

# Square - NXT

## Overview

### Challenge

Get an NXT car to follow a square path while driving.

### Age Range

8 - 14

### Topics

Rotation Sensors

### Subjects

Math & Science

### Programming Themes

Loops

### Related Math & Science Concepts

Velocity / Speed  
Angles and Geometry

## Building and Programming

### Materials

- NXT Car

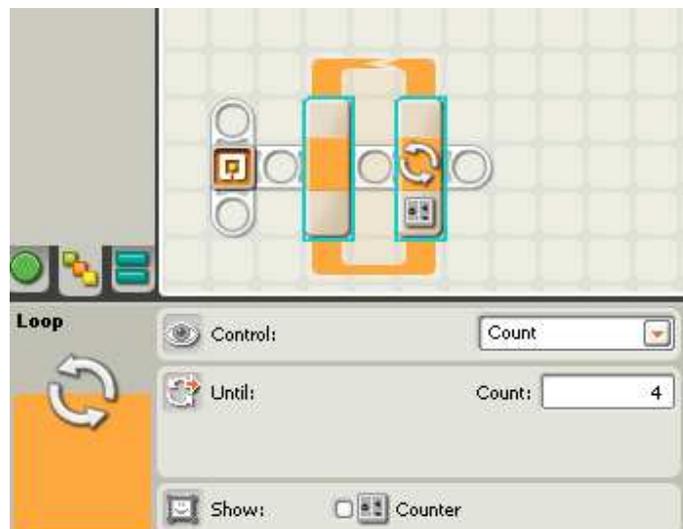
### Building Instructions

1. Build an NXT car.

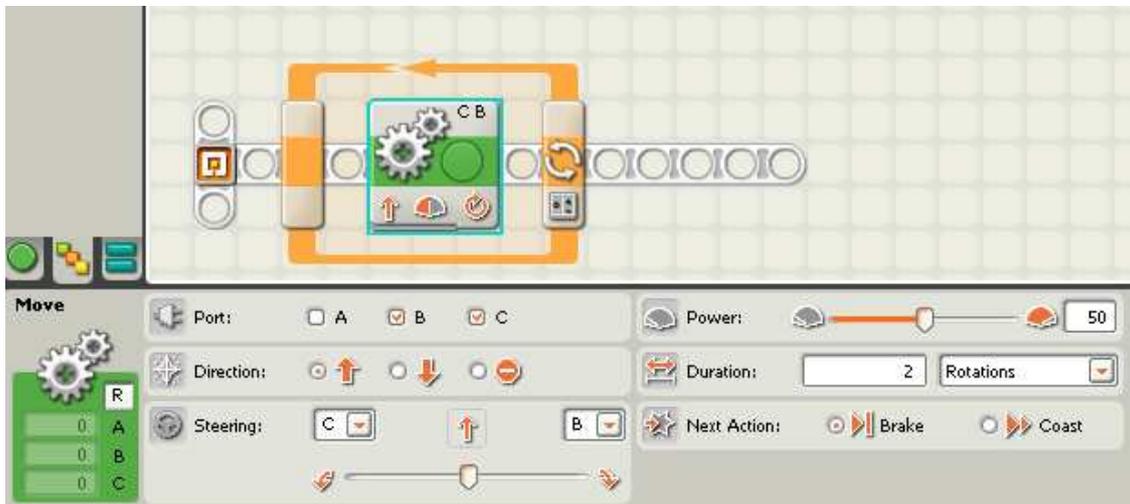
### Programming Instructions

Using Mindstorms NXT-G, program the NXT to move forward for a certain distance, turn 90 degrees to the right, and continue these motions until a square has been completed.

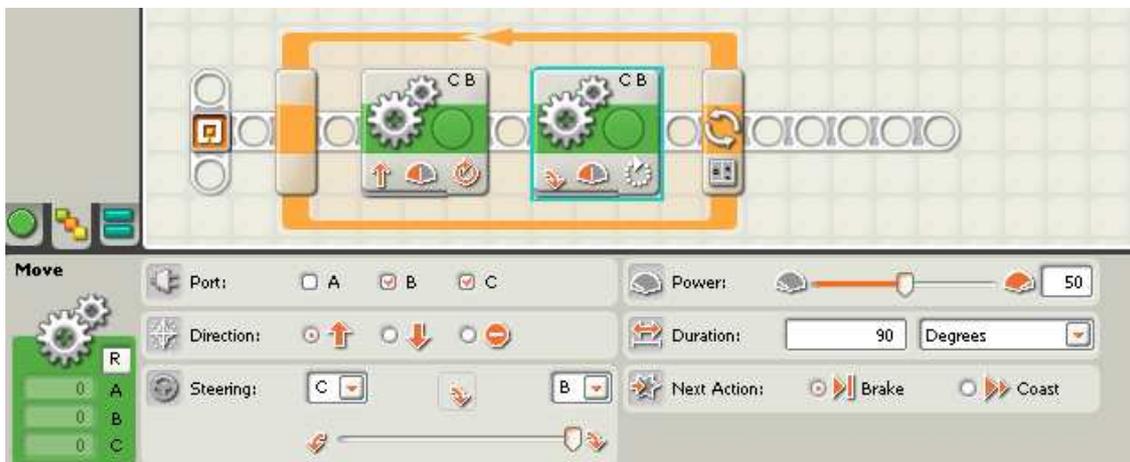
1. Start with a loop, set to repeat four times to make a full square. (Alternatively, set this to any amount to make less than or more than one full square at a time.)



2. Add a "Move" block inside the loop, and program it to move motors B and C (or whichever ports your motors are attached to) forward 2 rotations on power level 50.



3. Add a second "Move" block after the first one in the loop, setting it to move motors B and C (or whatever ports your motors are attached to) to the right for 90 degrees.



## In Action

Place the NXT car on a flat surface, such as a table or the floor – just make sure there is enough room for the car to complete a square without crashing! Run the program, and look at the shape of the car's path, and how many times the car completes that path. The car should complete one full square using the included instructions and sample program, "NXT-G\_Square.rbt".

## Resources/Help

### Related Activities

- Proportional Control
- Rotation Sensor Challenge
- Going the Distance – NXT
- Poor Man's Rotation Sensor

### Building & Programming References

- The NXT
- NXT-G\_Square.rbt

### Knowledge Base

- What is the difference between the Motor block and the Move block?
- How do I create a loop in NXT-G so that I can repeat one sequence of events over and over?

## Classroom Management

### Procedure

1. Set up a testing area for the cars, making sure there is as much open space as is practical so that the cars can complete their paths.
2. Begin the lesson with a description of how a square is formed geometrically, focusing especially on right angles. Other shapes' angles can be explored as well.
3. Each NXT brick should be programmed in Mindstorms NXT, either by the students if time permits or before the activity starts.
4. Each student or group of students should have an NXT car. They can build this themselves if time permits, or the cars can be built beforehand.
5. Have each student or group of students test their robot's ability to complete a square and end up where they started. If possible, allow them to make changes to the program's parameters – especially important items to change are the power levels (originally set to 50) and the angle values on the second Move block. These levels may respond differently on different surfaces such as wood, tile, or carpet, and may need to be adjusted to properly complete a square.
6. Collaborate as a class and compile a list of changes that might be helpful to the program, or what could be done to the robot itself to make it more able to complete a square and return to where it started.
7. Try out some ideas if the class is motivated and able to, or wrap up by talking about the activity and additional uses of robots returning to where they started, in manufacturing of cars or machines for example.