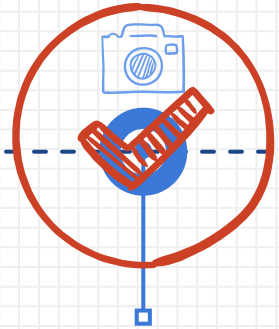
# EECS16A Touchscreen 1

TA, ASE, ASE, ASE

# Semester Outline



Imaging Module

Touchscreen Module

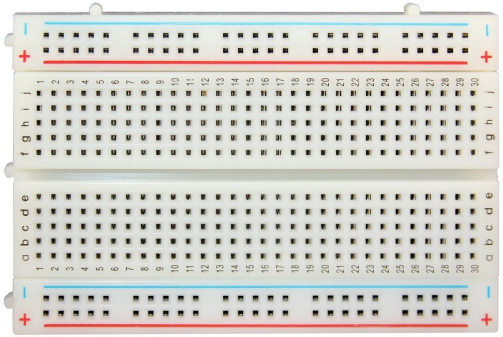
APS Module

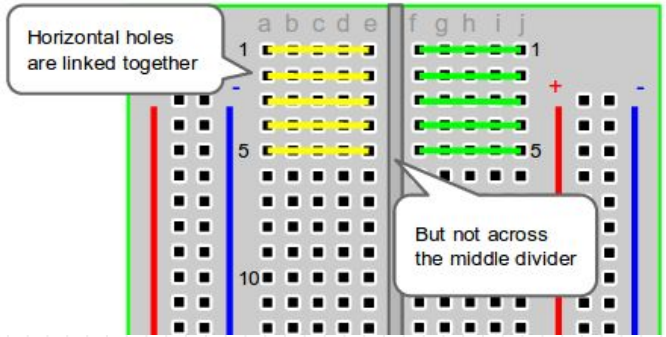
## Today’s lab:

- Breadboarding
- Build multiple functional circuits
- Learn how to use Multimeter

# Breadboarding basics

- Similar to Imaging 1: Intro to Breadboarding
- Build up breadboarding skills
  - Connect to concepts in lecture, including Voltage Dividers and KVL
- Very important skill: prototype, debug, and translate theoretical ideas into real circuits





# Poll time!

Review of breadboarding practices from Imaging 1.

1. Which of the following are good breadboarding practices
   a. Check the resistor value by its color bands
   b. Plug in component legs in different rows
   c. Use black and red wires for the rails

2. For which of the following components does polarity matter?

Resistor LED Capacitor Ambient Light Sensor

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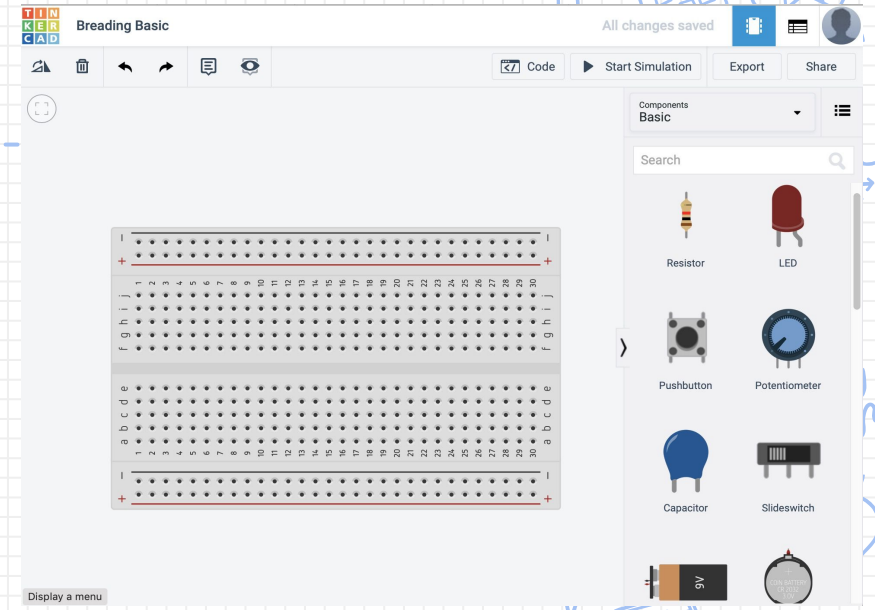
Resistor LED Capacitor Ambient Light Sensor

# Tinkercad

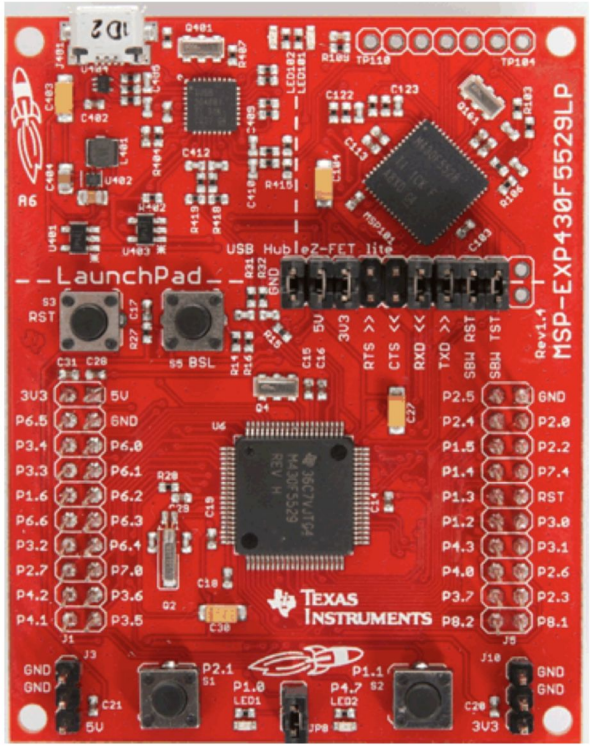
- Circuit design prototyping software
  - Primary circuit software in this course
  - Useful for many different electrical projects

- Ran online using an Autodesk account



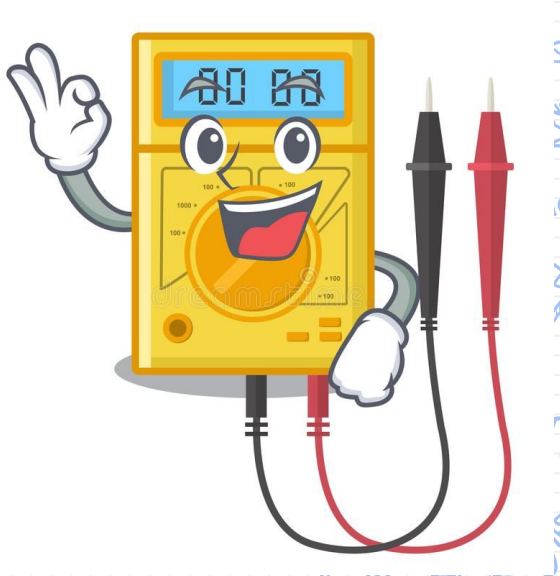
# Launchpad Review

- Micro-Controller
- Power Supply
- Voltmeter



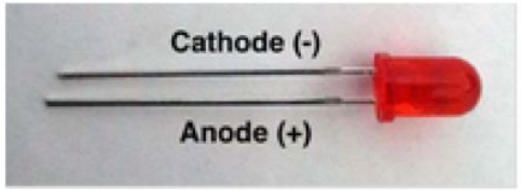
# Multimeter (Circuit Debugger)

- Voltmeter
  - Infinite resistance
  - Connect in parallel with component
- Ammeter
  - Very low resistance
  - Act as a wire in the circuit
  - Connect in series with component
- Ohmmeter
  - Remove resistor from circuit before use
  - Connect in parallel with resistor

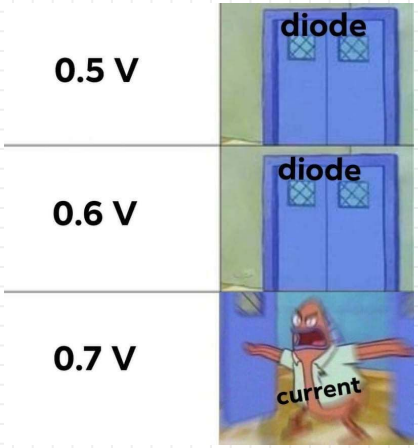


# Circuit Elements

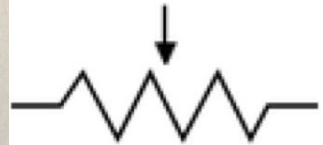
LED



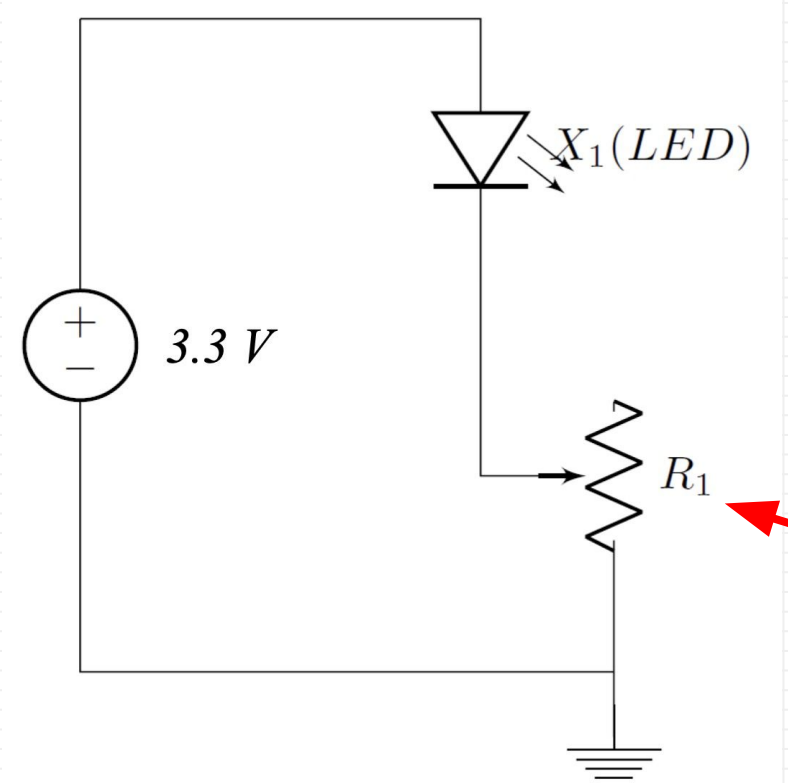





Potentiometer



# LED Fader Circuit

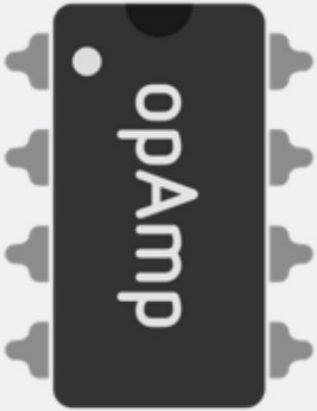



# Operational Amplifier (OpAmp)

741

Operational

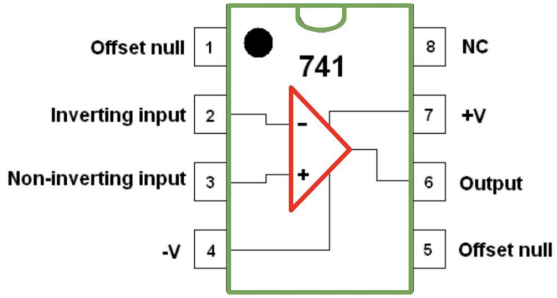
Amplifier

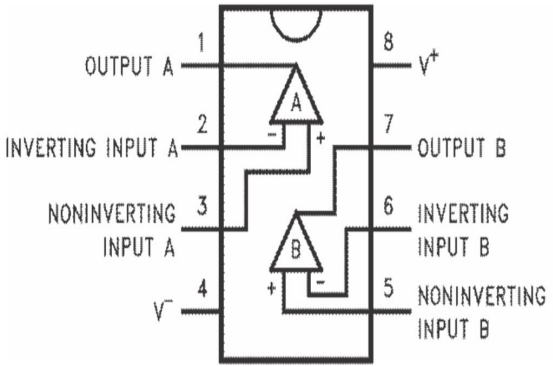




The 741 Operational Amplifier Fig.2

Pinout



# Voltage Divider Circuit

What is the voltage value $u_2$ at Node 2?

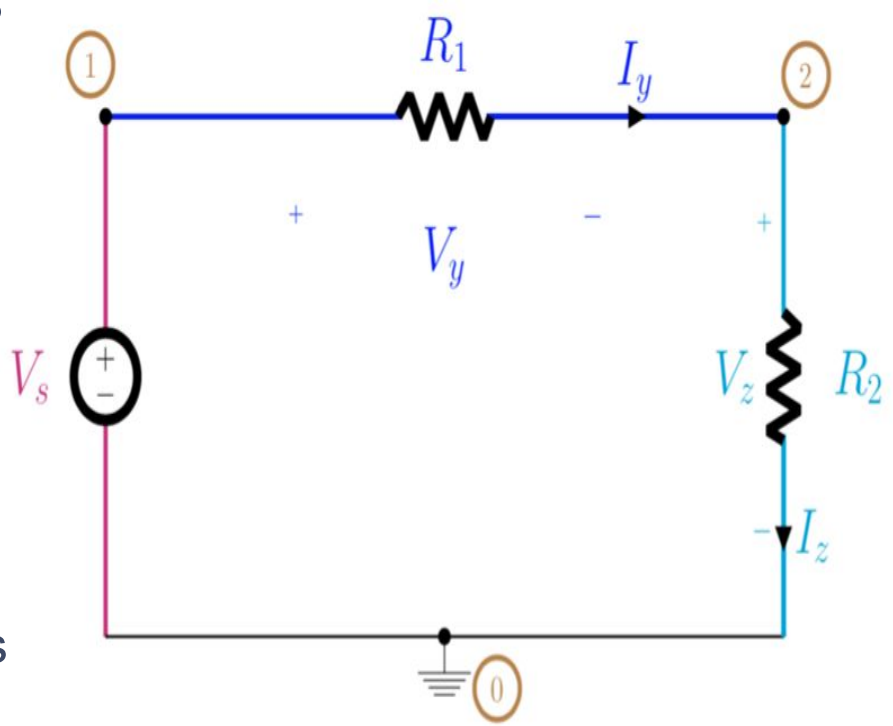
$$I_y = I_z = V_s /(R_1 + R_2) \text{ (Ohm's Law)}$$

$$u_2 - u_0 = R_2 * I_z$$

$$u_2 - 0 = R_2 * V_s /(R_1 + R_2)$$

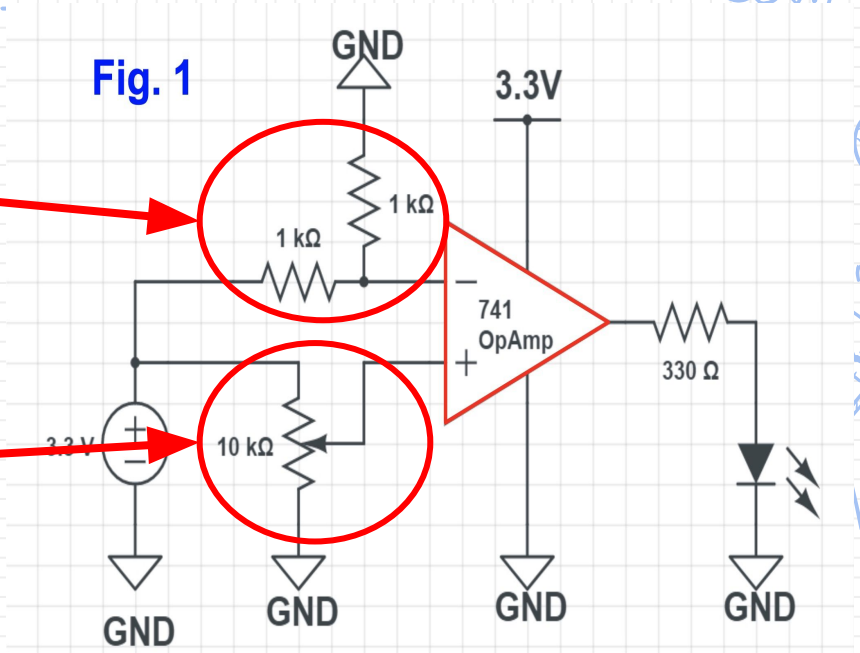
$$u_2 = V_s * R_2 /(R_1 + R_2)$$

What is the voltage value $u_2$ if $R_1$ equals to $R_2$ ?



# Mystery Circuit

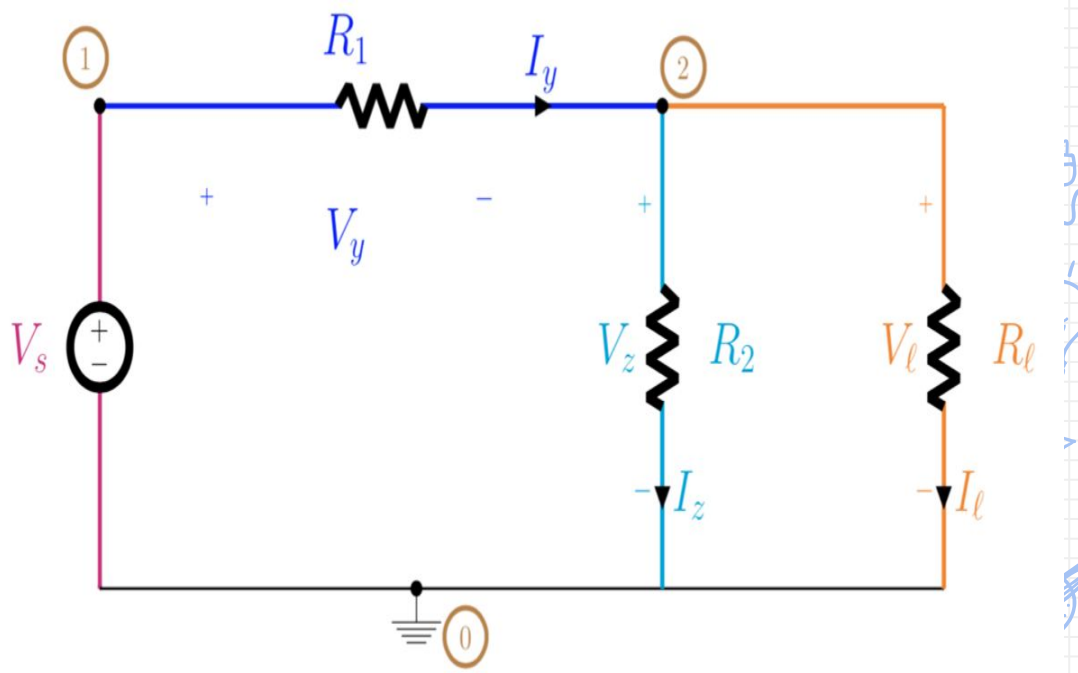
- Voltage Divider Circuit
  - Find it in this circuit?
- Potentiometer Circuit
  - Find it in this circuit?




- A breadboarding exercise - not meant to test circuit analysis knowledge

# Series and Parallel Resistors

- What is the relationship between $R_2$ and $R_l$?
- What about $R_1$ with $R_2$ and $R_l$?



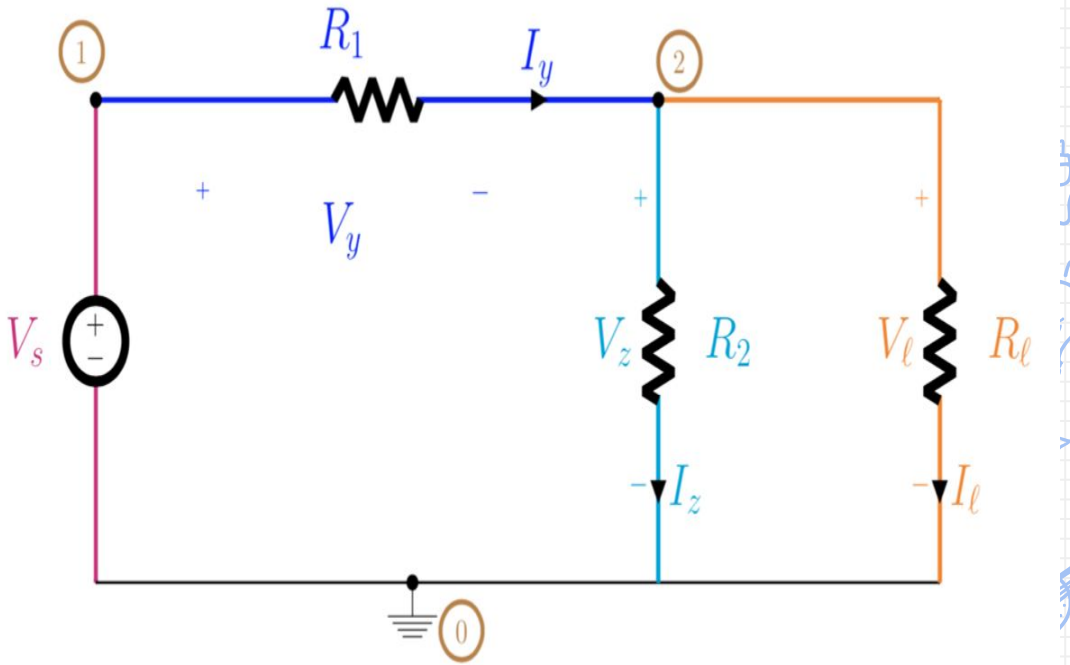
# Series and Parallel Resistors

Resistor Equation:

$$R = (\rho * L) / A$$

When in parallel what parameter changes? How does this affect overall resistance, (ie: $R_{eq}$ )

What about in series?



# Lab Structure

- Tasks are labelled Software or Hardware else Software in the title
- For students with hardware:
  - Some TinkerCAD tasks
  - Some hardware tasks
- For students without hardware:
  - Do the TinkerCAD versions of all tasks
  - Watch videos and work with group members to see hardware setup
- Optional Task 4 at the end of the notebook to try building more circuits

# Pointers

- Go through the TinkerCAD tutorial (if you haven’t already)
- Try to debug your circuit by yourself before you ask the TAs
  - However, don’t spend too long, after 5 minutes or so queue for help
- Task 3c: MSP acts as single point voltmeter