EMAT10007 – Introduction to Computer Programming

Exercises – Week 1. Introduction to Python, Variables and Operators

1.1 Introduction

Getting Started

- [**If completing these exercises off-campus/on your personal laptop:** install Anaconda by following the instructions in the links on blackboard **or** use remote desktop to access a lab computer.]

- Open Anaconda Navigator from the programs menu (if available) **or** by opening a terminal from the programs menu. If working on a University Linux lab computer, open the terminal application, type or copy-paste the following line and press enter:

  ```
  /opt/anaconda/2020.07/bin/anaconda-navigator
  ```

- Launch Spyder IDE from the Anaconda Navigator window by clicking on the Launch button next to the Spyder logo - we will use Spyder to write and run Python code.

- Complete the exercises using the Spyder IDE, save your work as a .py file.

- Try to complete all of the **Essential** questions in the lab.

- Complete any unfinished **Essential** questions for homework before the next class.

- The **Advanced** questions are optional. You may attempt these if you have finished the Essential questions.

Creating, saving and opening Python files in the Spyder IDE

- To create a new Python file click "File" and then "New File".

- Write some code.

- To save a Python file click "File" and then "Save".

- If this is the first time you are saving the file, you will be prompted to choose a file name and location. Name your file and save it somewhere appropriate with .py extension.

- Next time you open Spyder, you can access the file by clicking on "File" then "Open", and then navigating to where your file is stored.

Rules for naming variables

- Variables can be assigned values

- Variable names may contain letters or numbers

- Variable names must begin with a letter

- Variable names are case sensitive (`time` is not the same as `Time`)

- The value of the variable can be re-assigned. If we have `x = 1` in a program followed by `x = 2`, the original value of `x` will be overwritten with the new value, 2.

- We can also assign multiple variables on the same line.

  ```
  x, y = 5, 10
  ```

- Some `keywords` are reserved by the Python language and cannot be used as variable names. For a full list of keywords reserved by Python, enter the following in Spyder and press Run:

  ```
  import keyword
  print(keyword.kwlist)
  ```

1.2 Variables

Essential Questions

Exercise 1 - Numbers and Arithmetic Operators

Python can be used as a calculator. You can input operations, and store the results of operations as variables for use in additional calculations.

1. Create two variables, `A` and `B`, and assign a numerical value of your choice to each of these variables.

2. Calculate the sum of `A` and `B` and print the result in the Console window in Spyder.

3. Calculate the product of `A` and `B` and store the result as a new variable (avoid variable names `C` and `D` as we will use these later in the exercises).

4. Overwrite the value of the variable you just created with the value $\frac{A+B}{3}$.
   Hint: Python follows the same ordering of mathematical operations as any other calculator.

5. Find the remainder when `A` is divided by `B` and print the result..

6. Write a program that stores the radius of a sphere as a variable, then finds the volume of the sphere as a new variable.

7. In a single line of code, create 3 variables for the length, width and height of a cuboid. Then, write a program to store the volume of the cuboid as a new variable.

Exercise 2 - Strings

Strings are text data.

1. Create two variables `C` and `D`. Assign the value '`Hello`' to `C` and the value '`World`' to `D`.
2. Use arithmetic operators on these variables to create a new string variable with the value: '`Hello World`'
3. Print the third letter of `C`.
4. Print the last three letters of `D`

Advanced Questions

(A) Practise expressing some simple mathematical expressions of your own using arithmetic operations.

(B) What happens if you use arithmetic operators on Boolean (`True` or `False`) values?

1.3 Operators

Essential Questions

Exercise 3 - Comparison Operators

Comparison Operators output a `True` or `False` (Boolean) value.
Use variables `A`, `B`, `C` and `D` defined in Exercises 1 and 2 for these exercises.

1. Write a line of code that prints `True` in the Console window in Spyder if variable `A` is greater than `B`.
2. Write a line of code that prints `True` if the `type` of `A` is the same as `B`. Can you change the value of `A` and/or `B` to output a different result?
3. Write a line of code that prints `True` if the first letter of `C` is the same as the first letter of `D`. Change the value of `C` and `D` to check your code works as expected.
4. Write a program that compares the volume of a sphere found in Exercise 1.6 the volume of the cuboid found in Exercise 1.7 and outputs a message telling the user which is larger e.g.

   '`The volume of the sphere is greater:  True`'
   '`The volume of the cuboid is greater:  False`'

Exercise 4 - Logical Operators

Logical Operators output a `True` or `False` (Boolean) value.
Use variables `A`, `B` Exercise 1 for these exercises.

1. Write a line of code that prints `True` in the Console window in Spyder if both variables `A` **and** `B` are even.

2. Write a line of code that prints `True` if either variable `A` **or** `B` is even.

3. Create three variables in a single line of code. Each variable should be the name of a student and the value of the variable should be their score in an imaginary assignment e.g `Valentina = 75`. The pass mark for the assignment is 40. Write a program that outputs `True` if any of the three students passed the assignment.

Advanced Questions

(A) Write a program that sorts animals into three categories: herbivores, carnivores and omnivores based on two variables that indicate if the animal eats plants and/or eats meat.

(B) Create a variable with a numerical value. Write a program that prints `True` if the number is a square number or perfect square (the product of some integer with itself).

(C) Write a program, like the example shown in today's class, based on your own typical day, that tells you what action to do based on the time of day.

Checklist

- Check that you understand the basics: variables, different types of variables (numbers (integers, floats), Booleans, strings), the different types of operators, and how these work with both numbers and strings.

- Finish any incomplete Essential exercises for homework.

- Attend the drop-in session for one-to-one support from a Teaching Assistant if there was anything you didn't understand.