STEAM CLOWN™ PRODUCTIONS

ARDUINO INTRODUCTION

STEAM CLOWN™ & Squeaky Hinge PRODUCTIONS

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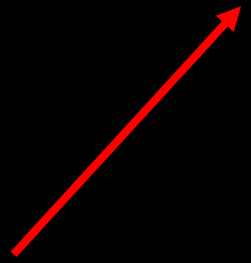
STEAM PROGRAMS



Art without Engineering is dreaming. Engineering without Art is calculating.

- Steven K. Roberts

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SEE APPENDIX A, FOR LICENSING & ATTRIBUTION INFORMATION

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ARDUINO INTRODUCTION

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NEW WORDS...

- Microprocessor
- Microcontroller
- Arduino
- Open-source

PC NEEDS A MICROPROCESSOR TO RUN, RIGHT?

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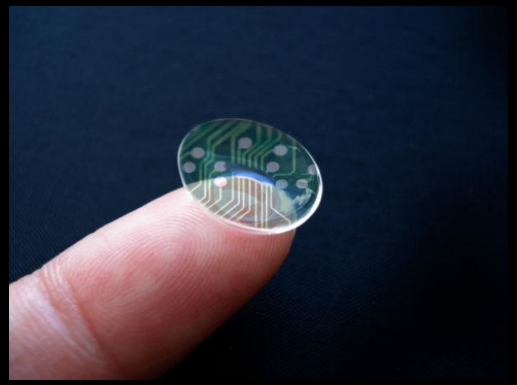
WHAT ABOUT THESE...



Did you know they are built with a Microprocessor or Microcontroller too?

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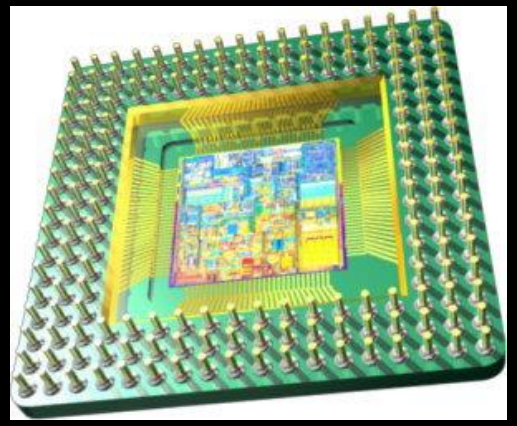
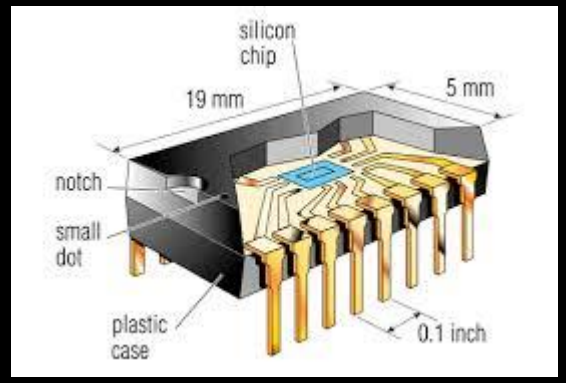
What is a Microprocessor?

What's the difference between a Microprocessor and a Microcontroller?

- A microprocessor, like the Intel Or AMD processors, contains
  - a CPU, but needs help from other components to make it function, components like DRAM and hard drives



- A microcontroller, like the Arduino, is a standalone single-chip that contains
  - a CPU, read-only memory to store the program, RAM to store variables used in the execution of the program.

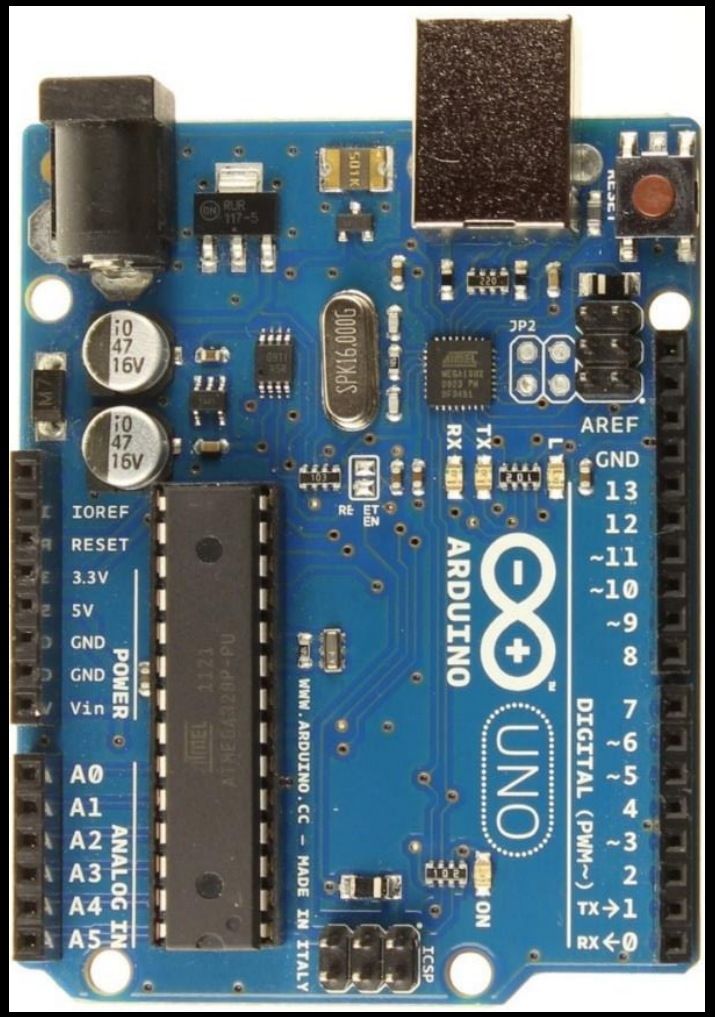


Did You Say "Arduino"?

- Arduino Is An Open-source Electronics Platform
  - With easy to use hardware & software.
  - Intended for anyone making interactive projects

- Arduino Can Sense & Control It's Environment
  - Receiving information from sensors on input pins
  - Affecting it's surroundings by controlling lights, motors, actuators, etc on output pins

- You Tell Your Arduino What To Do
  - Writing code in the Arduino programming language
  - Using the Arduino development environment



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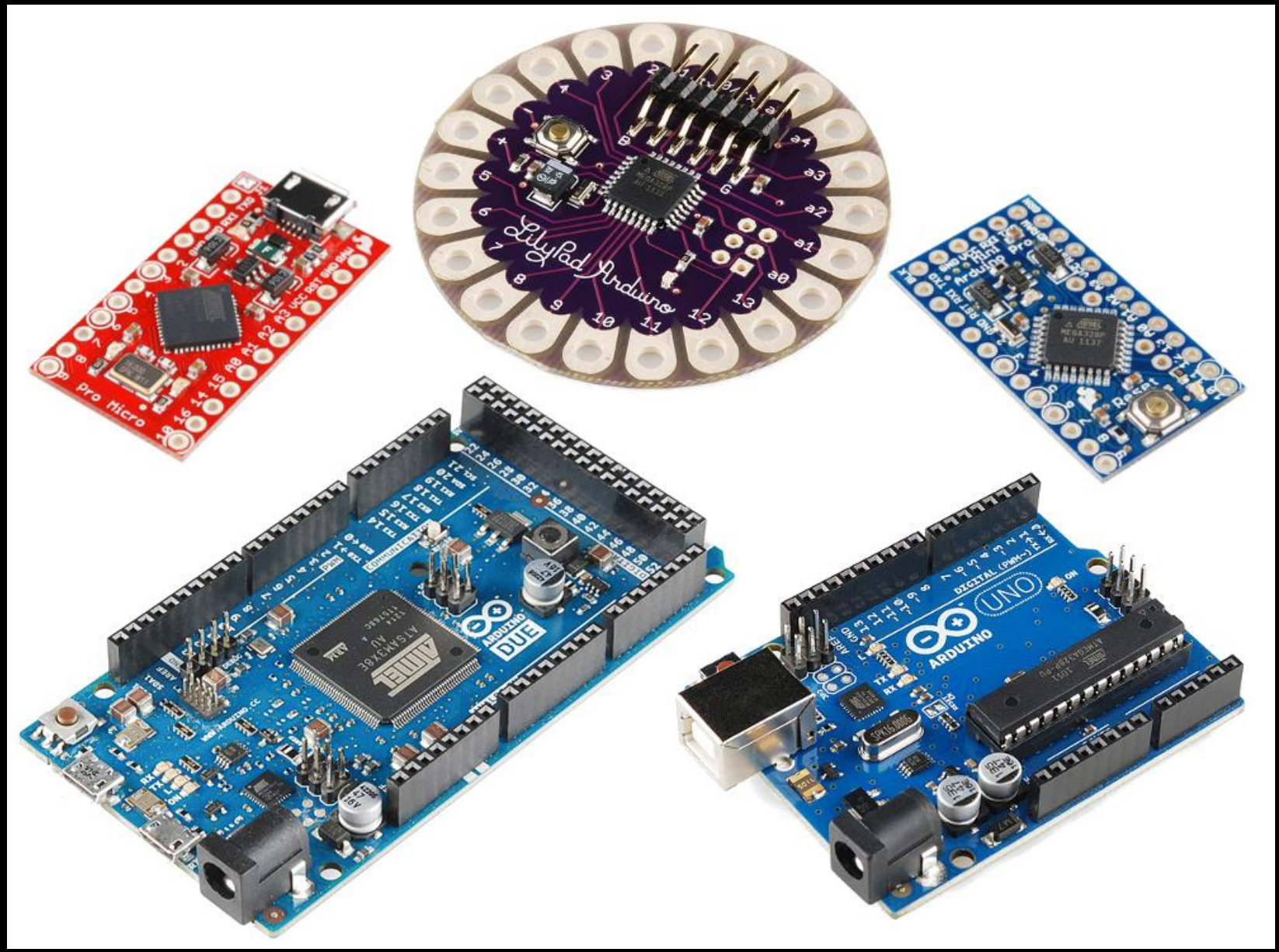
THERE ARE MANY TYPES OF ARDUINOS



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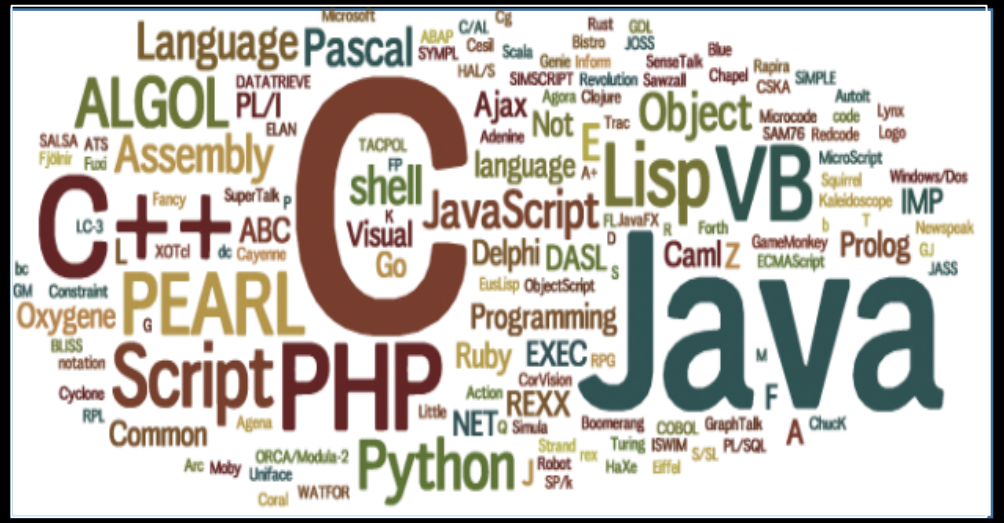
WHAT'S A PROGRAMING LANGUAGE?

- A programming language is
  - A formal constructed language designed to communicate instructions to a machine, particularly a computer
  - Programming languages can be used to create programs to control the behavior of a machine or to express algorithms.
- The Arduino uses C++



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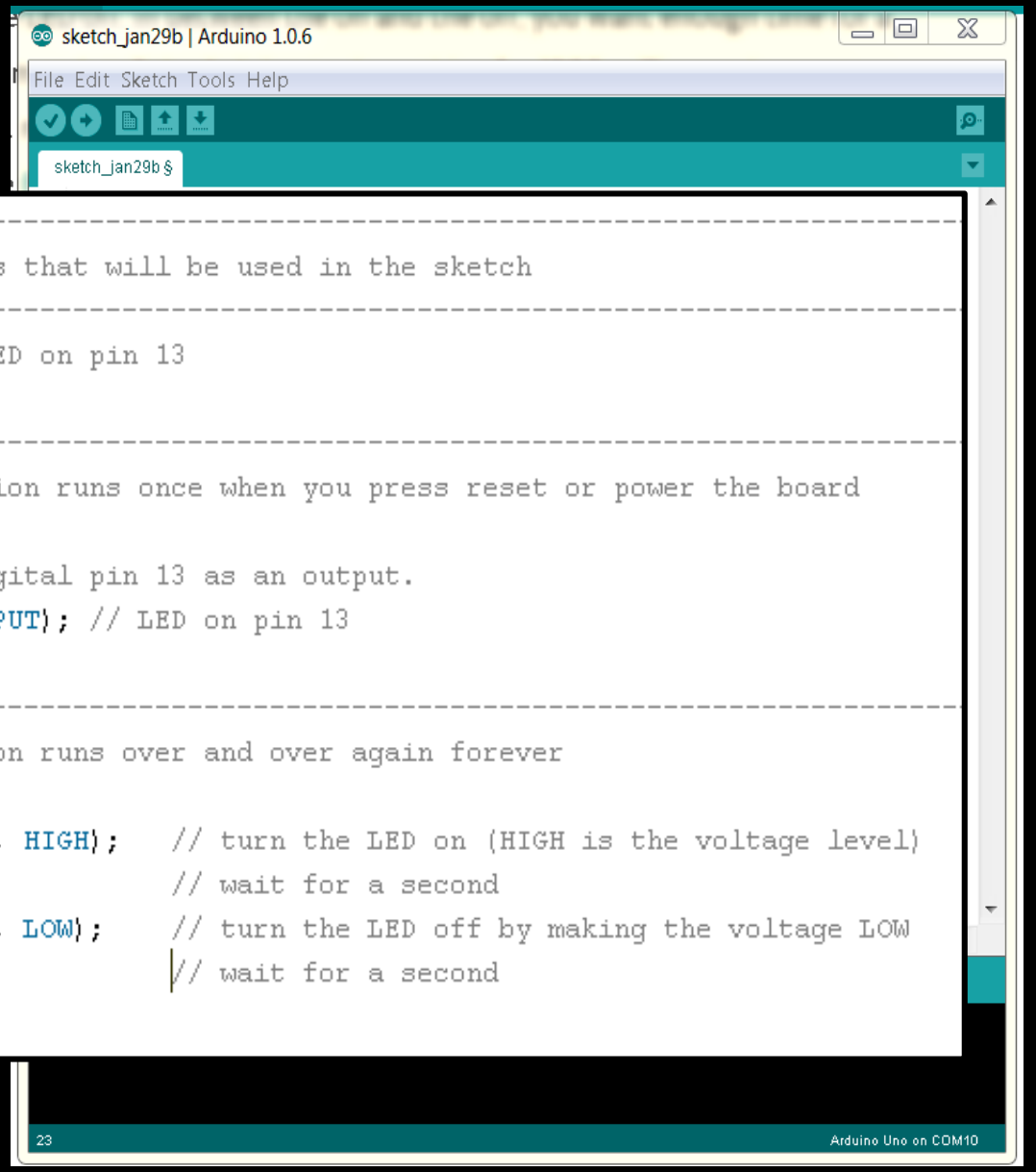
BLINK - FIRST SKETCH → C++

Defines Variables
Like I/O Pin
Connected to LED

Setup Loop

Main Loop

Turns LED ON
Delay 1 sec
Turns LED OFF
Delay 1 sec




```
12  // ----------------------------------------------------------------------
13  // define variables that will be used in the sketch
14  // ----------------------------------------------------------------------
15  int led = 13; // LED on pin 13
16
17  // ----------------------------------------------------------------------
18  // the setup function runs once when you press reset or power the board
19  void setup() {
20    // initialize digital pin 13 as an output.
21    pinMode(led, OUTPUT); // LED on pin 13
22  }
23  // ----------------------------------------------------------------------
24  // the loop function runs over and over again forever
25  void loop() {
26    digitalWrite(led, HIGH);    // turn the LED on (HIGH is the voltage level)
27    delay(1000);                // wait for a second
28    digitalWrite(led, LOW);     // turn the LED off by making the voltage LOW
29    delay(1000);                // wait for a second
30  }
```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Go from a Sketch to Blinking an LED

Host Computer

Source Code

Compiler & Linker

Executable

1011001010
0110101101
1110100100
1010101100
0101100110

Library Files

0011001010
1101111110
1010110100
1110101100
1001100110

1111001010
1100101101
1010110100
1110101100
1111100110

1011001010
1000100101
0101101001
1110101100
0011100110

Arduino

Flash Program Memory

1101001011
1110001001
1011101100
1110011101
1101110101

Bootloader

CPU

Ports

USB Download Cable

Blinking LED

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Is it possible to get help?

- Git Hub – See Steam Clown's Files Search for "STEAM Clown" on www.github.org
- http://www.arduino.cc/ ← Official Arduino Site
- http://www.arduinobook.com/
- Google Is Your Friend…
  - Google Arduino Getting Started
  - Google Arduino Tutorials
  - Google Arduino Sketches
- PDF books
  - Arduino Programmers Notebook
  - Arduino in a Nutshell
  - Introduction to Arduino - A piece of cake!
- YouTube
  - Arduino: Your First Arduino Sketch
  - Tutorial 01 for Arduino: Getting Acquainted with Arduino

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KIT AND INSTALL OF TOOLS

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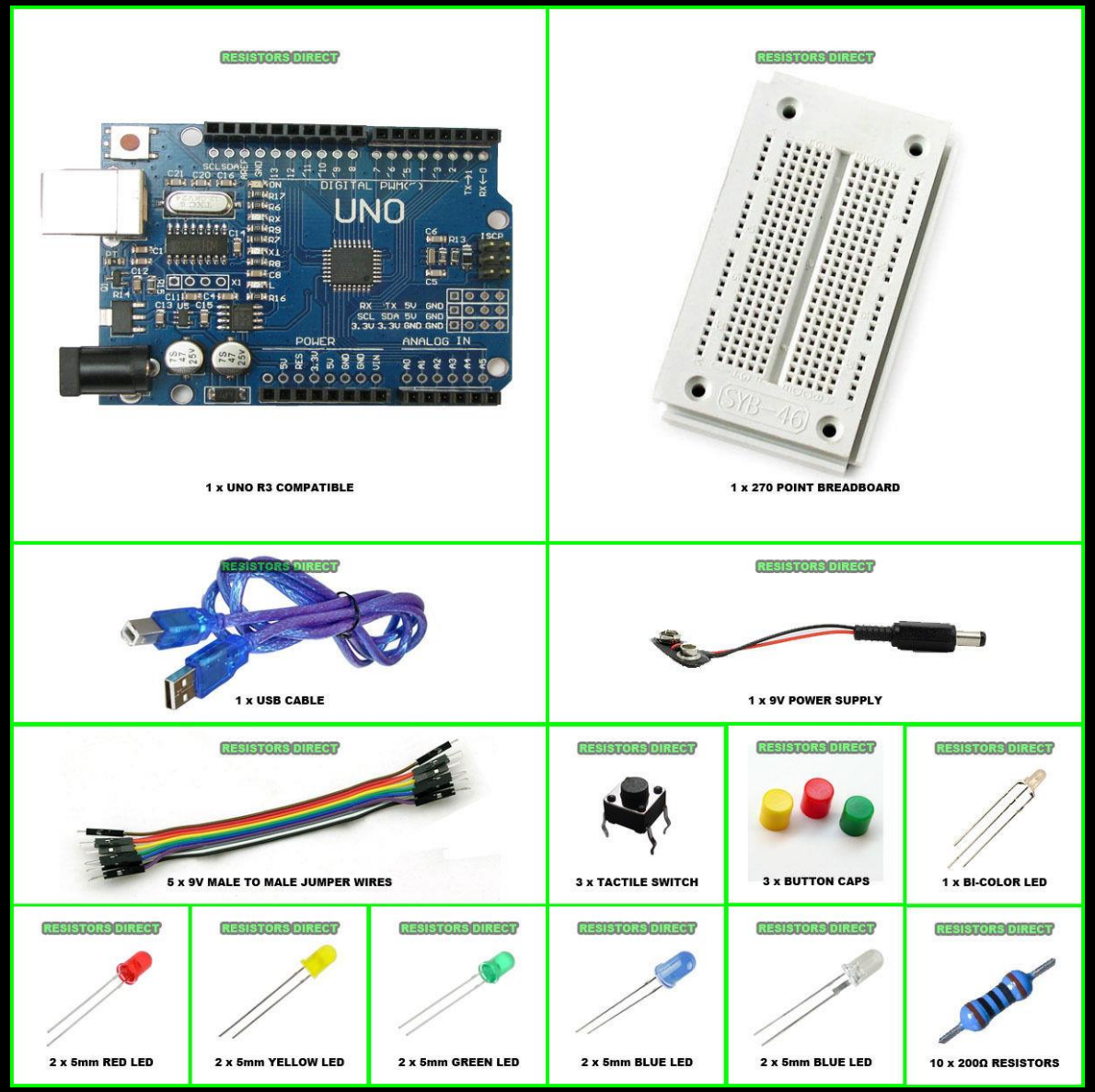
WHAT IN YOUR KIT

- Arduino Uno (clone)
- USB Cable
- Breadboard
- Jumper Wires
- Some Buttons
- LEDs
- Resistors



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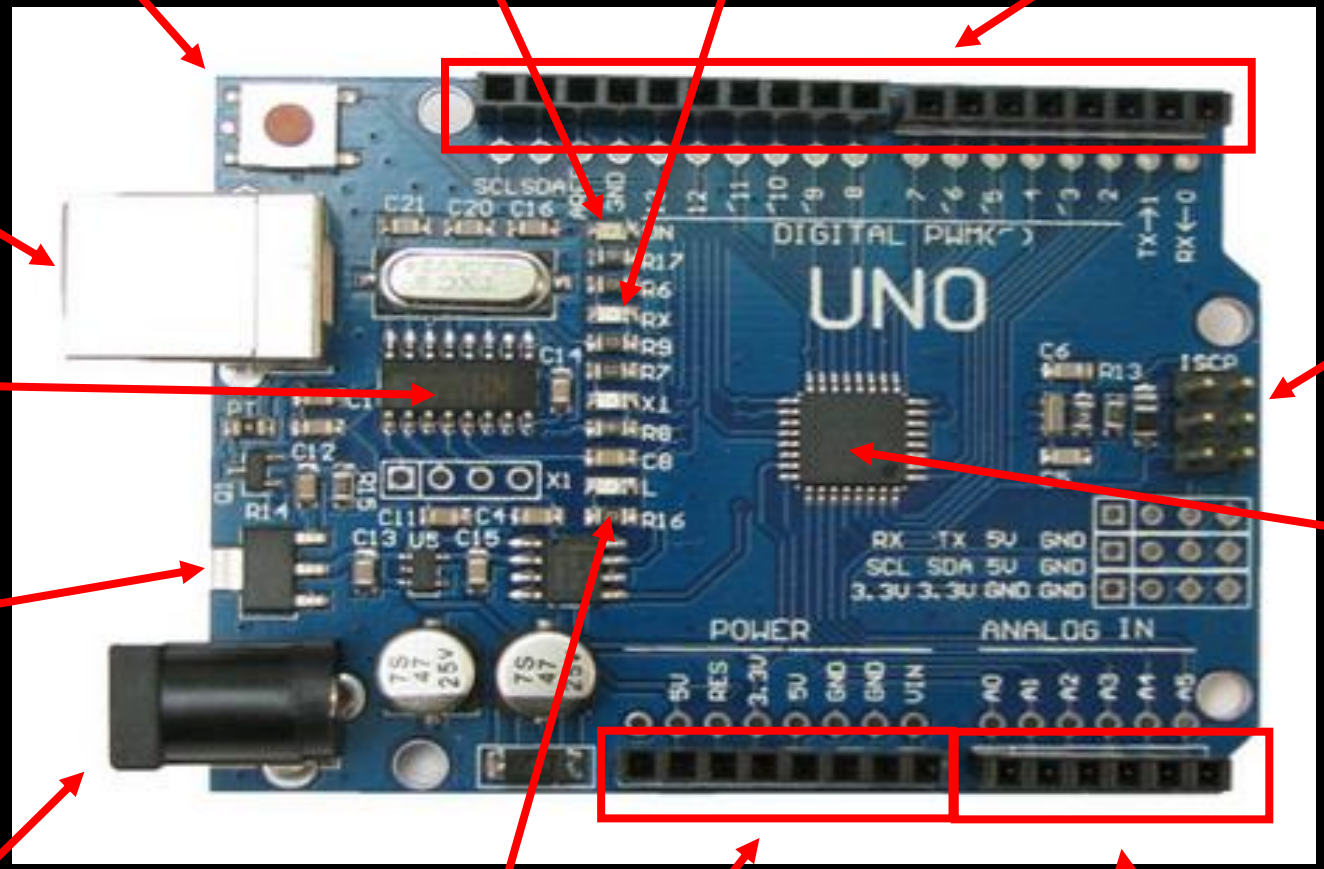
LET ME INTRODUCE YOU TO ARDUINO...



Reset Button

Power LED

Rx & TX LEDs

Digital I/O Pins

USB Port

ICSP Header

USB Chip

Atmel ATmega328

Voltage Regulator

External Power Jack

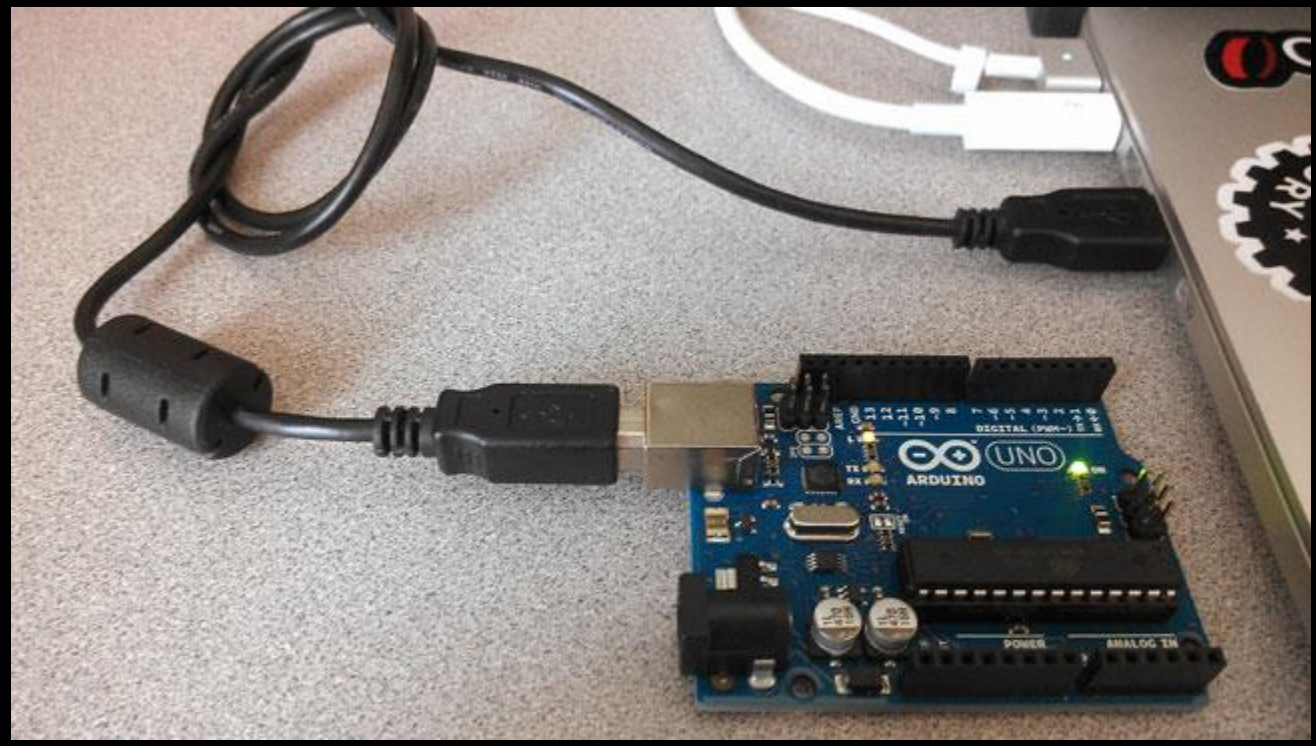
Pin 13 LED

Power Pins

Analog I/O Pins

Powering your Arduino up for the first time

- Connect the USB cable from your PC to the Arduino



- Power “good” LED will turn on, you will see a bunch of Blinking on the RX/TX LED, and LED 13 should start Blinking

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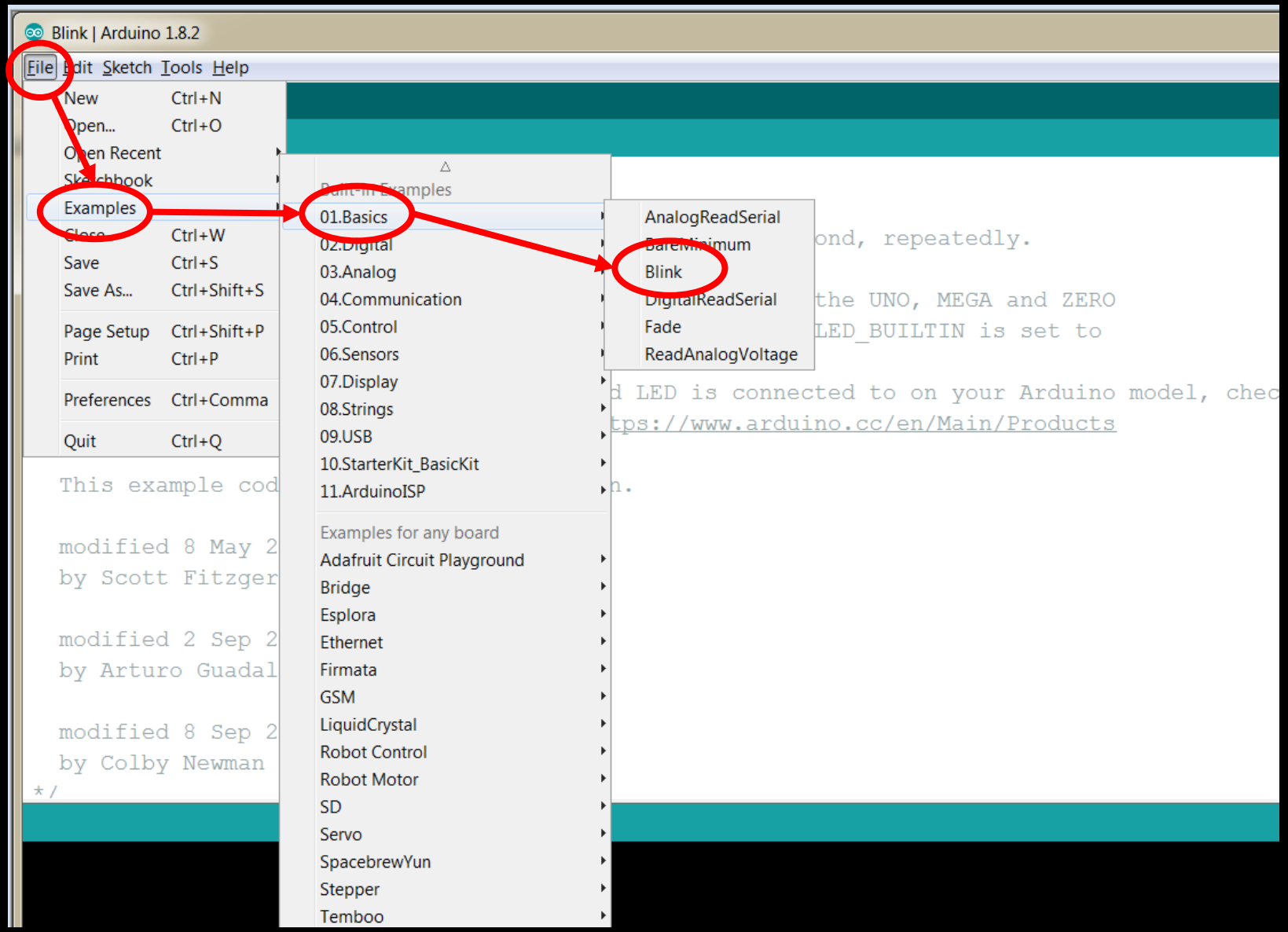
BLINK - FIRST SKETCH

BLINK



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BLINK - FIRST SKETCH

Setup Function

In Setup, Define Pin Direction

Main Loop

Turns LED ON

Delay 1 sec

Turns LED OFF

Delay 1 sec

```
// the setup function runs once when you press reset or power the b
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 th
  delay(1000);                       // wait for a second
  digitalWrite(LED_BUILTIN, LOW);    // turn the LED off by making
  delay(1000);                       // wait for a second
}
```

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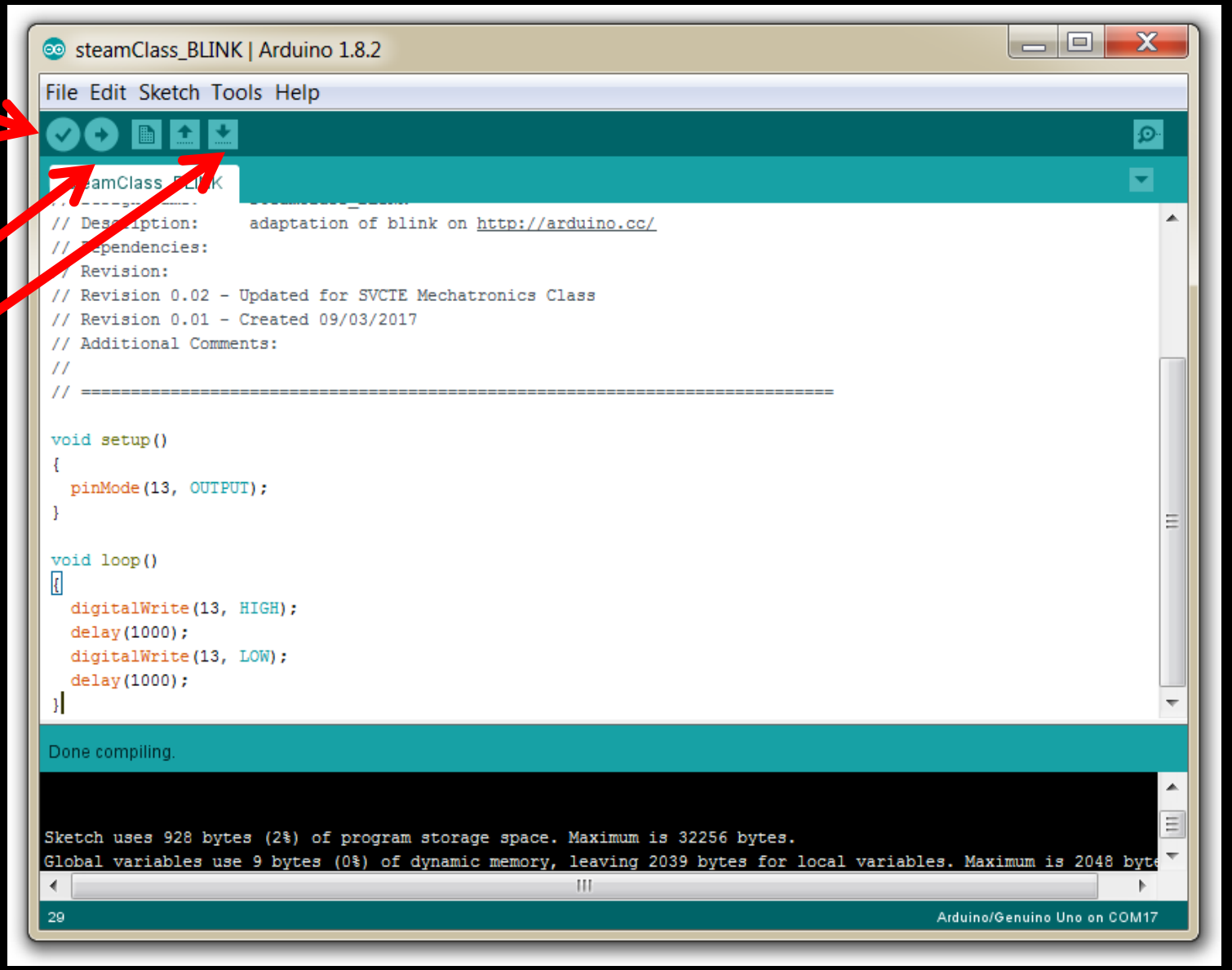
BLINK FASTER: VERIFY, SAVE, RUN

1. Verify
3. Upload & Run
2. Save



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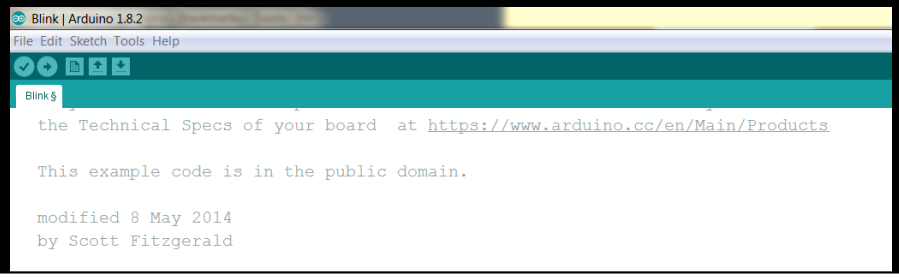
How do you change the blink rate?

- Change the number in the delay(1000)
- Delay is measured in ms
  - (1000 ms = 1 second)




```
// the loop function runs over and over again forever
void loop() {
  digitalWrite(LED_BUILTIN, HIGH);   //  is the voltage leve
  delay(250);                        // w
  digitalWrite(LED_BUILTIN, LOW);    //  aking the voltage L
  delay(250);                        // wait for a second
}
```

Change from 1000 to something like 500 or 250 or 100

What can happen in 500 ms?

REFERENCE SLIDES

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APPENDIX

Appendix A: License & Attribution

- This interpretation is primarily the Intellectual Property of Jim Burnham, Top STEAM Clown, at STEAMClown.org
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- My best attempt to properly attribute, or reference any other images, sources or work I have used are listed in Appendix B

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Appendix B: Attribution for Sources Used

- http://arduino.cc/
  - Has Software to download
  - Video, tutorials, labs, etc

RESOURCES

- Arduino Official Site - http://arduino.cc/
  - Has Software to download
  - Video, tutorials, labs, etc
- YouTube
  - https://www.youtube.com/watch?v=5F054MNB1QI