Lesson Plan 3

Goal: *Create a robot that follows a line.*

Materials Needed: Brookbot with light sensor.

**Part 1: Preliminaries**

A. *The Light Sensor*

First, explain the light sensor to your team. Recall that the light sensor returns a value between 0 and 100, where a larger number corresponds to more light. Point out the red light on the sensor and discuss its use. Remember to talk about ambient vs. reflected light. This would also be a good time to talk about the NXT's view menu, as your team will be using it extensively for this assignment.

B. *Line Following Theory*

To us, line following seems extremely simple, because our eyes and brains make it extremely intuitive. For a robot it is more difficult. Have your team brainstorm how to get a robot with a single light sensor to follow a black line on a white track. Make sure they break it down into a step by step process. They should come up with something roughly equivalent to what we have already done in class: the wiggling method, where the robot turns one way when on the line, and then turns the opposite direction when off the line.

C. *The Switch Block*

Recall that our wiggling method relied on testing the current light value and responding differently depending on the what that value was. Therefore we need to give the students the tool they need to program conditionals: the switch block. Start by showing them a simple program that makes use of the switch block. If you still have your touch sensor attached, you could make use of that:
This program goes forward when the touch sensor is pressed and stops when it is released. Note that the switch block’s options at the bottom are quite similar to the wait block’s options. The code on the top fork is executed if the condition specified in the sensor options holds true; the bottom fork is executed if the condition is false.

Part 2: Line Following

A. **Construction**

If your robot doesn’t already have a light sensor on it, designate someone to mount one low on the Brookbot, facing toward the floor. This should be a quick and easy construction task.

B. **Programming**

Your team now has all the tools it needs to write a line following program. Cut them loose, guiding them along when they need help. Remind your students to use the NXT’s view menu to determine what an appropriate threshold value is. An appropriate threshold is roughly halfway between your average light and average dark values. Below is a sample solution. Note that the code depends on which side of the line you start the robot on. Also note the light sensor’s options, which can be seen on the right of the switch block’s options. You can change the light value that the condition hinges on, and use either greater than or less than. In practice, this is identical to swapping the top and bottom forks of your switch statement. The generate light checkbox makes the light sensor produces the red light that causes reflection.