

CS1580 - Introduction to Programming Lab (FS2024)

Lab 6

Lab Objectives

In this lab, you will be implementing the following topics:

- Random Number Generation
- Template Functions
- Function Documentation

Lab Task: Randomized Shape Volume Calculation

Write a program that simulates the calculation of the volume for different 3D shapes (cube, cuboid, cylinder) using template functions. The program will generate random dimensions for these shapes, compute their volumes, and display the results.

1. Define a Template Function for Volume Calculation:
 - a. Create a template function:
T computeVolume(T dimension1, T dimension2, T dimension3, const string shape)

that calculates the volume of a shape based on the provided dimensions and shape type.
 - b. The function should support different data types (e.g., int, float, double).
 - c. The shapes and their volume formulas are:
 - i. **Cube**: volume = dimension1 * dimension1 * dimension1
 - ii. **Cuboid**: volume = dimension1 * dimension2 * dimension3
 - iii. **Cylinder**: volume = 3.14 * dimension1 * dimension1 * dimension2
(dimension1 is the radius, dimension2 is the height)
 - d. Use default arguments for the dimensions if not provided: dimension1 = 1.0, dimension2 = 1.0, dimension3 = 1.0.
2. Define another function to generate random dimensions using rand() function:
 - a. Create a function **double generateRandomDimension()** with no arguments.
 - b. Declare a variable **bool generateInt = rand() % 2**
This variable will return either 0 or 1.
 - c. If generateInt == 1, then generate a **random float between 1.0 and 10.0**
NOTE: rand() only generates int values. Use static_cast to float

If generateInt == 0, then generate a **random int between 1 and 10**
 - d. Seed the random number generator using **srand(time(0))**

Do not forget to import the following:

```
#include <cstdlib> ---> for rand() and srand()  
#include <ctime>
```

3. In your main():
 - a. Prompt the user to select a shape type: "cube," "cuboid," or "cylinder."
 - b. Based on the user's selection, generate random dimensions for the shape.

```
double dimension1 = generateRandomDimension();  
double dimension2 = generateRandomDimension();  
double dimension3 = generateRandomDimension();
```

- c. Call the computeVolume() template function using the randomly generated dimensions to calculate the volume.

For example, if the shape is "cube", call
`computeVolume<double>(dimension1, 0, 0, shape);`

- d. Output the computed volume.

Sample input/output

```
Enter your choice of shape  
1. Cube  
2. Cuboid  
3. Cylinder  
  
2  
  
Volume of cuboid with dimensions 3.2, 5.4, 2.8 is 48.384
```

```
Enter your choice of shape  
1. Cube  
2. Cuboid  
3. Cylinder  
  
1  
  
Volume of cube with dimension 5 is 125
```

Gitlab Cloning Instructions

- Open the browser and go to <https://git-classes.mst.edu/>. Click on the Lab4 repository named 2024-FS-303-lab5-<your_username>
- Click on 'Clone' button and copy the HTTPS link.
- Open Putty and
 - Change the directory to SDRIVE: `cd SDRIVE`
 - Clone the repository: `git clone <copy_the_HTTPS_link_here>`
 - Change the directory to cloned repository: `cd 2024-FS-303-lab5<your_username>`
- Start coding by opening a new file in nano: `nano lab5.cpp`

Compiling Instructions

- To run your code, `fg++ lab5.cpp`
- To get the output, `./a.out`

Submission Instructions

Push your code to your gitlab account.

- Add all your files to the repository, `git add .`
- Commit your changes, `git commit -m "<your_message_goes_here>"`
- Push the changes, `git push`