

Feb 15, 2019

Experiencing Arduino Programming

Step 1: Log onto the computer

Username: FSFGuest

Password: FSFGuest

The username and password are case sensitive, which means that the upper case letters can't be typed as lower case, nor can the lower case letters be typed as upper case.

If the computer ever goes into sleep mode (the screen is locked and you are asked to type the password for the Full Spectrum Farm clients), you can type the same password above to log back onto it.

The exercise done today is through real Arduino boards and circuits, but if you have a computer and internet, you can also simulate it at tinkercad.com by logging in using your social account (gmail, etc.)

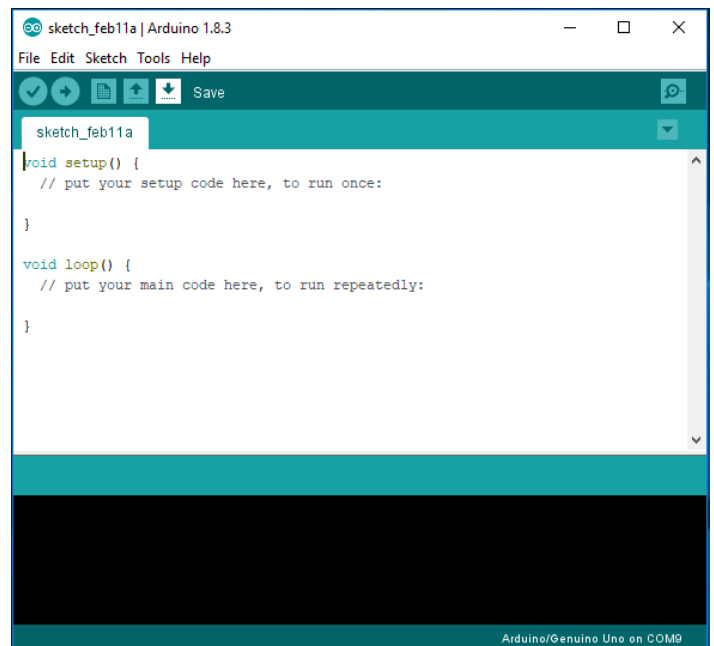
Step 2: Test the Arduino program

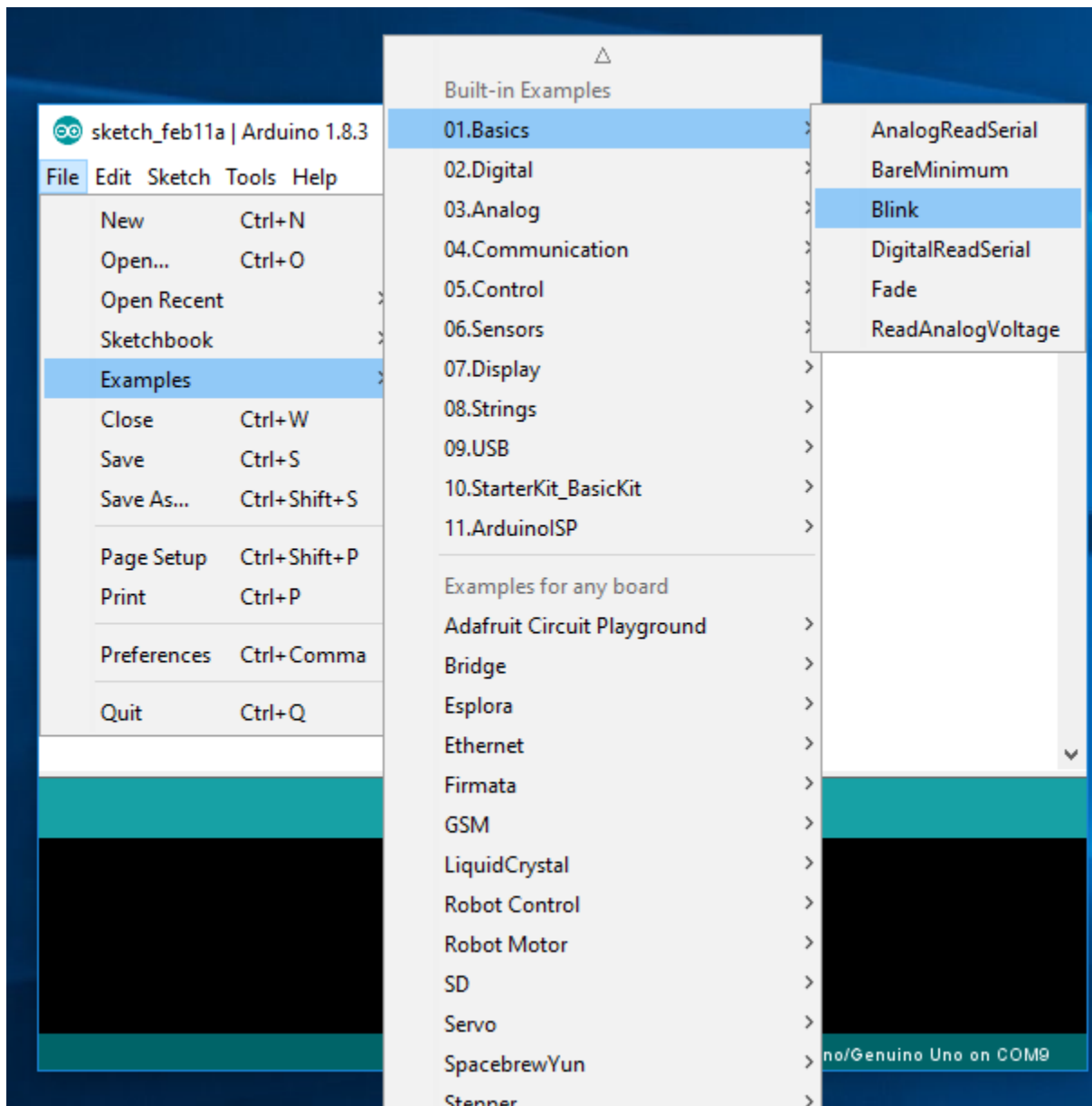
Look for an icon like below on the desktop:



Using the mouse's left key to double-click it, and this software, called "Arduino IDE", will start to show a window similar to the one at right.

Choose "File" on the menu, click "Examples", "01.Basics", and then "Blink". A program, called a sketch in Arduino environment, will open up in the name of "Blink". The menu items and the sketch view are shown in the next two images.



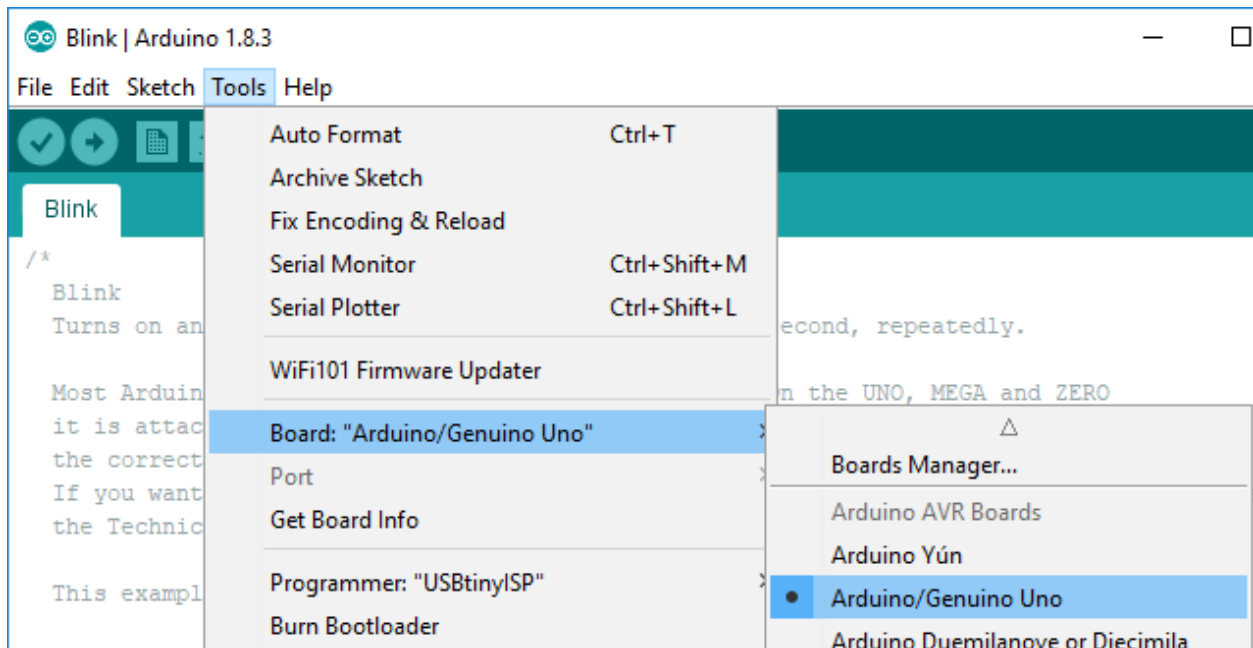




Blink

```
/*  
  Blink  
  Turns on an LED on for one second, then off for one second, repeatedly.  
  
  Most Arduinos have an on-board LED you can control. On the UNO, MEGA and ZERO  
  it is attached to digital pin 13, on MKR1000 on pin 6. LED_BUILTIN is set to  
  the correct LED pin independent of which board is used.  
  If you want to know what pin the on-board LED is connected to on your Arduino model, check  
  the Technical Specs of your board at https://www.arduino.cc/en/Main/Products  
  
  This example code is in the public domain.  
  
  modified 8 May 2014  
  by Scott Fitzgerald  
  
  modified 2 Sep 2016  
  by Arturo Guadalupi  
  
  modified 8 Sep 2016  
  by Colby Newman  
*/  
|  
  
// the setup function runs once when you press reset or power the board  
void setup() {  
  // initialize digital pin LED_BUILTIN as an output.  
  pinMode(LED_BUILTIN, OUTPUT);  
}  
  
// the loop function runs over and over again forever  
void loop() {  
  digitalWrite(LED_BUILTIN, HIGH); // turn the LED on (HIGH is the voltage level)  
  delay(1000); // wait for a second  
  digitalWrite(LED_BUILTIN, LOW); // turn the LED off by making the voltage LOW  
  delay(1000); // wait for a second  
}
```

Select "Tools" from the menu, go to "Board", and choose "Arduino/Genuino Uno".



Before you plug in the Arduino board (an example image is below), the "Port" (below "Board") in the menu as shown above will be gray.

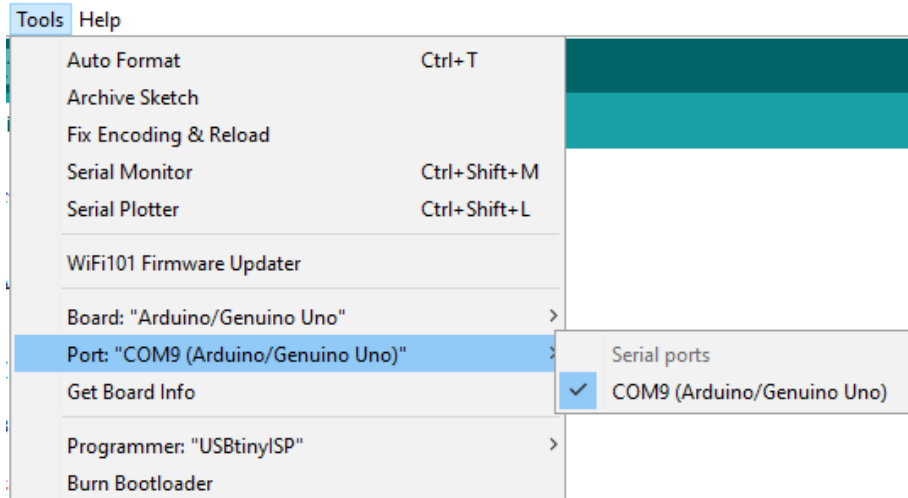


Now plug in the Arduino board into the computer through a USB cable. Any USB port on the computer (at the back side of the display) would do.

Then the menu item "Port" becomes solid black font but not gray as above. Please choose the COM number that is shown in your "Port" list, which should be in black.

The image on the next page is the COM number (COM9) on my computer, but your specific COM number may vary. It doesn't matter what the number is, as long as it is what the computer recognizes, you just choose it.

Once this port number is checked, it sets up the connection between the Arduino board and the Arduino IDE (programming environment).



Mouse over the check-mark icon below the “File”. A phrase “Verify” will show up on the right. Click the check-mark icon. This compiles the program.

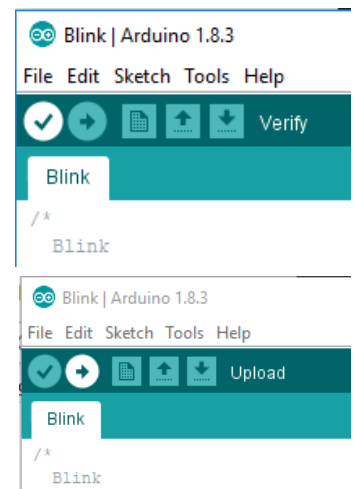
Then mouse over the right-arrow icon next to the check-mark icon. A phrase “Upload” will show up on the right. Click the right-arrow icon. This uploads the program onto the Arduino board.

Once this “Blink” sketch is properly uploaded onto the Arduino board through the steps above (verify and upload), the Arduino board’s onboard LED at pin 13 should start blinking at 1 second interval.

If you are very confident about your code, pressing “Upload” directly without doing “Verify” manually will prompt the program to “Verify” and “Upload” in sequence automatically, then pressing one button (“Upload”) is enough.

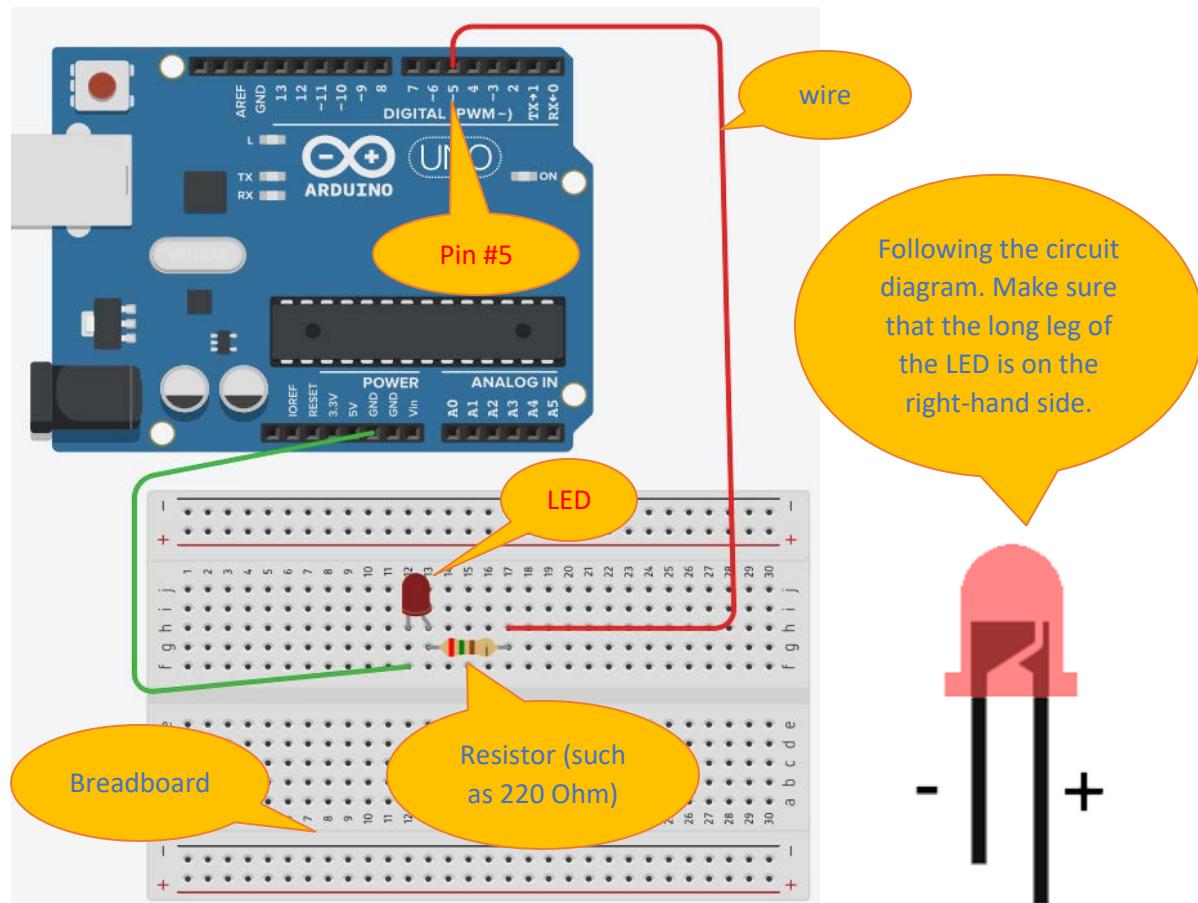
This verifies that your Arduino board and the Arduino IDE are set up properly, and this is Your First Program!

Congratulations!

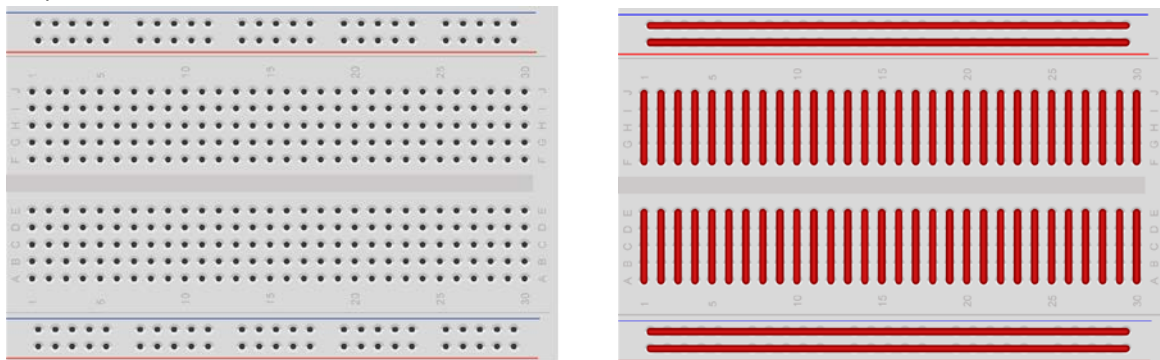


Step 3: Build a circuit

Now it's time to build a circuit that you can have more control of.



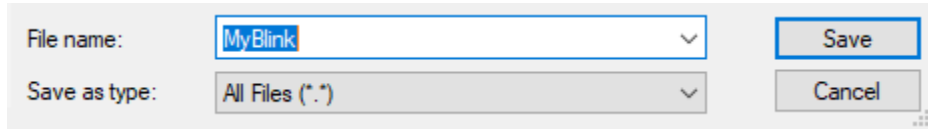
The breadboard has metal bars at its back to connect the slots in rows or columns in the pattern below, so that the components (wires, LED, resistor, and Arduino board) can be connected to build a closed-loop circuit.



The important thing here is to put the wires and the legs of the components into the proper slots on the breadboard and place the LED with the longer leg on the right. You can use different colors of the wires or the LED. In the diagram above, the wire on the right is between Pin #5 and a slot on the breadboard. The wire on the left is between GND (which means ground) and another slot on the breadboard.

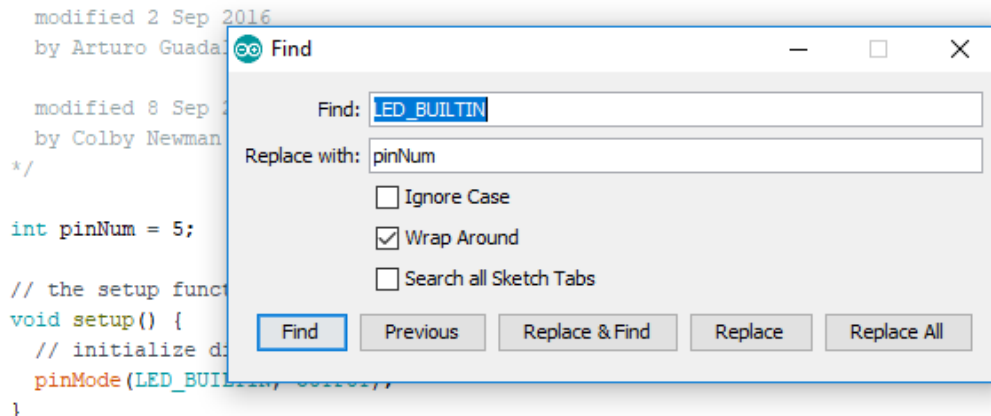
Step 4: Upload a program to drive the circuit you build

Log onto the computer (using the password in Step 1) and see if the sample Blink sketch (we talked about it at Step 2) is still open in the Arduino IDE software. If it is open, resave the Blink sketch in another name, such as MyBlink, by clicking “File” -> “Save As ...”, and save it onto the desktop.



If you have closed the Blink sketch earlier, open it up as explained in Step 2, and resave it into MyBlink.

- (1) Type a sentence
Int pinNum = 5;
above the line of “void setup(){}”
- (2) Click the menu of “Edit” and scroll down to the third line from the bottom, click “Find...”, a window will pop up, as below:



- (3) Please type “LED_BUILTIN” in the top blank of “Find:” line
- (4) Type “pinNum” in the second blank of “Replace with:” line
- (5) Uncheck “Ignore Case” by using the left key of the mouse to click the default check mark there.
- (6) You will see that the window now looks like above, and then click the “**Replace All**” button, which is the last (the fifth from left, the first from right) button at the bottom.

The main text in your new sketch that is not gray will look like below:

```
int pinNum = 5;

// the setup function runs once when you press reset or power the board
void setup() {
  // initialize digital pin pinNum as an output.
  pinMode(pinNum, OUTPUT);
}

// the loop function runs over and over again forever
void loop() {
  digitalWrite(pinNum, HIGH); // turn the LED on (HIGH is the voltage level)
  delay(1000);                // wait for a second
  digitalWrite(pinNum, LOW);  // turn the LED off by making the voltage LOW
  delay(1000);                // wait for a second
}
```

Follow the steps of “Verify” and “Upload” as explained in Step 2, to upload this new sketch onto the Arduino board.

Step 5: Debug, if need to

Do you see your LED blinking at 1 second interval?

If yes, congratulations! You’ve made a new program!

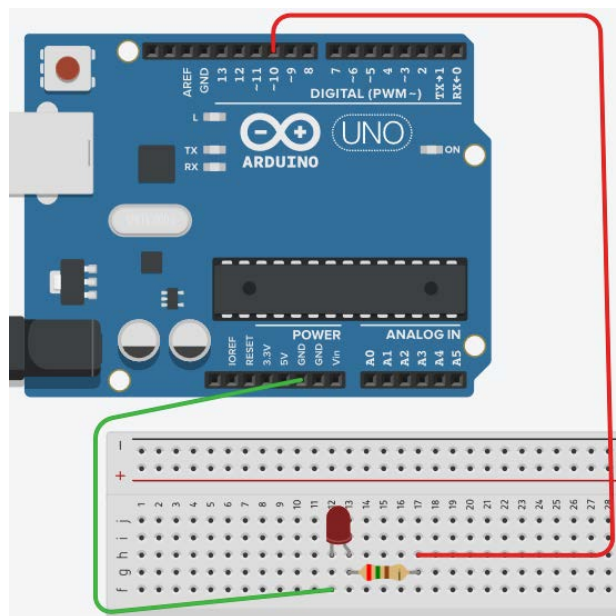
If not, please talk to any of us to find out the issue and we will make it work together.

Step 6: Play with the circuit and the program (called a sketch) with your variations

Okay, now you can take a moment to reflect on what you have achieved.

- (1) pinNum is the pin number that we specify on the Arduino board that connects to our circuit.

Question for you: If you move your wire to a new slot on the board (such as pin #10 as shown below, with everything else being unchanged), how would you change your sketch (the program we wrote in step 3) to make this LED still blink?



- (2) delay(1000) means that the action will take 1000 milliseconds (1 second is equal to 1000 milliseconds). digitalWrite(pinNum, HIGH) means that the pin will power up the LED circuit, while digitalWrite(pinNum, LOW) means that the pin will not be powered. Therefore, the blinking interval is 1000 milliseconds or 1 second.

Question for you: If you want the LED to blink faster, or the interval to be shorter, such as with an interval of 0.5 second, which is half of the interval below. How would you change your sketch (the program we wrote in step 3) to make this LED blink faster?

Step 7: Demonstrate and photo time!

We’d love to see what you built!