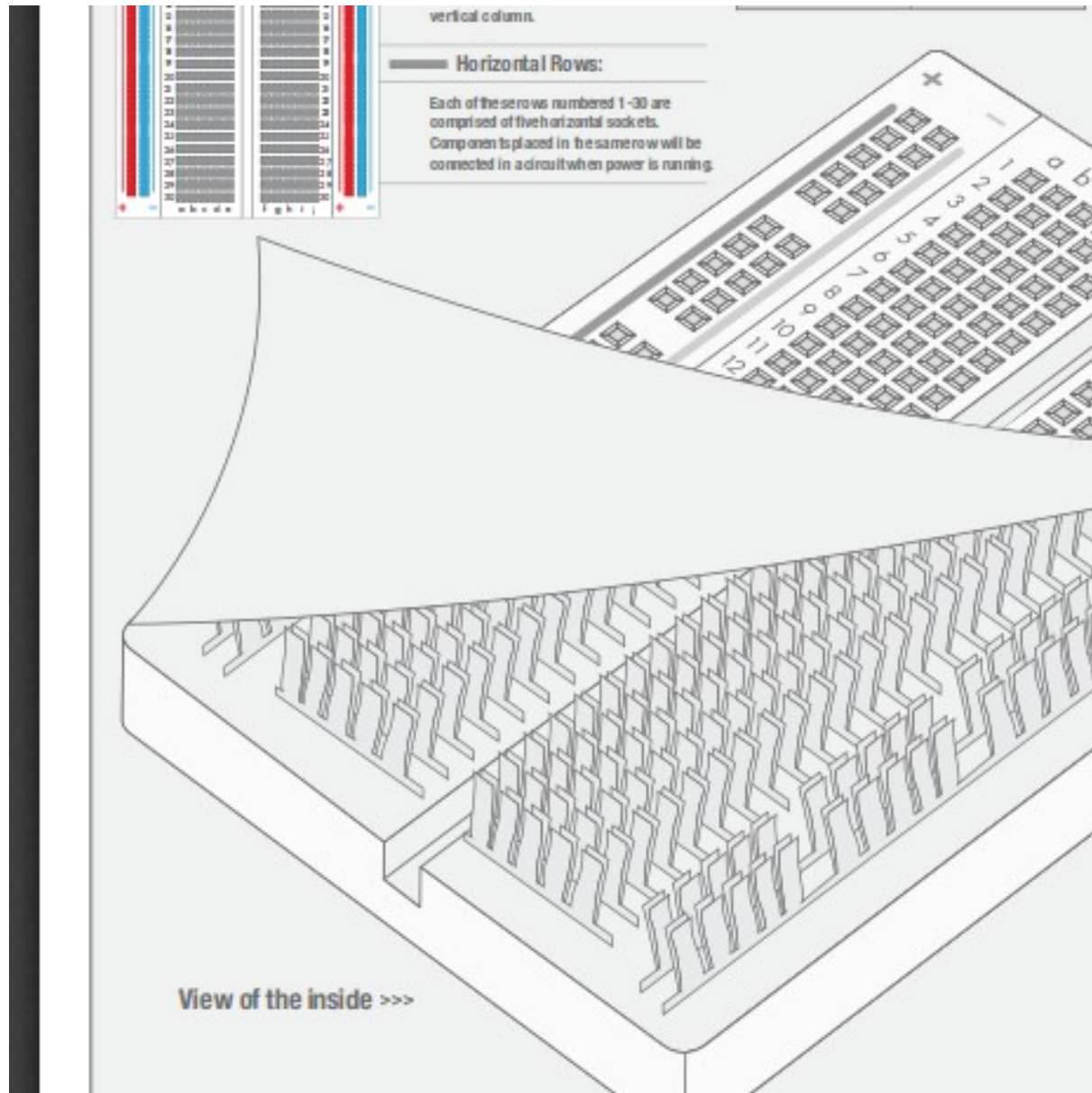


Building the Circuit

Bread board to the rescue!

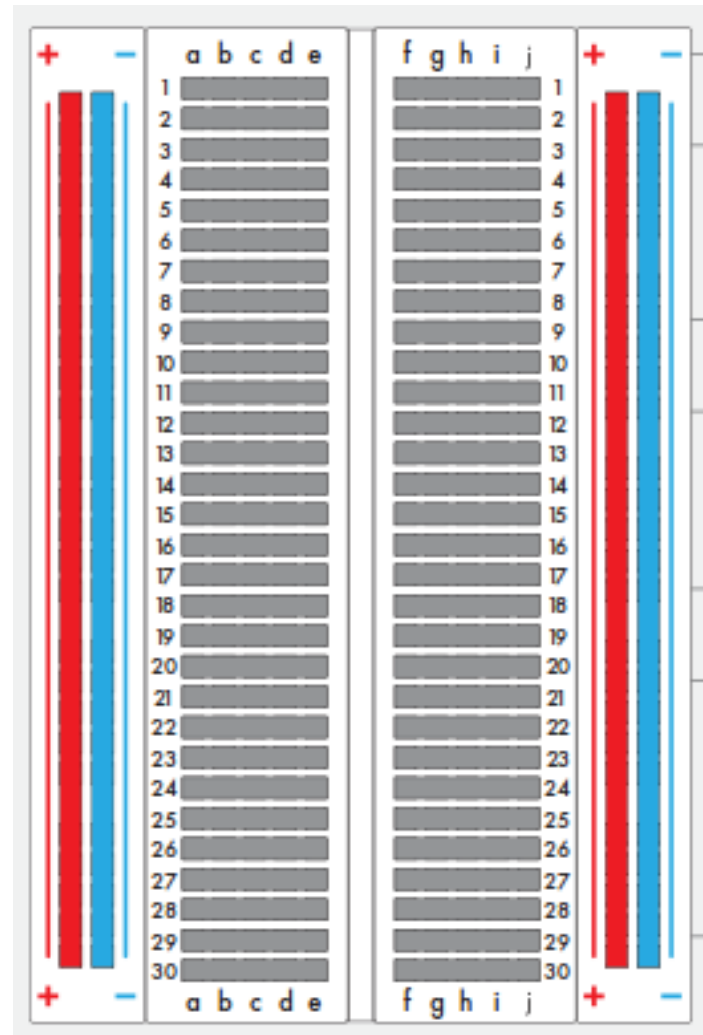


Building the Circuit



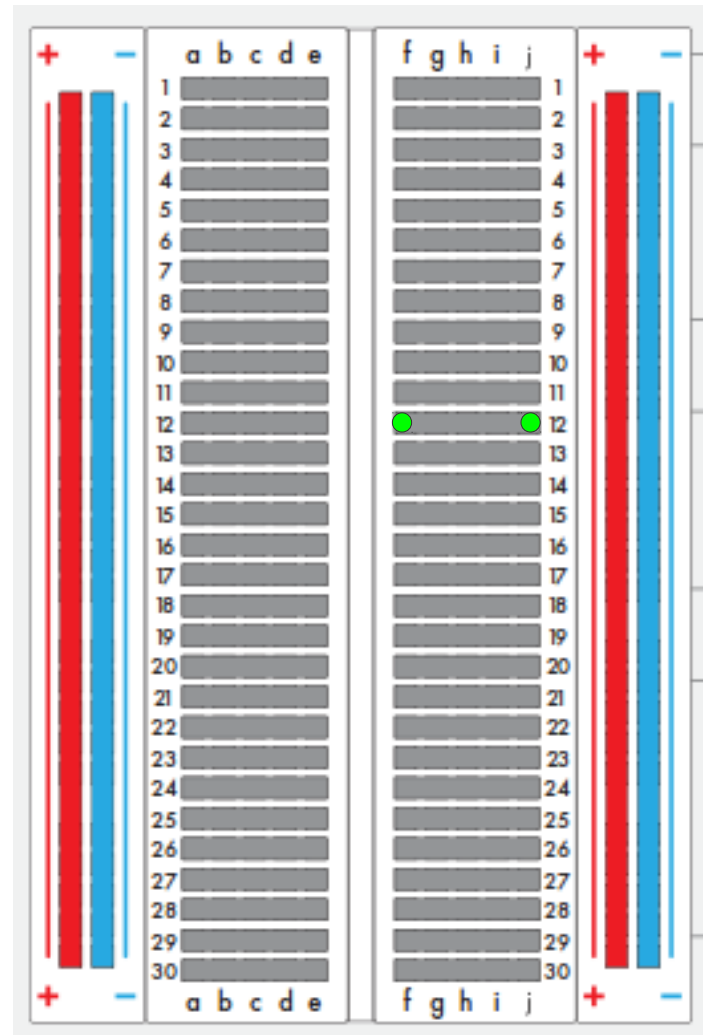
Building the Circuit

Bread board to the rescue!



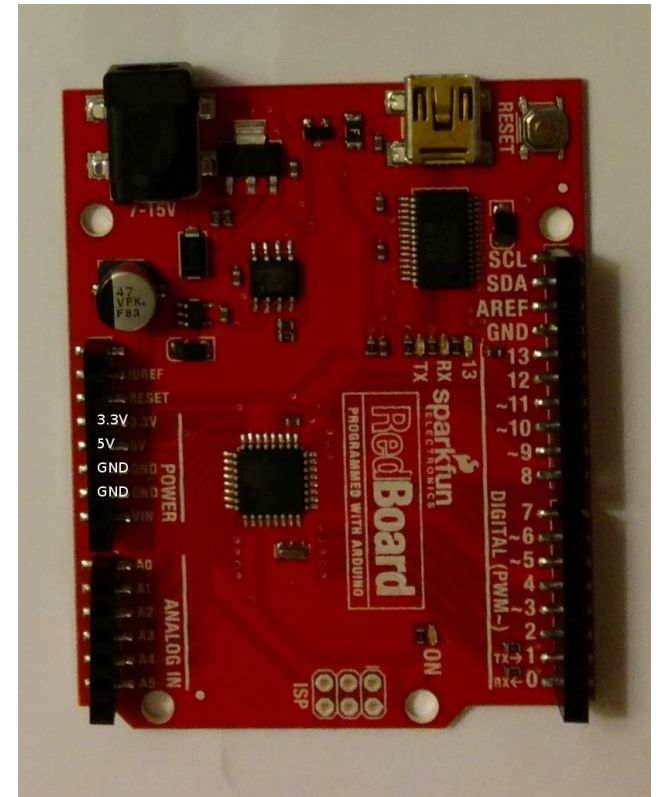
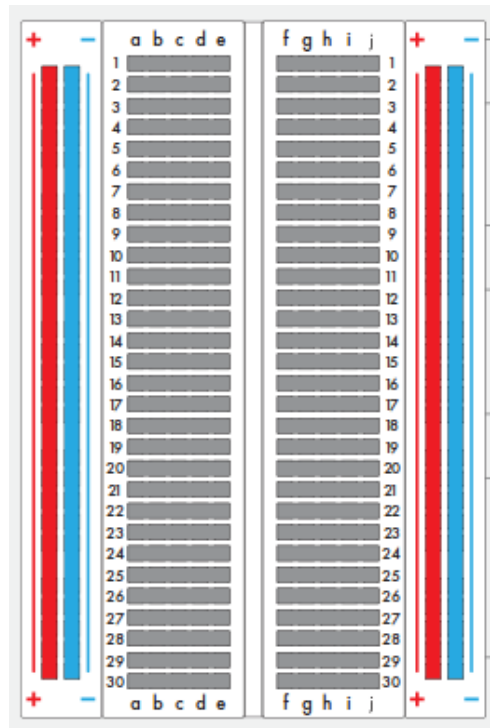
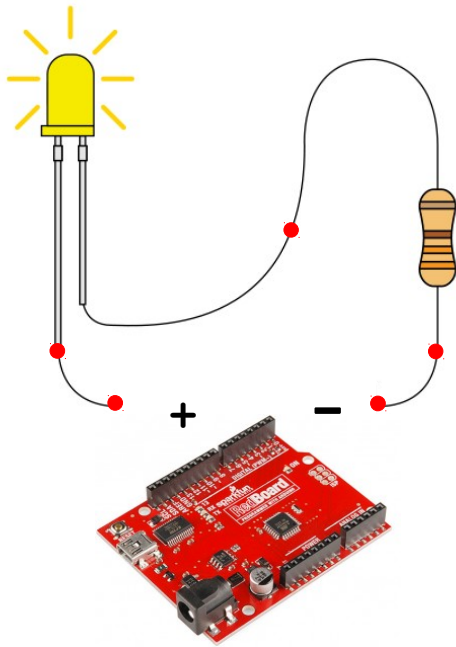
Building the Circuit

Bread board to the rescue!



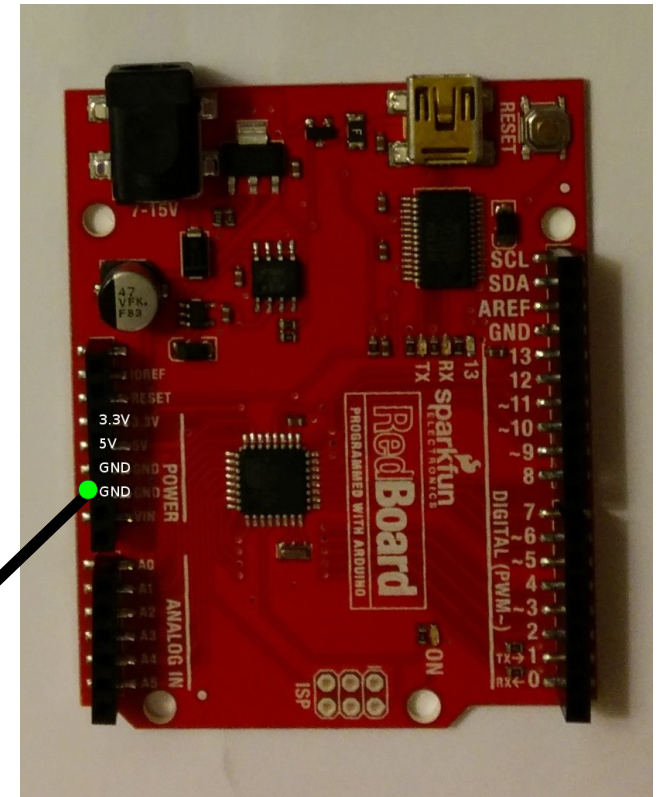
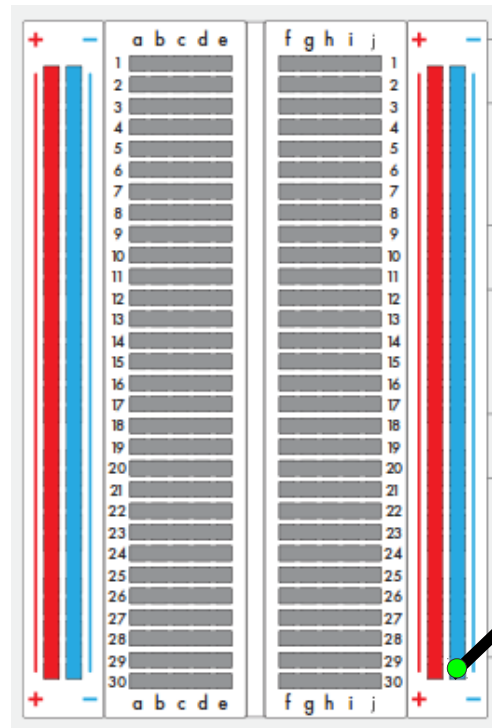
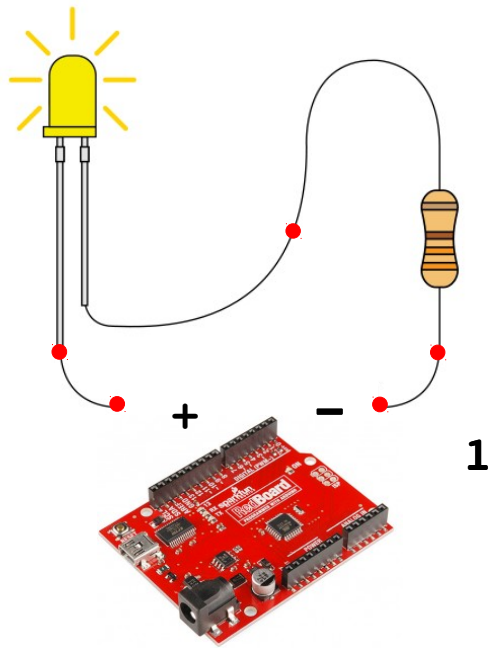
Building the Circuit

Bread board to the rescue!



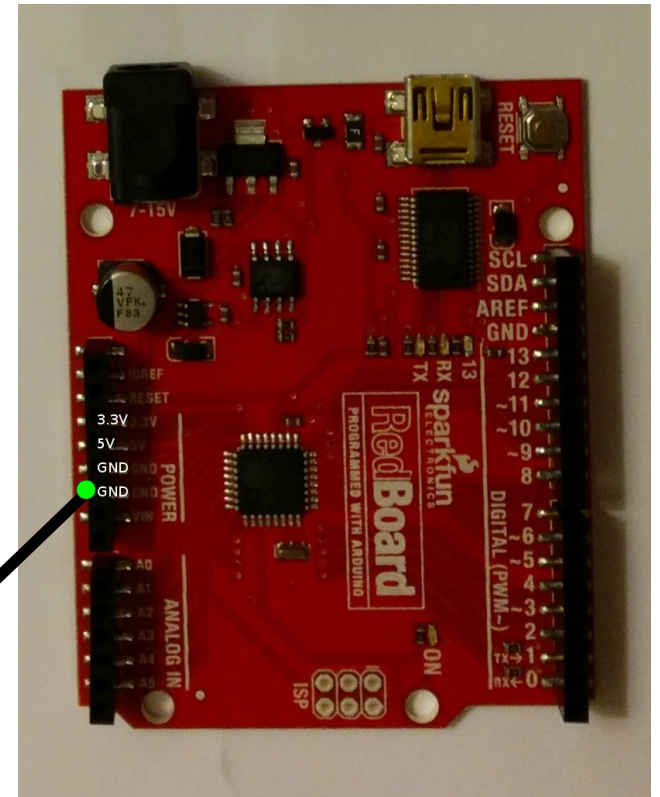
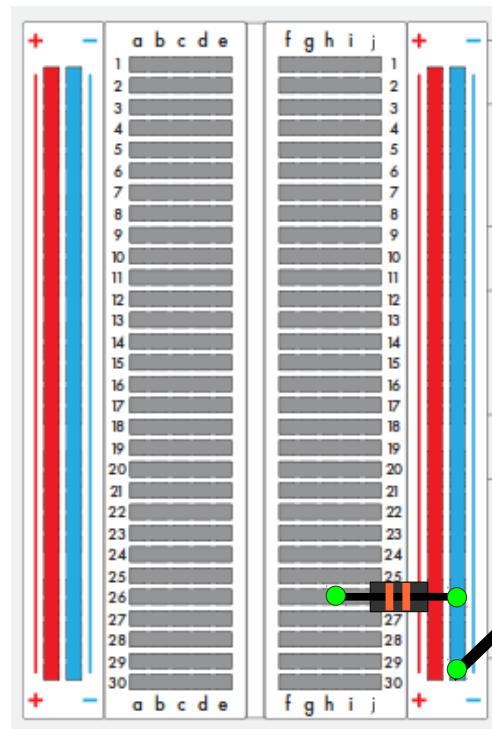
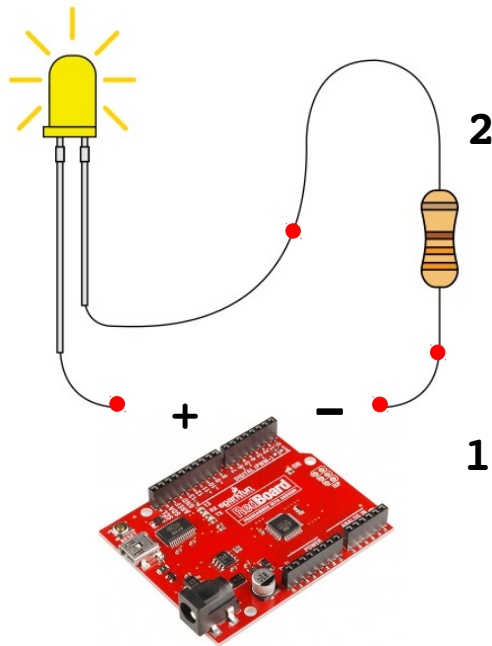
Building the Circuit

Bread board to the rescue!

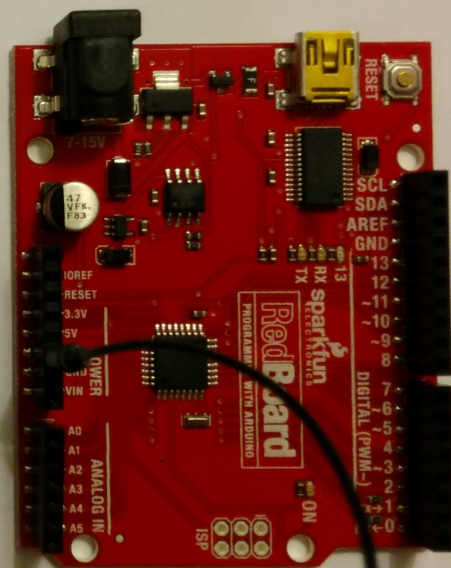
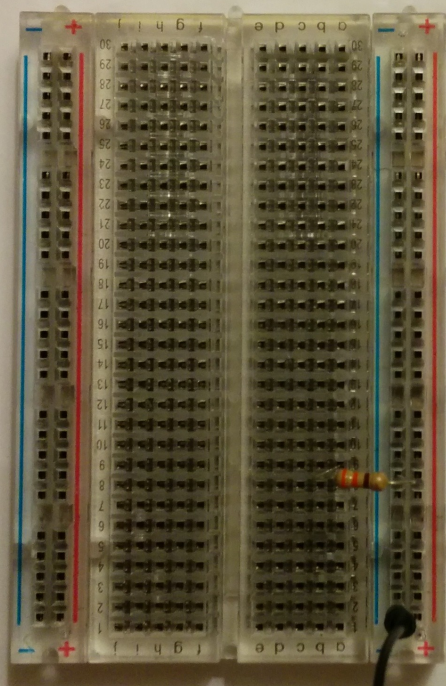


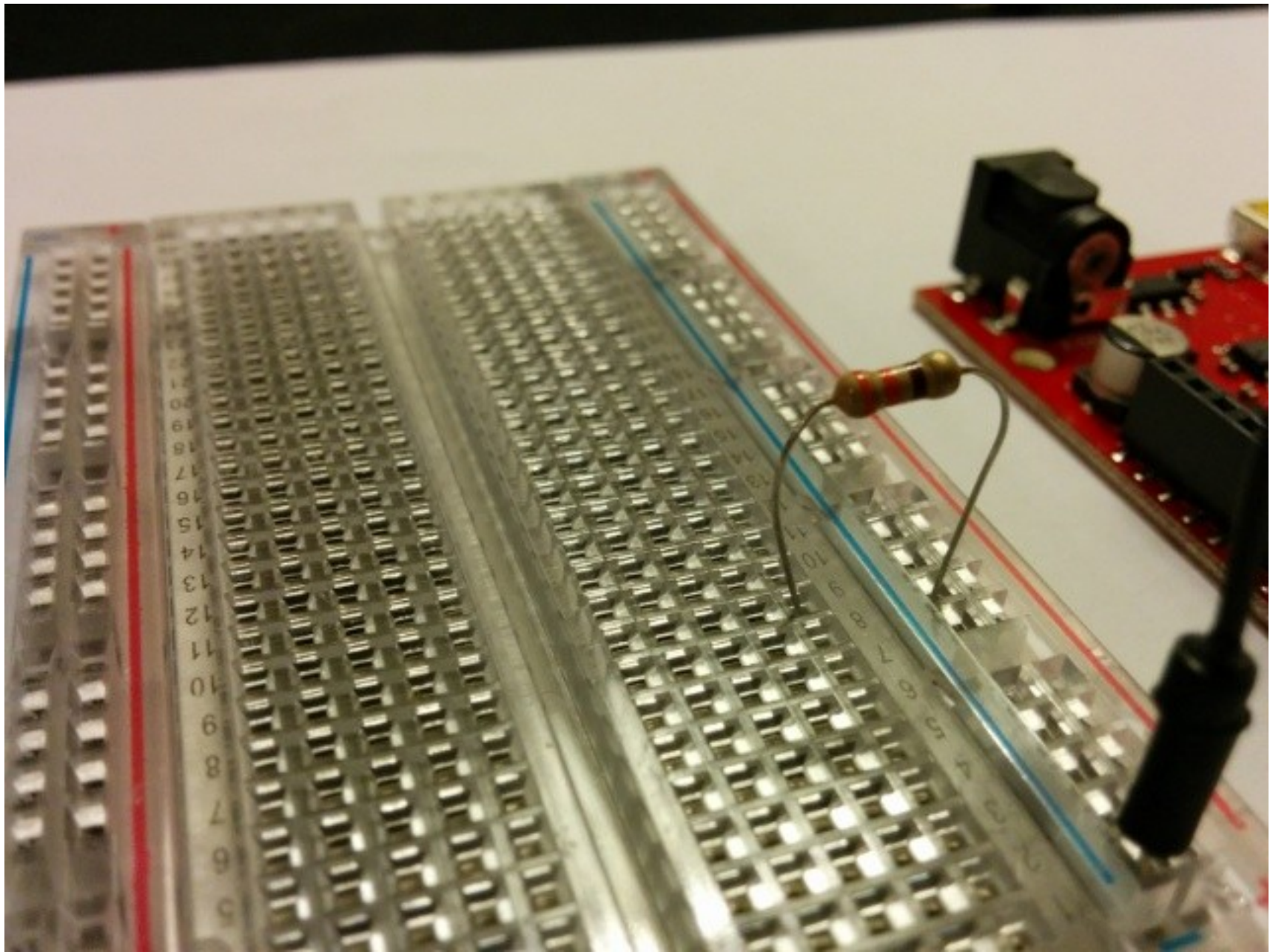
Building the Circuit

Bread board to the rescue!



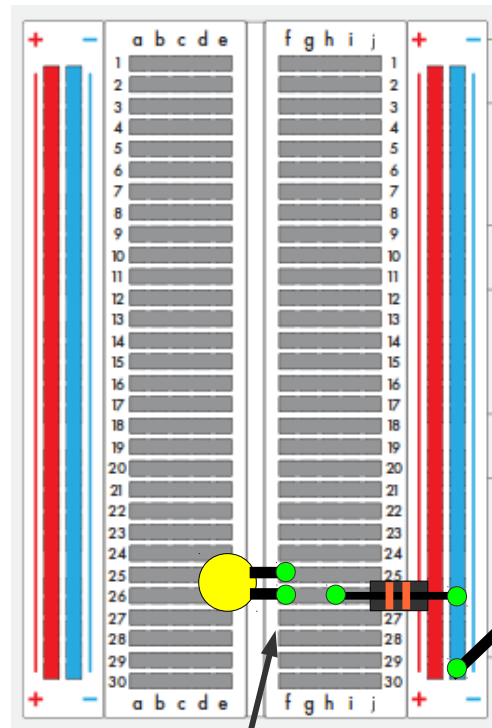
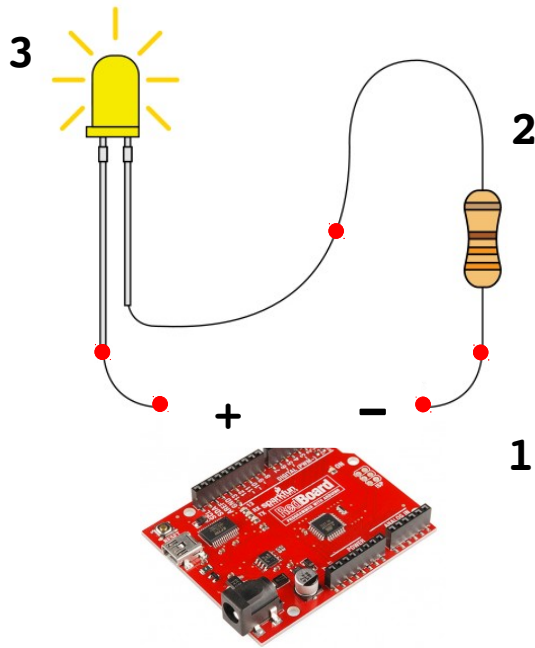
Short Leg



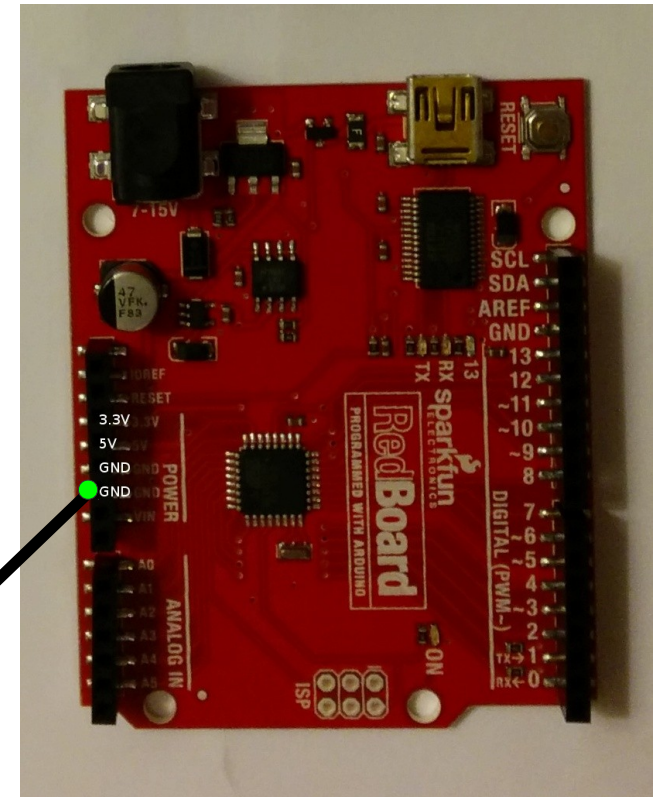


Building the Circuit

Bread board to the rescue!

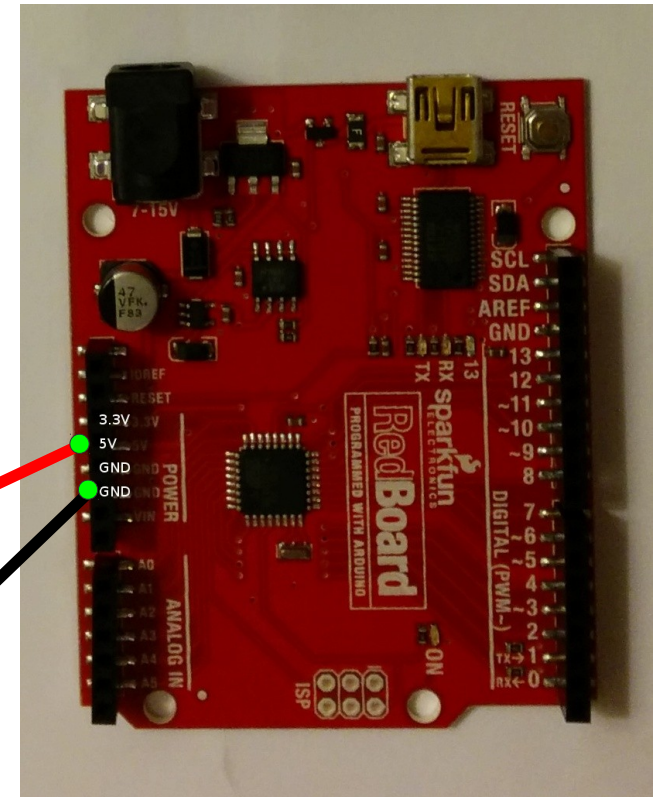
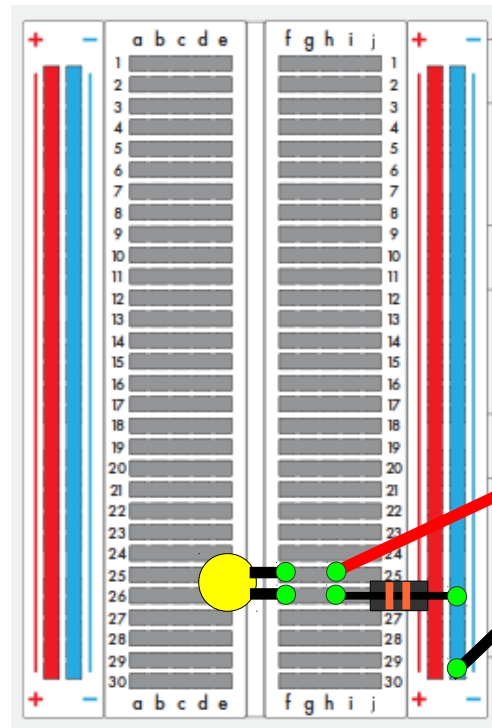
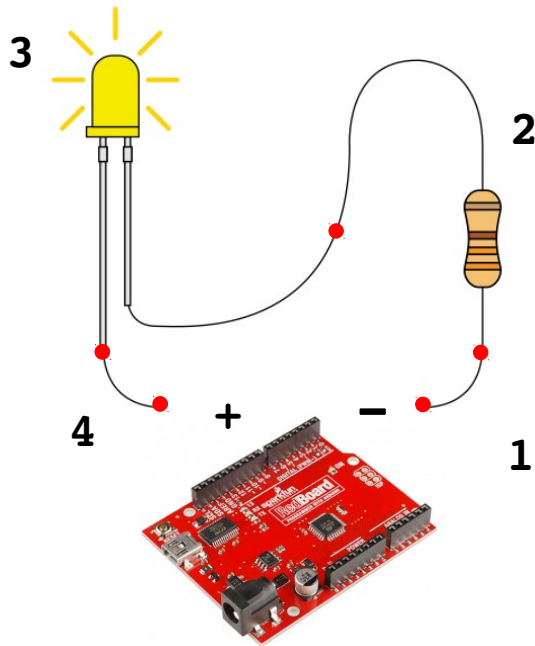


Short Leg

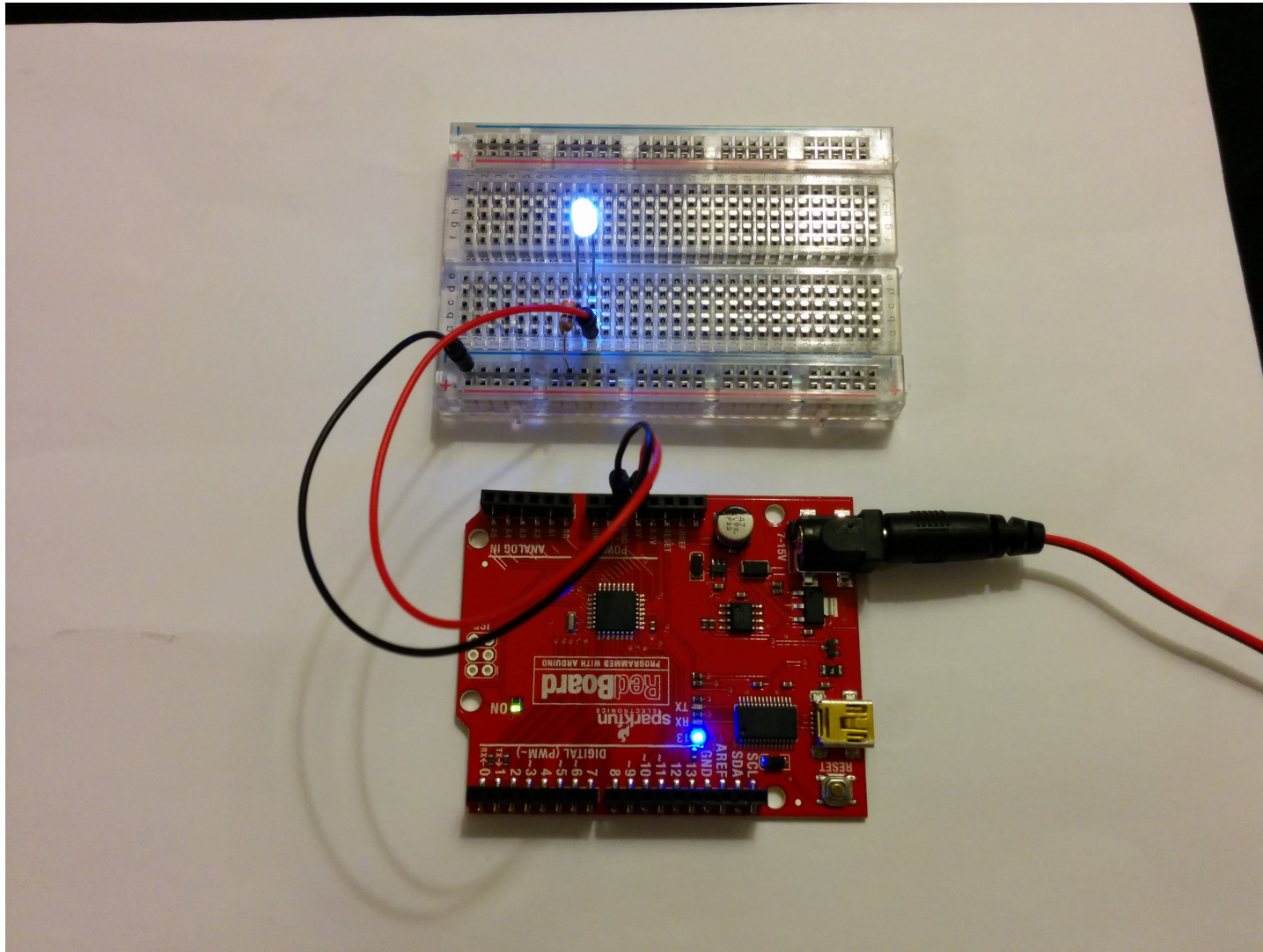


Building the Circuit

Bread board to the rescue!

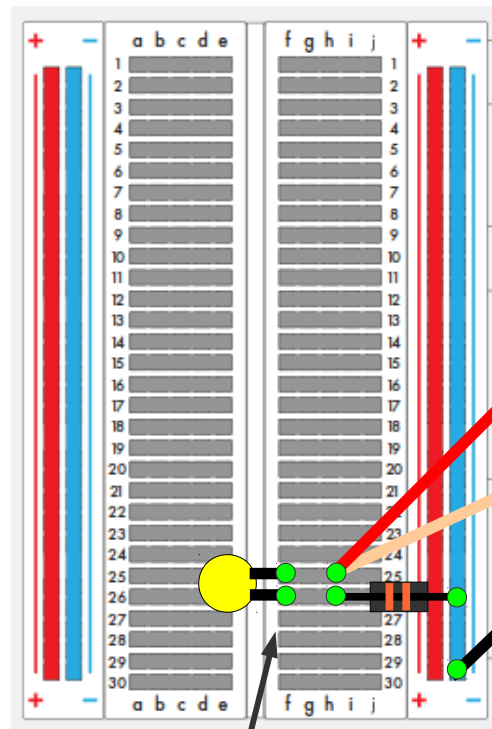
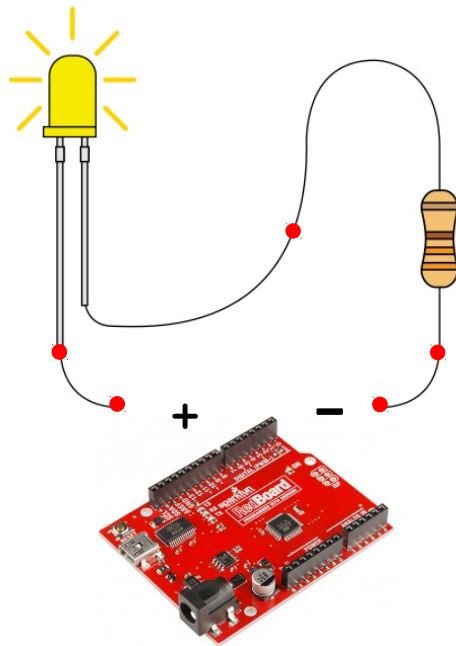


Testing the Circuit

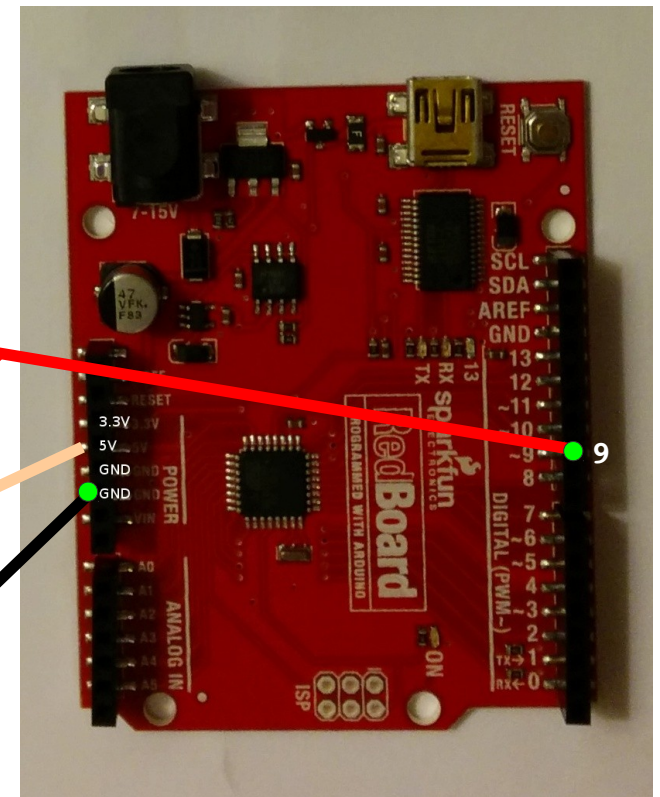


Getting ready to program the Circuit

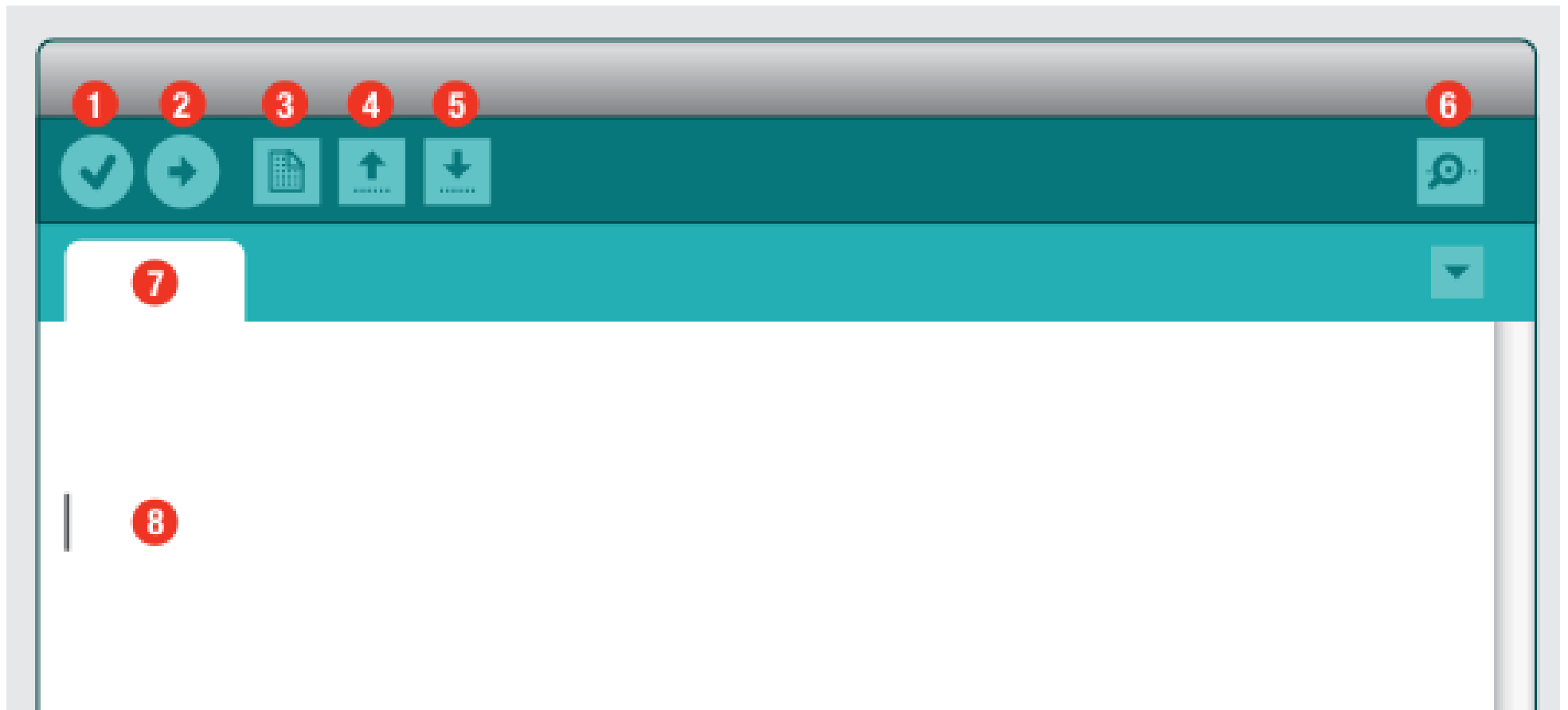
First, we need to connect to a pin we can control
(instead of the 5V power pin)



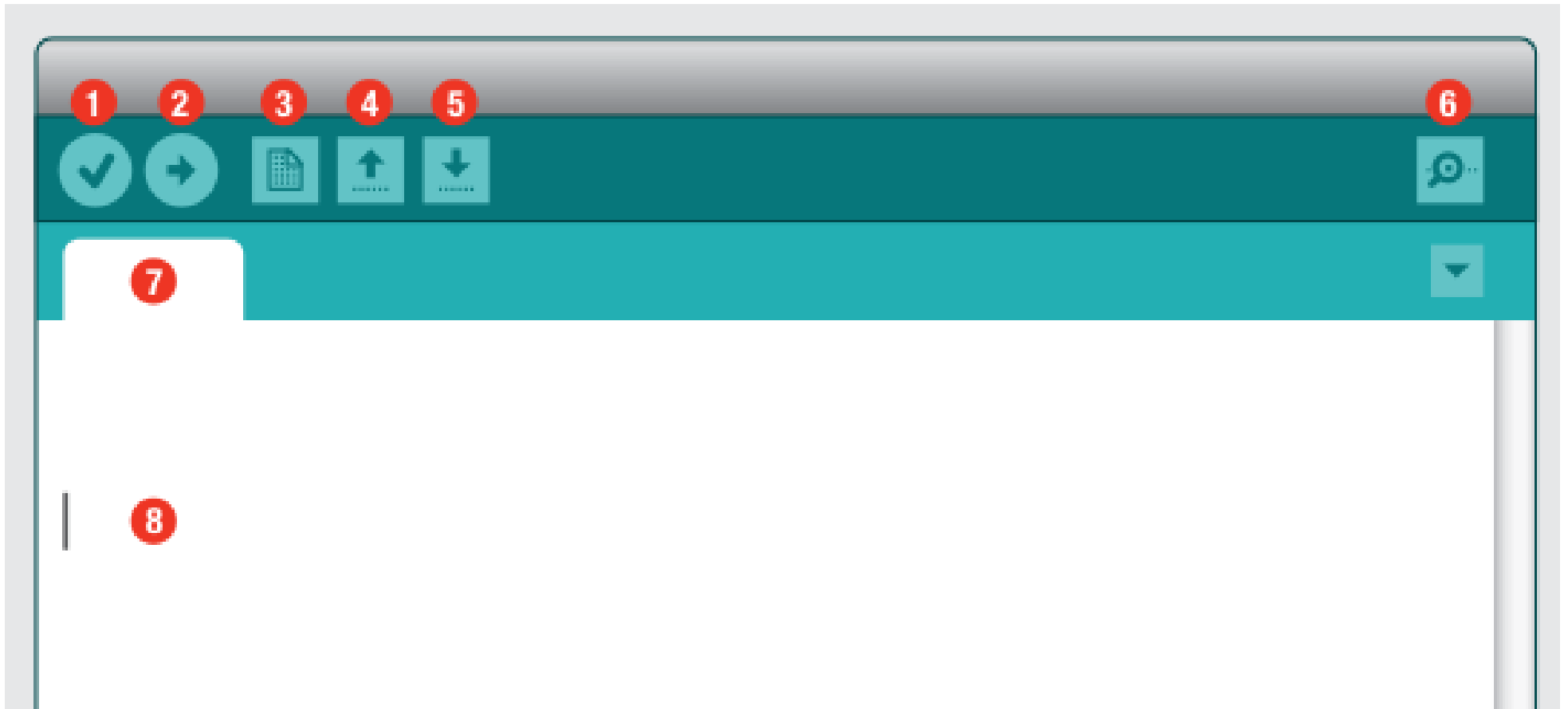
Short Leg



The Arduino IDE (Integrated Development Environment)

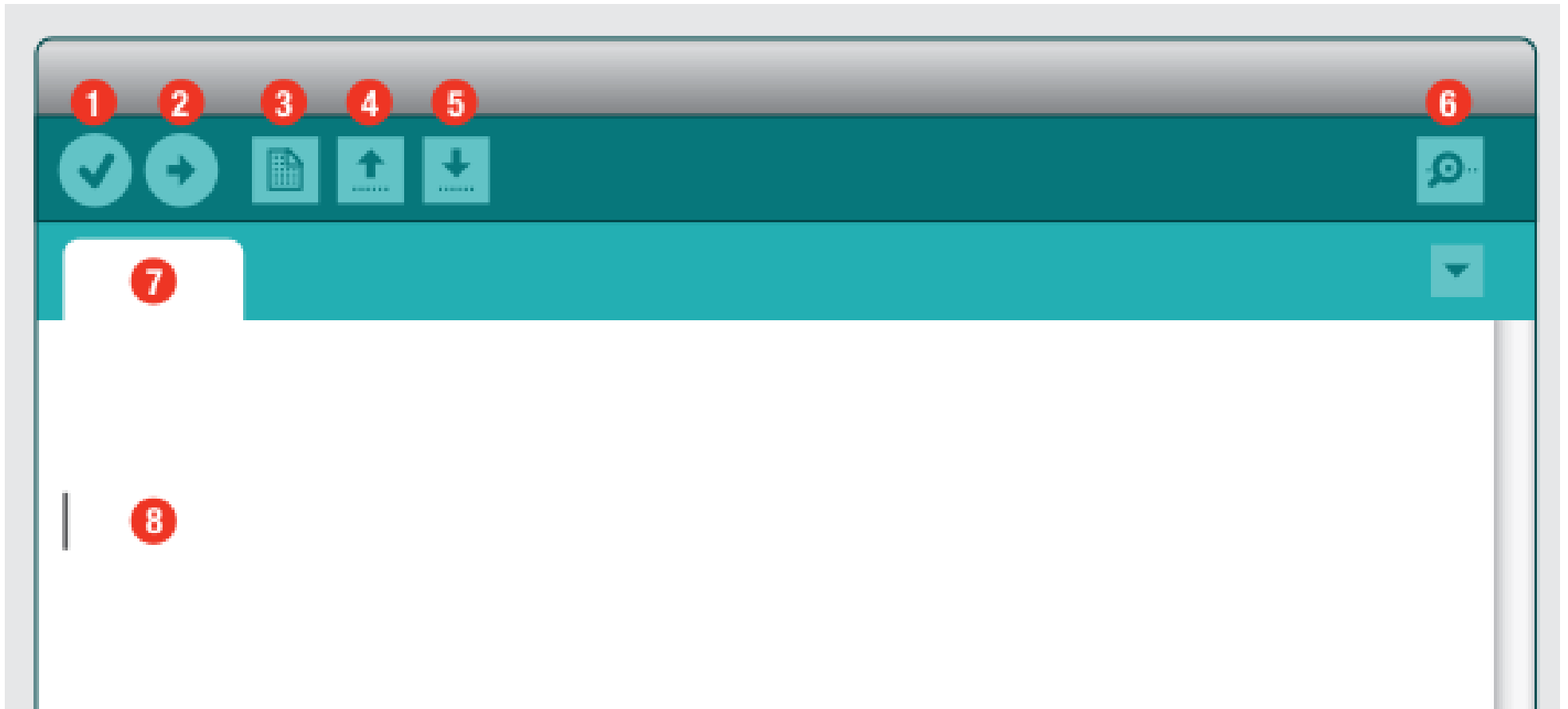


The Arduino IDE (Integrated Development Environment)



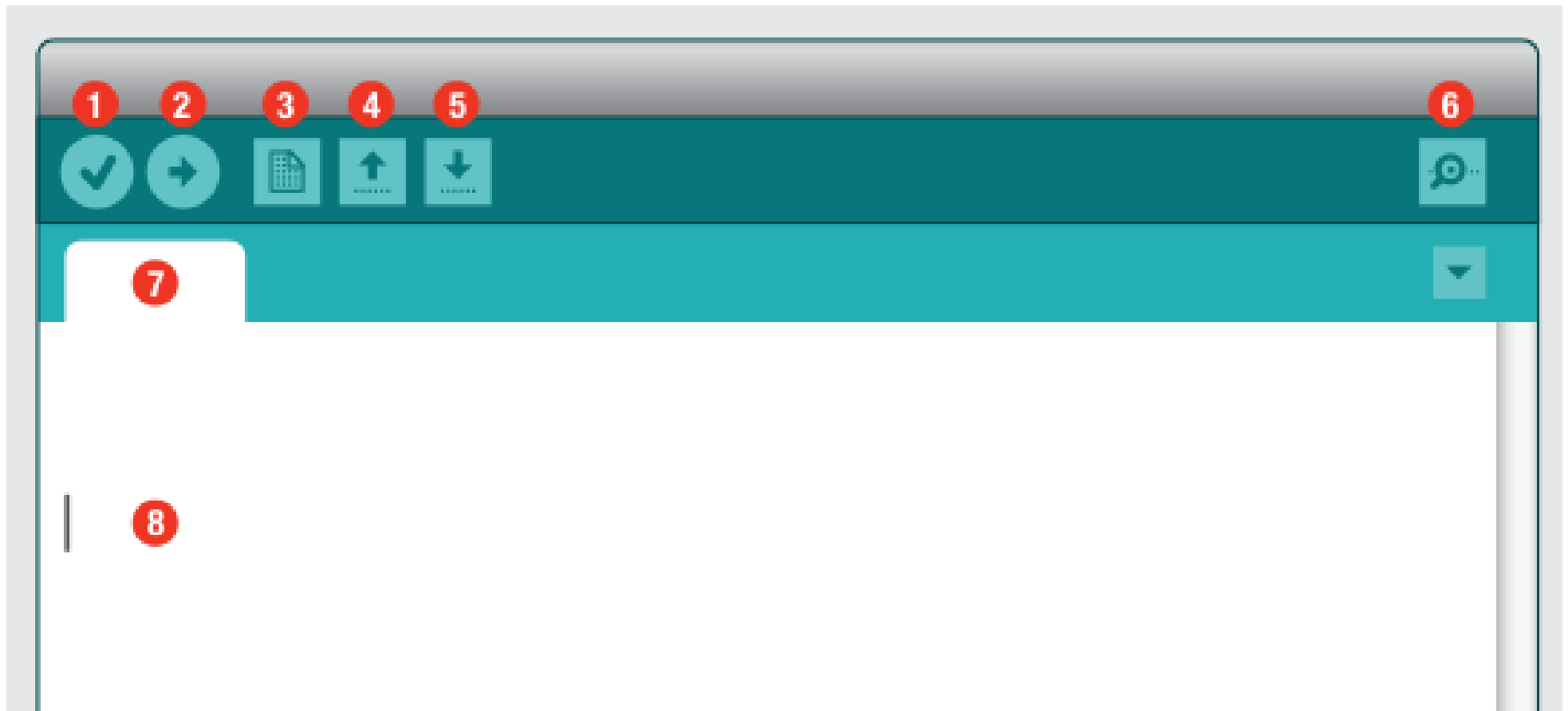
1. "verify" - check that your code is valid.

The Arduino IDE (Integrated Development Environment)



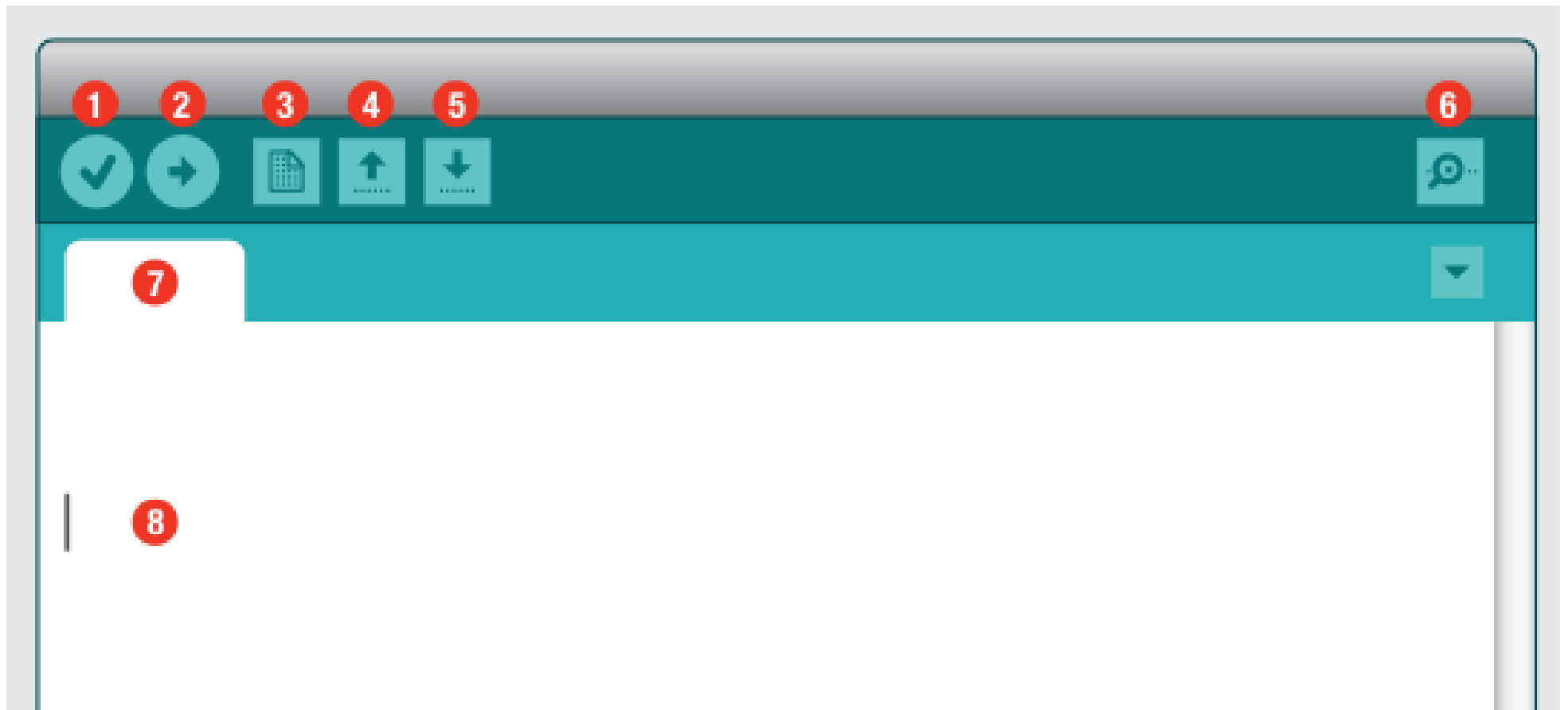
2. "upload" - loads program onto the Arduino

The Arduino IDE (Integrated Development Environment)



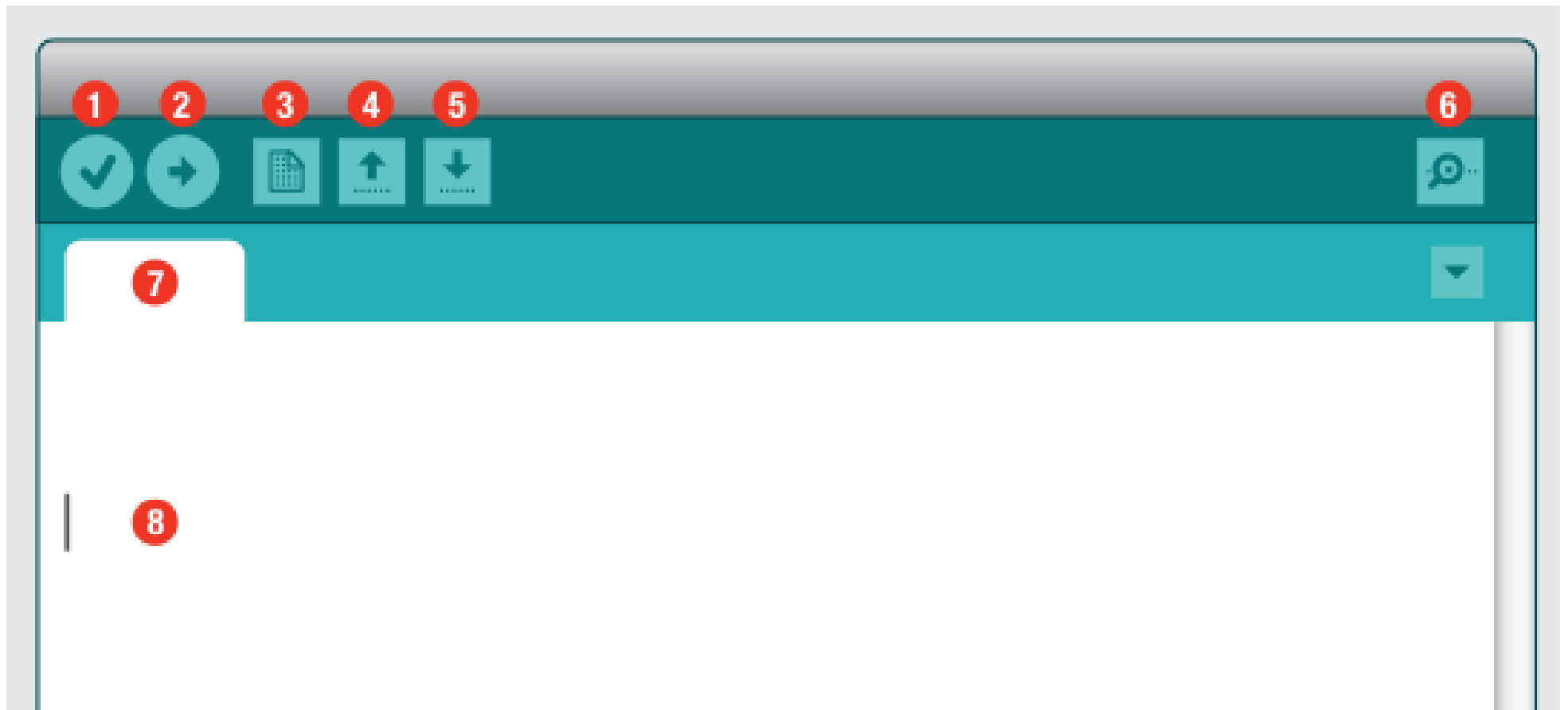
3. "New" - creates a new sketch

The Arduino IDE (Integrated Development Environment)



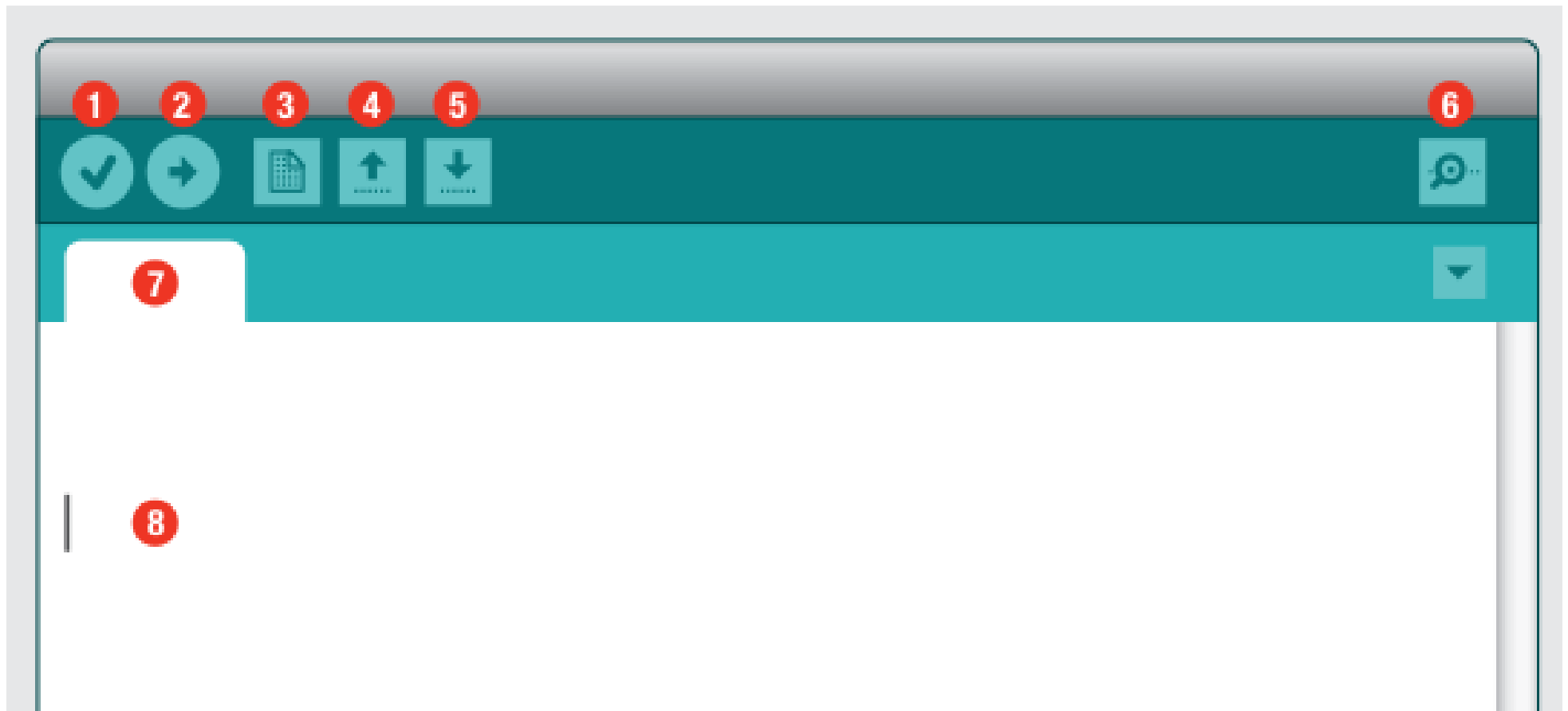
5. "Save" - save the current sketch

The Arduino IDE (Integrated Development Environment)



6. "Serial Monitor" - communicate with the Arduino

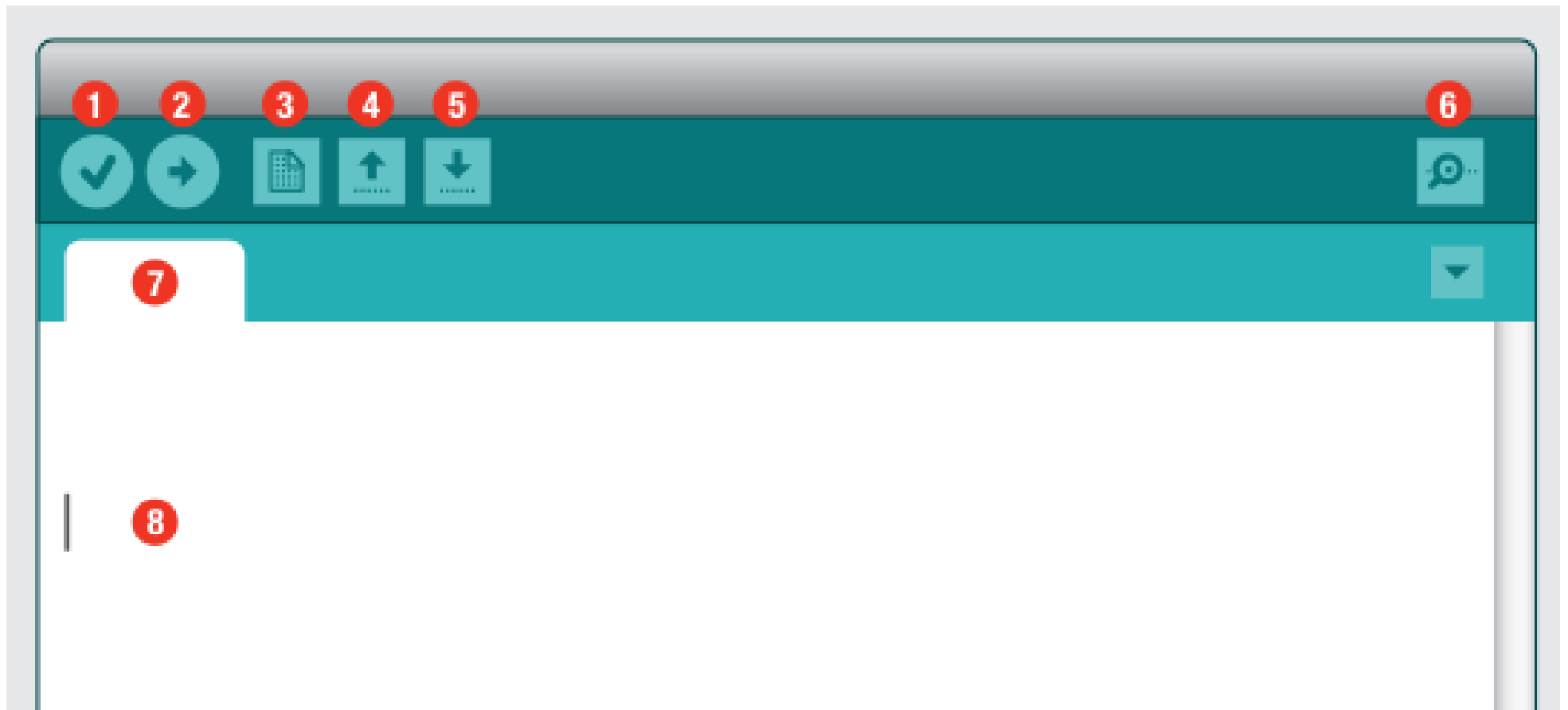
The Arduino IDE (Integrated Development Environment)



7- "Sketch Name" – Name of the current sketch

The Arduino IDE

(Integrated Development Environment)



8. "Editing Window" - edit your program here.

Programming Primer

```
// single-line comments look like this.
```

```
/*  
    Multi-line comments  
    look like this  
*/
```

```
// variable declarations look like this
```

```
int variable_name;  
boolean isOn;
```

```
// function declarations look like this
```

```
void func_name(args...)  
{  
    // function body  
}
```

```
// statements looks like this
```

```
do_something();  
led_state = readDigital(9);
```

Anatomy of an Arduino Sketch

```
// Global constants and state data
```

```
const int LED = 9;
```

```
// setup function that is called once at power on
```

```
void setup()
```

```
{
```

```
    pinMode(LED, OUTPUT);
```

```
}
```

```
// loop function gets called in a loop
```

```
void loop()
```

```
{
```

```
    // do exciting stuff!
```

```
    digitalWrite(LED, HIGH);
```

```
    delay(500);
```

```
    digitalWrite(LED, LOW);
```

```
    delay(500);
```

```
}
```

Anatomy of an Arduino Sketch

Global
Data

```
// Global constants and state data  
const int LED_PIN = 9;
```

One-time
Setup

```
// setup function that is called once at power on  
void setup()  
{  
    pinMode(LED_PIN, OUTPUT);  
}
```

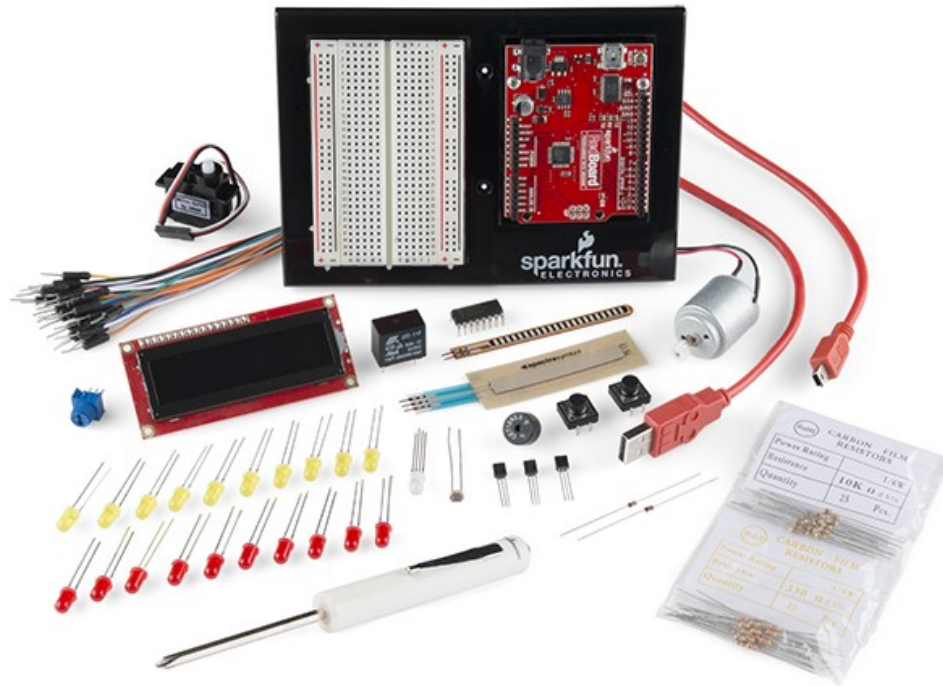
Loop

```
// loop function gets called in a loop  
void loop()  
{  
    // do exciting stuff!  
    digitalWrite(LED_PIN, HIGH);  
    delay(500);  
    digitalWrite(LED_PIN, LOW);  
    delay(500);  
}
```

**Blink**

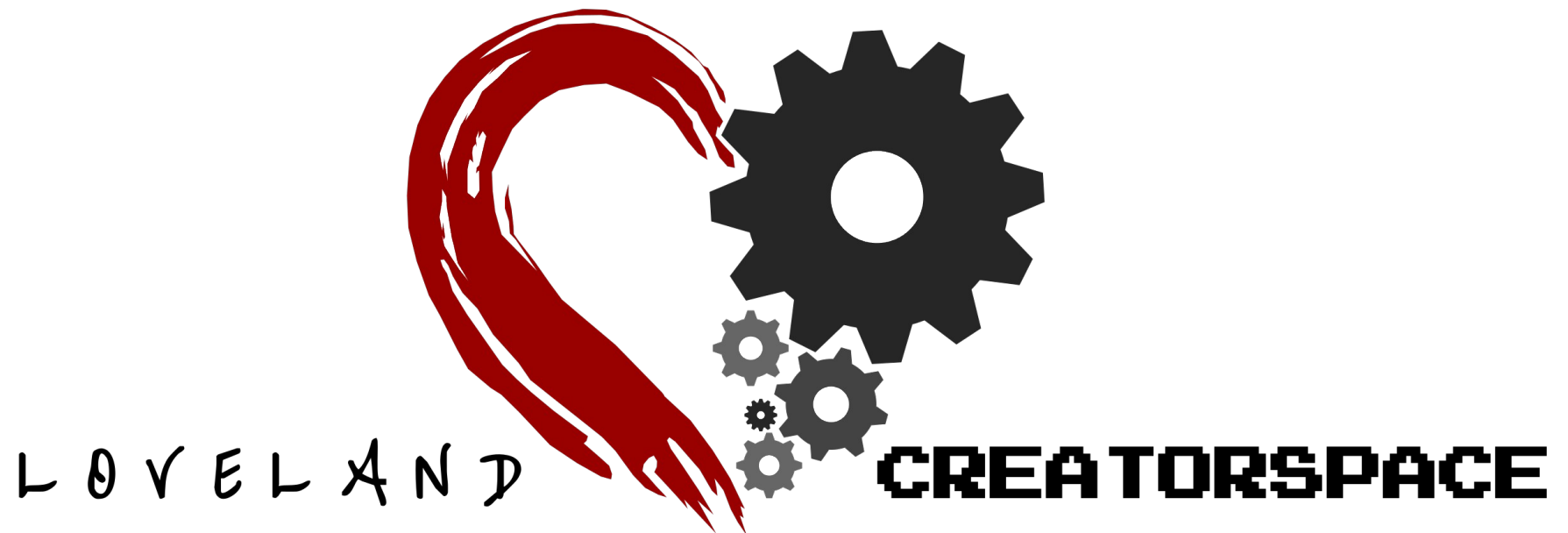
```
/*  
  Blink  
  Turns on an LED on for one second, then off for one second, repeat.  
  
  This example code is in the public domain.  
  */  
  
void setup() {  
  // initialize the digital pin as an output.  
  // Pin 13 has an LED connected on most Arduino boards.  
  pinMode(13, OUTPUT);  
}  
  
void loop() {  
  digitalWrite(13, HIGH); // turn the LED on (HIGH is the voltage level)  
  delay(1000);             // wait for a second  
  digitalWrite(13, LOW);  // turn the LED off by making the pin LOW  
  delay(1000);             // wait for a second  
}
```

Where to go from here



Sparkfun Inventor's Kit (SIK ~ \$100)

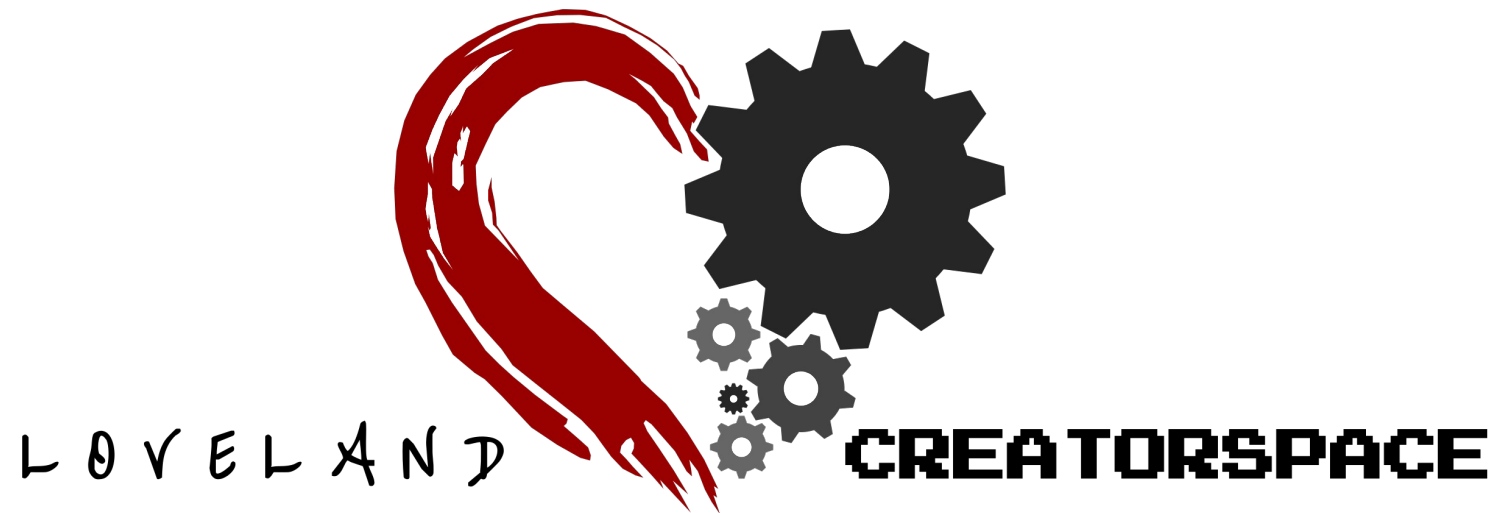
Where to go from here



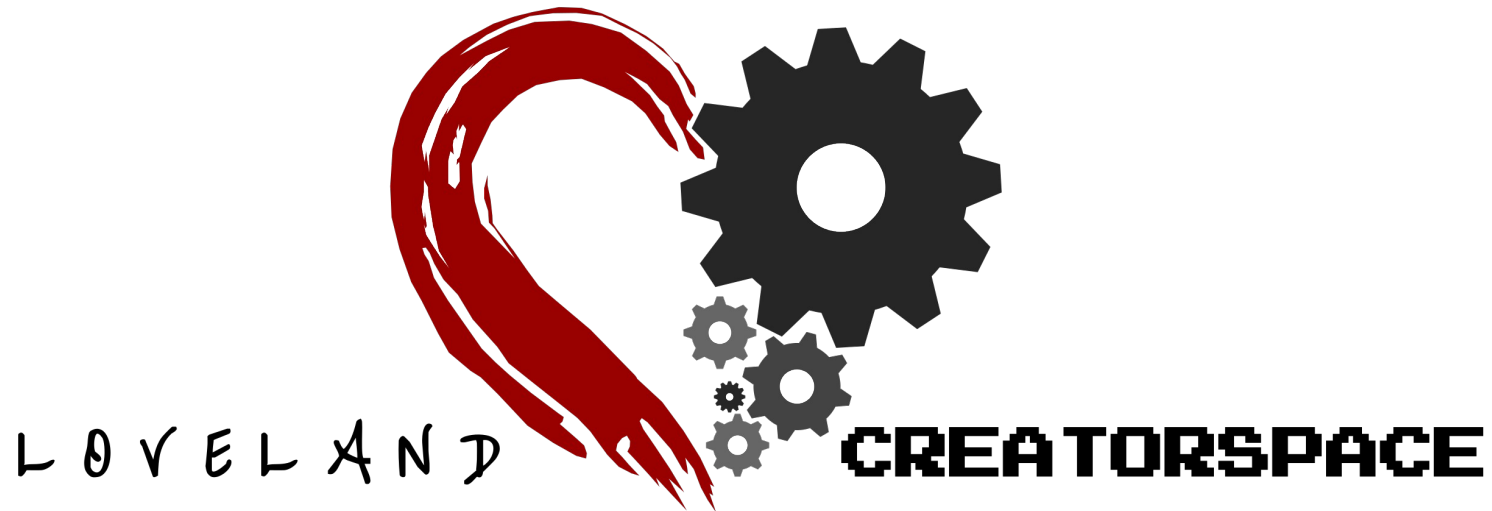
Arduino Classes

Where to go from here

- Arduino 102** - building interactive circuits
- Arduino 201** - writing a serial protocol
- Arduino 301** - build an Arduino shield



Thank you for coming!



Thank you for coming!

Did you enjoy today's class???

Help fund future LCS events!

"pay what you think it's worth"