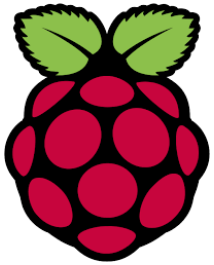
Python Computing: Building a Sensor System
CSCI 250
Lecture 4: Review, Python Practice, and What's in the Box: Sensors

COLORADOSCHOOLOFMINES
EARTH • ENERGY • ENVIRONMENT

Today's Plan

- Funch/Fike/Finner
- Review
- Python Practice
- GPIO …
- What's in the Box: Sensors

  ** Turn in your worksheet on your way out today



Learning Outcomes

- By the end of this course, students will be able to:
  - Create, navigate, and manage files and directory structures using basic Linux shell commands.
  - Describe the functionality and purpose of the individual components of the Raspberry Pi Hardware.
  - Install the Raspbian operating system onto the Raspberry Pi Hardware and setup basic configuration parameters.
  - Download, install, and develop programs using an Integrated Development Environment (IDE) on the Raspberry Pi Hardware.
  - **Develop and run basic Python functions and programs in the Linux environment to collect data from sensors using the Raspberry Pi Hardware (e.g., optical, acoustic, acceleration, magnetic field).**
  - Plot and analyze data from the sensor system and compare to mathematical models.

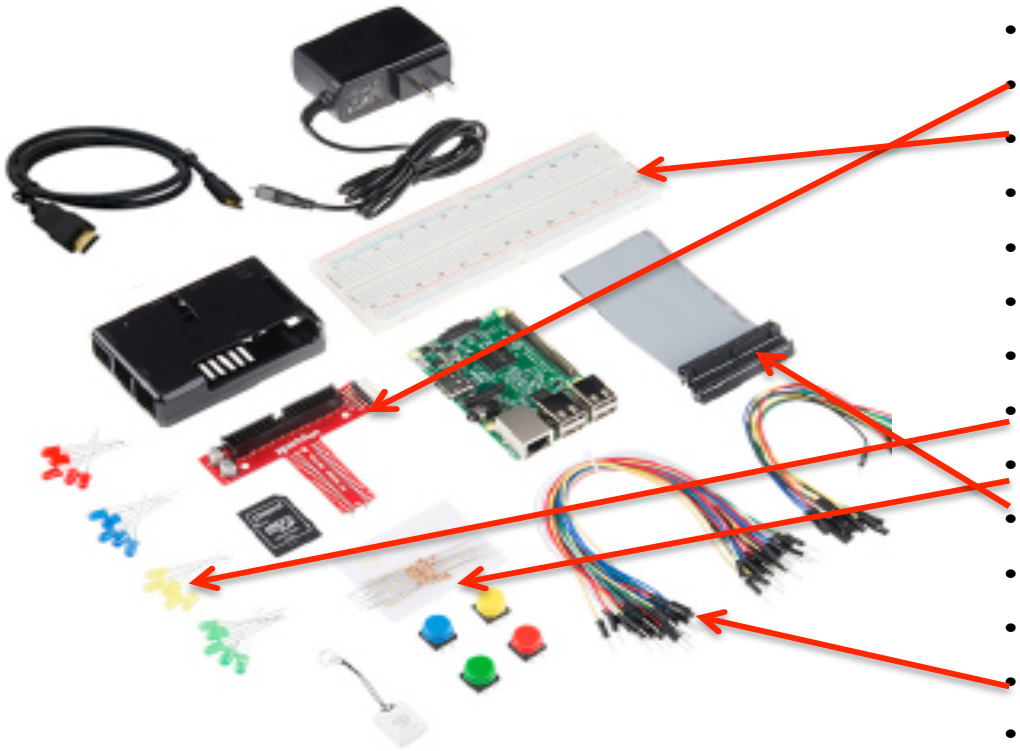
Review

- Questions on Assignment?
- Basic Linux Commands … we went fast ☺
- All set up and have your Pi running?
- Anyone still need kit … contact me …
- Reminder: Office Hours
  - W 1:00-4:00 Brown BB280D

Python Practice – Live Coding

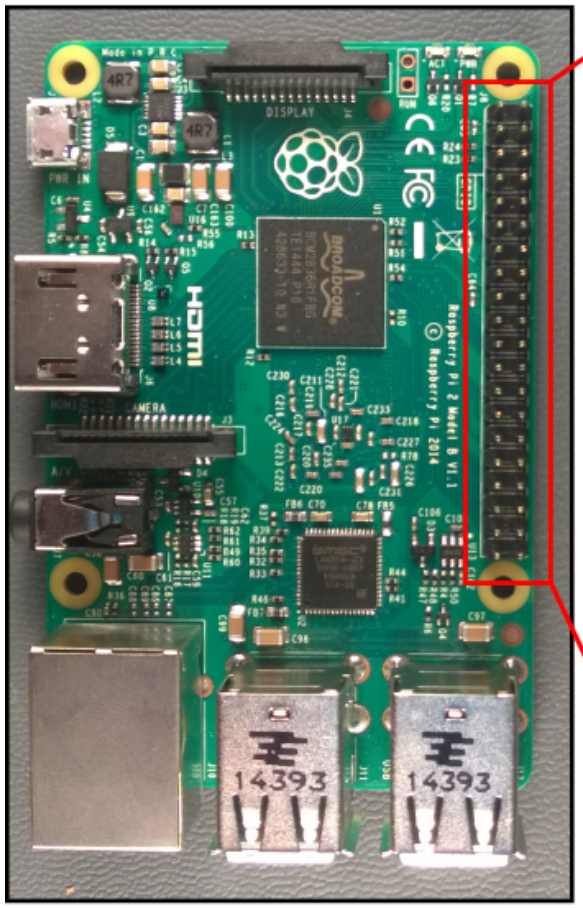
- Let's solve this problem … batch mode … together!
  - Create a new file to do the following
  - Include header information
  - Import the numpy and time libraries
  - Create three variables: one string, one int, one float
    - Print the values for your three variables
    - Generate a random number and assign return value to your float variable.
    - Sleep for 5 seconds
    - Print the values for your three variables
    - Multiply the int and the float – see the casting from int to float
    - Sleep for 5 seconds
    - Print the values for your three variables
    - Sleep for 5 seconds
  - Do it again … looping or multiple lines of code (next Chapter)

What's In the Box



- Raspberry Pi 3
- SparkFun Pi Wedge (Preassembled)
- Breadboard - Full-Size (Bare)
- Pi Tin for the Raspberry Pi - Black
- 16GB microSD (Preloaded with OS)
- microSD USB Reader
- Red, Blue, Yellow, Green Buttons
- Red, Blue, Yellow, and Green LEDs
- Resistors 330 Ohm 1/6 Watt PTH
- GPIO Ribbon Cable - 40-pin, 6”
- Wall Adapter Power Supply
- Jumper Wires Premium 6" M/F – 10
- Jumper Wires Standard 7" M/M - 30
- HDMI Cable

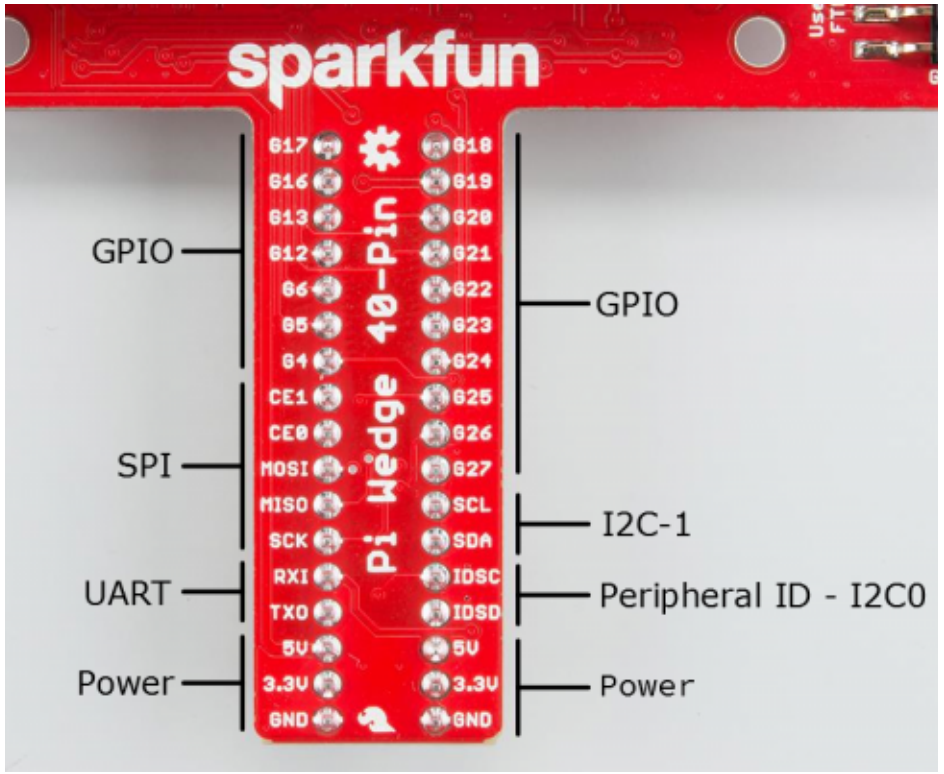
GPIO Pin Layout – Raspberry Pi



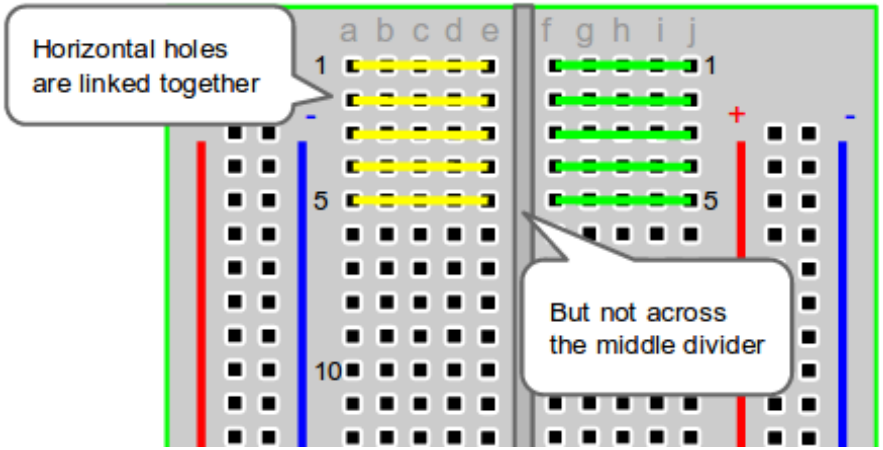
Alternate Function						Alternate Function
	3.3V PWR	1	2	5V PWR		
I2C1 SDA	GPIO 2	3	4	5V PWR		
I2C1 SCL	GPIO 3	5	6	GND		
	GPIO 4	7	8	UART0 TX		
	GND	9	10	UART0 RX		
	GPIO 17	11	12	GPIO 18		
	GPIO 27	13	14	GND		
	GPIO 22	15	16	GPIO 23		
	3.3V PWR	17	18	GPIO 24		
SPI0 MOSI	GPIO 10	19	20	GND		
SPI0 MISO	GPIO 9	21	22	GPIO 25		
SPI0 SCLK	GPIO 11	23	24	GPIO 8	SPI0 CS0	
	GND	25	26	GPIO 7	SPI0 CS1	
	Reserved	27	28	Reserved		
	GPIO 5	29	30	GND		
	GPIO 6	31	32	GPIO 12		
	GPIO 13	33	34	GND		
SPI1 MISO	GPIO 19	35	36	GPIO 16	SPI1 CS0	
	GPIO 26	37	38	GPIO 20	SPI1 MOSI	
	GND	39	40	GPIO 21	SPI1 SCLK	

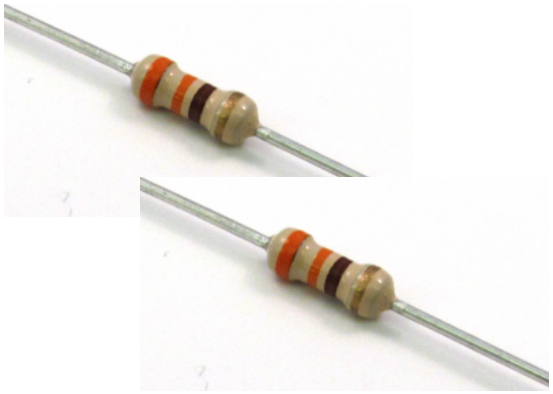
GPIO Pin Layout – Pi Wedge

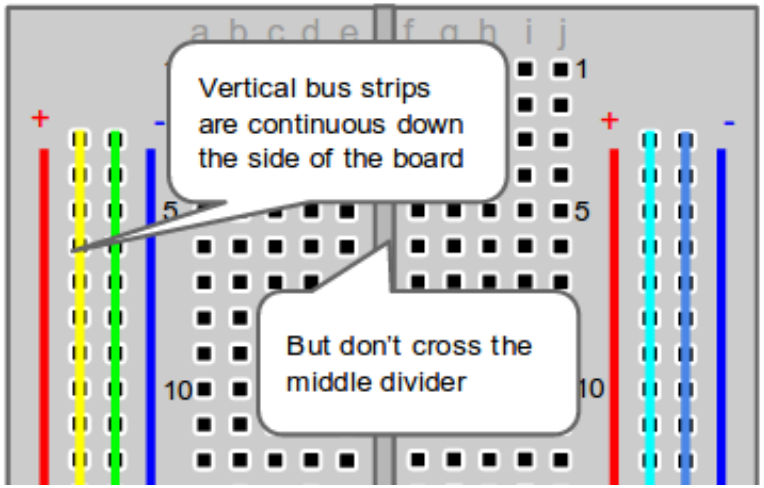
- GPIO Pins
- Include Library
- Hi/Low
- Pins – Lab 1
  - 3.3v
  - GND
  - G25



The Breadboard

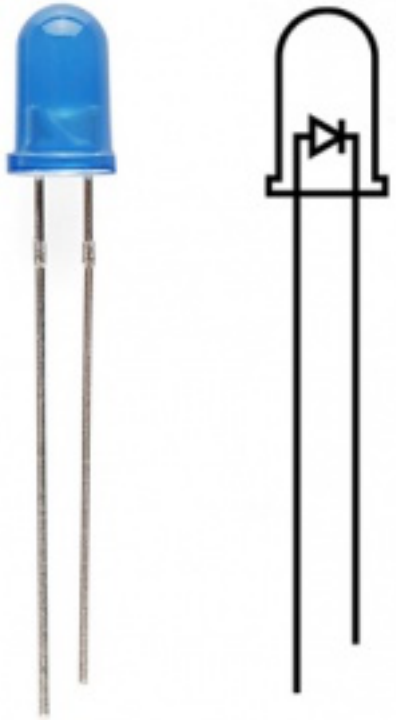




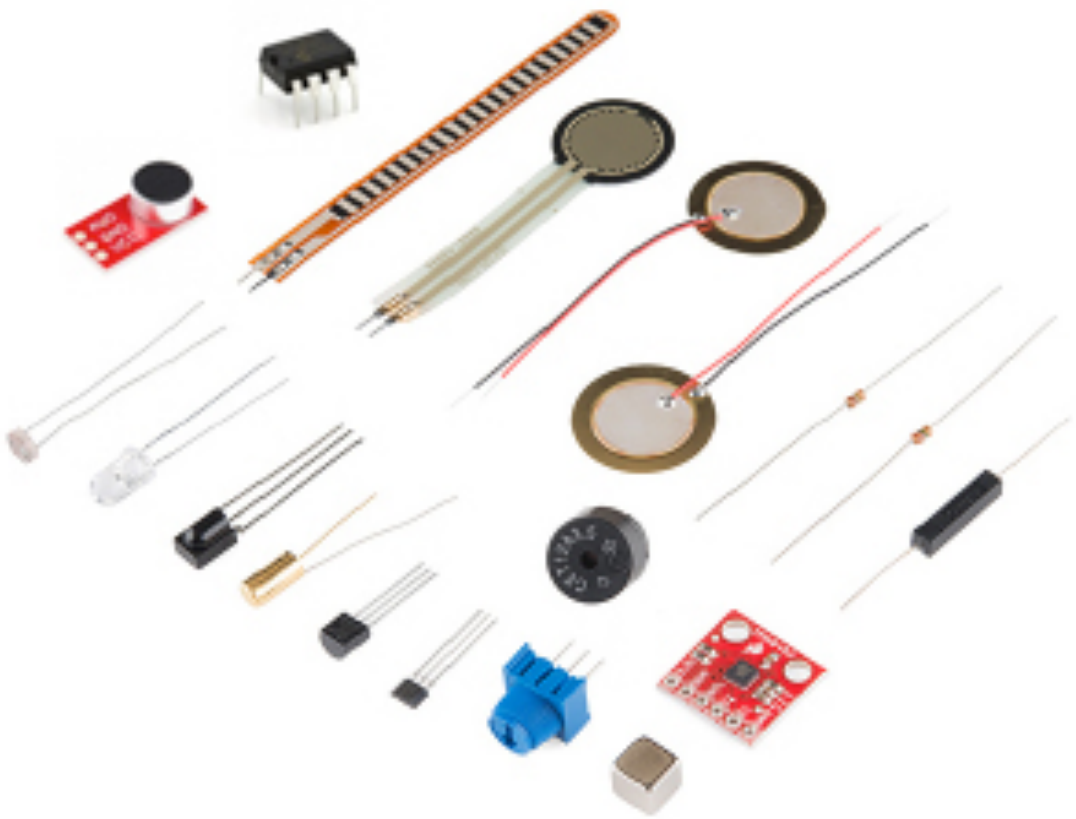


The LED

- Good news … we can't break them :~) – well, kinda … we do need to watch how much current we are sending in
  - 3.3v and Resistance 330 Ohm
- They simply won't work if they are in backwards
- Longer leg is positive



What's in the box?



- Triple Axis Accelerometer
- Hall Effect Sensor
- Tilt Sensor
- Piezo Element
- Insulated Reed Switch
- IR Receiver Diode
- Infrared LED
- Temperature Sensor
- Trimpot 10K with Knob
- Magnet Square
- Force Sensitive Resistor
- Mini Photocell
- Flex Sensor
- Piezo Buzzer/Speaker
- Resistor 1.0M Ohm 1/6 Watt PTH
- Microphone
- ADC Chip

Wrap Up

- Discussion:
  - Review, Python Practice, GPIO, and finish up worksheet for "What's in the Box: Sensors".
- Assignment:
  - Turn in "What's in the Box" Sheet
  - Reading Chapter 2.1-2.4
- Next class – Lab Day
  - Putting Practice into Action
  - Our first lab with creative extensions