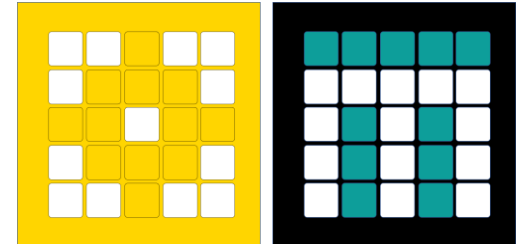


PRIME LESSONS

By the Makers of EV3Lessons



SQUARING ON LINES

BY SANJAY AND ARVIND SESHAN

LESSON OBJECTIVES

- Learn how to get your robot to square up (straighten out) when it comes to a line
- Learn how squaring (also known as aligning on a line) can help the robot navigate
- Learn how to improve initial code for aligning by repeating a technique
- Practice creating a useful My Block

REVIEW

- Move Steering lets you control both motors at the same time
- What if you want to move or stop one motor at a time?
 - Use the Single Motor Commands

```
motor = Motor('A')
```

```
run_to_position()
```

```
run_for_seconds()
```

```
run_to_degrees_counted()
```

```
start()
```

```
run_for_degrees()
```

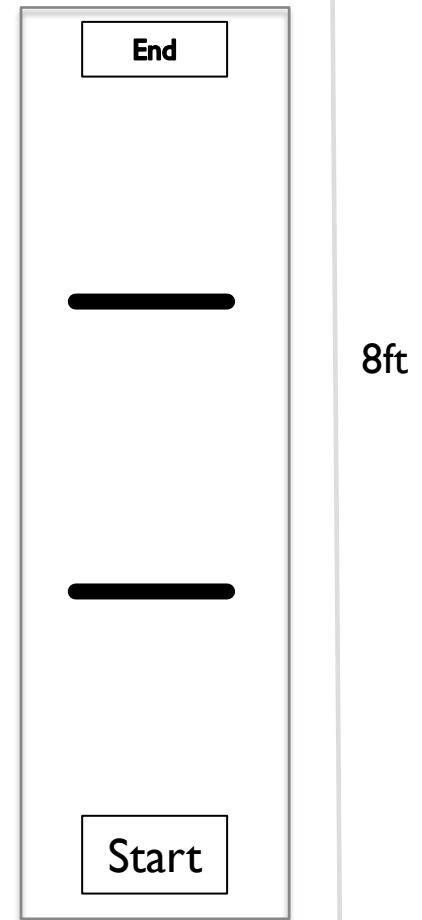
```
stop()
```

```
run_for_rotations()
```

```
start_at_power()
```

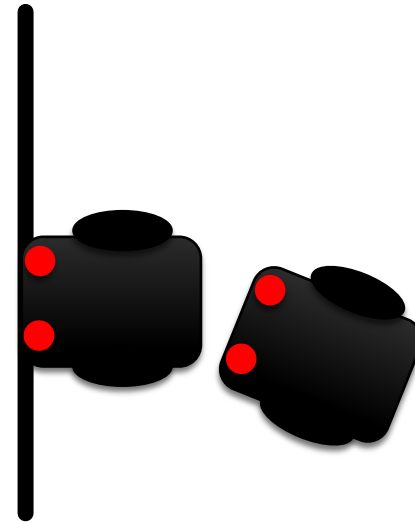
WHY ALIGN/SQUARE ON A LINE?

- Aligning on a line helps the robot navigate
 - Robots get angled as they travel farther or turn (the error accumulates)
 - Aligning on a line can straighten out a robot.
 - Aligning can tell a robot where it is when it has to travel far
- Example Goal: Your robot must deliver an object only inside a small END area. The distance between start and end is 8 feet (~2.5m)
 - Do you think your robot can travel 8 feet and continue to be straight?



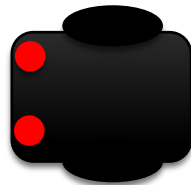
THREE EASY STEPS TO ALIGN

- **Challenge:** Make the robot straighten out (align/square up)
- STEP 1: Start both motors and a loop
- STEP 2: Stop one motor when the sensor on the corresponding side sees the line
- STEP 3: Stop moving the second motor when the sensor on that side sees the line
- STEP 4: Exit the loop
- Hints: Use Single Motors and a loop



NOTES ON THE SOLUTION

- Our solution uses 2 Color Sensors (connected in ports E and F).
- Our solution assumes that the color sensor on port E is next to the wheel on motor port A and color sensor on port F is next to the wheel on motor port B.
- You should adjust the ports as needed
- Your color sensors should NOT be placed right next to each other



BASIC SOLUTION: MOVE UNTIL LINE

```
from spike import PrimeHub, LightMatrix, Button, StatusLight, ForceSensor, MotionSensor, Speaker, ColorSensor, App, DistanceSensor, Motor, MotorPair
from spike.control import wait_for_seconds, wait_until, Timer
from math import *
```

```
hub = PrimeHub()
colorF = ColorSensor('F')
colorB = ColorSensor('B')
```

```
motorA = Motor('A')
motorE = Motor('E')
```

```
motorA.start(speed=-30)
motorE.start(speed=30)    Starts motors
```

```
foundA = False
foundE = False
```

```
while (not foundA or not foundE):
    if (colorF.get_color()=="black"):
        motorE.stop()
        foundE = True
    if (colorB.get_color()=="black"):
        motorA.stop()
        foundA = True
```

Wait for color sensors
to detect black and stop
motors

IMPROVING YOUR CODE

- What do you notice about the solution we just presented?
 - The robot is not always perfectly straight (aligned) at the end of it.
 - Both color sensors are on the line, but the robot stops at an angle if you started at a sharp angle
- **Challenge Continued: Think about how you can improve this code so that the robot ends straighter**
 - **Solution: repeat the align except look for white this time**

CREDITS

- This lesson was created by Sanjay Seshan and Arvind Seshan for Prime Lessons
- More lessons are available at www.primelessons.org



This work is licensed under a [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License](https://creativecommons.org/licenses/by-nc-sa/4.0/).