

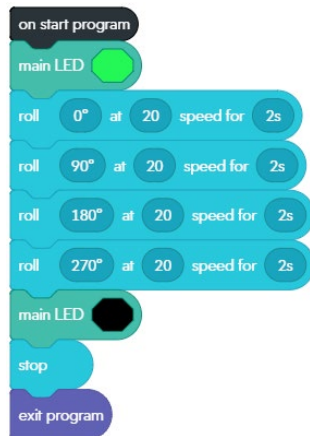
Come Back, Sphero?

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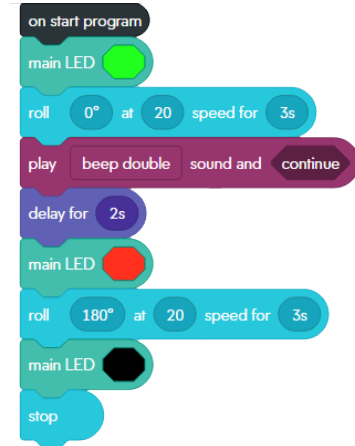
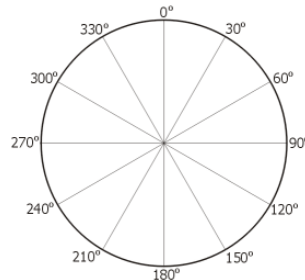
Can We Make Sphero Come Back?

Yes! There's a program at the right. We'll talk about it in class.

Can We Make Sphero Travel a Square?



Yes again! In order to do that, we must understand that Sphero's idea of direction is expressed as a *heading* expressed as the number of degrees from "north" on a circle.



Variables, Constants, and Data Types

In computing, a *variable* is a named area of memory that holds a value. So, variables have a *name* and a *value*. The name can usually be whatever the programmer wants. Variables can change value as a program runs.

A *constant* has a value, but usually not a name. The value is established by the programmer and does not change as a program runs.

Everything in a computer's memory is just ones and zeros. The bits 01000001 can represent the number 65, the capital A, or part of something else. To help programmers keep track of what the bits in a given area of memory mean, programming languages introduce the concept of *data type*, or just *type*. The block language for programming the Sphero defines four data types.



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- **Number:** A variable that is a number can hold either an *integer* (counting number) or a number with a decimal point, called a *floating-point number*. Examples are 1234 and 3.14159
- **String:** A string variable can hold letters, numbers, and punctuation. Examples are “Hello, World!” and “2190 Wallingford Drive.” The length of a string variable can change as a program runs.
- **Boolean:** Boolean variables can hold only the values True and False. Boolean variables are named for George Boole, an 18th Century British mathematician and philosopher who did work on the mathematics of True and False. They’re used for answering questions like, “Have we done this ten times yet?”
- **Color:** A color variable can hold information about both color and brightness.

Loops

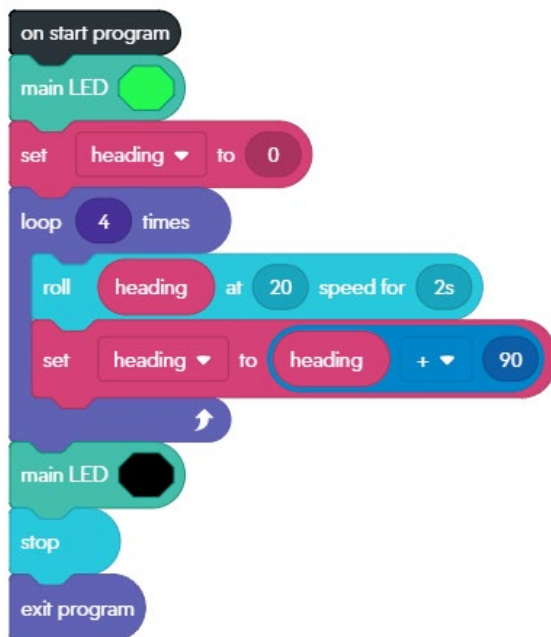
In computer programming, a loop repeats the same action, possibly with different data. A loop lets us avoid repeating the same block over and over like in the program to draw a square.

In Sphero’s programming language, we can make loops run forever, which really means until the program is stopped, or for a certain number of times, or until some condition becomes true.

The computer science work for loops is *iteration*.

Refactoring the Square Program

Refactoring means changing a program to make it faster, more efficient, or easier to understand. Let’s refactor the Square program to use a loop.



The thing that changed in the four “roll” blocks of our first program to draw a square was the heading; everything else was the same. So, we will make a variable called *heading*. We had four “roll” blocks before, so we want our loop to run four times.

We start with heading set to zero and command Sphero to roll. The difference in headings for the four sides of the square was 90 degrees, so after each roll, we add 90 to the *heading* variable.

Thought Challenges

What is the value of *heading* when the program ends?

Could you make the same program draw a triangle? What would you need to change?