**Virtual Initio Programming: Basic Data Types**

**AIM:** After completing this worksheet you should be able to describe the basic data types from Python, and some useful functions for manipulating them.

**You Need:** To complete this worksheet you need to have a virtual Initio simulator (see WS1), and to be able to use files to store Programs (WS5). You also need to know the commands to operate the Initio motors and sensors (WS3 & WS4). You should be able to use If statements (WS7), while loops (WS8 & WS10), variables, numbers (WS12) and strings (WS13) in Python programs.

**If the simulator isn’t already running: Start the Simulator, Select the Initio Simulation and default\_world.xml, then start IDLE (open a *new IDLE window* if you have used IDLE to start the simulator).**

We’ve met several different *data types* already in these worksheets:

**Integers** Whole numbers such as 1, 2, 340 and so on

**Floats** Real numbers with decimal points such as 1.5, 2.73

**Strings** words such as ‘forward’, ‘Y’, “hello world!”

**Booleans** True and False

It is also possible to represent complex numbers in Python, but we do not consider those here.

**Doing Mathematics: Integers and Floats**

You can do normal mathematics with integers and floats using the following symbols:

|  |  |
| --- | --- |
| + | Plus |
| - | Minus |
| \* | Times |
| / | Divide |

Consider the following program:

import simclient.simrobot as initio

import time

initio.init()

count = 0

total\_distance = 0

while (count < 20):

 total\_distance = total\_distance + initio.getDistance()

 time.sleep(3)

 count = count + 1

print("The Average Distance is: " + str(total\_distance/count))

**Question 1:** What is printed out when you run it? (It takes 1 minute to run)

**Question 2:** Now add a block to the work and run the program again moving the block backward and forward in front of the virtual Initio? What is printed out?

**Exercise 1:** Modify the program so that it prints out the total distance measured over 10 measurements.

**Exercise 2:** Write a program that will take readings from the distance sensor until a total distance of over 1000 has been measured and then prints out the average distance per reading.

**Working with Strings**

In Python strings are surrounded by either single or double quotes. But what do we do if we want to include a quote symbol in a string?

We use an *escape* which is the backslash symbol \. So, for instance we can use \” to include a double quote symbol in a string:

Try running the following program:

import simclient.simrobot as initio

name = input(['Please enter your name'])

print("Hello \"" + name + "\"")

**Question 3:** What happens?

You can also use the escape symbol to create special characters like new line symbols and tab symbols.

|  |  |
| --- | --- |
| \n | New line |
| \t | Tab |

**Exercise 3:** Write a program that uses new line and tab to ask someone their first name and then their surname then prints Hello followed by a tab then their first name and then prints their second name on a new line.

**Casting**

Remember that you can use the function **str** to turn a number into a string for printing. This is called *casting* from a number to a string. In the same way you can cast from a string to a number using **int** and to a float using **float**

**Exercise 4:** Write a program that asks the user to enter an integer. It then multiples that integer by 100 and prints out the result.



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