Introduction to ARDUINO

How to use electronics to make your projects better!

Guest wifi: HSNOTTS-guest Password: hackspacebiscuits
Presentation: http://wiki.nottinghack.co.uk/wiki/Arduino101
Software: http://arduino.cc/en/Main/Software

Welcome!

- Let's get programming!
- What did we just do? What is an “Arduino” anyway?
- Serial communications (making your Arduino talk to your laptop)
- Electrical Basics: Voltage, current, resistance
- More blinking LEDs
- Using switches

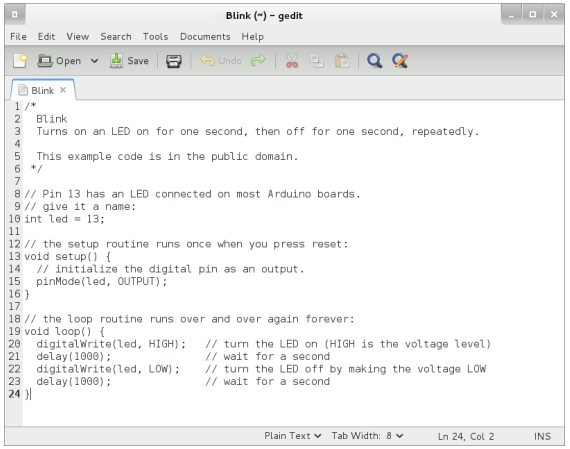
Welcome!

- Lunch?
- Structure and Decisions: Order out of chaos
- Your Arduino is a wimp: giving it some muscle!
- Life isn't digital: reading real-world values
- Putting it all together

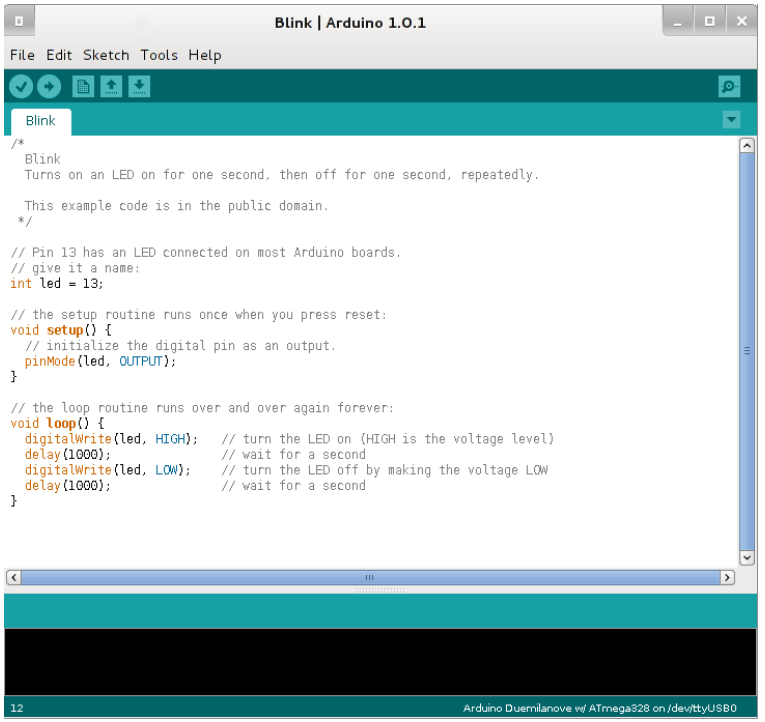
Dive in: Blink an LED

Code Along #1

What just happened?



The Arduino IDE is a text editor combined with programming tools.



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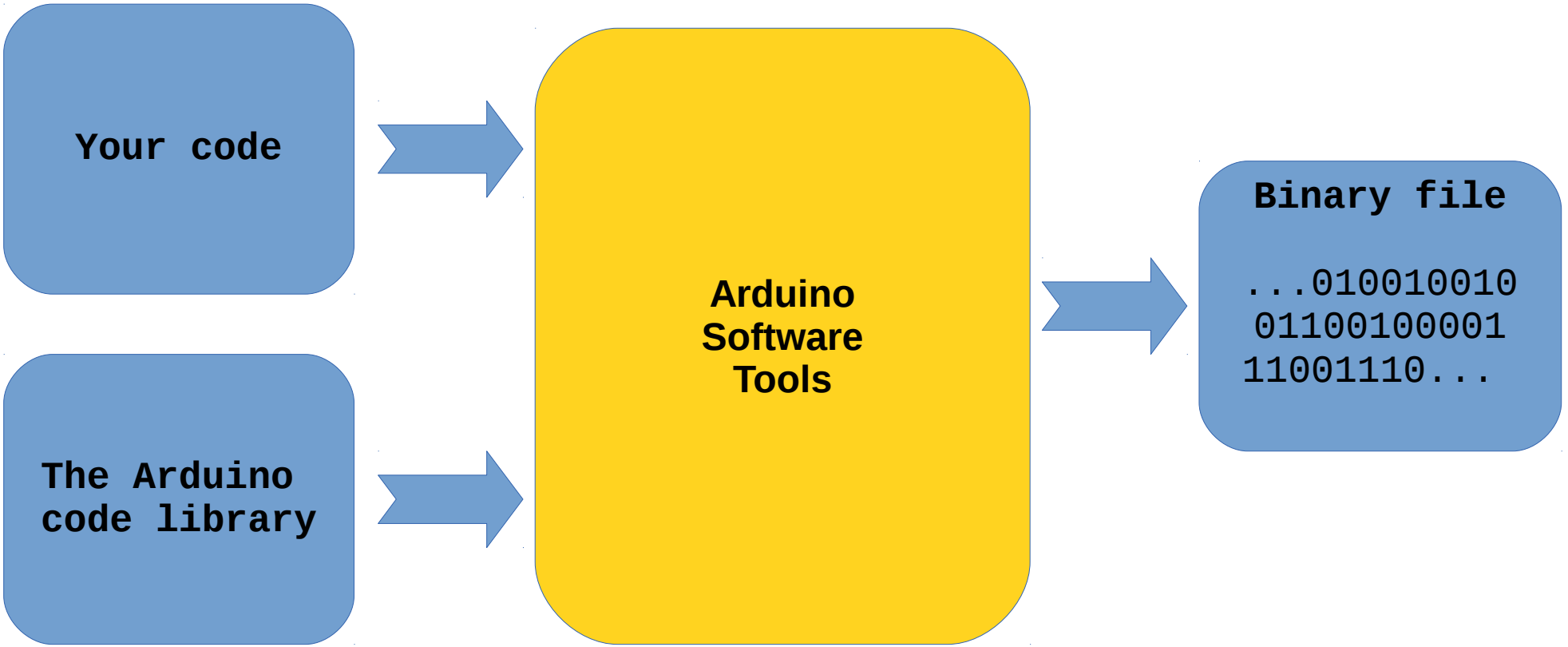
What just happened?



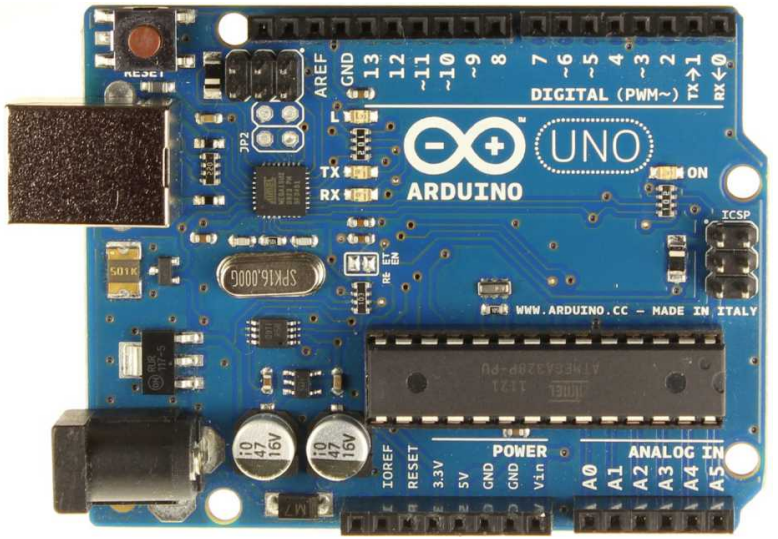
When you press the “Upload” button, your code is combined with the Arduino library and made into a file that the Arduino microcontroller is programmed with.

What just happened?

Binary file

```
...010010010
01100100001
11001110...
```

USB



… and then gets sent down the USB cable to the Arduino. Once there, it stays there until you re-program it, even if the power is removed.

Serial Monitor

Code Along #2

Variables

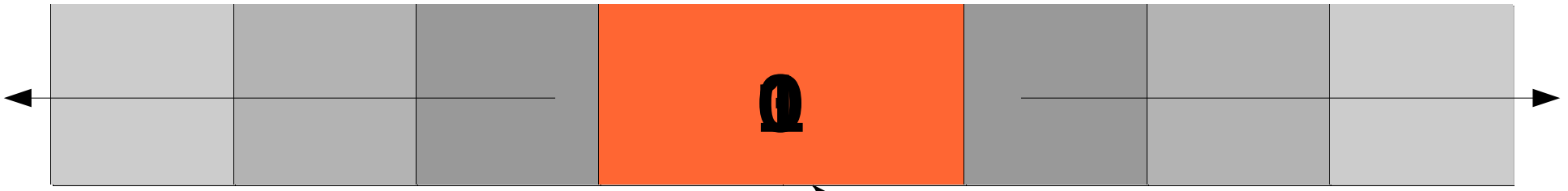
Code Along #3

Variables

Named places to store your data

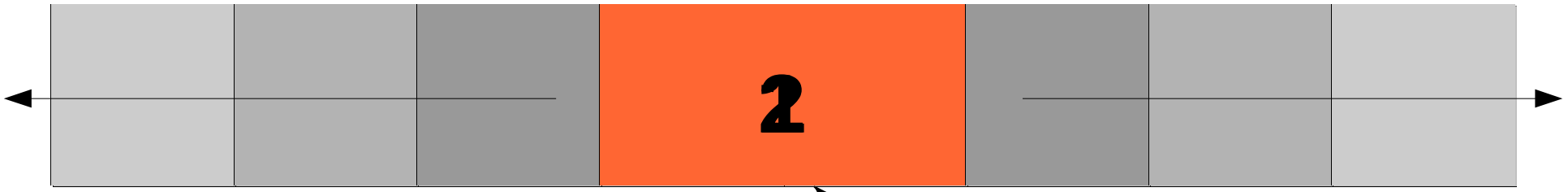

```
int loop_counter = 0;
```

Variables



```
loop_counter = loop_counter + 1;
```

Variables

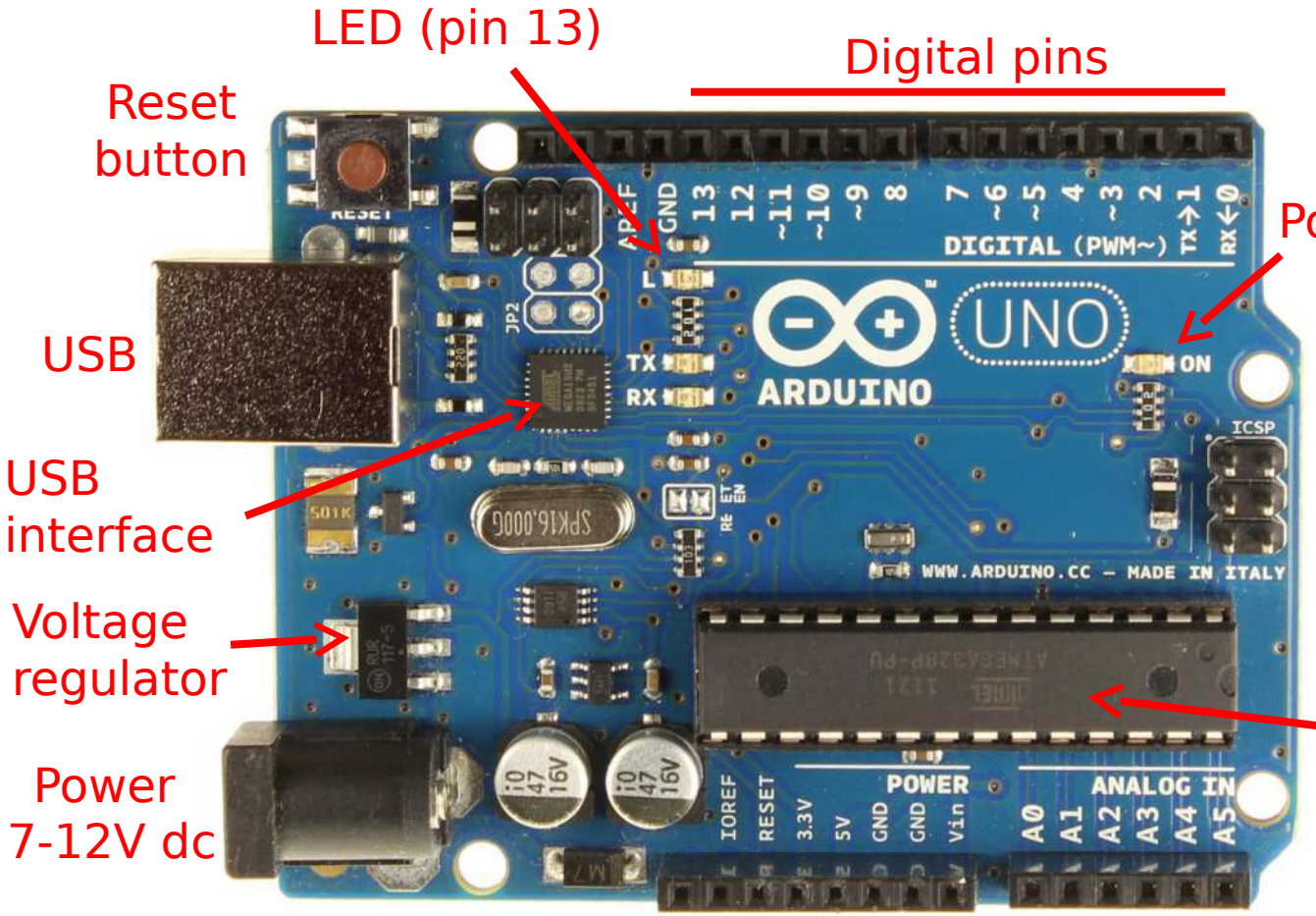



```
loop_counter = loop_counter + 1;
```

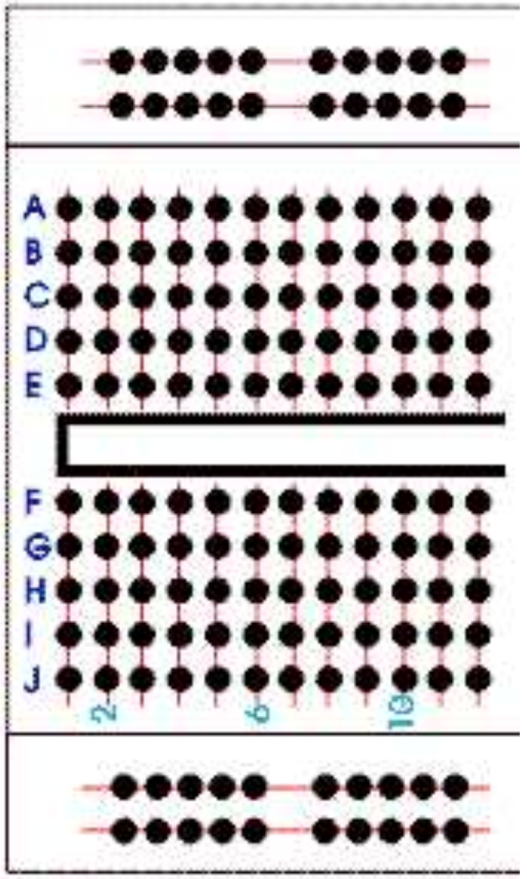
Variables: Size and Limits

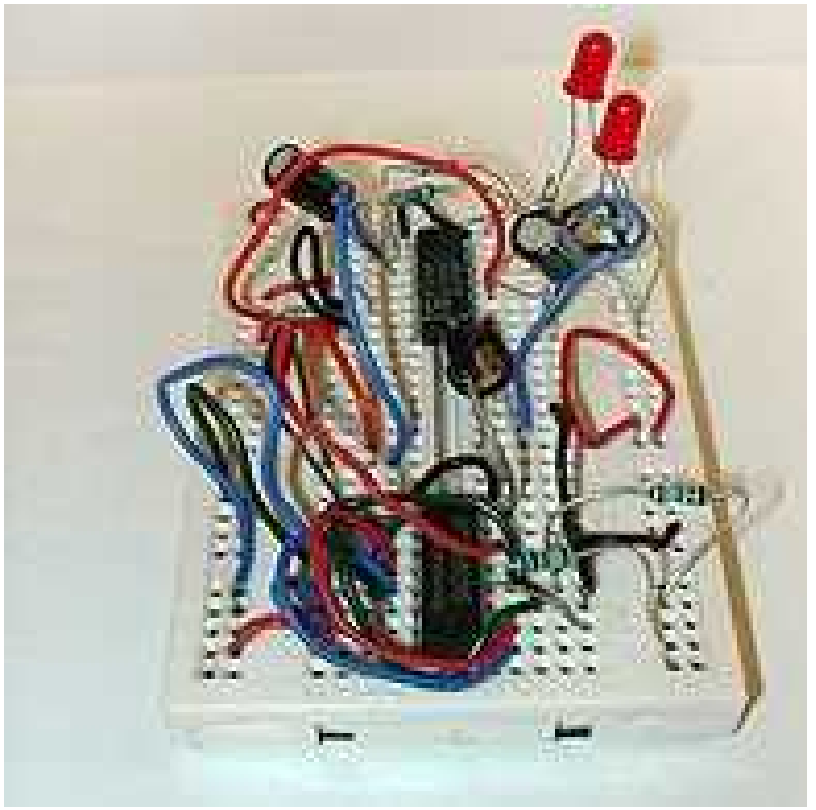
`char`	Character 'a', 'b', 'c'... or -128 to 127	1 byte
`unsigned char`	0 to 255	1 byte
`int`	-32768 to 32767	2 bytes
`unsigned int`	0 to 65535	2 bytes
`bool`	`true` or `false`	1 bytes
`String`	`String hello = “Hello!”;`	???

The Arduino Uno



Breadboard





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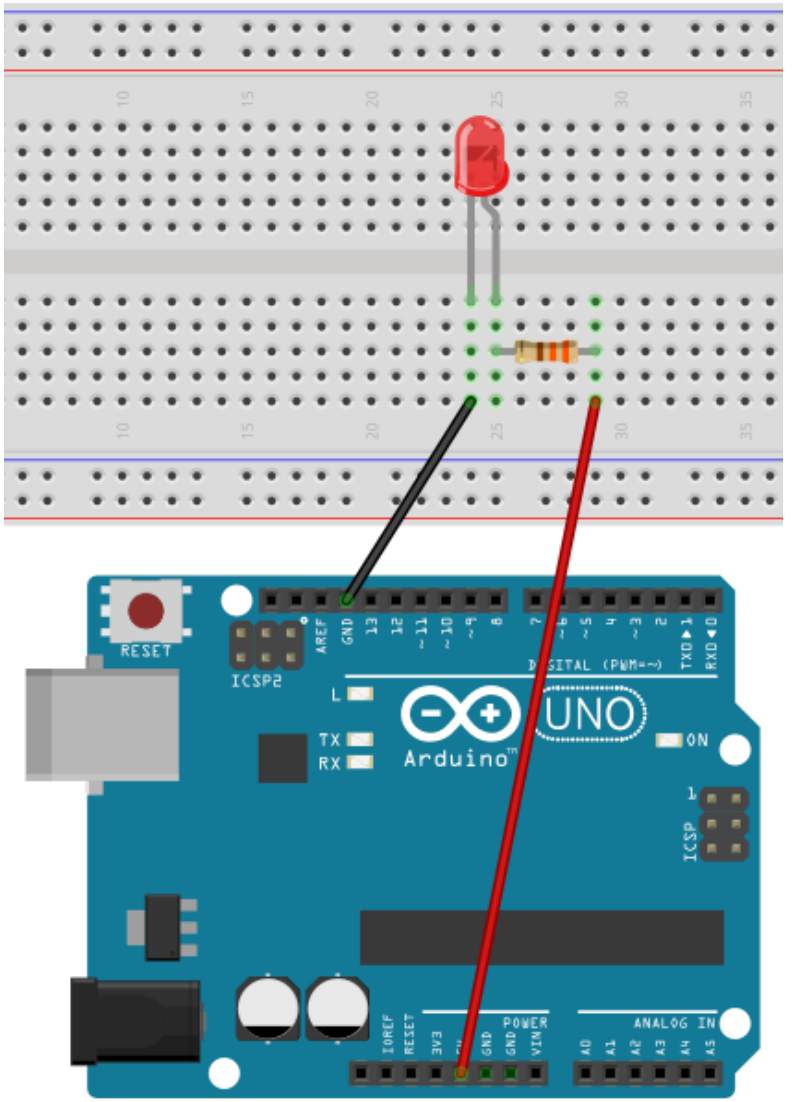
Using other components



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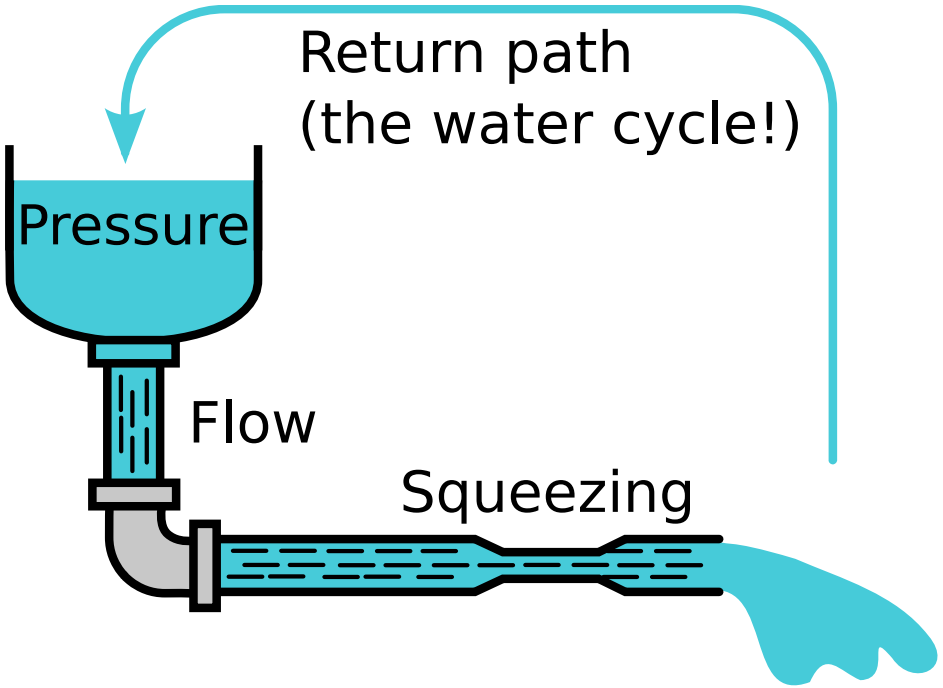
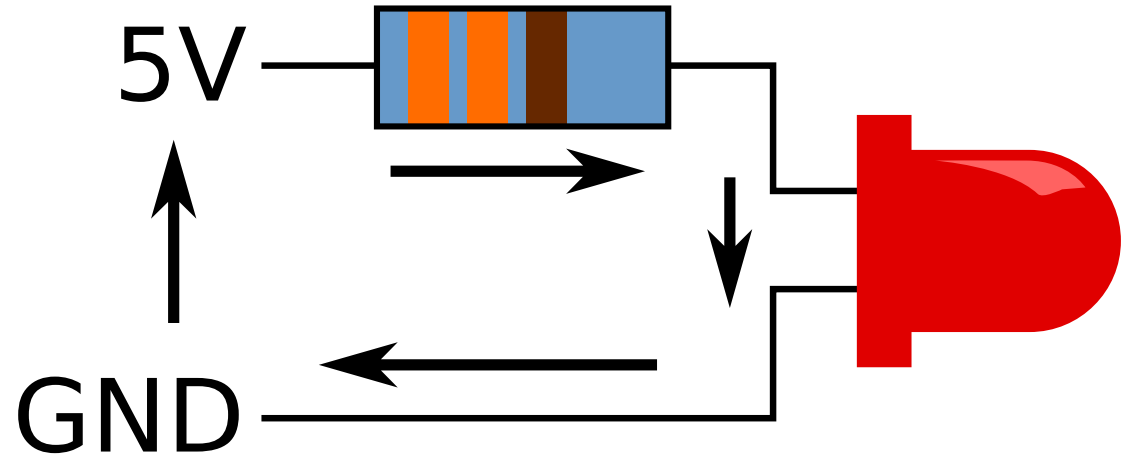
Voltage, Current, Resistance

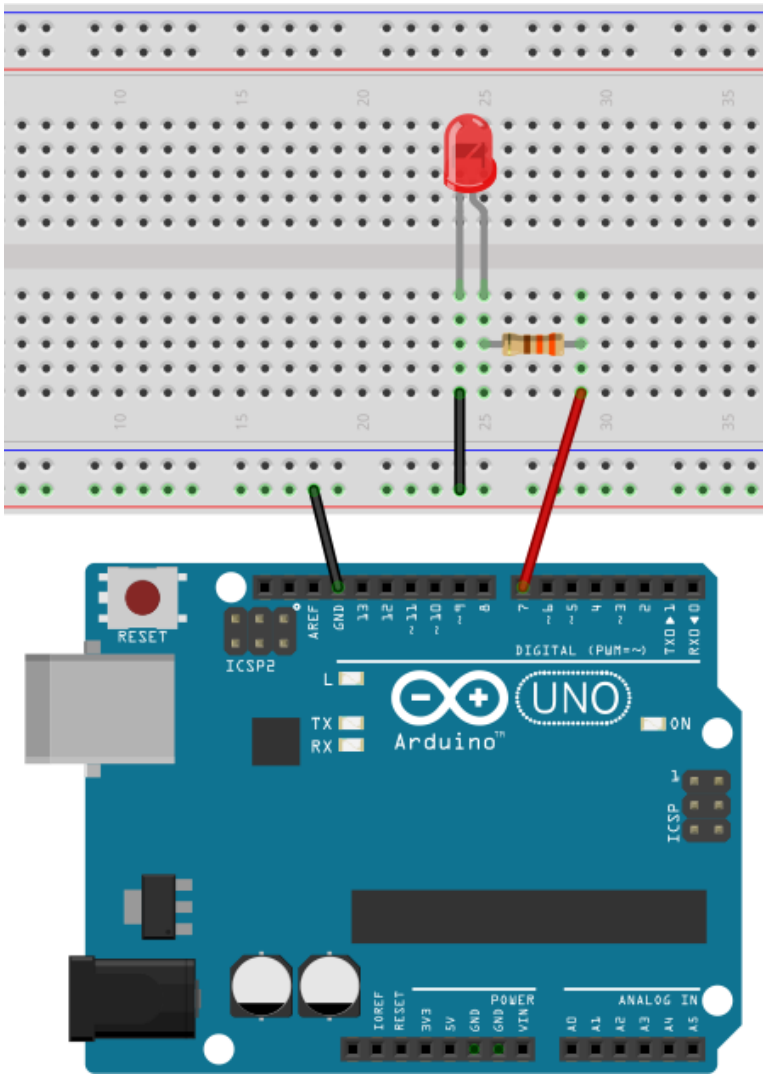




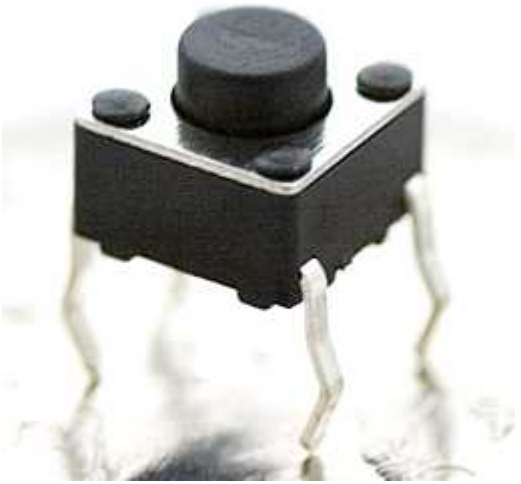
Another blinking LED

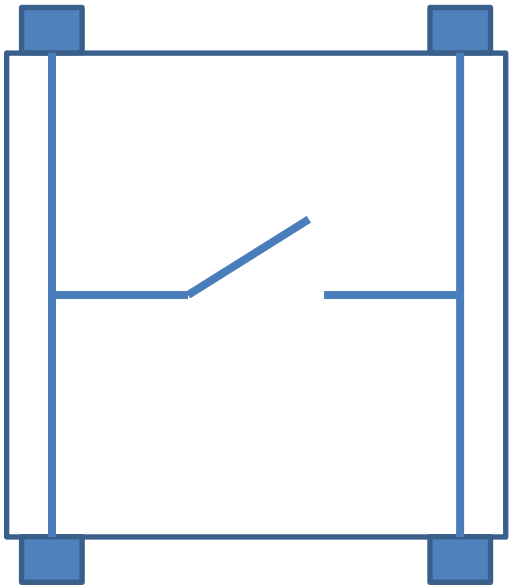
Change your breadboard circuit as shown.

Code Along #4



Tactile Switch





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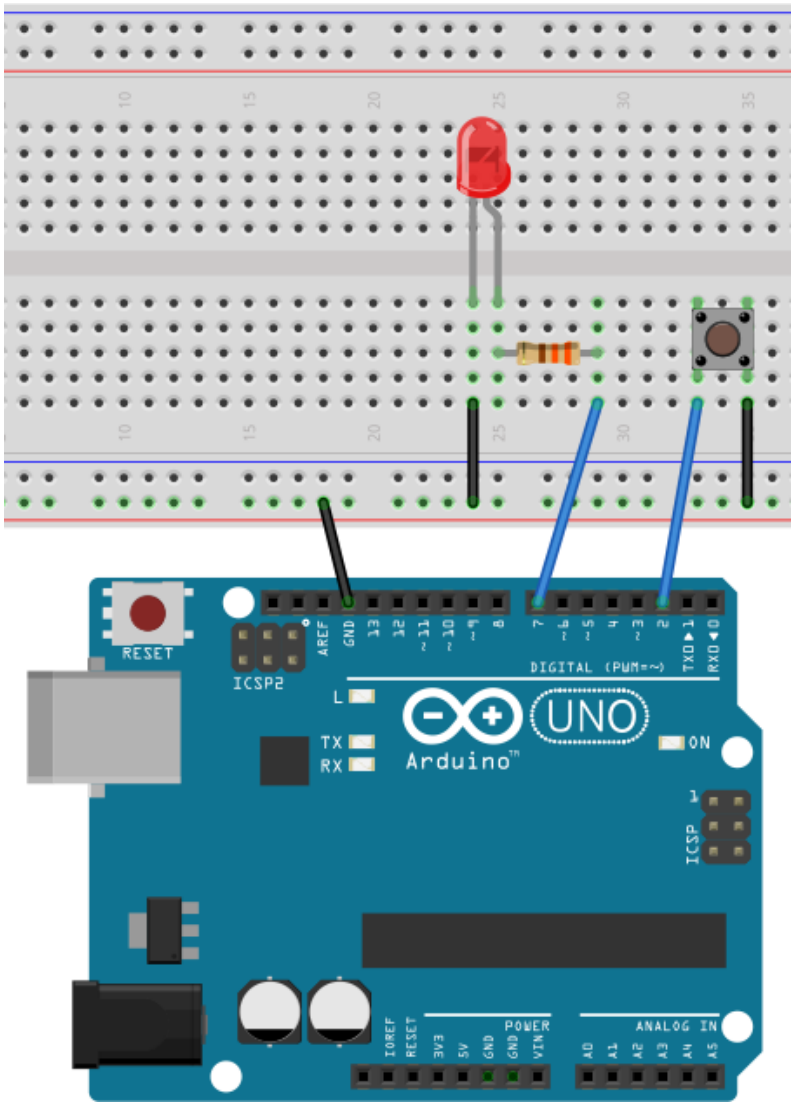
Switch controlling LED

Change your breadboard circuit as shown.

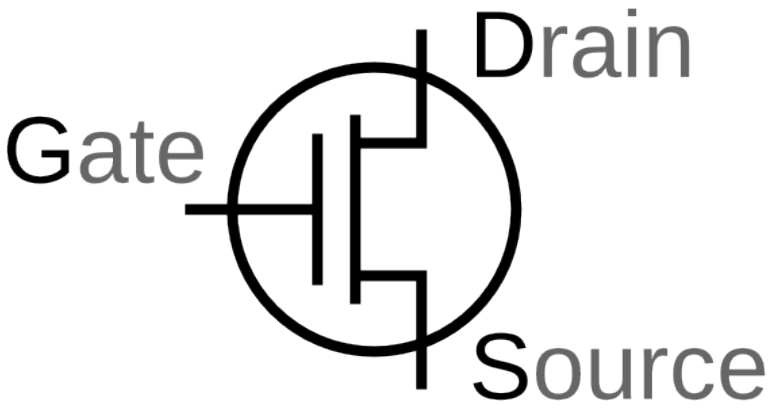
Code Along #5

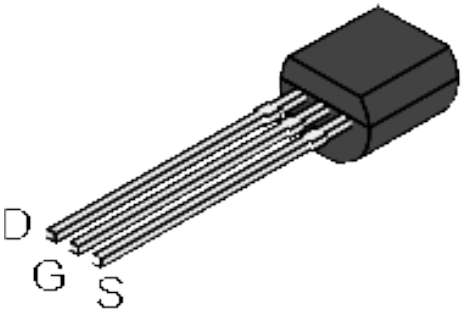


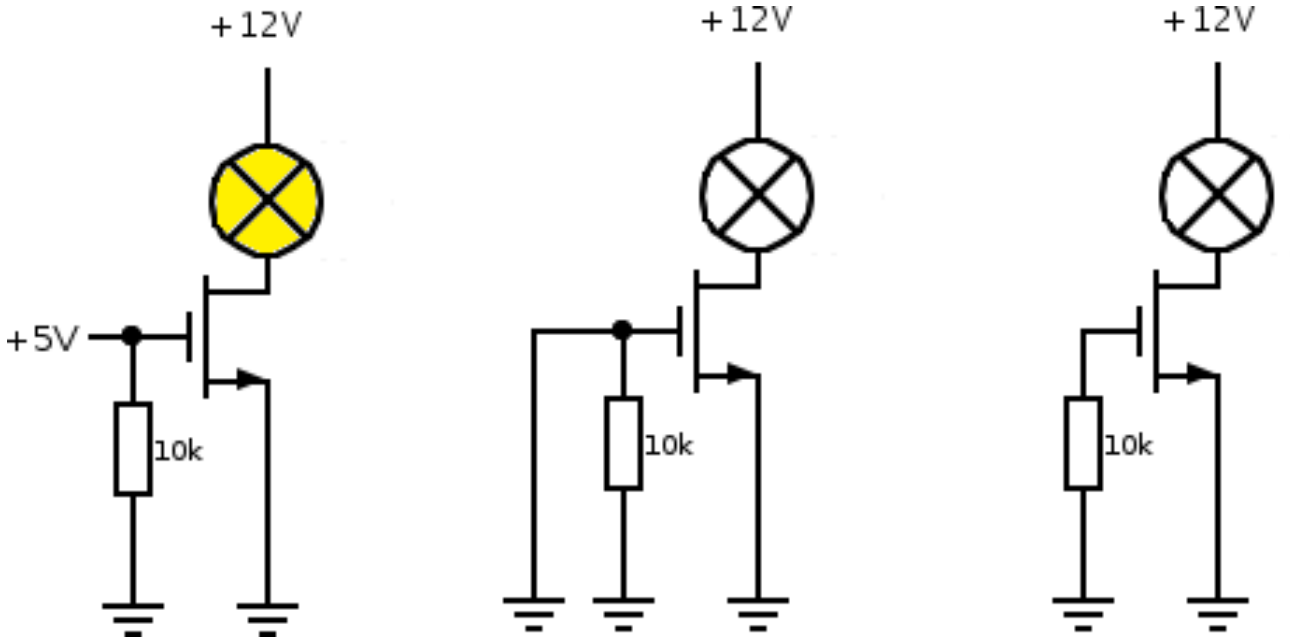
High Power Loads

- These devices need more current than the Arduino can supply.
- They might need more voltage too.
- We use a transistor to increase the current and/or voltage.
- Transistor acts as a Arduino controlled switch.
- Need protection from inductive loads (usually wound coils such as motors and relays).
- **NPN Bipolar** and **N-channel MOSFET** are commonly used with the Arduino.

N-Channel MOSFET







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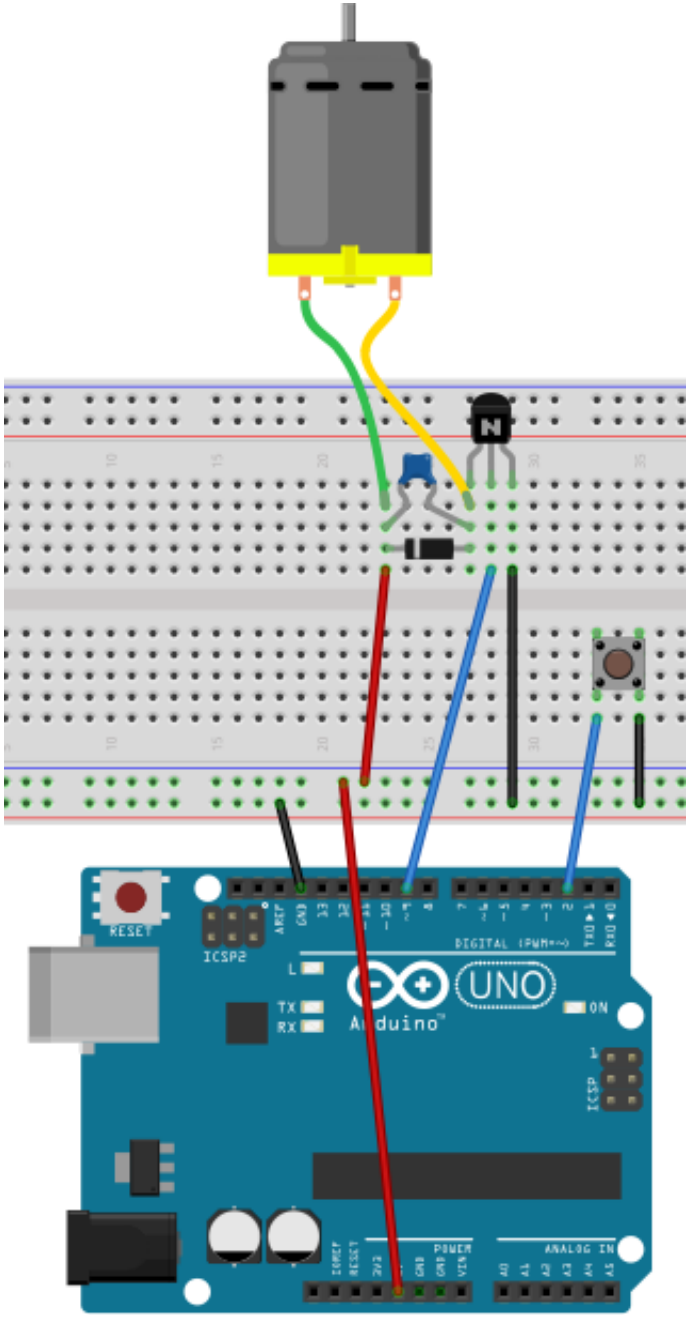
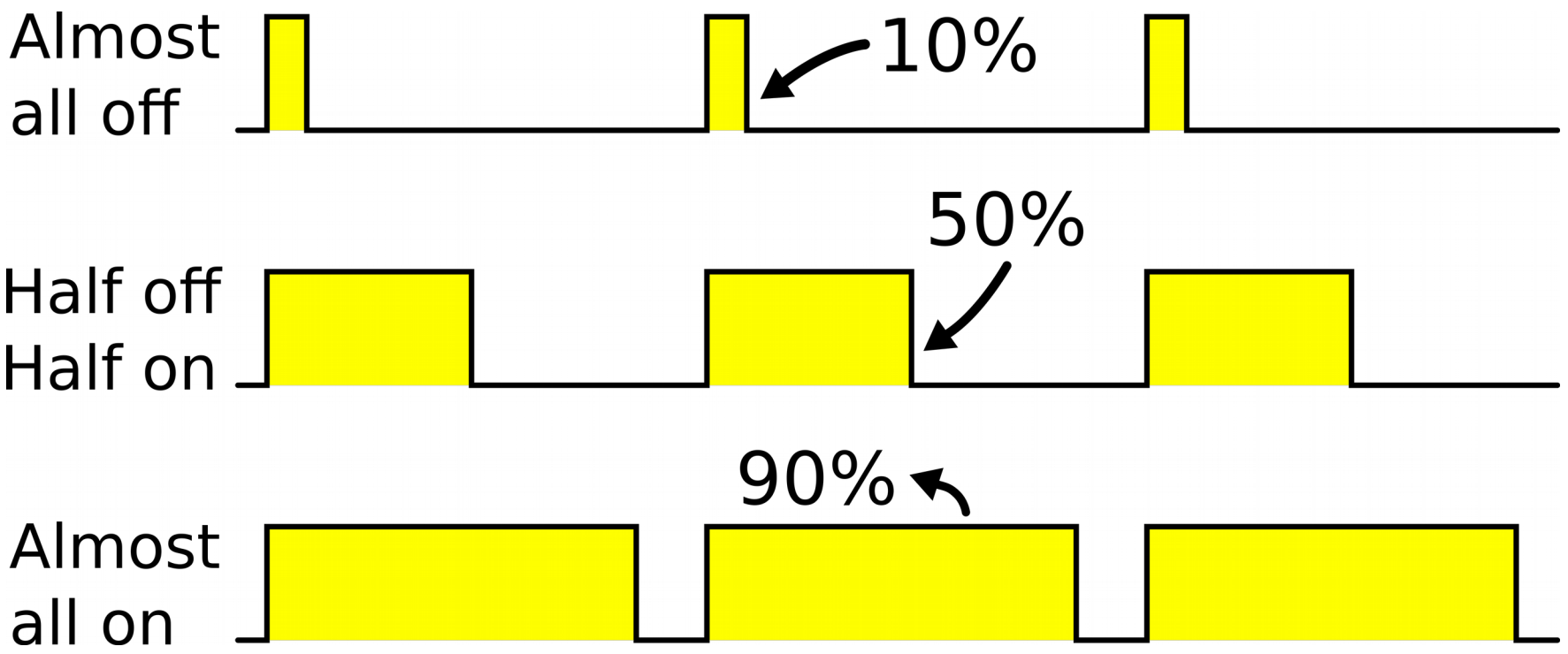
Motor Control



Change your breadboard circuit as shown.

Code Along #6

Pulse Width Modulation

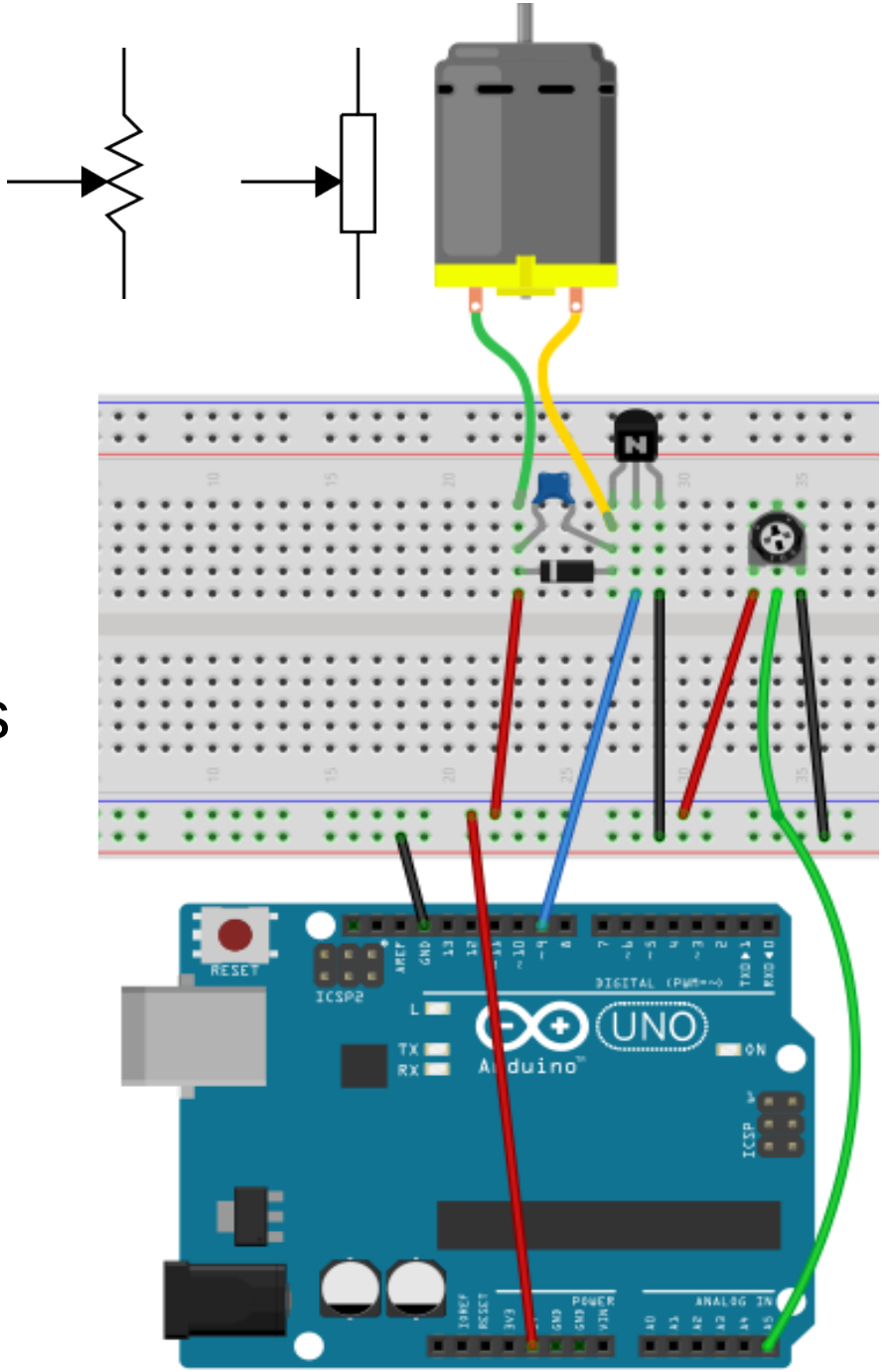


- Not available on all pins! On the Uno, pins 3, 5, 6, 9, 10, 11 can be used
- Use analogWrite(pin, value), where value is between 0 and 255
- Gives motors torque AND speed control!

Reading real-world signals

- Arduino has 6 analog inputs
- Read with:
  - int value = analogRead(pin);
  - Pin is 0-5 or A0-A5
  - Value from 0 to 1023 representing voltage of 0-5V

Potentiometer (Variable Resistor)



Change your breadboard circuit as shown.

Code Along #7

Doing more than one thing

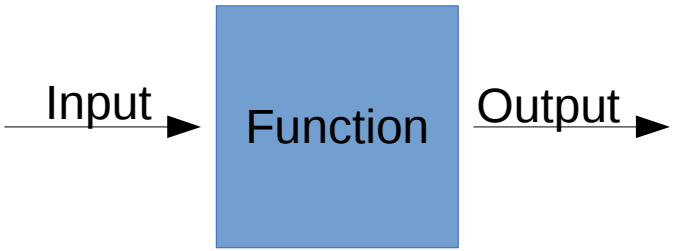
Code Along #8

Functions

Named blocks of code that perform a particular job

- Arduino library provides *loads* of them for you.
- Using a function is known as “calling” or “invoking” it.
- `loop` and `setup` are functions in your sketch.
- You can write your own!

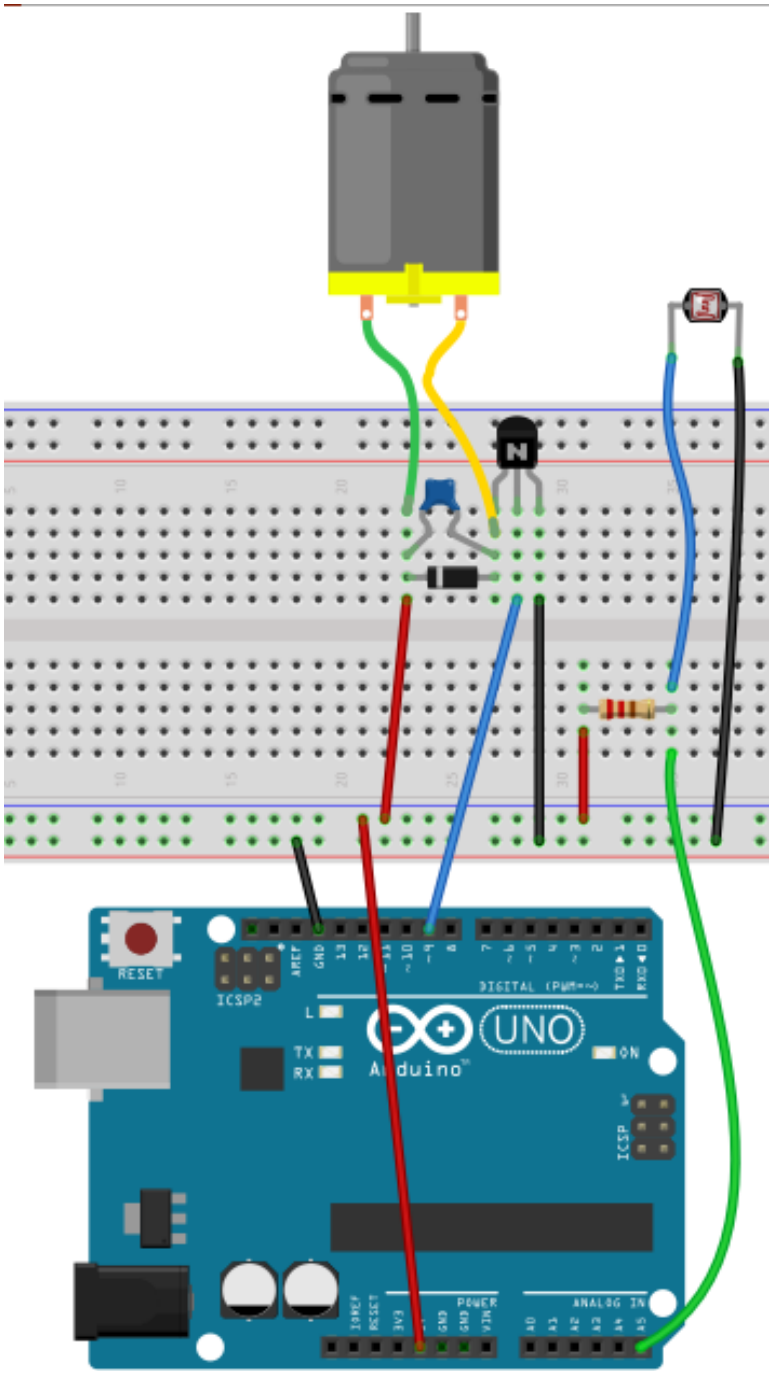
Functions may have *inputs* and *outputs.*



e.g.
`digitalWrite` (inputs, no output)
`digitalRead` (inputs and output)
`loop`, `setup` (no input or output)

Light Dependant Resistor

Change your breadboard circuit as shown.



Doing more than one thing

Code Along #8

Functions

Named blocks of code that perform a particular job

- Arduino library provides *loads* of them for you.
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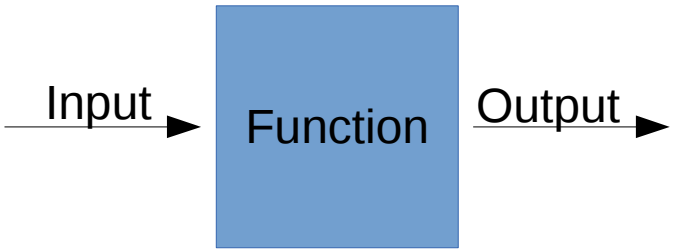

e.g.
`digitalWrite` (inputs, no output)
`digitalRead` (inputs and output)
`loop`, `setup` (no input or output)

Functions

Code Along #9

That's It!

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