Lab Questions: Lab Session 4

Deadline: 13.09.2017 11:59pm SGT

Complete all assignments below. For those questions that are marked with an asterisk *, i.e. questions 6 and 10, create the script files as requested. Once you are done with it, submit the file via `iNTU`.

Important!!! Make sure your scripts work properly, as we give 0 marks otherwise. Please name the scripts according to the requirements, and upload each file separately and not in a Zip file or similar. The submission system closes at the deadline. Hence after that, you will get no marks for your solution.

1. Write a simple script called `spherevolume.py` that will calculate the volume of a sphere by the formula

$$V = \frac{4\pi}{3} r^3$$

   where r is the radius of the sphere. In the script, assign a value to a variable `r` for the radius. Then, using this variable, compute the volume and store it in `vol`. Include comments in the script to clearly explain what you are doing.

2. The atomic weight is the weight of a mole of atoms of a chemical element. For example, the atomic weight of oxygen is 15.9994 and the atomic weight of hydrogen is 1.0079. Write a script that will calculate and print the molecular weight of hydrogen peroxide, which consists of two atoms of hydrogen and two atoms of oxygen. It is up to you how to name the input and the output variables. Include comments in the script.

3. Write an input statement that will prompt the user for the name of a chemical element as a string. Then, print the length of the string.

4. Test your knowledge and understanding of the `print` function for integers (give both the old-style and new style formatting answers). Use `print` function to print the integer 12345,

   (a) without specifying any field width
   (b) in a field width of 5
   (c) in a field width of 8
   (d) in a field width of 3

5. Test your knowledge and understanding of the `print` function for real numbers or float (give both the old-style and new style formatting answers). Use `print` function to print the real number 12345.6789,

   (a) without specifying any field width
   (b) with 7 decimal places
   (c) in a field width of 10 with 4 decimal places
   (d) in a field width of 10 with 2 decimal places
   (e) in a field width of 6 with 4 decimal places
   (f) in a field width of 2 with 4 decimal places

6. * Write a script <YourMatricNo>_Lab4_CalcAreaTrap.py to prompt the user for the lengths of the parallel sides, and the height of a trapezoid, and print its area with 2 decimal places. Put comments in the script.

7. In the metric system, fluid flow is measured in cubic meters per second (m^3/s). A cubic foot per second (ft^3/s) is equivalent to $0.028 m^3/s$. Write a script titled `flowrate.py` that will prompt the user for flow in cubic meters per second and will print the equivalent flow rate in cubic feet per second. Here is an example of running the script. Your script must produce output in exactly the same format as this:

```
>>> flowrate
Enter the flow in m ^ 3 / s:  15.2
A flow rate of 15.200 meters per sec is equivalent to 542.857 feet per sec
```

8. On average, Singaporeans spend 8% to 10% of their income on food. Write a script that will prompt the user for an annual income. It will then print the range that would typically be spent on food annually. Also, print a monthly range. Make sure your answer is meaningful, i.e. print not only the result but also some text.

9. Write a script that first asks the user to enter a string. Then, the script asks the user to enter two letter positions and eventually prints the new string with the two chosen letters swapped. Here is an example of one execution:

```
Please enter a string: I am studying in NTU
Please enter the index of the first letter (counting starts at 0): 2
Please enter the index of the second letter (counting starts at 0): 7
I um stadying in NTU
```

   Write that script with two different strategies:

   (a) (script 1) by storing the user input in a string

   (b) (script 2) by storing the user input in a list (you can use the `join` method from string objects)

10. * Write a script <YourMatricNo>_Lab4_RandMatrix.py that accomplishes the following task. First, it creates a matrix of size 3×4 of random integers in the range $[10, 99]$. Then it prints the matrix (free format). Finally, it asks the user to enter a row value and a column value, and it prints (in field of width 3) the sum of all elements of the entered row, and the sum of all elements of the entered column.
    Hint: use the function `randint` from the numpy random (`https://docs.scipy.org/doc/numpy/reference/generated/numpy.random.randint.html`)
    Here is an example of one execution:

```
The generated matrix is:
   [[72    13    78    54]
    [38    49    81    50]
    [95    44    26    68]]
```

```
Please enter the row (counting starts at 0): 1
Please enter the column (counting starts at 0): 3
The sum of all elements of row 1 is 218
The sum of all elements of column 3 is 172
```