

ZERO ROBOTICS

ISS PROGRAMING CHALLENGE

Getting Into CS





Now that you have had a chance to experience how computers operate, you are going to learn some specific programming concepts. These include:

- Variables
- Data types
- Loops
- Conditional statements



Let's start with a short debrief of the sandwich activity:

- We used *the English language* to create a series of instructions (the program) to 'act on' the materials or 'data' (e.g., bread, jelly, and so on) to produce a certain output or result (a sandwich).
- In computer science *a programming language* helps a programmer make a computer do things. The program is a set of instructions that tells a computer what to do with certain data and how to do it to produce a certain output.
- A program usually contains different types of data to represent numbers, letters and so on. Programs need a way of 'remembering' the data they are given; this is usually done by creating variables and putting data into them.



What is a variable?

- Imagine that a variable is a box that carries a certain value.
- You can take the value out of this variable 'box' and put in a new one.
- You can look up the value in the box and do things with it.
- You can take the values from other boxes and put them in this box.



In most programming languages, you need to declare variables before you use them.

- Means that you make the boxes that you want to store values in.
- Just like in real life, boxes come in all shapes and sizes—and you need the right box for the object you are going to put in it.
 - For example: You cannot fit a bicycle into a jewelry box, right?
 - In programming you have to have the right “size” box for the “size” of your data.
 - Some boxes can't store certain values beyond their limits (data type).



Let's look back at *Getting to Know the ZR IDE*. How would you go about changing the value of the variables in this tutorial?
(Hint: You assign it a different value!)



```
void loop ()  
{  
  Y = 1.5;  
  setPos (0, Y, 0);  
  return;  
}
```

Becomes

```
void loop ()  
{  
  Y = 2.5;  
  setPos (0, Y, 0);  
  return;  
}
```



- In mathematics, there are various ways of representing numbers and other data:
 - different types of numbers (e.g., whole numbers and decimals, positive and negative numbers)
 - sets of data like coordinate points and vectors
- In programming, any piece of data used must be ‘declared’ to tell the computer to store and use it.
 - If you don’ t type in a declaration of your data prior to using it, your computer will output an error.
 - All declarations use the following structure:
 DataType Name;



Example: **float distance**;

- This declaration, is telling the computer the **type of data** it will process—something known as a ‘float number’ —and the **name of the data** that will be processed—in this case, data measuring a distance.
- In the sandwich activity, the data is the materials (peanut butter, jelly, and bread), and the instructions telling the performer what to do with the ‘data’ constitutes the ‘program’.



- Remember the analogy about boxes? Well, when you are writing a computer program, you often want the program to be able to “remember” a value. You can do this by assigning the important value to a named variable.
- Each variable has a name and contains a value. For example, a variable can be named X and contain the value 2. Thus you can say $X + X$ equals 4. Variables are categorized by the types of data they store. You must tell the computer what type of data you will be putting in the variable. Attempting to put data of the wrong type into a variable will cause an error.



**In the last activity, you were asked to write instructions to make ONE sandwich. How would you write instructions for making hundreds of sandwiches, for example, in a cafeteria?
(To make things simpler, you can assume you have unlimited supplies of the materials!)**

Let's start by looking at the final instructions for making sandwiches again.



- a) Take a slice of bread
- b) Open the jar of peanut butter by twisting the lid counter clockwise
- c) Pick up a knife by the handle
- d) Insert the knife into the jar of peanut butter
- e) Pull the knife out of the jar of peanut butter and run it across the slice of bread
- f) Take a second slice of bread
- g) Repeat steps a–e with the second slide of bread and the jar of jelly
- h) Press the two slices of bread together such that the peanut butter and jelly meet



Can you think of one additional instruction you can add to these instructions to tell the ‘performer’ or a computer how to make 100 sandwiches?

Example Answer to Activity Introducing Loops



- a) Take a slice of bread
- b) Open the jar of peanut butter by twisting the lid counter clockwise
- c) Pick up a knife by the handle
- d) Insert the knife into the jar of peanut butter
- e) Pull the knife out of the jar of peanut butter and run it across the slice of bread
- f) Take a second slice of bread
- g) Repeat steps a–e with the second slide of bread and the jar of jelly
- h) Press the two slices of bread together such that the peanut butter and jelly meet
- i) Repeat Steps a-h 99 more times***

Activity Introducing Conditionals



Suppose the cafeteria serves PB&J sandwiches every day except on Fridays, when it serves both sandwiches and pizza.

Since most students would rather eat pizza, the cafeteria should make fewer sandwiches on Friday.

How could you change your program to make fewer sandwiches only on Fridays?

Example Answer to Activity Introducing Conditionals



- a) Take a slice of bread
- b) Open the jar of peanut butter by twisting the lid counter clockwise
- c) Pick up a knife by the handle
- d) Insert the knife into the jar of peanut butter
- e) Pull the knife out of the jar of peanut butter and run it across the slice of bread
- f) Take a second slice of bread
- g) Repeat steps a–e with the second slide of bread and the jar of jelly
- h) Press the two slices of bread together such that the peanut butter and jelly meet
- i) Repeat Steps a-h 99 more times unless today is Friday
If today is Friday, repeat steps a-h 29 more times***