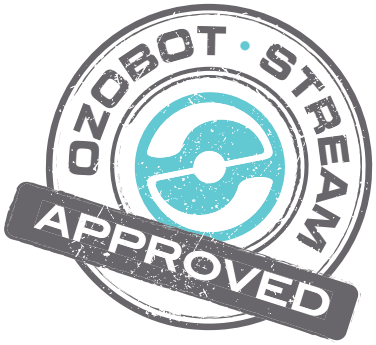

Challenge: Random Walk on Cartesian Plane with Turn Counts

Created by

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Topics

Math (coordinate system, random numbers)

Programming (algorithm design)

Ages

Grades 7-12

Duration

Approx. 60 min

Challenge:
Random Walk on Cartesian Plane with Turn Counts

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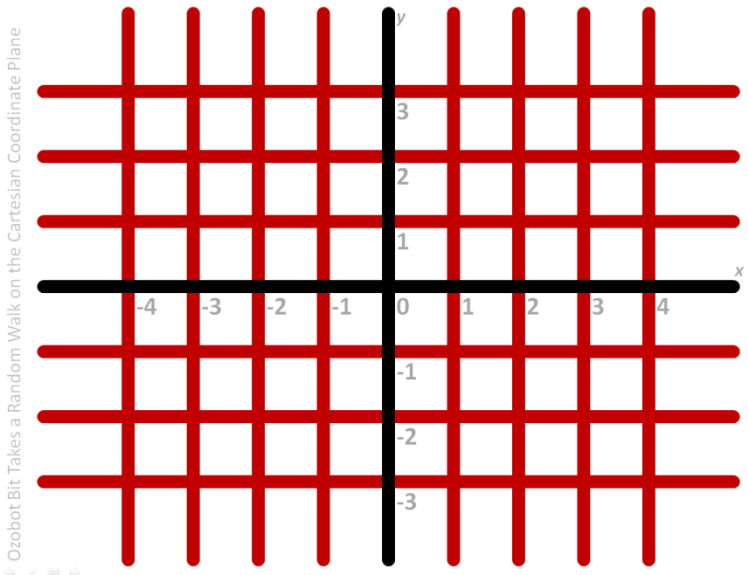
A random walk is the path that results from a succession of random steps. Random walks can be made on a one-dimensional number line, a two-dimensional lattice such as the Cartesian coordinate system, and even in three dimensions are higher. The study of random walks has been applied to many fields including economics and modeling of share prices, physics and Brownian motion of molecules of gasses or liquids, and in computer science to estimate the size of the World Wide Web, just to mention a few.

Ozobot Bit can be easily programmed to take random walks, and it is fun to watch him as he moves about. You may have worked with the Random Walk program found in the OzoBlockly Examples. In that random walk, Ozobot does his walk using free movement. In this challenge, you will be programming Ozobot Bit to take a random walk using line-following on a finite Cartesian coordinate plane. Programming it is a tad easier if the plane is infinite in all directions, but such a plane is difficult to draw on a piece of paper.

Program Ozobot Bit to take a 40-step random walk on the Cartesian coordinate plane using the printout on the last page of this document. A small version is shown in the figure below for ready reference while studying the challenge program requirements.



Program Requirements:

1. Use Mode 4 (Advanced) or higher for programming this challenge.
2. Ozobot should be moving fast (65 mm/s), though you might want him to move slower while you are building and debugging your program.
3. Make sure that Ozobot Bit is calibrated on paper prior to running the program.
4. Ozobot Bit should initially be placed on the Cartesian plane's origin at (0, 0) facing in the positive y direction.
5. To start the program, press the start button twice.
6. All steps are to be one Cartesian unit long.
7. Ozobot Bit's first step will be to move straight from (0, 0) to (0, 1). Thereafter, his remaining 39 steps should be random. While he is within the coordinate plane, he should move either:
    a. One step straight ahead.
    b. One step to the right.
    c. Or one step to the left

    each of the above three with equal probabilities.

8. The only time Ozobot Bit should move "back" is when he reaches any of the line ends at the top, bottom, left, or right of the maze.
9. When Ozobot Bit has completed his 40-step random walk, he should immediately stop and then blink the number of right, left, straight and back turns that he executed during the walk:
    a. The number of right turns should be displayed by blinking the LED a BLUE color the number of times a right turn was made during the random walk.
    b. The number of left turns should be displayed by blinking the LED a YELLOW color the number of times a left turn was made during the random walk.
    c. The number times that Ozobot moved straight ahead should be displayed by blinking the LED a VIOLET color.
    d. The number of times that Ozobot executed a "back" move should be displayed by blinking the LED an AQUA color.
10. Note that as a check, the sum of the four counts should be 40.
11. After displaying the four counts Ozobot Bit should turn off.

Ozobot Bit Takes a Random Walk on the Cartesian Coordinate Plane