Pre-lab 1 Due September 10, 2013, at **END** of lab

This prelab must be completed individually (not in groups).

Pre-lab exercise for Lab 1 – Motors and Rotation Sensors

This laboratory has the following objectives:

- Learn how to power and turn a tribot powered by two independently powered wheels
- Understand the various ways power and can be applied (and removed) from a motor
- Understand how the rotation sensors can be used to control movement

This prelab exercise is due at the ***start*** of class. *Late submissions will not be accepted. You may use printed references and online course material from Lego or other schools. If so, list references that were used and attach to end of this report. STAPLE ALL PAPERS BEFORE SUBMISSION.* (Bring an electronic version that you can pull up while working on the lab in class!)

Concept 1: Rotation sensors

The LEGO motors can be commanded via a **Move** function block or a **Sync** function block to rotate for a specified duration in seconds, rotations, or degrees. You can also specify a power level to each motor, which determines the speed at which it spins.

Suppose the LEGO motors powering the tribot are driving wheels 6 cm in diameter. You wish to travel forward 42 cm. When the motors are powered at 100%, they spin at 4 rotations/second. Answer the following questions and show all work.

1) How many rotations must the wheels turn to travel 42 cm?

2) How many degrees must the wheels turn to travel 42 cm?

3) How many seconds must the wheels turn?

Suppose the motors are powered at only 75% of full power and, consequently, spin 3/4 as fast as before.

4) How many rotations must the wheels turn to travel 42 cm?

5) How many degrees must the wheels turn to travel 42 cm?

6) How many seconds must the wheels turn?

7) Power to the wheels also varies with battery level. You may not know the current battery strength in your NXT controller. What are the preferable means to command the tribot to travel a given distance that would not be affected by battery strength? Why?

Concept 2: Turning the tribot

The tribot is driven by two side-by-side wheels, each driven by a different motor. Turning the tribot is accomplished by powering the two wheels at different power levels, and possibly different directions. Suppose the wheels are 5 cm in diameter and they are spaced 16 cm apart, as shown below.

You want to command the **tribot** to spin **in place** (i.e. no forward or backwards movement while turning, spinning about the center of the axle shown above) until the body of the tribot rotates 180 degrees. Power should be applied to both wheels, one in the forward and one in the reverse direction. How many degrees much each wheel rotate for the tribot to turn 180 degrees?

Alternatively, you may want the tribot to spin about one tire -- thus no power is applied to one tire, and power is only applied to the other tire. How many degrees must the powered motor rotate a single wheel in order to spin the tribot 180 degrees?

When programming the NXT, the **Motor** function blocks in the programming environment provide you with complete control of each motor (power, direction, duration or rotations for which block should run). However, in your lab you will use **Move** and **Sync** function blocks, which allow you to control a pair of motors and specify turn directions, making such calculations as these a little less necessary.

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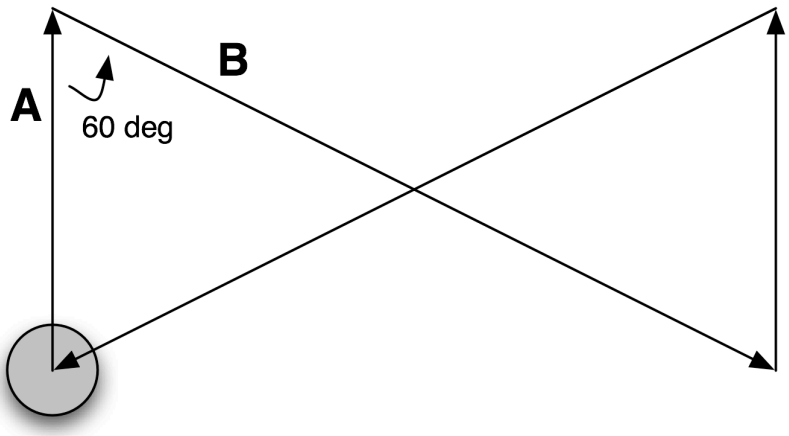
Concept 3: Traveling in a closed loop

In your lab, you will be commanding the tribot to travel a path described in the figure below. Starting at the circle, you most travel forward along each segment and turn to the next segment. The goal is to return to the starting point as close as possible.



1) If segment A is 2.5 meters long, how long is segment B? (the angle indicated is 60 degrees)

2) If the motor requires 8 rotations to travel segment A, how many rotations are required to travel the duration of segment B?

3) How many degrees to the right must the tribot turn at the first turn?

4) How many degrees to the left must the tribot turn at the second turn?