EMAT10007 – Introduction to Computer Programming

Exercises – Week 1:
Objects, variables and operators

Getting Started: Pycharm IDE

Open PyCharm on linux lab computers

- Scroll down to bring up log in screen and log in with your UoB user name and password.
- Click activities (top left corner) to bring up the side panel.
- Click the grid of 9 dots to bring up applications.
- Choose JetBrains PyCharm
- When prompted about the user agreement click accept and read

Create a new project and Python file

- Click New project or File >> New project >> Pure python
- Unselect 'Create a main.py welcome script'
- Note the file location:
  /home/**UoB_username**/PycharmProjects/**your_projectname**/venv
  where **UoB_username** is your UoB username and rename **your_projectname** to be a name of your choice e.g. EMAT10007_exercises
- Right click on the folder icon with project name next to it (top left of window).
- Choose new >> python file
- Give your file a name e.g. week_1_exercises.py

Write and run code

Type some code and click the green play arrow at the top to run.

Save your project

File >> Save all to save your wor

Open a project you created previously

Click File >> Open >> /home/**UoB_username**/PycharmProjects/**your_projectname**/venv, Open >> New window

Rules for naming variables

- 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`)
- 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 run the following comand in the editor you are using:

  ```
  help("keywords")
  ```

- Use a consistent naming convention:
  - `snake_case`: lower case letters, words separated by underscore (_)
  - `camel_Case`: first letter of each word capitalised, excluding first word
  - `Pascal_Case`: first letter of each word capitalised

Exercise 1 - Objects and Variables

1. Create two variables, a and b and assign an integer value to each variable. Calculate the product of a and b and print the result.
2. Create two variables, c and d and assign a floating point value to each variable. Calculate the difference between c and d and store the result as a new variable, e. Print e.
3. Overwrite the value of the new variable you just created with the value $\frac{a+b}{3}$.
4. Find the remainder when c is divided by d and print the result..
5. Cast c as an integer
6. Cast b as a string
7. Cast a as a Boolean

8. Create a new variable, f and assign a string value to it
9. Print the last character in the string assigned to f
10. Create two variables, g and h and assign a string value to each variable. Connect the two strings using the addition (+) operator. Can you work out how to separate the two strings with a space when connecting them? .

Exercise 2 - Arithmetic and Assignment Operators

1. Create a variable, a, with a numerical value. Reassign the value of a so it is 3 times its original value.
2. Write a program that finds the volume (V) of a sphere with diameter 30cm as $14138.\dot{9}\text{cm}^3$, then displays the value with the correct units.
   Volume of a sphere:
   $$V = \frac{4}{3}\pi r^3$$
   r = radius. Assume $\pi = 3.142$
3. Find the Euclidean distance, d between two points with 3-dimensional position vectors $\mathbf{a} = [5.0, 4.5, 2.0]$ and $\mathbf{b} = [10.6, 11.5, 6.2]$ as 9.90 (to 2 d.p.) using
   $$d = \sqrt{(x_a - x_b)^2 + (y_a - y_b)^2 + (z_a - z_b)^2}$$

Exercise 3 - Comparison and Identity Operators

Create three variables x=1.2, y=3.3 and z = 4.0.

1. Write an expression to test if x is greater than or equal to y
2. Write an expression to test if x multiplied by 3 is less than y
3. Write an expression to test if the object type and value of x is the same as y
4. Write an expression to test if x is less than y, and y is less than z
5. Write an expression to test if y is less than both x and z
6. Write an expression to test if the sum of x and 2.1 is equal to y

Change the values of x, y and z to verify that the expressions you have written still work

Exercise 4 - Logical Operators

Create four variables u=2, v=-4, w = 1 and x=5

1. Write an expression to test if u is greater than v and w is less than x
2. Write an expression to test if v, w and x are all smaller than u
3. Write an expression to test if at least one of v, w and x are greater than u.
4. Write an expression to test if x divided by 2 is less than or equal to u - 1.2
5. Write an expression to test if the value of any of the variables are negative

Change the values of u, v, w, and x to verify that the expressions you have written still work

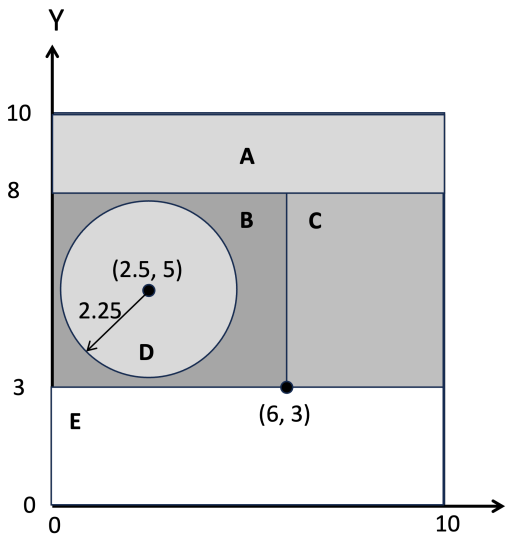

Figure 1: Map

Exercise 5 - Putting it all together

A point lies on a map (Figure 1). Each region excludes its outer boundary. For a given point (x,y) where x and y are each a floating point number in the range (0, 10).
Hint: The equation of a circle with centre (a, b) and radius r is:

$$r = \sqrt{(x-a)^2 + (y-b)^2}$$

1. Write an expression to test if the point is in region A
2. Write an expression to test if the point is in region B
3. Write an expression to test if the point is in region C
4. Write an expression to test if the point is in region D
5. Write an expression to test if the point is in region E
6. Combine these statements in a different order to minimise the number of times you need to code each comparison explicitly.