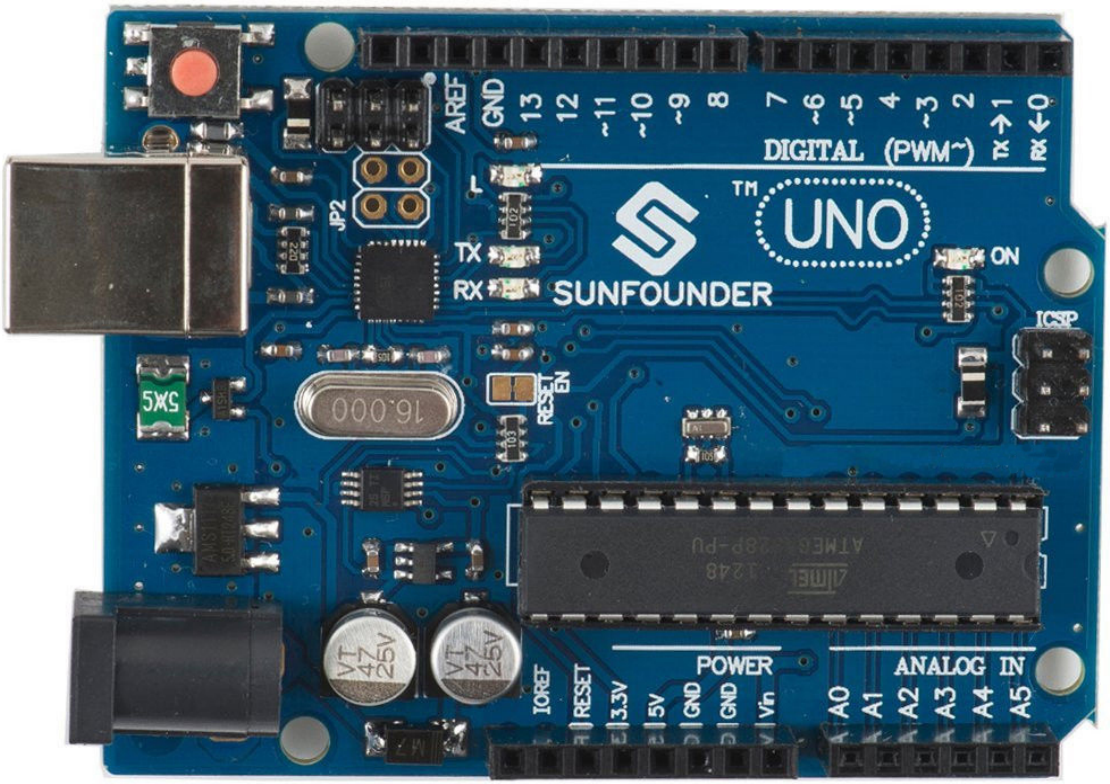
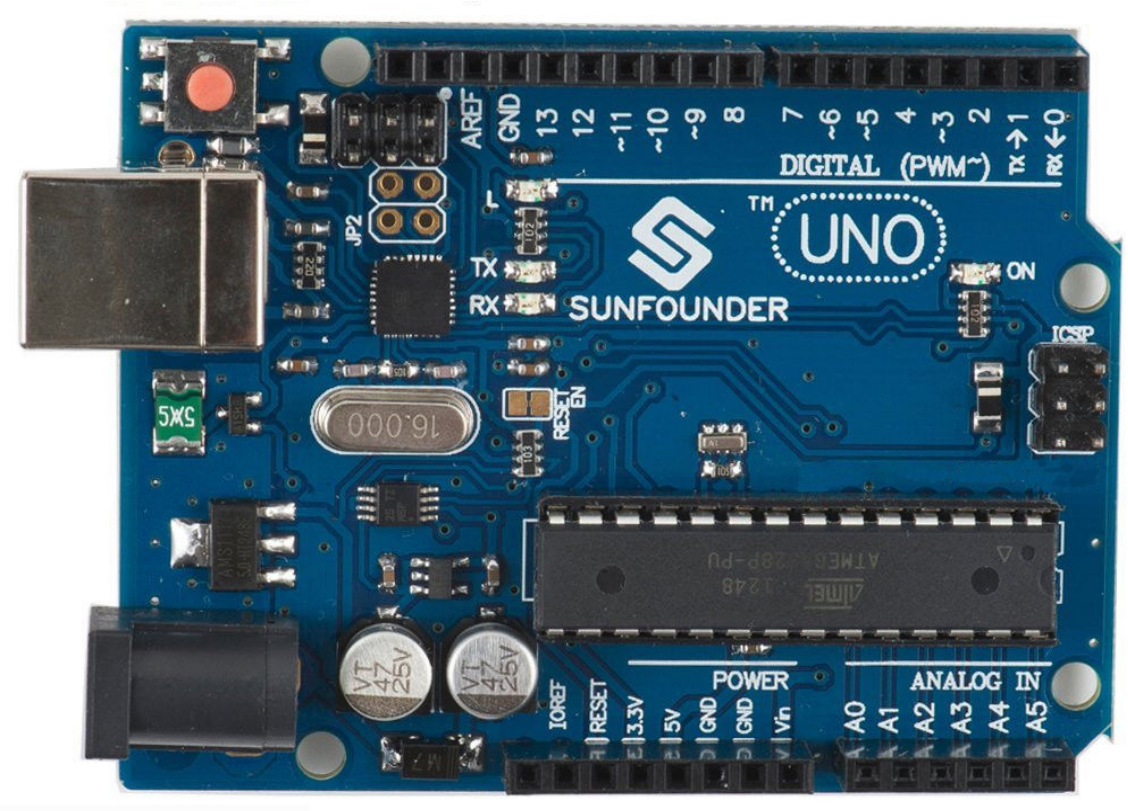
Introduction to the Arduino Uno

UCHS – Computer Science Principles



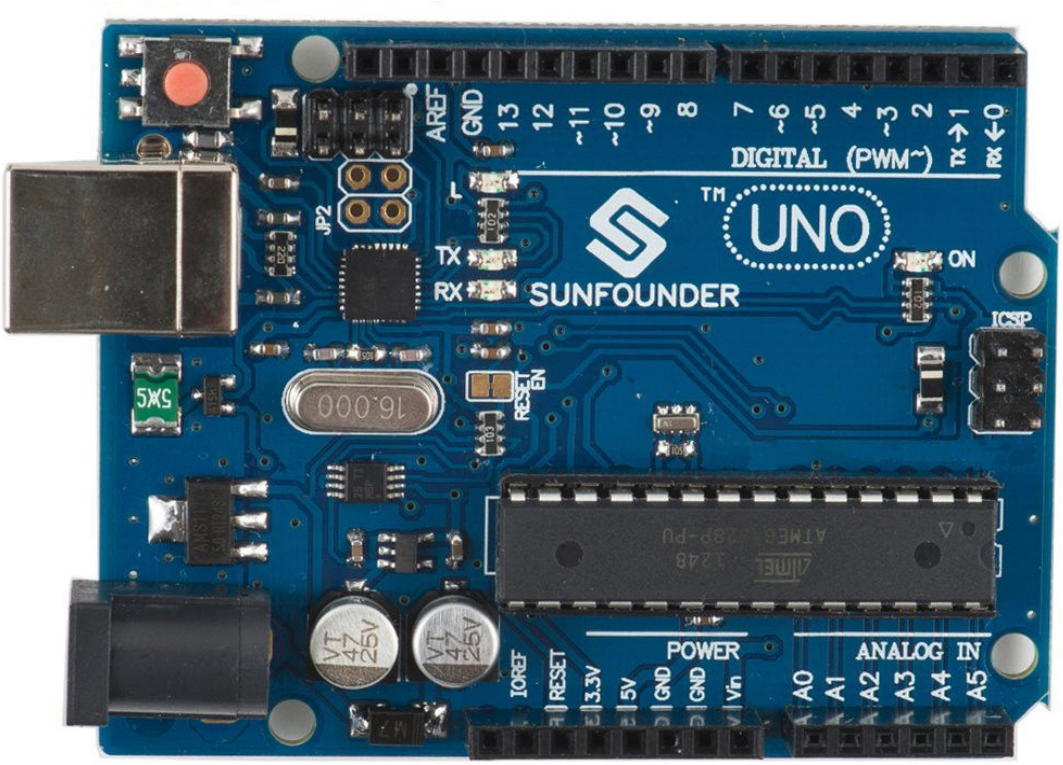
Overview

- Why Arduino?
- History of the Arduino
- Other Arduinos
- Meet the Arduino Uno



Why Arduino?

- Arduino is a low-cost microcontroller board that lets even a novice do really amazing things.
- You can connect an Arduino to all kinds of sensors, lights, motors, and other devices
- Uses easy-to-learn software to program how your creation will behave.
- Arduino has spawned an international do-it-yourself revolution in electronics. You can buy an Arduino board for just about US $30 or build your own from scratch
- All hardware schematics and source code are available for free under public licenses.
- As a result, Arduino has become the most influential open-source hardware movement of its time.



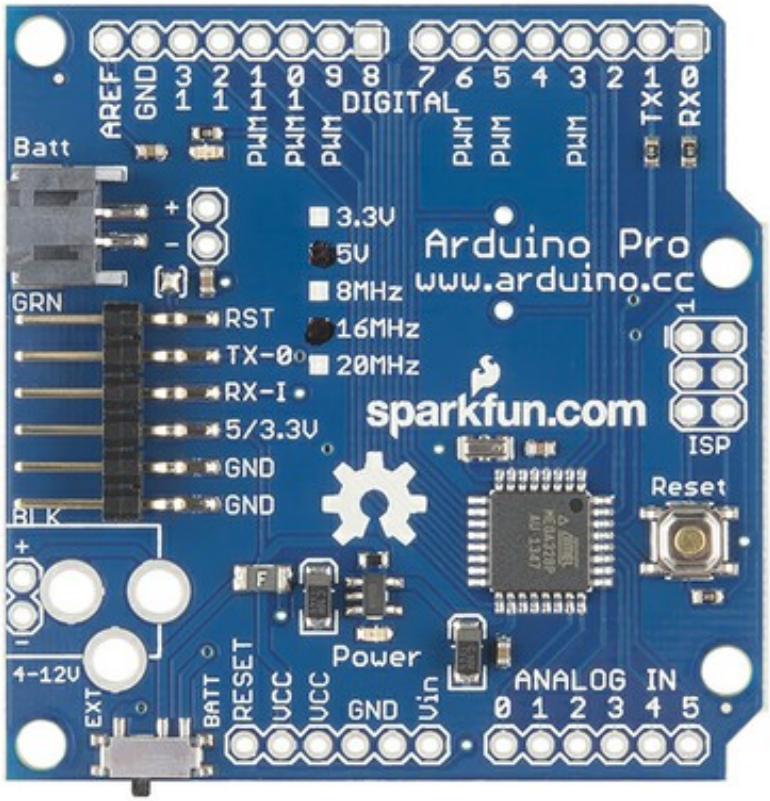
History of Arduino

- Five Friends from Italy
- 1002 King Arduin
- Bar di Re Arduino
- Released in 2005 as a modest tool for Banzi's students at the Interaction Design Institute Ivrea (IDII)
- How to teach electronics fast
- http://spectrum.ieee.org/geek-life/hands-on/the-making-of-arduino

Other Arduinos

Arduino Pro

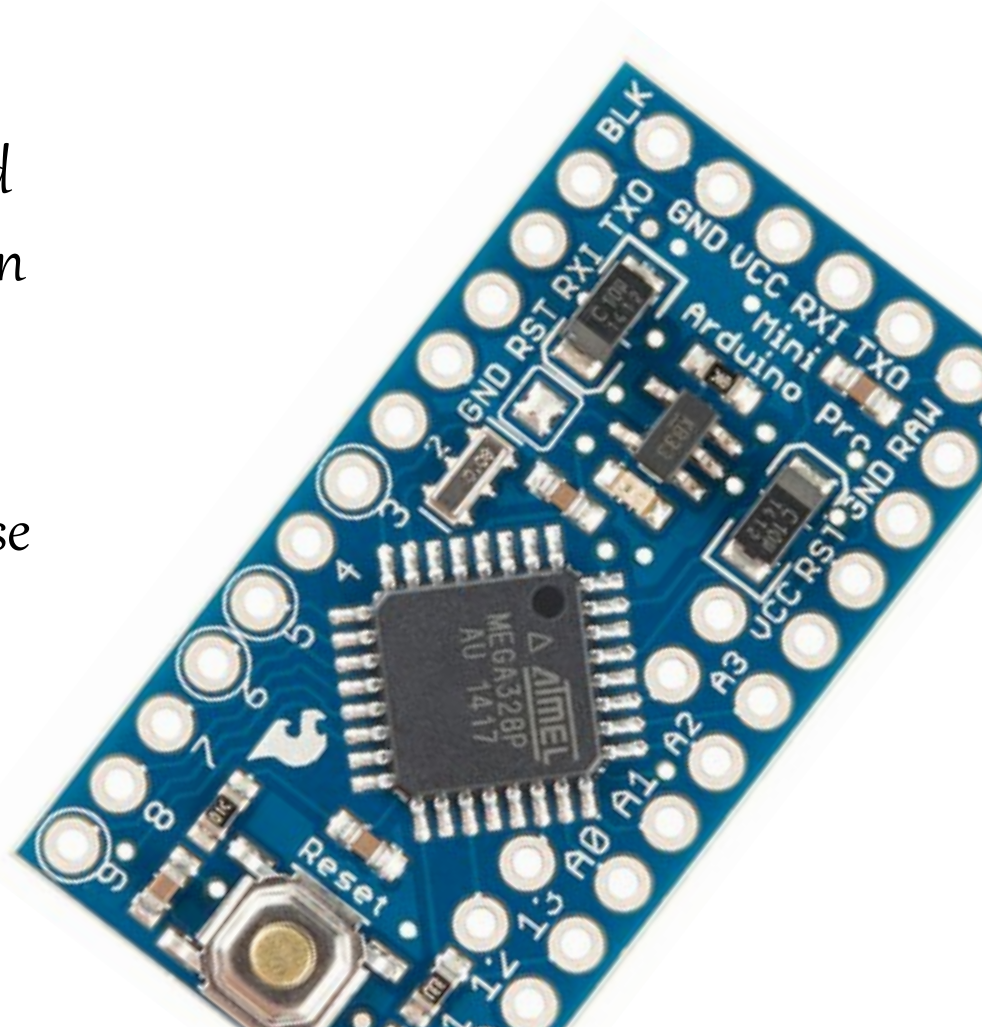
- The Arduino Pro is intended for semi-permanent installation in objects or exhibitions.
- The board comes without pre-mounted headers, allowing the use of various types of connectors or direct soldering of wires.
- The pin layout is compatible with Arduino shields.
- The 3.3V versions of the Pro can be powered with a battery. - www.arduino.cc



Other Arduinos

Arduino Pro Mini

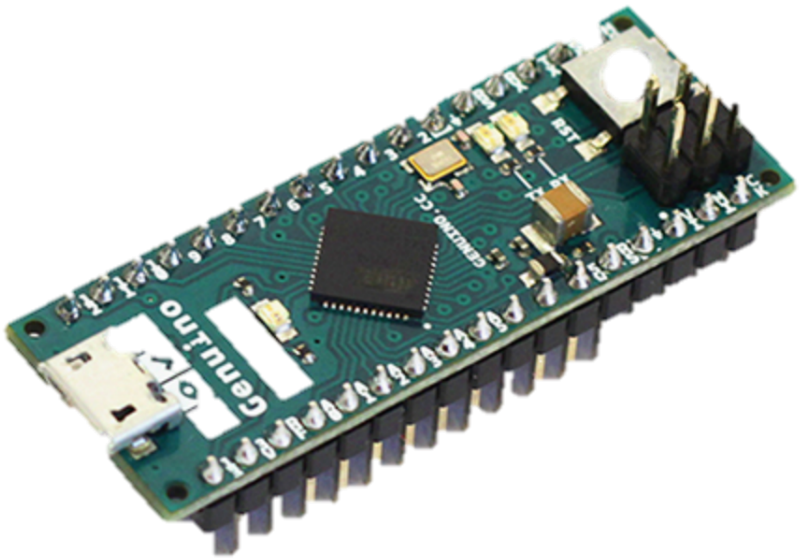
- The Arduino Pro Mini is intended for semi-permanent installation in objects or exhibitions.
- The board comes without pre-mounted headers, allowing the use of various types of connectors or direct soldering of wires.
- The pin layout is compatible with the Arduino Mini. www.arduino.cc



Other Arduinos

The Micro

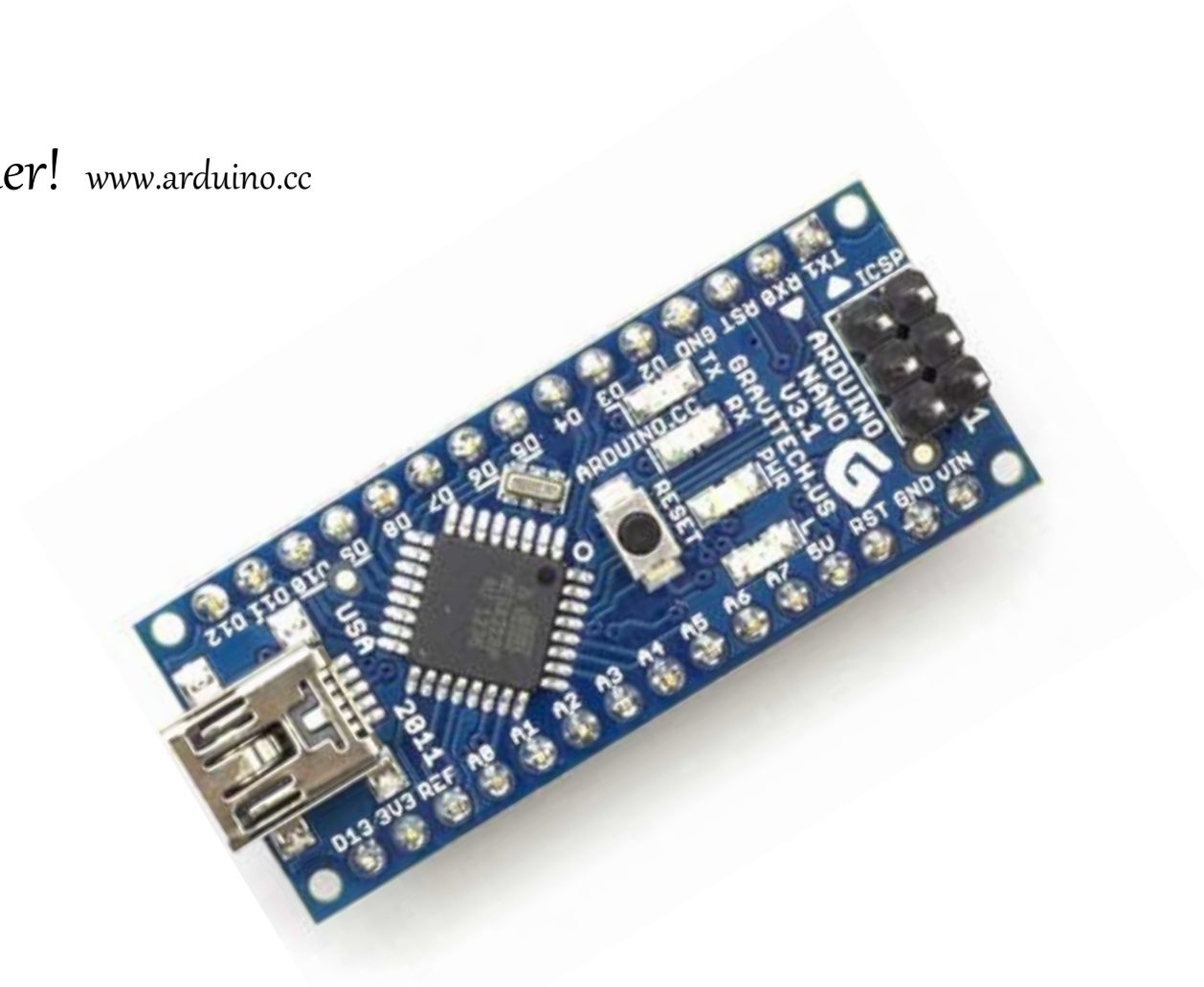
- The Micro is the smallest board of the family, easy to integrate it in everyday objects to make them interactive.
- The Micro is based on the ATmega32U4 microcontroller featuring a built-in USB which makes the Micro recognisable as a mouse or keyboard. www.arduino.cc



Other Arduinos

The Nano

- Even smaller! www.arduino.cc



Other Arduinos

The Nano

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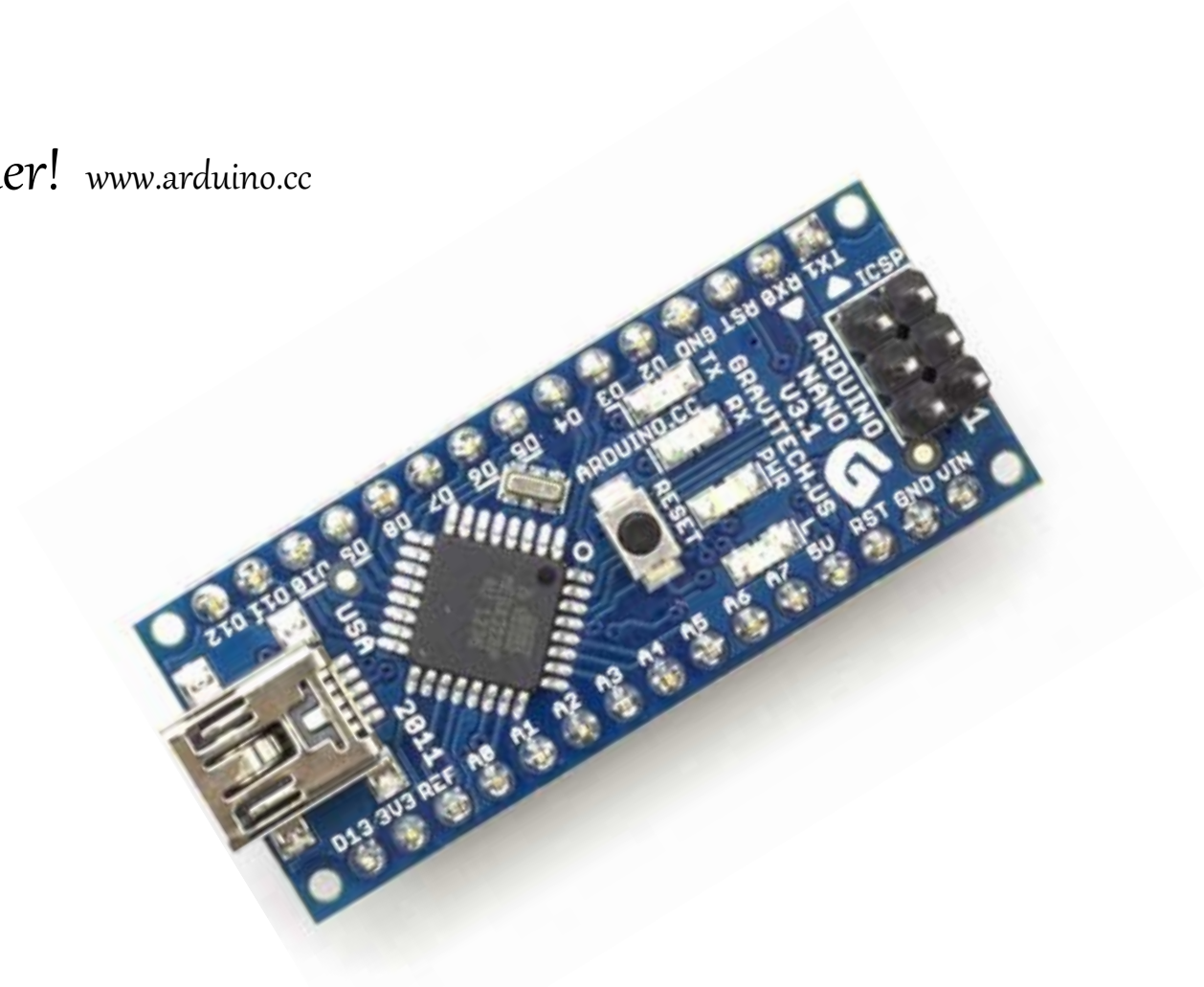
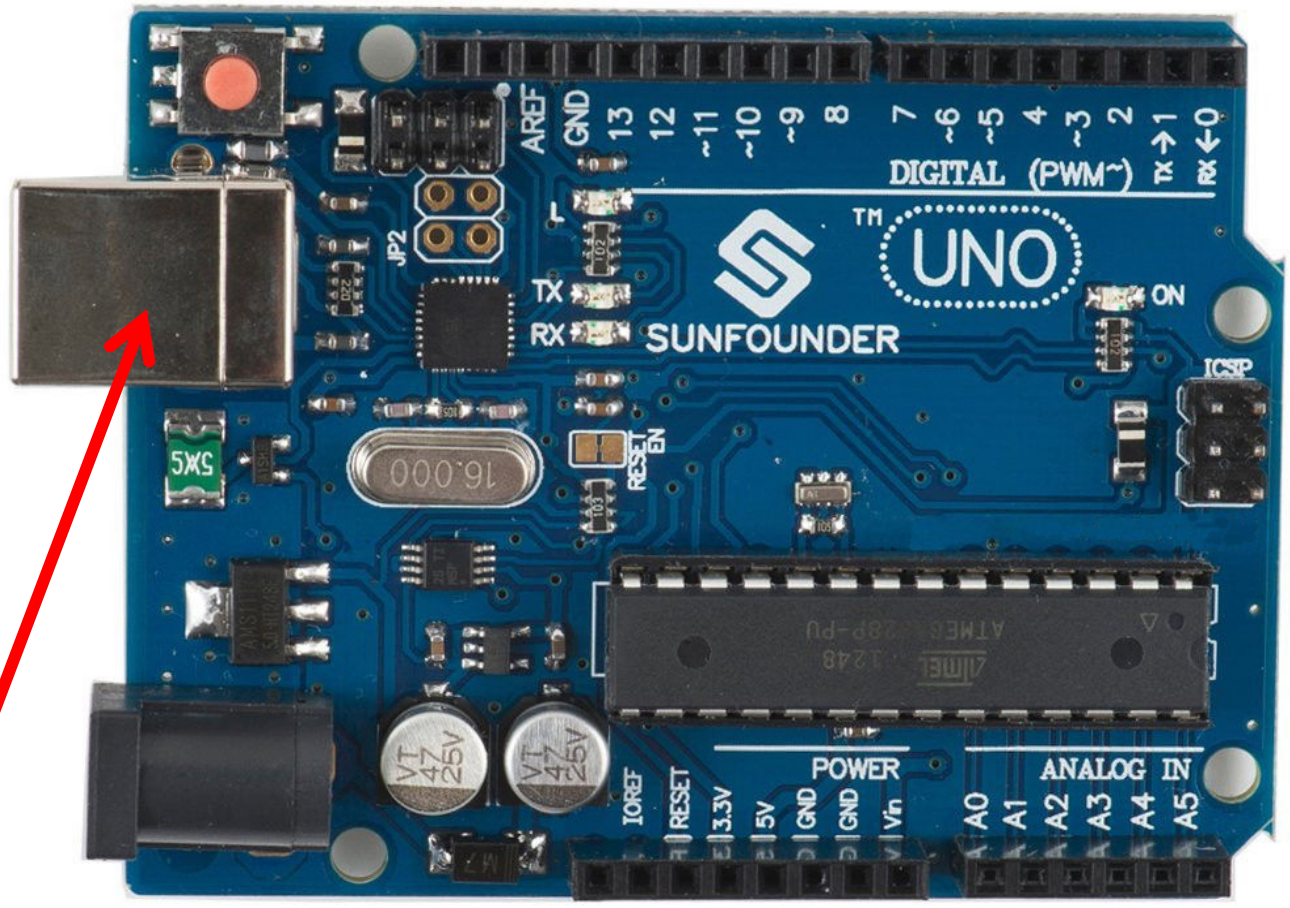


Meet the Arduino Uno

- USB – Universal Serial Bus – Connects Board to your computer
  - Supplies power to the board
  - Uploads your instructions to the Arduino
  - Send data to and receive it from your computer.



Why Arduino

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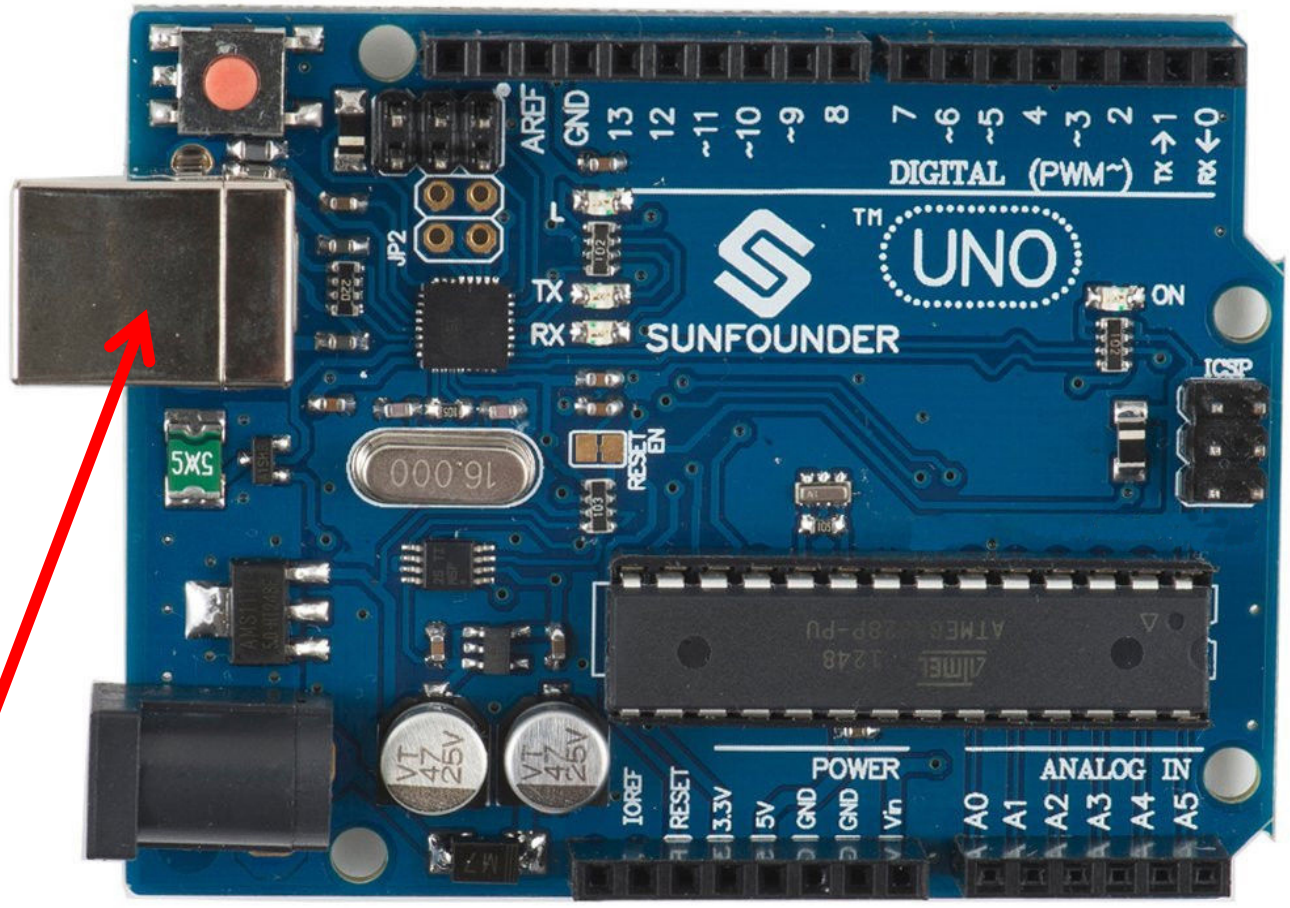
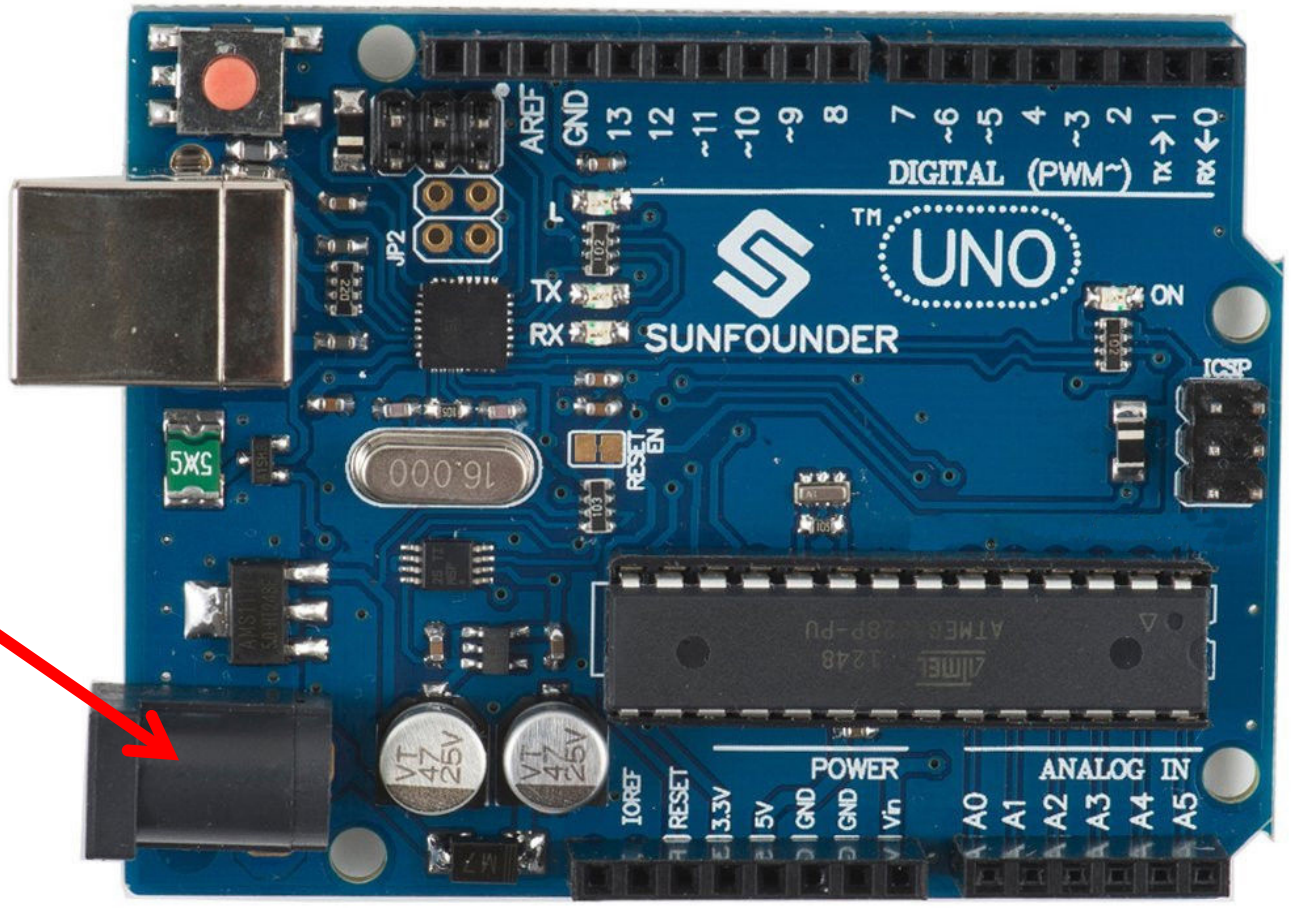


Meet the Arduino Uno

Power Connector: Can power the Arduino with a standard mains power adapter.



Communication with the Arduino

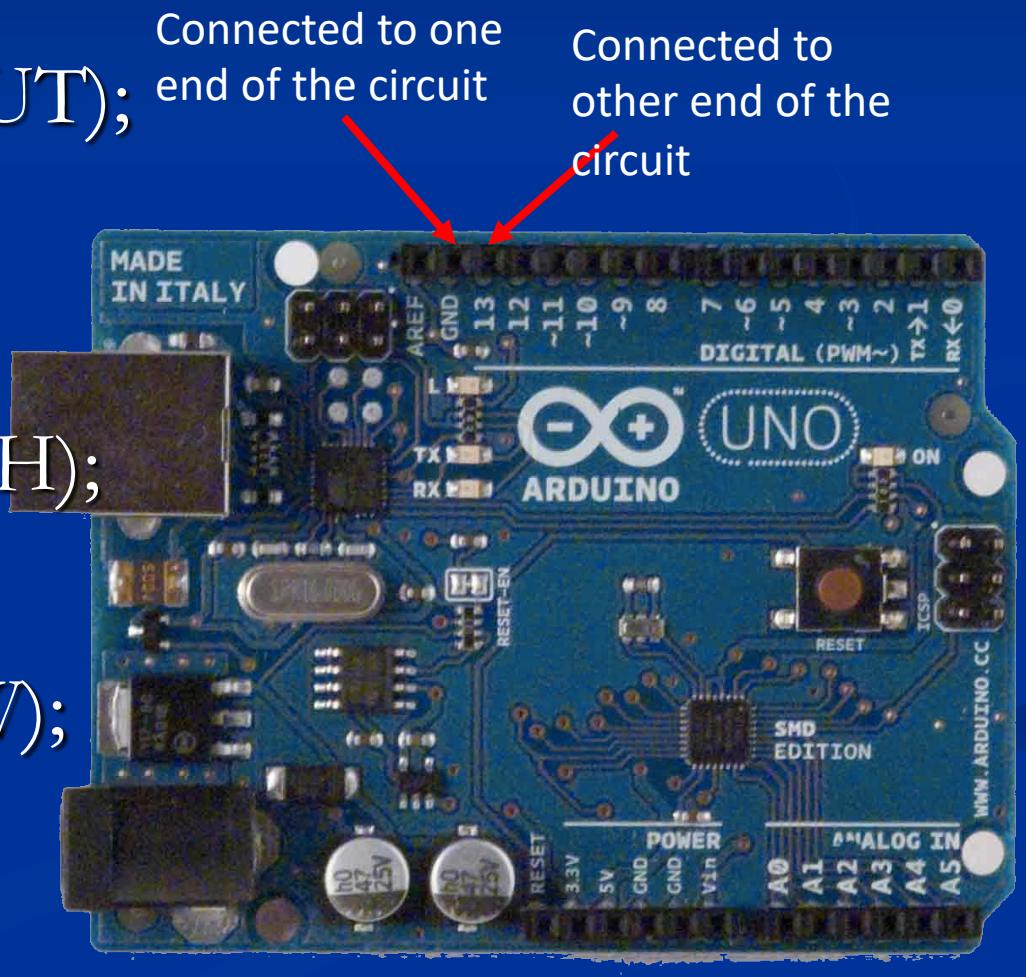
- Start the Arduino program
- If it loads in wrong language, go to arduino online and find language support
- Pull up the Blink sketch file – under file, examples, basics, blink.
- Check the Setup: go to tools, board=uno,
  - Windows: port=highest number (guess and try another)
  - Mac: port should have /dev/tty.usb… in it.

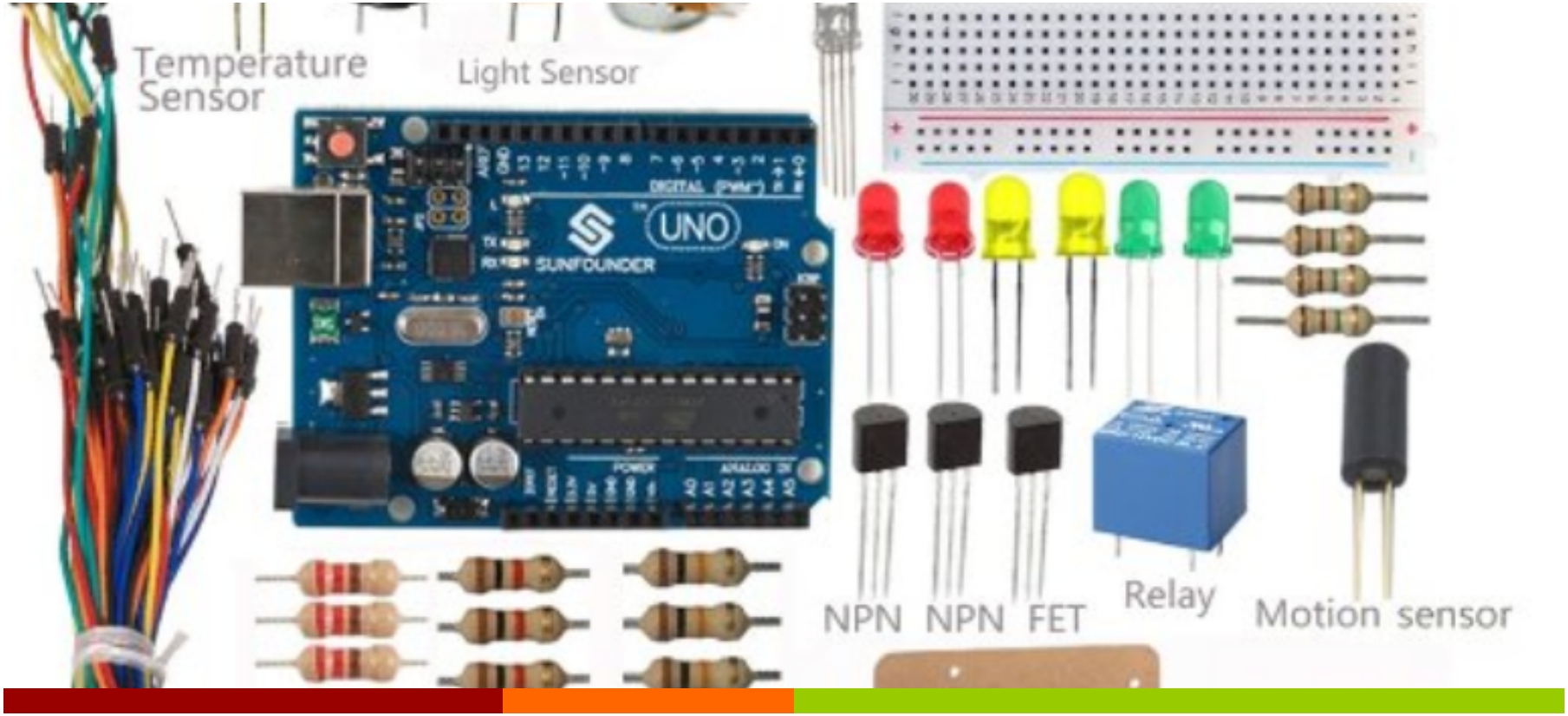
Communication with the Arduino

- Upload blink – (it might be preloaded – but upload again. → on top left
- Bar indicates progress
- Yellow light should blink on and off.
- Test with faster blink
  - In blink sketch, change delay from 1000 to 500, in both places: UPLOAD again. should blink faster
  - try 100

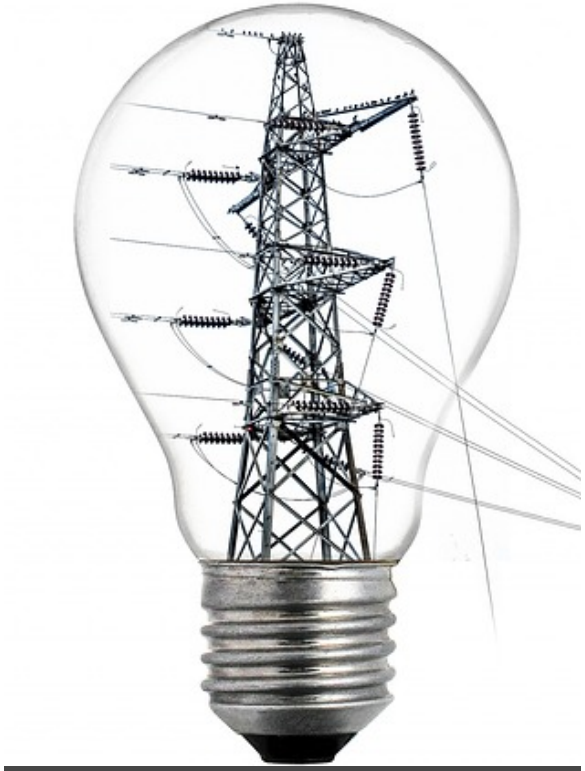
Blink Sketch

```
void setup( ) {
  pinMode(13, OUTPUT);
}
void loop( ) {
  digitalWrite(13, HIGH);
  delay(1000);
  digitalWrite(13, LOW);
  delay(1000);
}
```



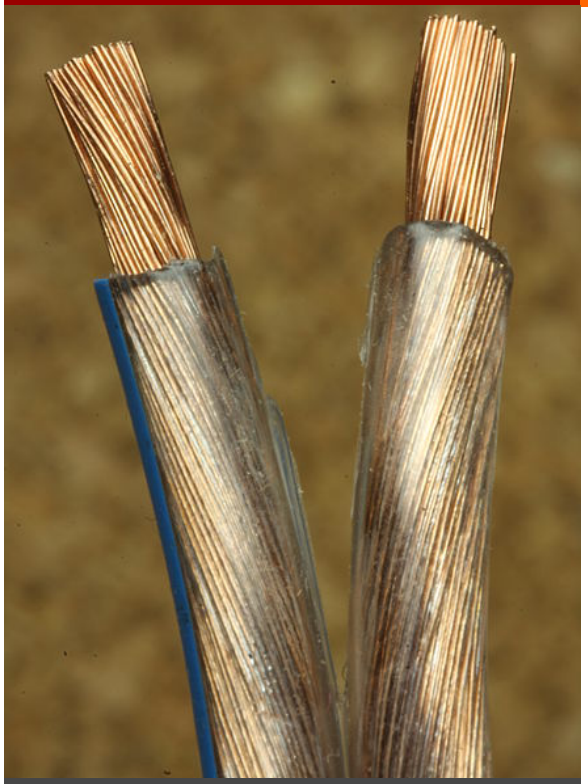


Get to know your tools…



Electricity

- Electricity is a type of energy, like heat gravity, light

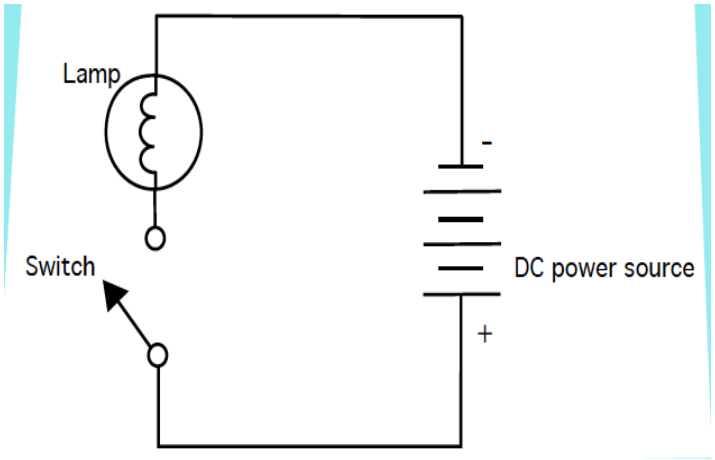


Conductors

- Electrical Energy moves through conductors, like wires.
- You can convert electrical energy to do other necessary things – like turn a light on, make a noise come out of speakers.

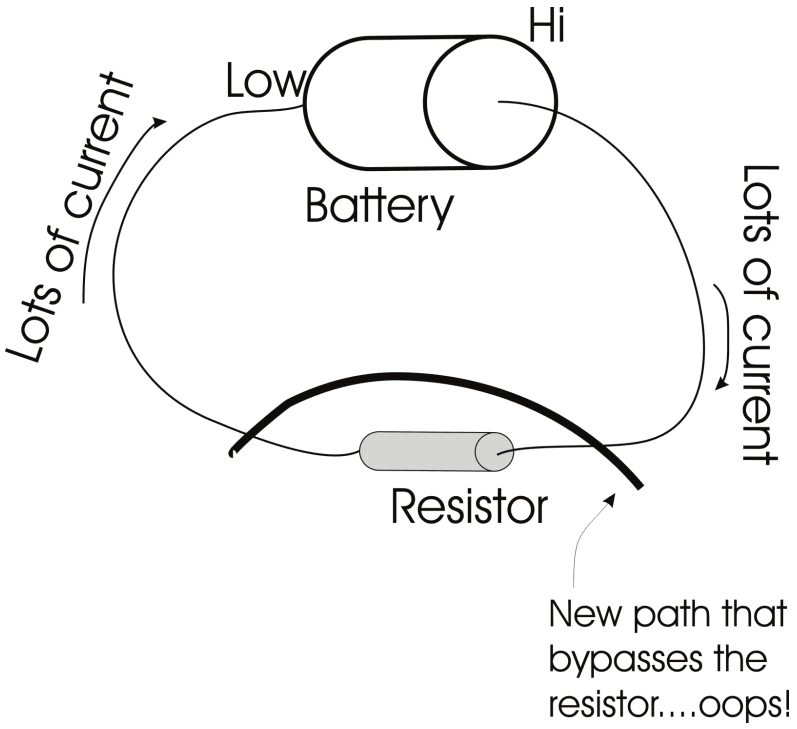
Transducers

- Transducers change other types of energy into electrical energy and vice-versa
- Sensors convert other forms of energy into electrical energy
- Actuators convert electrical energy into other forms of energy.(LEDS or Motors)



Circuits

- Circuits are closed loops of wire with a power source (like a battery) and something to do something useful with the energy, called the load.
- There needs to be a complete path from energy source (power) to the point of least energy(ground) to make a circuit.



Short Circuit

- If you have a circuit that connects power and ground together without resistance you will cause a short circuit.
- The power source will convert EE into light/heat – explosion!

LEDs

- LEDs convert electrical energy into light energy. It is polarized, -only allow energy to flow through them in one direction.
- Cathode – shorter leg(-) connects to the ground
- Anode – longer leg(+) connects to the power
- When you connect anode to voltage and cathode to ground, emits light

Resistors

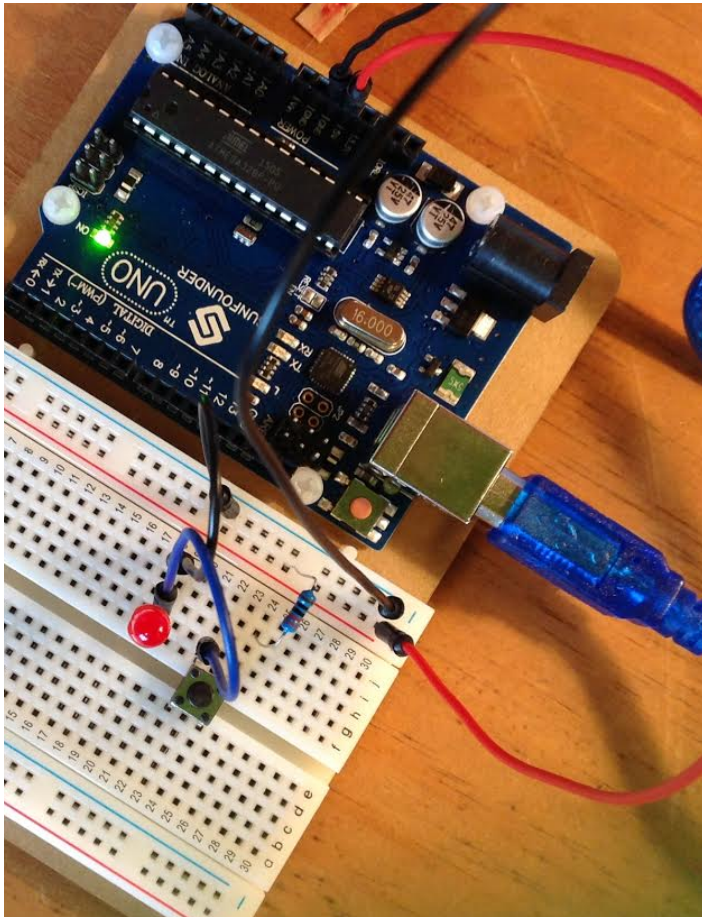
- Resistors resist the flow of electrical energy.
- Convert some of the electrical energy into heat. If you put it in series with a LED it will use up some of the EE and the LED will dim.
- Allow you to supply the components with the amount of energy they need.

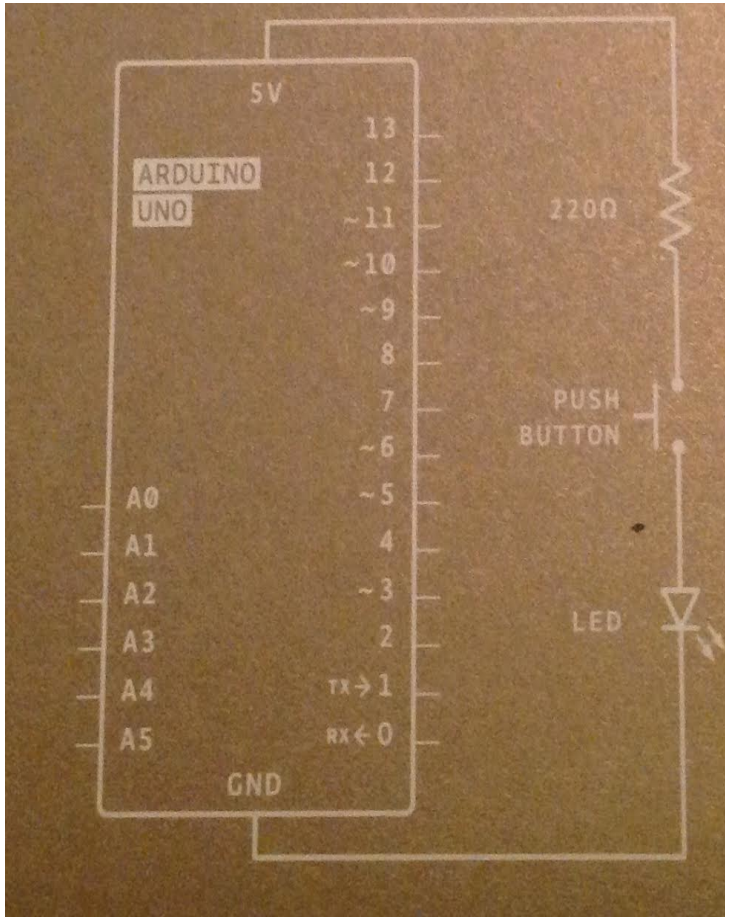
Switches

- Momentary switches interrupt the flow of electricity – breaking the circuit when open.`

Build Your First Circuit

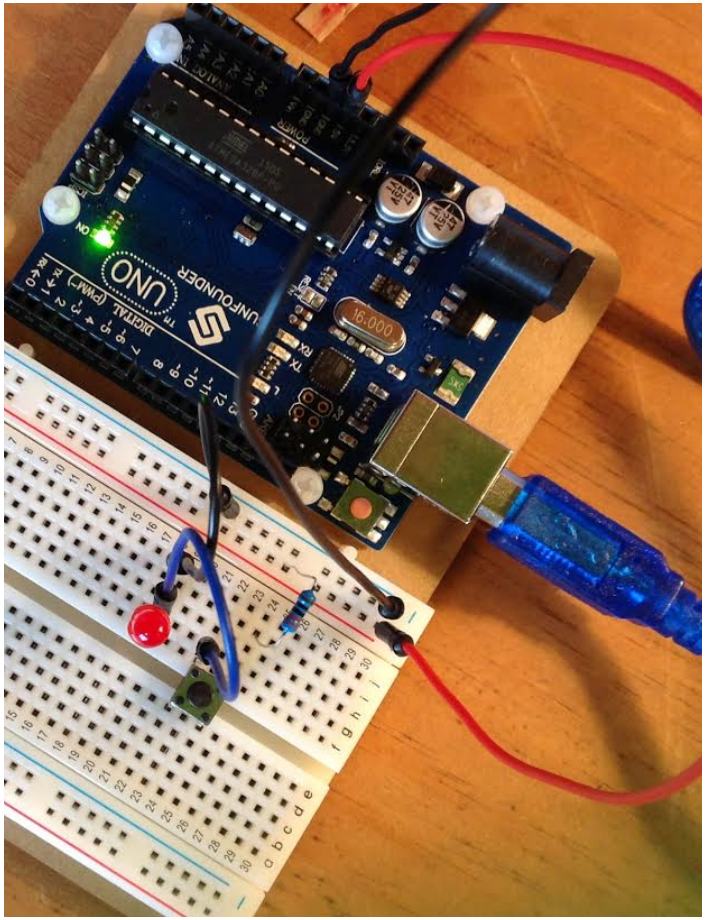
- 1. unplug Arduino before building circuits!
- 2. Need: switch, 220 ohm resistor, LED, long red wire, long black wire, short blue wire, short black wire.

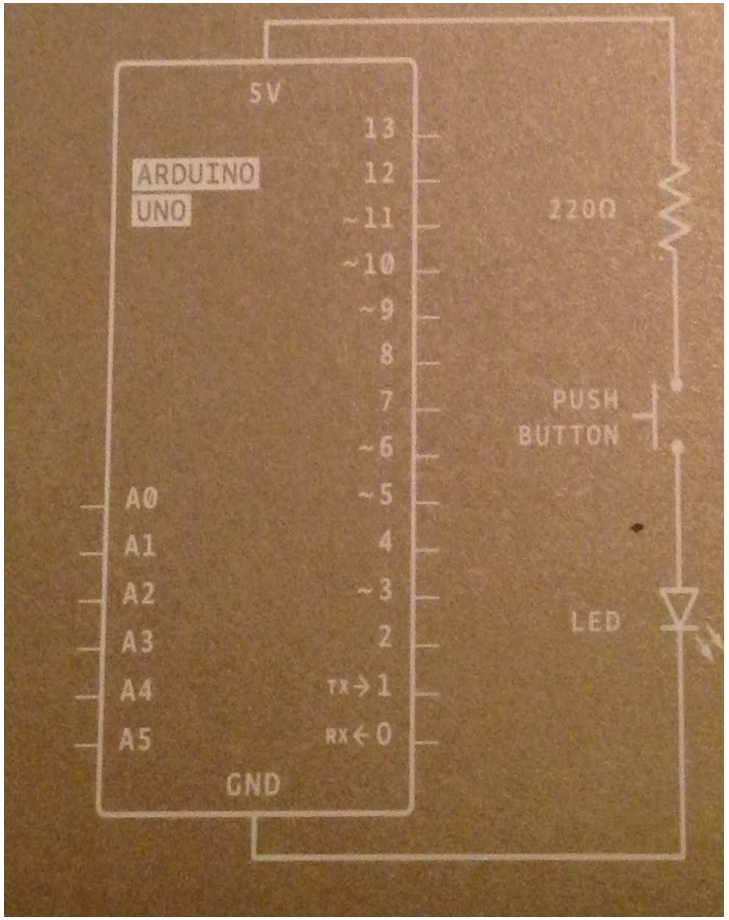




Build Your First Circuit

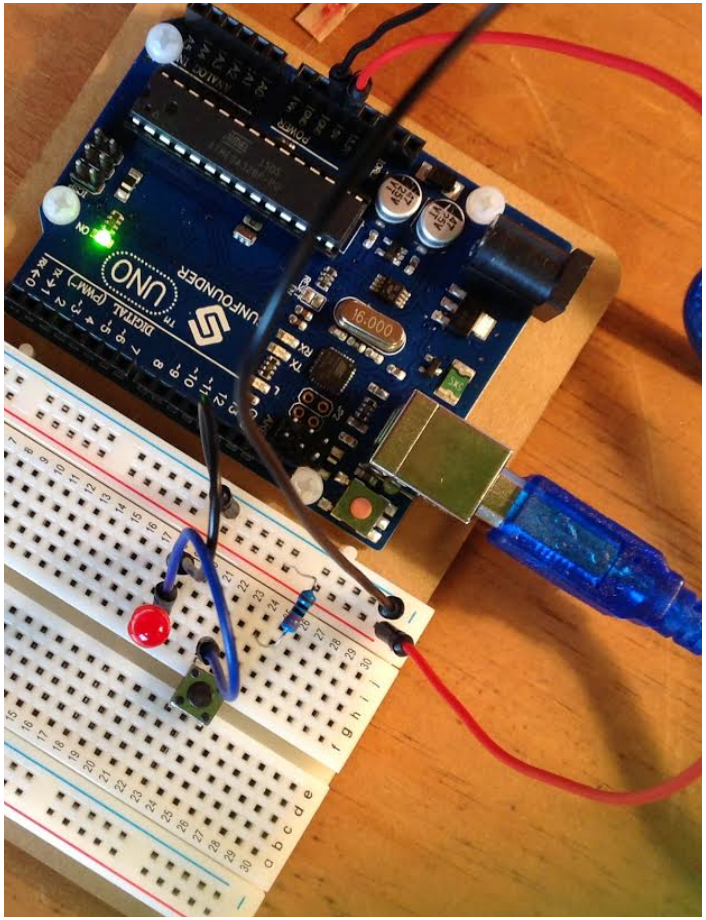
- 3. Connect red wire to 5v pin on Arduino – and other into + bus line at top of bread board
- 4. Connect black wire from ground on Arduino to (-) ground bus line.

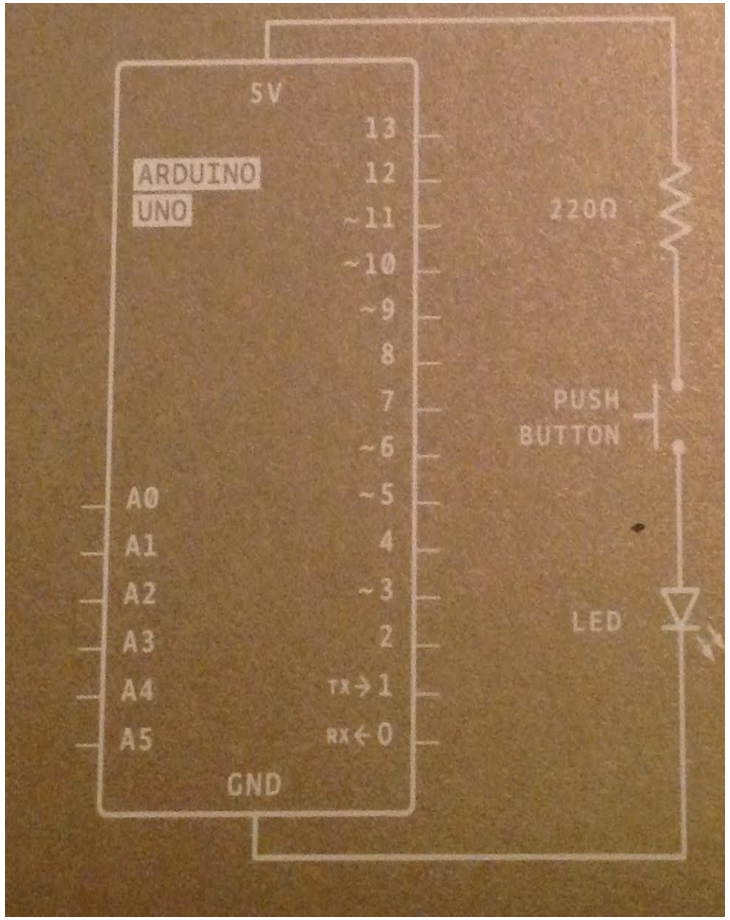




Build Your First Circuit

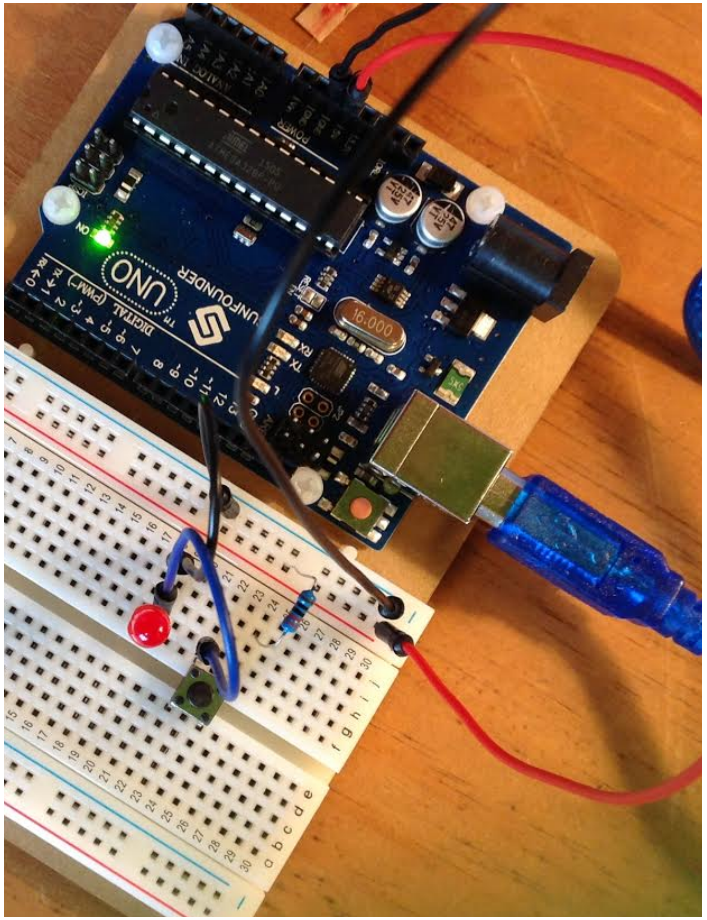
- 5. Put switch across middle of breadboard – spider legs point in.
- 6. Put 220 resister (Red Red Black Black (brown) See back of box) – from (+) bus to top left line of switch

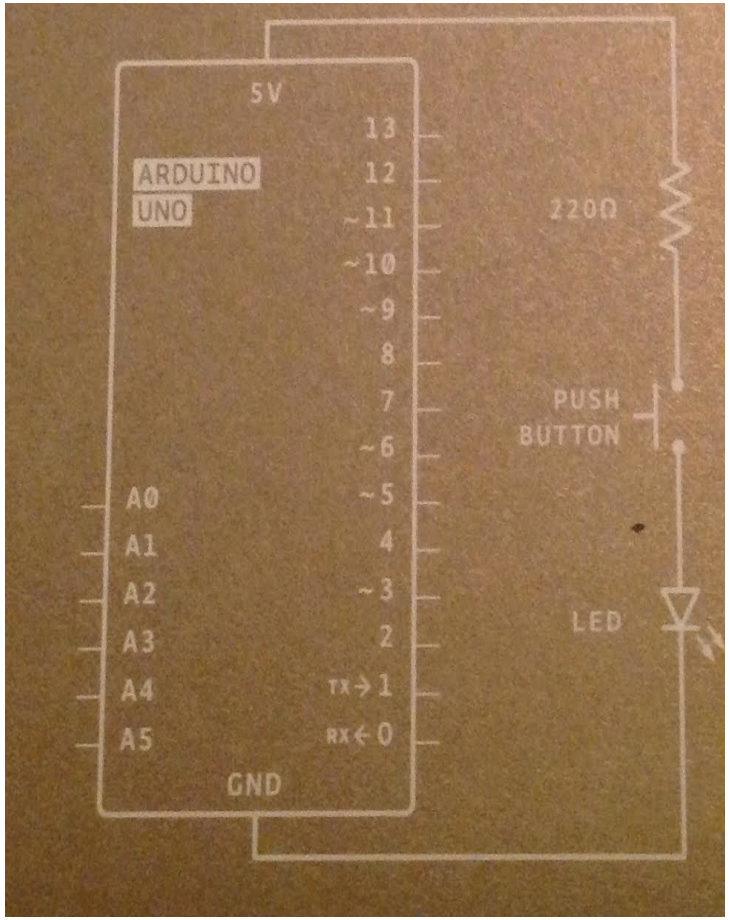




Build Your First Circuit

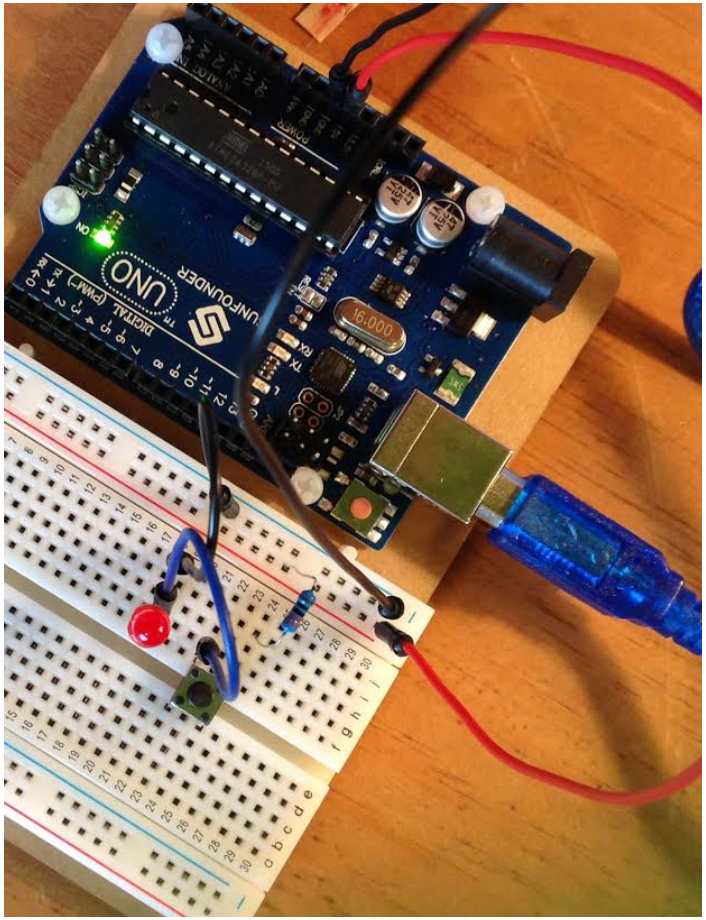
- 7. LED same column as left side switch (+) closes to switch.
- 8. Blue wire switch line to LED (+) line
- 9. Black wire LED (-) to ground (-)
- 10. Push Red Button

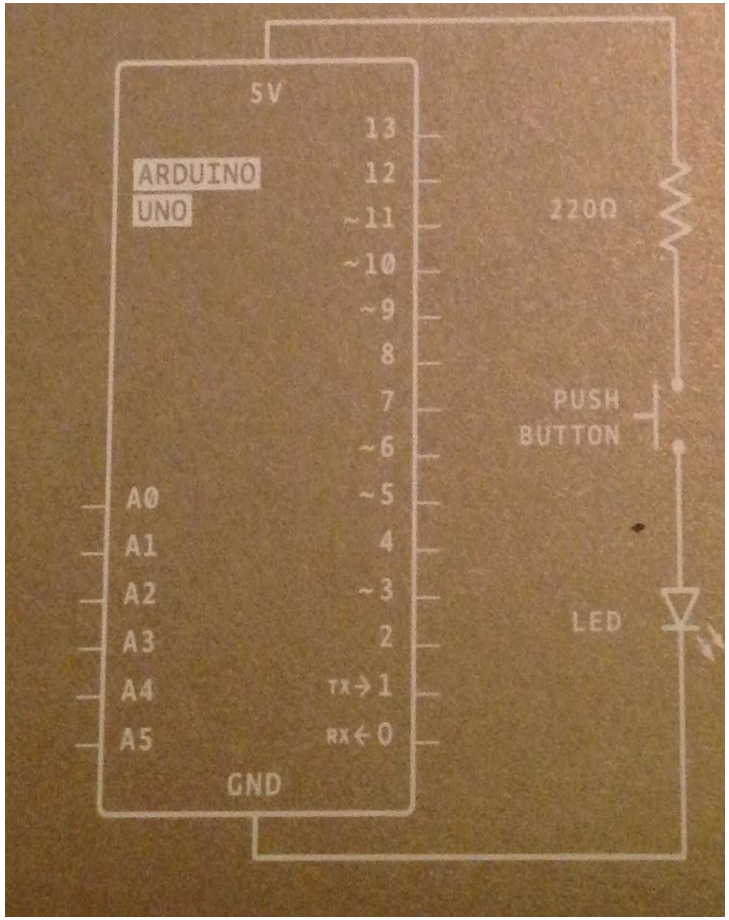




Build Your First Circuit

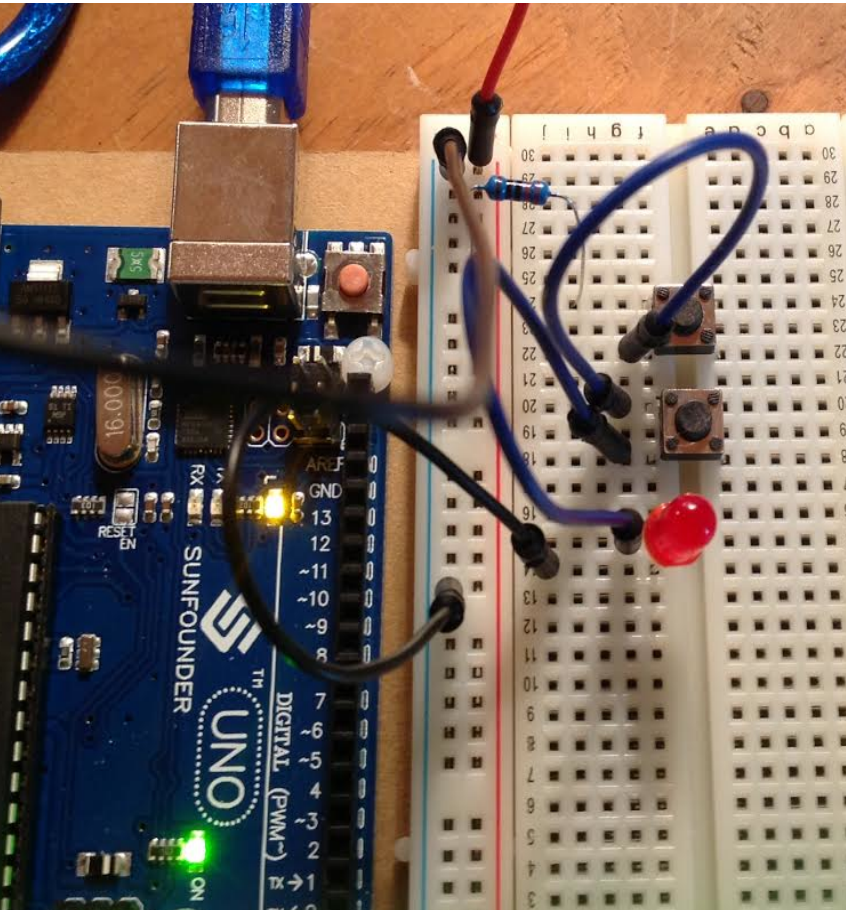
- 9. Plug power back in
- 10. Push Red Button

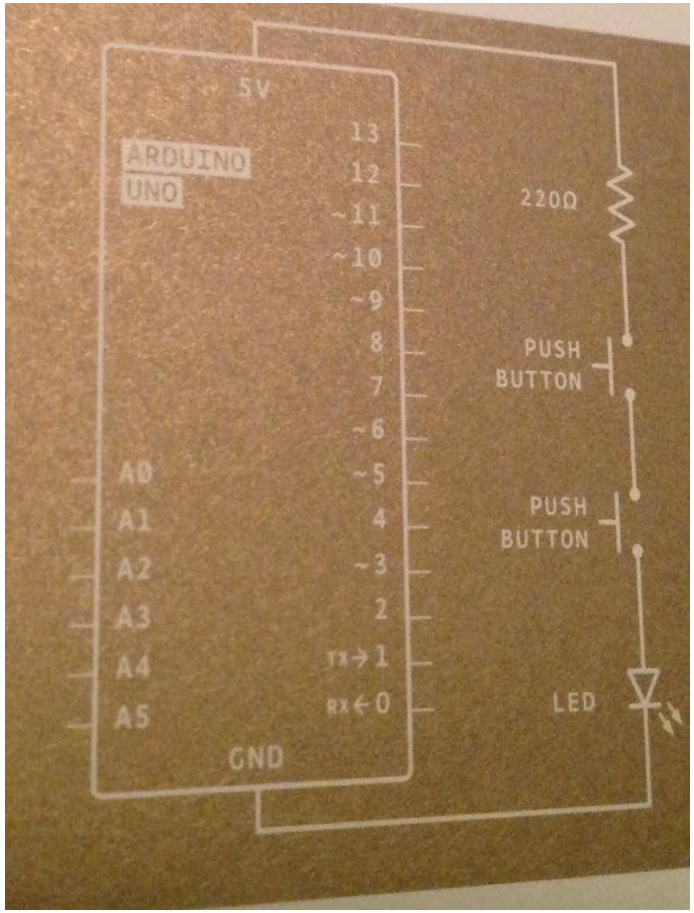




Series Circuit

- ****Remove board from power source.
- 1. Add a switch below the one already on your breadboard
- 2. Need another blue wire going from switch out to switch in.
- 3. All else is the same.

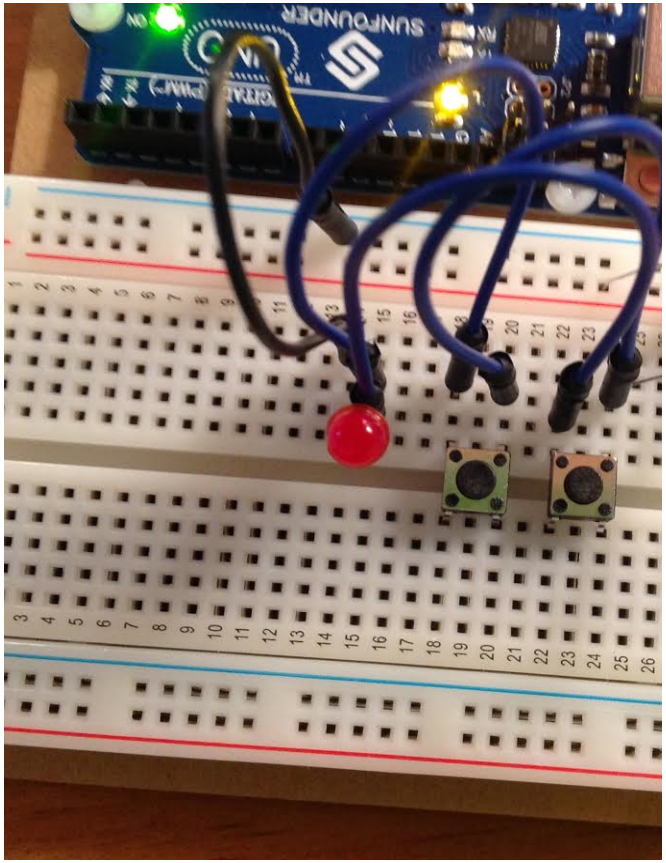


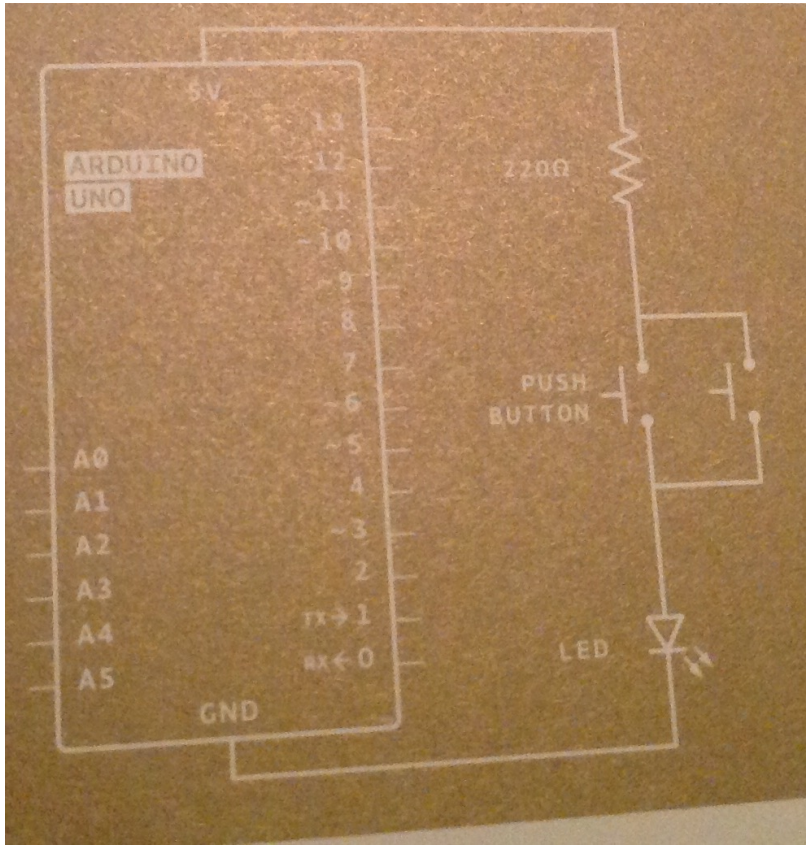


Parallel Circuit

Disconnect power suppply

- 1. Keep switches and LED where they are but remove connections between the two switches.
- 2. Wire both switches to the resister. (+) top left of each resister row. 2nd one will require a wire.
- AND OR OR GATE?

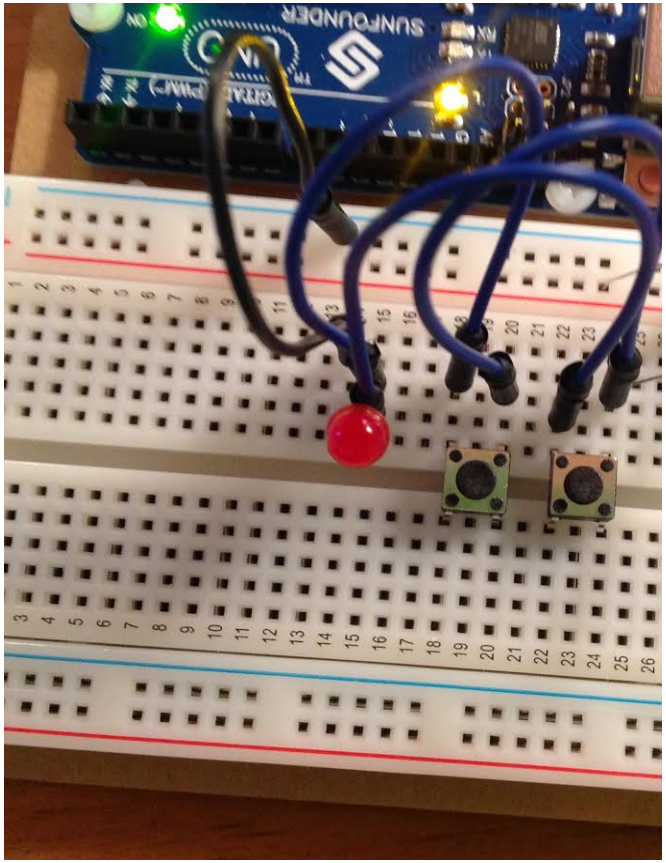


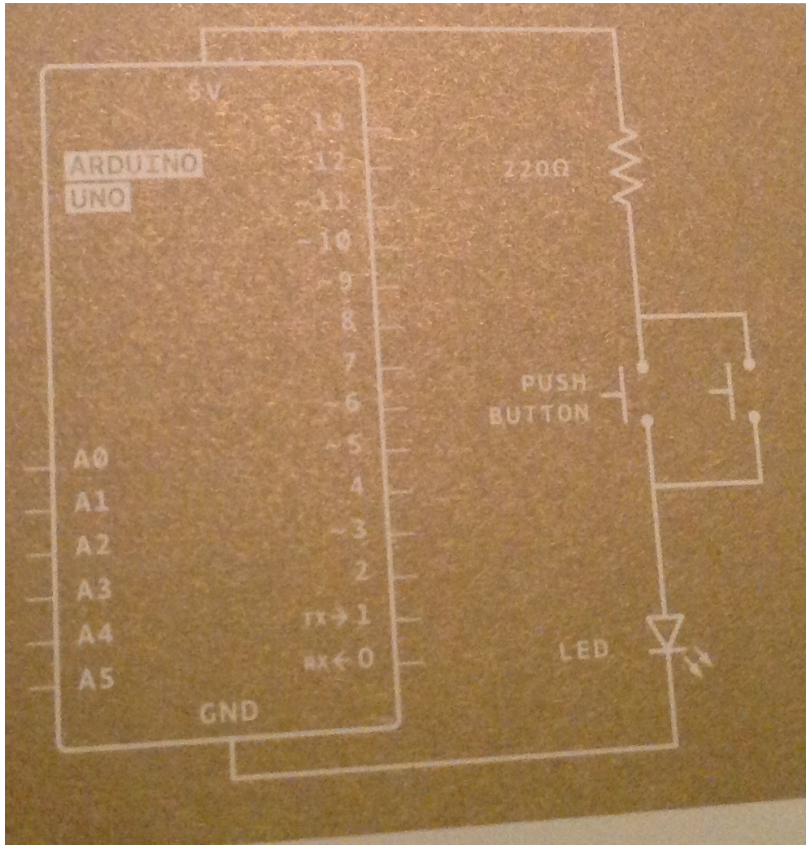


Parallel Circuit

- 3. (-) of each switch to LED line (+)
- 4. (-) LED to ground bus

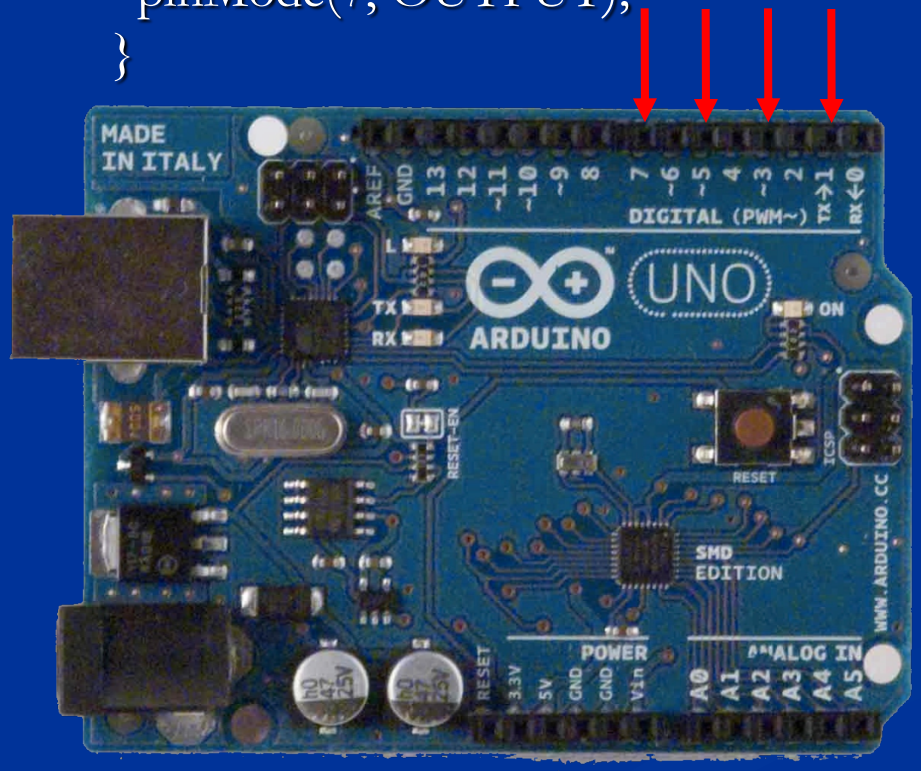
AND or OR GATE?





4 LED Blink Sketch

```
void setup( ) {
  pinMode(1, OUTPUT);
  pinMode(3, OUTPUT);
  pinMode(5, OUTPUT);
  pinMode(7, OUTPUT);
}
```




```
void loop( ) {
  digitalWrite(1, HIGH);
  delay (200);
  digitalWrite(1, LOW);

  digitalWrite(3, HIGH);
  delay (200);
  digitalWrite(3, LOW);

  digitalWrite(5, HIGH);
  delay (200);
  digitalWrite(5, LOW);

  digitalWrite(7, HIGH);
  delay (200);
  digitalWrite(7, LOW);
}
```