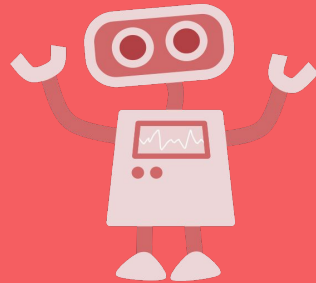


# WELCOME!

**Lego Robotics Camp 2023**



# Camp Goals

- ❖ Learn the foundations of computational thinking
- ❖ Play with robots
- ❖ Learn how to code
- ❖ See that anyone can be a computer scientist
- ❖ Have fun!!

# Daily Schedule

- ❖ 9:00-9:15 Arrival
- ❖ 9:15-10:15 Computational thinking unplugged activity
- ❖ 10:15-10:30 Snack break
- ❖ 10:30-11:30 Daily lesson and lab overview
- ❖ 11:30 - 12:30 Lunch and free time
- ❖ 12:30-2:30 Lab
- ❖ 2:30-3:30 Wrap-up and free time (soccer, swimming, etc)
- ❖ 3:30 Show & tell and dismissal

# Rules

- ❖ Treat each other with respect
- ❖ Don't be disruptive
- ❖ No such thing as a stupid question
- ❖ Be patient (with each other and with your instructors!)
- ❖ Be kind to your robots 😊
- ❖ Don't give up
- ❖ Clean up after yourself

# Today's Plan

Discuss how computers solve problems

Design **algorithms** for simple, everyday tasks

Get to know our robots

Learn about variables

# Computational Thinking

How to think like a computer scientist:

- ❖ Decomposition – break big problems up into small pieces
- ❖ Pattern recognition – look for similarities within a problem
- ❖ Abstraction – ignore unimportant information and focus on stuff that matters
- ❖ Algorithms – develop step-by-step rules for solving the problem

We will use these four ideas to solve problems with our robots!

# Peanut Butter and Jelly

- ❖ Let's make an algorithm for making a PB&J sandwich
- ❖ What is an **algorithm**?
  - A process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer
- ❖ Algorithms provide computers with a successive guide to completing actions



# Peanut Butter and Jelly

- ❖ Supplies:
  - Peanut butter (sun butter)
  - Jelly
  - Loaf of bread
  - Two knives
  - Plate
- ❖ Work in groups of 3! Write down your steps.
- ❖ Be specific!





# Peanut Butter and Jelly

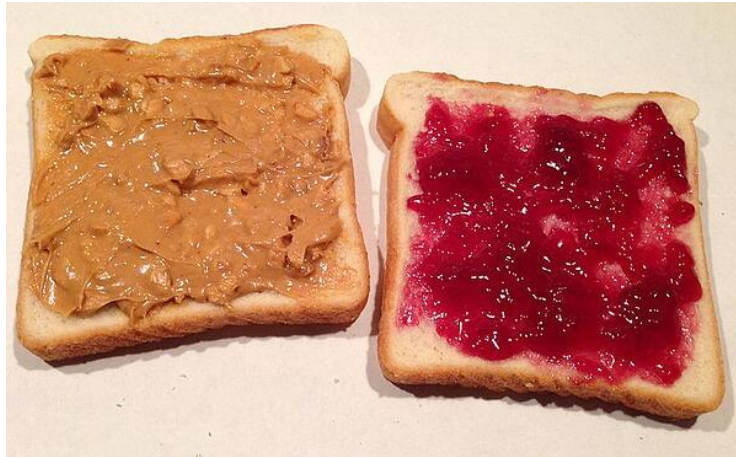


# Peanut Butter and Jelly

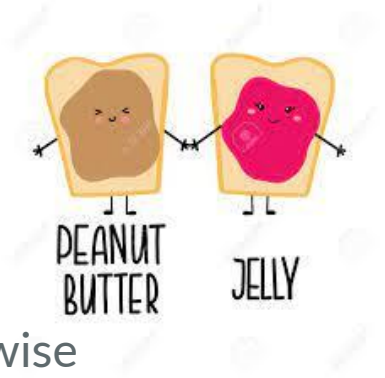
It's easy to overlook crucial information and details!

As a programmer, you need to develop specific directions to help the computer solve your problems.

Try again!



# Peanut Butter and Jelly

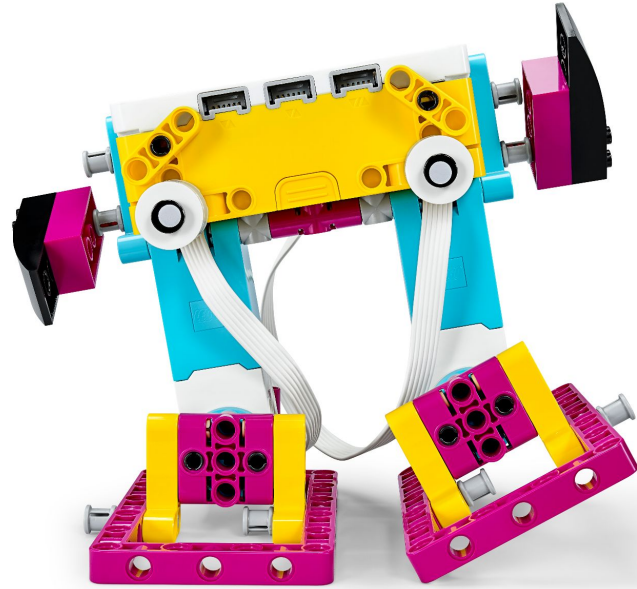


1. Open the bag and take a slice of bread out of the bag
2. Open the jar of peanut butter by twisting the lid counter-clockwise
3. Pick up a knife by the handle
4. Insert the knife into the jar of peanut butter to cover knife with peanut butter
5. Withdraw the knife from the jar of peanut butter and run it across the slice of bread
6. Take a second slice of bread out of the bag
7. Repeat steps 2-5 with the second slice of bread and the jar of jelly
8. Press the two slices of bread together such that the peanut butter and jelly meet
9. Enjoy!

# Lessons Learned

- ❖ Computers are really not that smart!
- ❖ But they are VERY good at following directions. They only do EXACTLY what you tell them to do.
- ❖ We must provide specific instructions for solving problems

# Robot Basics



# Robot Basics

Helps to know what basic actions we can use to instruct our robot

What actions might we want our robot to perform?

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Helps to know what basic actions we can use to instruct our robot

What actions might we want our robot to perform?

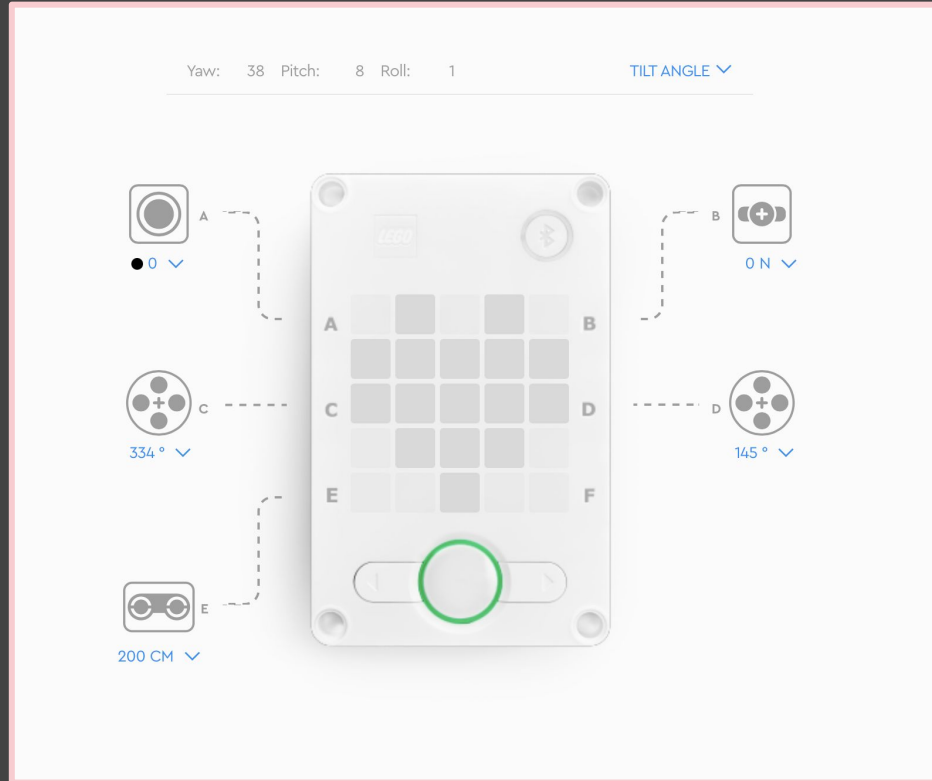
- ❖ Sound: beep, speak?
- ❖ Display: lights on/off, show image
- ❖ Movement: go forward, backward, turn/rotate, stop
- ❖ Advanced actions: react to “sensed environment” in some way (requires sensors for light, sound, temperature, touch, etc)

Today we will begin learning how to perform very basic actions with our robots

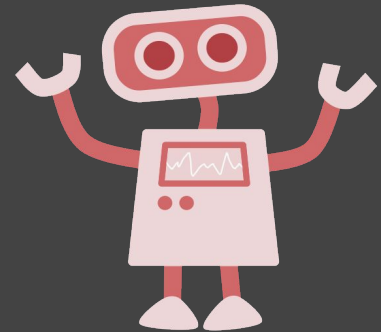
For the rest of the week, we'll use these basic actions to solve problems

# Sensors, motors, hubs, oh my!

The hub menu displays all the connected sensors!



By the end of this week, you will have used everything here!





# Pre-Lab

This is the first time of many you will be building a robot!

First, open the Spike app and choose Prime.

Then, go through the tutorial activities for all the sensors.

## Tutorial Activities

↓ UPDATE AVAILABLE



**1** The Light Matrix



**2** The Motor



**3** The Color Sensor



**4** The Distance Sensor



**5** The Force Sensor



**6** The Gyro Sensor



# Variables

- Variables are labels for a piece of information
  - For Example:
    - `myLuckyNumber = 13`
    - `applesEaten = 2`
    - `n = 0`

**Variable (label) = Information**

**In code, the equals sign (=) is called the assignment operator because it *assigns* the information on the right to the variable on the left**



# Data Types

Variables can also be labels for information other than numbers.

**Integers**

```
x = 3
```

**Floats**

```
num = 4.6
```

**Strings**

```
message = "Hello"
```

**Booleans**

```
isLightOn = True
```

Every value has a data type. This allows us to choose the right operations for values.

# Data Types: Integers and Floats



Integers include all positive whole numbers, all negative whole numbers, and zero

# Data Types: Floats

5.6 3.1 2.65  
9.3 0.7 1.24  
8.2 0.1 2.2  
0.12 7.7 0.3

Floats are any decimal number

# Data Types: Strings

Strings are any piece of text in between quotes

```
"Hello, World"
```

```
"Welcome to Introduction to Computer Science"
```

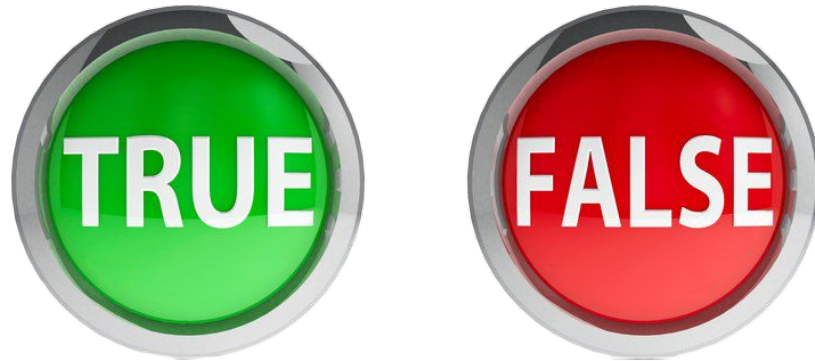
```
"CS134"
```

```
"True and False"
```

```
"I am a String!"
```

# Data Types: Booleans

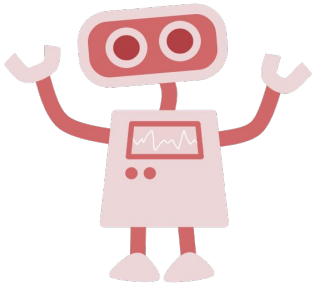
booleans, also called bools, are either True or False





# Custom Variables in Spike

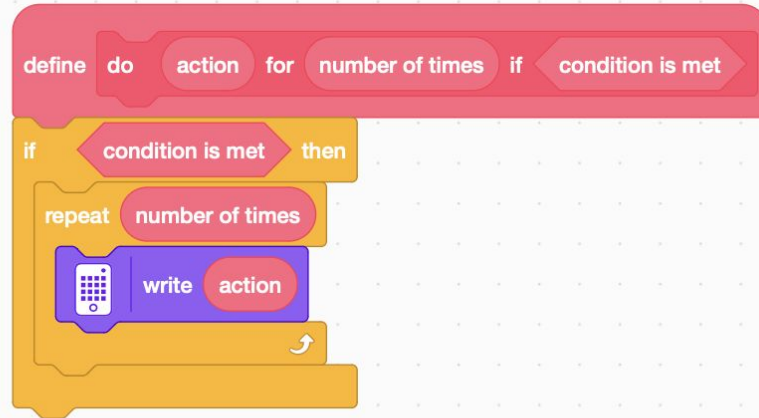
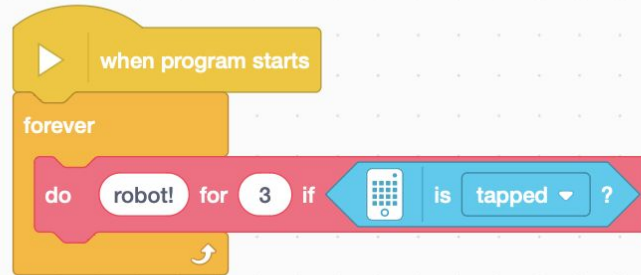
1. Find the My Blocks section at the bottom
2. Click make a block
3. Click to add text, numbers, or conditions
4. Save and define the block!



The screenshot shows the 'My Blocks' section at the bottom of the interface, with a 'Make a Block' button. A pink arrow points from this button to a 'Make a block' dialog box. The dialog box contains a block structure: a red 'do' block containing an 'action' block, a 'for' block with 'number of times', and an 'if' block with 'condition is met'. Below the block structure are three options: 'Add an input number or text', 'Add an input boolean', and 'Add a label text'. At the bottom of the dialog are 'CANCEL' and 'SAVE' buttons.

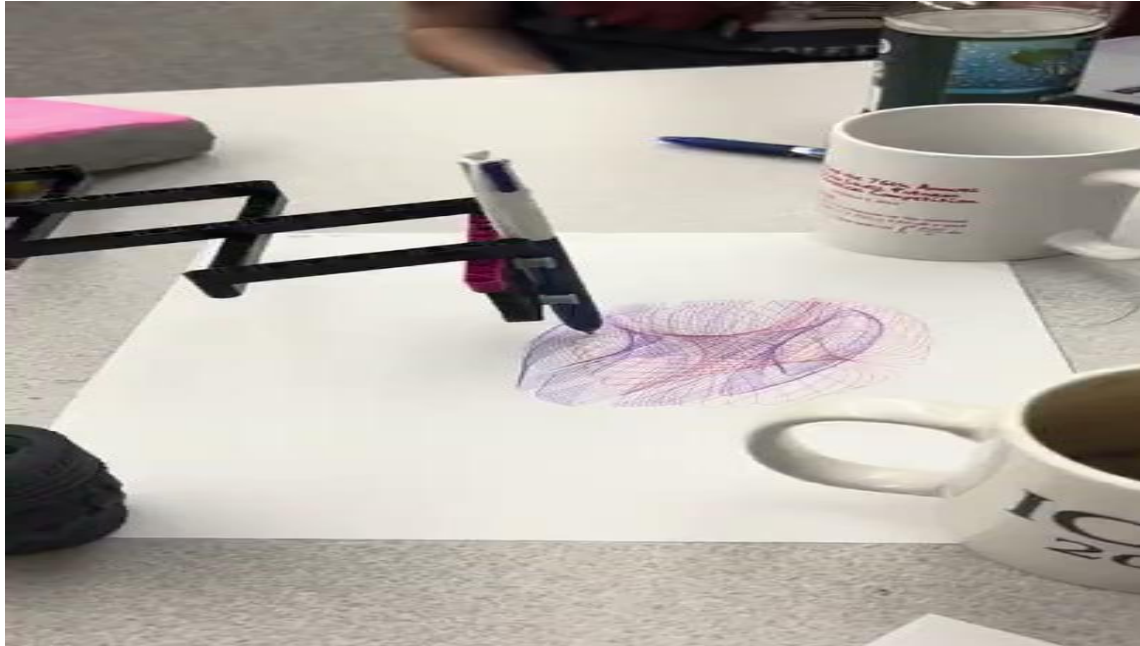
# Pre-Lab TWO

Create a program with a custom block to write your name in lights when the hub is tapped!

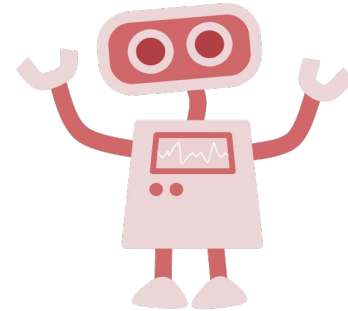




# Lab



Mmmm...  
Spiro + bot...



# Lab Hints

Find the folder “build instructions” on your laptop and open day 1 to build **spiro-bot**!

Connect your hub through the menu, and name it to the number corresponding to the sticker on it.

When creating the custom block, use variables representing the speeds of the right and left motors of your **spiro-bot**, and a third variable to represent the time to draw.

The longer the motors run, the more the pictures develop so leave **spiro-bot** in position for more than 50 seconds. How many pictures can you make with different speed percentages?