Engineering Robotics Competition

Workshop #1

What is going on here!?

Agenda

1. What is the Engineering Robotics Competition?
2. The Rules
3. Intro to LEGO Mindstorms -EV3
4. Intro/Review of programming fundamentals
5. T Shirt reveal
6. Time to practice


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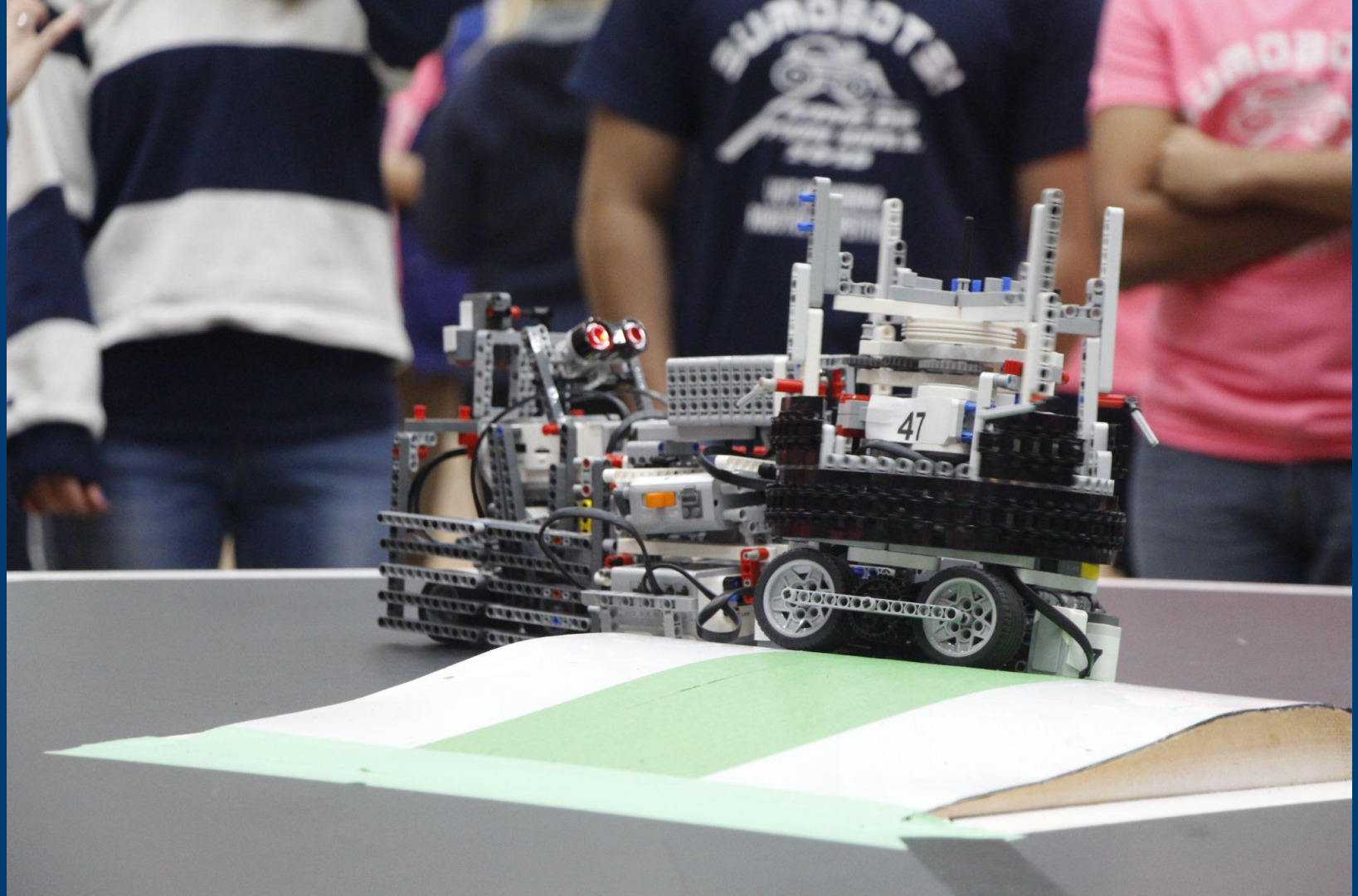
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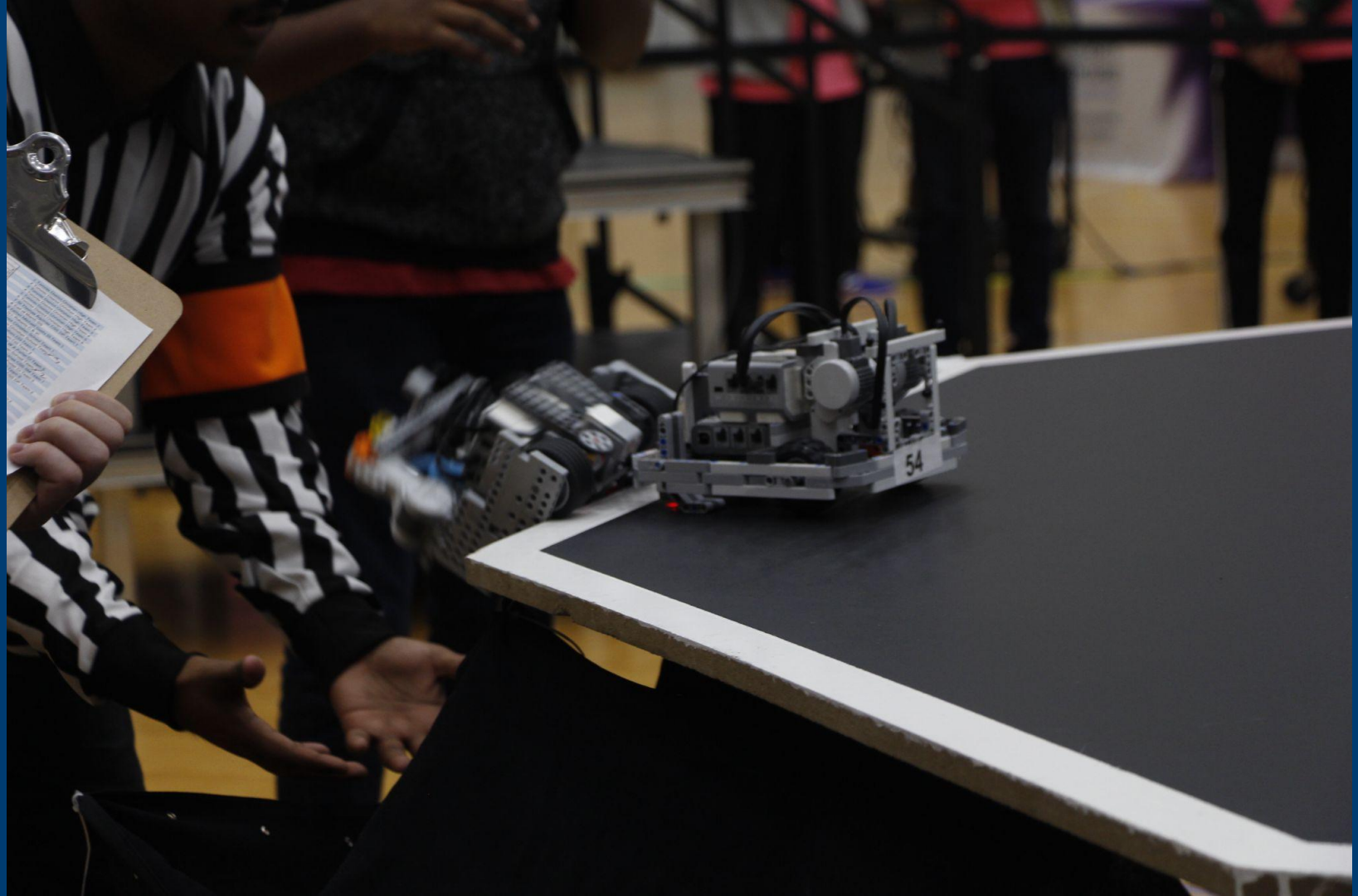
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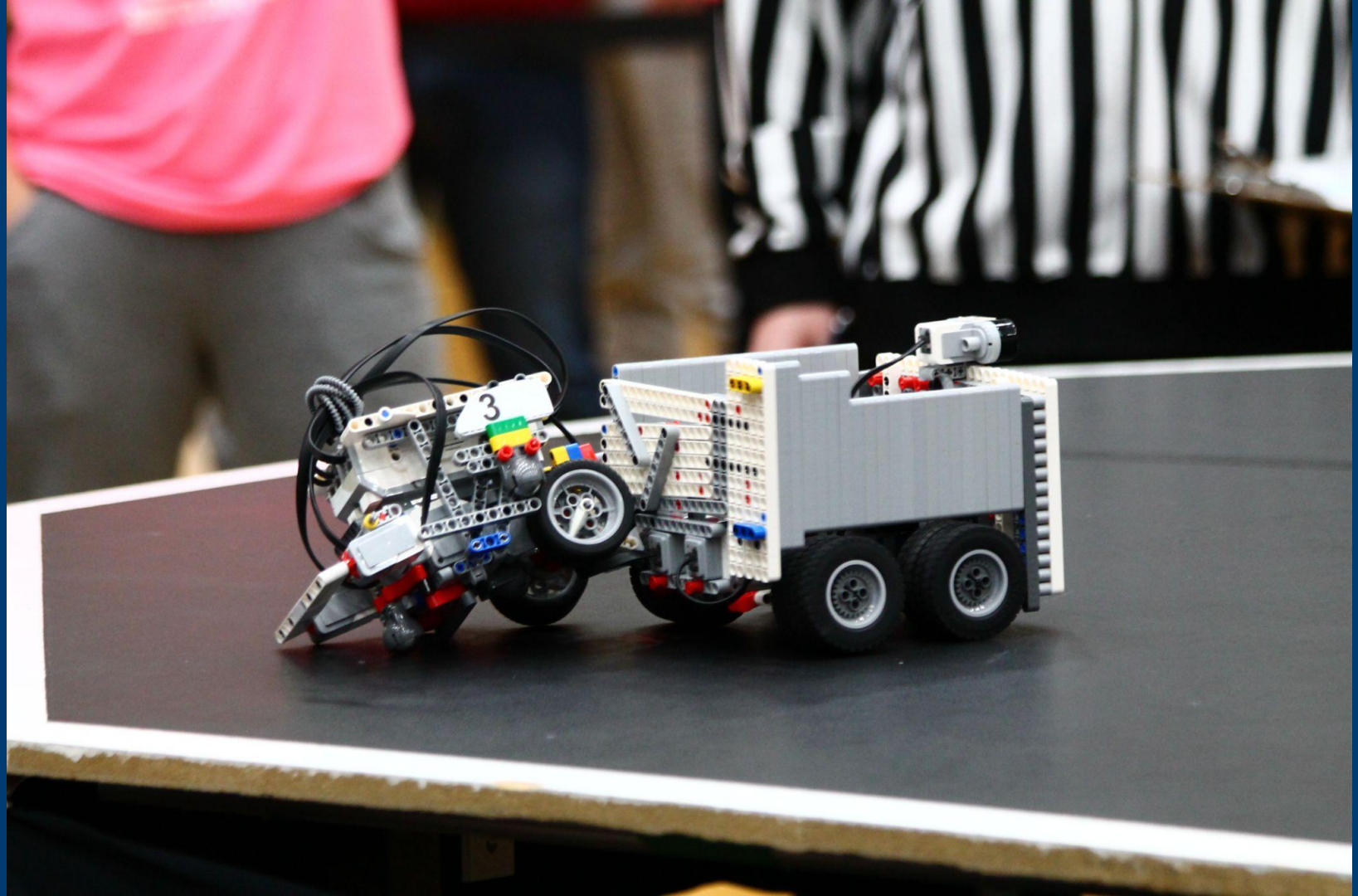
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The Rules

The Engineering Design Process

Ontario Tech Engineering Outreach

c_wonder ACADEMY

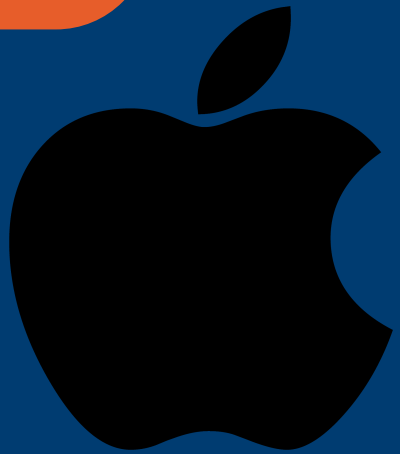
Getting Started With LEGO MINDSTORMS EV3

Username: Robotics
Password: EngRobo22

Software

//EV3 CLASSROOM

Windows 10
(MICROSOFT STORE)



Mac
(Official LEGO Website)

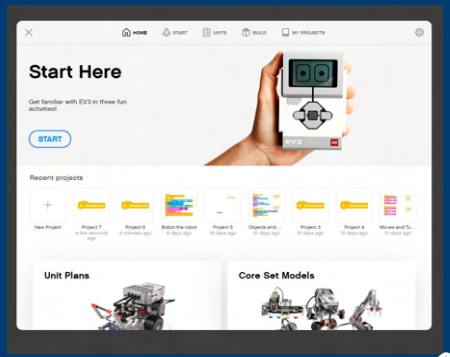
Chromebook
(Official LEGO Website)
Or
(Google Play Store)

Opening the Software

- Open the software
- New Project
- Connect Via Bluetooth or USB Cable
- Profit!

Skip it!

Click New Project

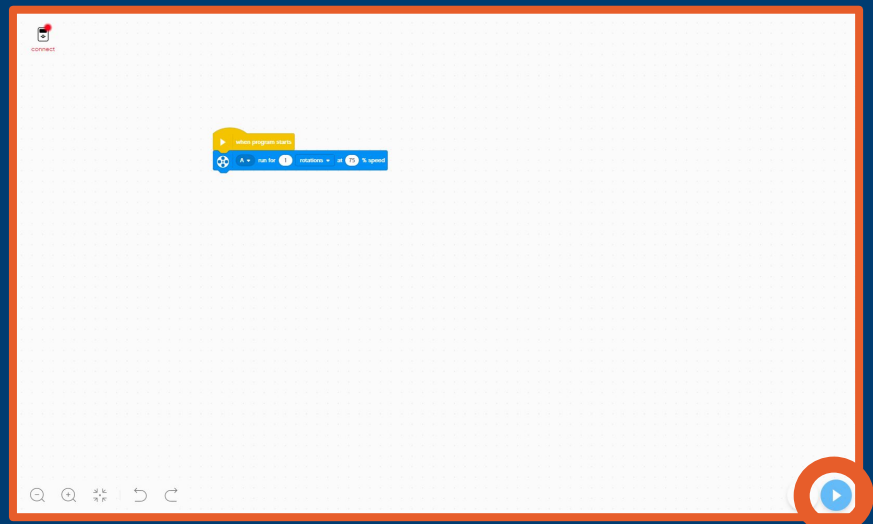


Connect with Bluetooth or Cable

The world is your oyster!

Uploading your program to the robot

- **Connect the robot to your device with Bluetooth or the USB-Cable**
- **Press the Blue play button**
- **Your program will be available on the Mindstorm Brick at any time!**
- Press the blue button again to stop the program
- Any updates to the code will require you to press the play button on your device again to run the new code



Right here!

Components

Gyroscope
//Measures and detects rotational motion. Can be used to detect if your robot has fallen over

Color Sensor
//Detects color or intensity of light. Can be used to detect or respond to other robots

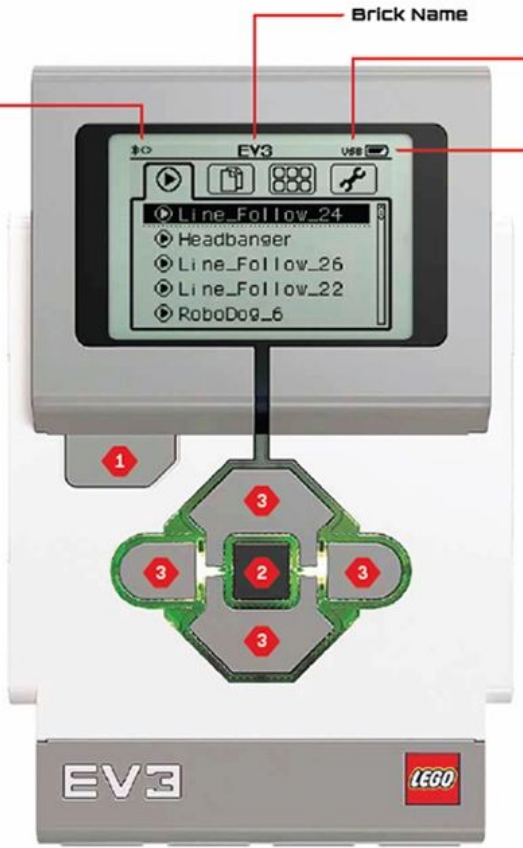
Ultrasonic Sensor
//Uses echolocation to measure distance between objects. Can be used to detect other robots

Motors
//Rotates and also can measure the degree of rotation. Should be used for moving your robot around

Touch Sensor
//Detects if the red button in front has been touched. A red piece can be attached to the button for longer range

Navigating the UI 1

EV3 Brick



Wireless Connection Status Icons

(from the left):

Bluetooth enabled but not connected or visible to other Bluetooth devices

Bluetooth enabled and visible to other Bluetooth devices

Bluetooth enabled and your EV3 Brick is connected to another Bluetooth device

Bluetooth enabled and visible and your EV3 Brick is connected to another Bluetooth device

Wi-Fi enabled but not connected to a network

Wi-Fi enabled and connected to a network

USB

USB connection established to another device

Battery level

Brick Buttons

1. Back
This button is used to reverse actions, to abort a running program, and to shut down the EV3 Brick.

2. Center
Pressing the Center button says "OK" to various questions—to shut down, to select desired settings, or to select blocks in the Brick Program App. You would, for example, press this button to select a checkbox.

3. Left, Right, Up, Down
These four buttons are used to navigate through the contents of the EV3 Brick.

Navigating the UI 2

EV3 Classroom

Motors	**Commands that affect the motor** (E.g counting rotations, starting/stopping motors) 
Movement	**Commands that affect pairs of motors to move** (E.g moving in different directions, assigning movement motors) 
Display	**Blocks that display messages or emotions on your EV3 Brick** (Try making an angry face on your robot!)
Sound	**Blocks that make noises or silence your robot** (E.g beeps, hellos, or a volume slider)
Events	**Timers, broadcast signals, and starting conditions** (Use these to start your code!)
Control	**If statements, repeats, and waiting** (Use these with sensors to find your opponents!)
Sensors	**Blocks that affect sensors and time** (E.g timers, angles, distance) 
Operator	**Random numbers, operators, strings and concatenating, rounding and mods**
Variables	**Lists and Variables** (For counting or storing values)
My Blocks	**Tired of writing the same lines of code over and over again? Introducing My Blocks!** (Use this for repetitive code)

Navigating the UI 3

EV3 Classroom

Icons		Functions
Magnifying Glass-		Zooms Outwards
Magnifying Glass+		Zooms Inwards
Reset Tool		Resets the zoom back to 100%
Undo		Rewinds any changes made
Redo		Undoes the Undo button
Play		Downloads and starts the program on your brick
Download		Uploads the program to the EV3 Brick

Tips & Tricks

- **READ THE RULES!!!**
- Focus on making as much friction between your robot and your wheels as much as possible. Try using rubber wheels instead of plastic ones. This will help increase your pushing power against other robots
- If you plan on using a plow or arm, try putting it as close to the ground as possible so it functions like a ramp
- Try gear reductions on your robot! It's stylish and helps boost your pushing power (Link attached)
- Be mindful of your sumobot shape! It needs to be able to turn around quickly so don't make it too wide
- If others are using ultrasonic sensors, you can use the sound blocks to throw them off

This one's got some nice torque!

Identify the Problem

Having issues? The first step to solving the problem is to identify it!

Try asking yourself these questions

- What was the problem as stated?
- What do you know for sure? What do you not?
- Are there any underlying problems that may not have been stated?
- What tools and materials do I have access to?
- What other limitations exist to how I solve the problem?
- Does a (partial) solution already exist?
- What have others tried? What can you infer from them?

Test and Evaluate

After testing out your machine, take a step back and review everything.

- What worked? What didn't?
- Is there anything you think may be wrong with your project?
- Does this meet the requirements? Do you feel like it's incomplete in any way?
- Are you happy with it?

Troubleshooting

- Screen stuck on “Starting…” or “Updating…”

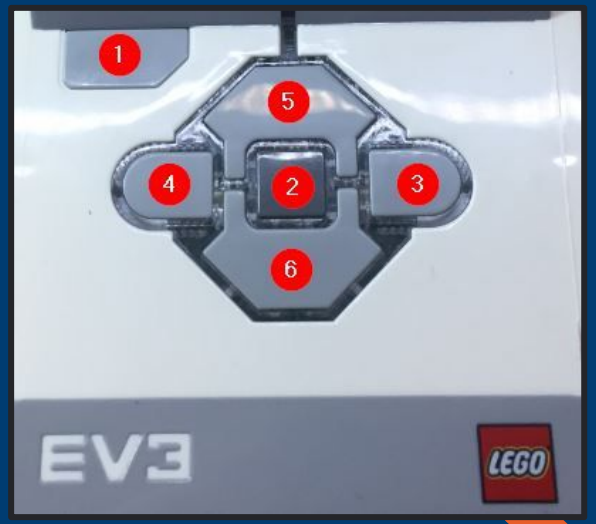
  Take out the batteries, put them back in, and press 4, 2, and 3. Plug the machine into a computer and EV3 Classroom should tell you to update.

- EV3 Brick displays “Communication Failure” when trying to connect

  Reboot your computer and the EV3 Brick. If that doesn’t work, try disabling your antivirus.

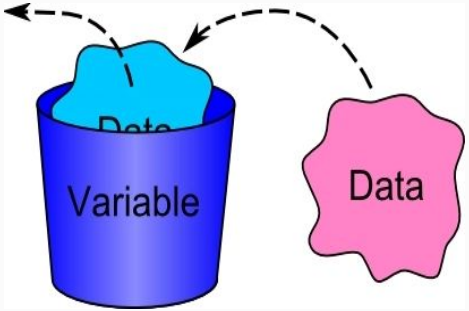
- Brick beeps before turning off

  Most likely a battery issue. Try replacing your battery pack with 6 AA Batteries, or charge the battery pack and try later



Variables

This is like a bin that stores information

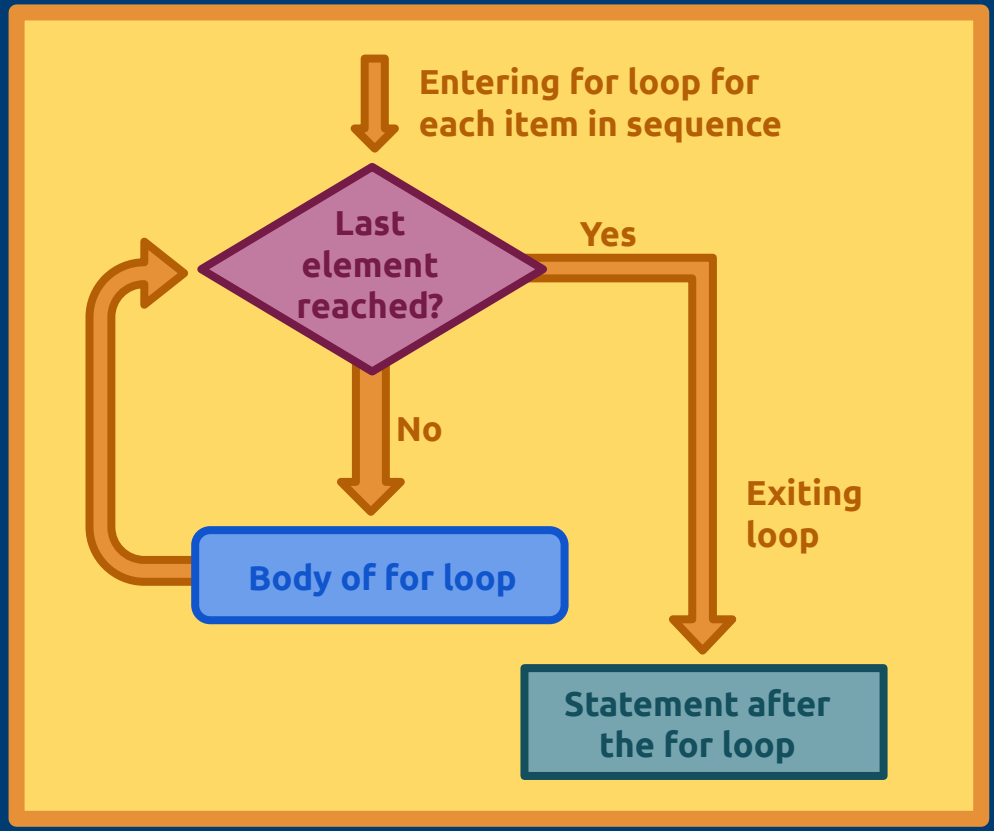


Or you can think of an x (or a different letter/symbol) you use in math or algebra to represent a value

X + Y = ?

For Loops

For loops will repeat stuff for everything in a list



If Statements

Only executes a certain block of code depending if the condition is **true** or **false.**

If the statement is **true** the code runs

If the statement is **not true (false)** it skips the code and moves on

It follows the given path

If statements work with the **boolean** data type.

Else Statements

Basically the **last resort** if all the other conditional statements are false.

Catches anything which isn't caught by the previous if.

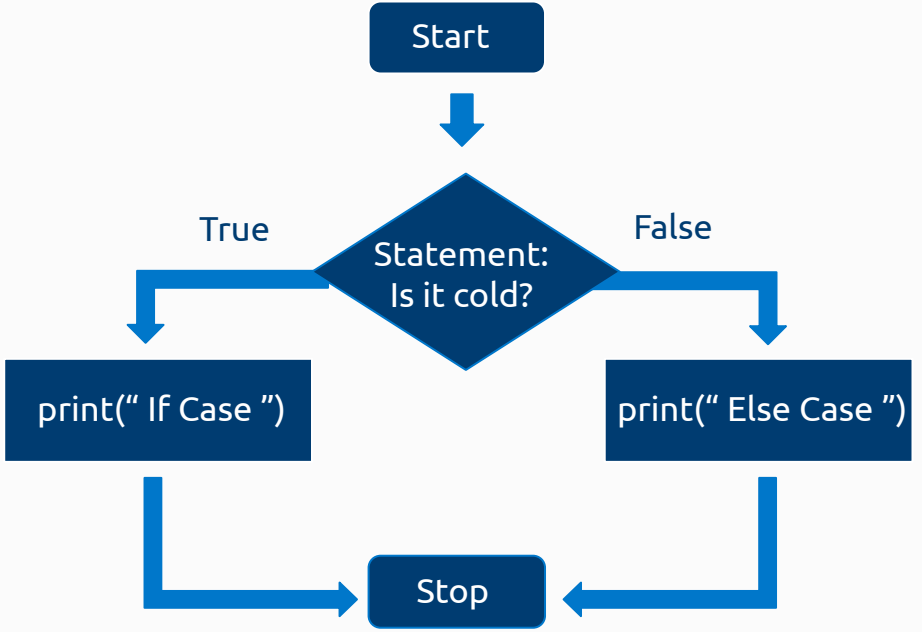
Example

If *it is cold*

Put on a jacket

Else

Do not put on jacket



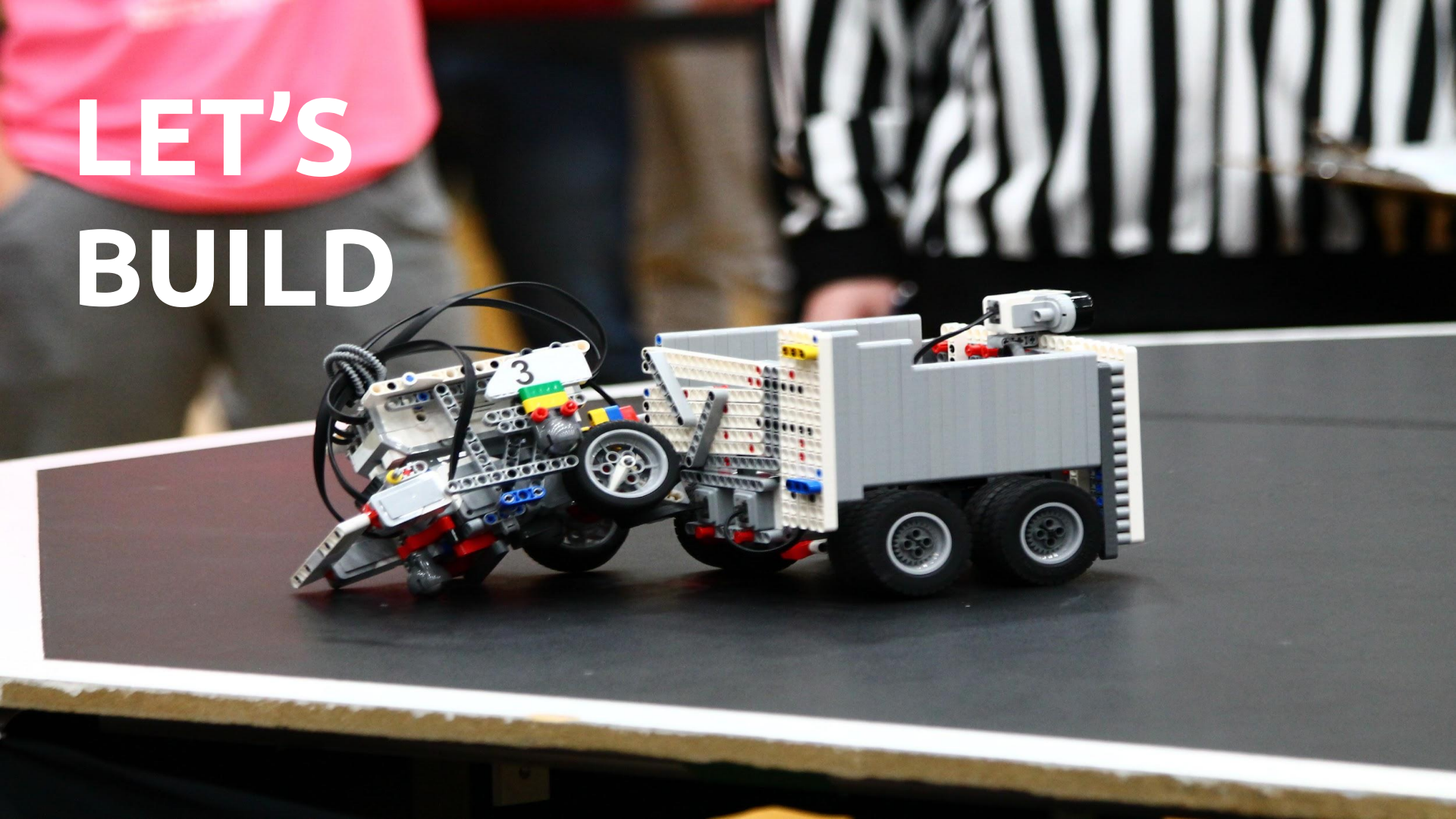
Comparison Operators

Comparison operators are used to **compare two values.**

Symbol	Meaning	Example
==	Equal	x == y
!=	Not Equal	x != y
>	Greater than	x > y
<	Less than	x < y
>=	Greater than or Equal to	x >= y
<=	Less than or Equal to	x <= y

T-SHIRT REVEAL!

LET'S BUILD



Want to learn more about upcoming programs?

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Send us pictures of your designs to engineeringoutreach@ontariotechu.ca

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