

# CS1026: Assignment 2

## Volume Calculator

Due: October 21<sup>st</sup> 2020, 9:00pm

Weight: 8%

### >Learning Outcomes

- By completing this assignment, you will gain skills relating to
- Using loops
- Using functions
- Using lists in Python
- Creating and using Python modules
- Testing programs and designing test cases
- Following program specifications and requirements.

### >Task

In this assignment, you will write a **complete** program in Python that computes the volume for cubes, pyramids and ellipsoids. Your program should make use of functions, loops, and lists.

Your program will consist of two files: one is a module, `volume.py`, which computes volumes and the other is a main program, `main.py`, which uses the functions in module `volume.py`. The main program, `main.py`, is to prompt the user for a type of object (e.g. a “cube”) and validate that is one of the expected object types before computing the volume. In addition, your main program should keep track of each volume that is calculated. After the user chooses to “quit” your program should display the volume for all the shapes entered in sorted order.

### >Functional Specifications

1. Your main module, `main.py`, **should handle the prompting and input for the different shapes and the output**. Specifically, `main.py` should:
  - Prompt the user for the shape they are interested in, check to make sure that their input is valid. **Valid input options are:** “cube” or “c”, “pyramid” or “p”, “ellipsoid” or “e”, “quit” or “q”; ***you should accept the input in any combination of upper and lower case letters***. If the user enters an invalid option, your program should print a message and continue to prompt the user for a correct choice.
  - Continue to prompt the user for different shapes until the user enters “quit” or “q”; allow for any combination of upper and lower characters, e.g. “Quit”.

- Prompt the user for the necessary dimensions for each of the respective shapes. ***You may assume that the user enters positive floating values and so you DO NOT have to check the input of dimensions for valid values.***
- Use the correct function in `volumes.py` to compute the volume (see below) of the specified shape.
- Output a message with the computed volume.
- Add the resulting shape and its volume to a list of volumes. Your program should have **one** list and each item in the list should be tuple of the form (shape-name, volume). The shape-name will be one of: "cube", "pyramid" or "ellipsoid" (lower case). You will have a single list of tuples that contains all the shapes entered and their computed volumes. For example, the list might look like `[("cube", 1.00), ("cube",9.00)]`.
- Once the user has entered "quit" (or "q"), your program should sort the list from lowest to highest. To sort a list, `myList`, of tuples, you can use the following version of the Python sort function:

```
myList.sort(key = lambda myList: myList[1])
```

This tells Python to sort `myList` using the element in position 1 – this should be the volume in your tuple.

Your program should then print the list of shapes and volumes ***in sorted order***. **The output should look like:**

```
Output: Volumes of shapes entered in sorted order:
        pyramid 42.67
        pyramid 768.00
        cube 1331.00
        ellipsoid 2111.15
```

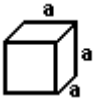
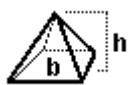
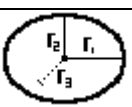
Your output should consist of a header line ***exactly*** as above and each shape and volume on separate lines; all volumes should be printed with 2 decimals and output should make use of the Python formatting operator "%".

- If the user quits before entering any shapes, then the program should print out:

```
Output: No shapes entered.
```

2. Your module, `volumes.py`, should contain the functions for computing the volumes.

- Each of your functions should calculate the volume of the shape **and return that value (it should not print a message)**; volumes for the different shapes are computed as follows:

Shape	Volume
cube	 $volume = a^3$ where $a$ is the length of a side
pyramid	 $volume = \frac{1}{3}b^2h$ where $b$ is base length and $h$ is height
ellipsoid	 $volume = \frac{4}{3}\pi * r_1 * r_2 * r_3$ where $\pi$ is $\pi$ and $r$ is used to represent each radius

### >Non-functional Specifications

- Include brief comments in your code identifying yourself, describing the program, and describing key portions of the code.
- Assignments are to be done individually and must **be your own work**. Software may be used to detect cheating.
- Use Python coding conventions and good programming techniques, for example:
  - Meaningful variable and function names,
  - Conventions for naming variables and constants,
  - Use of constants where appropriate,
  - Readability: indentation, white space, consistency.

### >Submission requirements

#### >What to submit

You should submit your files `volumes.py` and `main.py`. **Make sure you upload (attach) the files; DO NOT put the code inline in the textbox.**

### >What You Will Be Marked On

- Your program will be executed by an automated testing program.** This testing program assumes that:
  - The program name is `main.py`.
  - That you are using Python 3.8.
  - That you have submitted it via OWL by uploading it.

**Failure to adhere to these constraints will likely cause the testing program to fail. This may require a remarking of your program which will include a 20% penalty.**

## 2. Functional specifications:

- ❑ Are there modules `volumes.py` and `main.py` and are they defined according to specifications? In particular, all input, messages and error checking should ONLY be done in the main program
- ❑ Does the program compute the volumes correctly?
- ❑ Does the program handle invalid input for the type of object?
- ❑ Is there an effective use of functions?
- ❑ Is the output according to specifications?

## 3. Non-functional specifications: as described above.

### >Examples of output and some test cases

The following illustrate possible messages and out for your program and values for testing your program. These examples do not necessarily test all aspects of your program. ***It is your responsibility to design your own test cases to test it thoroughly.***

#### >Example 1

```
Please enter shape (quit/q, cube/c, pyramid/p, ellipsoid/e): pyramid
Enter the base of the pyramid: 12
Enter the height of the pyramid: 16
The volume of a pyramid with base 12.0and height 16.0 is:    768.00

Please enter shape (quit/q, cube/c, pyramid/p, ellipsoid/e): p
Enter the base of the pyramid: 4
Enter the height of the pyramid: 8
The volume of a pyramid with base 4.0and height 8.0 is:      42.67

Please enter shape (quit/q, cube/c, pyramid/p, ellipsoid/e): cube
Enter length of side for the cube: 11
The volume of a cube with side 11.0 is:    1331.00

Please enter shape (quit/q, cube/c, pyramid/p, ellipsoid/e): e
Enter the first radius: 7
Enter the second radius: 8
Enter the third radius: 9
The volume of an ellipsoid with radii 7.0 and 8.0 and 9.0 is:  2111.15

Please enter shape (quit/q, cube/c, pyramid/p, ellipsoid/e): quit
Output: Volumes of shapes entered in sorted order:
pyramid 42.67
pyramid 768.00
cube 1331.00
ellipsoid 2111.15
```

## >Example 2

```
Please enter shape (quit/q, cube/c, pyramid/p, ellipsoid/e): CUBE
Enter length of side for the cube: 12
The volume of a cube with side 12.0 is: 1728.00

Please enter shape (quit/q, cube/c, pyramid/p, ellipsoid/e): Ellipsoid
Enter the first radius: 11
Enter the second radius: 12
Enter the third radius: 11
The volume of an ellipsoid with radii 11.0 and 12.0 and 11.0 is: 6082.12

Please enter shape (quit/q, cube/c, pyramid/p, ellipsoid/e): cub
-- invalid input: enter (quit/q, cube/c, pyramid/p, ellipsoid/e
Please enter shape: cube
Enter length of side for the cube: 18
The volume of a cube with side 18.0 is: 5832.00

Please enter shape (quit/q, cube/c, pyramid/p, ellipsoid/e): c
Enter length of side for the cube: 3
The volume of a cube with side 3.0 is: 27.00

Please enter shape (quit/q, cube/c, pyramid/p, ellipsoid/e): quit
Output: Volumes of shapes entered in sorted order:
cube 27.00
cube 1728.00
cube 5832.00
ellipsoid 6082.12
```

### >Example 3

```
Please enter shape (quit/q, cube/c, pyramid/p, ellipsoid/e): ell
-- invalid input: enter (quit/q, cube/c, pyramid/p, ellipsoid/e)
Please enter shape:ellip
-- invalid input: enter (quit/q, cube/c, pyramid/p, ellipsoid/e)
Please enter shape:ellipsoid
Enter the first radius: 1
Enter the second radius: 2
Enter the third radius: 3
The volume of an ellipsoid with radii 1.0 and 2.0 and 3.0 is:    25.13

Please enter shape (quit/q, cube/c, pyramid/p, ellipsoid/e): c u b e
-- invalid input: enter (quit/q, cube/c, pyramid/p, ellipsoid/e)
Please enter shape:cube
Enter length of side for the cube: 9
The volume of a cube with side 9.0 is:    729.00

Please enter shape (quit/q, cube/c, pyramid/p, ellipsoid/e): pyrm
-- invalid input: enter (quit/q, cube/c, pyramid/p, ellipsoid/e)
Please enter shape:pyramid
Enter the base of the pyramid: 12
Enter the height of the pyramid: 10
The volume of a pyramid with base 12.0and height 10.0 is:    480.00

Please enter shape (quit/q, cube/c, pyramid/p, ellipsoid/e): PYRAMID
Enter the base of the pyramid: 4
Enter the height of the pyramid: 2
The volume of a pyramid with base 4.0and height 2.0 is:    10.67

Please enter shape (quit/q, cube/c, pyramid/p, ellipsoid/e): end
-- invalid input: enter (quit/q, cube/c, pyramid/p, ellipsoid/e)
Please enter shape:Q
Output: Volumes of shapes entered in sorted order:
pyramid 10.67
ellipsoid 25.13
pyramid 480.00
cube 729.00
```