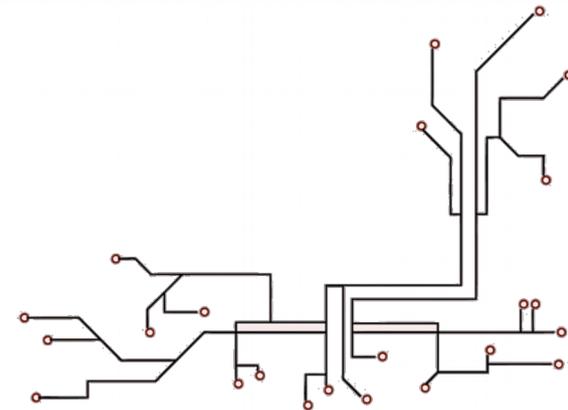
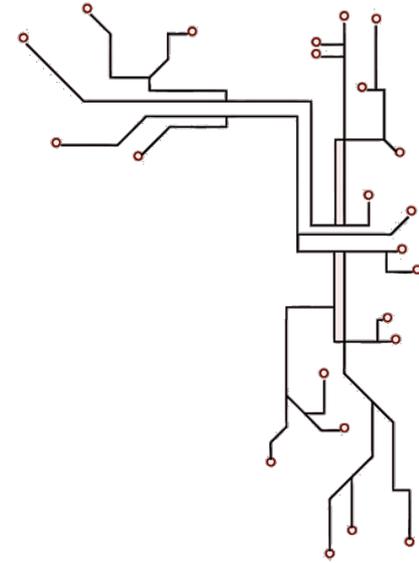


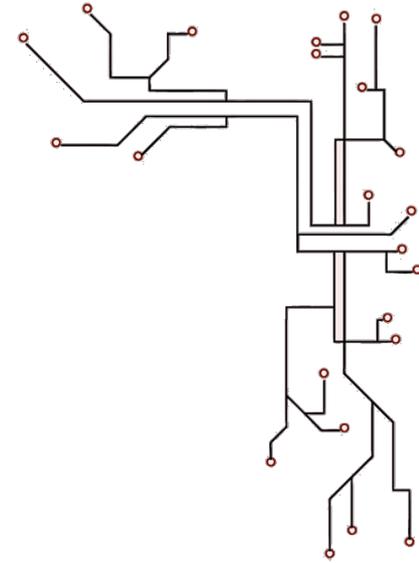
# 2-Wheel Robots

- 2-Wheel Robots (Review)
- Robot Educator Build (Finish)
- EV3 Ports (Input/Output)
- Mini-Challenge: Travel Distance

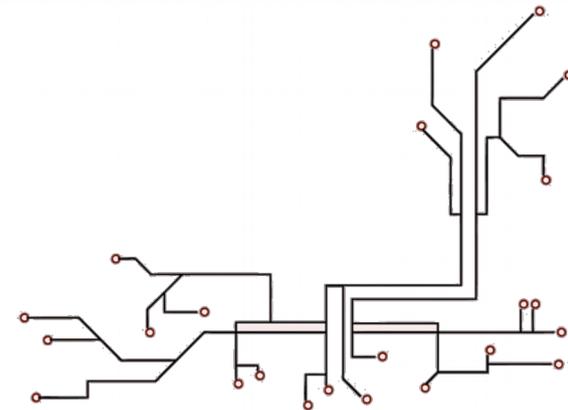


# NXT Robot Educator

## Review 2-Wheel Drivetrain

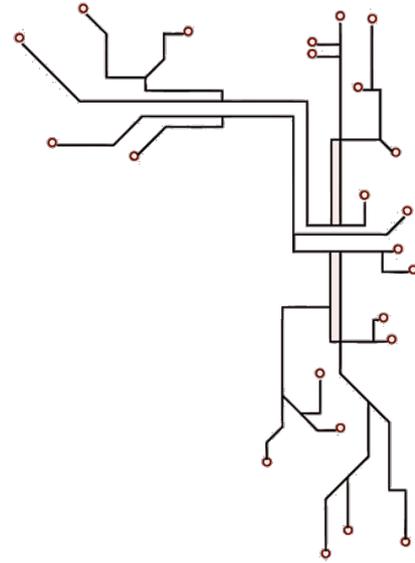
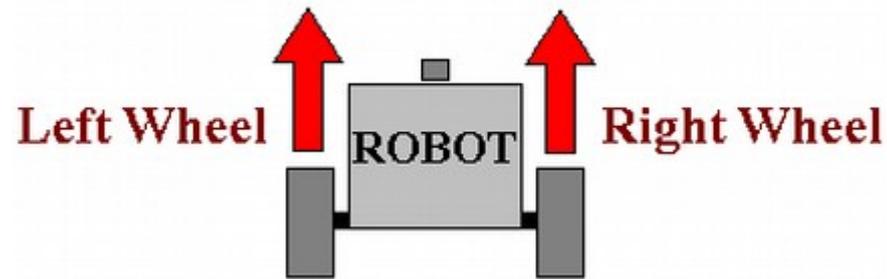


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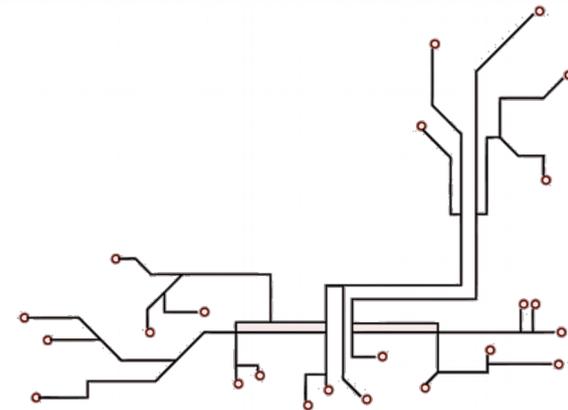
# 2-Wheel Differential Drive

Forward

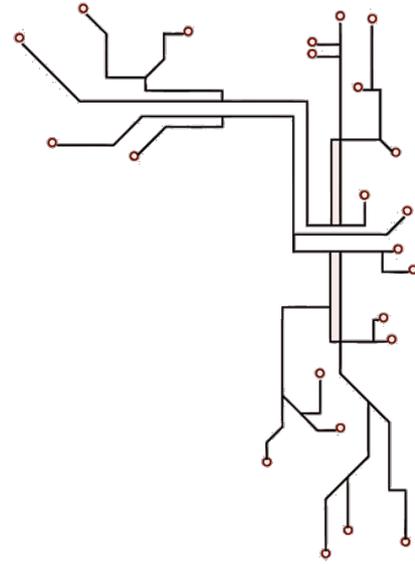
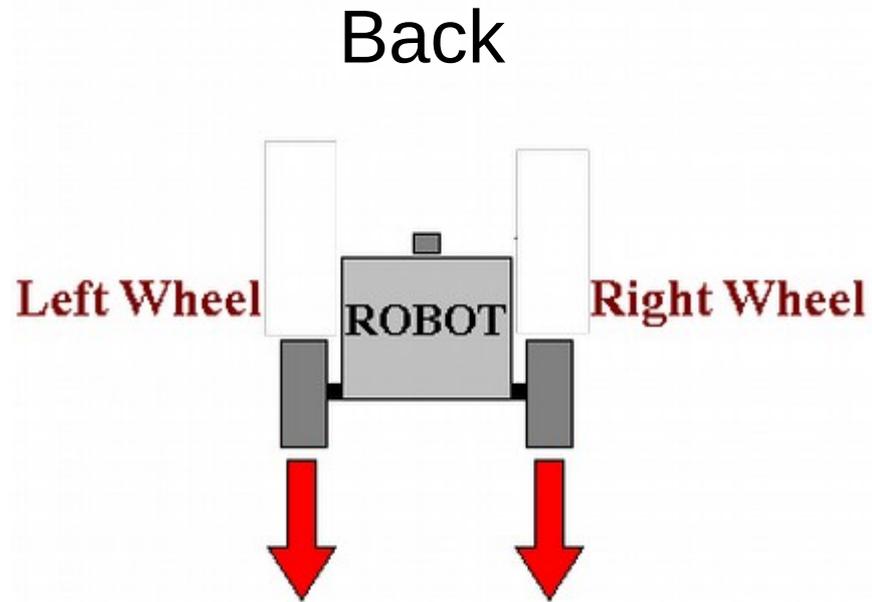


**A POSTERIORI**

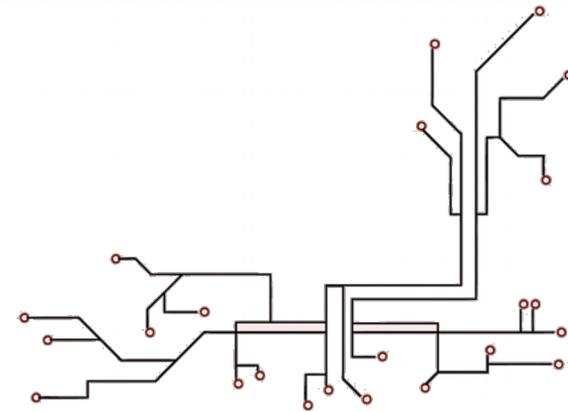
Play · Experience · Learn



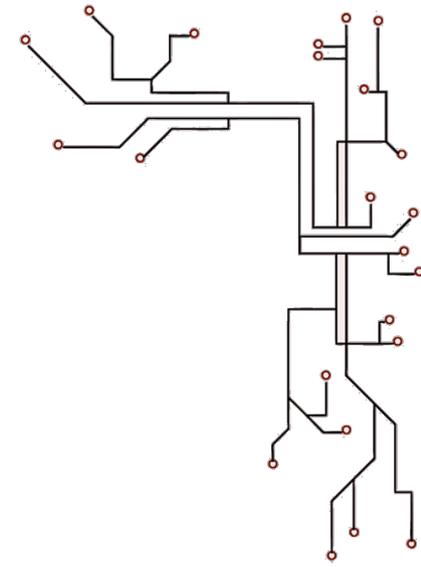
# 2-Wheel Differential Drive



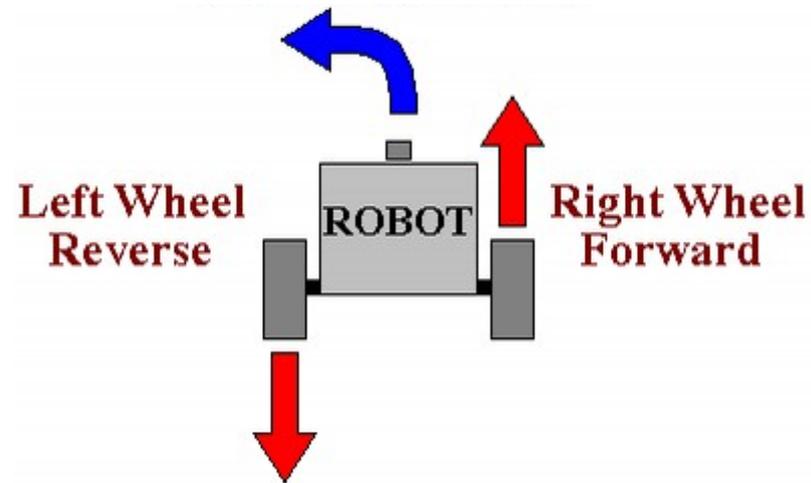
**A POSTERIORI**  
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# 2-Wheel Differential Drive

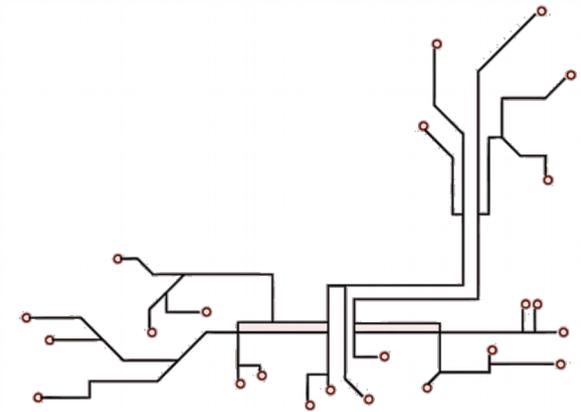


Left Turn



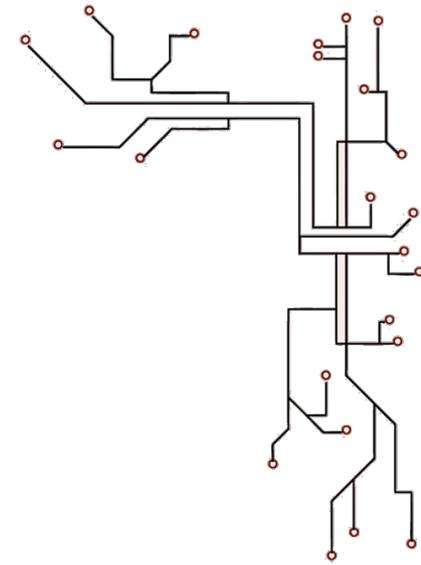
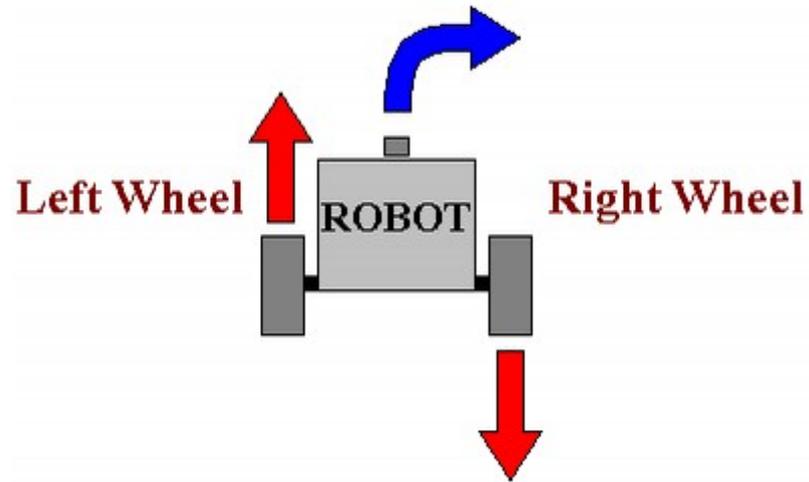
**A POSTERIORI**

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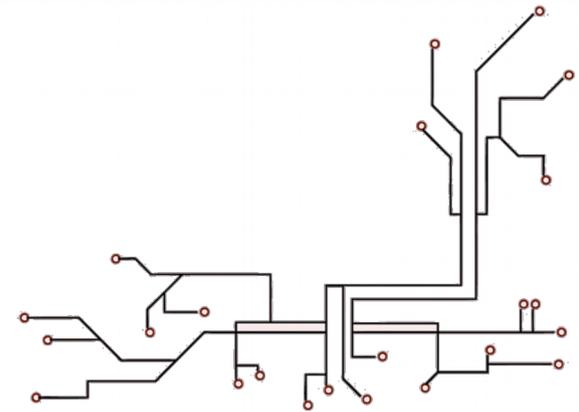
# 2-Wheel Differential Drive

Right Turn



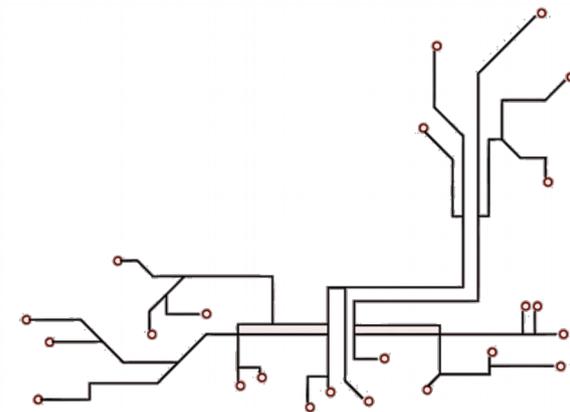
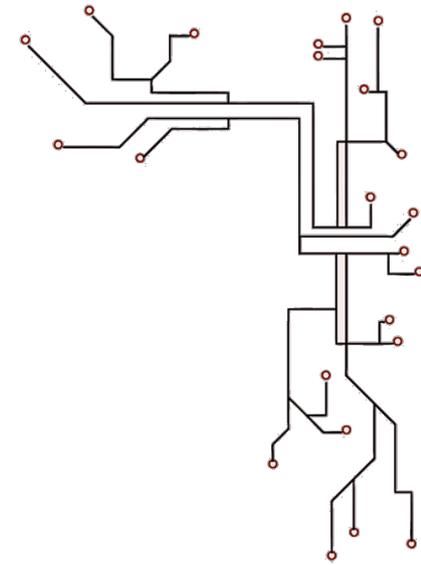
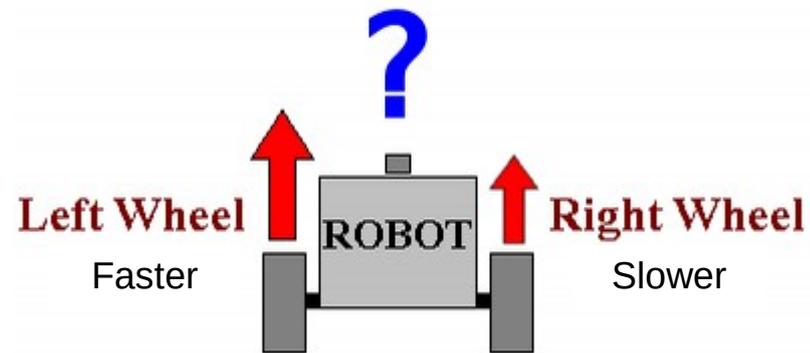
**A POSTERIORI**

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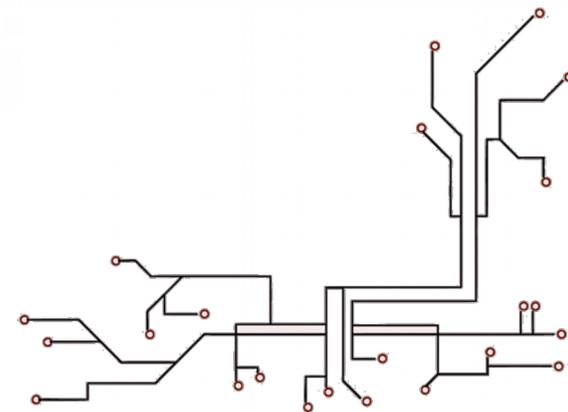
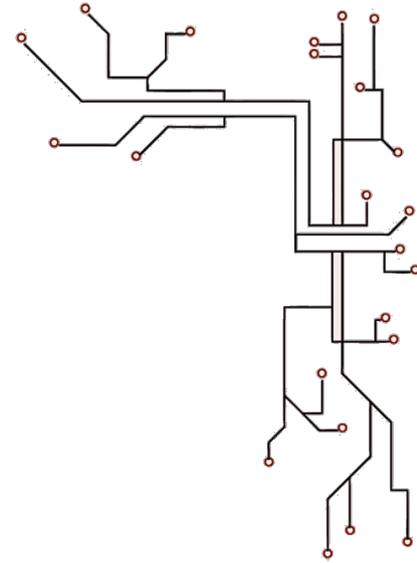
# 2-Wheel Differential Drive

What is the expected behavior?

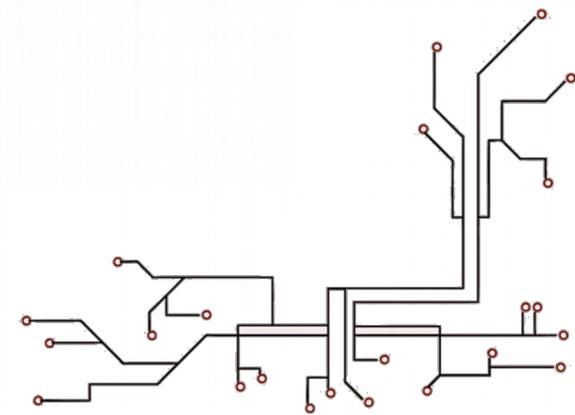
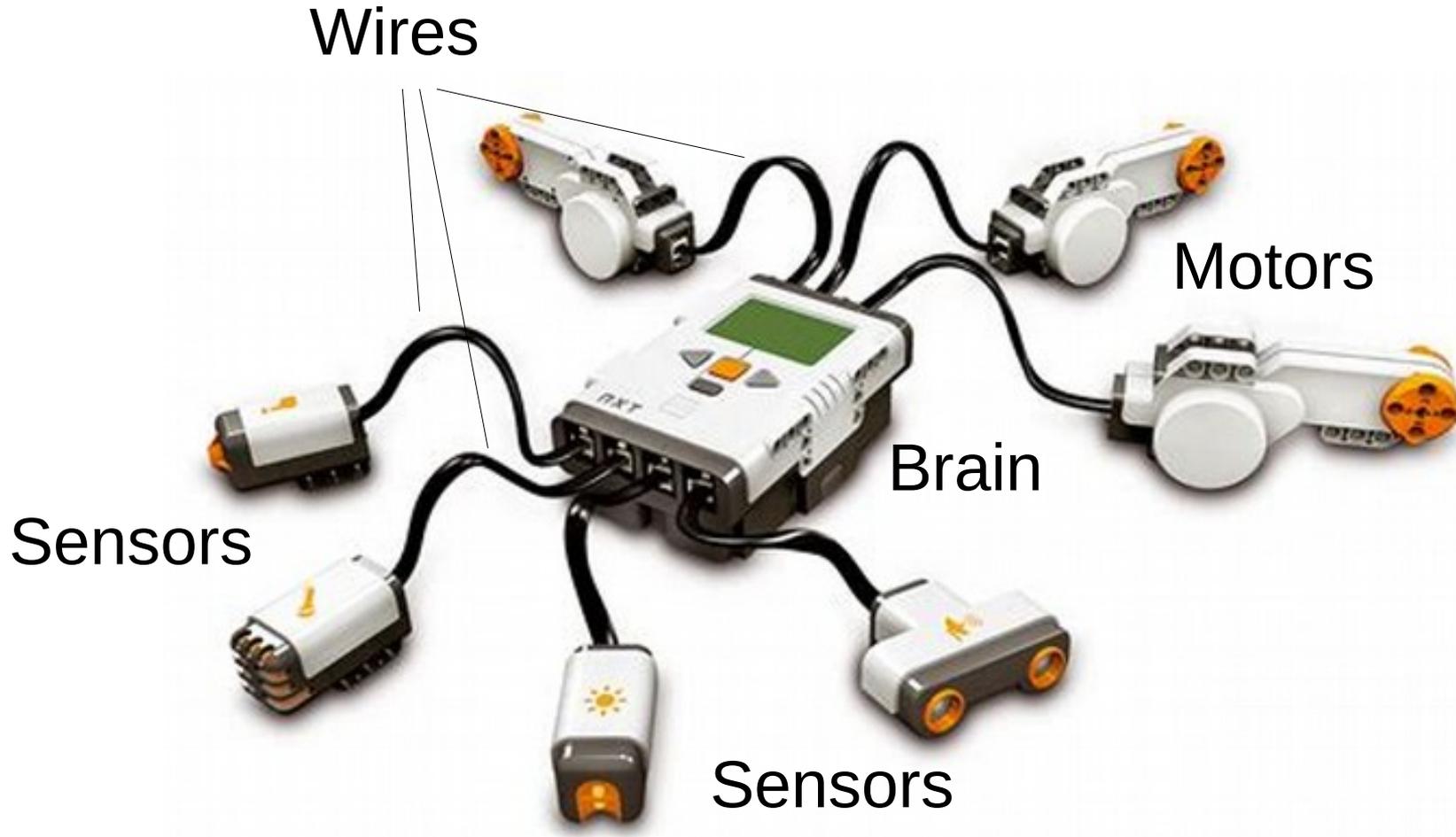
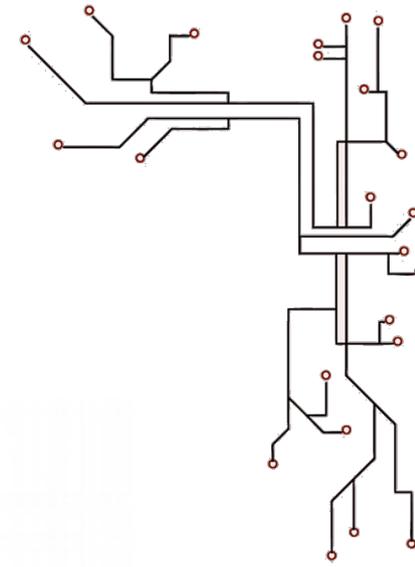


# EV3 Robot Educator

Let's Finish the Build!!!  
(wires & all)

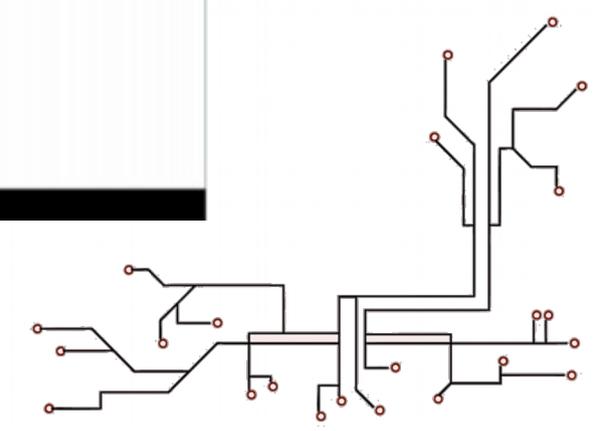
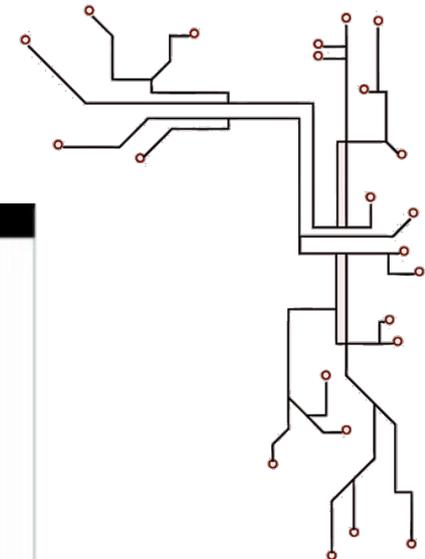
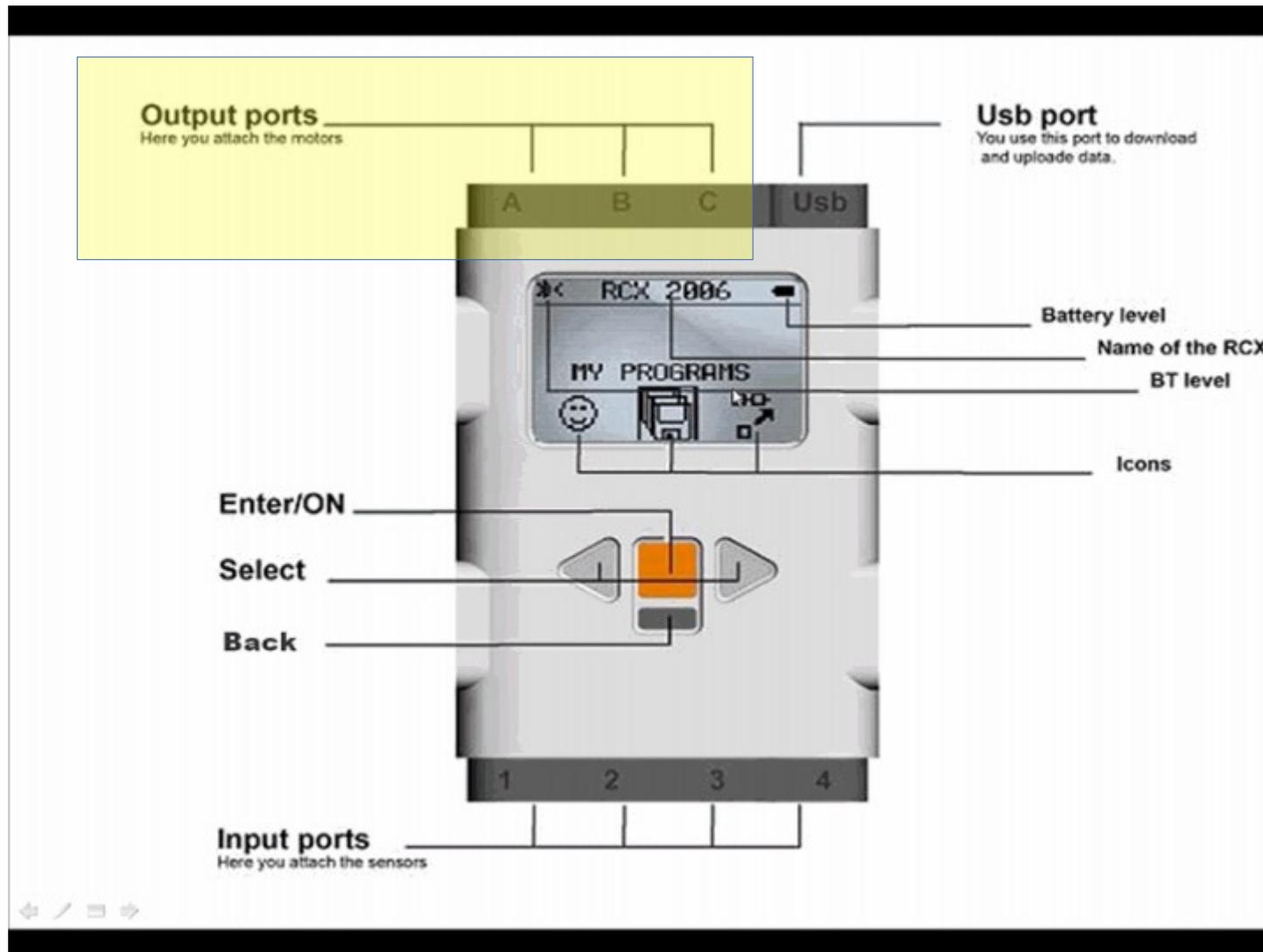


# What is Mindstorms/NXT?



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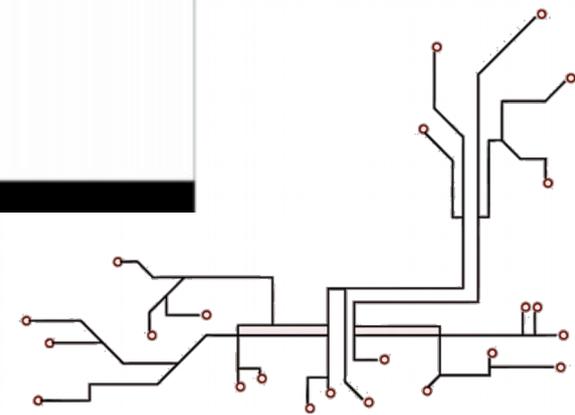
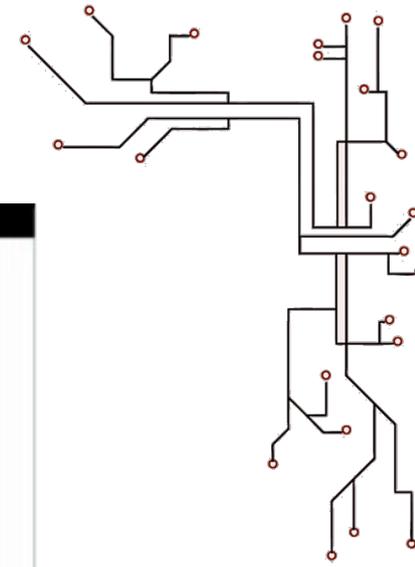
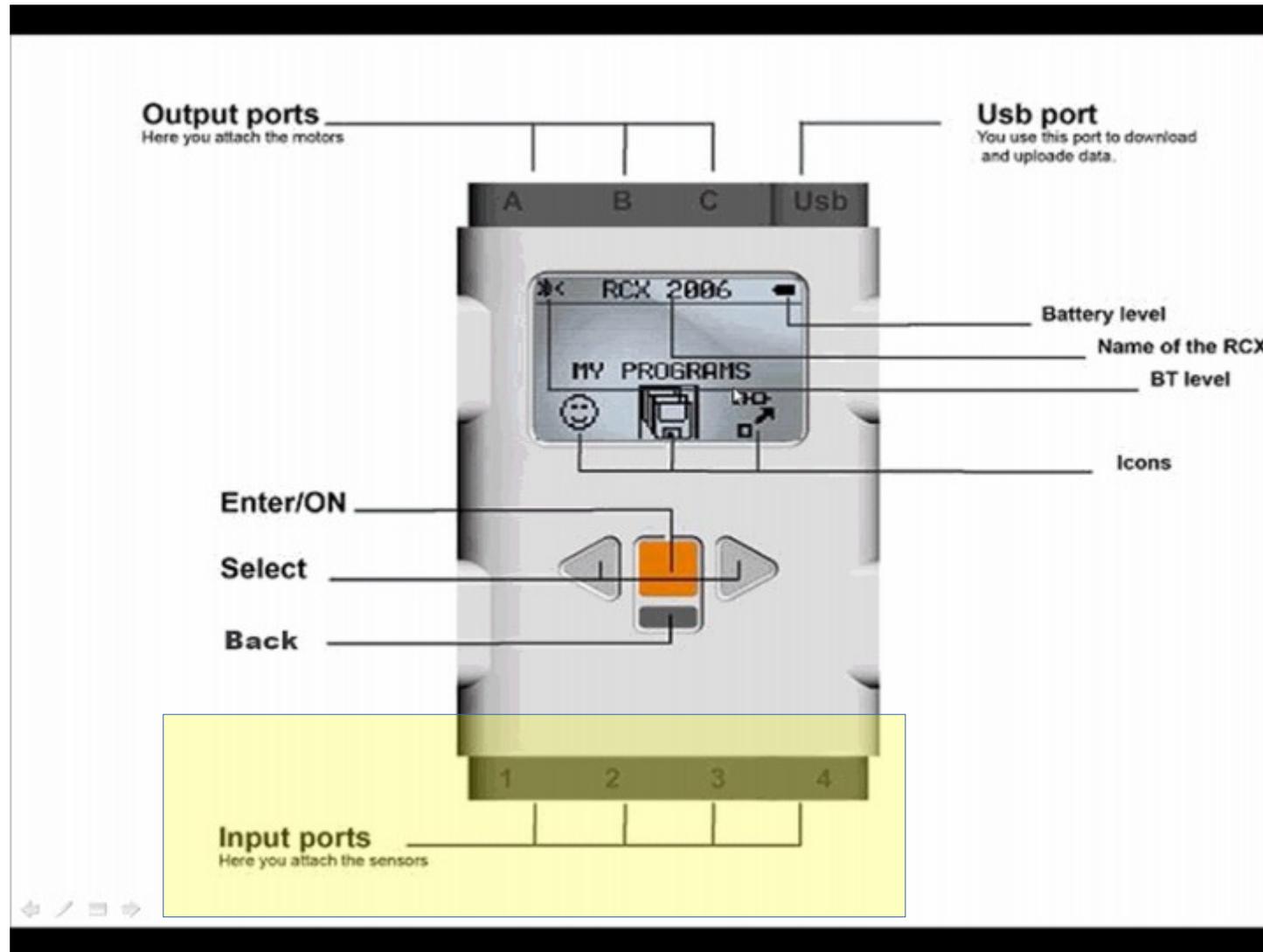
# Outputs – Motors



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# Inputs – Sensors & Buttons

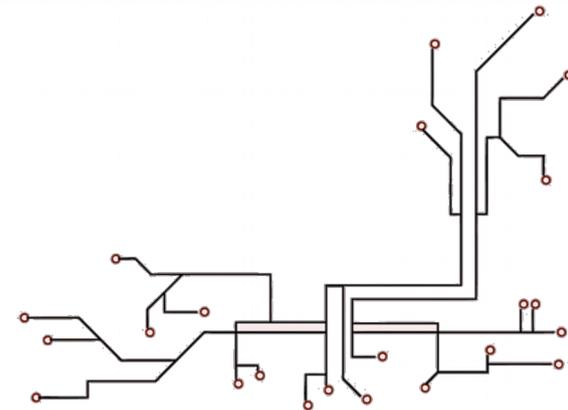
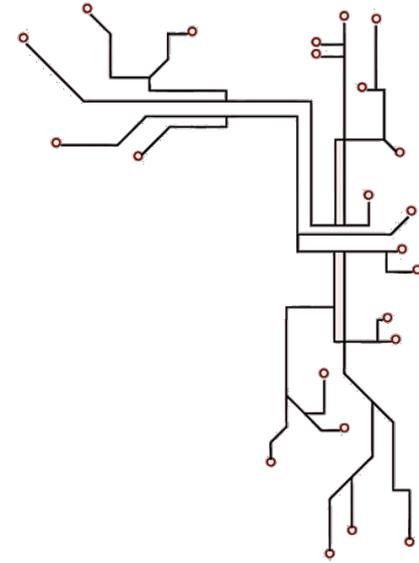


# Outputs – Motor Control

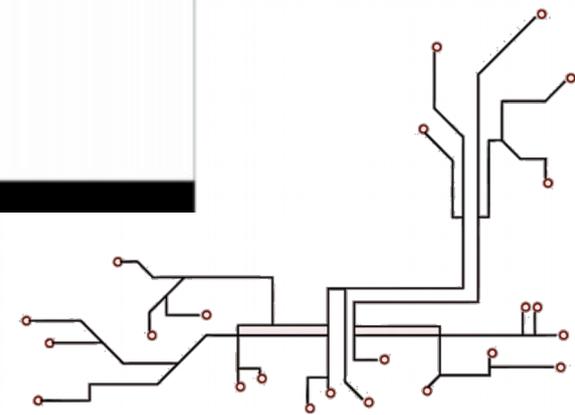
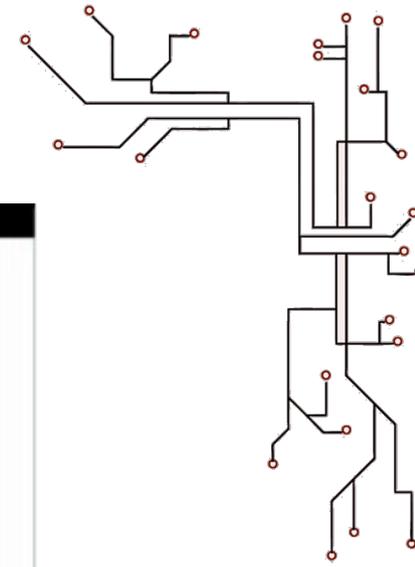
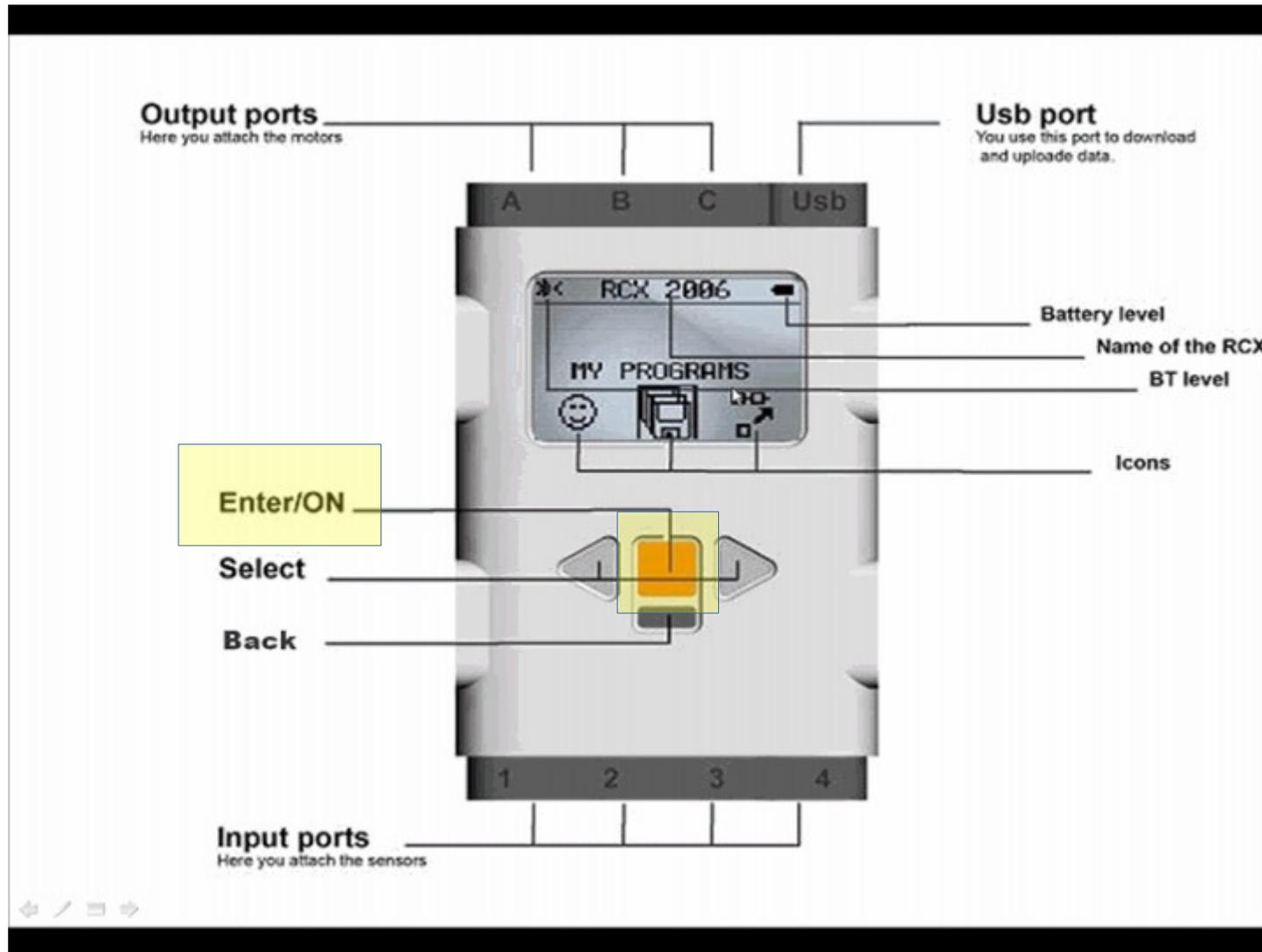
Which Motors Ports, A – C,  
Should you Connect for Two-Wheel  
Drive?

**No Right Answer...**

Common Usage:  
**B + C**

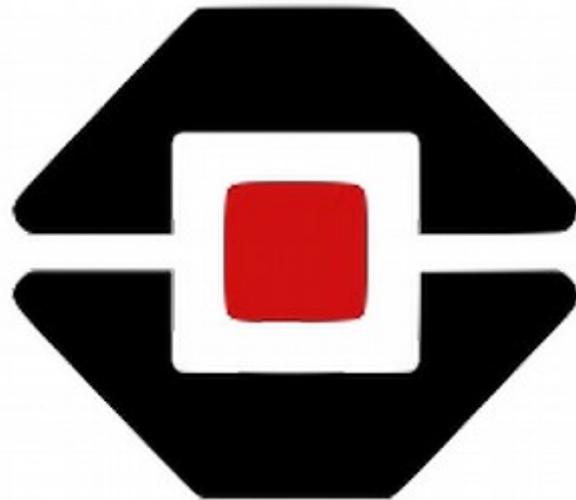


# Turn On Your NXT Brick

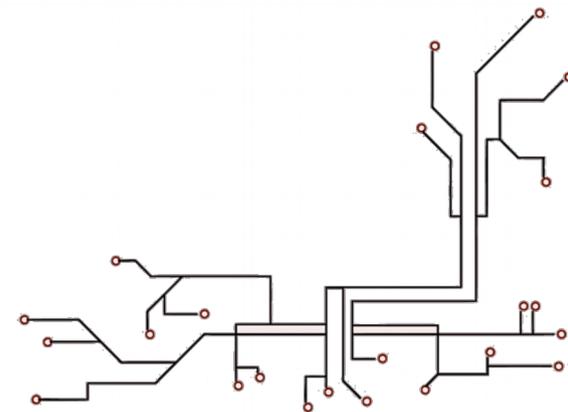
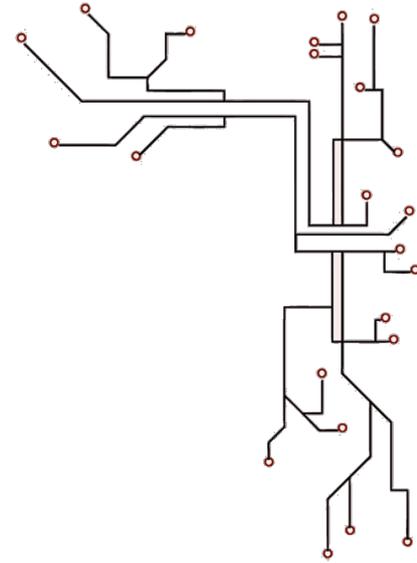


Make sure you inserted **batteries!**

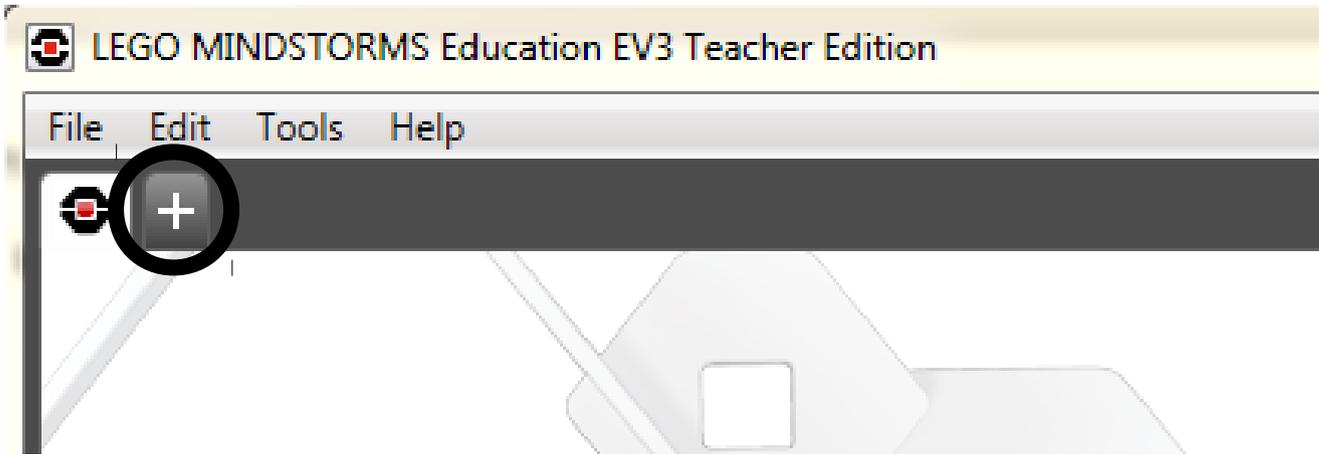
# EV3 – Run EV3 Software



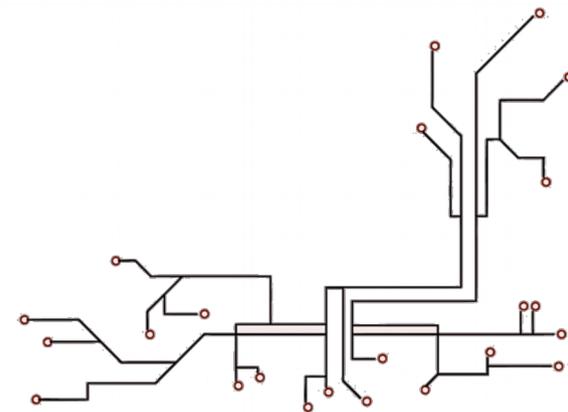
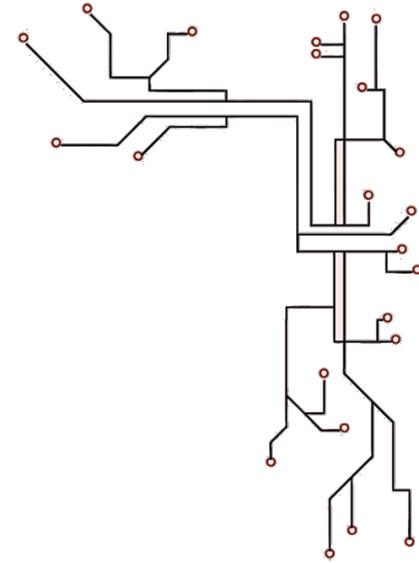
Find this  
icon on  
your PC  
and **run it!**



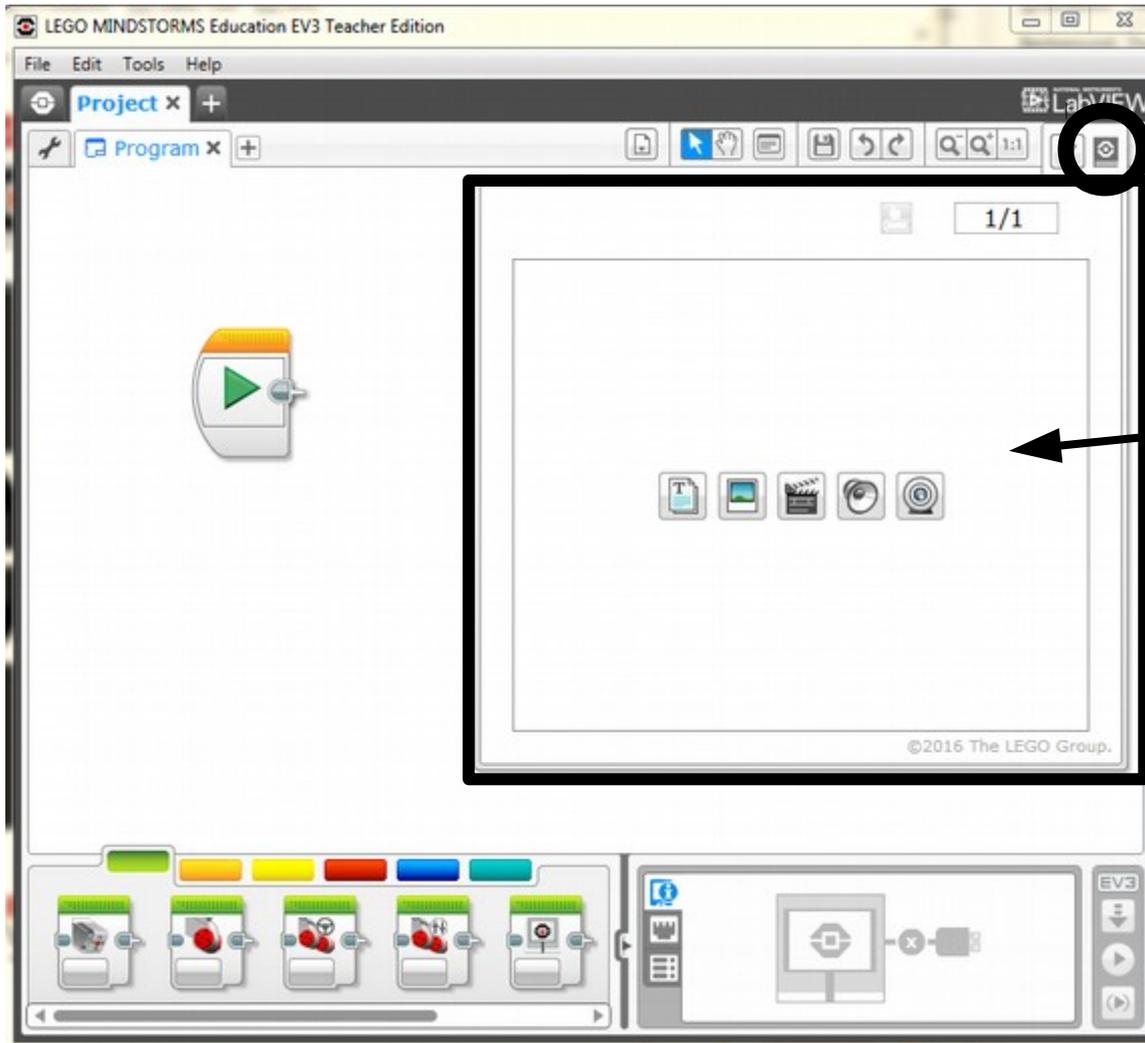
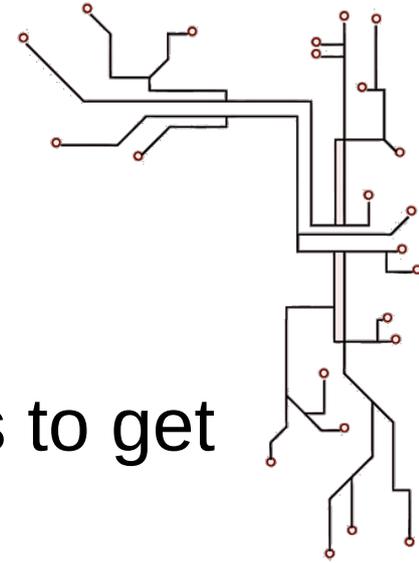
# EV3 – Start New Project



Click the  
[+] sign on  
top of the  
welcome  
screen

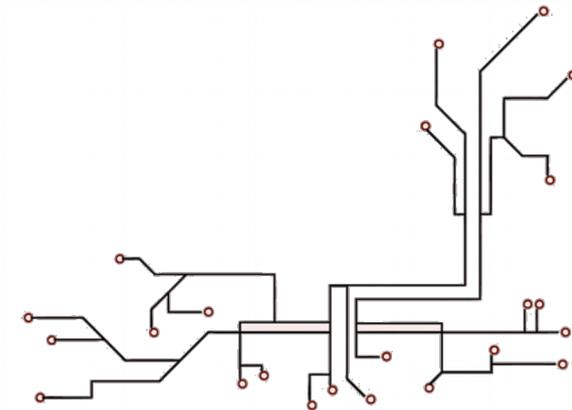


# EV3 – Close Content Editor

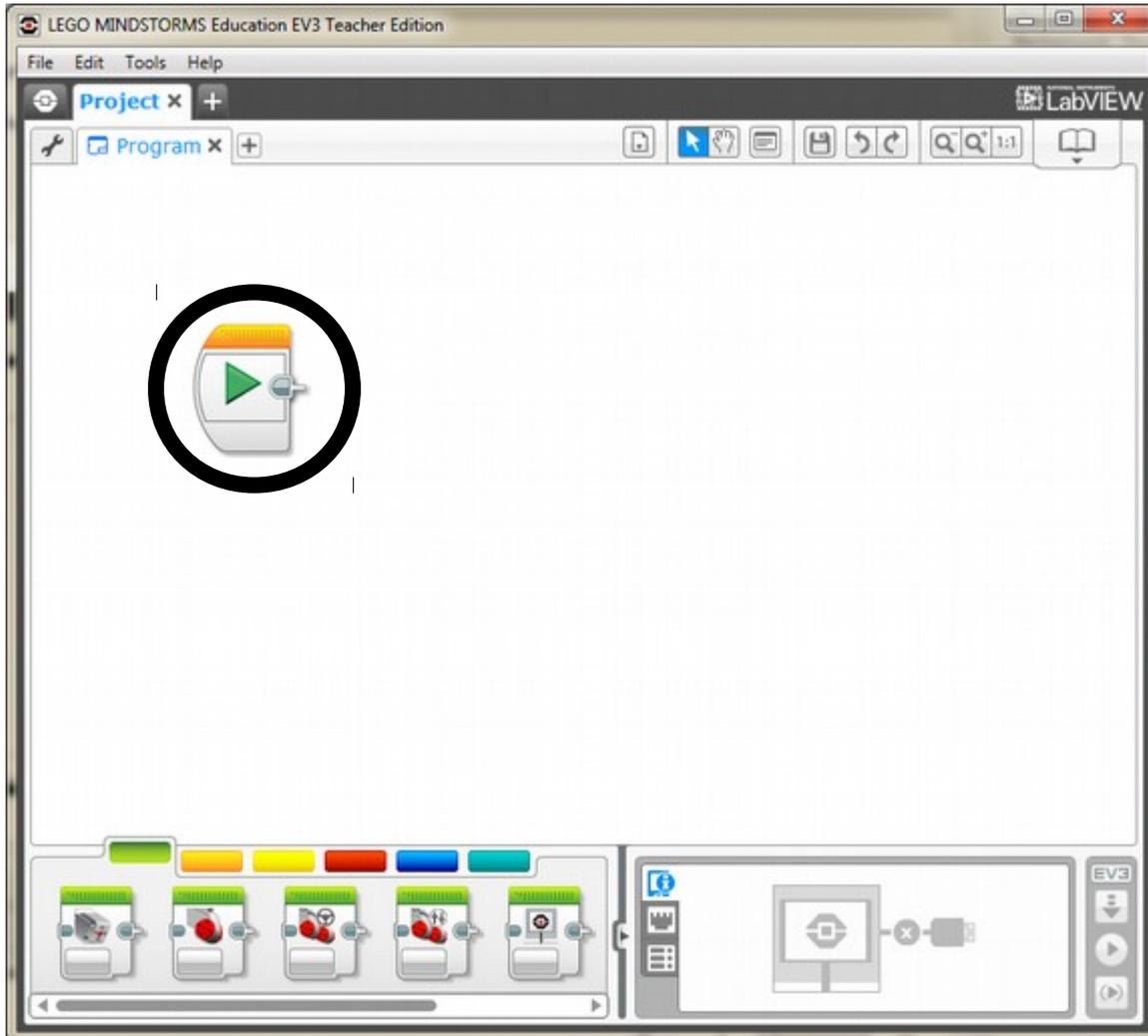


Click this to get rid of the **Content Editor**.

We won't need it for most of our projects.



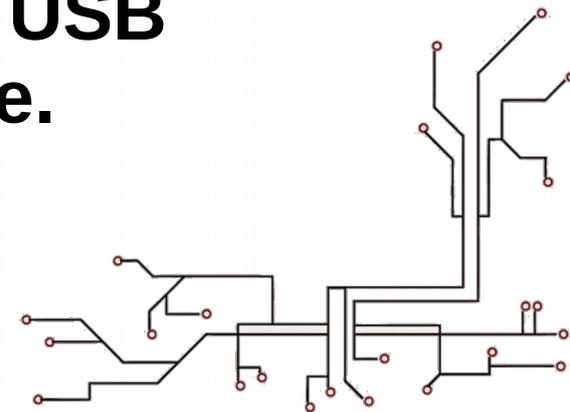
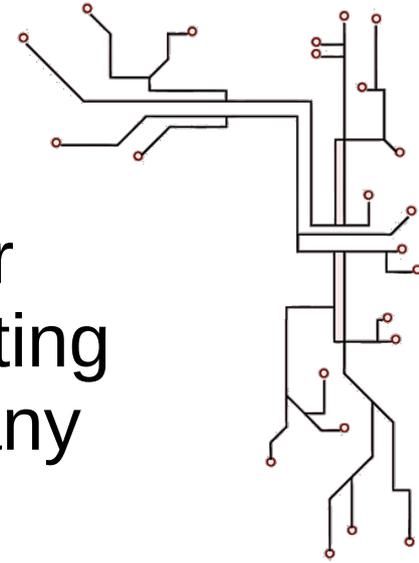
# EV3 – Starting Point



This is our basic starting point for any Program.

But, first, we need to connect a brick.

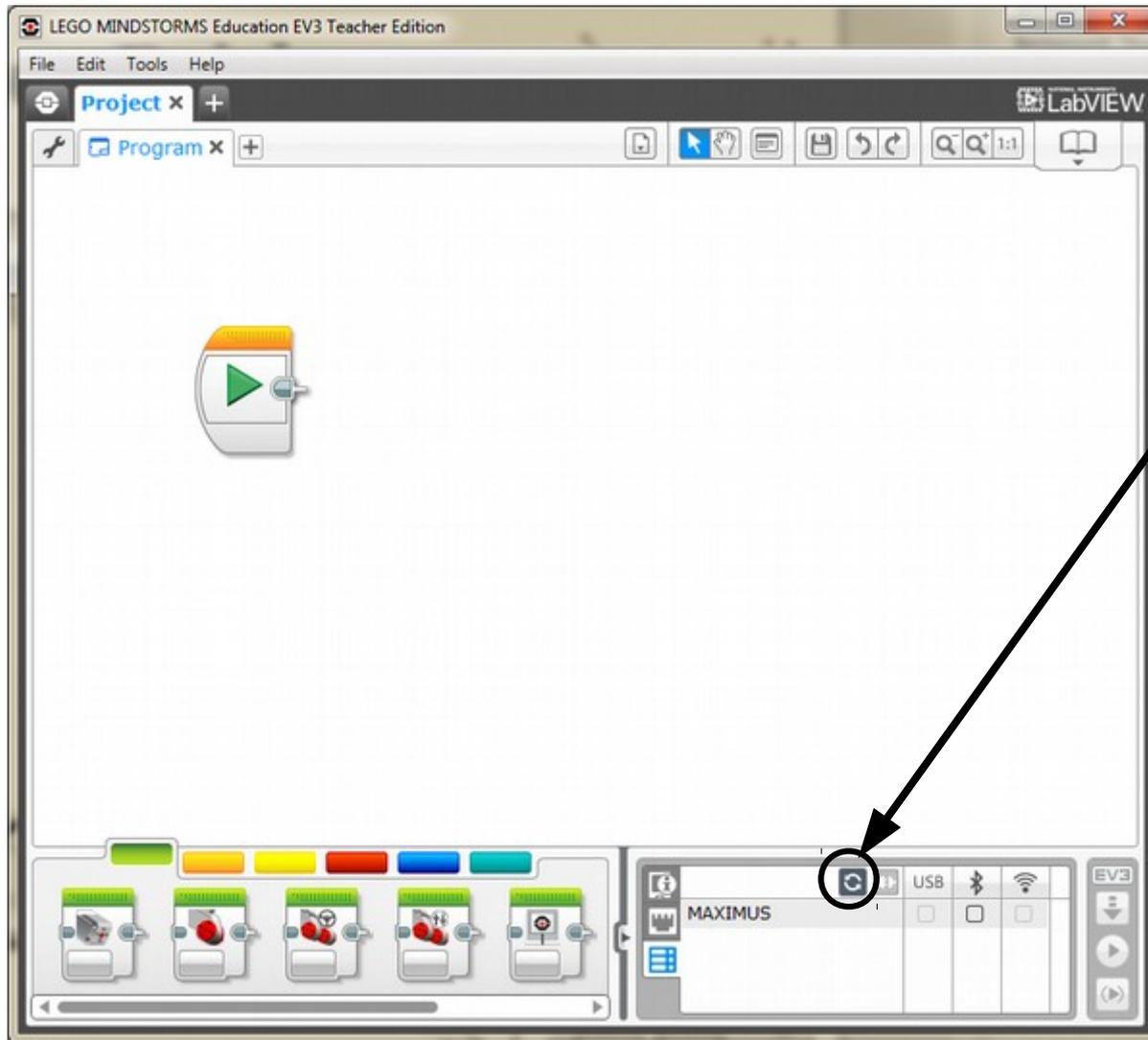
**Find USB Cable.**



**A POSTERIORI**

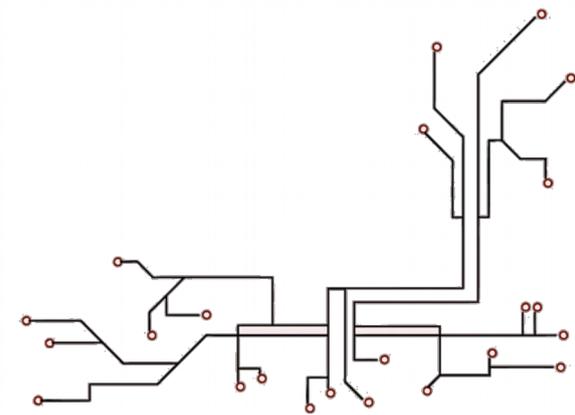
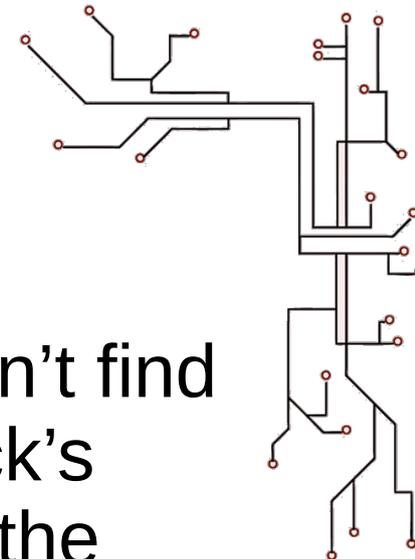
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# EV3 – Connect Brick

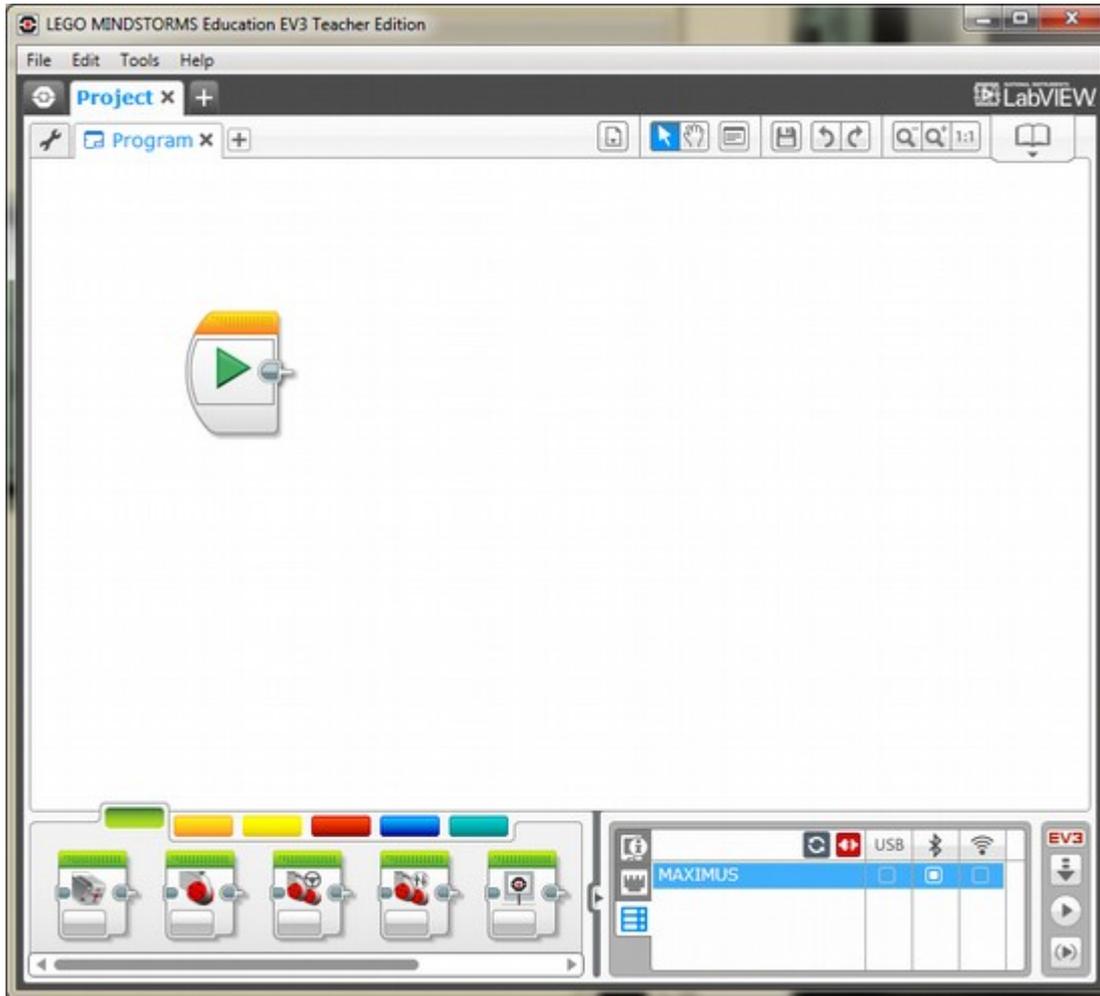
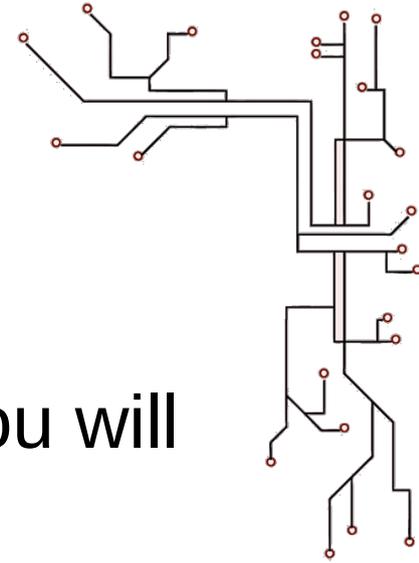


If you don't find your Brick's name in the list, let us know.

It should come up as soon as you connect.

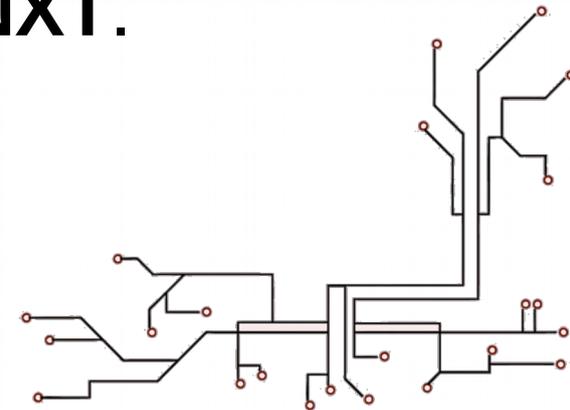


# EV3 / NXT – Connected!



Once you manage to connect, you will see the **brick name highlighted** and the **USB box checked**.

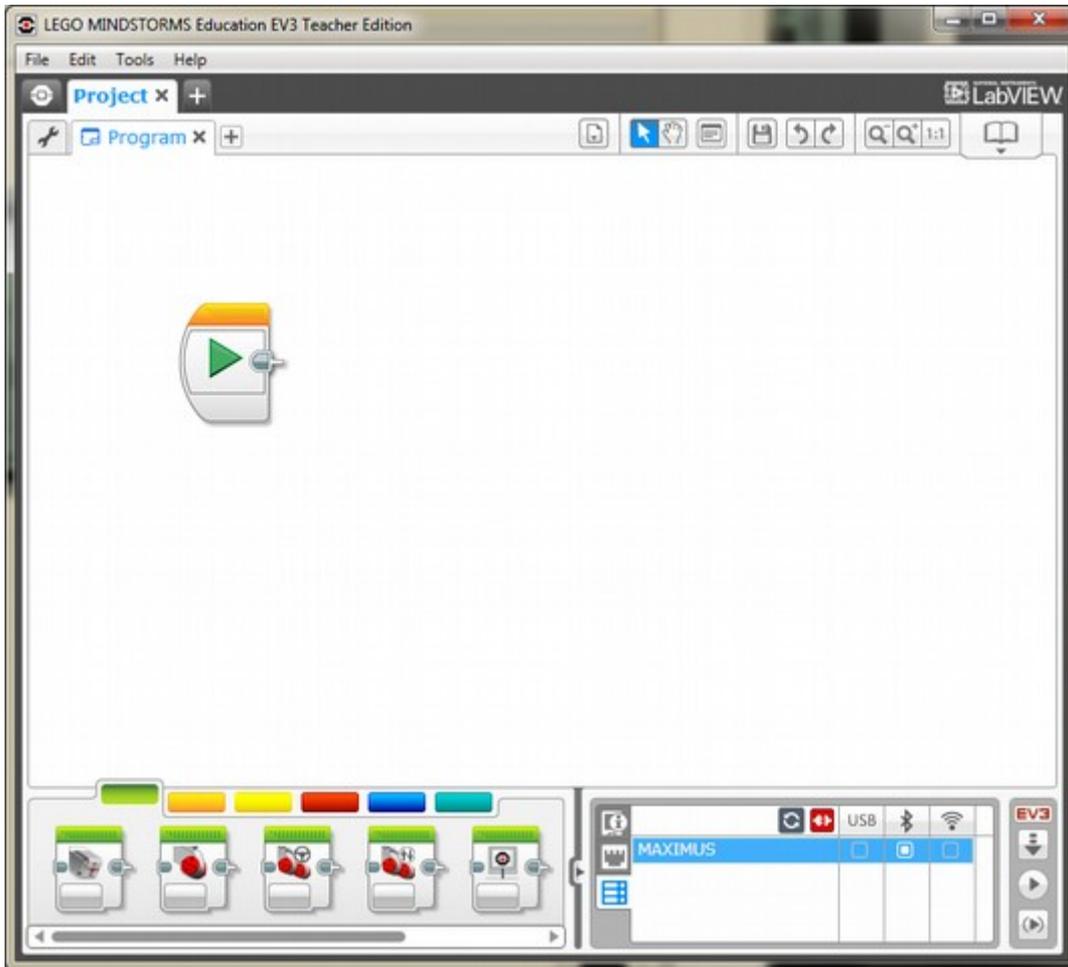
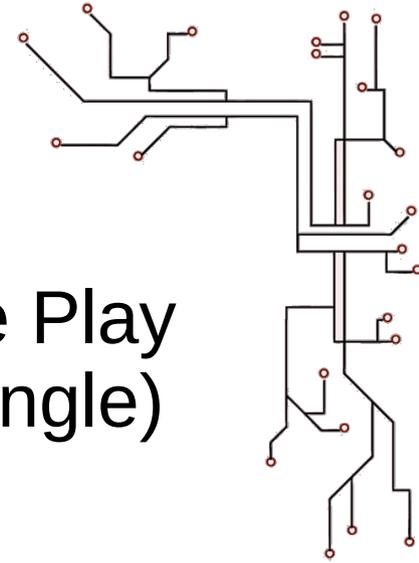
**No Bluetooth with NXT.**



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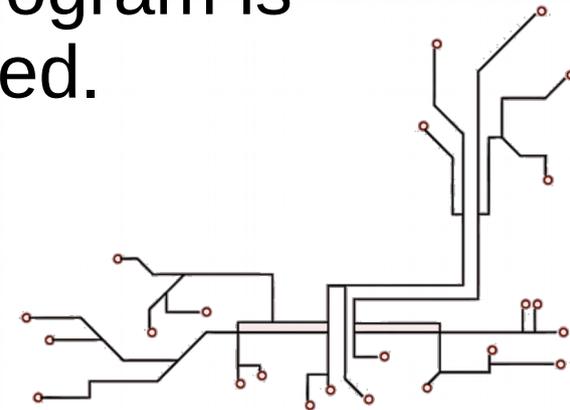
# EV3 – Play Program



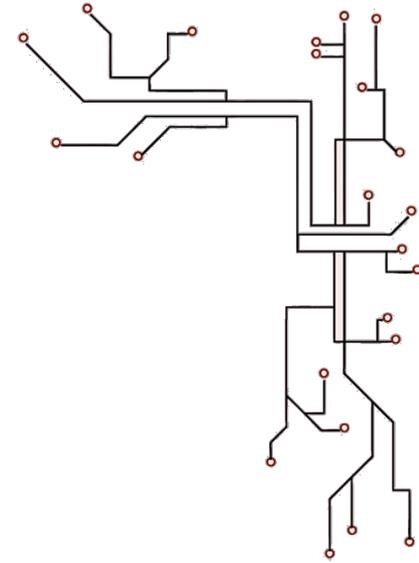
Click on the Play (Green Triangle) button.

You should hear your NXT make a sound.

That indicates a new program is activated.

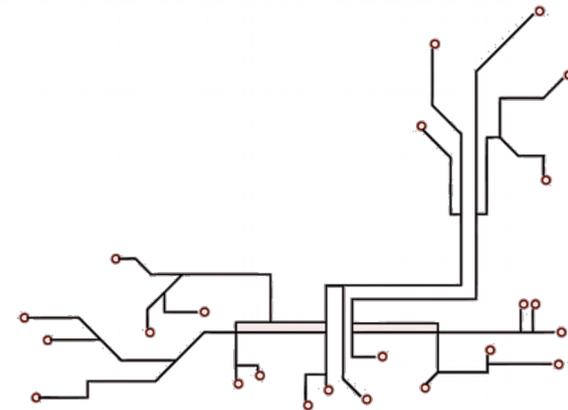


# EV3 – Motor Blocks

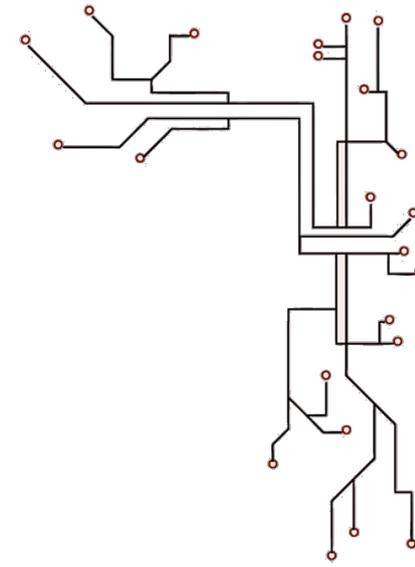
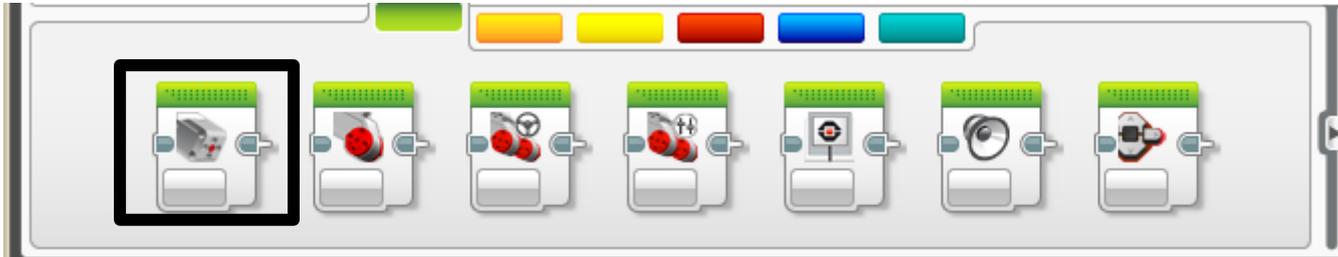


There are 4 motor blocks under the Actuator (green tab) in the Blocks window.

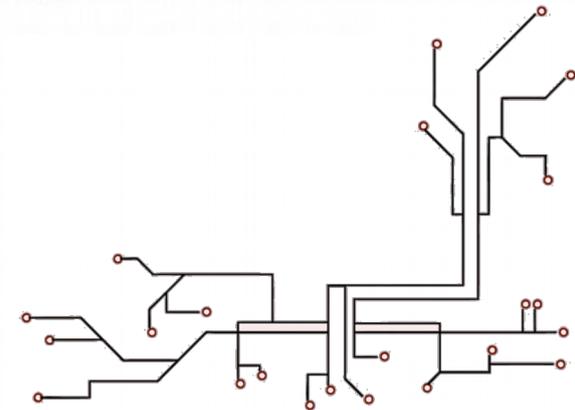
We will use some of these to get our robot to move.



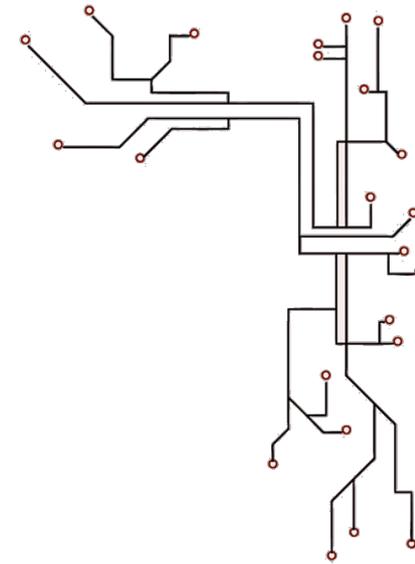
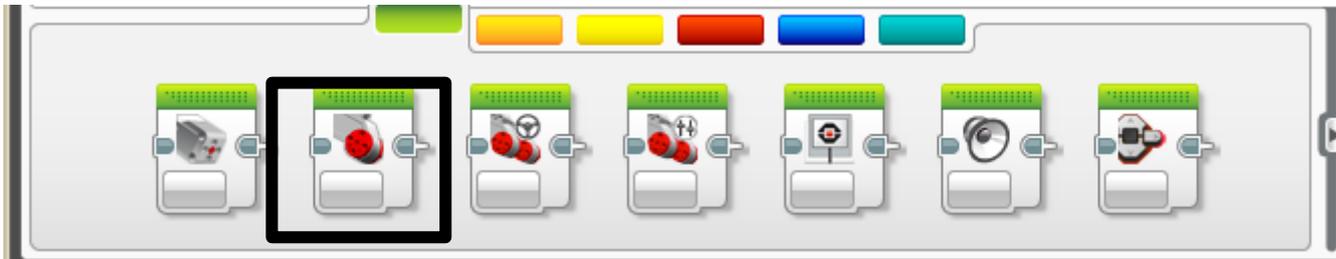
# EV3 – Medium Motor



We won't be using that with  
NXT at all...

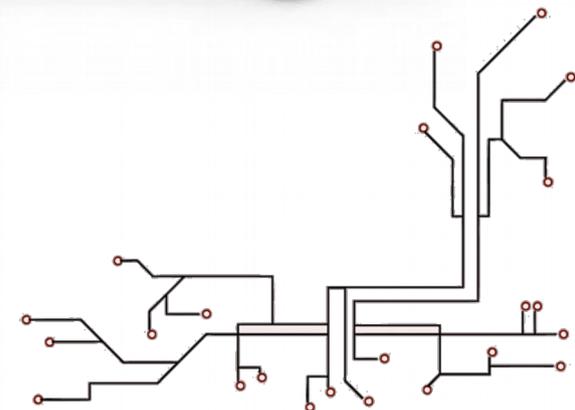


# EV3 – Large Motor

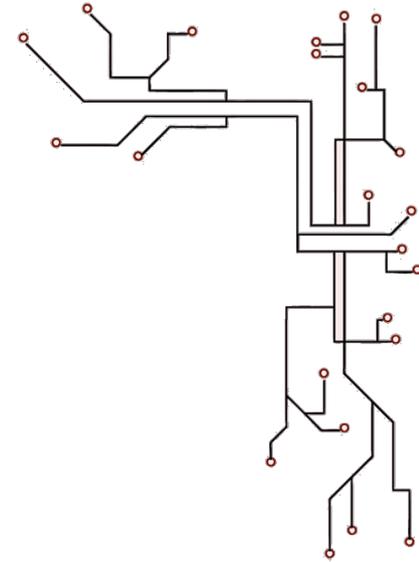
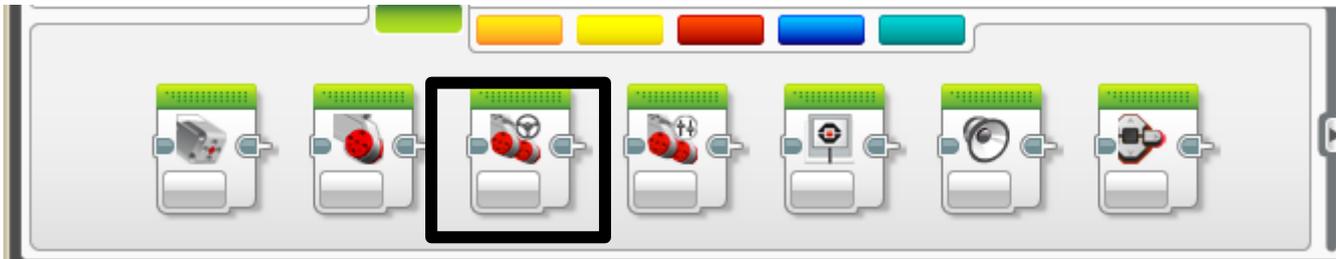


We can use this to control one of our motors, but we wish to control both wheels at the same time...

This is useful only when the Large Motors are used independently...



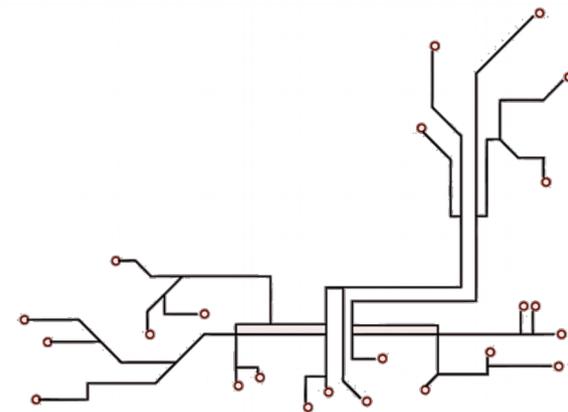
# EV3 – Move Steering



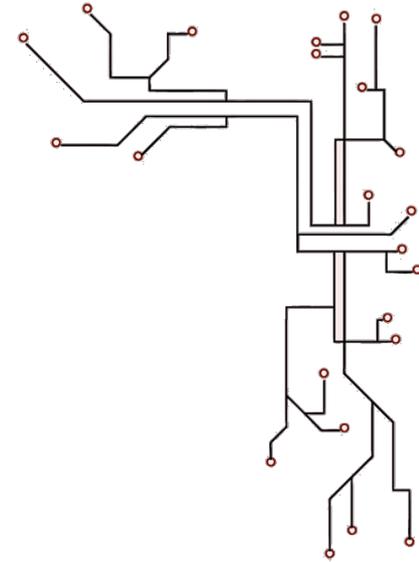
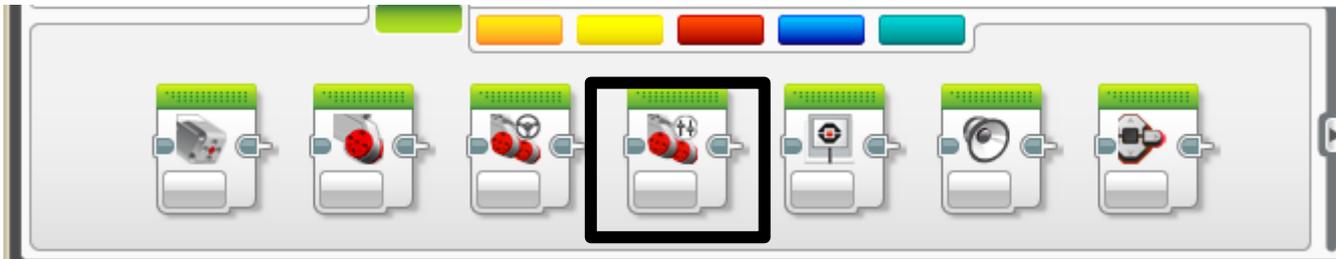
## Move Steering

This could be used to move our 2-Wheel Robot.

It's the easiest way to control our Robot.



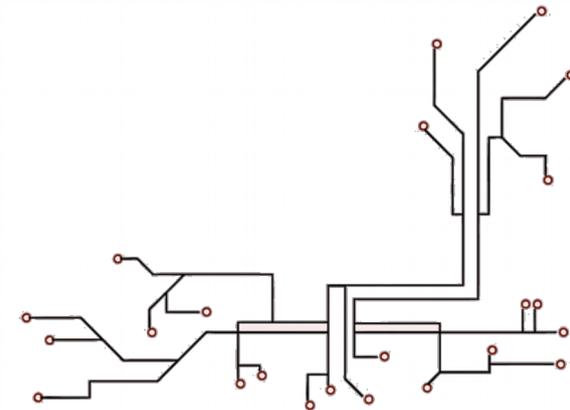
# EV3 – Move Tank



## Move Tank

This could also be used to move our 2-Wheel Robot.

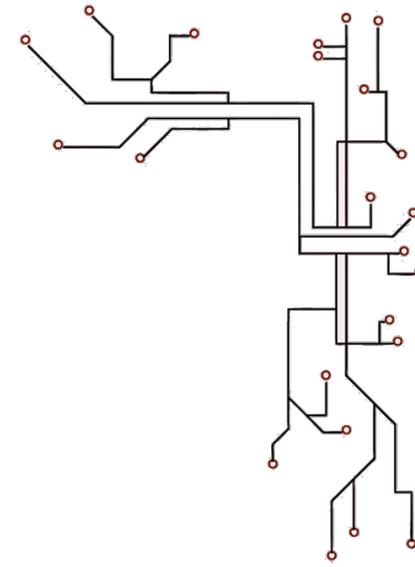
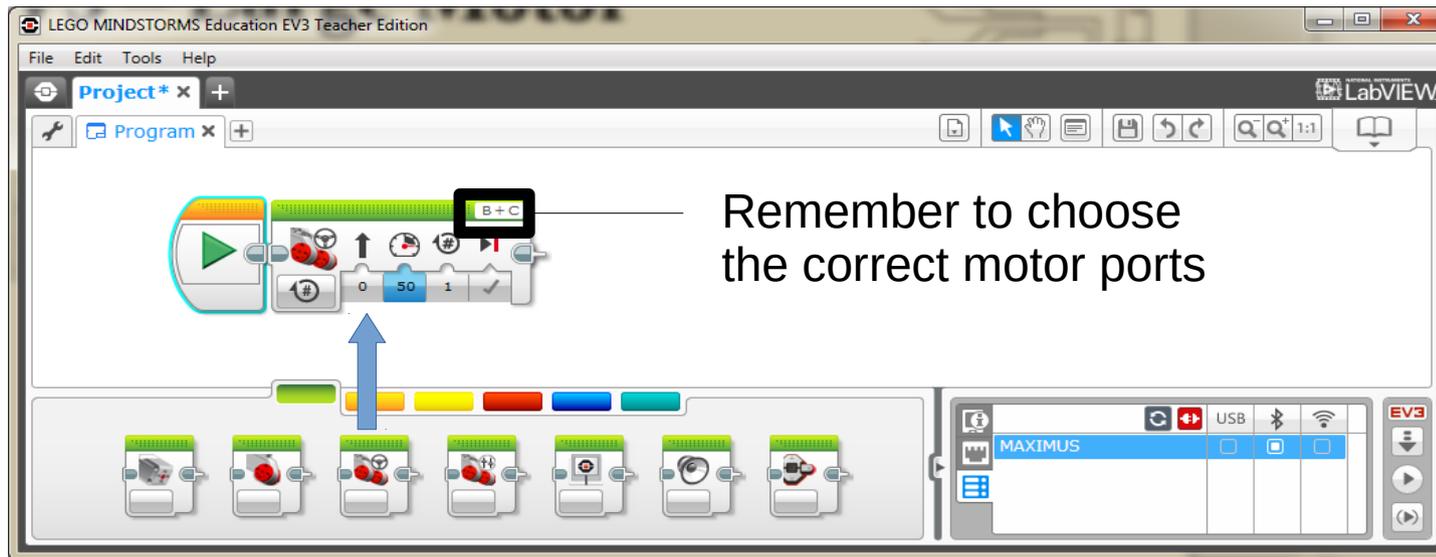
In this one each motor is independently controlled, but their behavior changes together.



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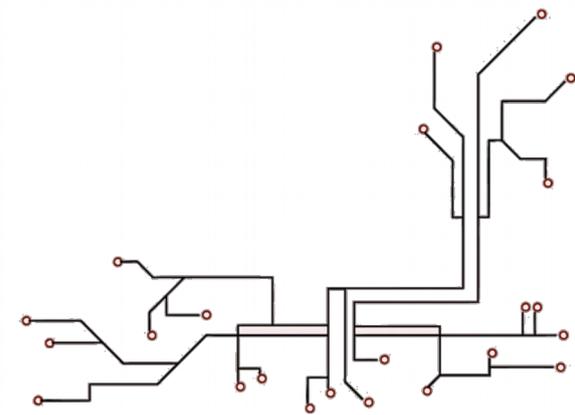
# EV3 – Move Steering



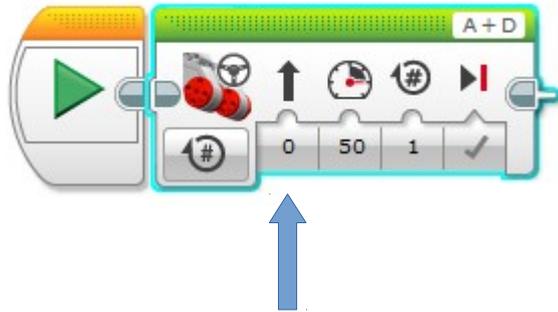
Drag a Move Steering block next to the Play button.

Press Play and see what your robot does.

**DON'T LET IT FALL OFF THE TABLE!**



# EV3 – Move Steering

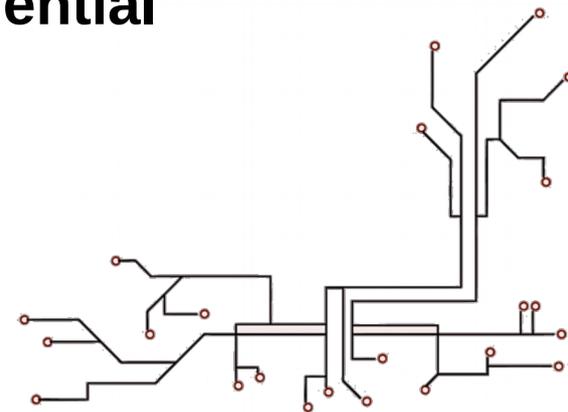
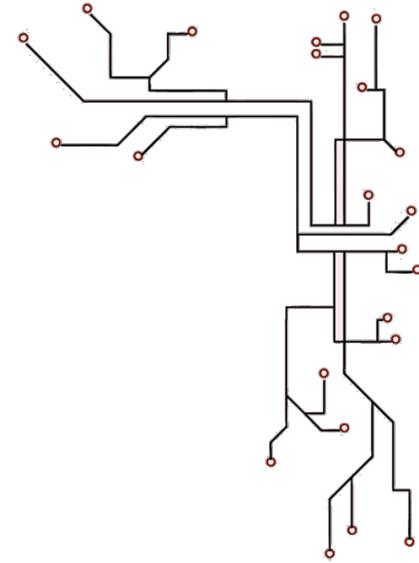


## Direction:

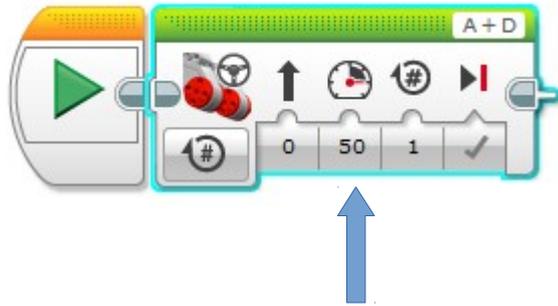
If FWD – it will drive the 2 motors equally

If BACK – it will drive the 2 motors equally in reverse

If LEFT/RIGHT – it will decide based on **differential drive algorithm**



# EV3 – Move Steering



**Power: How fast the motor turns**

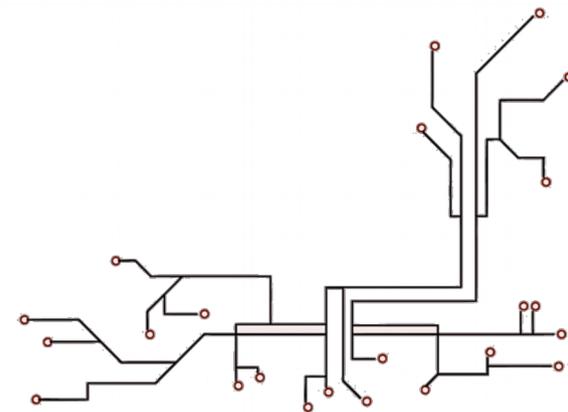
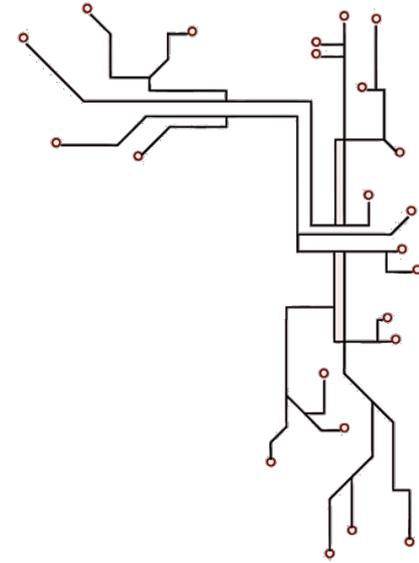
50 - medium speed

100 – full speed

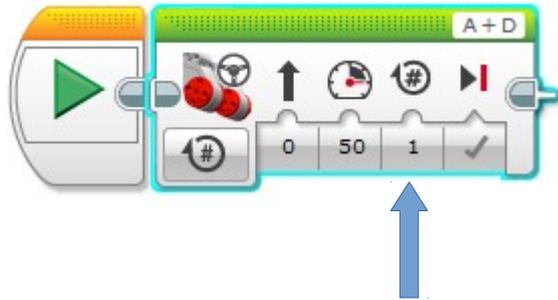
See what happens if you try a very low power...

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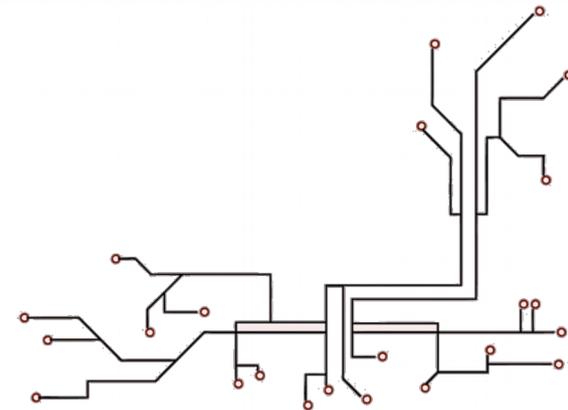
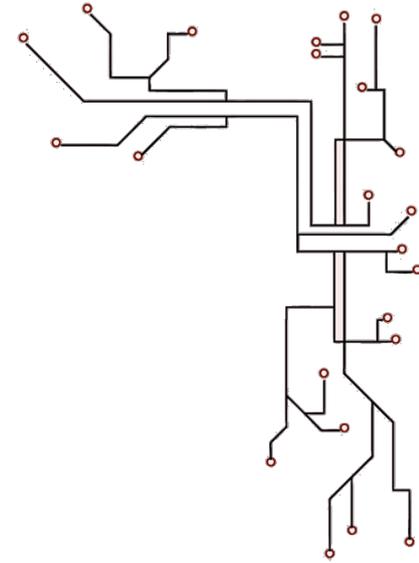
# EV3 – Move Steering



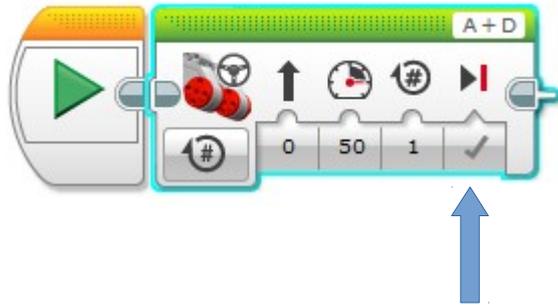
## Rotations:

How many times to rotate the wheel.

This is a sort of distance. How far to go...



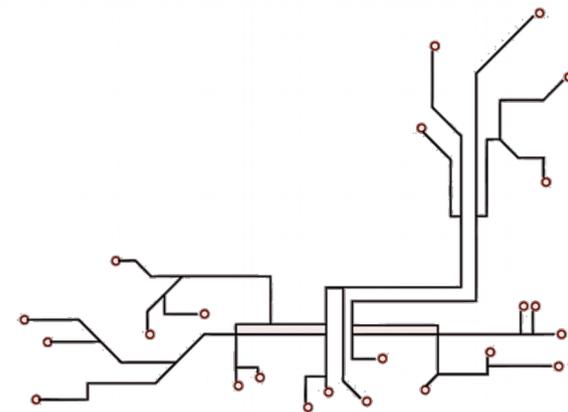
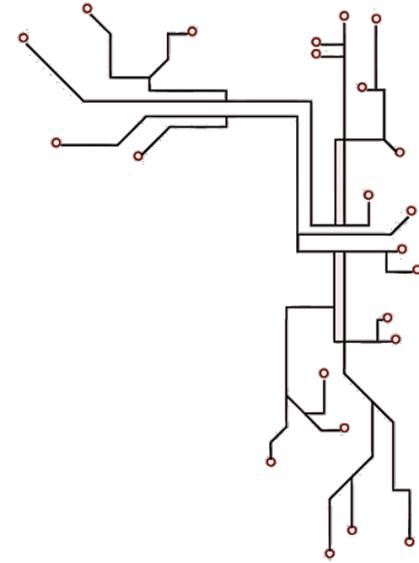
# EV3 – Move Steering



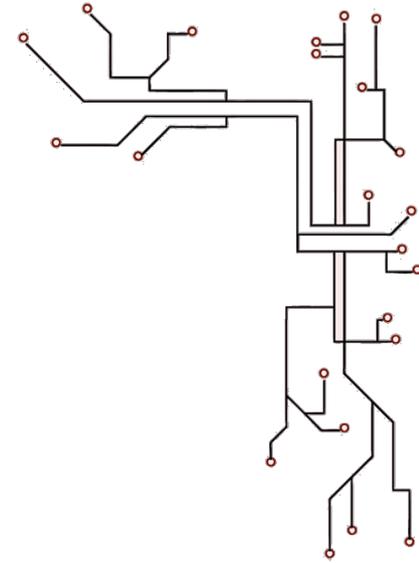
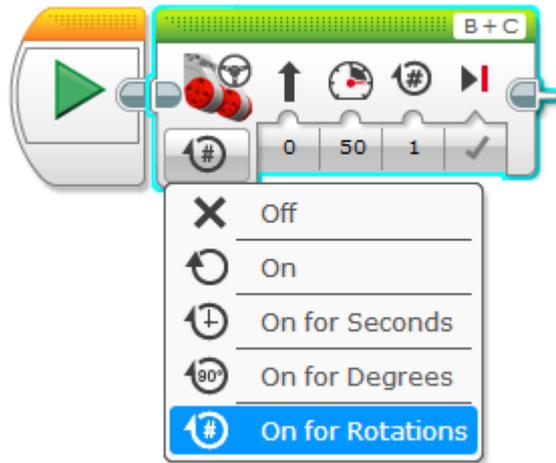
## Break:

When finished to move, apply hard break, or leave wheels to move and come to a stop on their own...

**Test behavior** with break and no break.



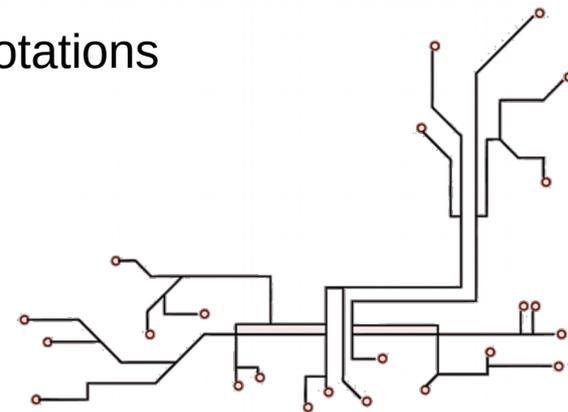
# EV3 – Move Steering



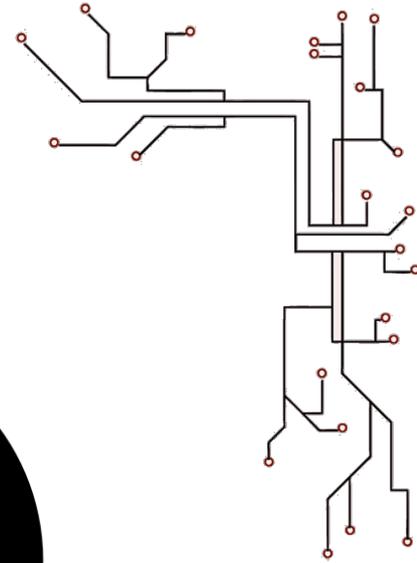
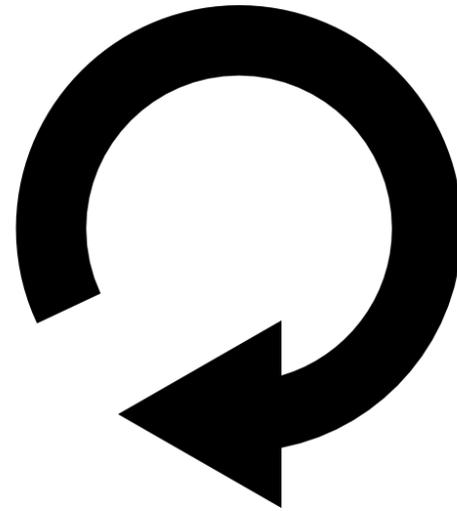
On for Seconds – do the movement for some time

On for Degrees – do the movement for a fraction of a rotation

On for Rotations – do the movement for a number of full wheel rotations



# EV3 – Move Steering

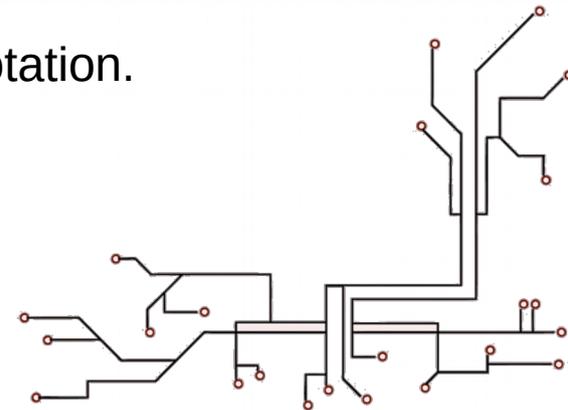


## On for Rotations –

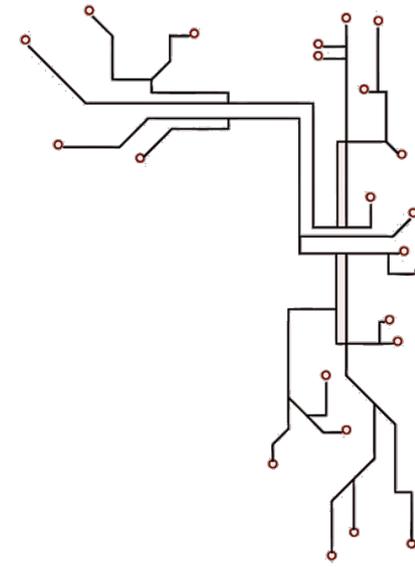
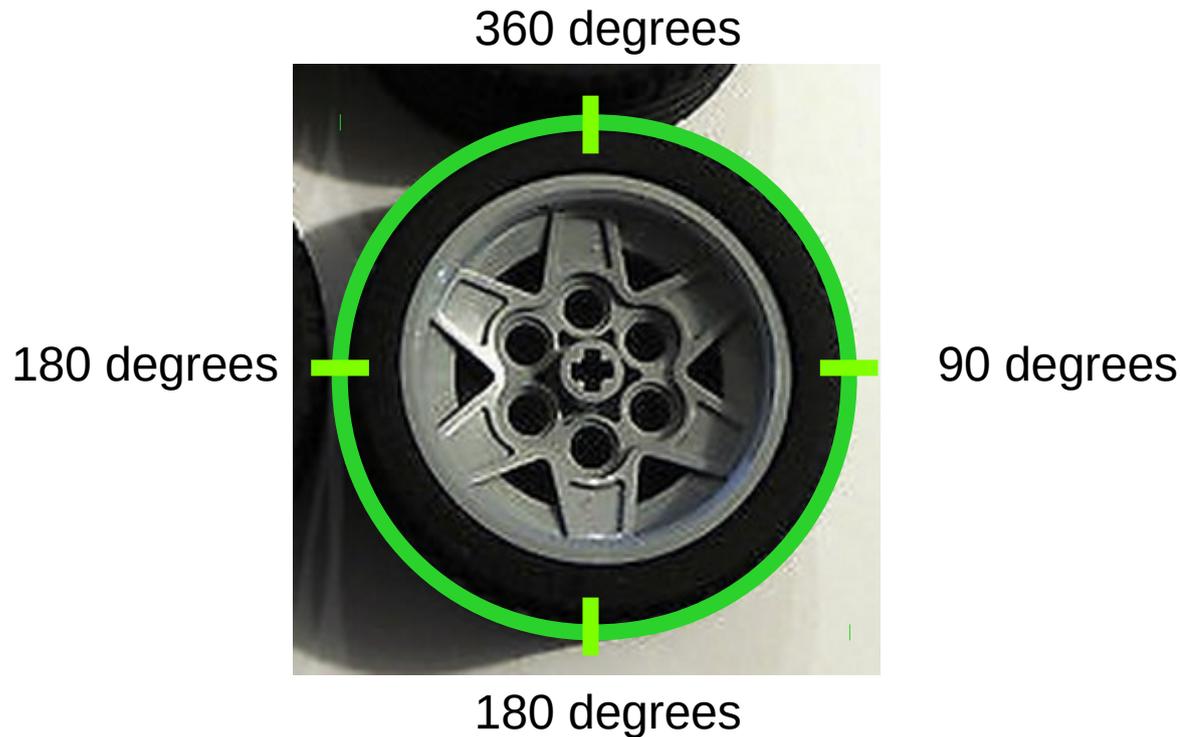
Each time the wheel spins around completely it turns **ONE** full rotation.

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# EV3 – Move Steering

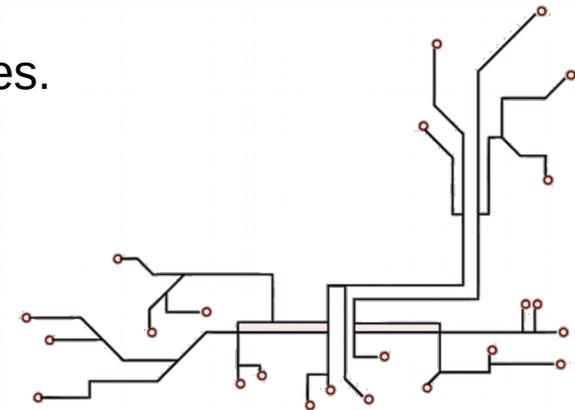


## On for Degrees –

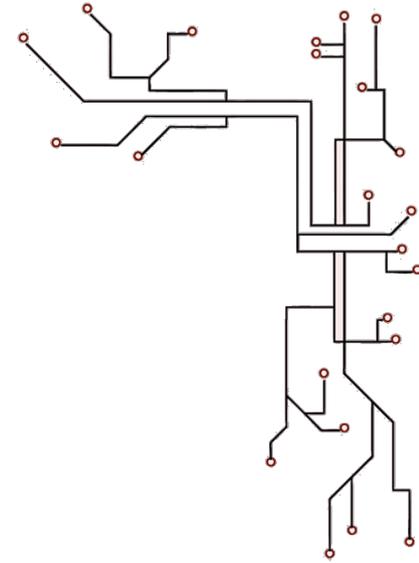
Each time the wheel spins around completely it turns **360** degrees.

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# EV3 – Move Steering



## Challenge 1

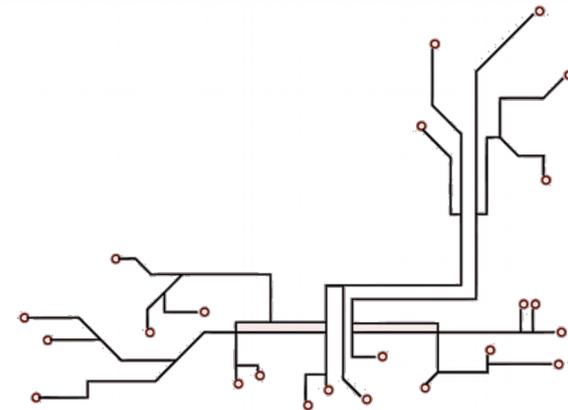
How far will the robot go in 1 rotation?

## HINT

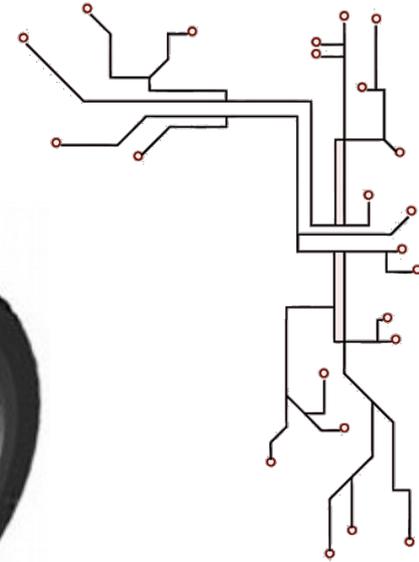
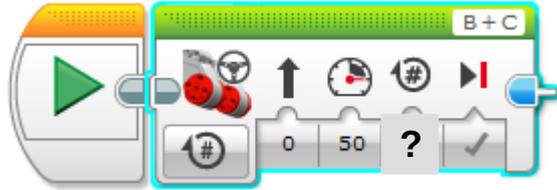
Use string to measure wheel circumference...

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# EV3 – Move Steering



## Challenge 2

Make your robot start directly over starting line, and come to a stop directly over finish line...

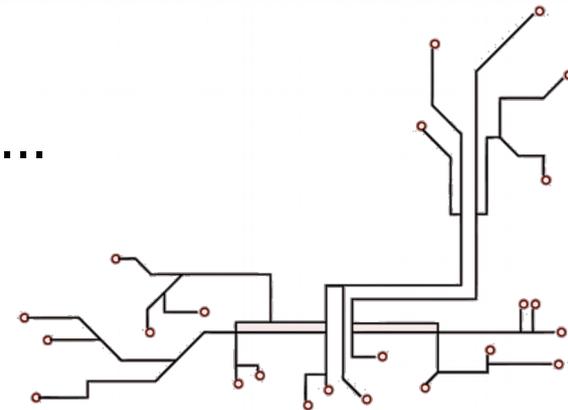
No Trial & Error.

You're only allowed to use rulers, string, and measuring tape.

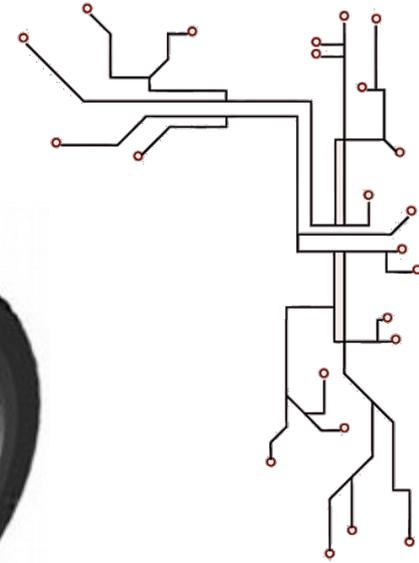
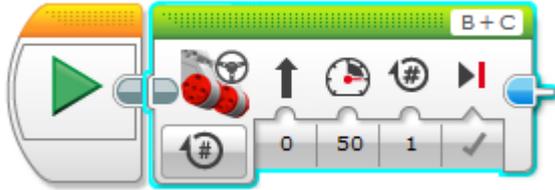
**HINT** - Use some math... Answer can be decimal...

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# EV3 – Move Steering



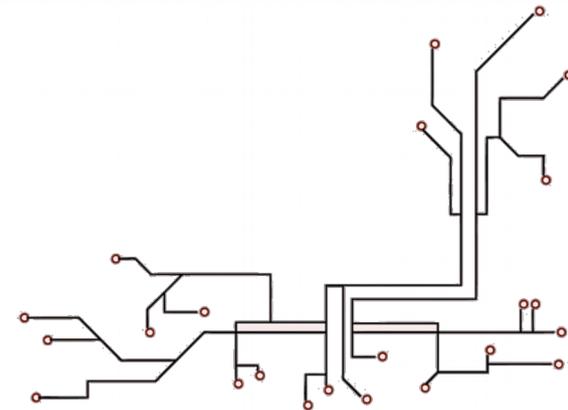
## Challenge 3

Make your robot move forward 1 meter,  
then turn left at a 90 degree angle

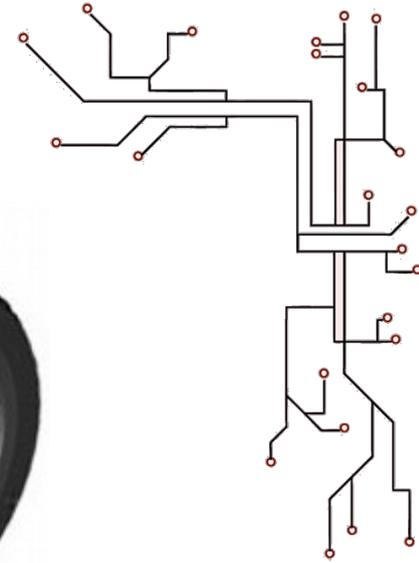
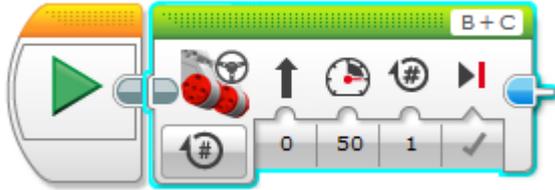
(**NOT** On for 90 degrees...)

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# EV3 – Move Steering

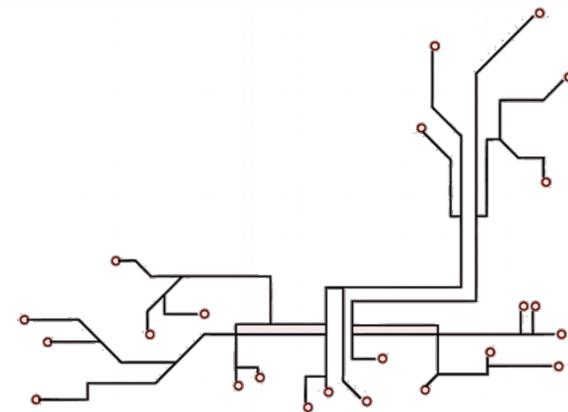


## Challenge 4

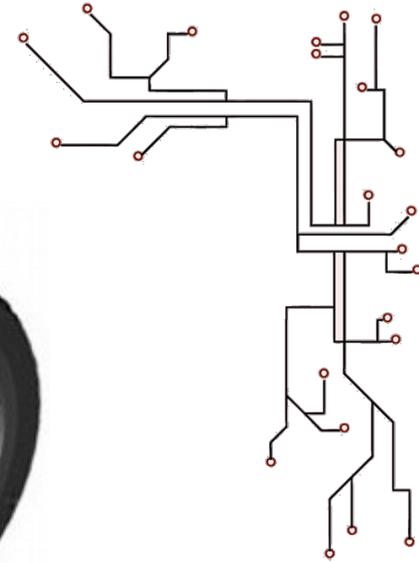
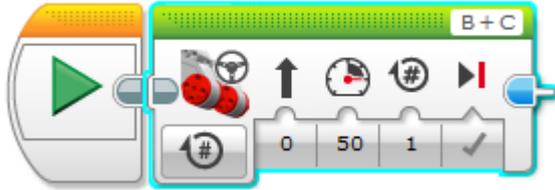
Make your robot move around in a *Square Pattern*

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# EV3 – Move Steering



## Challenge 5

Make your robot move around in a *Triangle Pattern*

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