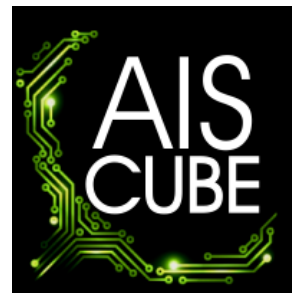


# BUILD YOUR OWN ARDUINO UNO SHIELD

SESSION 01

12  
GEEKS



# AIS CUBE

Artificial Intelligence Solutions

RAPID PROTOTYPING • 32BIT DEV TOOLS • A.I COURSES

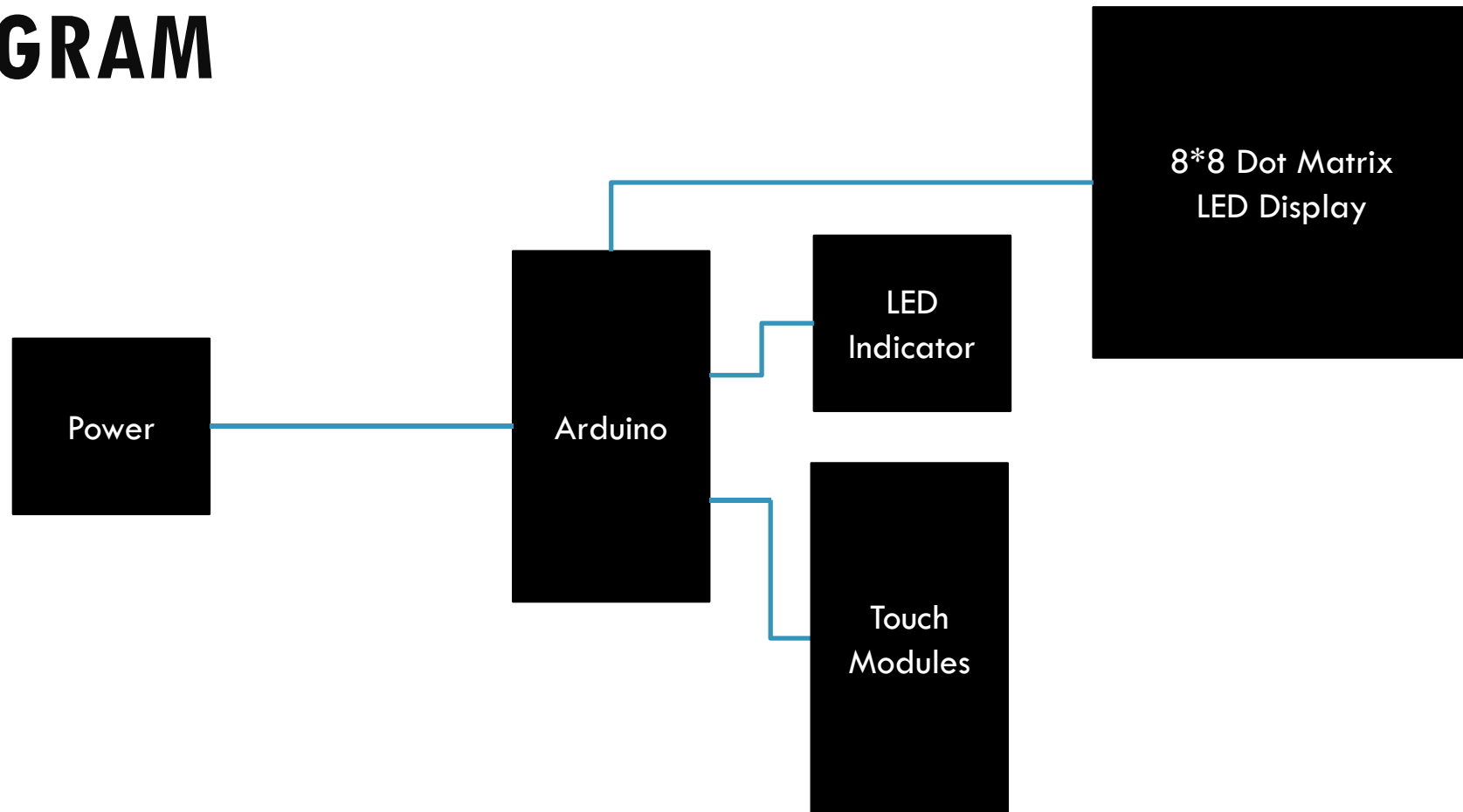
## A LITTLE BACKGROUND INTRODUCTION

We've been around since 2002

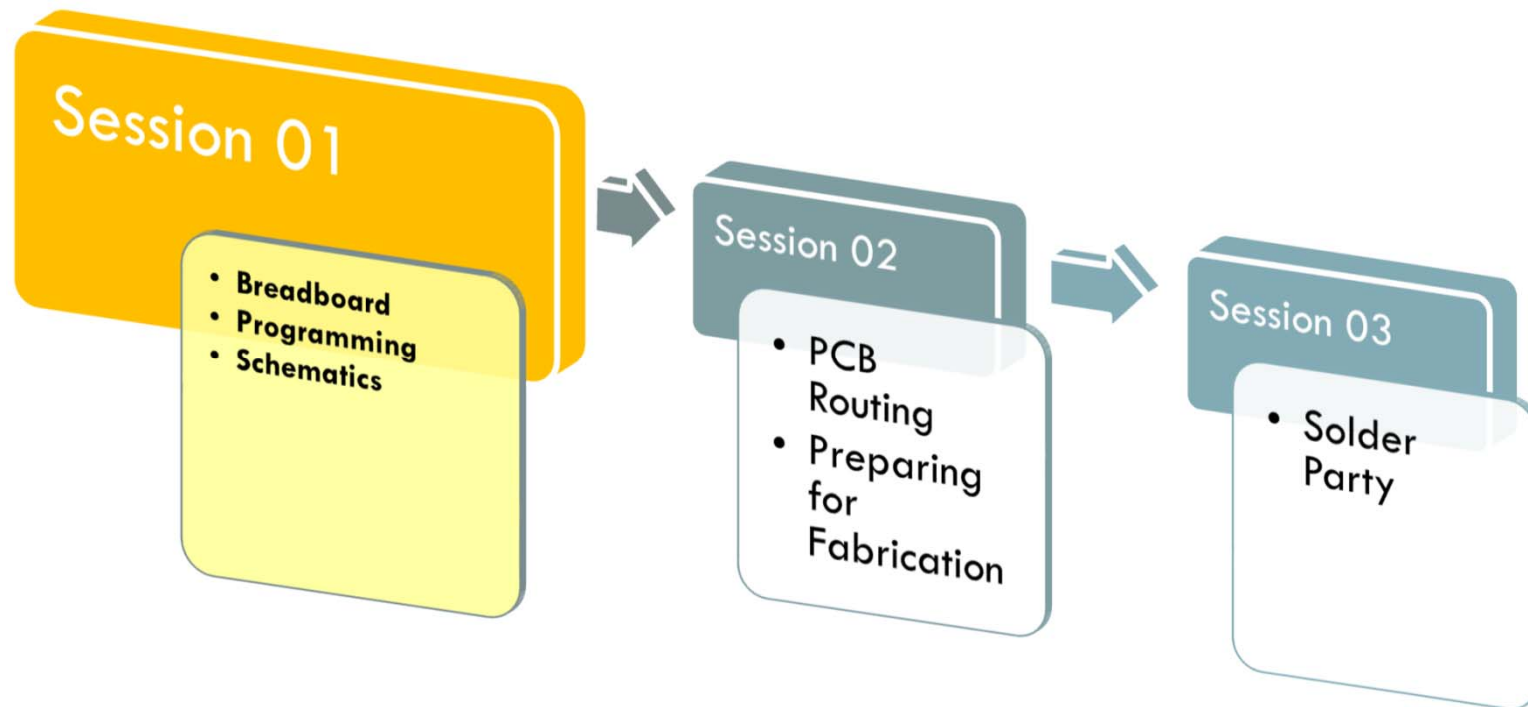
PS: No, we're not a start up

PPS: No, I'm not a fresh grad

# BLOCK DIAGRAM



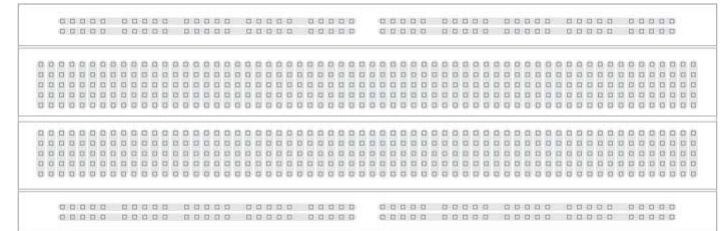
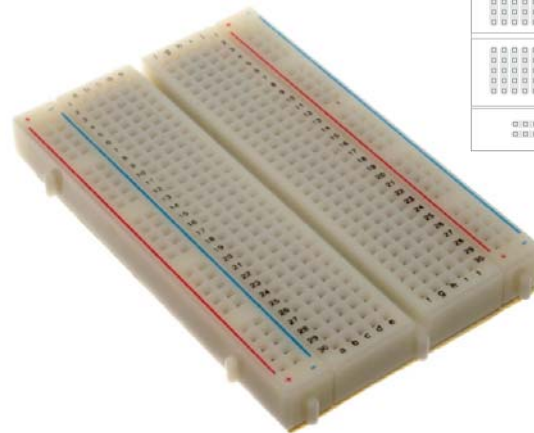
# SIMPLIFIED PROTOTYPING PROCESS



# WHAT'S A BREADBOARD?

What's it used for

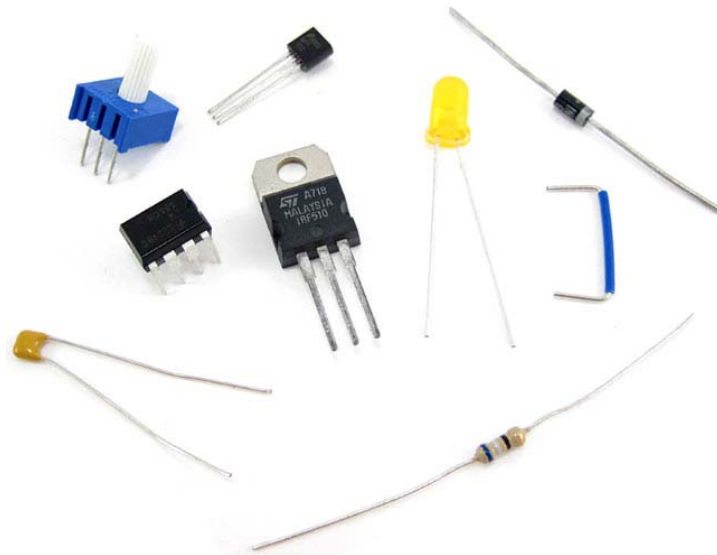
- Testing circuits
- Making non-permanent connections
- Easily add/remove components



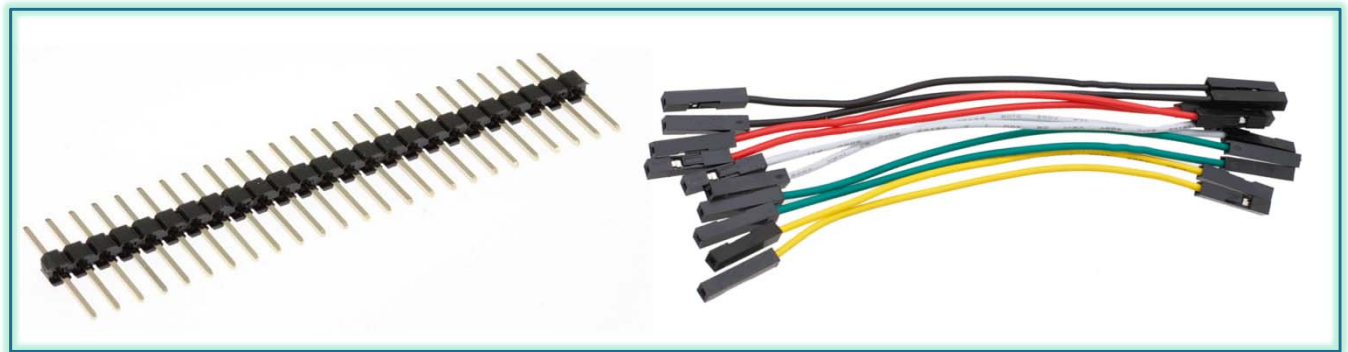
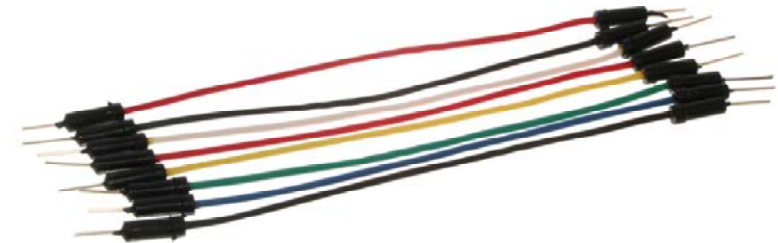
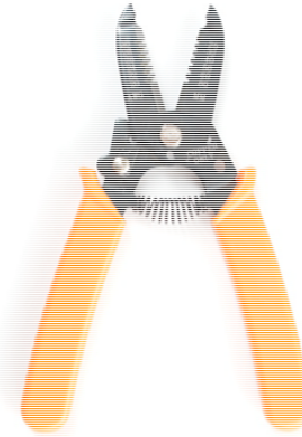
# WHAT GOES INTO A BREADBOARD?



Through-hole components



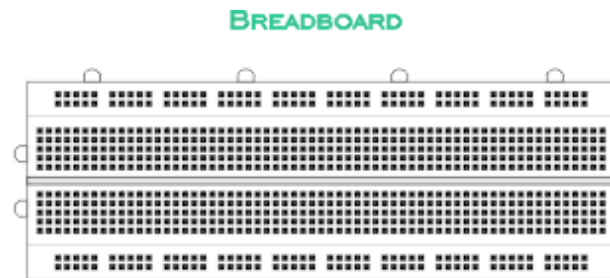
...and wires



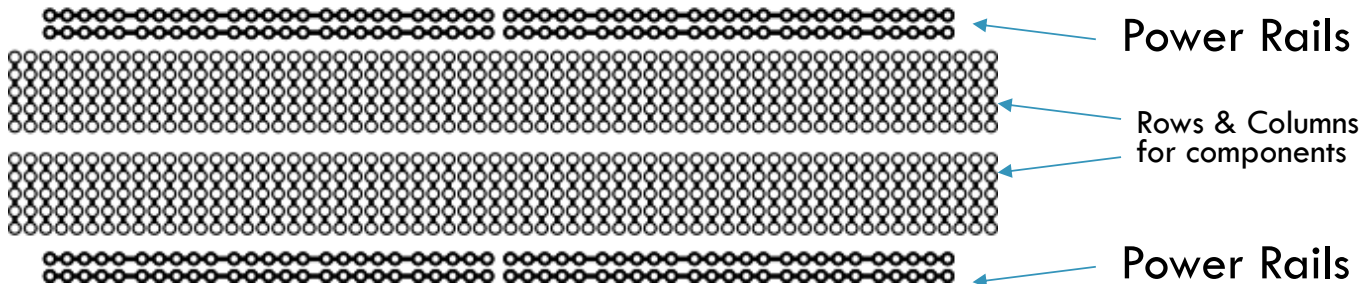


# WHAT'S INSIDE A BREADBOARD?

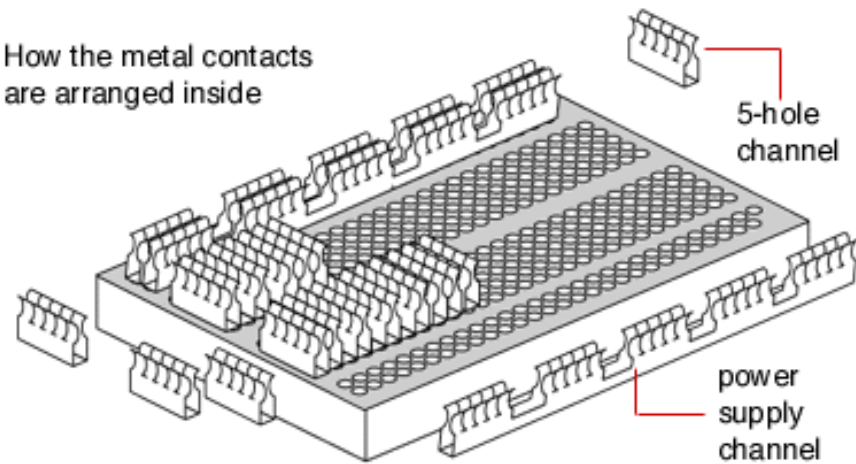
## Internals



### INTERNAL CONNECTION

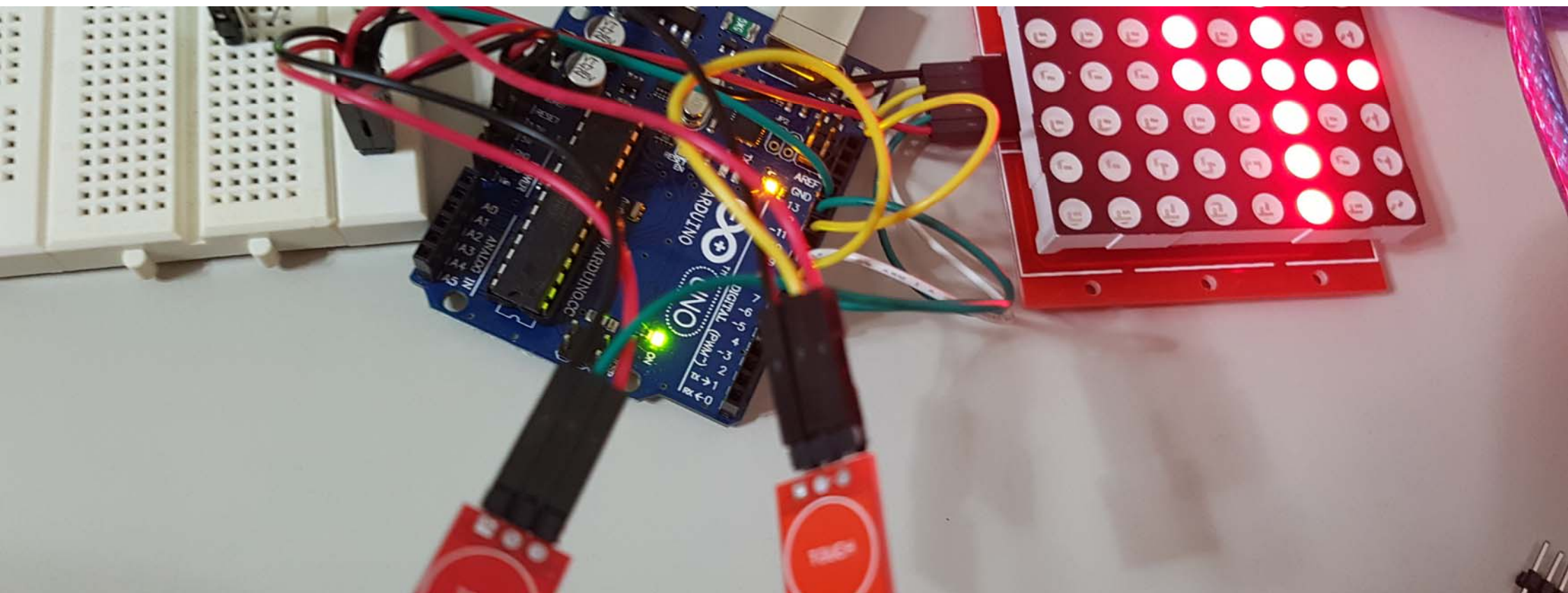


How the metal contacts are arranged inside



Doesn't it remind you of paper clips?





LET'S GET STARTED |





**SAFETY FIRST!**

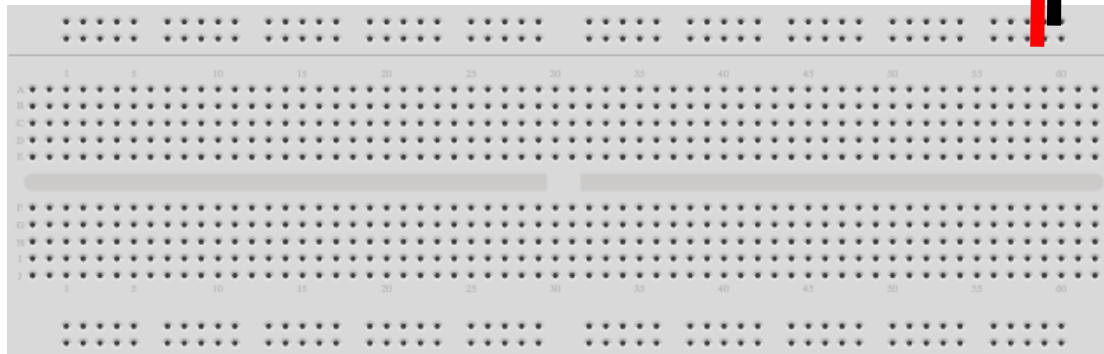




# LET'S TALK ABOUT POWER



VCC (+) GND (-)

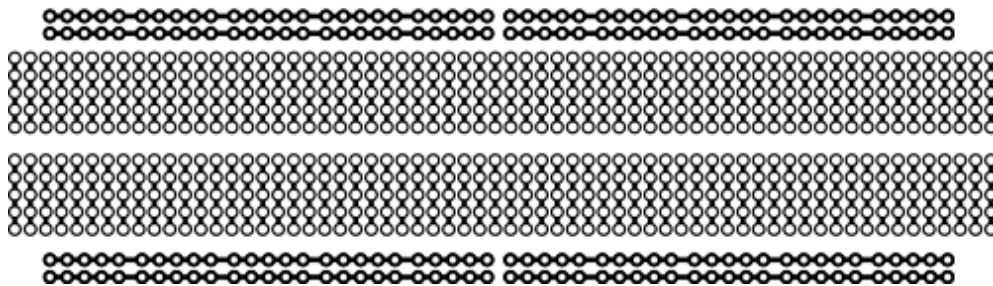


Insert  
Dual Row  
5 Way Pin Header



# LET'S TALK ABOUT POWER

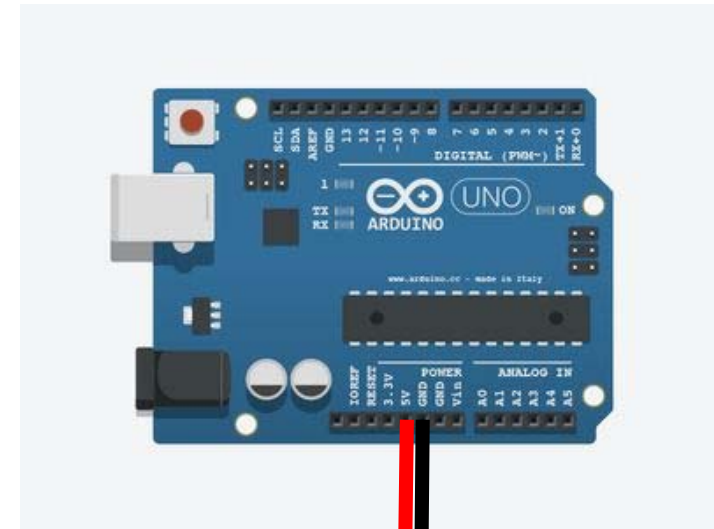
INTERNAL CONNECTION



Power Rails

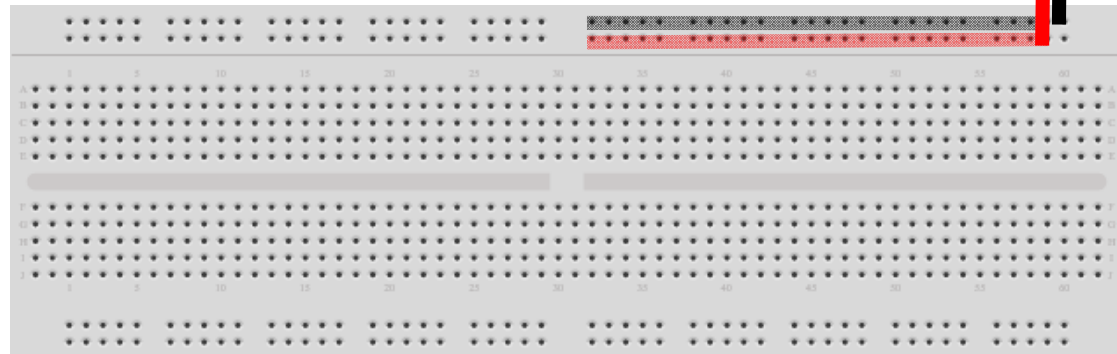
Rows & Columns  
for components

Power Rails



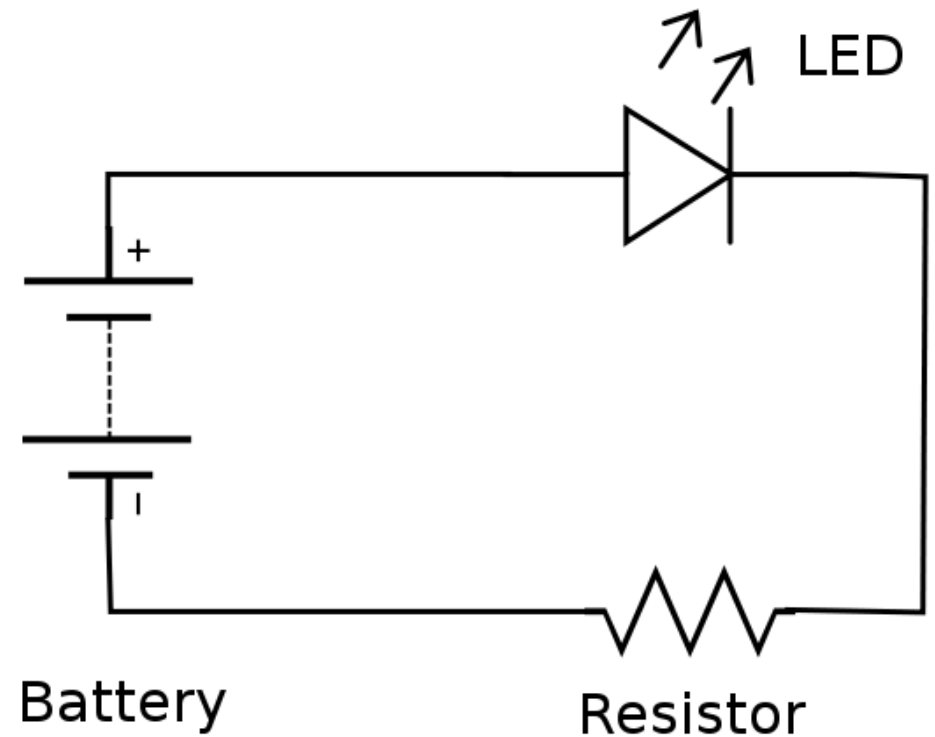
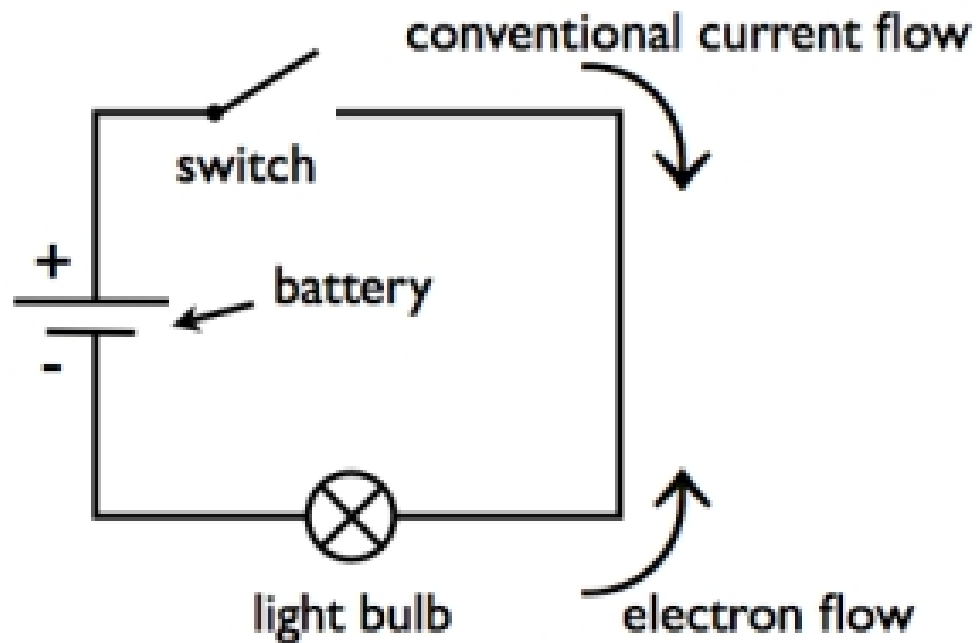
VCC (+)

GND (-)





# ANYBODY REMEMBER THIS?





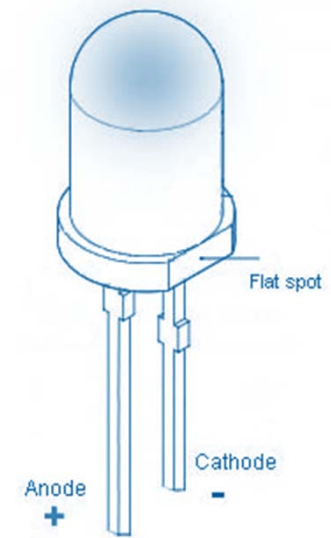
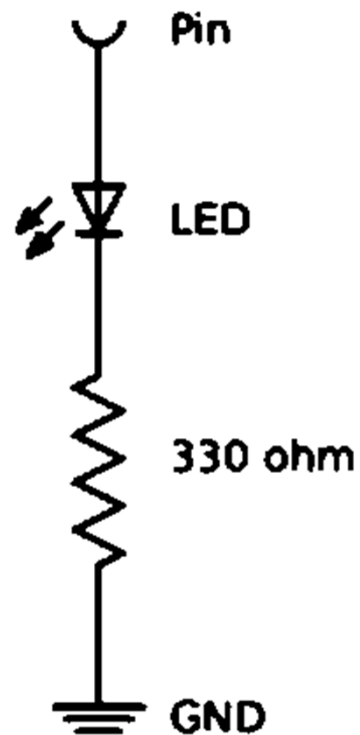
# BASIC LED CIRCUIT

Through hole component

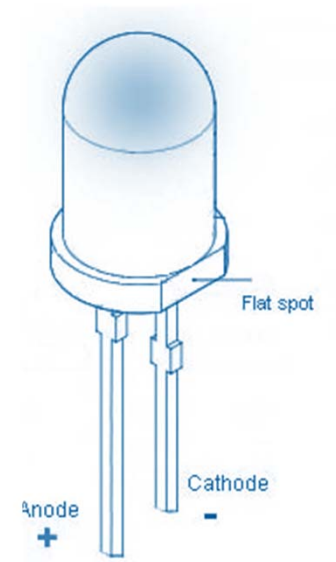
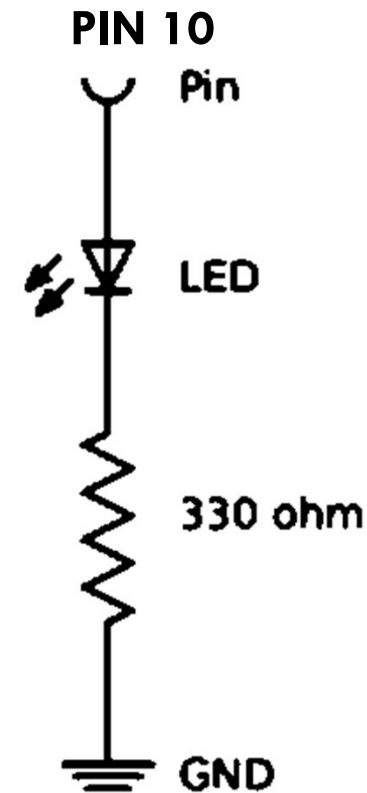
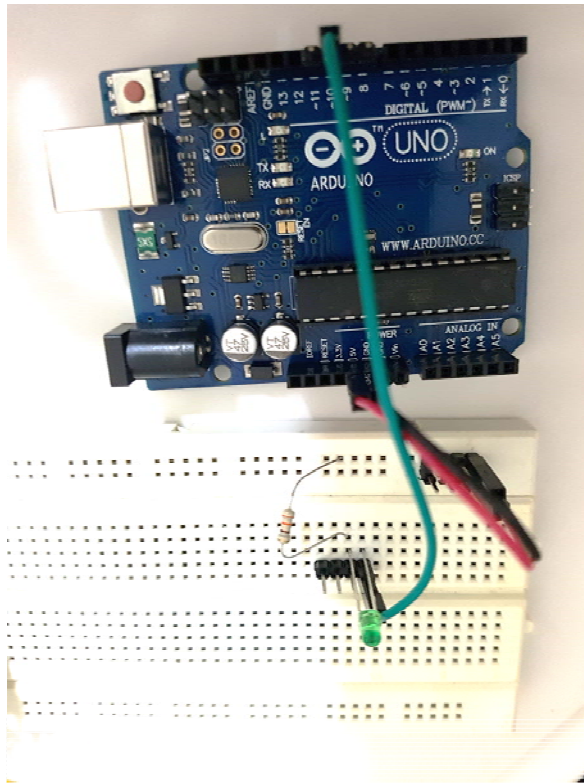
Looking for polarity

Resistors – 330 ohms

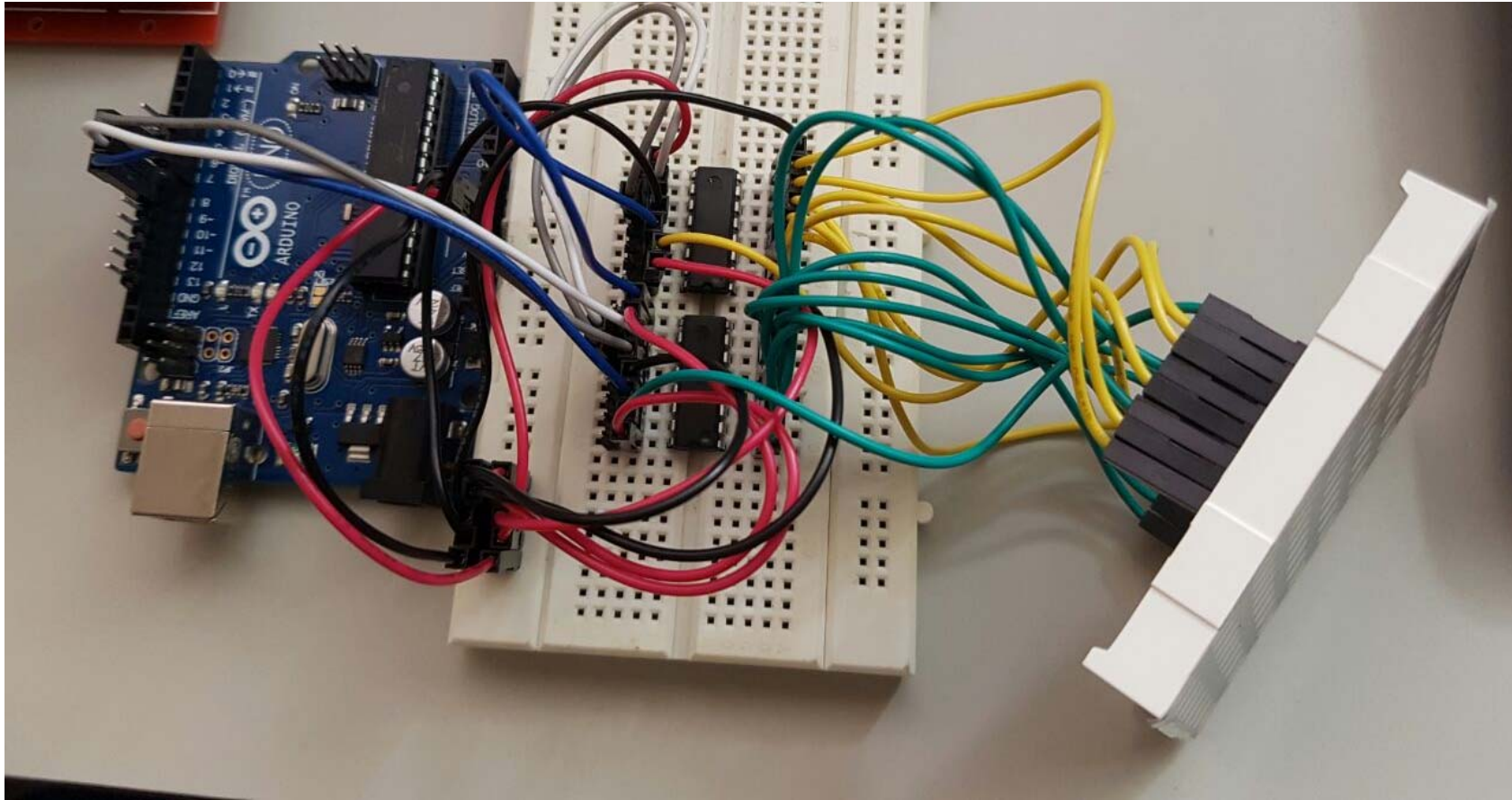
How the circuit works



# LET'S BUILD THAT LED CIRCUIT



# 8\*8 DOT MATRIX LED DISPLAY

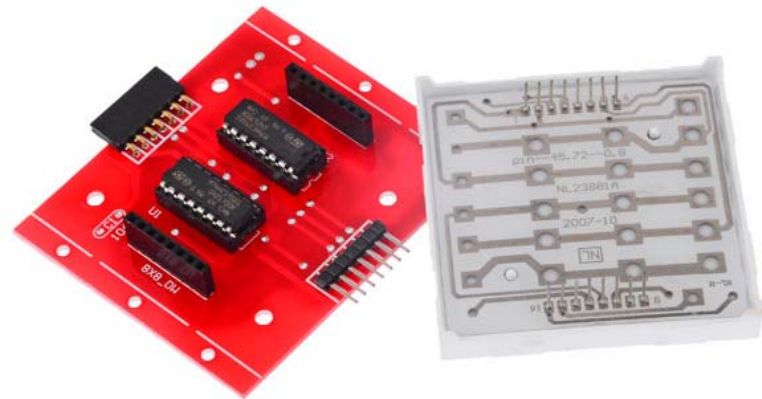


# 8\*8 DOT MATRIX LED DISPLAY MODULE

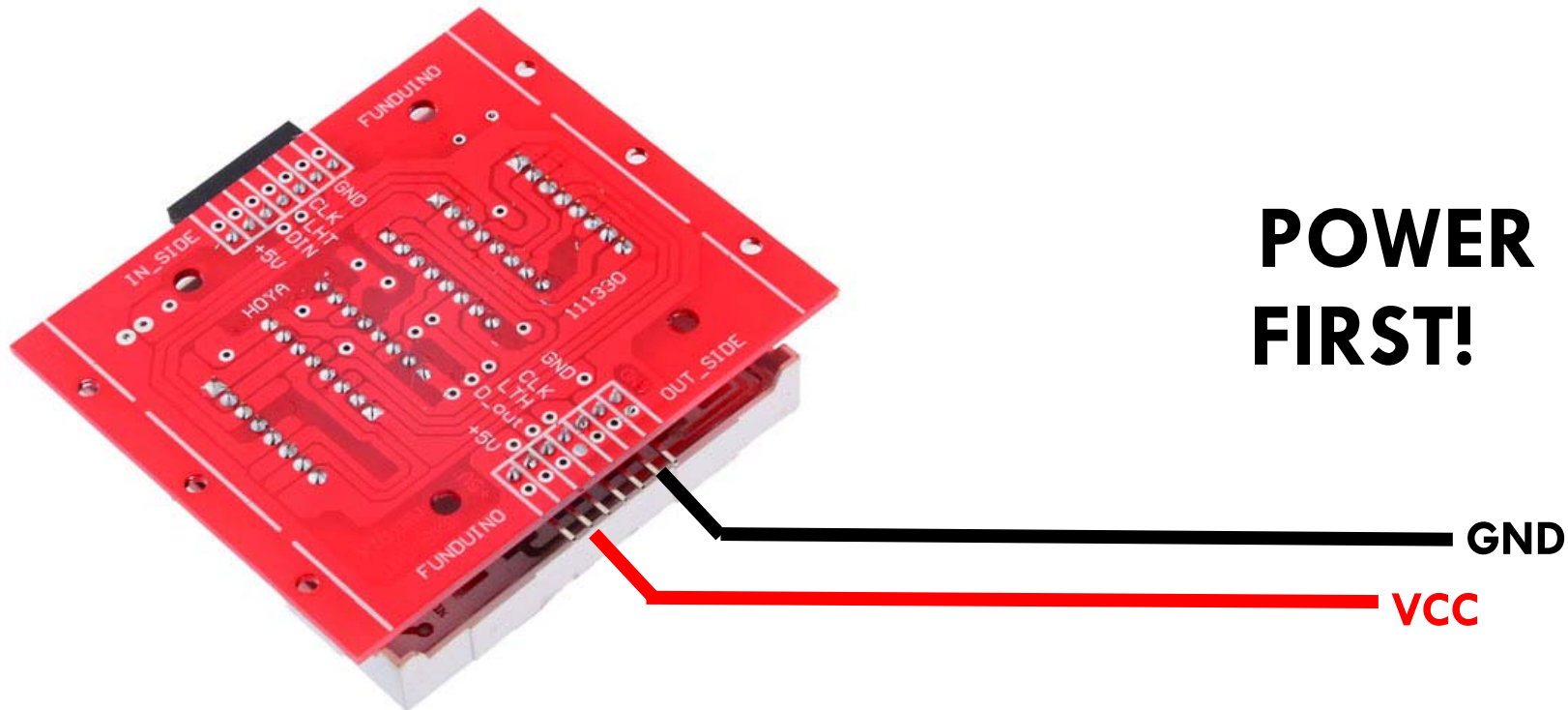
8\*8 dot matrix module

Under the hood – 2x 8bit Shift Registers (74HC595)

Serial to Parallel

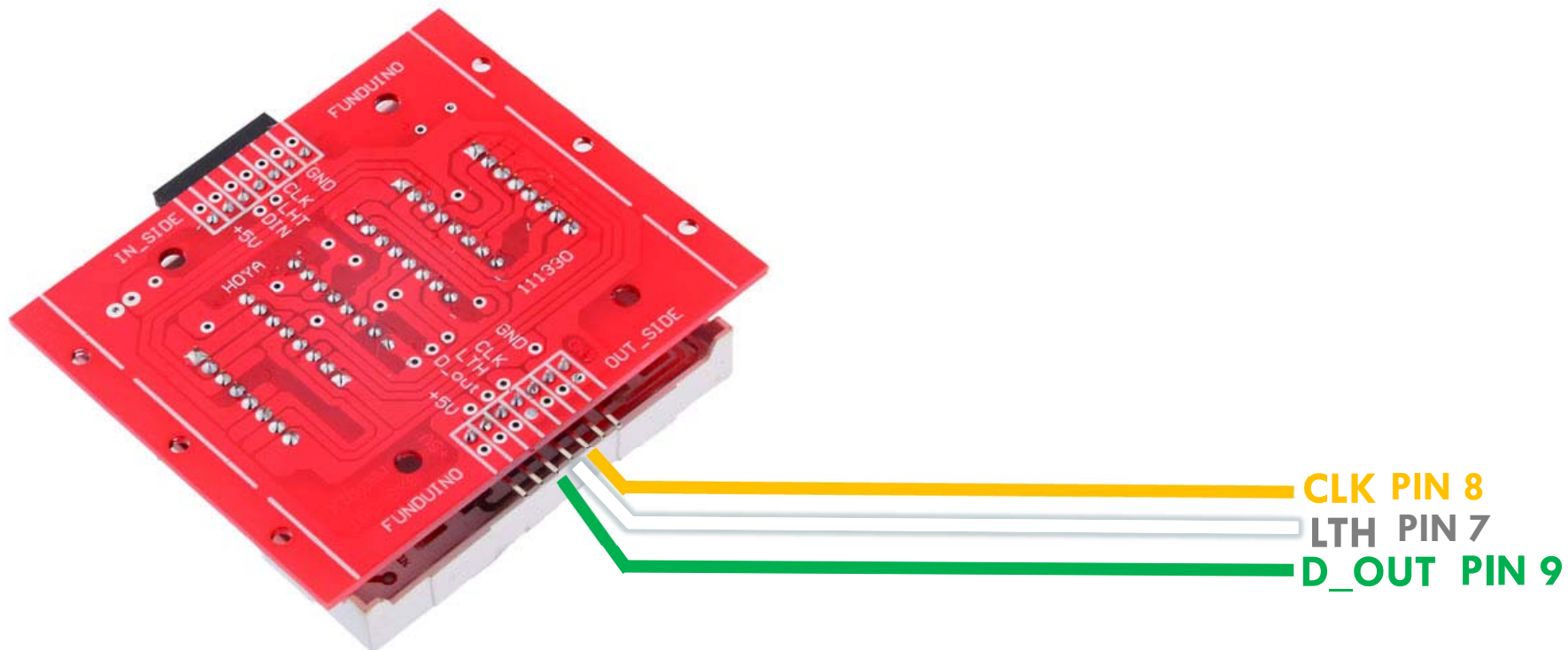


# CONNECTING THE DOT MATRIX MODULE





# CONNECTING THE SERIAL LINES



# AND FOR THE GRAND FINALE

Adding the capacitive touch buttons to pins 5 & 6

*By yourself :p*

# AND THAT'S IT!

Let's program it.

**For the next part, you will need to download the Arduino Program**

[HTTP://WWW.GITHUB.COM/AISCUBE/BYOG\\_Shield](HTTP://WWW.GITHUB.COM/AISCUBE/BYOG_Shield)

## Arduino Program Examples

SHIELD\_8x8\_ex1 – Display char at setup.

SHIELD\_8x8\_ex2– Display 0 to 9.

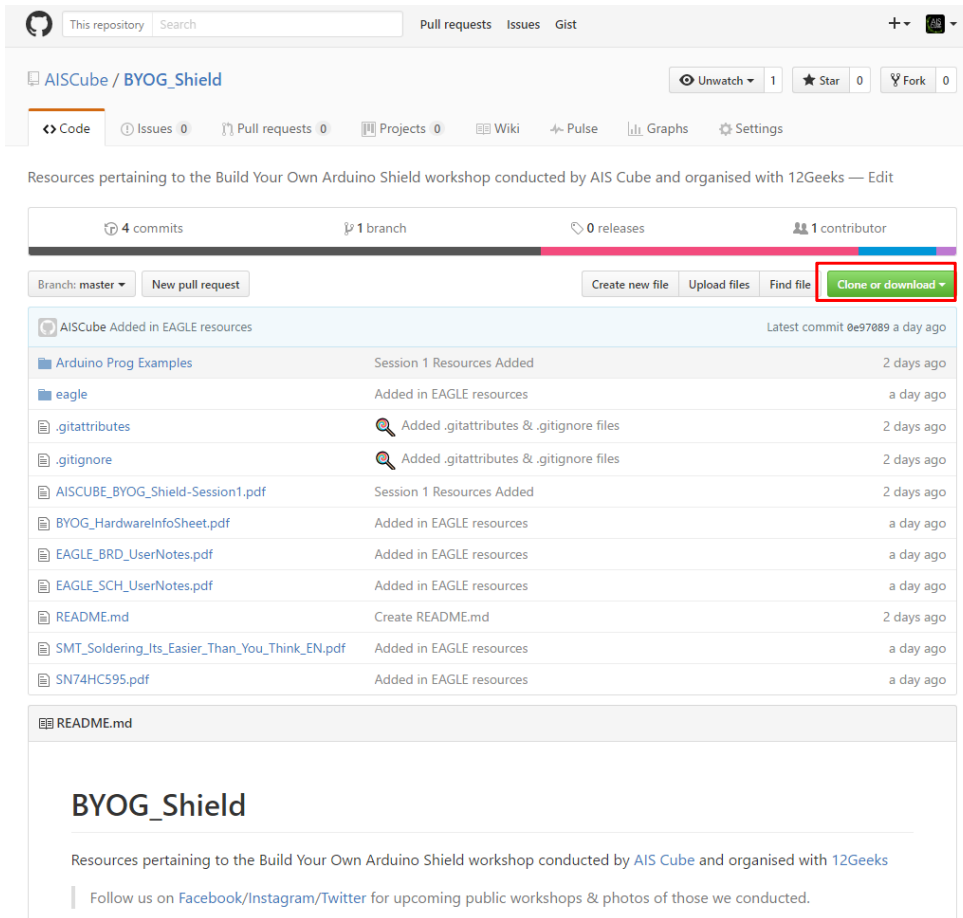
SHIELD\_8x8\_ex2b – Display A to Z.

SHIELD\_8x8\_ex3 – Use PB1 to increase.

SHIELD\_8x8\_ex3b – Use PB1 and PB2 to decrease.

SHIELD\_8x8\_ex4 – animate Square.

# https://github.com/AISCube/BYOG\_Shield



Repository: AISCube / BYOG\_Shield

Unwatch 1 Star 0 Fork 0

Code Issues 0 Pull requests 0 Projects 0 Wiki Pulse Graphs Settings

Resources pertaining to the Build Your Own Arduino Shield workshop conducted by AIS Cube and organised with 12Geeks — Edit

4 commits 1 branch 0 releases 1 contributor

Branch: master New pull request Create new file Upload files Find file Clone or download

File	Commit	Time
Arduino Prog Examples	Session 1 Resources Added	2 days ago
eagle	Added in EAGLE resources	a day ago
.gitattributes	Added .gitattributes & .gitignore files	2 days ago
.gitignore	Added .gitattributes & .gitignore files	2 days ago
AISCUBE_BYOG_Shield-Session1.pdf	Session 1 Resources Added	2 days ago
BYOG_HardwareInfoSheet.pdf	Added in EAGLE resources	a day ago
EAGLE_BRD_UserNotes.pdf	Added in EAGLE resources	a day ago
EAGLE_SCH_UserNotes.pdf	Added in EAGLE resources	a day ago
README.md	Create README.md	2 days ago
SMT_Soldering_Its_Easier_Than_You_Think_EN.pdf	Added in EAGLE resources	a day ago
SN74HC595.pdf	Added in EAGLE resources	a day ago

README.md

## BYOG\_Shield

Resources pertaining to the Build Your Own Arduino Shield workshop conducted by AIS Cube and organised with 12Geeks

Follow us on Facebook/Instagram/Twitter for upcoming public workshops & photos of those we conducted.

1. Download ZIP
2. Extract the contents

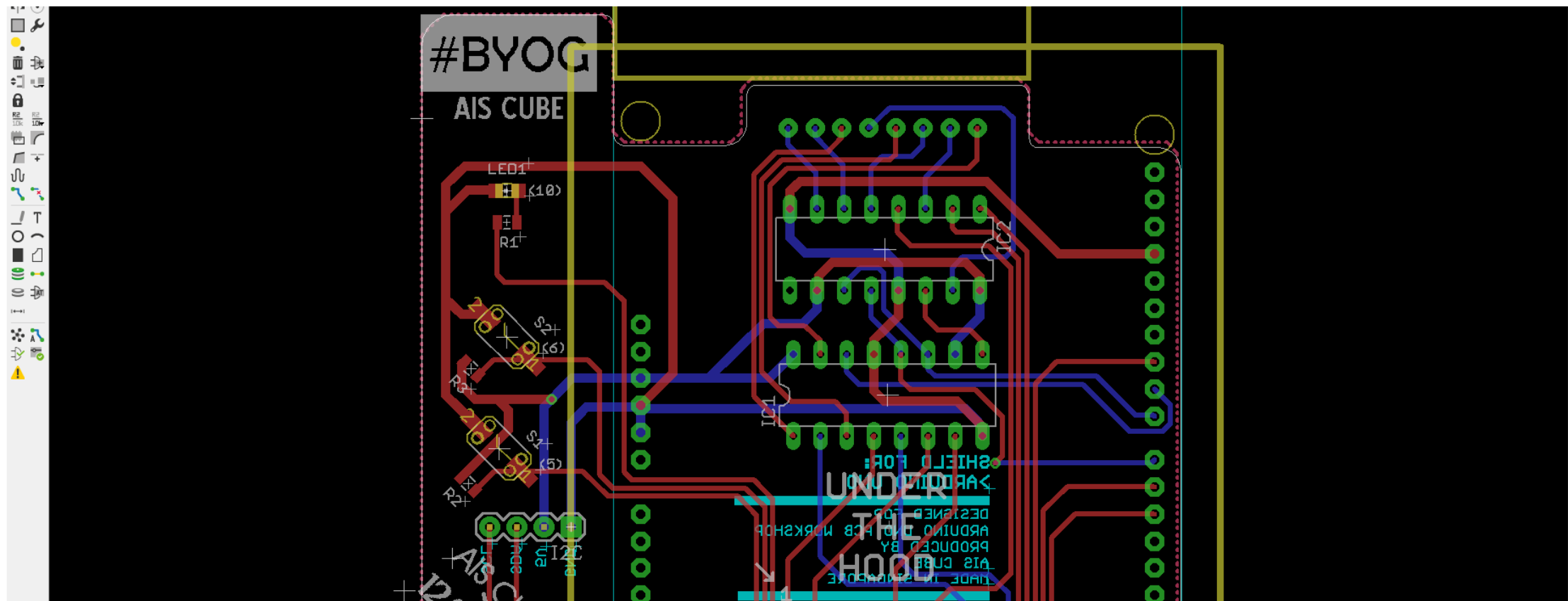
```

4 int pb1Pin = 5;
5 int pb2Pin = 6;
6 int ledPin = 10;
7
8 int latchPin = 7;
9 int clockPin = 8;
10 int dataPin = 9;
11
12 const char data[][8] ={
13 {0B00000000, 0B00000000, 0B00000000, 0B00000000, 0B00000000, 0B00000000, 0B00000000, 0B00000000},
14 {0B00000100, 0B00000100, 0B00000100, 0B00000100, 0B00000100, 0B00000100, 0B00000000, 0B00000100},
15 {0B00001010, 0B00001010, 0B00001010, 0B00000000, 0B00000000, 0B00000000, 0B00000000, 0B00000000},
16 {0B00000000, 0B00001010, 0B00011111, 0B00001010, 0B00011111, 0B00001010, 0B00011111, 0B00001010},
17 {0B00000111, 0B00001100, 0B00010100, 0B00001100, 0B00000110, 0B00000101, 0B00000110, 0B00011100},
18 {0B00011001, 0B00011010, 0B00000010, 0B00000100, 0B00000100, 0B00001000, 0B00001011, 0B00010011},
19 {0B00000110, 0B00001010, 0B00010010, 0B00010100, 0B00001001, 0B00010110, 0B00010110, 0B00001001},
20 {0B00000100, 0B00000100, 0B00000100, 0B00000000, 0B00000000, 0B00000000, 0B00000000, 0B00000000},
21 {0B00000010, 0B00000100, 0B00001000, 0B00001000, 0B00001000, 0B00001000, 0B00000100, 0B00000010},
22 {0B00001000, 0B00000100, 0B00000010, 0B00000010, 0B00000010, 0B00000010, 0B00000100, 0B00001000},
23 {0B00010101, 0B00001110, 0B00011111, 0B00001110, 0B00010101, 0B00000000, 0B00000000, 0B00000000},

```

## PROGRAMMING THE 8\*8 DOT MATRIX





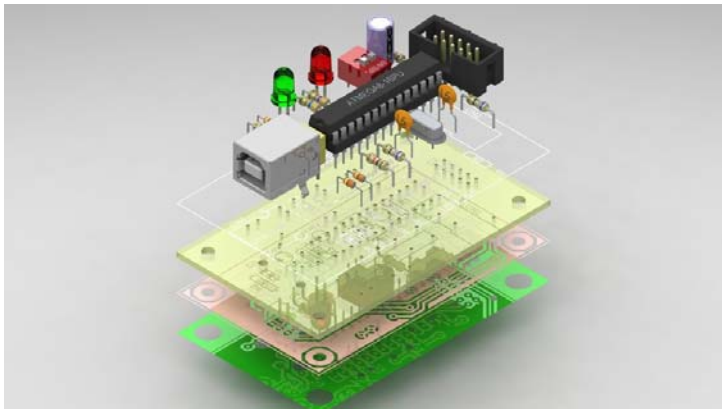
# INTRODUCTION TO EAGLE

# SO, YOU WANT TO MAKE YOUR OWN PCB

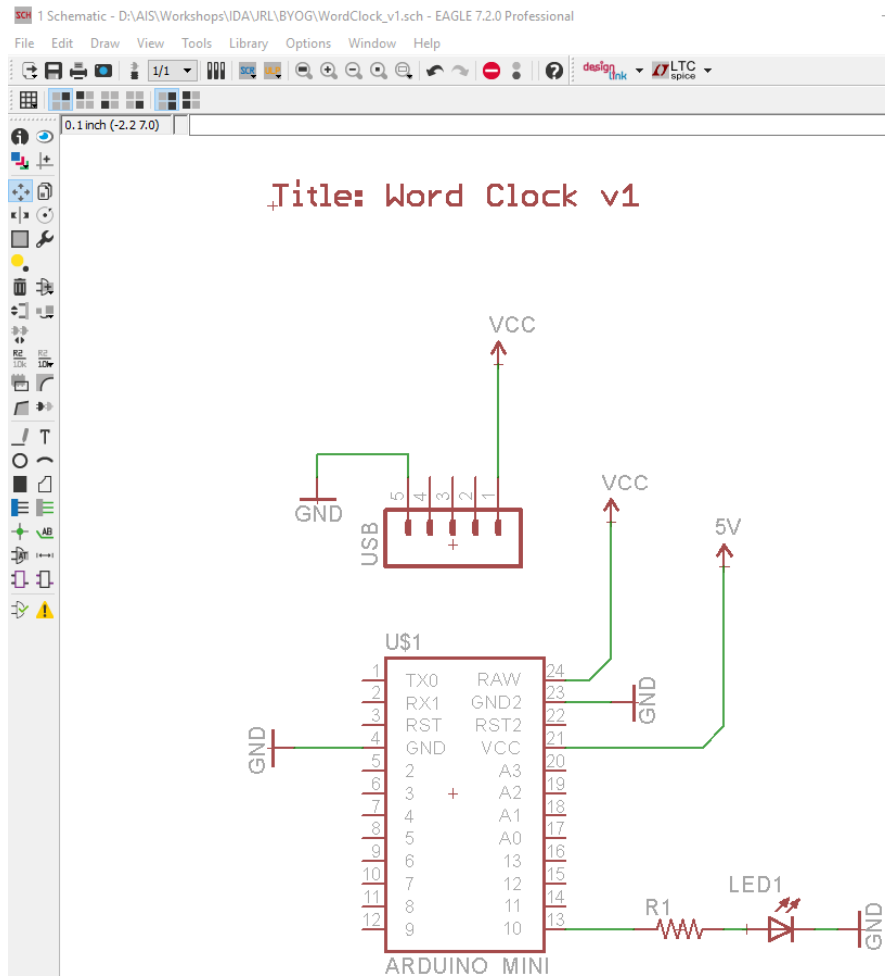
PCB = Printed Circuit Board

Tools of the trade:

- PCB CAD (Computer Aided Design) Design Software

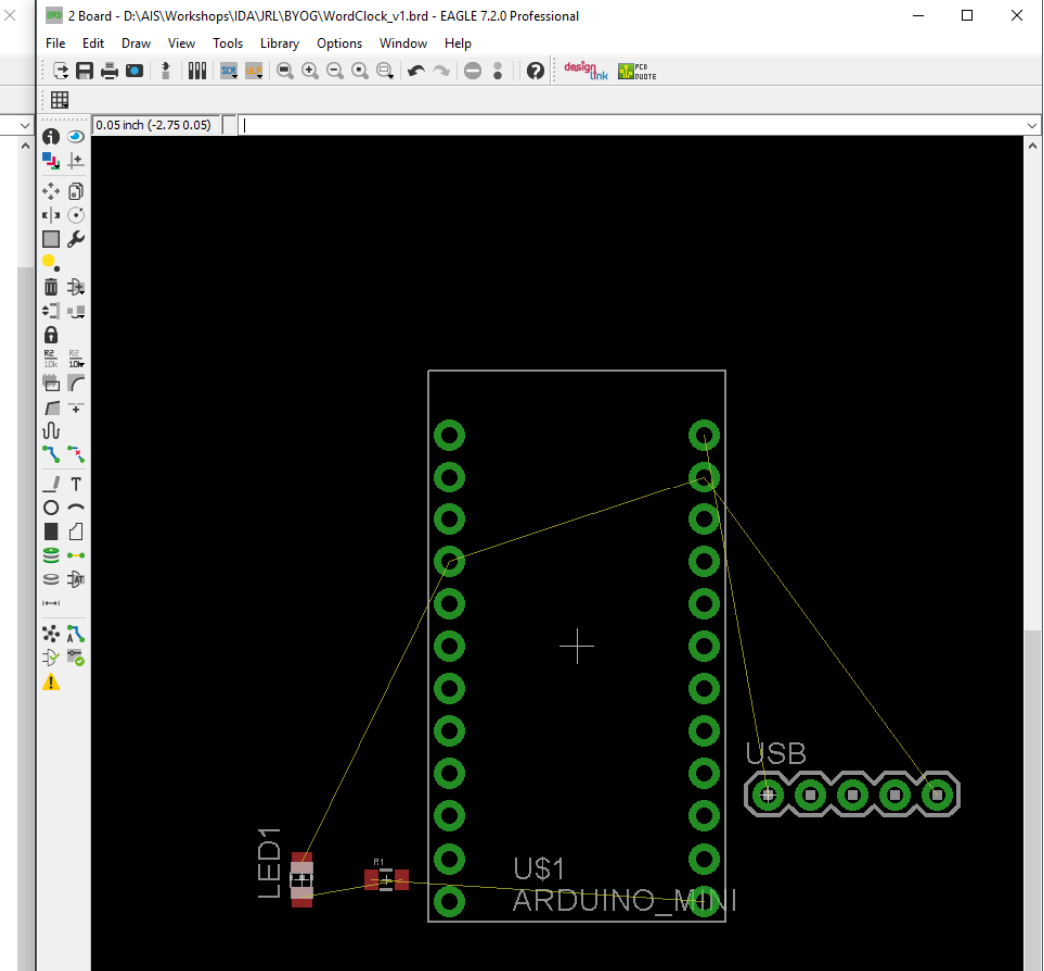


# Schematic (.sch)



## Electronic Symbols

# Board Layout (.brd)



## "Footprint" of Electronic Parts

# DIVING RIGHT IN... WHY EAGLE?

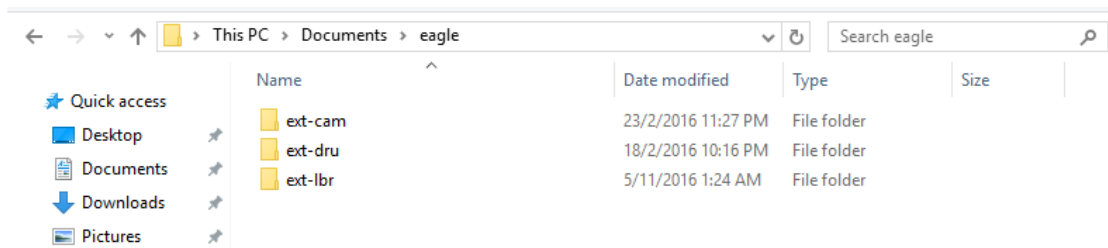
- Cross Platform – Windows/Mac/Linux
- Free version is great for students/hobbyists (non-commercial)
  - **Limitations:**
    - 2 Layer Board
    - Board Dimension: 10 \* 8 cm
    - Schematic : Max 2 Sheets
- Great community support
  - Loads of tutorials
  - Many open source hardware designers use EAGLE
  - **Open Source Libraries** – Need a part footprint? It's probably already available somewhere out there.
    - Eagle Community
    - Sparkfun
    - Adafruit
    - Element14
    - (and a lot more)

# SETTING UP EAGLE

We've provided some libraries and files that you will find useful in this workshop (and hopefully beyond.) We'll need to let EAGLE know we have these files.

Look for the folder “eagle” inside the contents of the folder you downloaded from github.

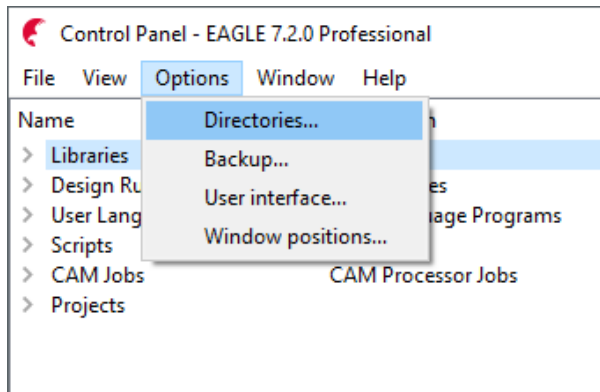
Copy the folder into “Documents” so that it looks like this in file explorer. (or equivalent in MAC/Linux)





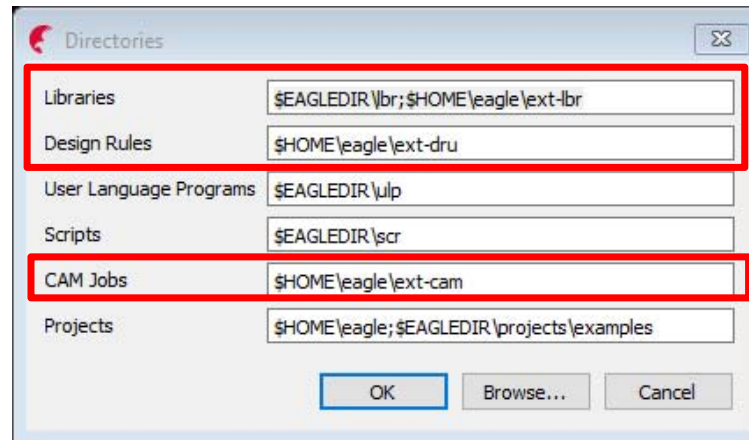
## STEP 1

In the Control Panel of EAGLE:  
**Go to Options > Directories**



## STEP 2

Make the following changes for **Libraries, Design Rules & CAM Jobs**  
For Windows Users,  
Follow the screenshot below.

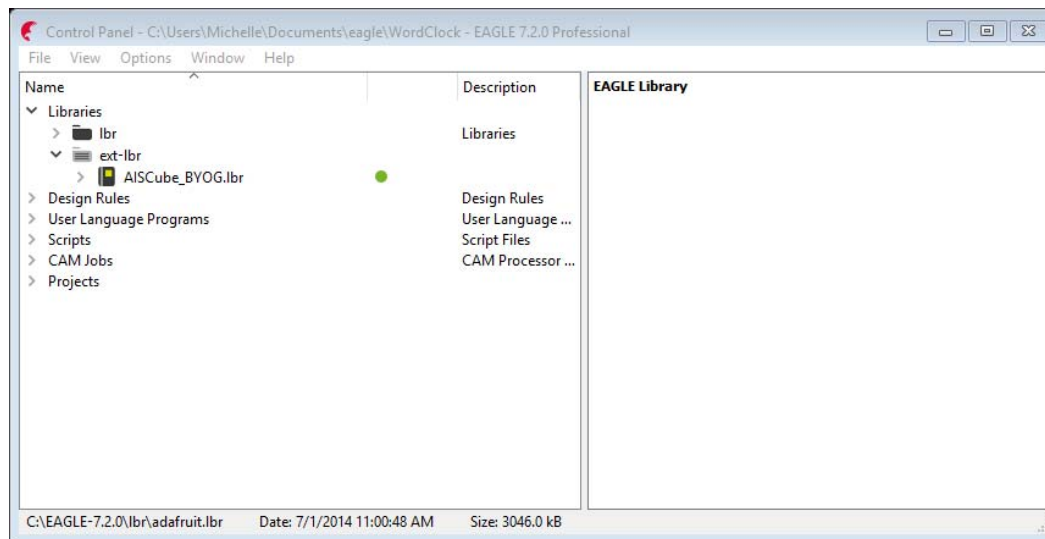


## MAC (append using ':')

: /Users/yourComputerName/Documents/eagle/ext-lbr

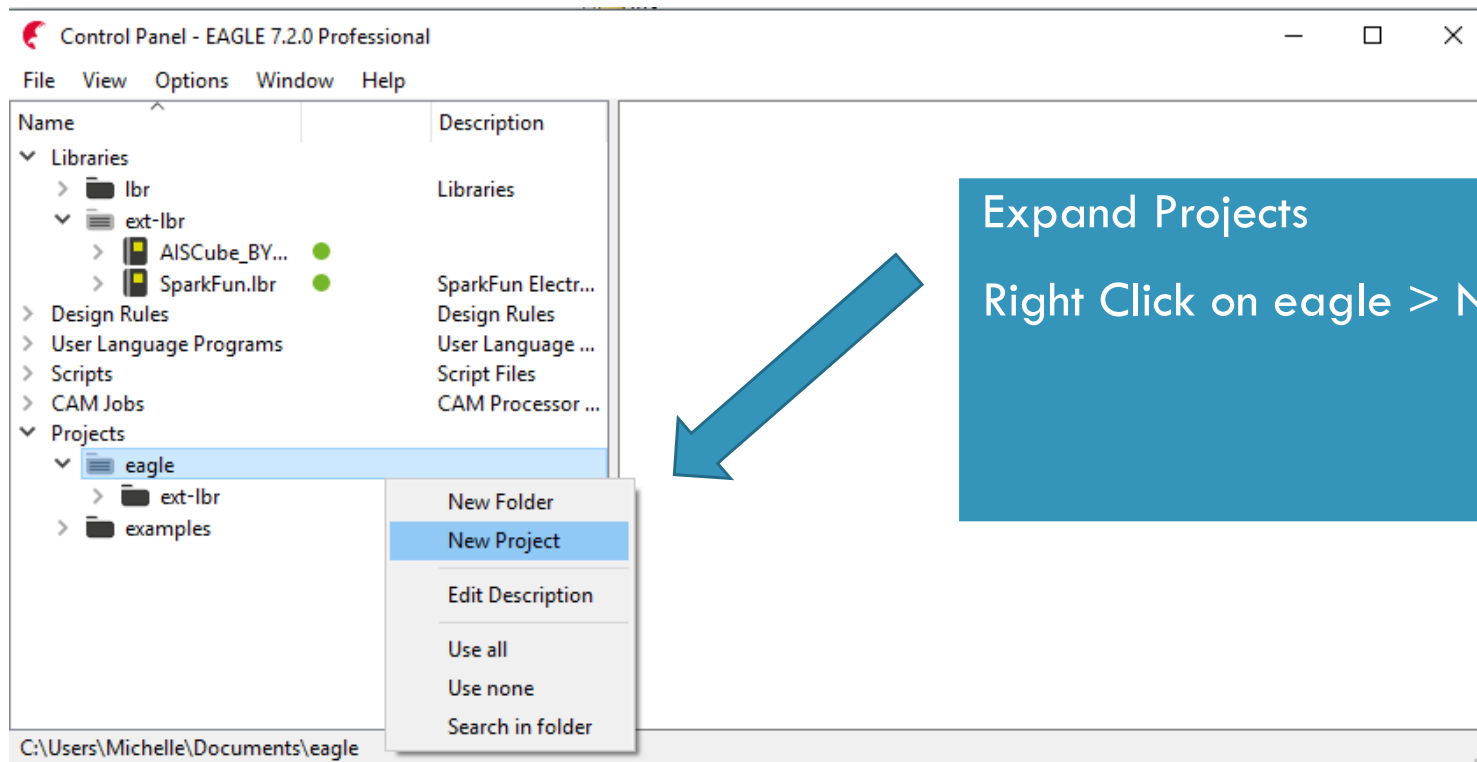
# GO TO EAGLE'S CONTROL PANEL

## Expand ext-lbr



Click on the grey dot to enable use of the libraries

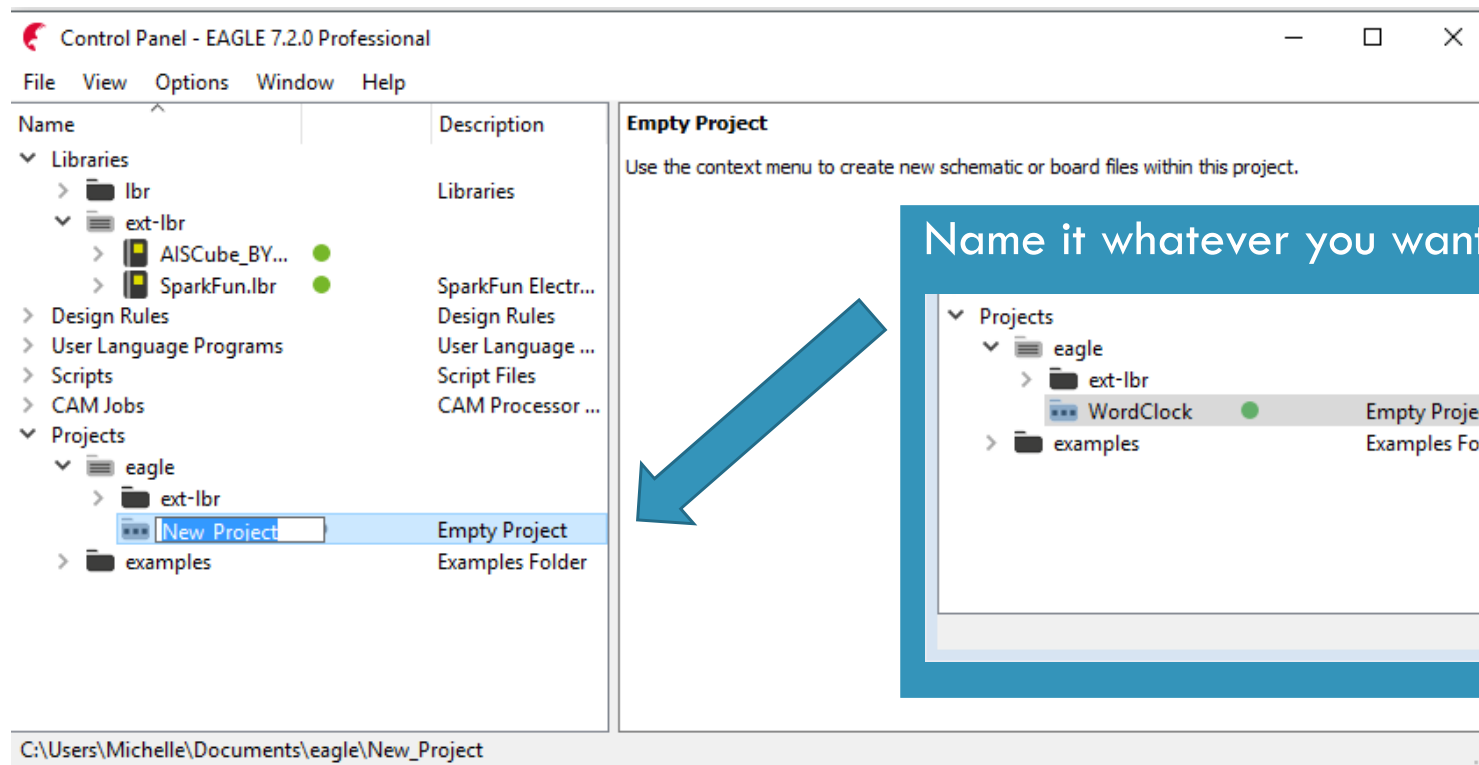
# LET'S CREATE A NEW PROJECT



Expand Projects

Right Click on eagle > New Project

# NAME IT WHAT EVER YOU WANT.



Name it whatever you want

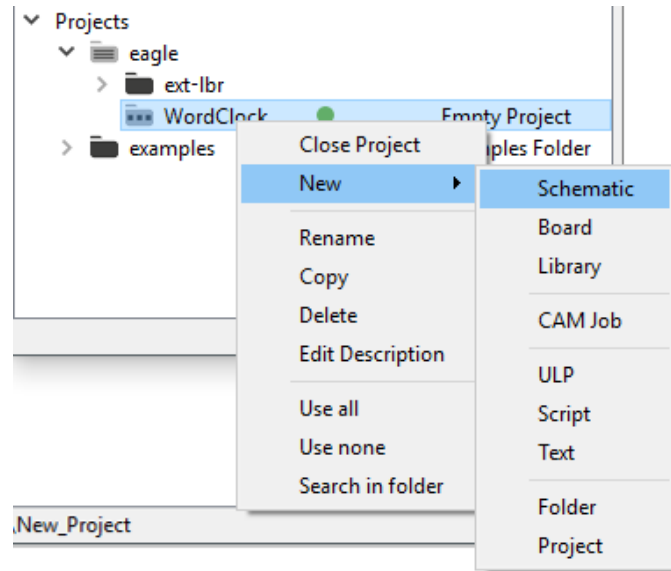
Projects

- eagle
  - ext-lbr
    - WordClock Empty Project
  - examples Examples Folder

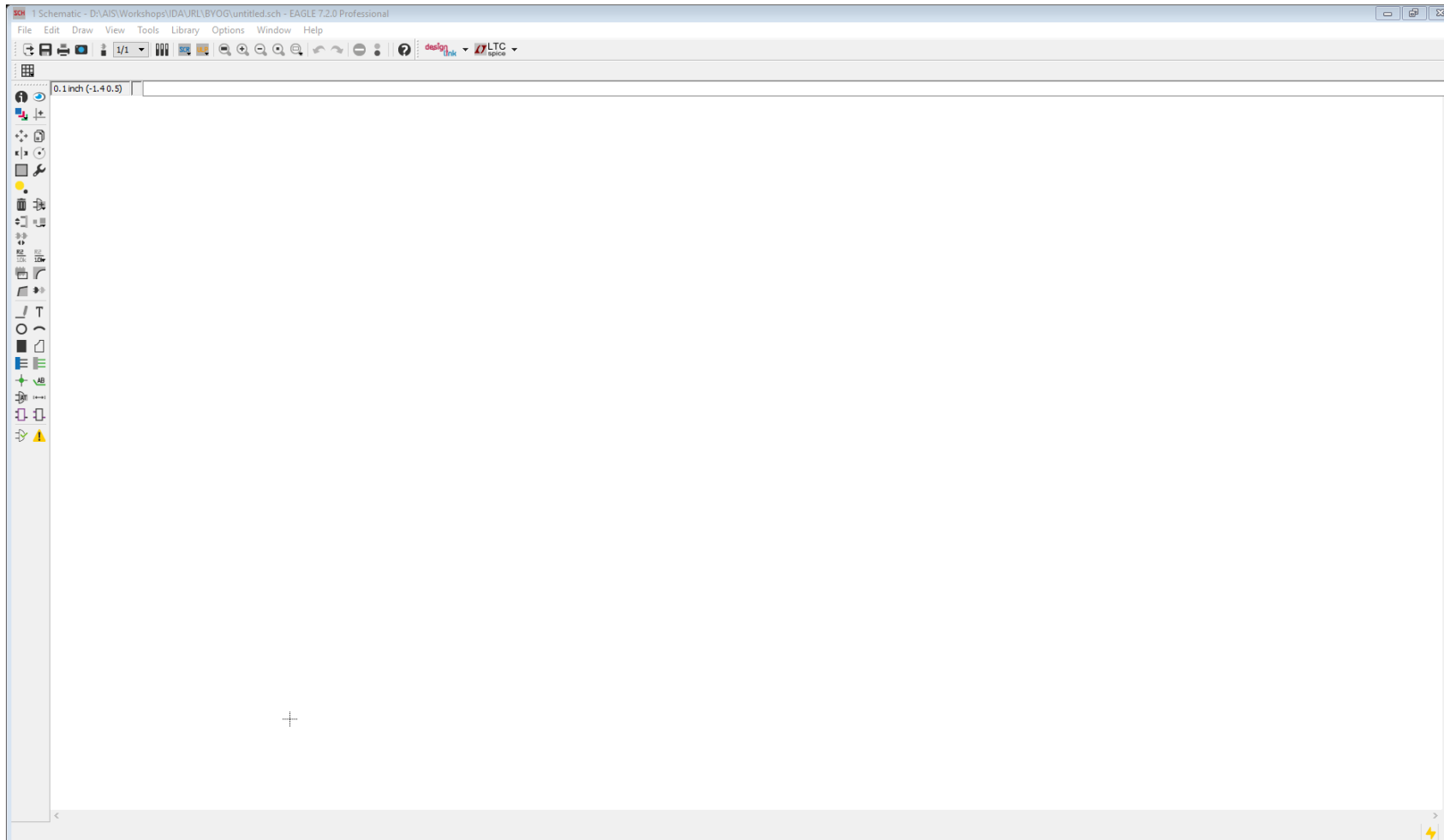
# CREATE NEW SCHEMATIC

Right Click on your project

New > Schematic

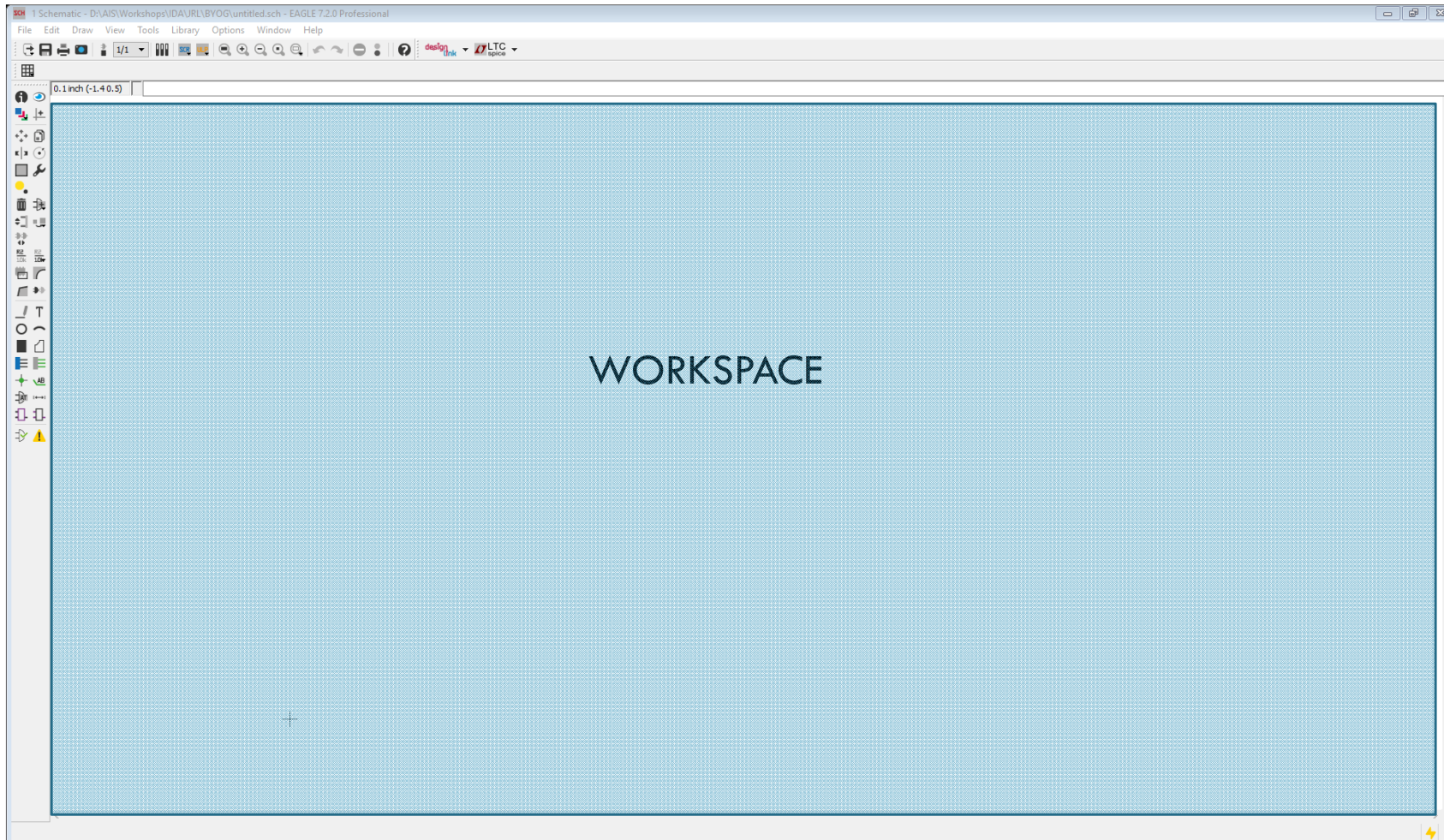


# WELCOME TO EAGLE

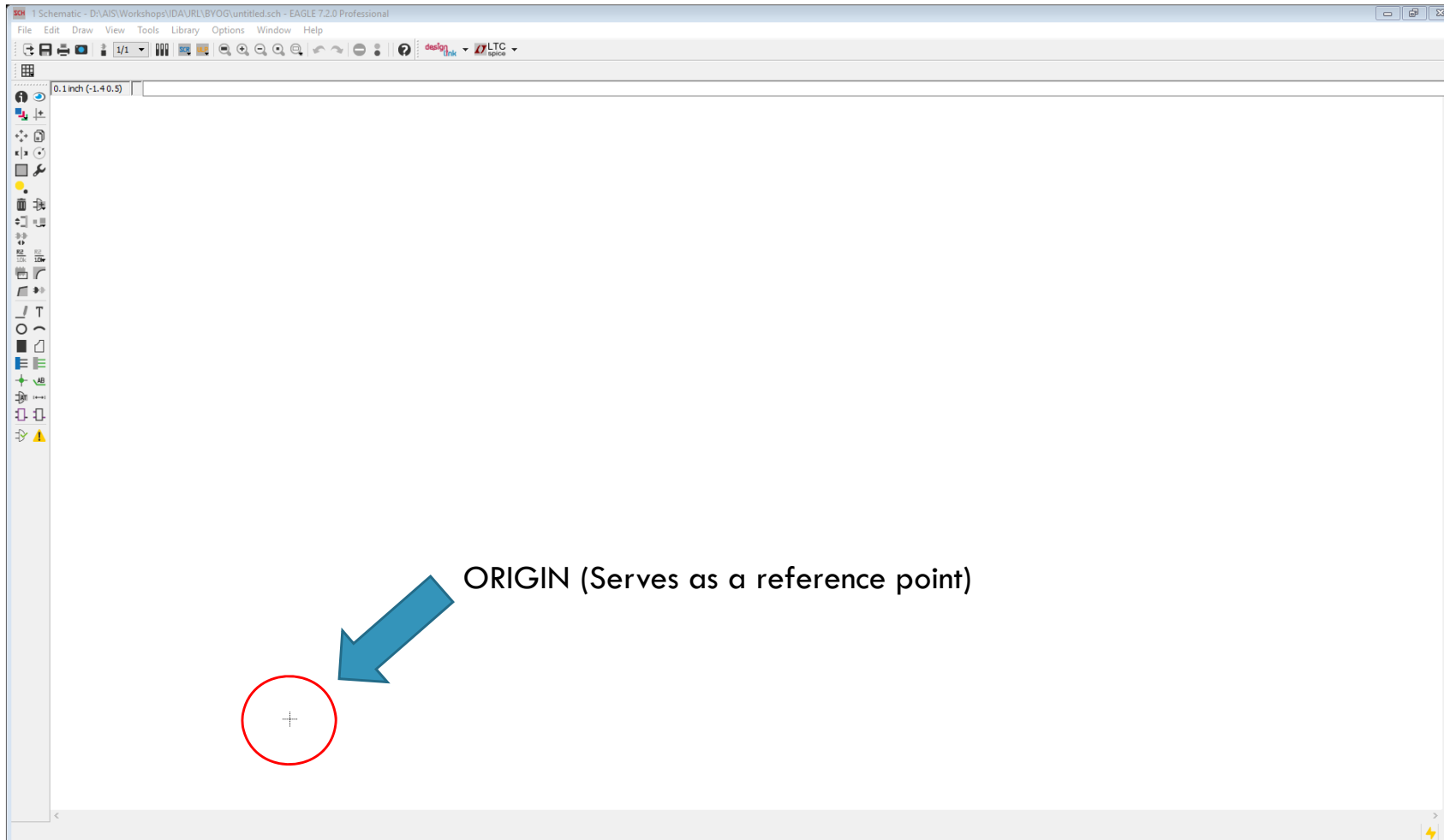




# WELCOME TO EAGLE ☺



# WELCOME TO EAGLE ☺



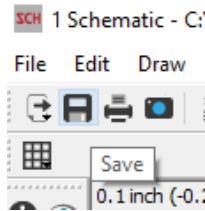
# LET'S SAVE THE SCHEMATIC

Any of these methods

➤ FILE > SAVE

➤ Save icon

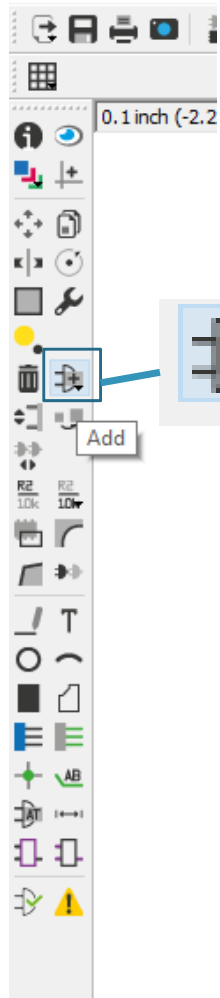
➤ Ctrl + S



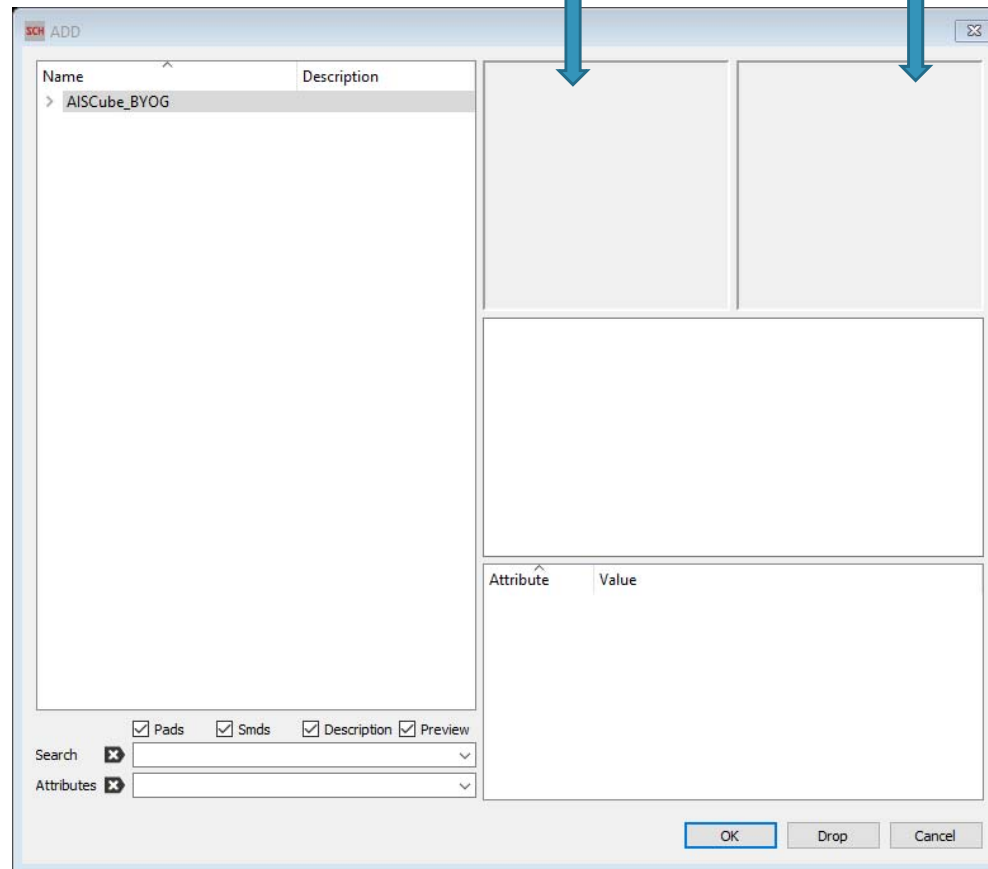
# ADDING COMPONENTS

SCH 1 Schematic - D:\A

File Edit Draw



Symbol Preview Footprint Preview

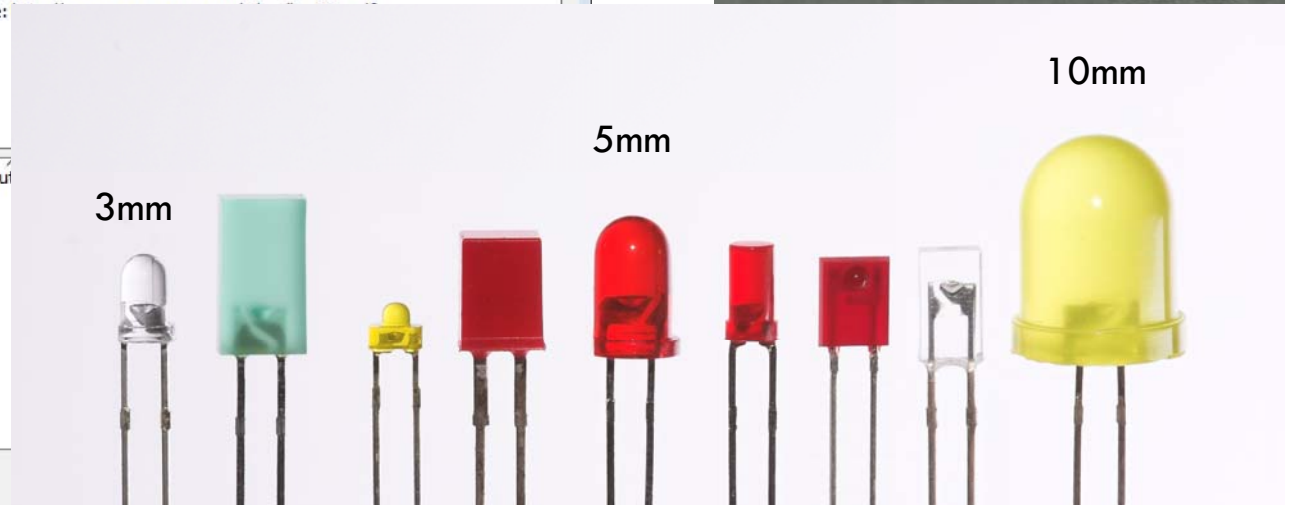
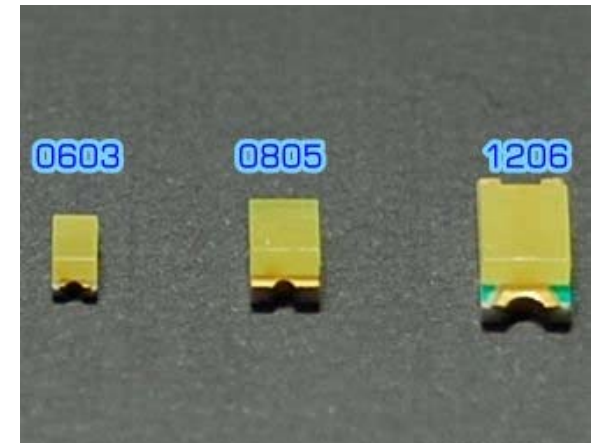
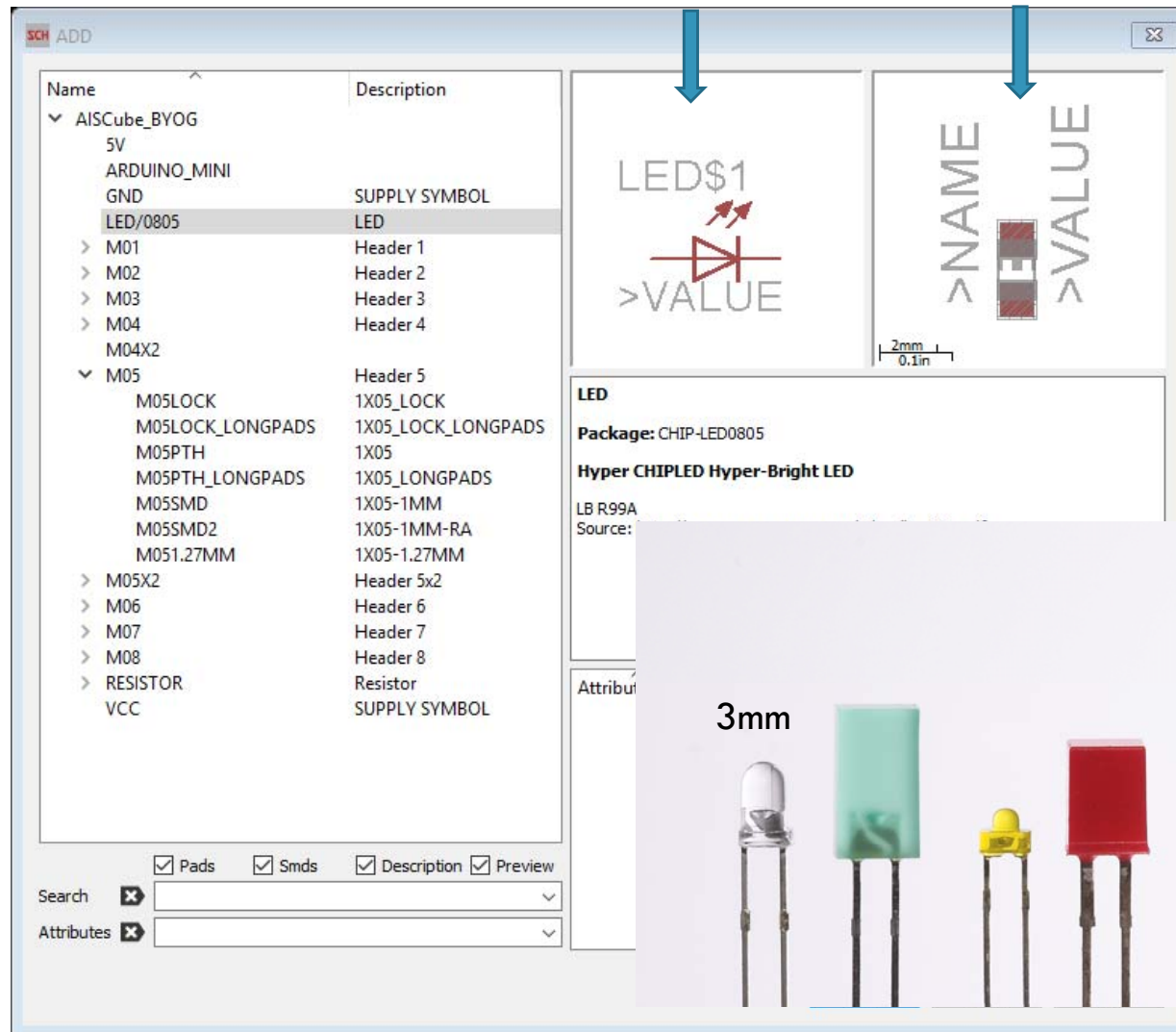


Symbol Preview

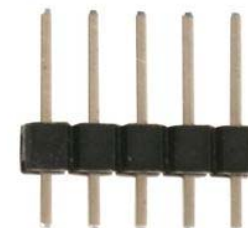
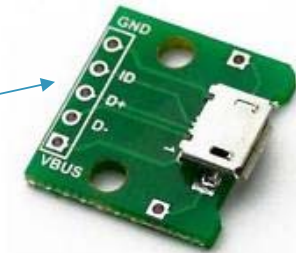
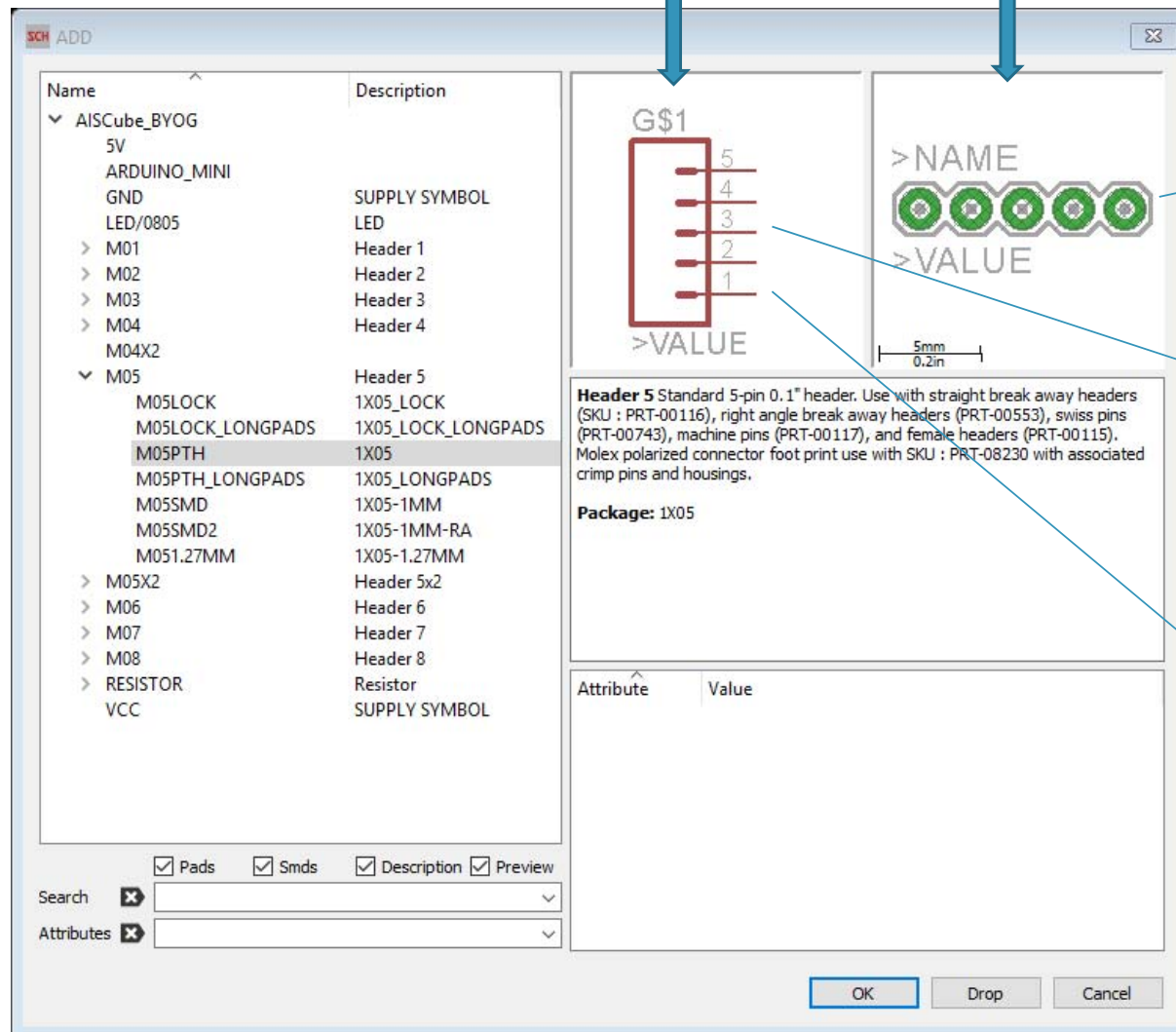
(DOES NOT CHANGE)

Footprint Preview

(CHANGES)



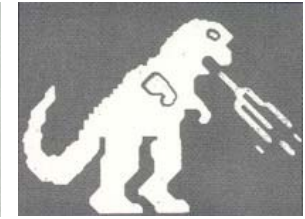
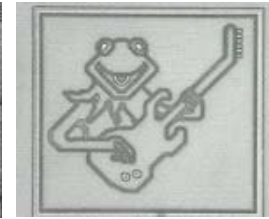
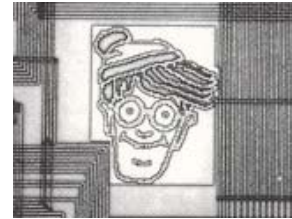
## Symbol Preview    Footprint Preview





# HOMEWORK

Logo/Image for Silkscreen



## Remember!

Bring your mouse! And your laptop charger / a fully charged laptop!

