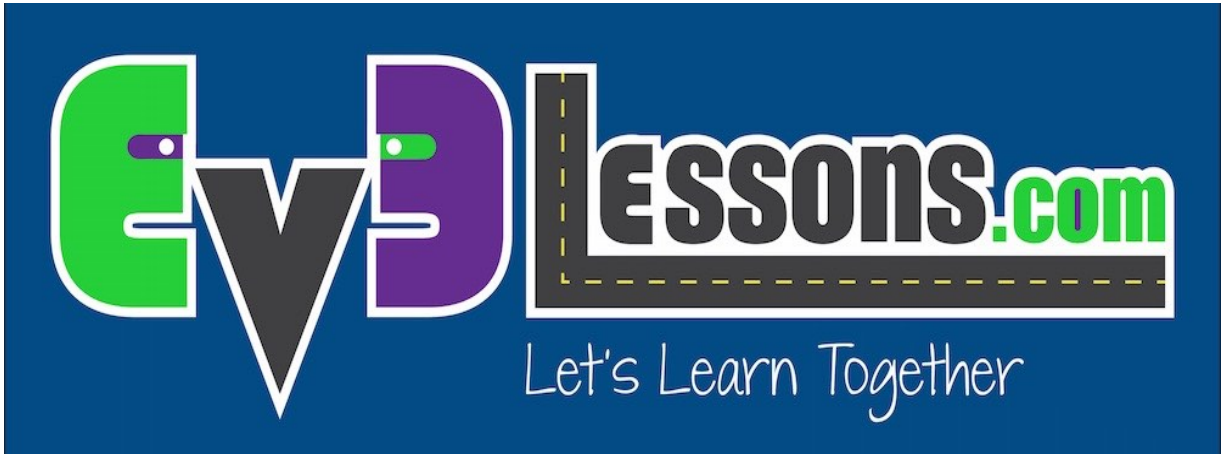
TABLET LESSONS



BASIC LINE FOLLOWER

By Sanjay and Arvind Seshan

Lesson Objectives

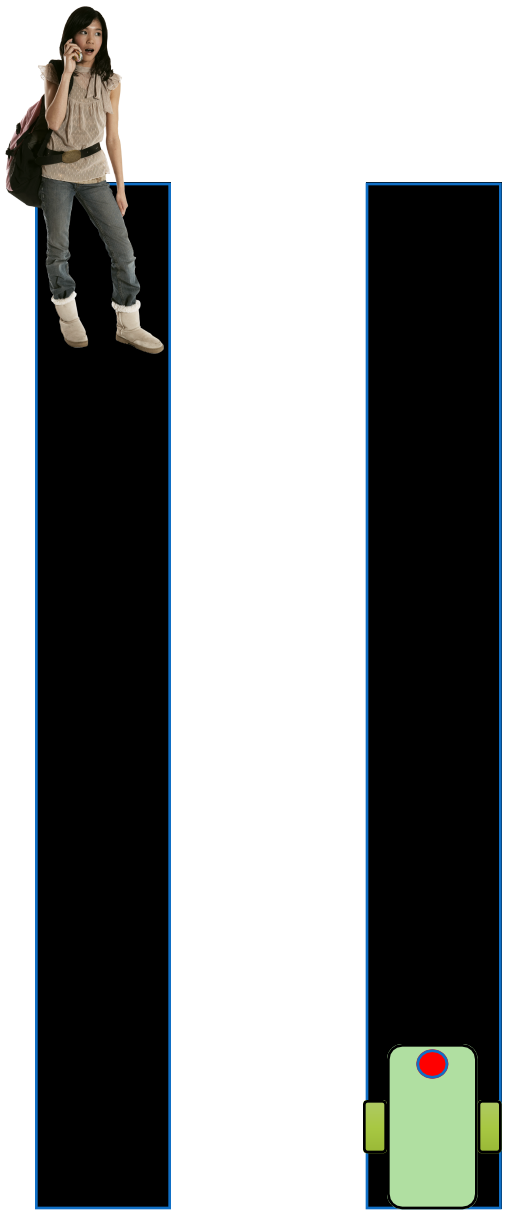
1. Learn how humans and robots follow lines
2. Learn how to get a robot to follow a line using Colour Mode on the EV3 Colour Sensor
3. Learn how to follow a line until a sensor is activated
4. Learn how to follow a line for a particular distance
5. Learn how to combine sensors, loops and switches

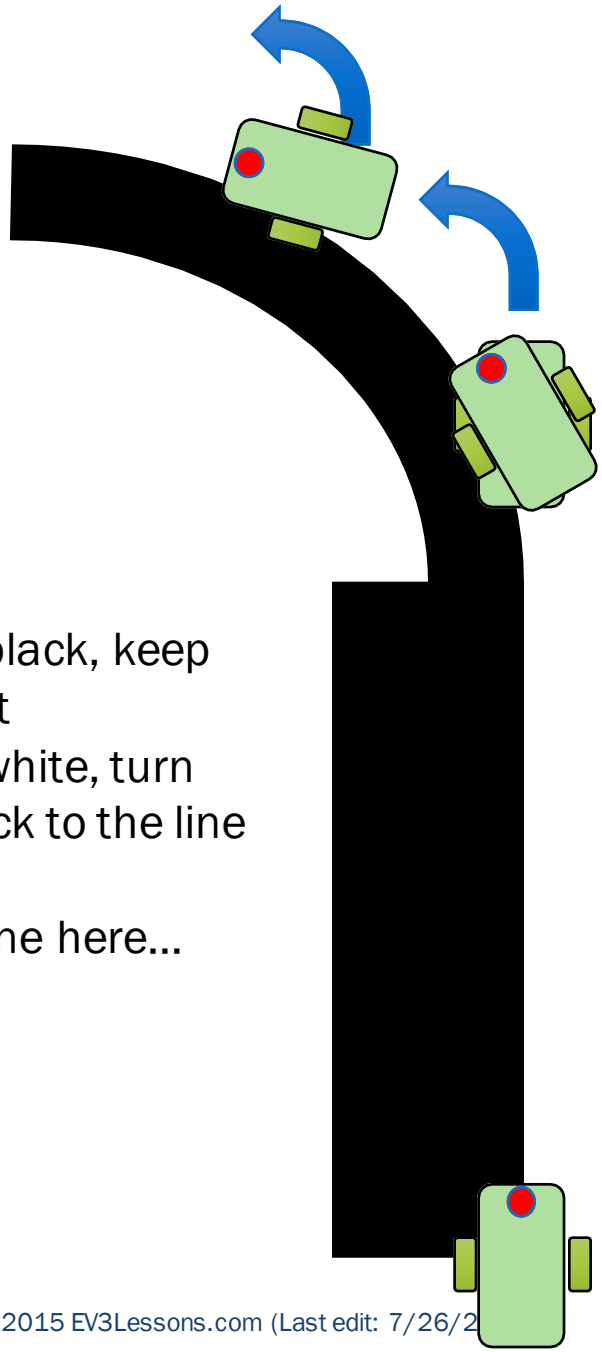
Teacher Instructions

- Slides 4-7 are animated. For students to better understand how a line follower works and how a human and a robot follow a line, we recommend that you play the animation
- Give each student/team a copy of the worksheet.
- Challenge 1 begins on slide 10 and Challenge 2 on Slide 13
- Discussion Guide is on Slide 16
- More advanced students might be interested in other line followers on EV3Lessons.com

Follow the Middle

- Humans want to follow the line in the middle.
- Let's have the robot do the same thing using the Colour Sensor
- What type of questions can we ask using this sensor
  - *Are you on line or not?*





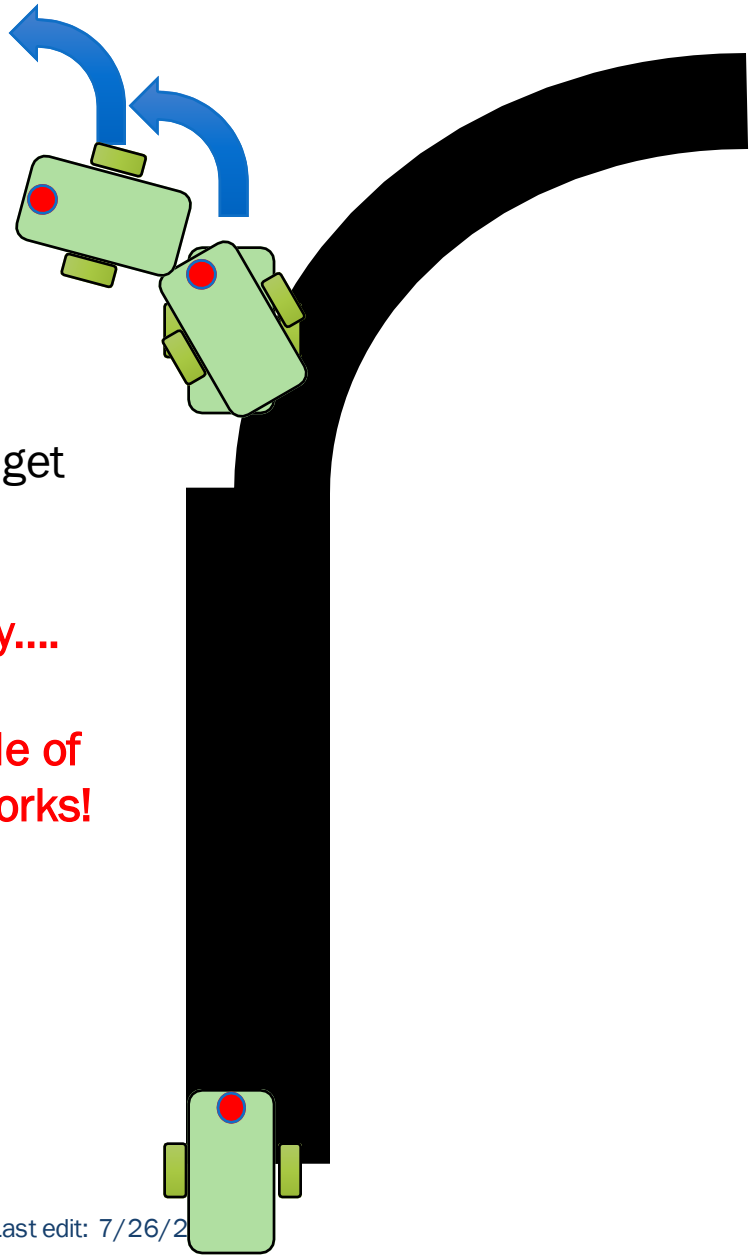
1. If we are on black, keep going straight
2. If we are on white, turn left to get back to the line

Seems to work fine here…

1. If we are on black, keep going straight
2. If we are on white, turn left to get back to the line

OH NO... my robot is running away....

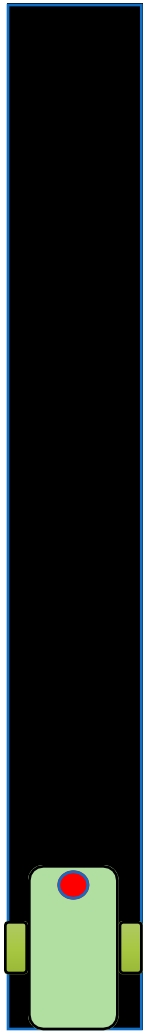
When the robot leaves the left side of the line, the program no longer works!



Line Following: Robot Style

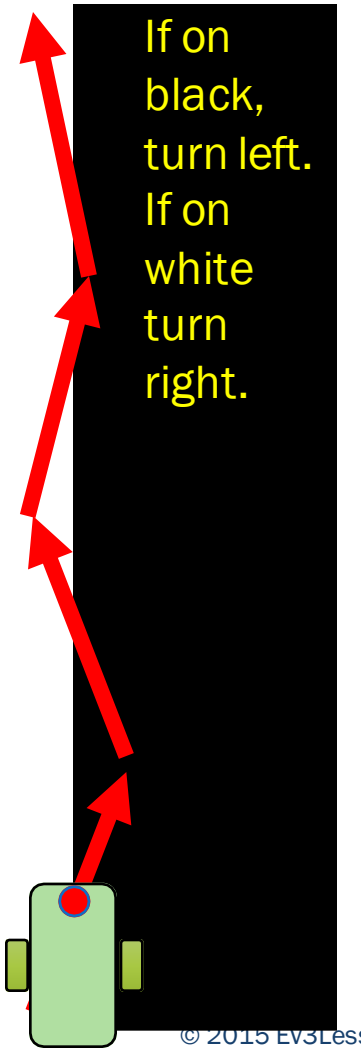
- Why could the Human follow the middle?:
  - *They can see ahead.*
  - *They can see the whole line and its surroundings*
  - *They see both sides and which side they left*

- Why can't the Robot do the same thing?:
  - *Can't tell right or left side of the line*
  - *How do we make sure the robot always veers off on the SAME SIDE of the line?*
    - Instead of the middle, could the robot follow the "edge"?
  - *So now the robot will fall off only the same side.*
  - *We will now show you how this works!*



Line Following at the Edges

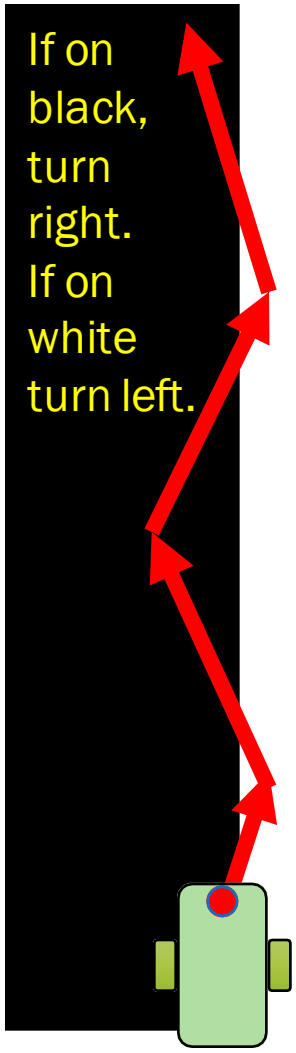
Left side line following



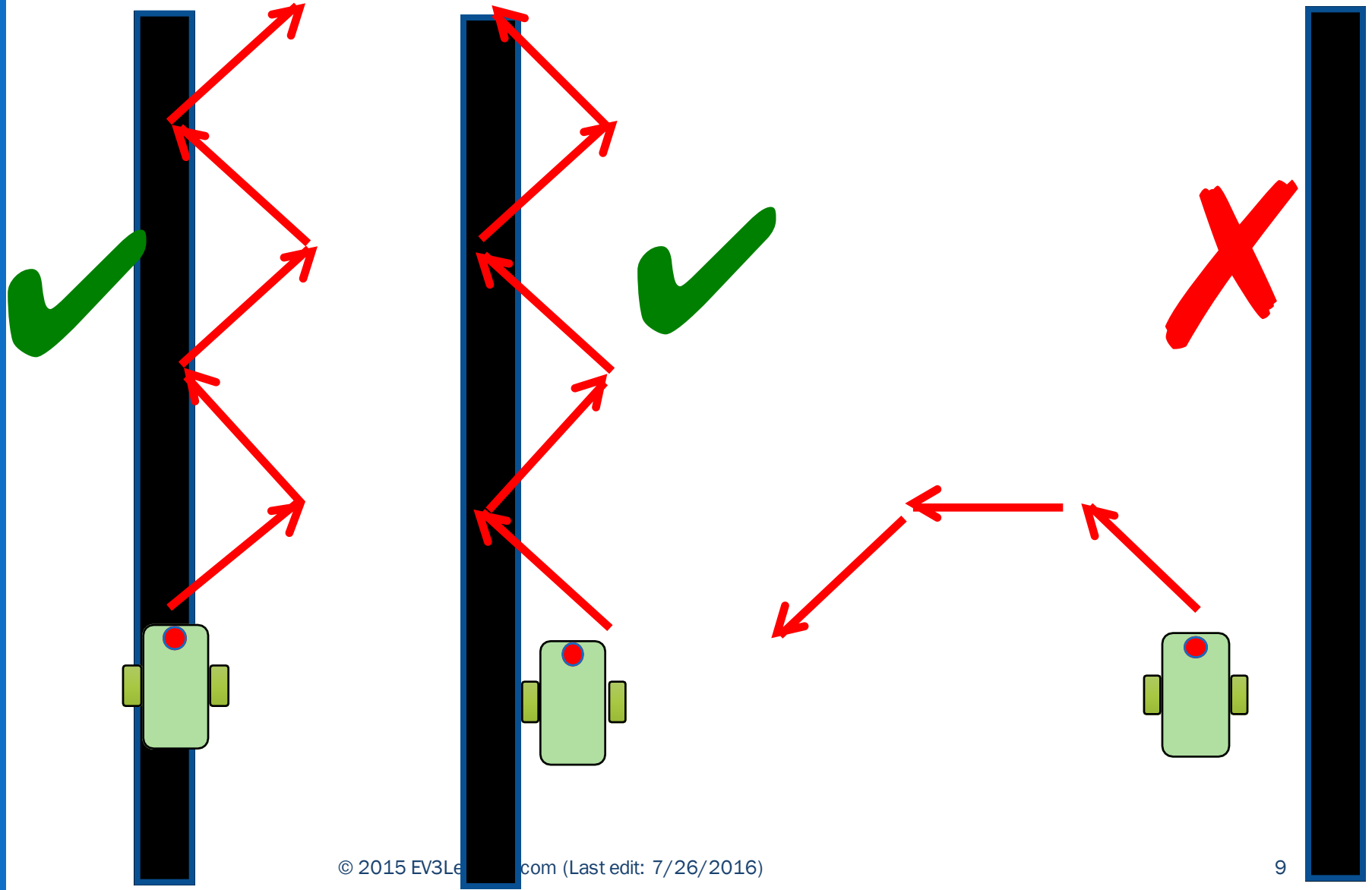
The robot has to choose which way to turn when the colour sensor sees a different colour.

The answer depends on what side of the line you are following!

Right side line following

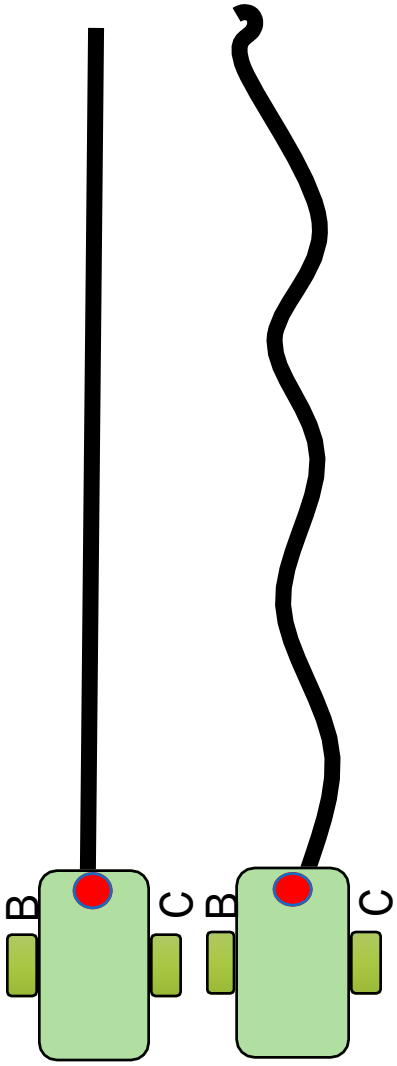


The Correct Side of the Line

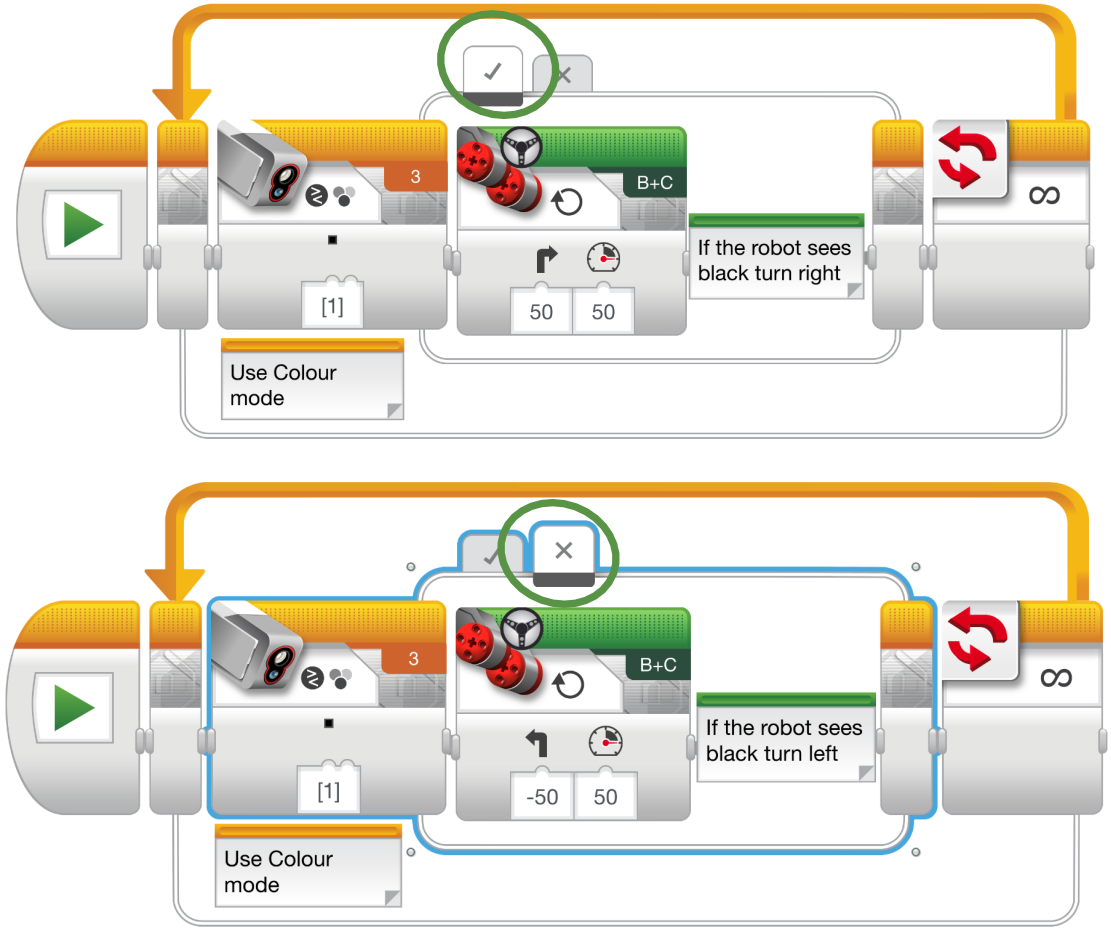


Line Follower Challenge 1

- Step 1: Write a program that follows the RIGHT edge of a line.
- Hints: If your sensor sees black, turn right. If your sensor sees white, turn left. Use loops and switches!
- Step 2: Try it out on different lines.
- Did your line follower work the same on straight and curved lines?
- Step 3: If not, instead of turn Steering = 50, try smaller values.
- Is it better on the curved lines now?



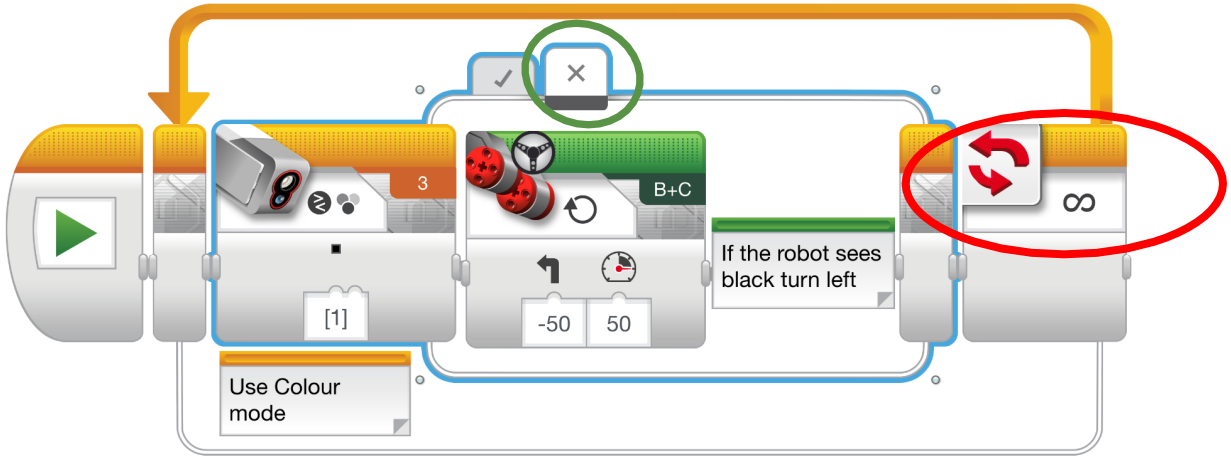
Challenge 1 Solution

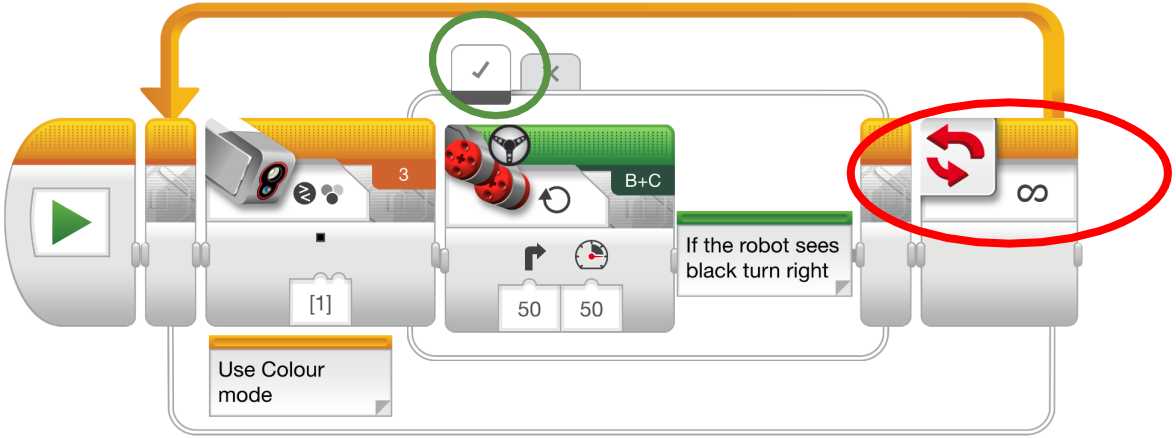


Q. Does this program follow the Right or Left side of a line?

A. The robot is following the Right Side of the line.

Challenge 1 Solution (Cont.)





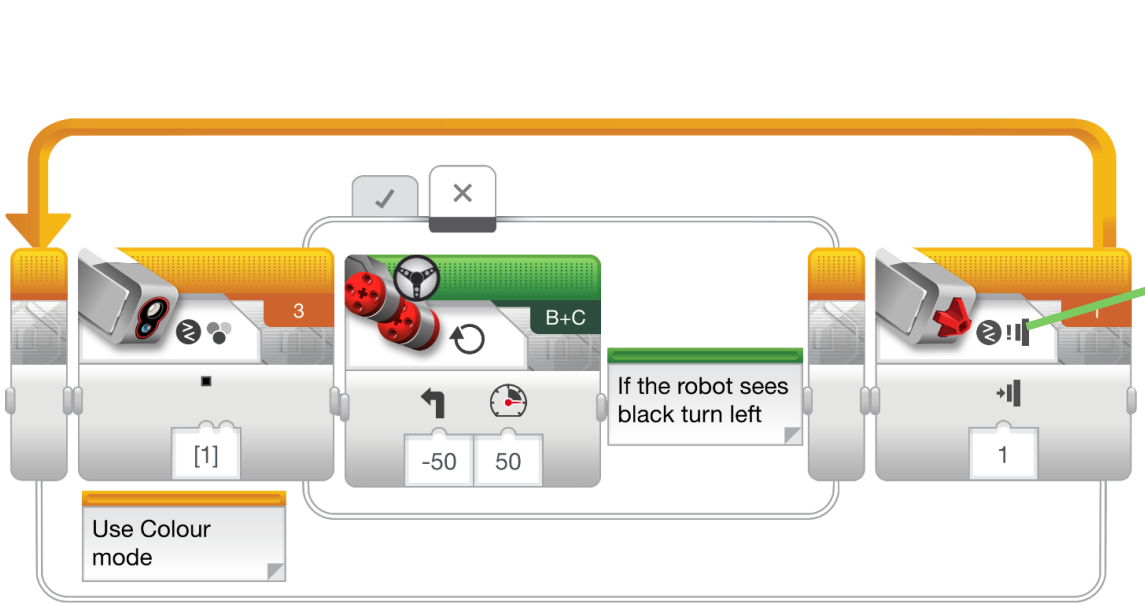
Q. This line follower goes forever. How do we make this stop?
A. Change the end condition on the loop.

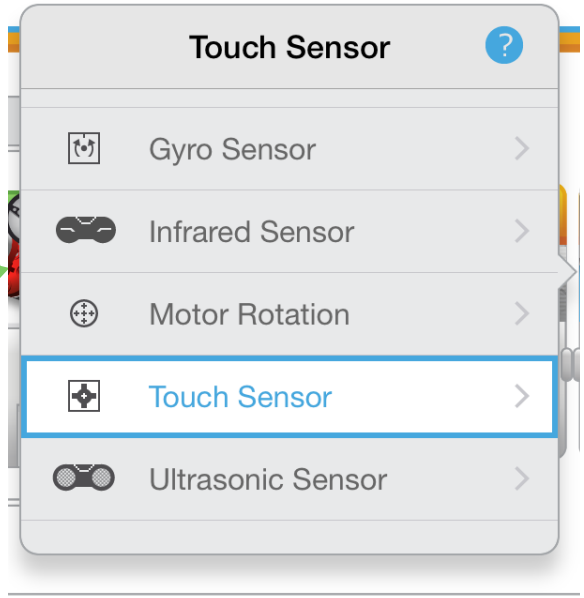
Line Follower Challenge 2

Part 1: Make a line follower that stops when you press the touch sensor

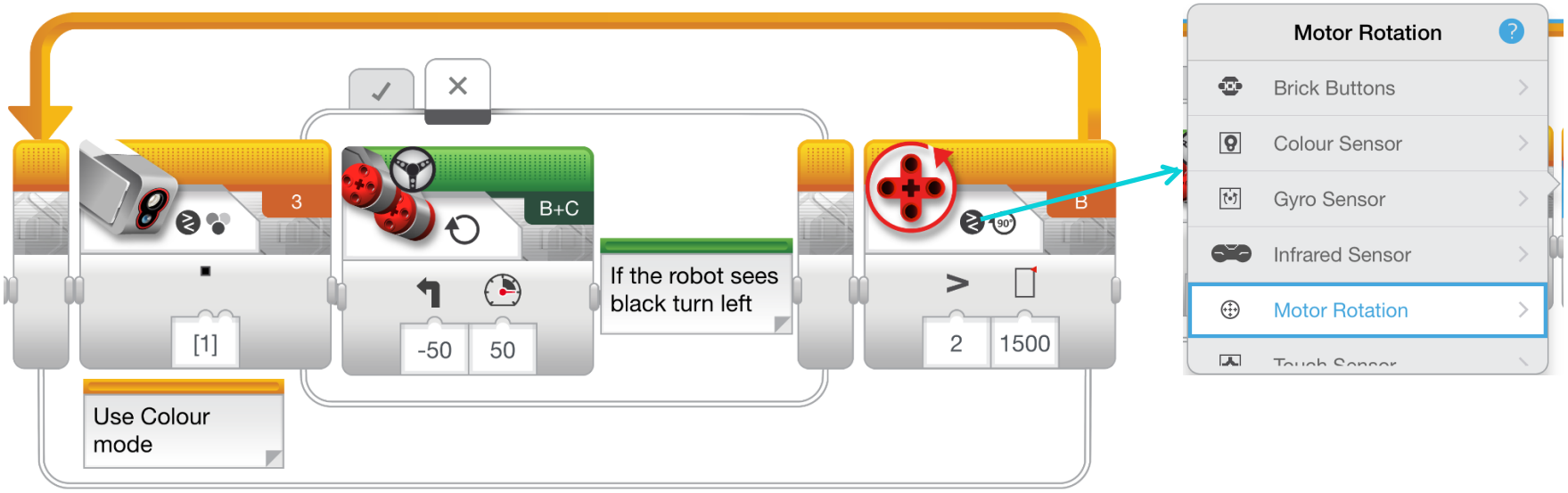
Part 2: Make a line follower that stops after it travels a particular distance

Challenge 2 Solution (Touch)





Challenge 2 Solution (Distance)



Note: You cannot add any block before the line follower (end after distance mode) because there is no rotation reset block

Discussion Guide

- Why is it important for the robot to follow the same side of the line?
  - *The robot only knows to check if it is on or off the line.*
- This is a basic line follower. What are some things that were not good about this line follower? Do you think the line follower can be improved?
  - *It wiggles a lot. Smoother line followers are described in the Advanced lessons*
- What sensor measures how far you have travelled?
  - *The rotation sensor used in Challenge 2 solution measures how much the wheels have turned*
- How would you write a line follower that will stop when it sees a line? Or another colour?
  - *Change the loop exit condition to use the colour sensor.*

Credits

- This tutorial was created by Sanjay Seshan and Arvind Seshan
- More lessons are available at www.ev3lessons.com