ARDUINO WORKSHOP

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STEM PREP-SPECIALIST

WEST BOUNTIFUL ELEMENTARY

GOALS FOR THIS WORKSHOP

- Conquer our fears and learn something new

- Microcontrollers
  - What are they and what do they do?
  - What are all these parts and components?
  - Make some simple circuits.

GOALS FOR THIS WORKSHOP

- Coding
  - What is coding and how much do I need to know?
  - Visual programming versus Arduino IDE.
  - Set up development environments.
  - Get some programs to run on our Arduino.

GOALS FOR THIS WORKSHOP

- Work through the challenges that came with the Arduino kits.
- Combine your circuit skills and your coding skills to upload and run programs on your Arduino.
  - Work in small groups and alone.
  - Be able to explain what you're doing.
  - Take notes and fill out wiring diagrams and schematics for each challenge.
- Use the Air Quality Sensor.

NOTES AND THINGS

You will get a link to a shared OneDrive containing my notes, files, and PowerPoint presentation for this class, including a full sheet of resources on the web.

Taking notes and filling out worksheets later on... I promise it's not busy work, it really will help you retain what we learn and enable you to recreate your work later.

AN ARDUINO IS A MICROCONTROLLER

A microcontroller is a circuit board that has a programmable chip on it.

By itself, a microcontroller is capable of:

1. Doing some basic math
2. Reading an input
3. Setting an output.

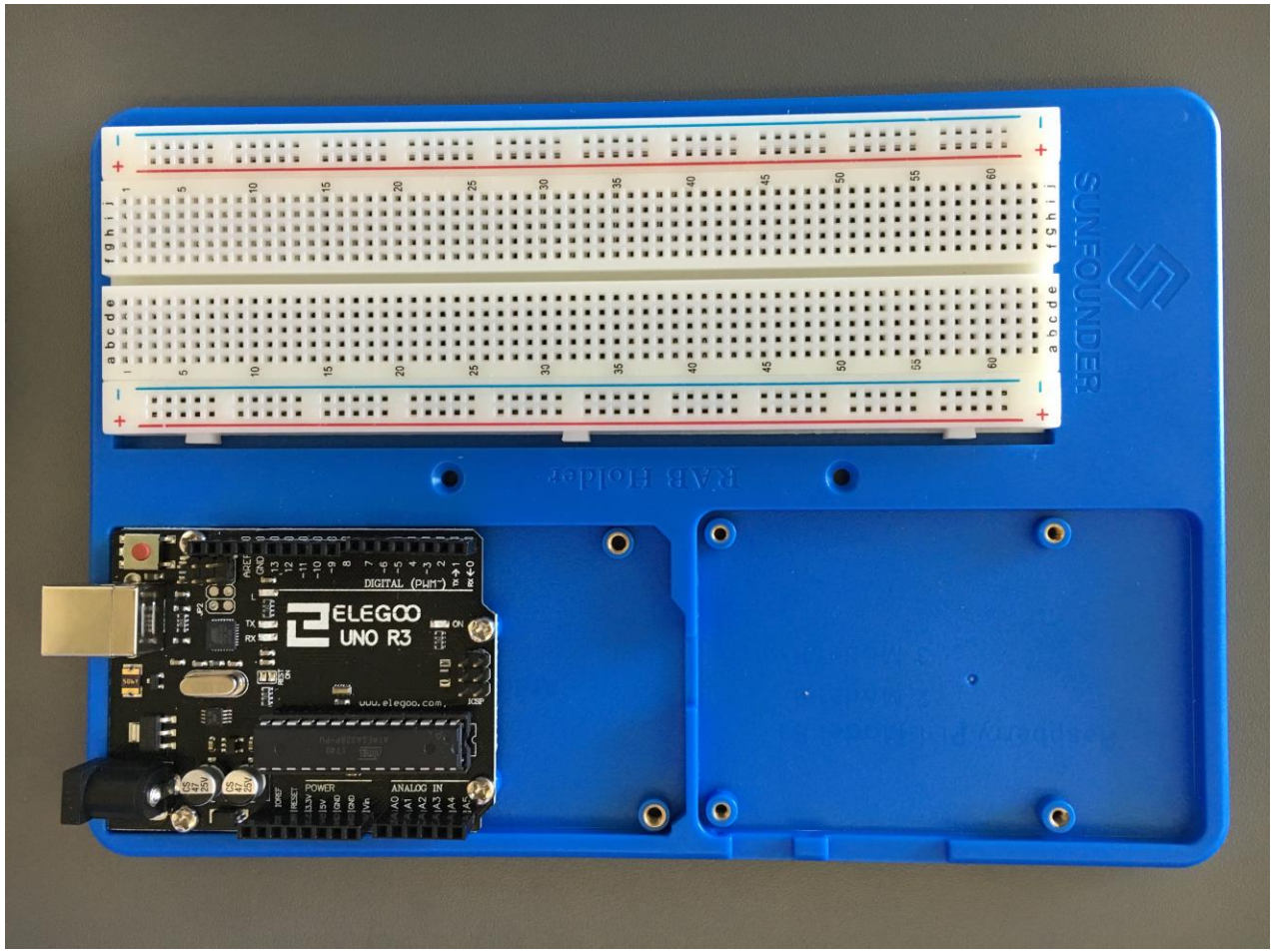
MICROCONTROLLERS IN REAL LIFE

Microcontrollers are designed to perform a specific task.

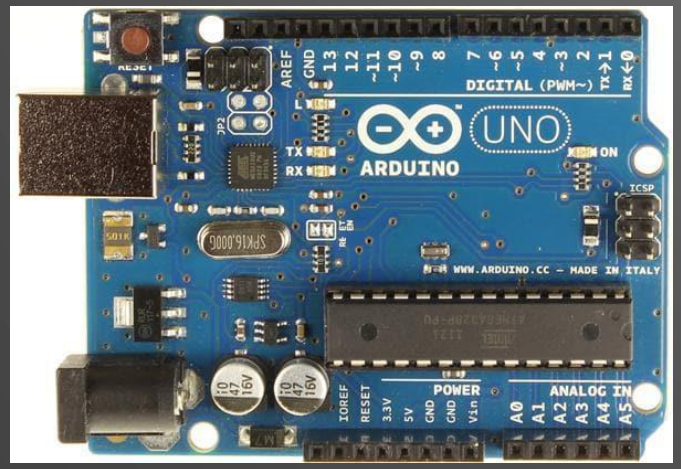
Found in: keyboard, computer mouse, washing machine, remote control, microwave, car, telephone, watch.

Not designed to hold an operating system.

LET'S OPEN THOSE KITS!



I don't have anything called "Arduino" in my kit...?



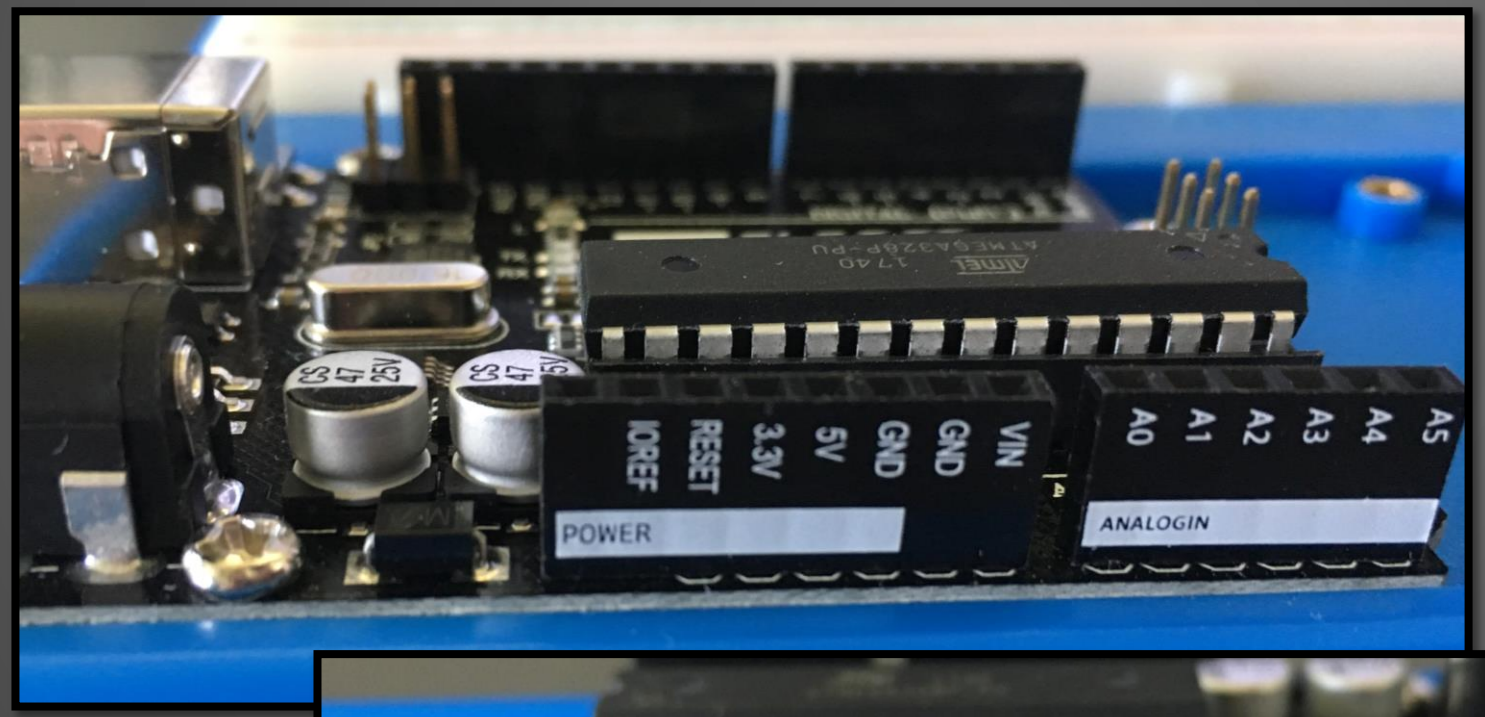
Arduino is an open-source technology. The plans are published under a Creative Commons license, so anyone is welcome to make and sell their own.

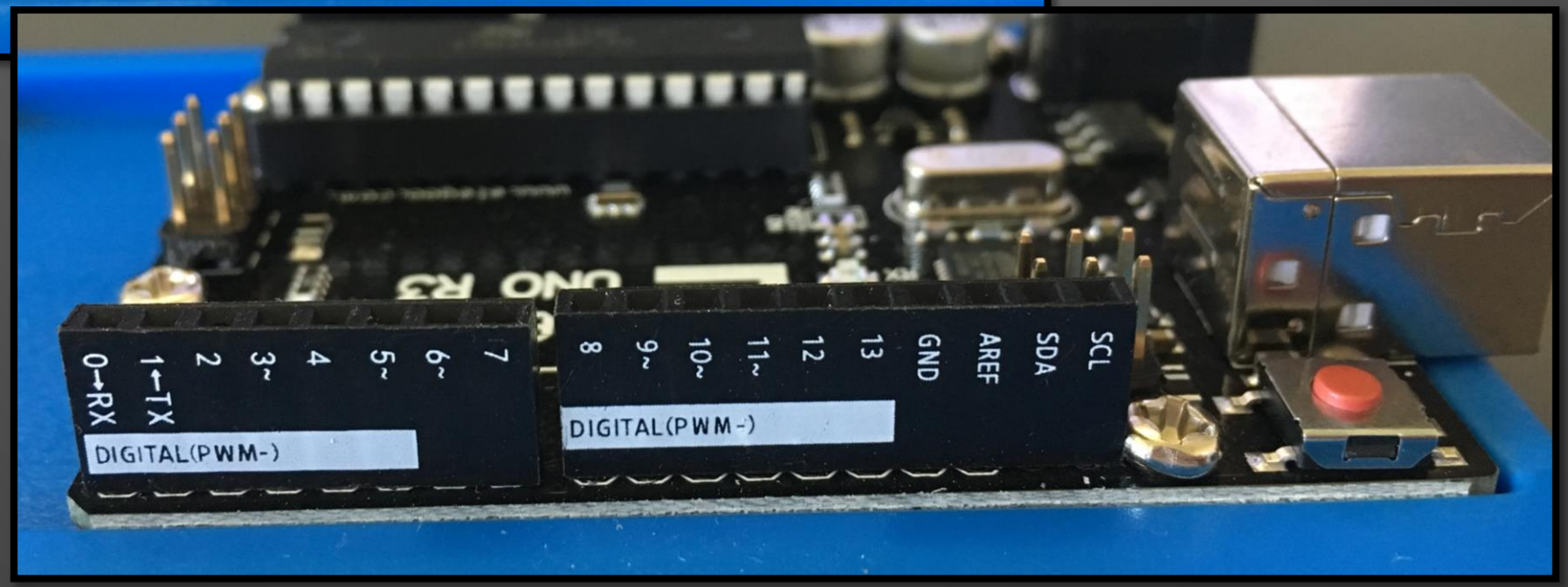
Parts:

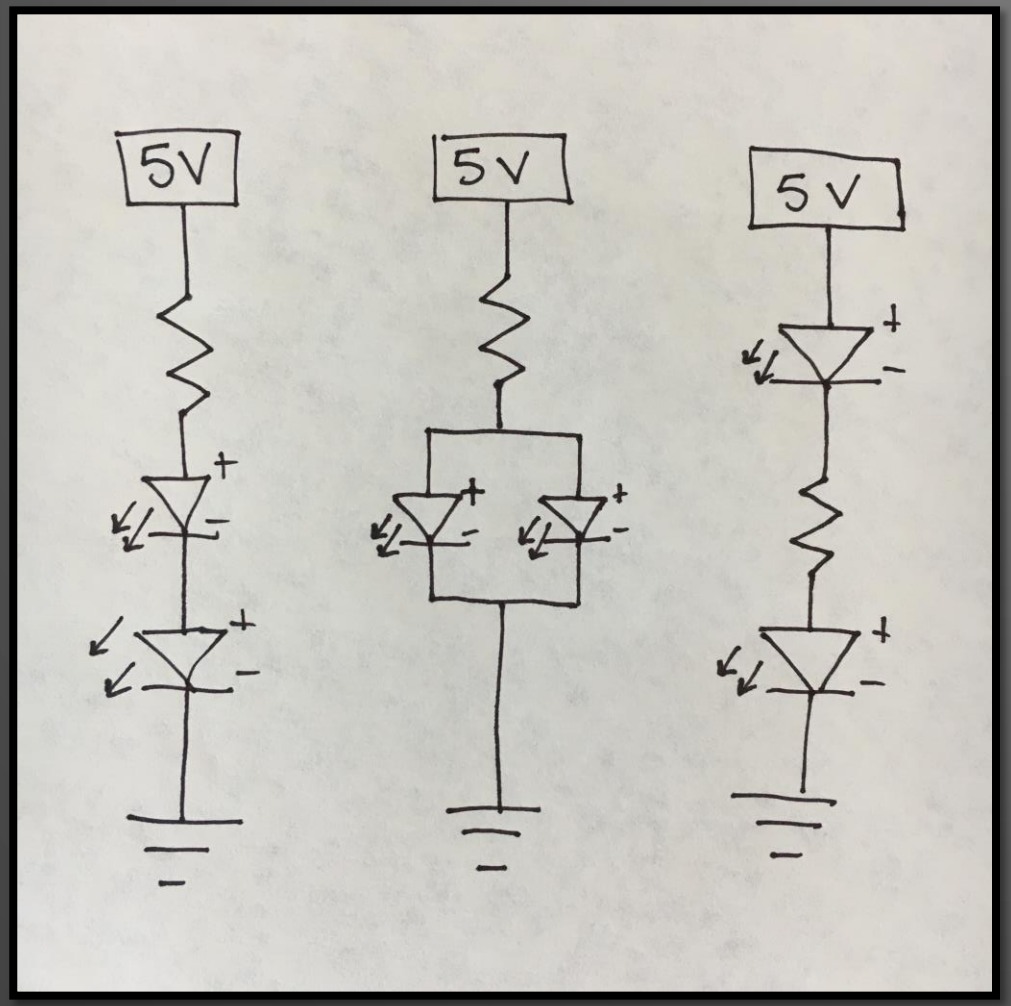
- Uno board
- Breadboard
  - http://safeyoutube.net/w/fNJd
  - https://learn.sparkfun.com/tutorials/how-to-use-a-breadboard
- Components
  - LEDs, resistors, jumper wires, button, slide switch, potentiometer...
- Multimeter
  - https://learn.sparkfun.com/tutorials/how-to-use-a-multimeter

Input versus Output

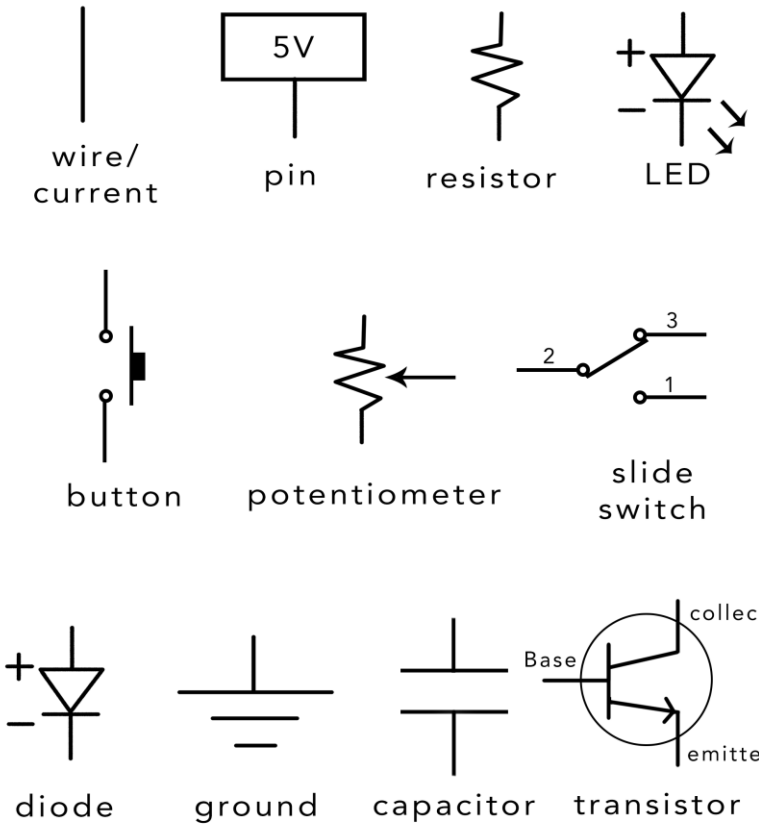
Which of these components do you think provide input? Which provide output?


IOREF
RESET
3.3V
5V
GND
GND
VIN
POWER
A0
A1
A2
A3
A4
A5
ANALOGIN


0→RX
1←TX
2
3~
4
5~
6~
7
DIGITAL(PWM-)
8
9~
10~
11~
12
13
GND
AREF
SDA
SCL
DIGITAL(PWM-)



Wiring Diagram Symbols

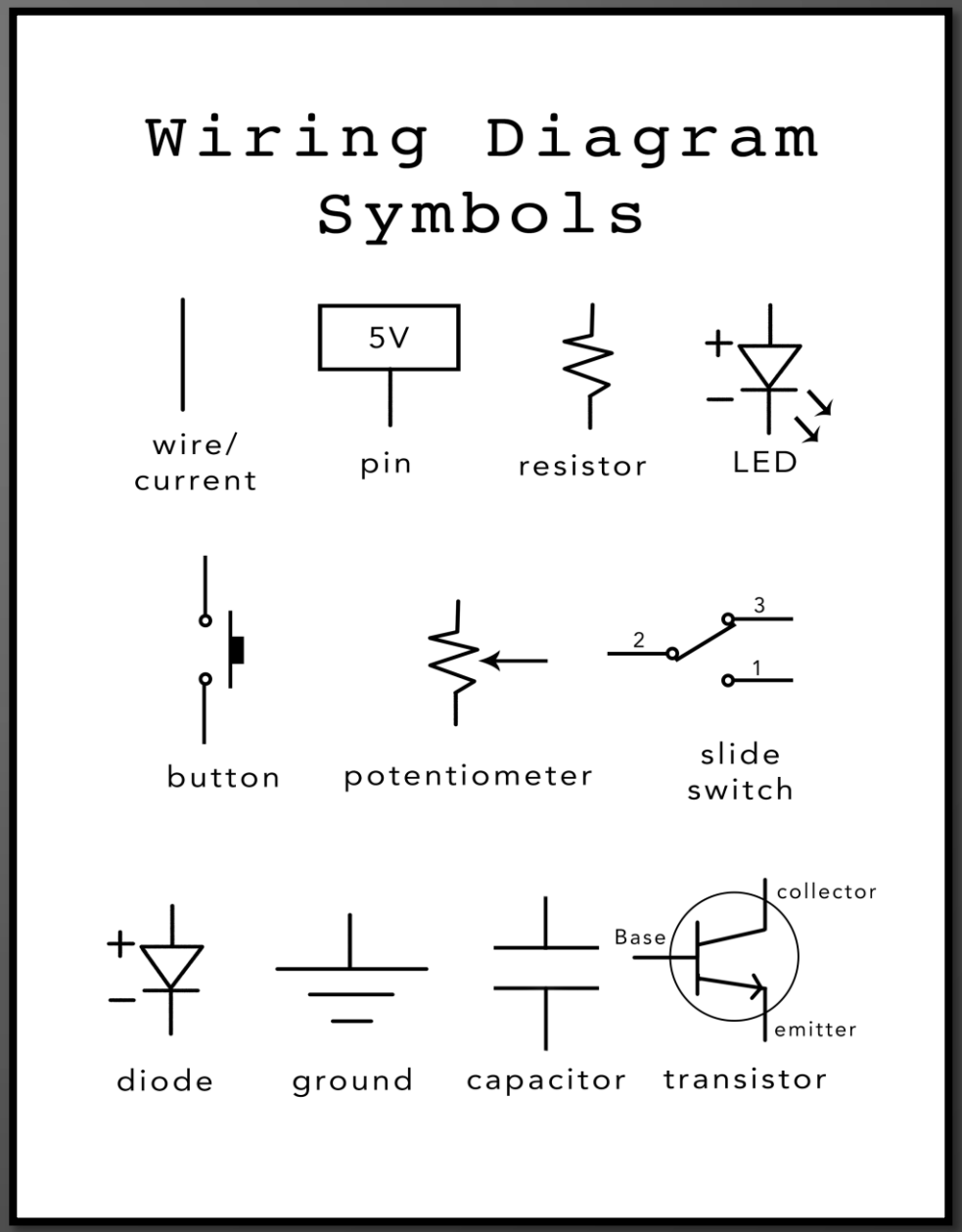


Let's build some simple circuits

When we are not uploading any code, all circuits begin at the 5V pin and end at GND. (Any of the 3 GND pins are okay.)

Build each circuit and draw a diagram as well.

1. Turn on 1 LED (always with a resistor!)
2. Turn on 2 LEDs in parallel.
3. Turn on 2 LEDs in series.
4. Turn on an LED by pushing a button.
5. Try using different strengths of resistors to turn on your LED.
6. Make any other simple circuit you'd like.

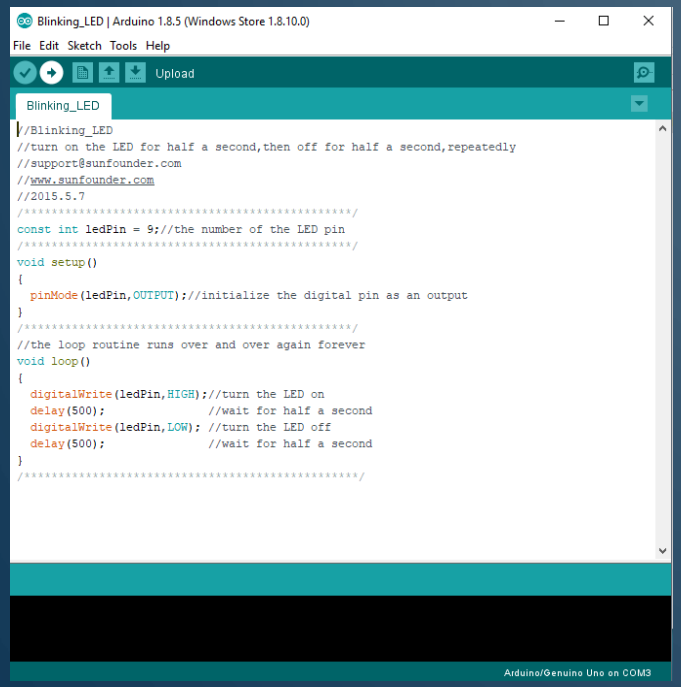


LET'S TALK ABOUT CODING

- Coding requires you to break a problem down into its most basic steps and form an algorithm*.
  - *Algorithm: a list of steps to finish a task.
  - Ex. You all know how to brush your teeth, but when you teach a child, you have to break it way down. If you wanted to tell a teenage to brush her teeth, what would you say? If you wanted to tell a toddler to brush her teeth, what would you say?
  - The trick is to know how far you have to break it down for a computer to understand what you want it to do.

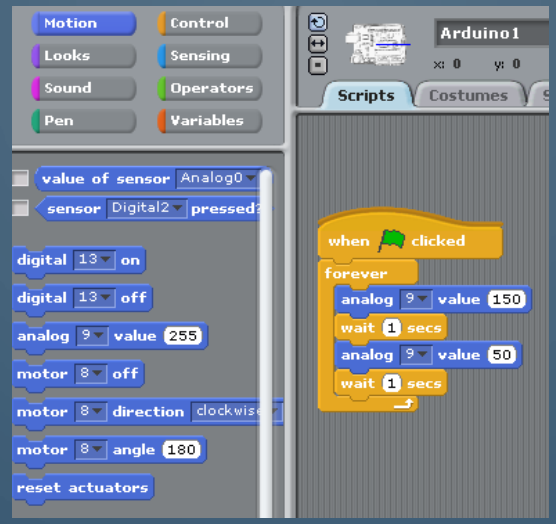
- Basic concepts to understand
  - Loop - The action of doing something over and over again.
  - Conditional Code - Statements that only run under certain conditions.
  - Variable - A placeholder for a piece of information that can change.

ARDUINO IDE

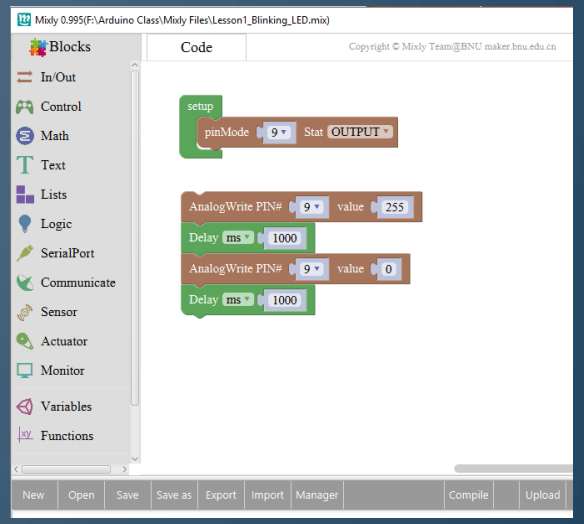


C++ programming language.

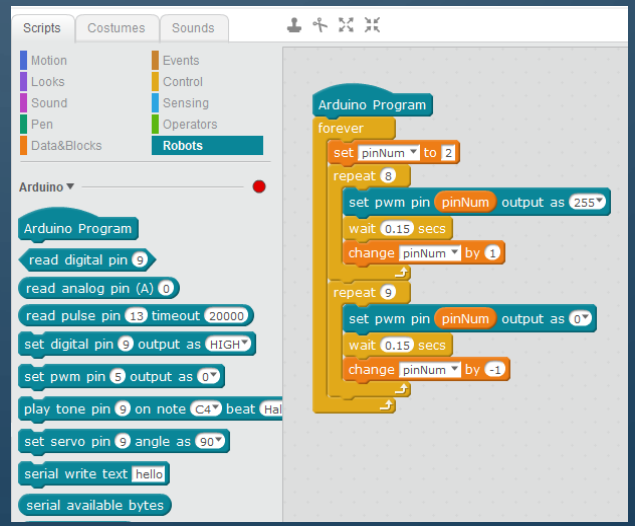
SCRATCH FOR ARDUINO (S4A)



MIXLY



MBLOCK



Graphical/Visual programming languages

INSTALL ARDUINO IDE AND S4A

- Head to https://www.arduino.cc/en/Main/Software and install Arduino 1.8.5
- Head to http://s4a.cat/, click on Downloads, and install for Windows.
  - You will also need to grab a firmware file which we will open with the Arduino IDE and install on your Uno board. This allows S4A to "talk" to your Uno board.
  - Firmware is in the shared OneDrive and is called S4AFirmware16.ino.txt

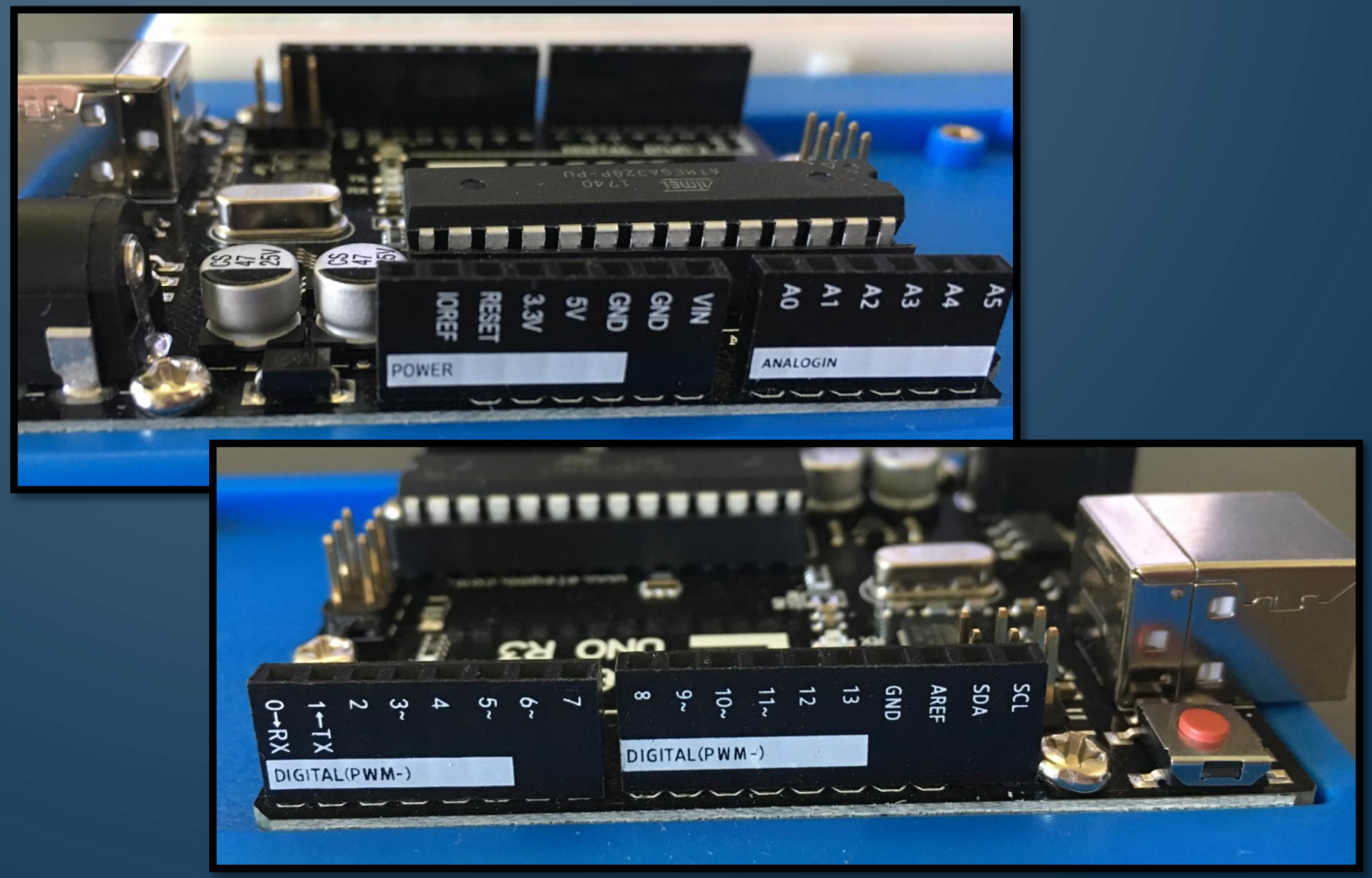
Digital versus Analog?

Digital reads and returns HIGH or LOW (TRUE or FALSE).
Analog reads and returns a number between 0 and 1023.

S4A controls how we use the pins.

Output Only:
- Digital: 13, 12, 11, 10
- Analog: 9, 6, 5
- Motor: 8, 7, 4

Input Only:
- Analog Sensors: A0, A1, A2, A3, A4, A4
- Digital Sensors: 2, 3



EXERCISES FROM THE SUNFOUNDER KIT

- https://www.sunfounder.com/learn/category/Super-Kit-V3-0-for-Arduino.html

- If you have any "ah-ha" moments, please jot them down to share with the group later.
  - What didn't make sense or was just written in a confusing way? How did you troubleshoot and debug your issues? What helped? What made things worse?