COSC 1000: Getting Started with Arduino

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Goals

- Familiarize yourself with:
  - Electronics
  - Installing tools on your labtop
  - Basics of programming in C
- Evaluation:
  - Based on two projects, the latter being completely up to you
    - But you will get proposals

Prerequisites

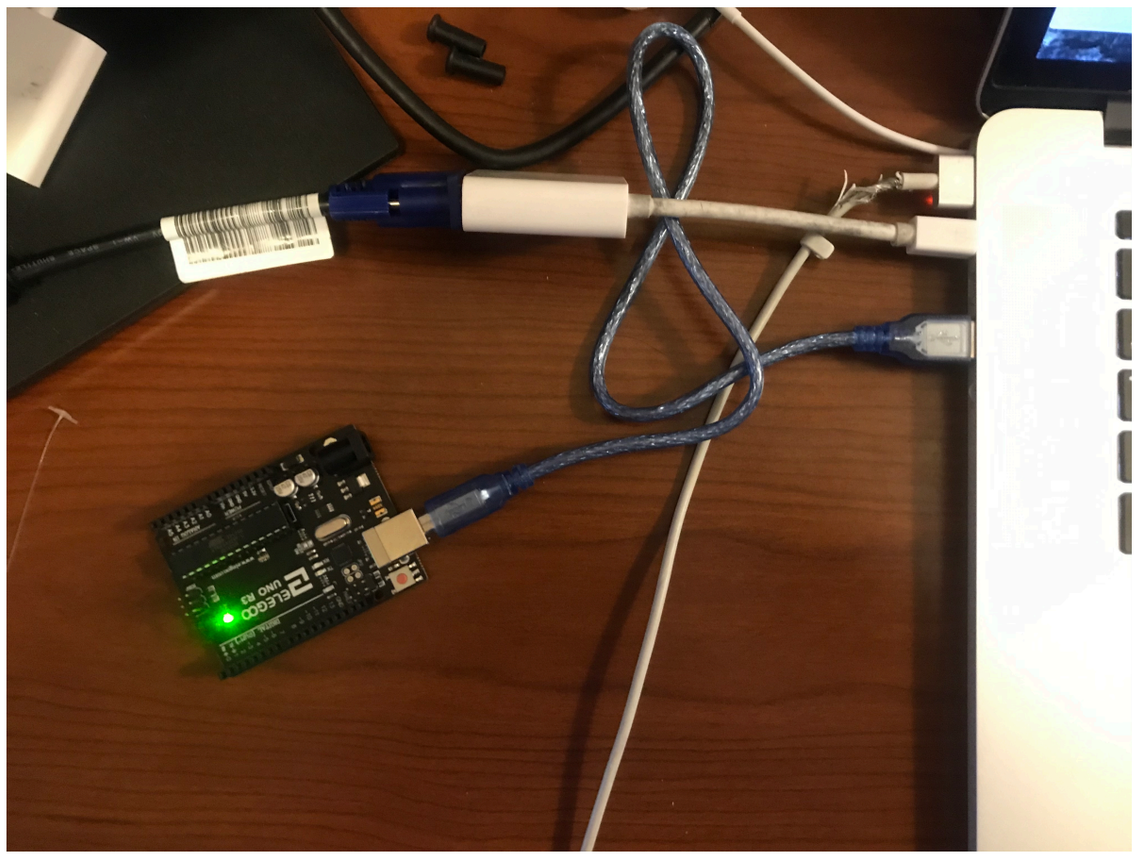
- Functioning Arduino:
  - Uno or Mega
  - Selection of Boards, wires, LEDS, …
    - e.g. from Elegoo, a set of cheap clones from China
    - e.g. from Arduino.cc itself

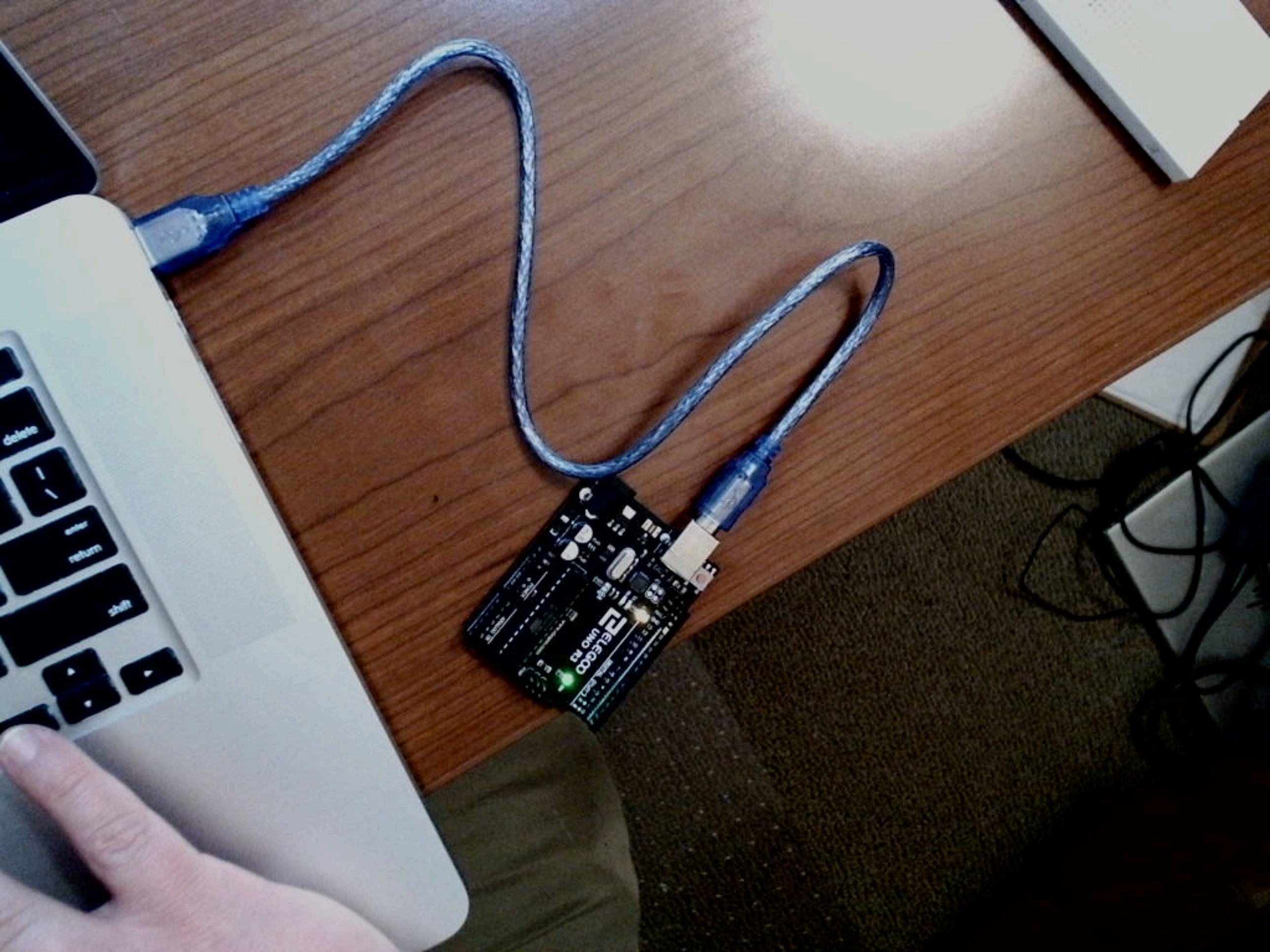
Getting Started with Arduino

- **Step 1**: Installing the Arduino software on your computer
  - This depends heavily on your computer
    - Go to the Arduino web-page
    - **Allow pop-ups**
    - Select your platform: Windows, Mac, Linux
    - Follow the instructions
      - You do not have to donate

Getting Started with Arduino

- Find the Arduino Uno board in your kit
  - Connect via the USB cable
    - If you have a Mac, you will need a USB to USB-C converter



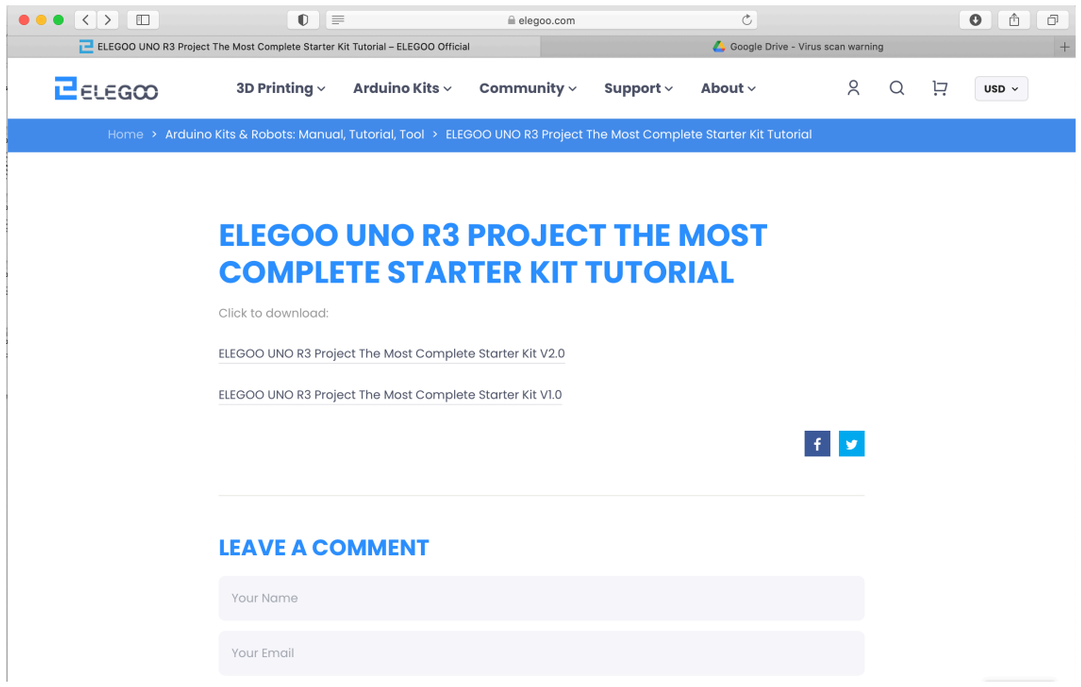

delete
enter
return
shift
ELEGOO
UNO R3

Getting Started with Arduino

- The Arduino is powered
  - either by the USB cable from your computer
  - The power source

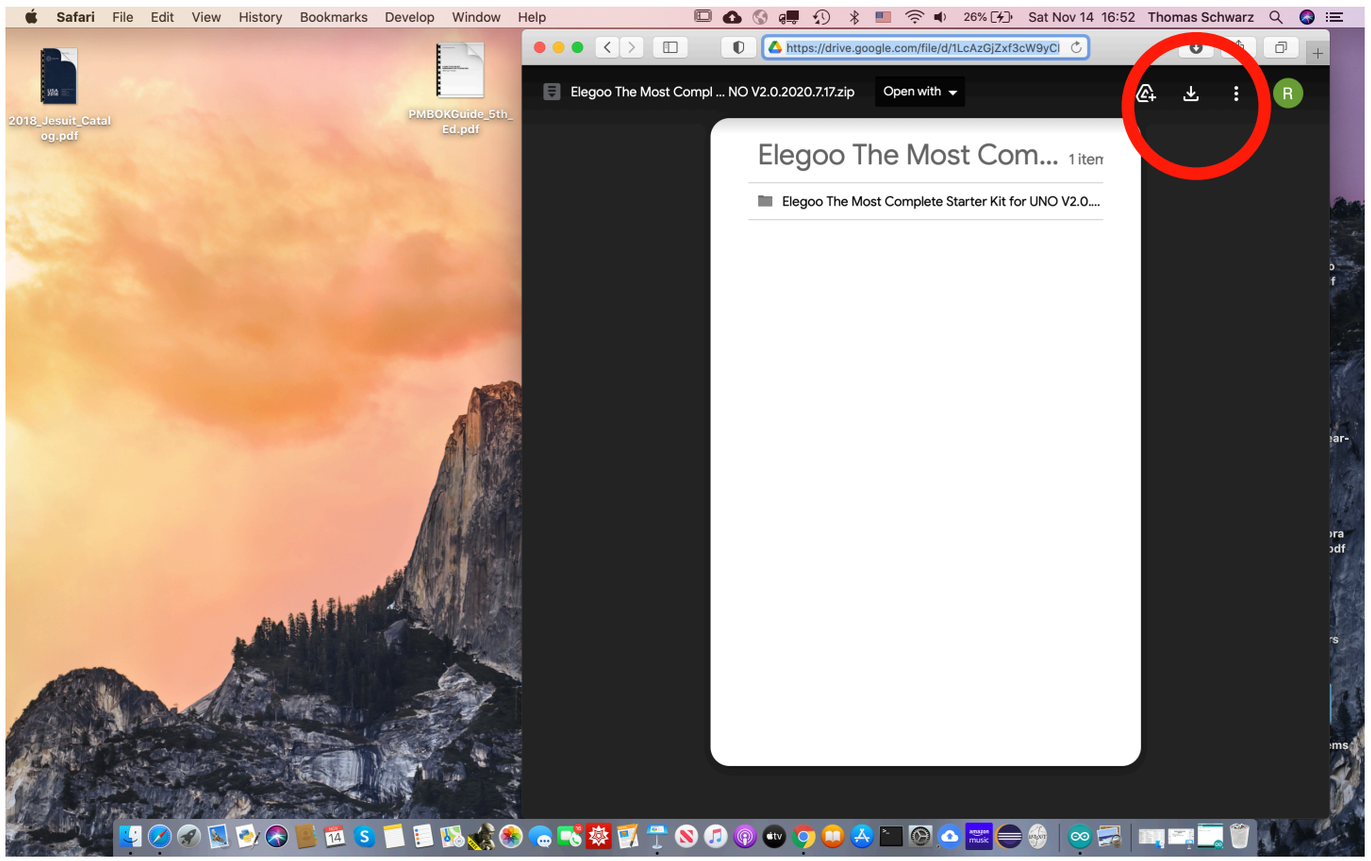
Getting Started with Arduino

- You can go to the Elegoo website and download the documentation
- Go to the page for your kit (under Robotics and Arduino)



Getting Started with Arduino

- Elegoo manual download
  - This will lead you to a google doc page
    - Use the download arrow on the top right
      - And forego virus checking on Google Drive

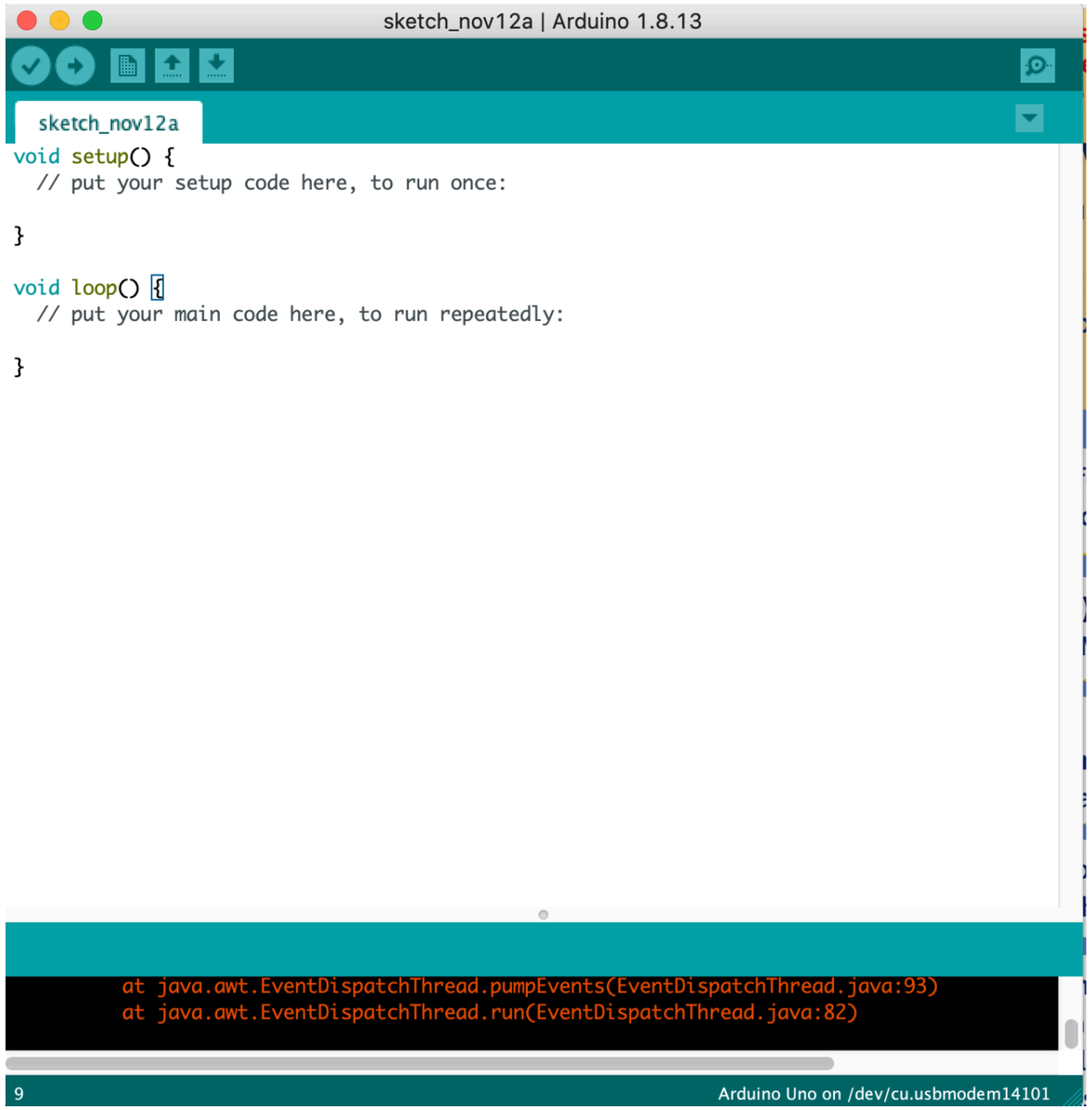


Getting Started with Arduino

- You will find the downloaded pdf in your download folder

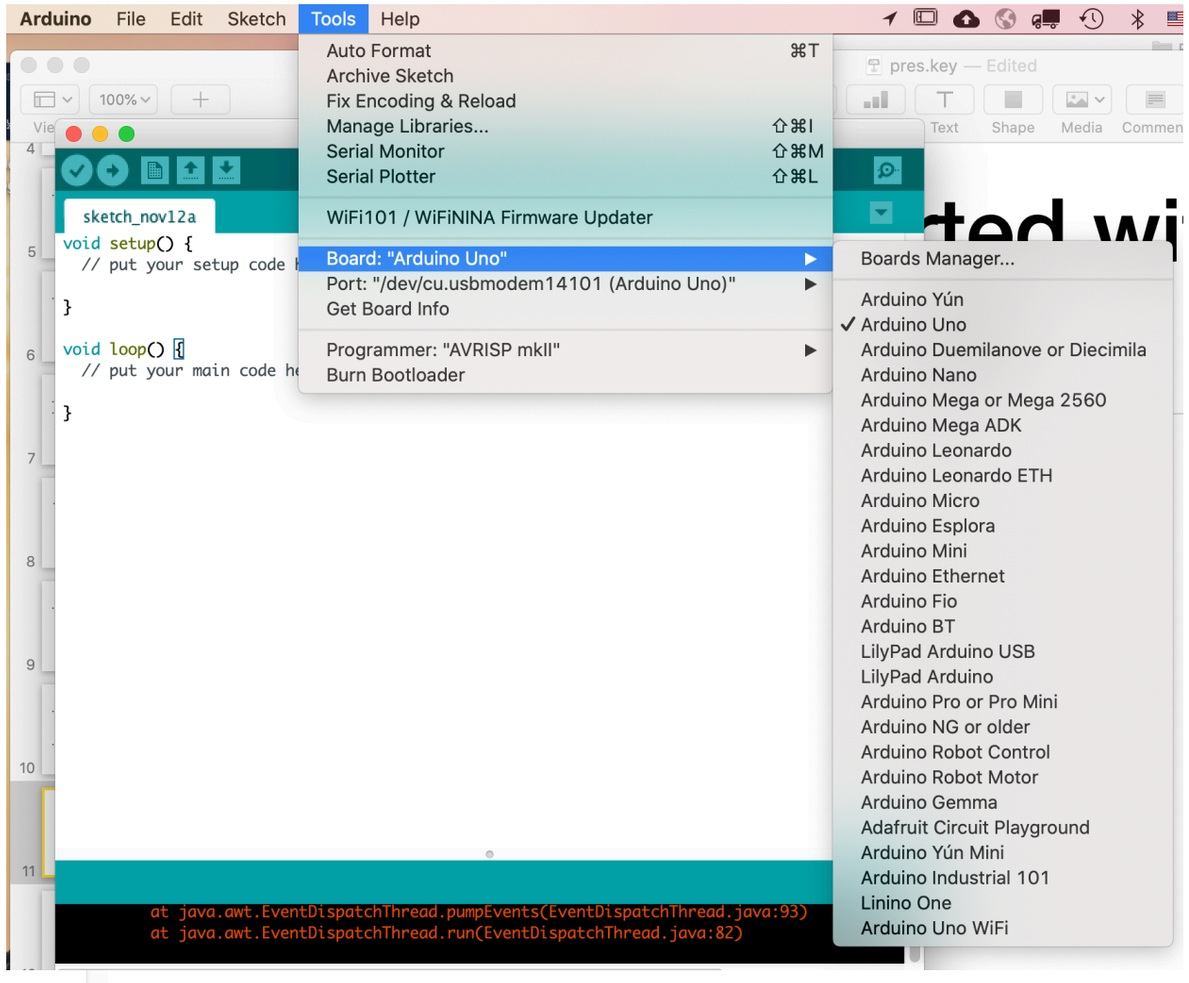
Getting Started with Arduino

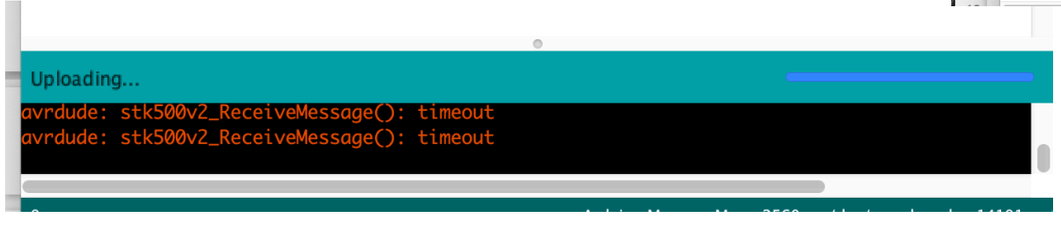
- Open up the Arduino IDE
  - This is how you program the Arduino
  - You then need to upload the program to the Arduino
- Default program:
  - The Arduino comes with a default program that blinks a yellow LED.



Getting Started with Arduino

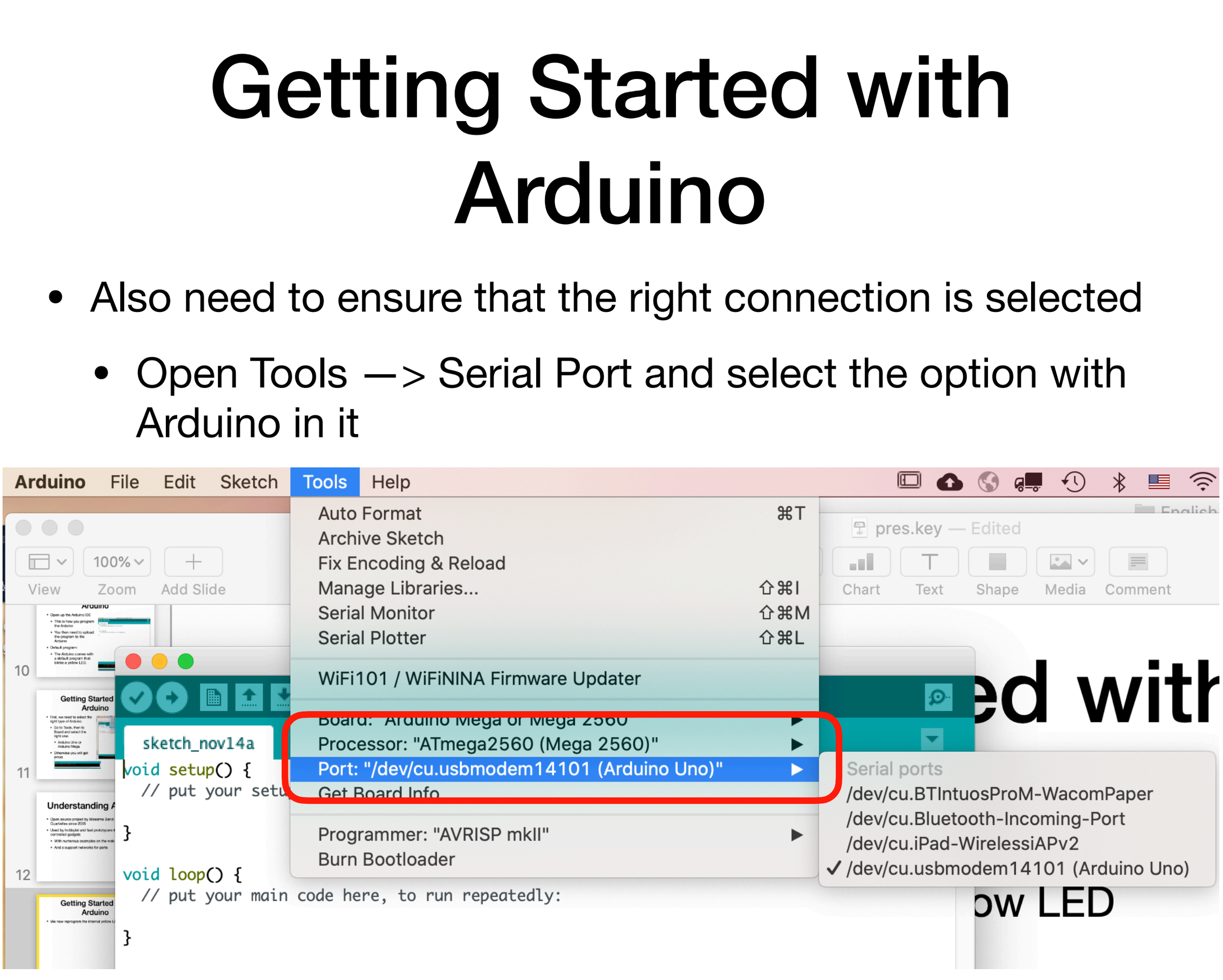
- First, we need to select the right type of Arduino
  - Go to Tools, then to Board and select the right one:
    - Arduino Uno or Arduino Mega
- Otherwise you will get errors





Getting Started with Arduino

- Also need to ensure that the right connection is selected
  - Open Tools —> Serial Port and select the option with Arduino in it



Understanding Arduino

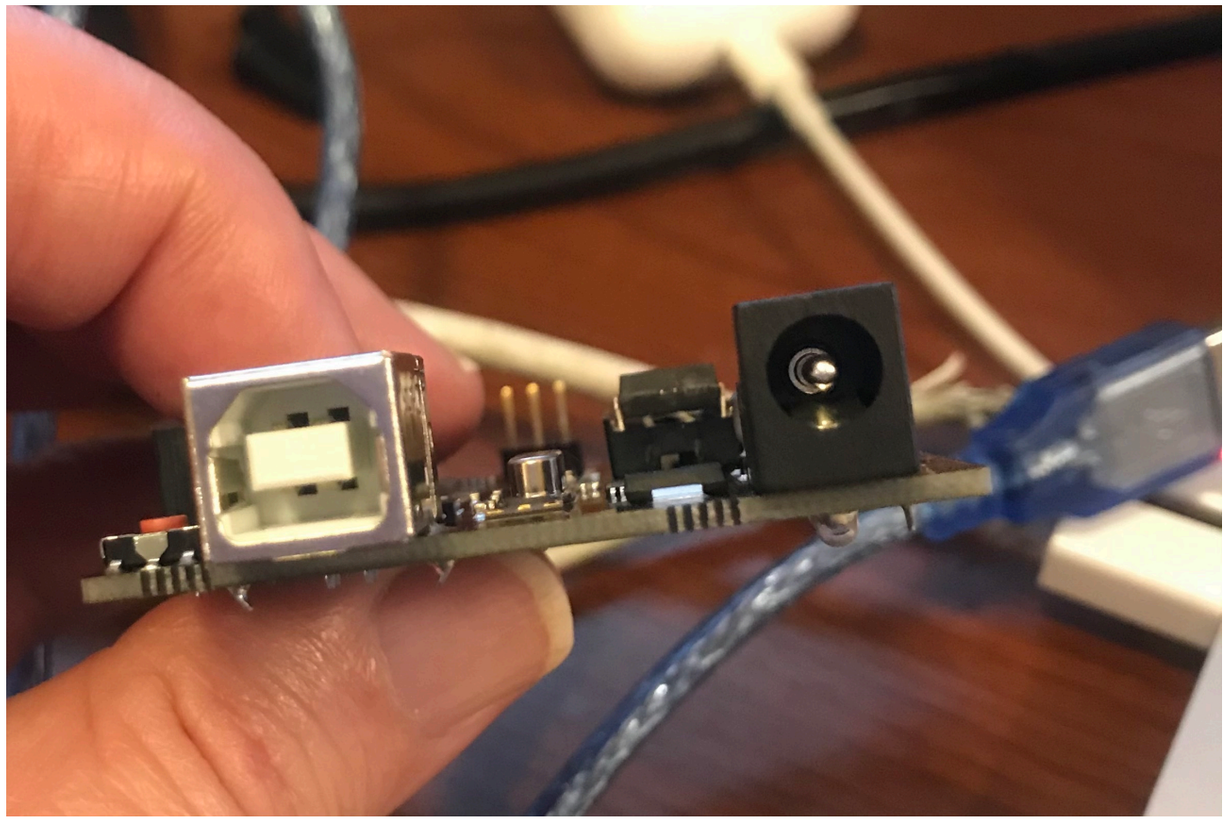
- Open source project by Massimo Banzi and David Cuartielles since 2005
- Used by hobbyist and fast prototypers to build digitally controlled gadgets
- With numerous examples on the web
- And a support networks for parts

Understanding Arduino

- Arduinos are built to interact with the environment
  - Can use a humidity sensor to warn that it is raining
  - Can detect light and change state because of it
  - ...

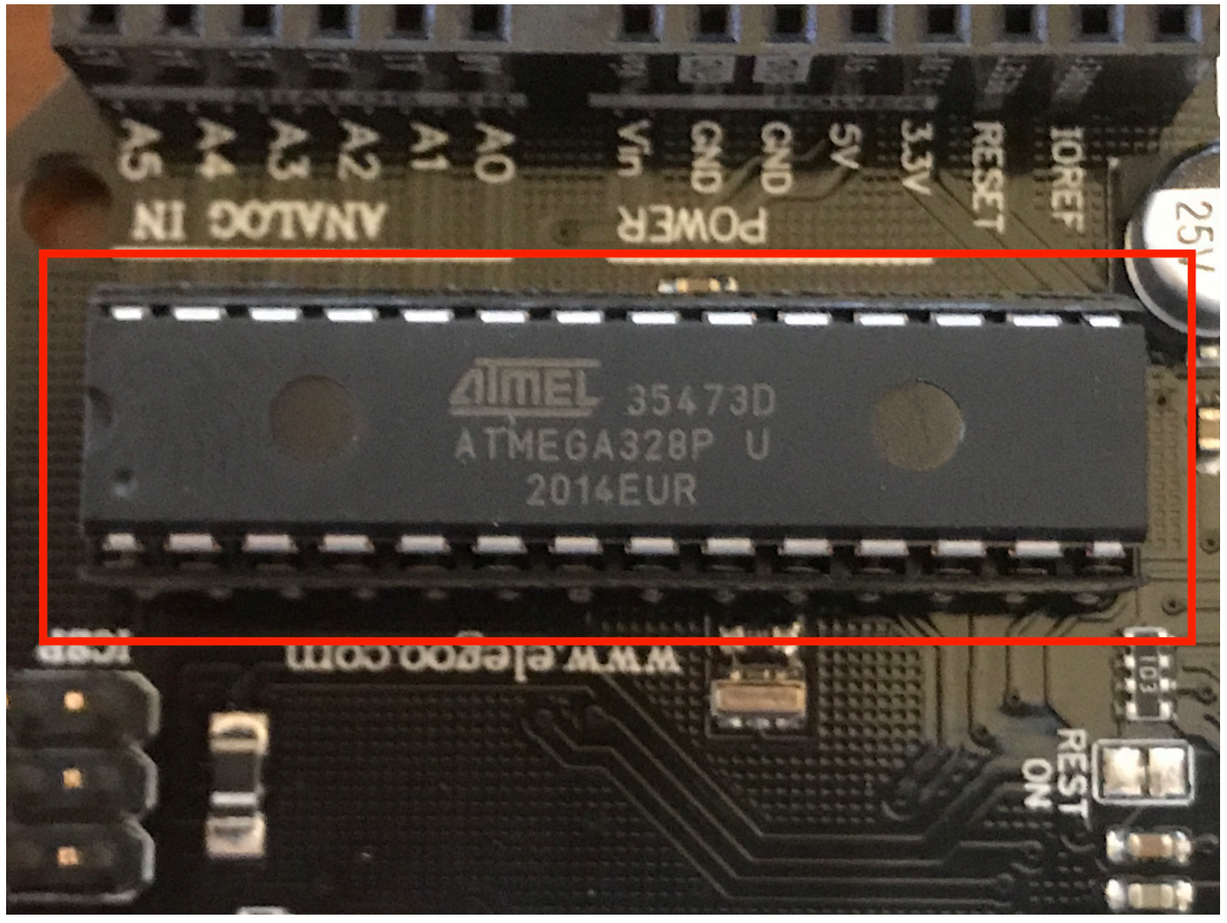
Understanding Arduino

- Arduinos come with
  - USB (left) and Power Connector (right)



Understanding Arduino

- Micro-controller
  - This is a “computer on a chip”

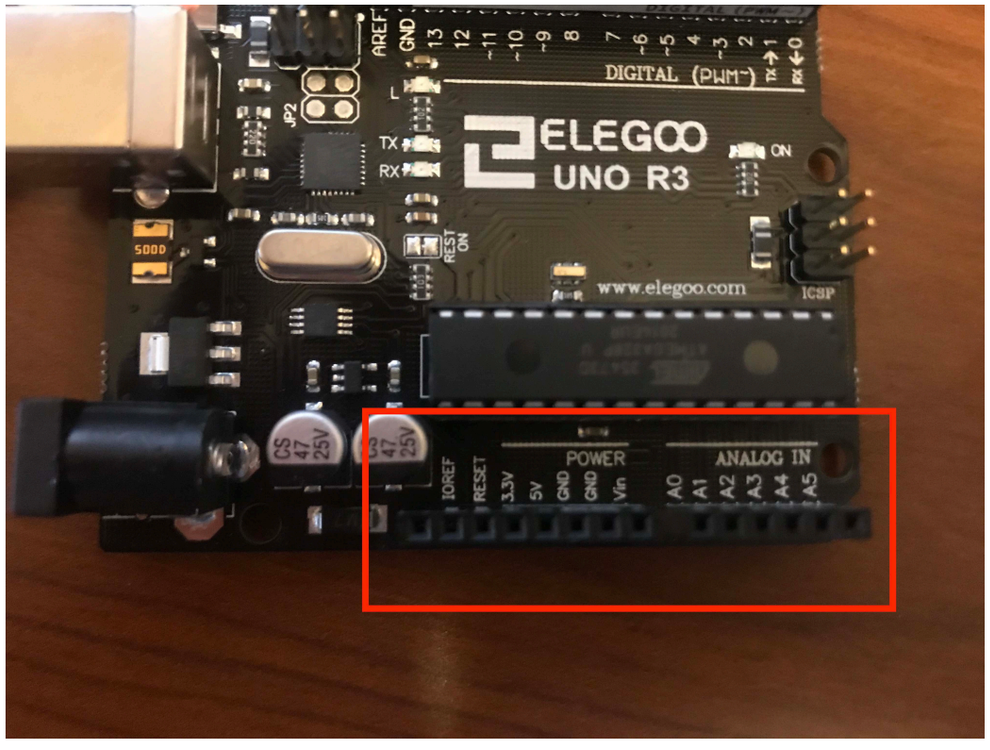


And now for something completely different

St. Xavier’s Ahmedabad, Gujarat

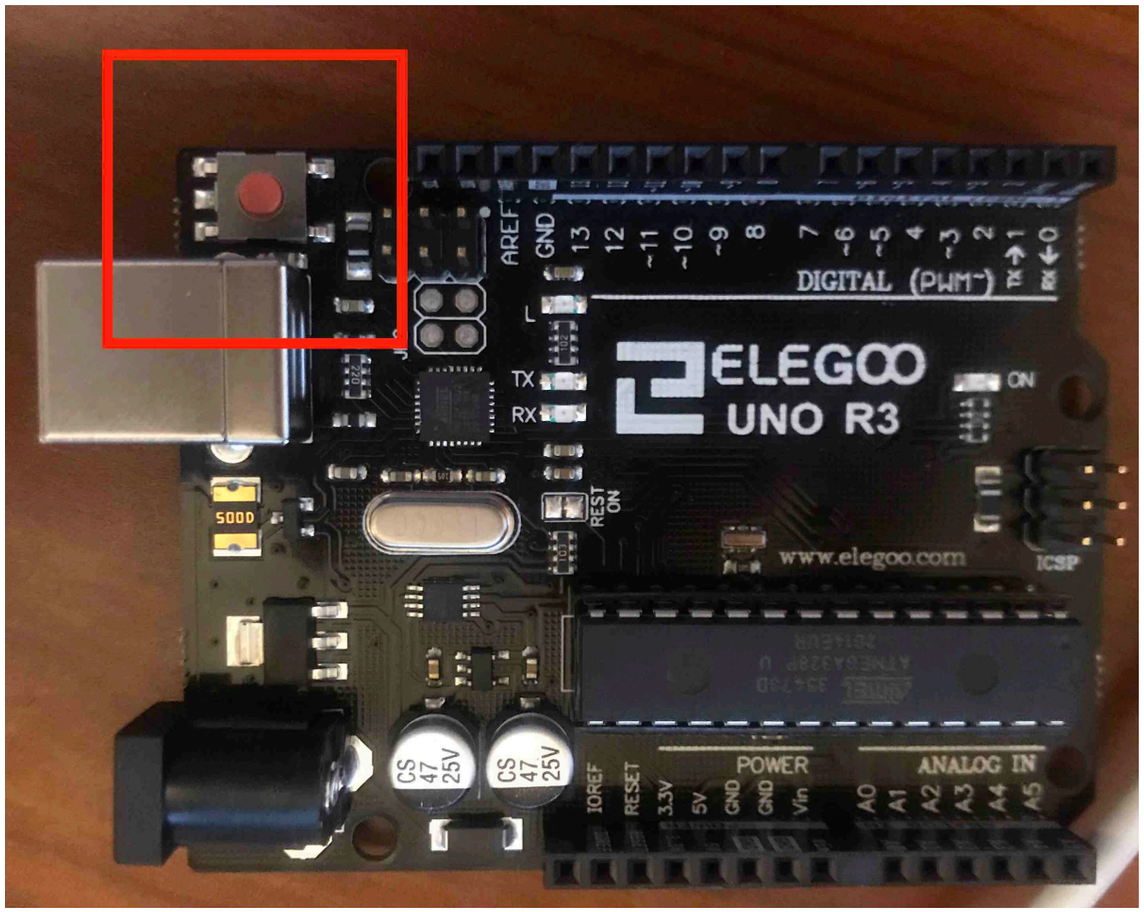
Understanding Arduino

- On the long edges, we have pins
  - Lower pins:
  - Left:
    - Power connections
    - Input for external reset button
  - Right:
    - Analog inputs



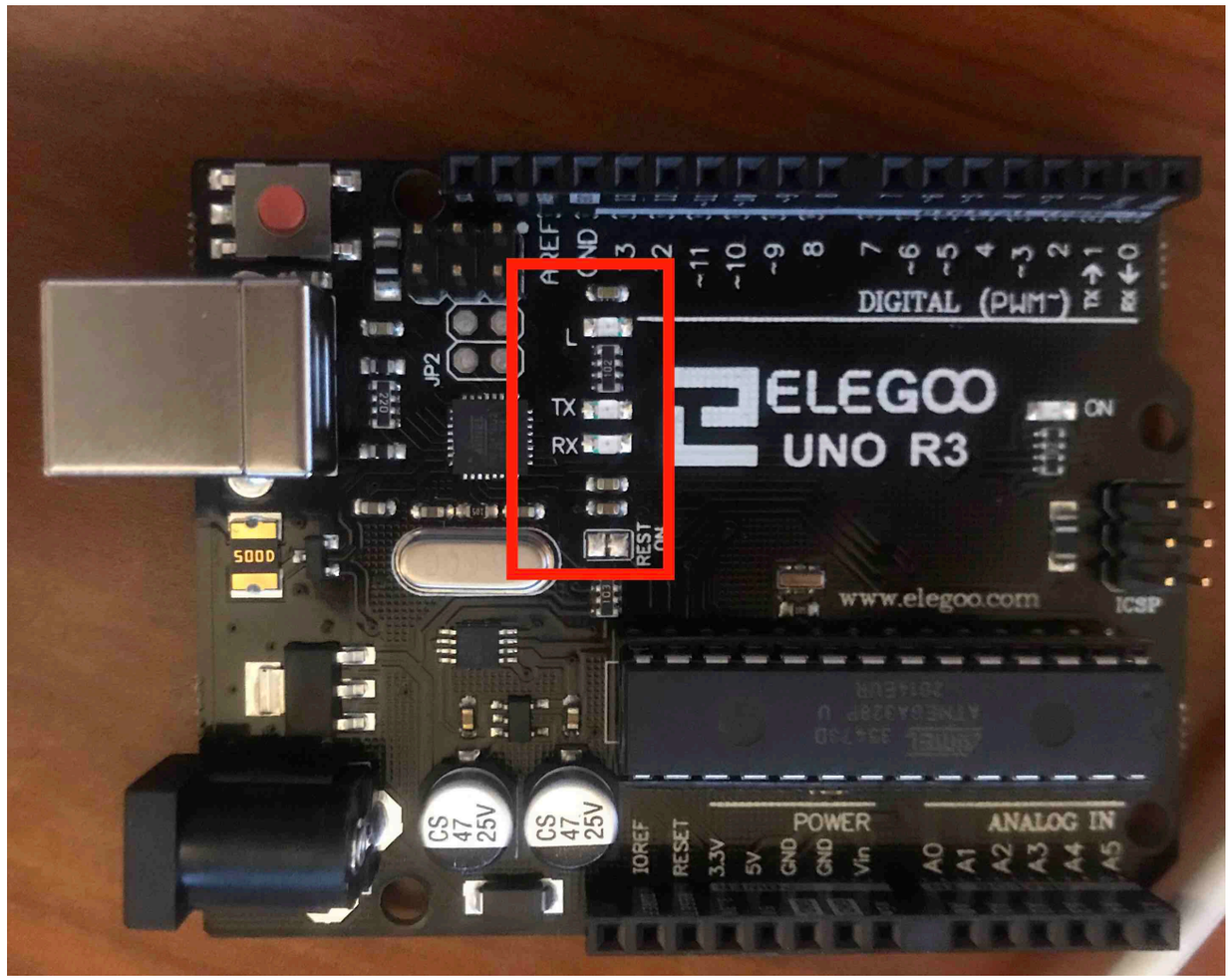
Understanding Arduino

- Upper left above USB connector:
  - A brownish reset button



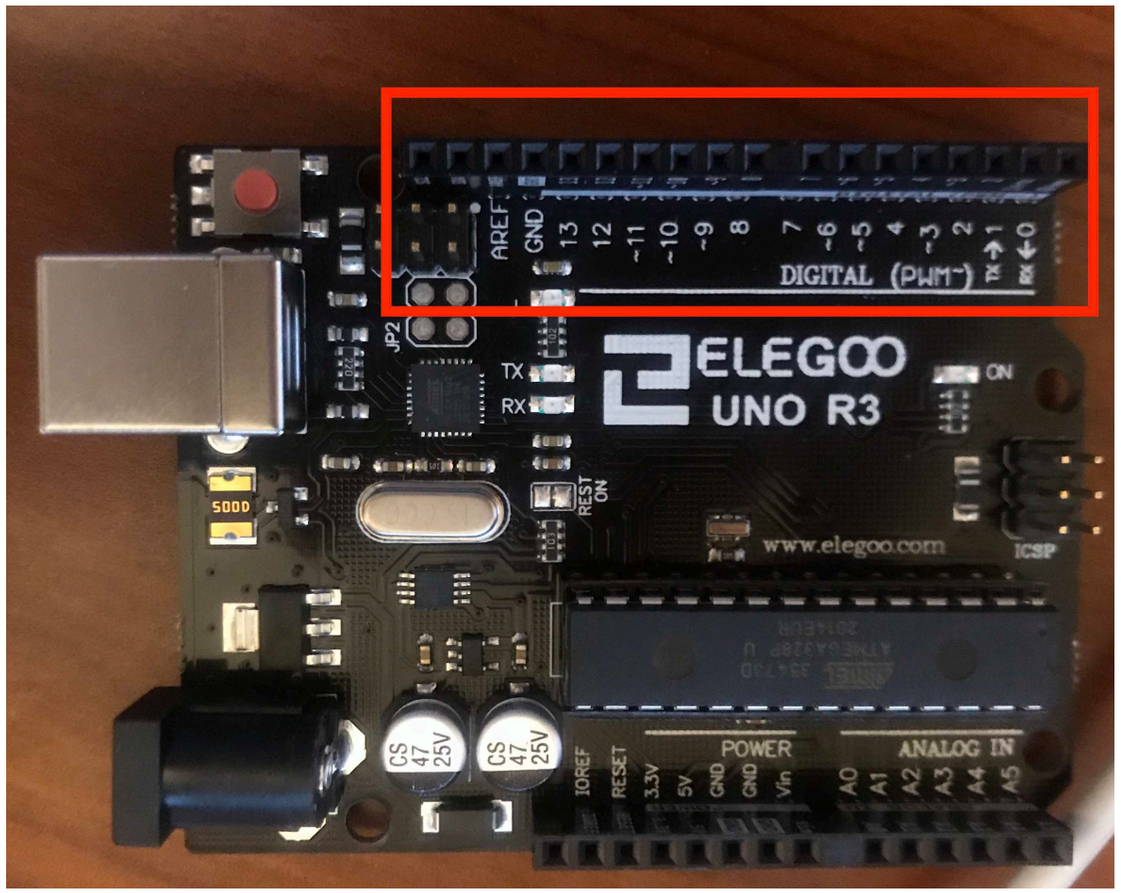
Understanding Arduino

- Three Light Emiting Diodes (LED)
  - TX, RX light up when data is transmitted
  - L LED is controlled by programmer
- There are some components to the left to control the USB port
- To the right, there is a green ON LED that blinks if the Arduino has power



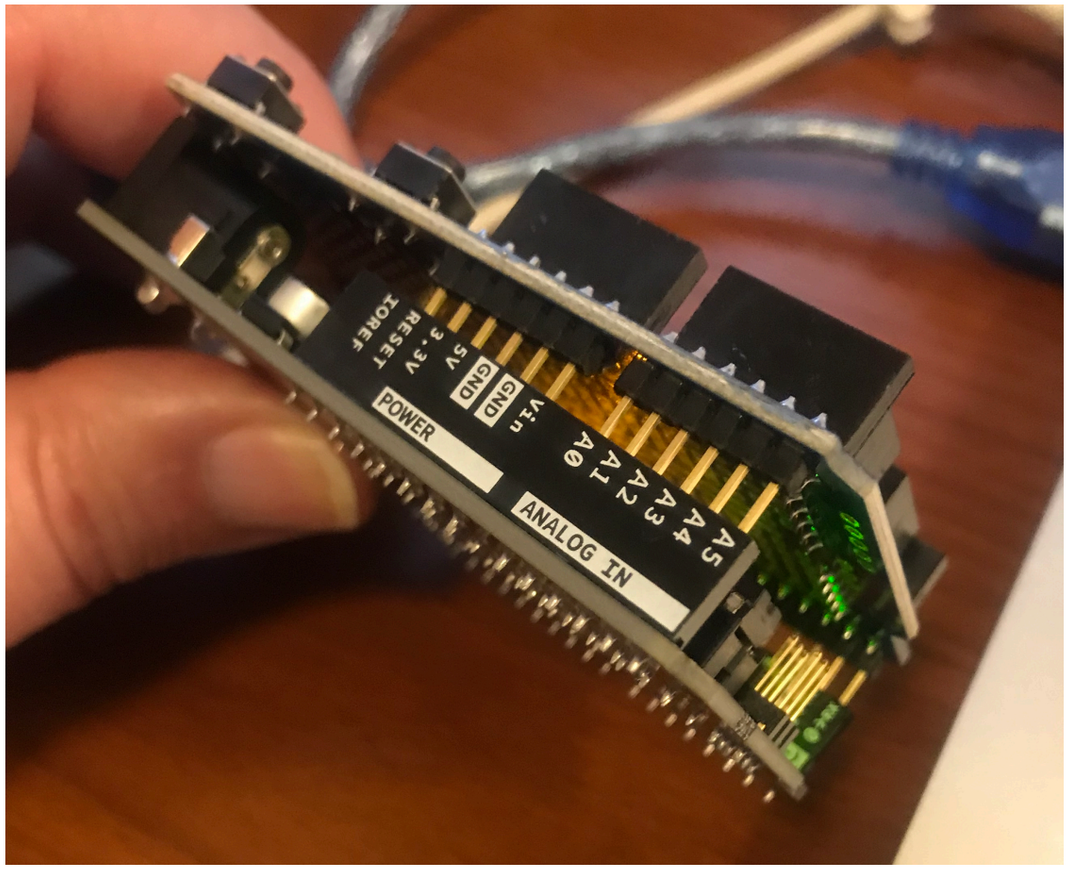
Understanding Arduino

- Upper row contains pins
  - Sockets (pins) 0-13 are digital input/ output (I/O) pins
  - Can detect whether an electrical signal is present or can generate a signal
  - Pins with a tilde ~ can generate varying electrical signals



Understanding Arduino

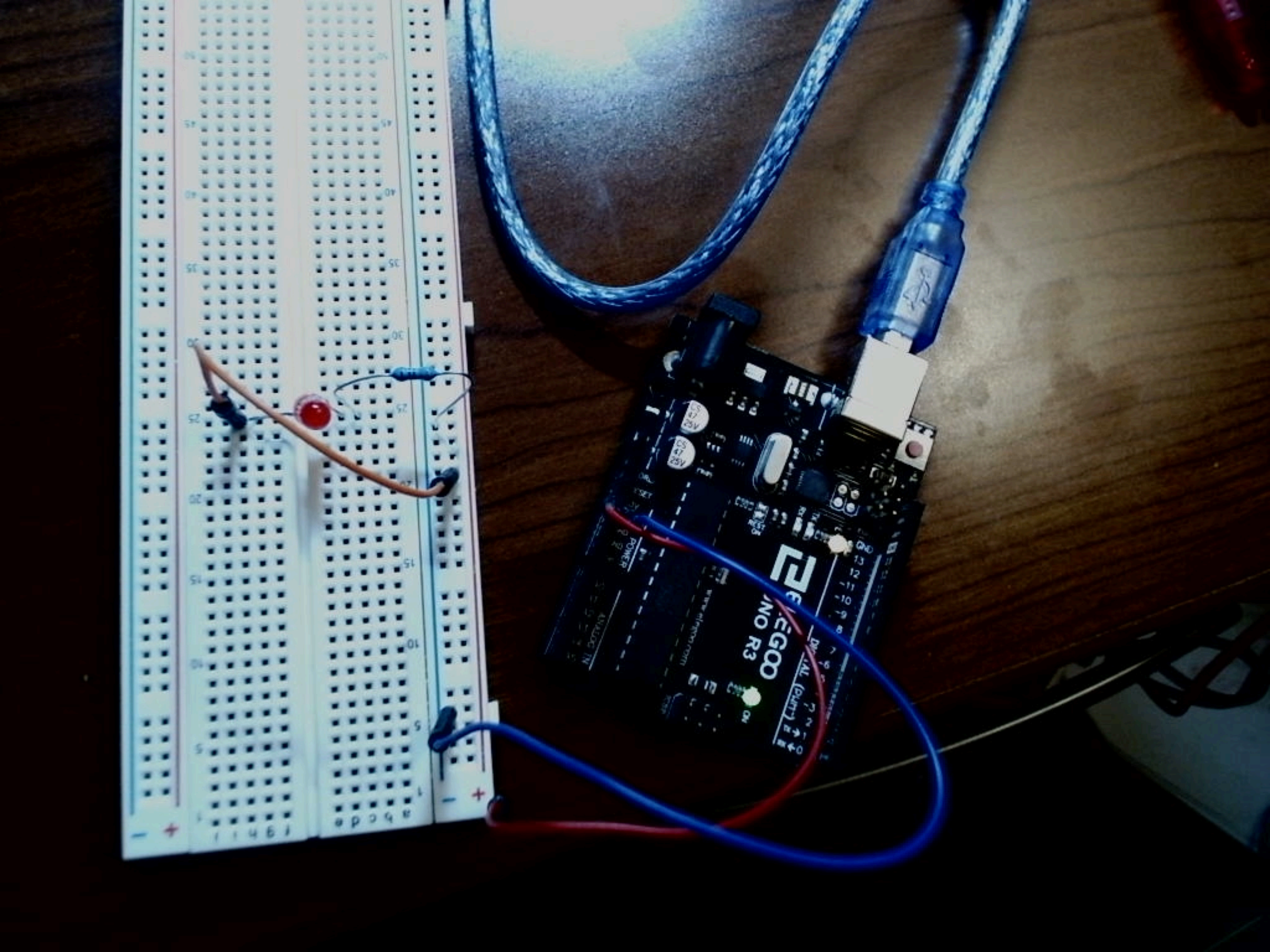
- Shields:
  - You can buy shields that connect to all pins
  - A shield comes with copper pins that need to be inserted completely into the Arduino
  - The Elegoo kit has a “prototype shield”, but you can get ethernet shields, … to connect to the internet, …
  - A shield has the same type of outputs on its top

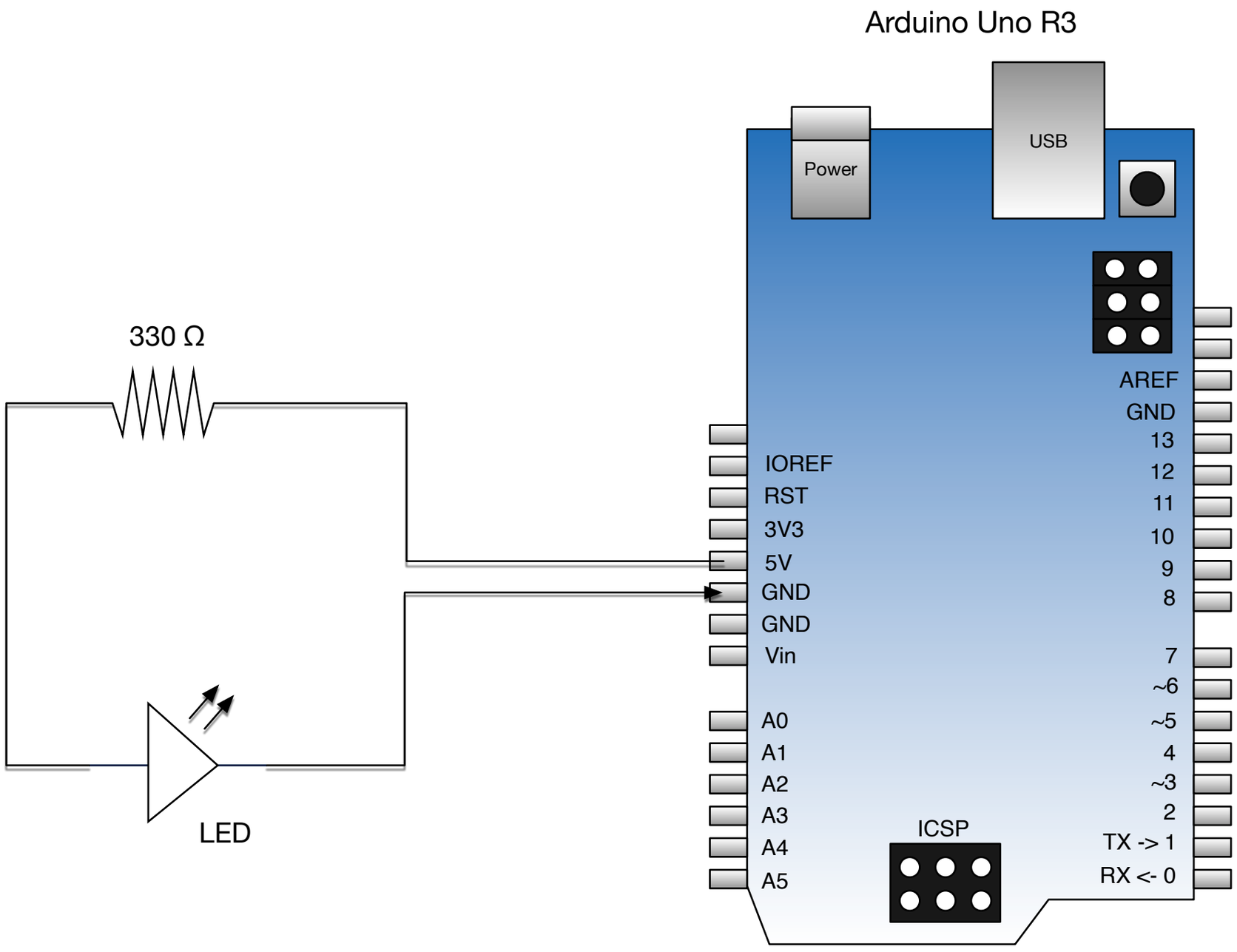


Partially inserted shield showing the copper pins.

Understanding Arduino

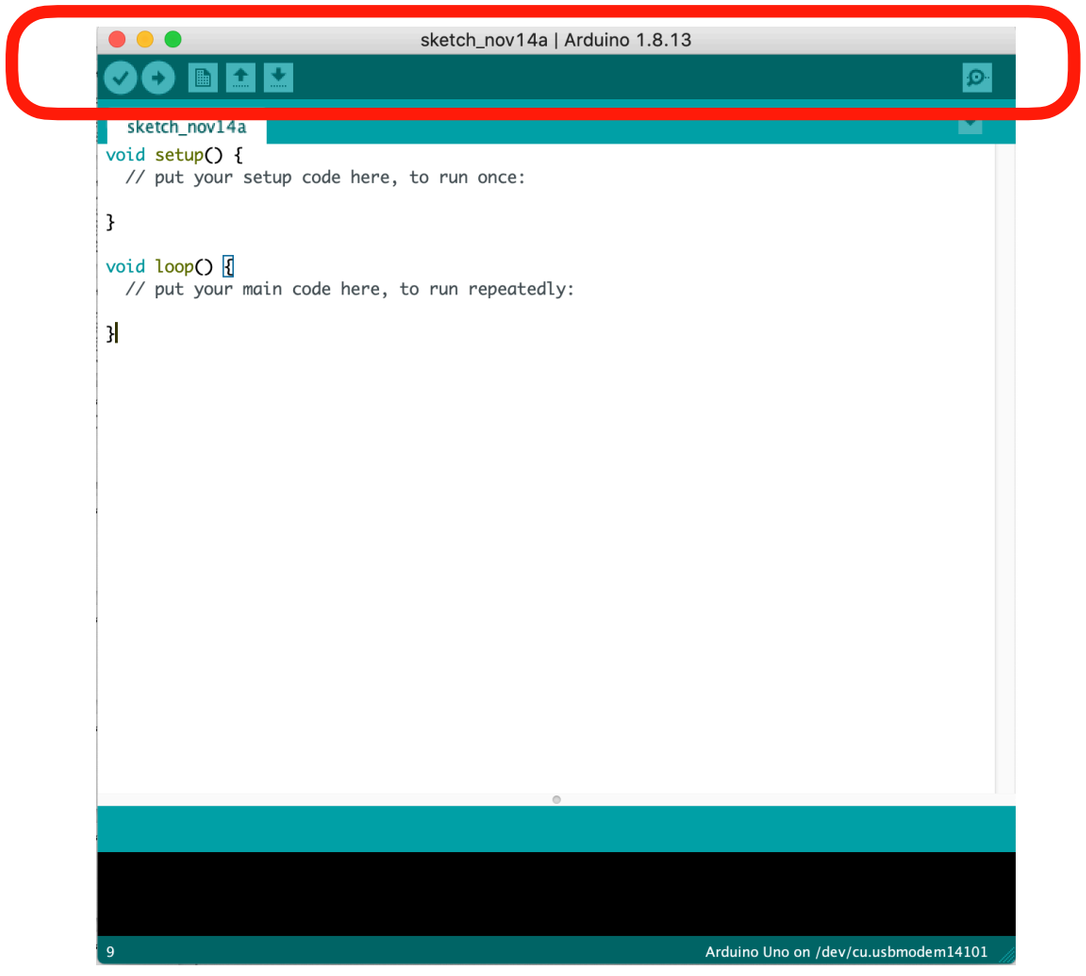
- We can use the power supply to set up our first circuit
  - We let a LED shine
  - CAUTION: We need to limit current between power and ground
  - We do this by using a resistor.
  - Take out the breadboard, a LED and a 330Ω resistor
  - Bread-board has horizontal wiring on the inside and vertical wiring on the outside
  - Connect - to ground, + to Power


POWER
GND
ON


Arduino Uno R3
USB
Power
330 Ω
AREF
GND
13
12
11
10
9
8
7
~6
~5
4
~3
2
TX -> 1
RX <- 0
IOREF
RST
3V3
5V
GND
GND
Vin
A0
A1
A2
A3
A4
A5
ICSP
LED

Understanding the IDE

- Arduino comes with an Integrated Development Environment
  - A program used to write the software for your Arduino



Command Area

Title Bar,
Menu Items (in a Mac on top of screen)
Icons

Understanding the IDE

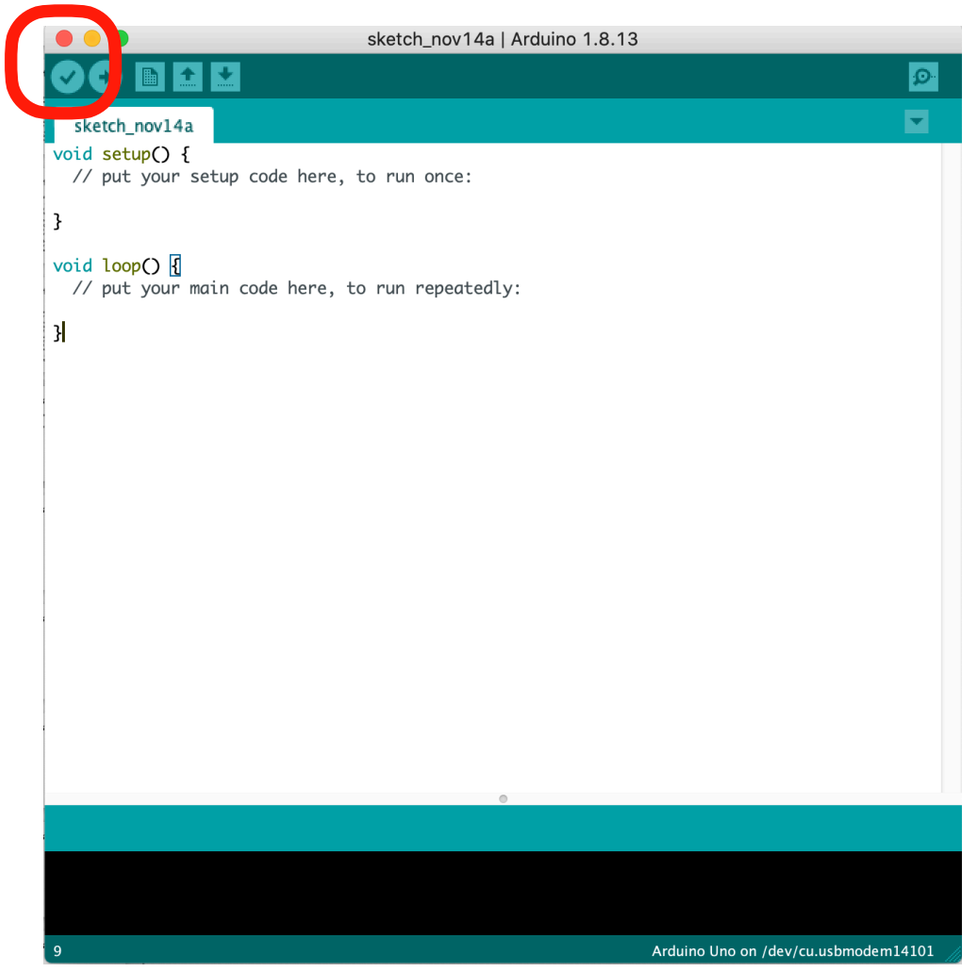
- To create a program
  - Write the program in the sketch area
    - Need to provide a set-up function
      - Runs only once, at the beginning
  - Should provide a loop function
    - Executed over and over again

Understanding the IDE

- Programming language is C
  - Statements are separated by semicolons;
    - Usually consists of function calls
      - delay, digitalWrite
      - Which have parameters:
        - delay: an integer indicating the number of milliseconds
        - digitalWrite: pin number and type of output:
          - HIGH / LOW

Understanding the IDE

- After writing the program:
  - Verify using the checkmark button
  - If something goes wrong:
    - Study the error message carefully

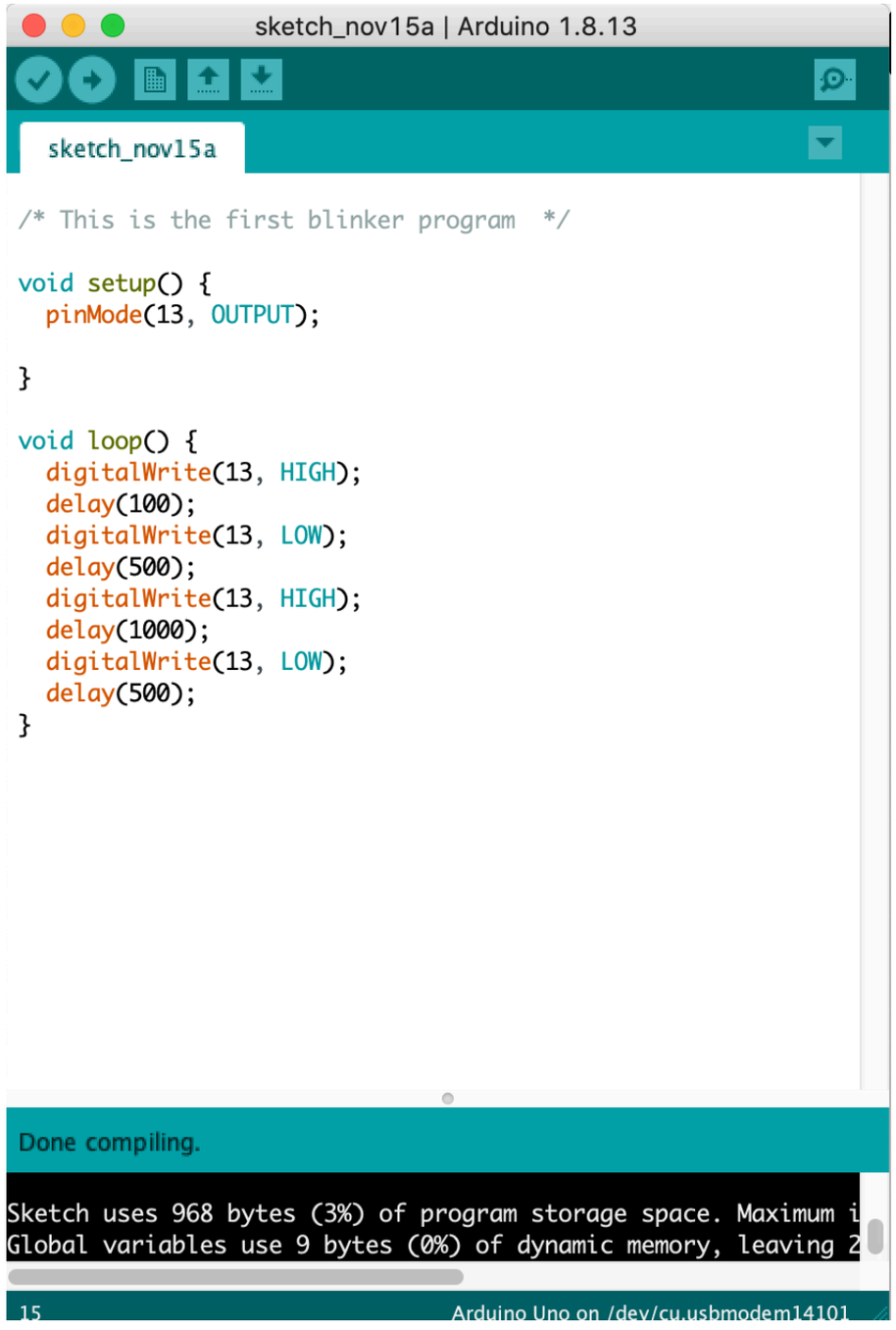


Understanding the IDE

- The offending line of code is high-lighted
- The status-window below shows the error
- I should have used HIGH instead of High

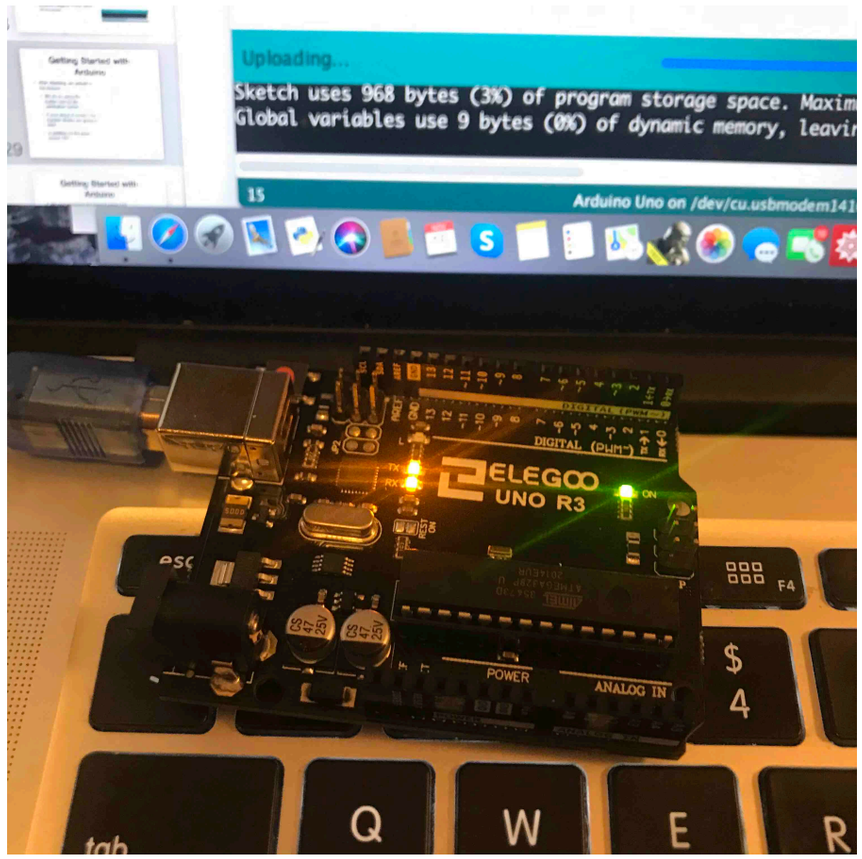
Understanding the IDE

- Let's try it out
- First line is a comment
  - Indicated by /* … */
- setup:
  - We declare to Arduino how to treat PIN 13
    - (The built-in LED)
- loop:
  - We put voltage on 13, then wait for 1/10 of a second
  - We remove voltage on 13, then wait for 1/2 of a second.
  - …



Getting Started with Arduino

- After checking, we upload to the Arduino
  - We do so using the —> button next to the verification button
- If your setup is correct, the transfer diodes are going to blink
- In addition to the green power LED



Getting Started with Arduino

- We have reprogrammed the internal yellow LED
  - And the Arduino starts executing your program
  - You will find it blinking