

Building Circuits

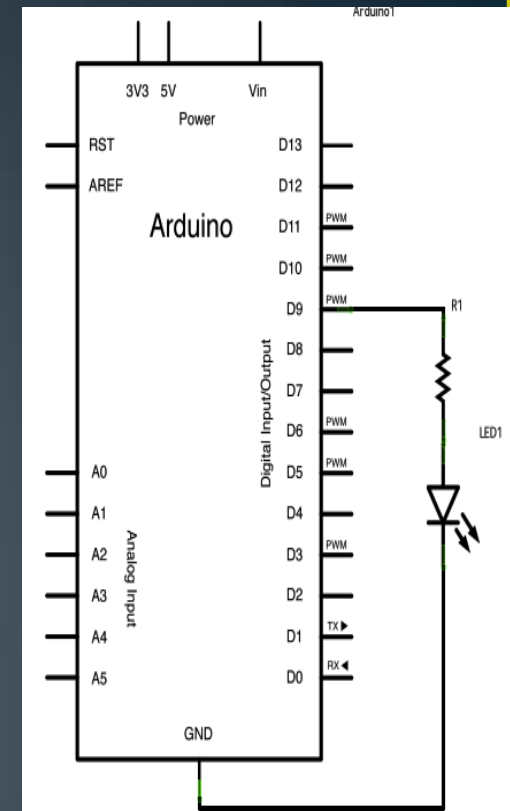
Shady Eltobgy

Outline

- 1- Schematic Diagram.
- 2- Schematic diagrams components.
- 3- Solderless Breadboard.
- 4- Multimeter.
- 5- Soldering.
- 6- Examples of translating schematics into Circuits .
- 7- Fritzing.

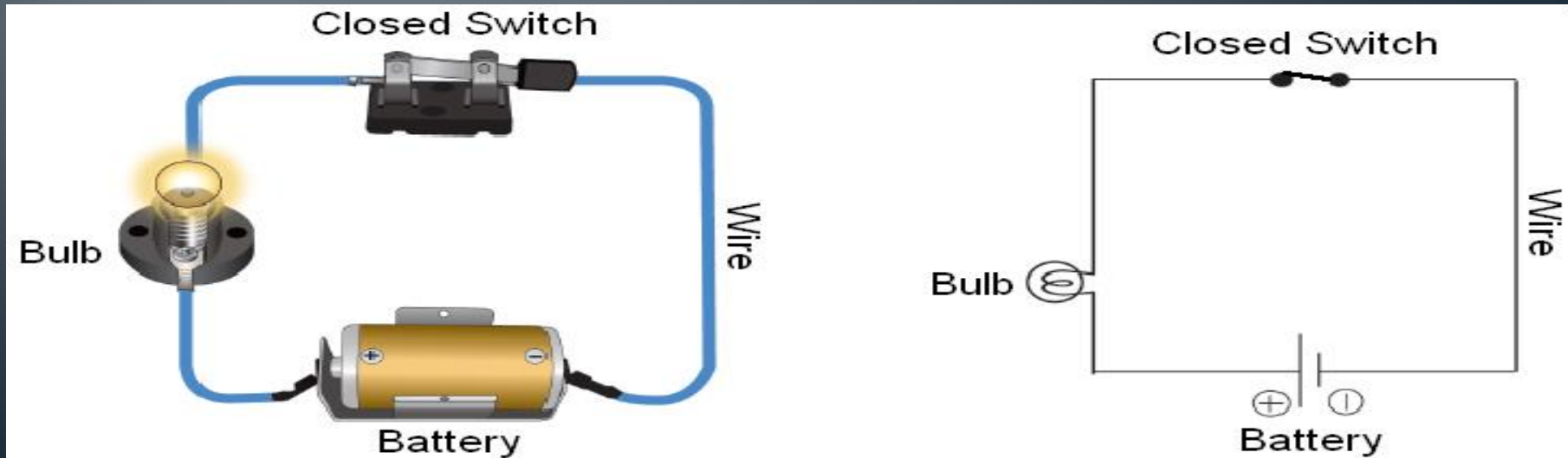
Schematics (Paul Spinrad, 2011)

- Schematics are just maps showing how show
- how a circuit's components are connected
- together.
- The easiest way to translate most schematics
- into a working circuit:
- 1-Connecting the circuit's components together
- on a solderless breadboard using jumper wires.
- 2-Testing connections and debug the circuit using a multimeter.
- 3- committing it to soldering on printed circuit board.



Schematic diagrams (Paul Spinrad, 2011)

- Schematic diagrams consist of two things:
- 1- Symbols that represent the components in the circuit.
- 2- Lines that represent the connections between them.



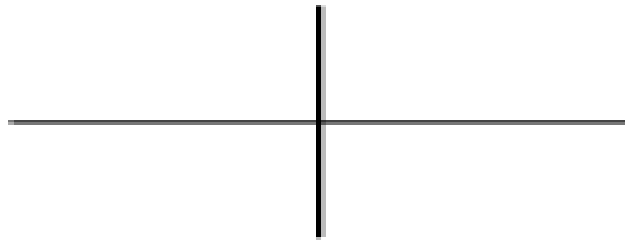
Connections (Paul Spinrad, 2011)

- -If a line runs between two components this means that these two components are connected.
- -These lines can be wires a metal chassis, or anything else that electricity will run through without much resistance.
- -. The length of a line also has nothing to do with the connection's actual distance in real life

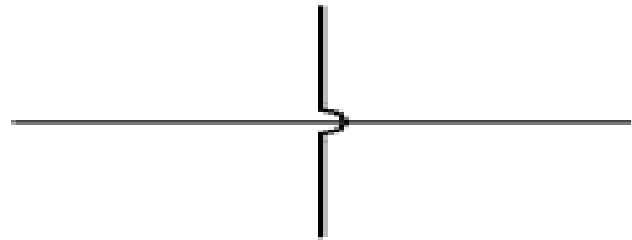
Connection Symbols (Paul Spinrad, 2011)

Older convention

Connected

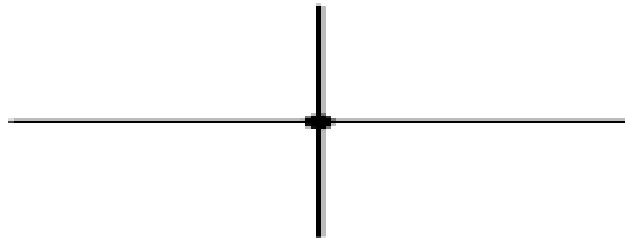


Not connected

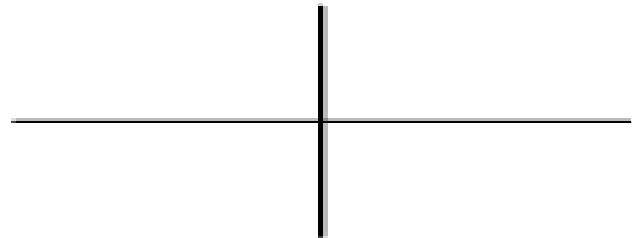


Newer convention

Connected



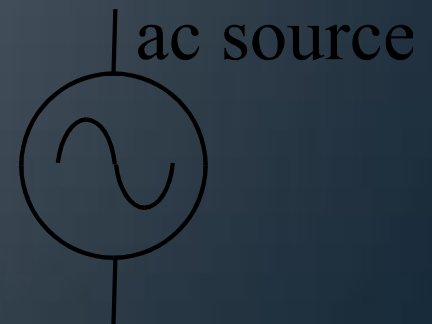
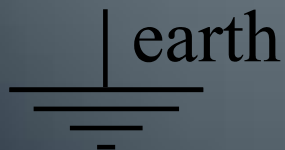
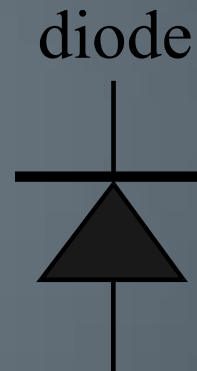
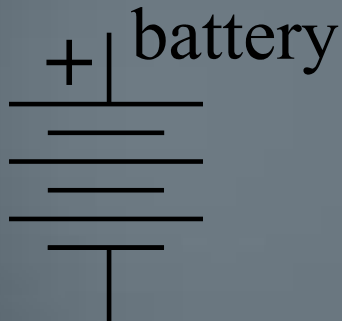
Not connected



Components (Paul Spinrad, 2011)

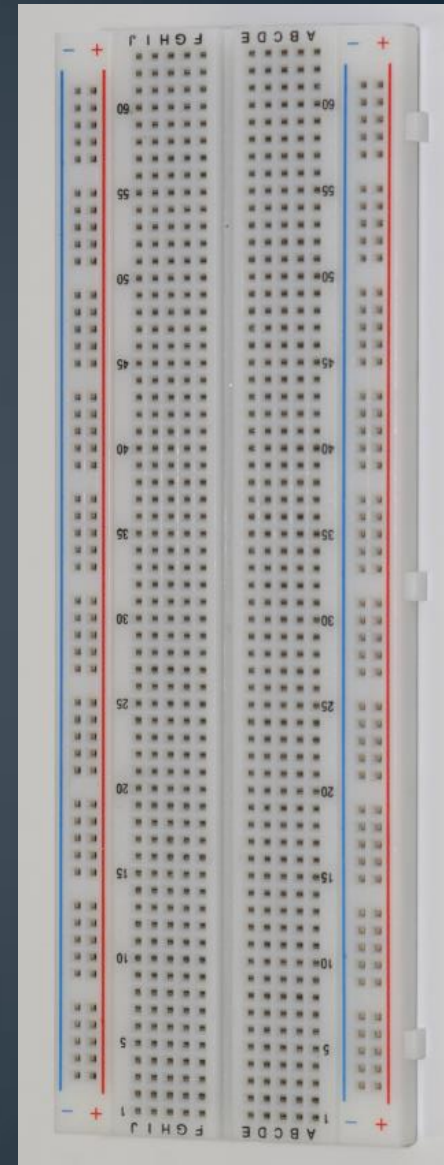
Each circuit component is represented by a symbol that indicates the general type of component.

- Most Common Components:

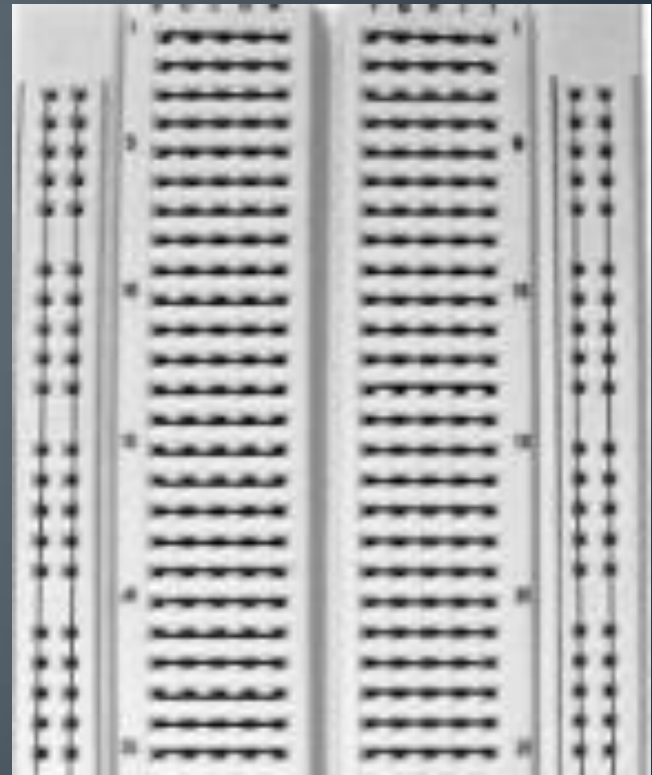
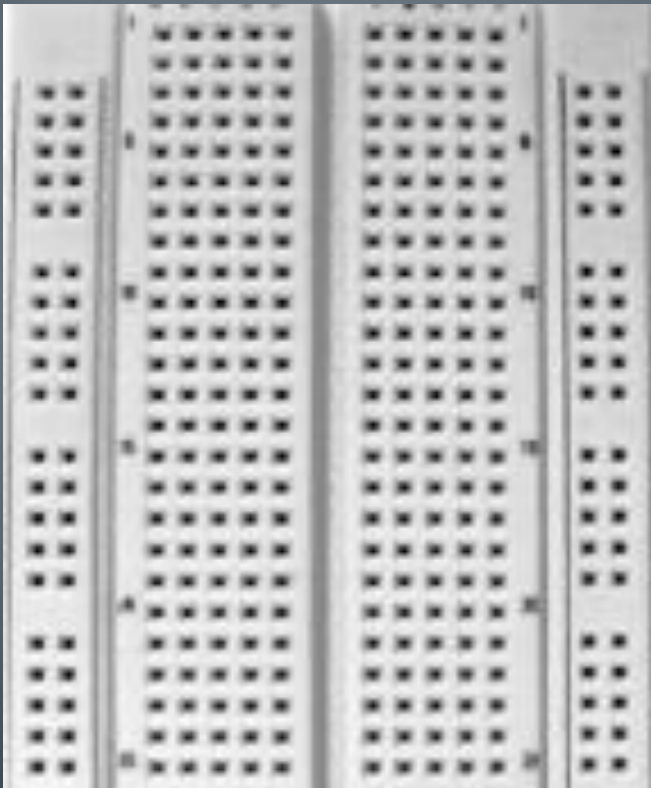


Solderless Breadboards (peterson, Brad)

- What is Solderless breadboards ?
- Solderless breadboards are commonly used in
- experimentation or to make a prototype of a circuit
- before the circuit is soldered or made in mass production.
- Why Solderless Breadboards?
- - because it is solderless , installing components on the
- board doesn't require soldering.
- - the ability to quickly change components during testing.
- - less time and money when creating the circuit.

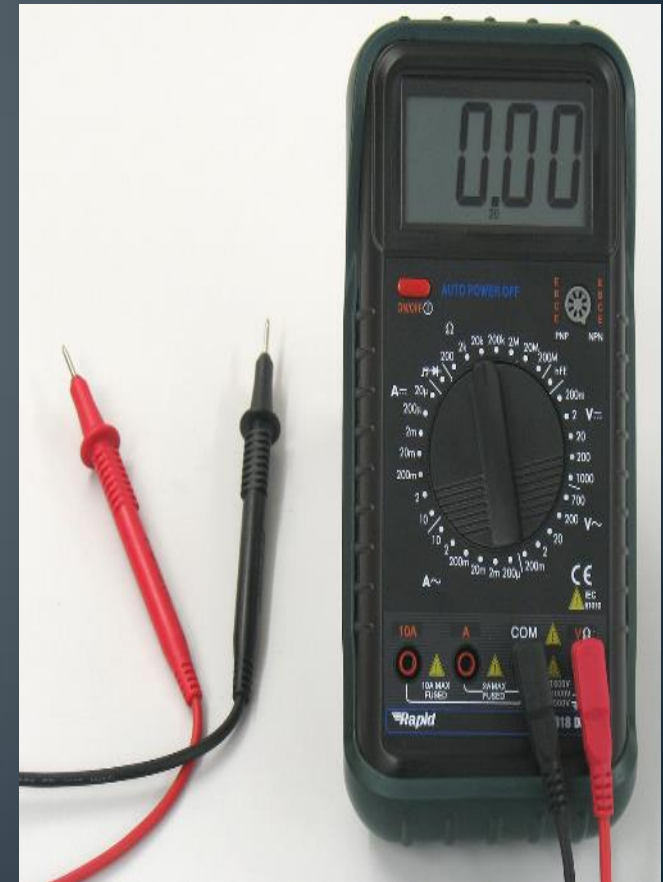


How the breadboard is Working(peterson, Brad)



Multimeter (Multimeter,wiki)

- Multimeters can act as your X-ray vision to debug the circuit by checking that the voltage between any two points in a circuit, or the current flowing past a certain point, is as expected.
- It is used to measure:
 - DC voltage and DC current.
 - AC voltage and AC current.
 - Resistance up to 200 M Ω .



Multimeter (Multimeter,wiki)

- There are many types of multimeters like :
- 1- Analog multimeter.
- 2- Digital multimeter.



Soldering (O'Sullivan, Dan., Igoe, Tom. , “Physical Computing”)

- When the user is satisfied with prototype created with solderless breadboard and after checking the circuit using multimeter that all readings whether voltage , current or resistance are as expected. The user may want to make it more robust by redoing all the connections on a soldered board, also called a printed circuit board (PCB)
- Soldering – fastening metal objects using molten metal (solder) as the glue.

Soldering (O'Sullivan, Dan., Igoe, Tom. , “Physical Computing”)

- Soldering consists of three components:
- Low melting point metal (wire solder)
 - **Tin-Lead solder** 40 % tin- 60% lead
 - **Silver-bearing Solder** 62% Tin, 36% Lead, 2 % Silver
- Heat source (soldering iron)
- Flux (to prevent surfaces from oxidizing)
- Like rosin flux.



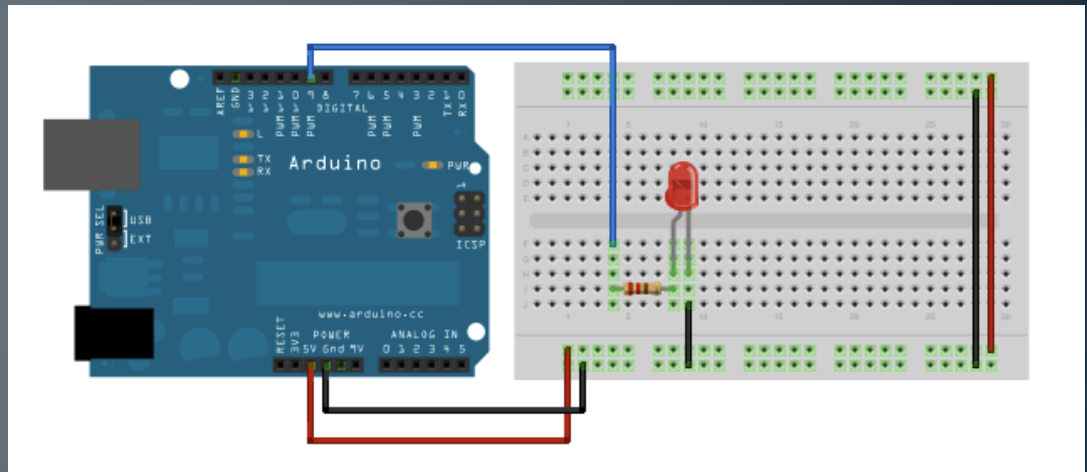
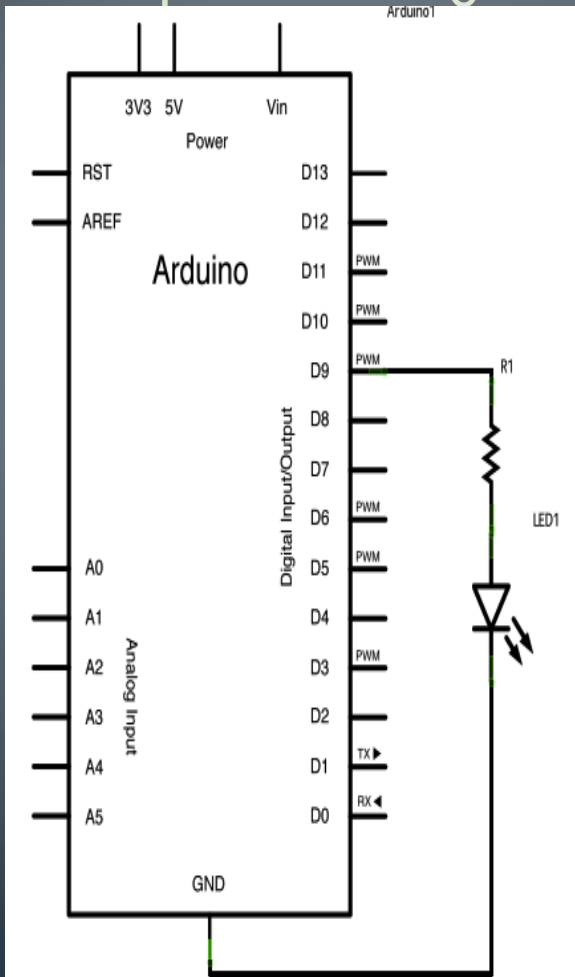
Soldering

O'Sullivan, Dan., Igoe, Tom. , “Physical Computing”

- The soldering process steps as follows:
- 1- let the soldering iron get hot, wipe the tip on a damp sponge quickly.
- 2- melt some solder directly onto the tip to ensure smooth soldering.
- 3-Apply the iron in contact with both the circuit board pad and the component lead. Apply solder to the joint, not to the iron, and allow the heated joint to melt the solder

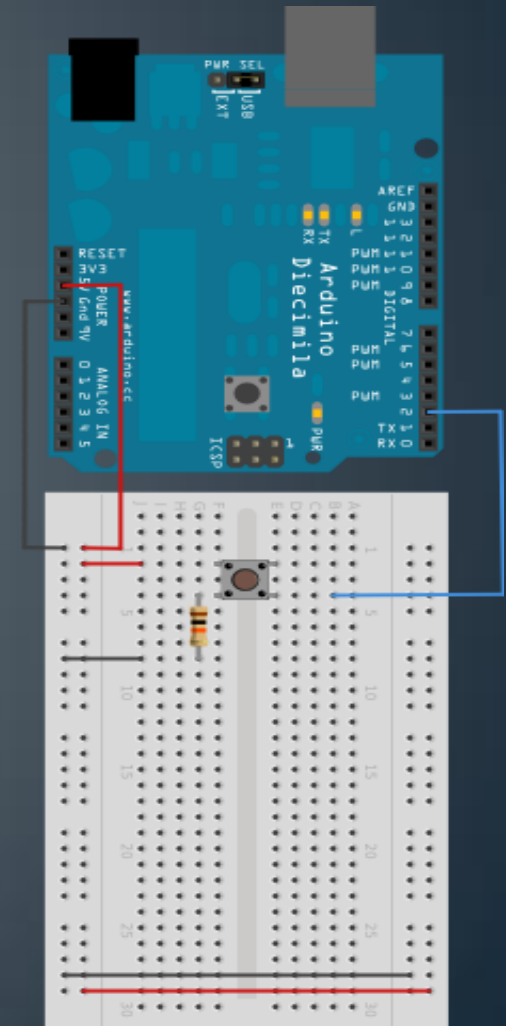
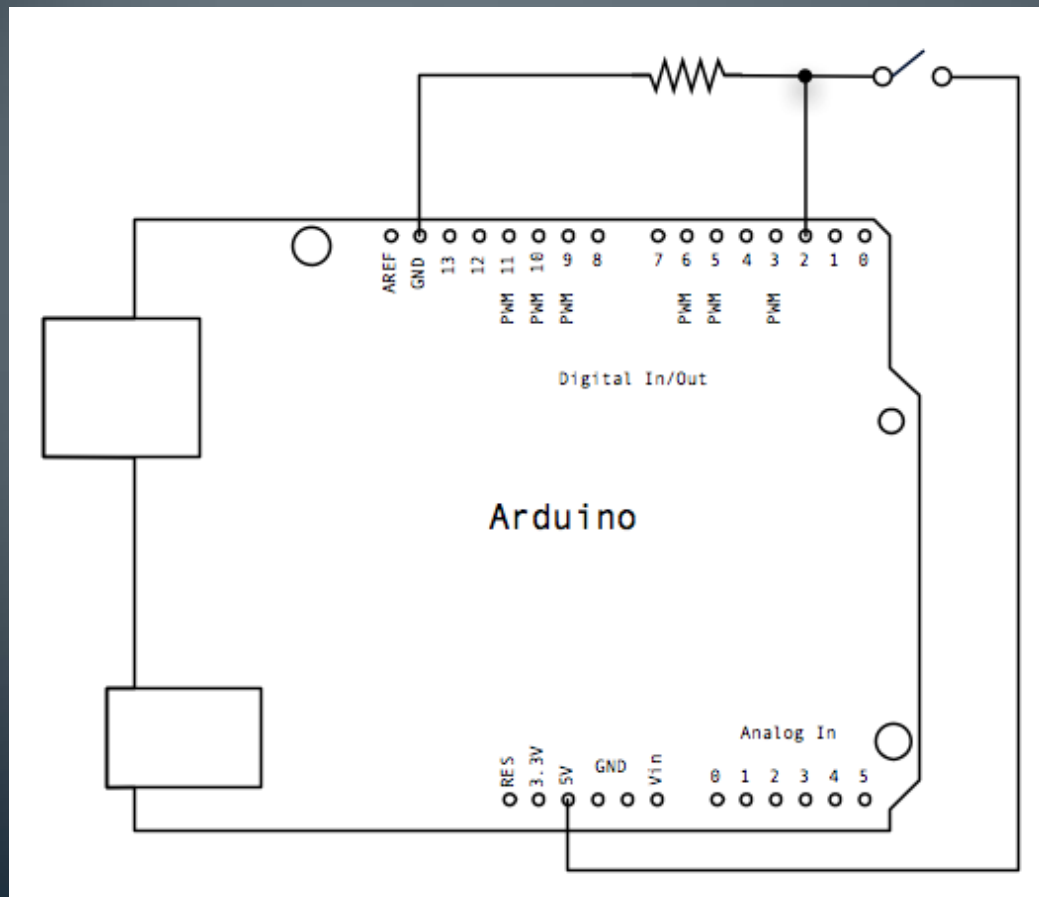
Translating Schematics into Circuits examples

- Example 1:Fading



Translating Schematics into Circuits examples

- Example 2: Button to open and close led



Fritzing (fritzing)

- Fritzing is an Electronic Design Automation software for designers or anyone who has interest in physical computing and prototyping.
- Fritzing is used to build robust prototypes of circuits easy by dragging and dropping components on the targeted board.
- Fritzing allows users to *document* their prototypes, *share* them with others to get a feedback and changes in prototype.

References

- Spinrad, Paul., “**Skill Set: Reading circuit diagrams.**”, **Skill Set: Reading circuit diagrams** Blog, January 25th, 2011
- Available at <http://makezine.com/2011/01/25/reading-circuit-diagrams/>
- peterson, Brad. ,”BreadBoard.”, PowerPoint presentation. State of South Dakota K-12 Data Center, available at <http://bp025.k12.sd.us/images/PoE/Breadboarding%20Electronics.pptx>.
- Multimeter available at en.wikipedia.org/wiki/Multimeter
- O'Sullivan, Dan., Igoe, Tom. , “Physical Computing”. Chapter 3 Building circuit., available at http://www.hangar.org/docs/docs_lab/PhysicalColmputing.pdf
- Fritzing , <http://fritzing.org/home/>

- Questions