STEAM CLOWN™ PRODUCTIONS

ARDUINO STEAM ACADEMY

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

Blink and LED

PC NEEDS A MICROPROCESSOR TO RUN, RIGHT?

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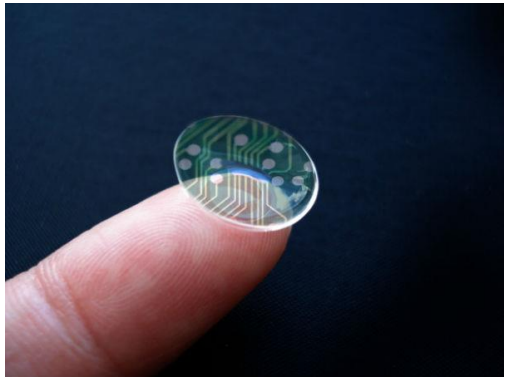
WHAT ABOUT THESE...



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

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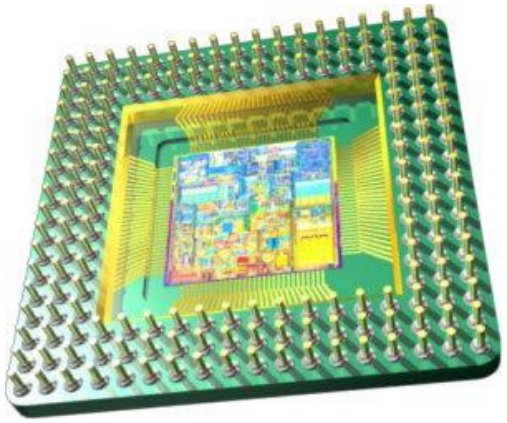
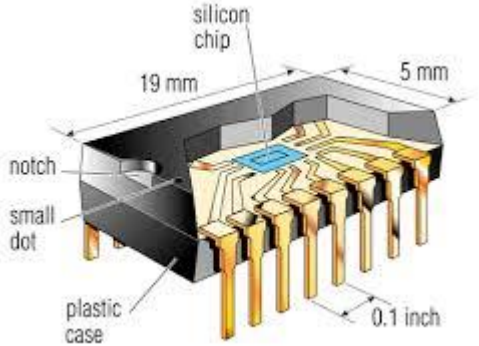
What is a microprocessor? What's the difference between a microprocessor and a microcontroller?

- 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

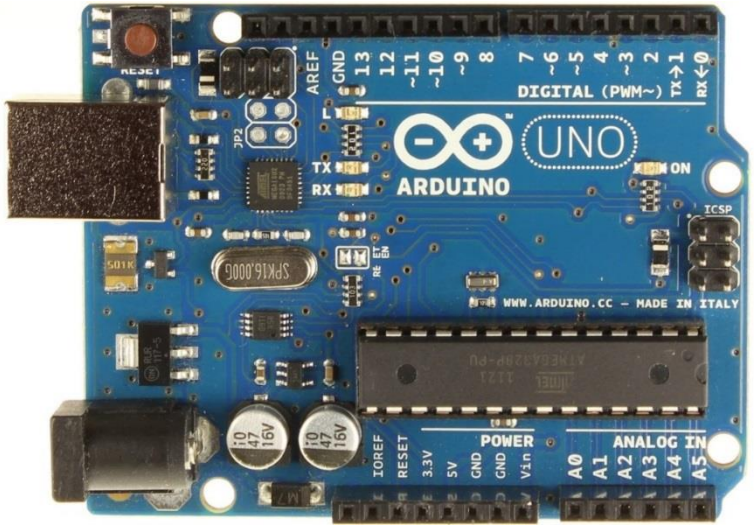
- A microcontroller, like the Arduino, is a standalone single-chip that contains
  - a CPU, read-only memory to store the program, RAM to store variables used in the execution of the program.





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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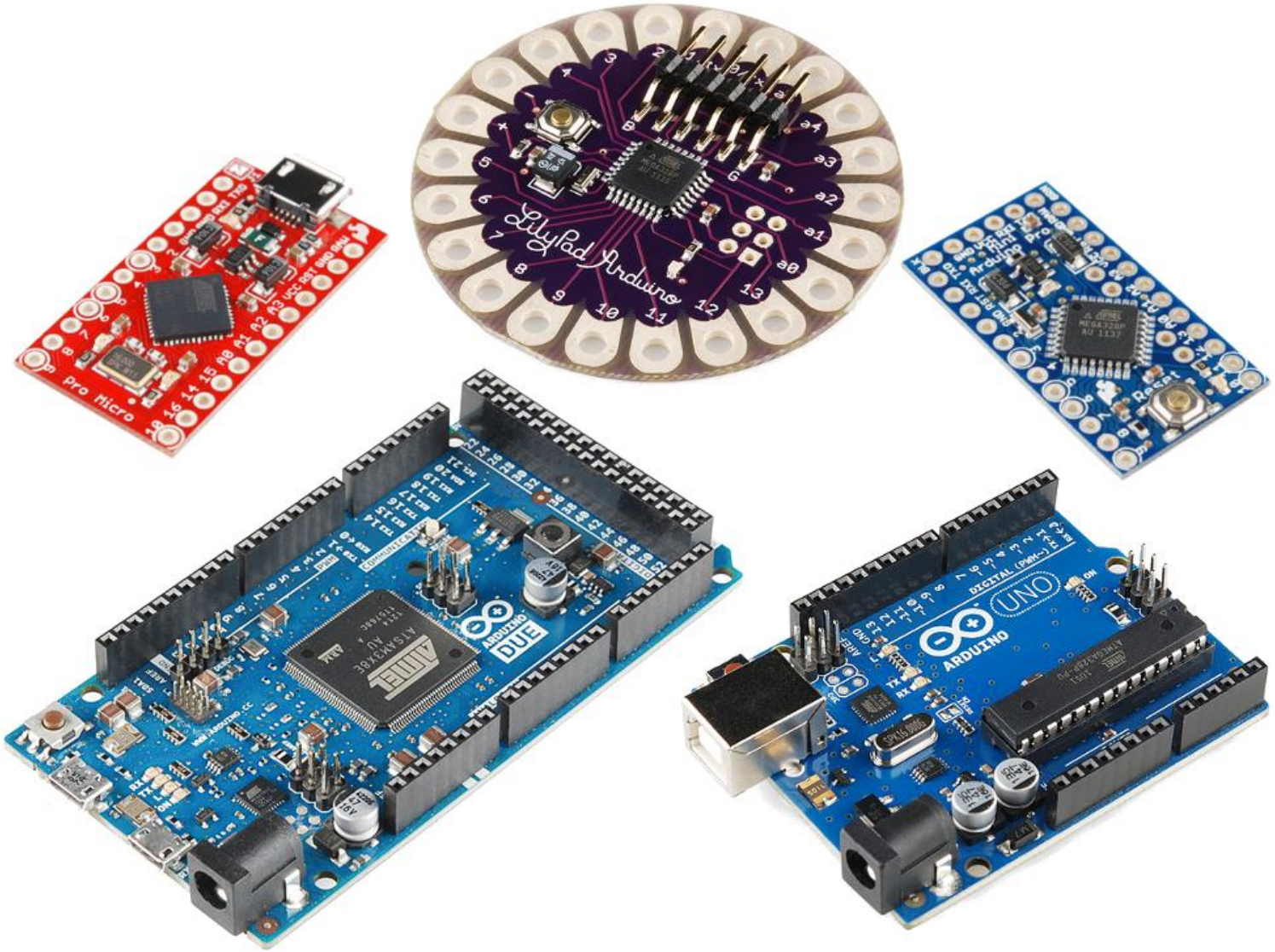
THERE ARE MANY TYPES OF ARDUINOS



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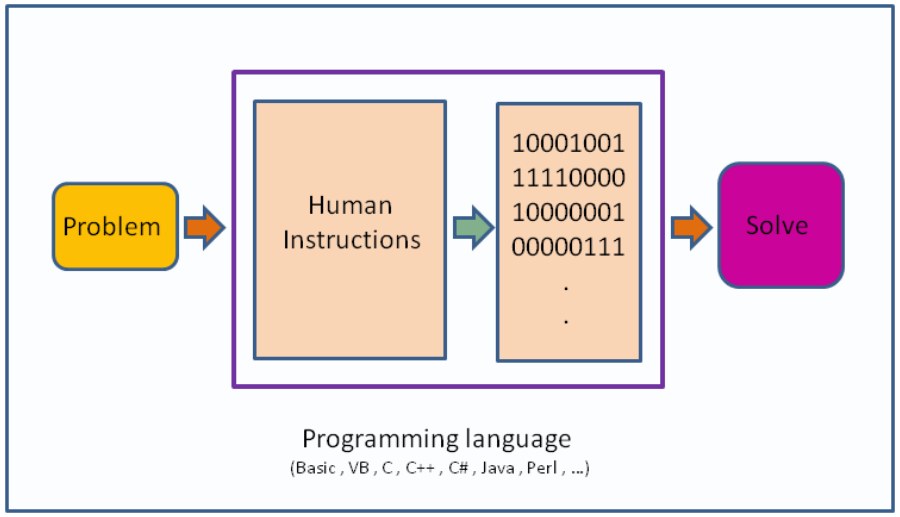
WHAT'S A PROGRAMING LANGUAGE?

- 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++



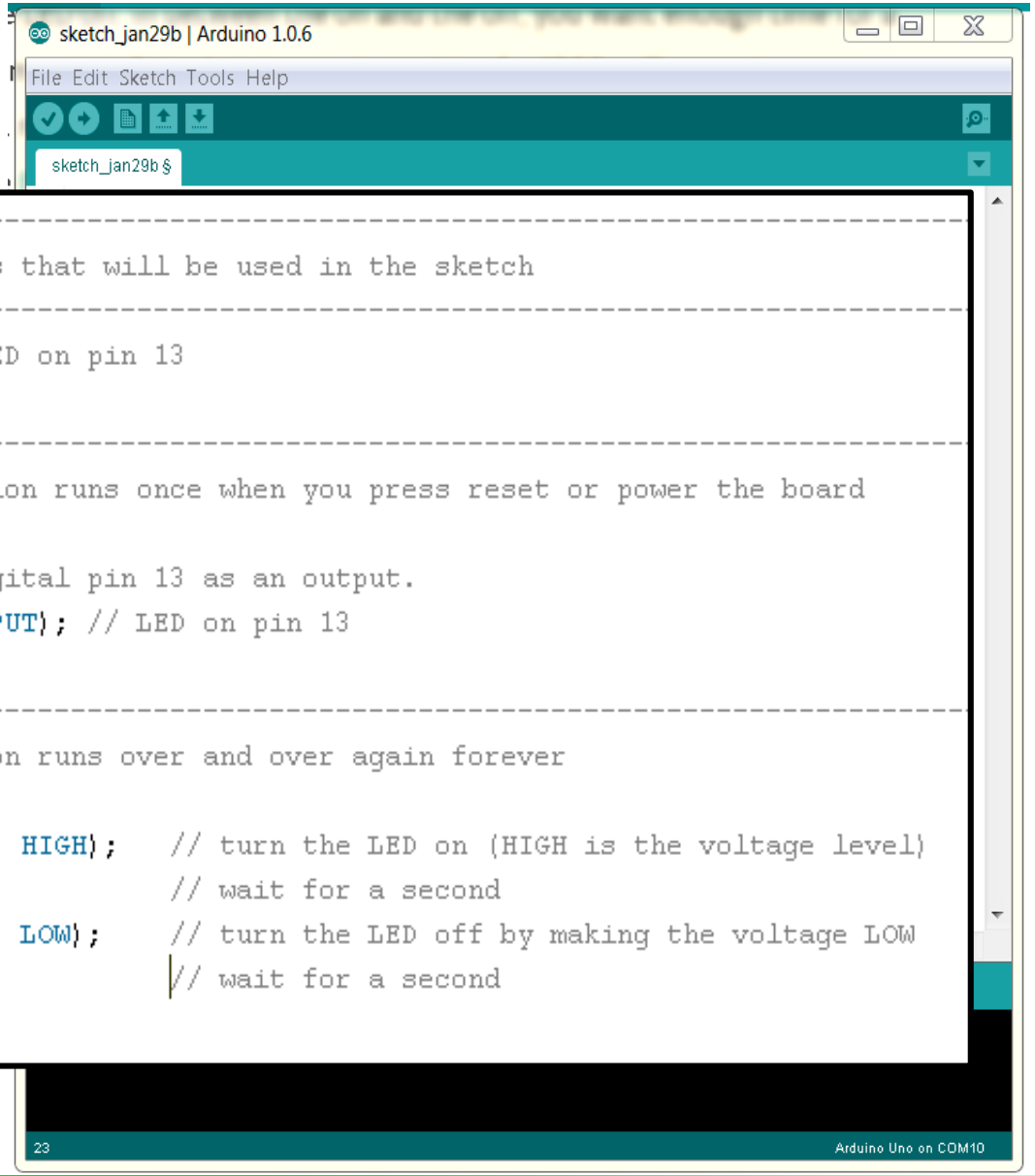
BLINK - FIRST SKETCH → C++

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  }
```

GO FROM A SKETCH TO BLINKING AN LED

Host Computer

Arduino

Source Code

Executable

1011001010
0110101101
1110100100
1010101100
0101100110

Compiler & Linker

Library Files

0011001010
1101111110
1010110100
1110101100
1001100110

1111001010
1100101101
1010110100
1110101100
1111100110

1011001010
1000100101
0101101001
1110101100
0011100110

Flash Program Memory

1101001011
1110001001
1011101100
1110011101
1101110101

Bootloader

CPU

Ports

USB Download Cable

Blinking LED

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A1

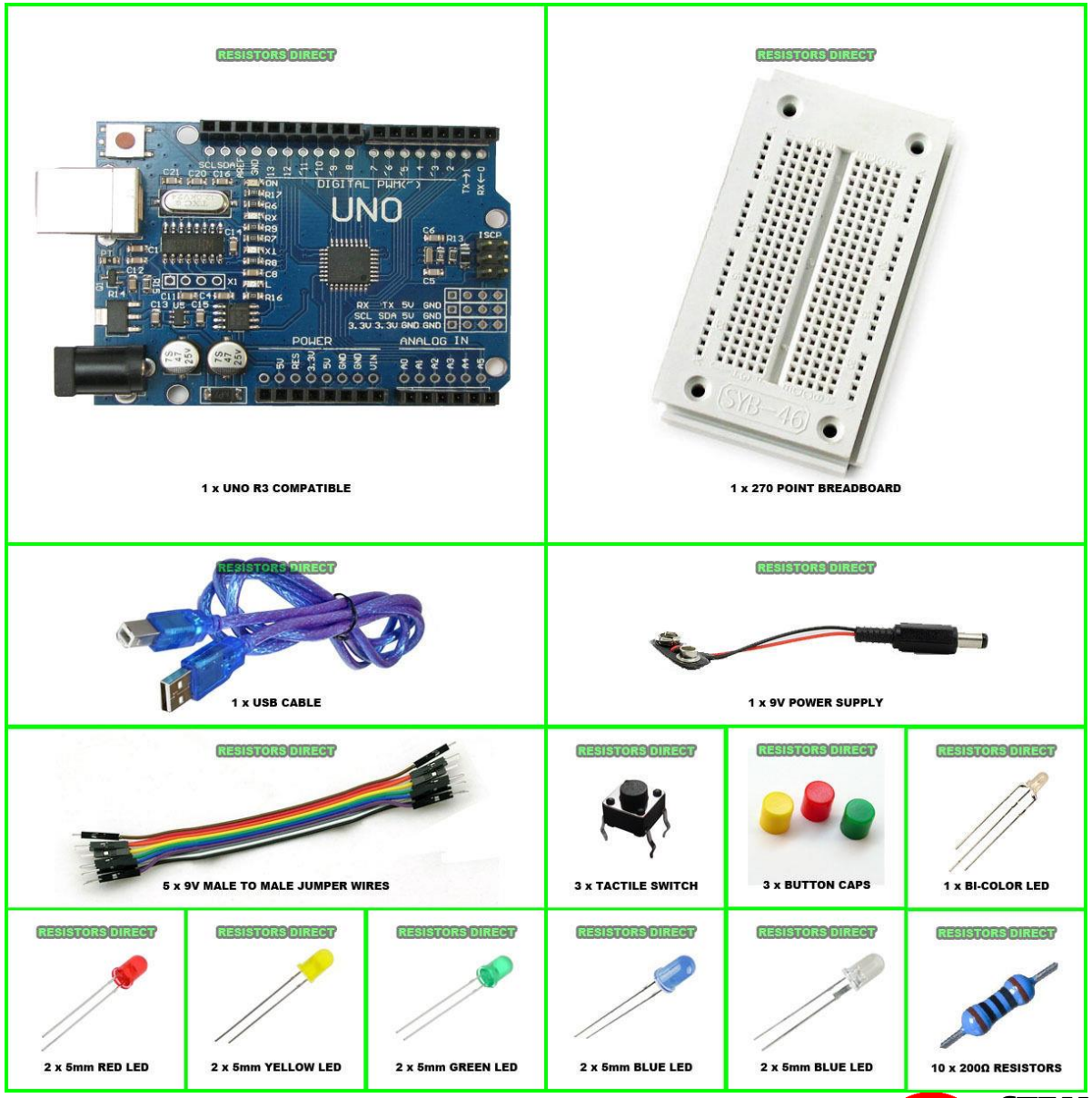
IS IT POSSIBLE TO GET HELP?

- Git Hub – See Steam Clown's Files
- 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

KIT AND INSTALL OF TOOLS

WHAT IN YOUR KIT

- Arduino Uno (clone)
- USB Cable
- Breadboard
- Battery Connector
- Jumper Wires
- 2 Buttons
- LEDs
- Resistors



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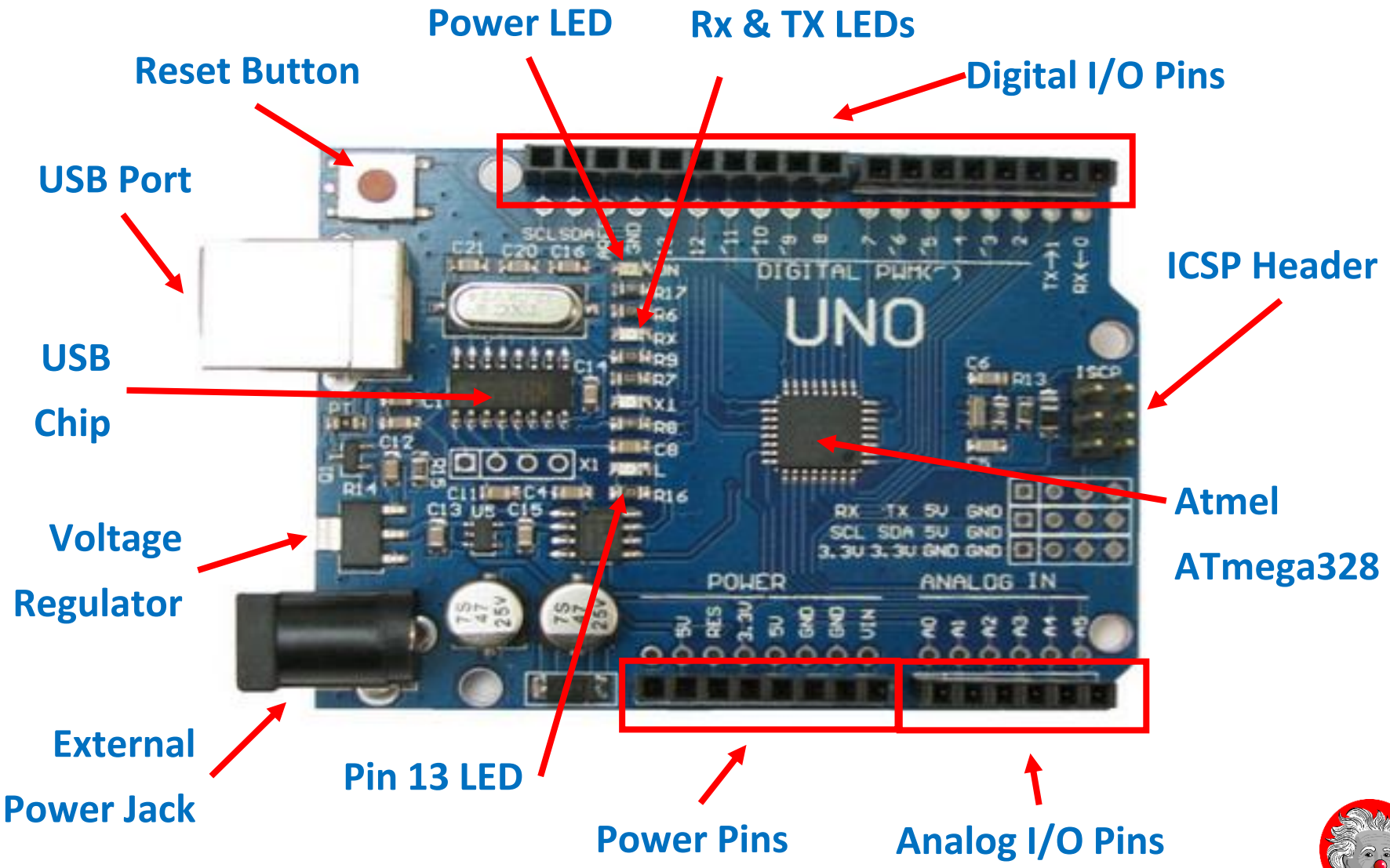
LET ME INTRODUCE YOU TO ARDUINO...



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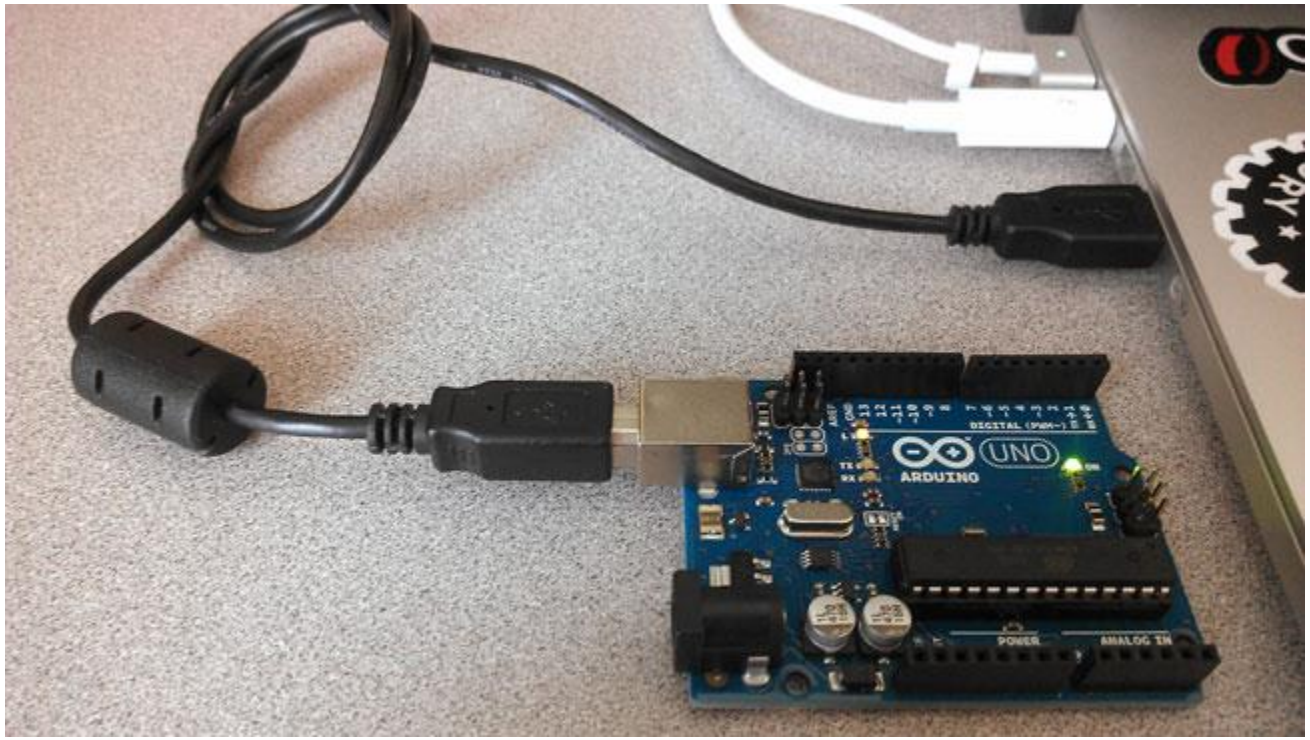
Powering your Arduino up for the first time

- 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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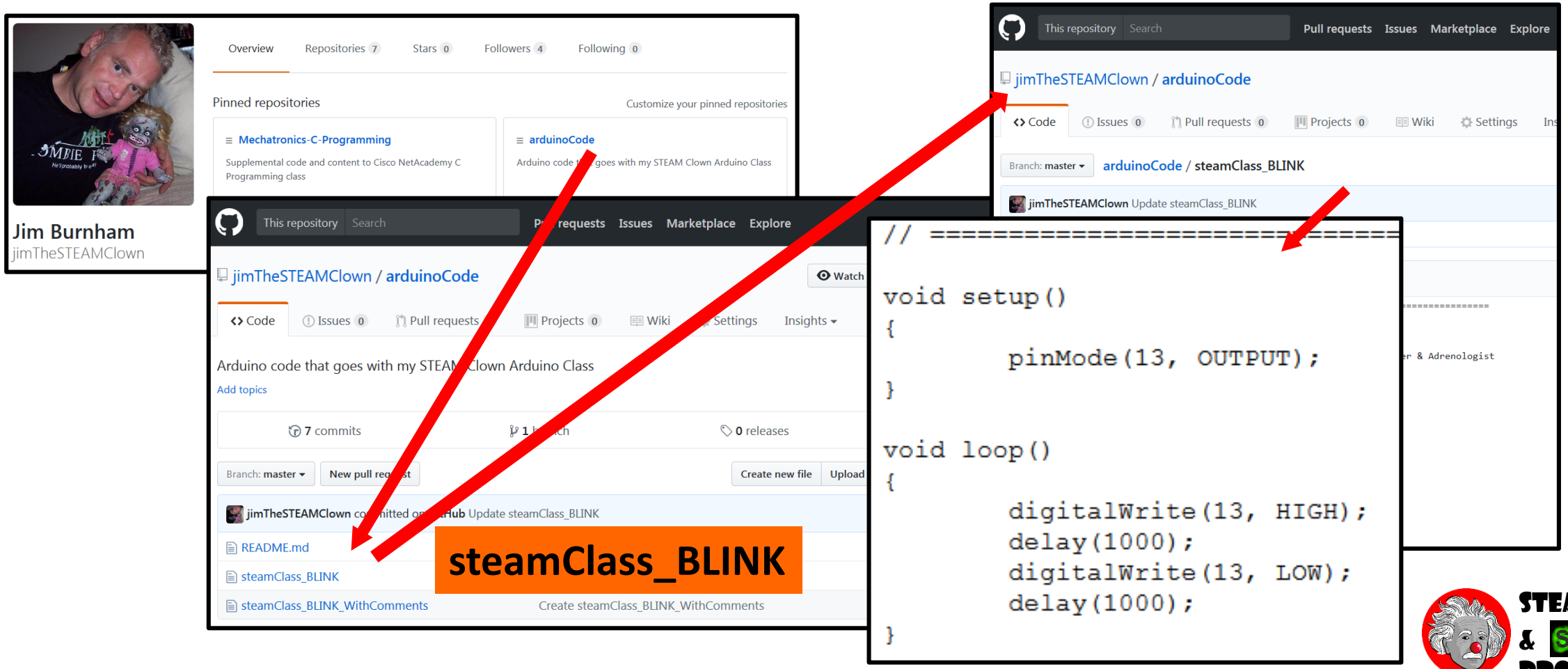
BLINK - FIRST SKETCH

WHERE ARE MY CODE EXAMPLES?

- Github - https://github.com/jimTheSTEAMClown



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BLINK - FIRST SKETCH

steamClass_BLINK on github

Setup Function

In Setup, Define Pin Direction

Main Loop

Turns LED ON

Delay 1 sec

Turns LED OFF

Delay 1 sec

```
16  // ================================
17
18  void setup()
19  {
20          pinMode(13, OUTPUT);
21  }
22
23  void loop()
24  {
25          digitalWrite(13, HIGH);
26          delay(1000);
27          digitalWrite(13, LOW);
28          delay(1000);
29  }
```

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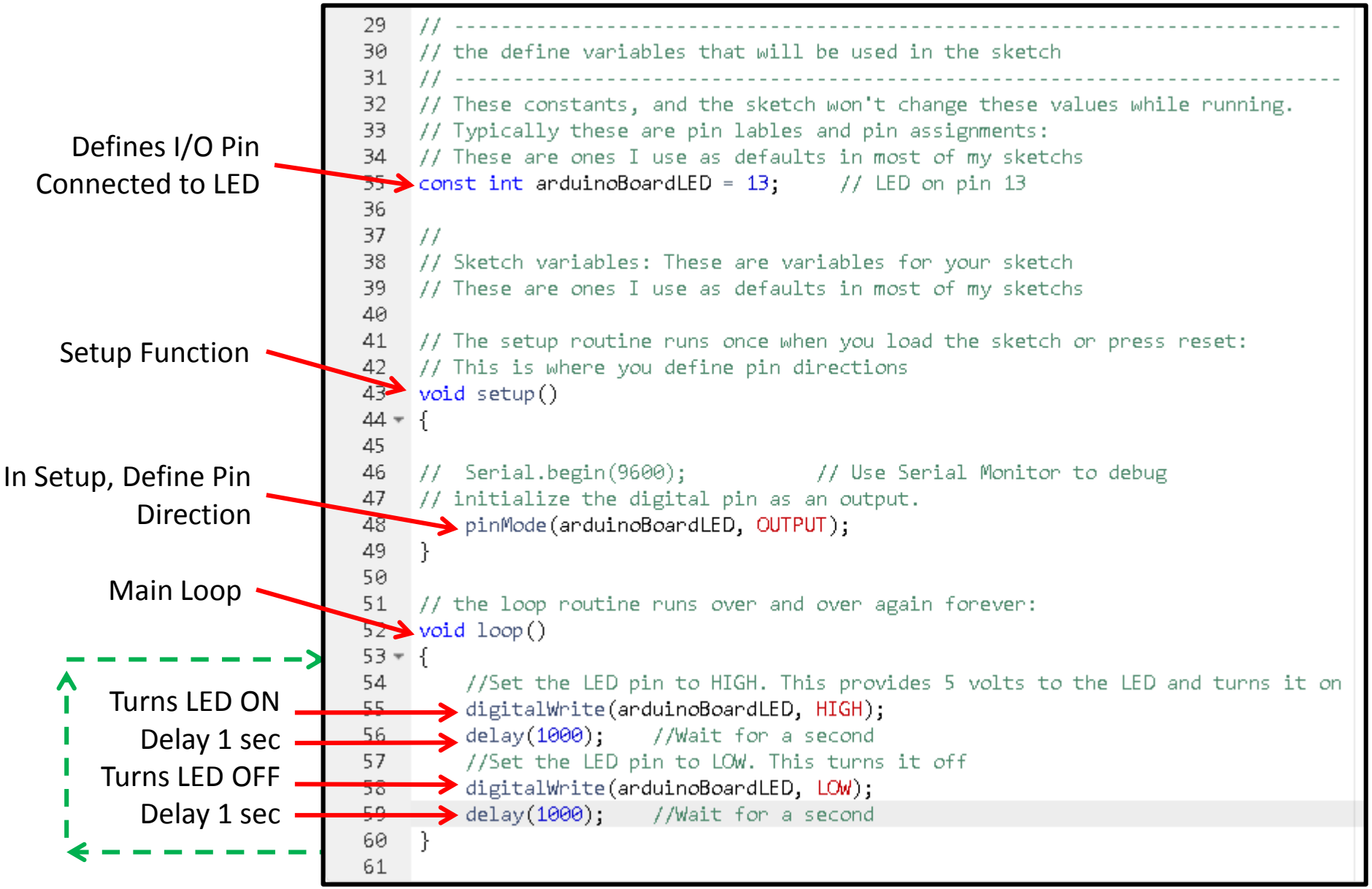
BLINK - FIRST SKETCH

steamClass_BLINK_WithComments on github




```
29  // ----------------------------------------------------------------------------
30  // the define variables that will be used in the sketch
31  // ----------------------------------------------------------------------------
32  // These constants, and the sketch won't change these values while running.
33  // Typically these are pin lables and pin assignments:
34  // These are ones I use as defaults in most of my sketchs
35  const int arduinoBoardLED = 13;     // LED on pin 13
36
37  //
38  // Sketch variables: These are variables for your sketch
39  // These are ones I use as defaults in most of my sketchs
40
41  // The setup routine runs once when you load the sketch or press reset:
42  // This is where you define pin directions
43  void setup()
44  {
45
46  //  Serial.begin(9600);           // Use Serial Monitor to debug
47  // initialize the digital pin as an output.
48    pinMode(arduinoBoardLED, OUTPUT);
49  }
50
51  // the loop routine runs over and over again forever:
52  void loop()
53  {
54      //Set the LED pin to HIGH. This provides 5 volts to the LED and turns it on
55    digitalWrite(arduinoBoardLED, HIGH);
56    delay(1000);    //Wait for a second
57    //Set the LED pin to LOW. This turns it off
58    digitalWrite(arduinoBoardLED, LOW);
59    delay(1000);    //Wait for a second
60  }
61
```

MAKE SURE YOU RENAME YOUR SKETCH

- When you name your Sketches, please Remove **STEAM_Clown** or **steamClass** from your Sketch names…
- Please…

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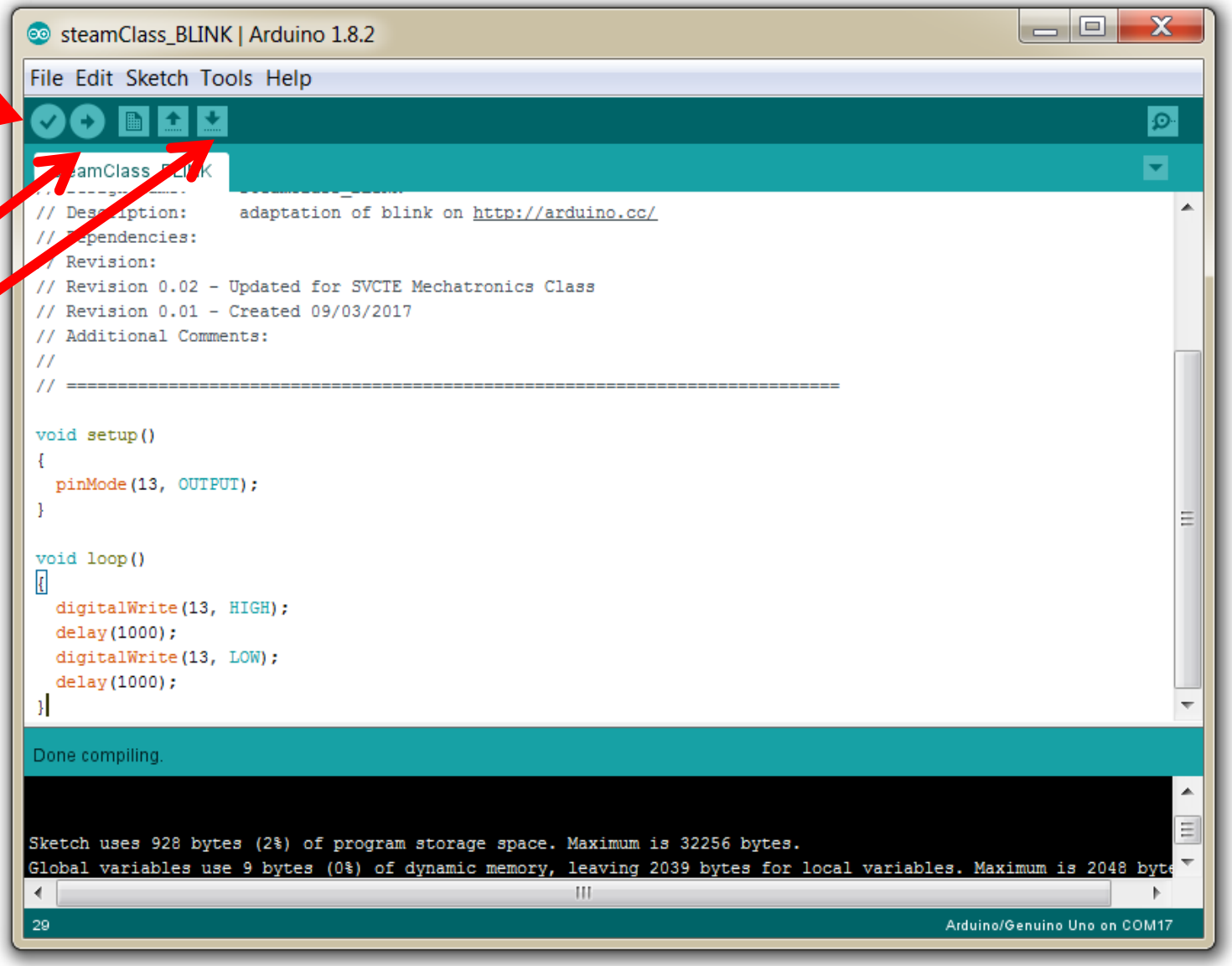
BLINK FASTER: VERIFY, SAVE, RUN

1. Verify
3. Upload & Run
2. Save



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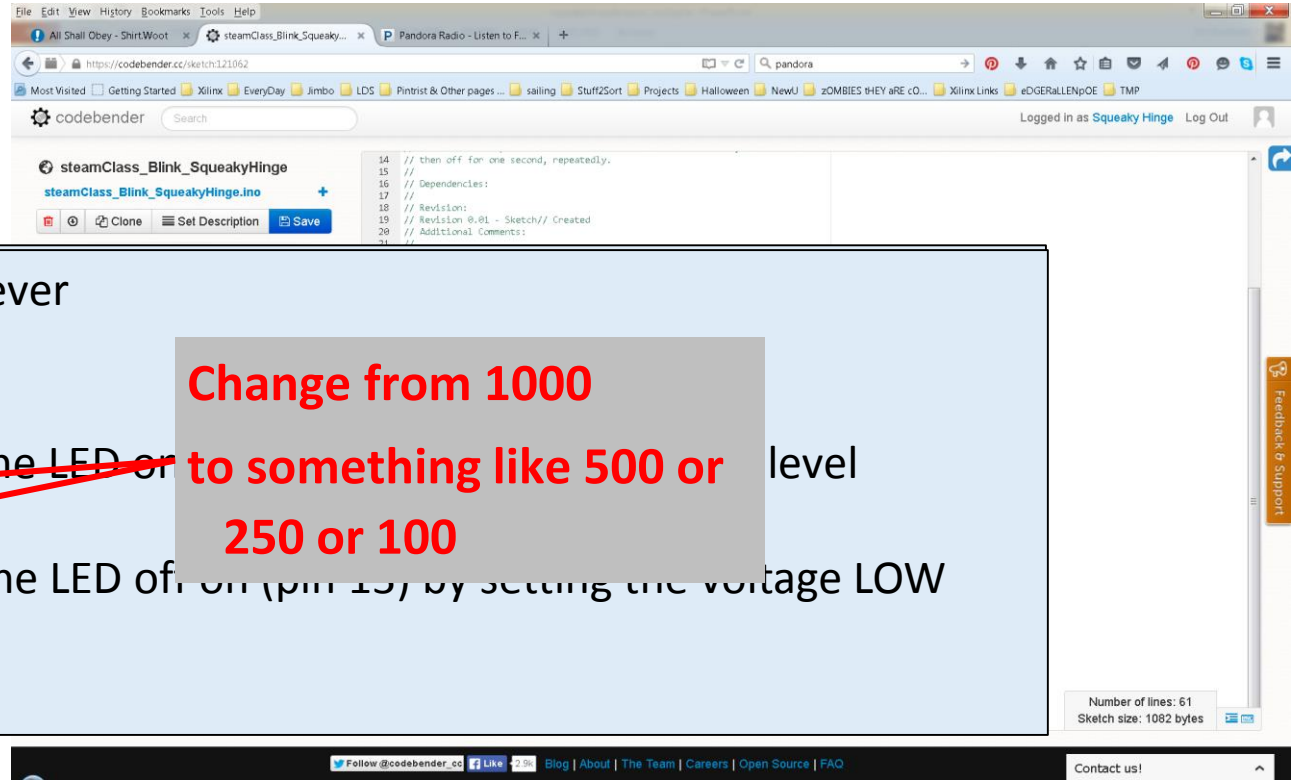
How do you change the blink rate?

- 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(arduinoBoardLED, HIGH);   // turn the LED or                level
  delay(500);               // wait for a second
  digitalWrite(arduinoBoardLED, LOW);    // turn the LED off (pin 13) by setting the voltage LOW
  delay(500);               // wait for a second
}
```

Change from 1000 to something like 500 or 250 or 100

What can happen in 500 ms?

APPENDIX

Appendix A: License & Attribution

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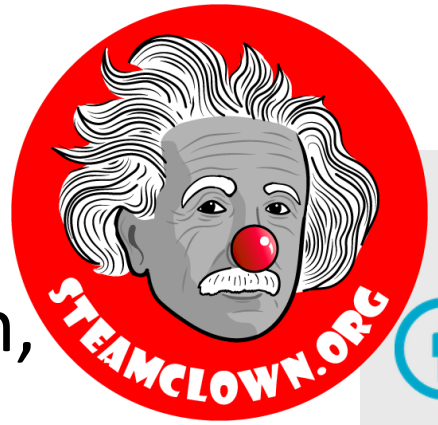
- My best attempt to properly attribute, or reference any other sources or work I have used are listed in Appendix B



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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

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REFERENCE SLIDES