
CPT113 – Programming Methodology & Data Structures

Tutorial Week 4

Inheritance and Composition

Question 1

This question has three parts. You need to answer them sequentially.

Part 1:

Write a class called `Shape` where the variables can hold the following values: `height`, `width`, `length` which are declared as `private` and the methods declared as a `public` member of the class. Write the following function:

- a) `print`
- b) `setVal` to set the values of all the variables
- c) `getHW` to access the values of height and width
- d) default constructor
- e) overloading constructor
- f) destructor
- g) write the main to test all functions

Part 2:

Create another class that is inherited from `Shape` called `Prism`. `Prism` has one `private` member to retain the `volume`. `Prism` has the following function:

- a) `print` to print `l`, `w`, `h` & `volume`
 - b) `setDimension` to set the length, width and height
 - c) `calculateVol` to calculate the volume of the prism
 - d) default constructor
 - e) overloading constructor that accepts **four parameters**
 - f) destructor
 - g) write the main to test overloading `Prism` constructor and to calculate the volume and print it out.
- P.S.:** Only change length variable from `Shape` to `protected`. Others must be maintained.

Part 3:

Write a new class called `Cube`. `Cube` has two `private` members: `volume` and composition of class `Shape`. `Cube` has the following functions:

- a) `print` to print `l`, `w`, `h` & `volume`
- b) `setDimension` to set the length, width and height
- c) `calculateVol` to calculate the volume of the `Cube`
- d) default constructor
- e) destructor
- f) write the main to test the functions created.

Formula:

Prism volume = length * height * width

Cube volume = height * height * height

Question 2

This question has four parts. You need to answer them sequentially.

Part 1:

Write a class called `Circle` where the variables can hold the values: `radius`, `radian`, `degree` and `area` which is declared as `private` and the methods declared as a public member of the class. Declare `PI` as a `constant` member class variable. Write the following function:

- a) `print`
- b) `setVal` to set the values of `radius` and `degree`
- c) `getVal` to access all the values of variable in `Circle`
- d) `calcRadian`
- e) `calcArea`
- f) default constructor
- g) overloading constructor
- h) destructor
- i) write the main to test all functions

Part 2:

Create another class that is inherited from `Circle` called `Cone`. `Cone` has three private members to retain the height, area and volume. `Cone` has the following function:

- a) `print` to print `radius`, `height`, `area` and `volume`
- b) `setDimension` to set the `radius` and `height`
- c) `calculateArea` to calculate the surface area of the cone
- d) `calculateVol` to calculate the volume of the `Cone`
- e) default constructor
- f) overloading constructor that accepts **two parameters**
- g) destructor
- h) write the main to test overloading `Circle` constructor and to calculate the area and volume and print it out.

P.S.: Change `radius` variable from `Circle` to `protected`. Others must be maintained. Add method(s) if necessary in the base class.

Part 3:

Write a new class called `Cylinder`. `Cylinder` has two private members: `volume` and composition of class `Circle`. `Circle` has the following functions:

- a) `print` to print `radius`, `height`, `area` & `volume`
- b) `setDimension` to set the `radius` and `height`
- c) `calculateVol` to calculate the volume of the `Cylinder`
- d) default constructor
- e) destructor
- f) write the main to test the functions created.

Part 4

Create a class name `Ellipse` inherited from `Circle` with another variable as a private member representing the shorter radius. Write the function to calculate the Ellipse area.

Formula:

Radian calculation = $\text{degree} \times \pi / 180$

Circle area = $\pi * \text{radius}^2$

Cone area = $\pi * \text{radius} * (\text{radius} + \sqrt{\text{height}^2 + \text{radius}^2})$

Cone volume = $\pi * \text{radius}^2 * \text{height} / 3$

Cylinder surface area = $(2 * \pi * \text{radius}^2) + (2 * \pi * \text{radius} * \text{height})$

Cylinder volume = $\pi * \text{radius}^2 * \text{height}$

Ellipse area = $\pi * \text{radius} * \text{shortRadius}$