

CL-217

Object Oriented Programming

Lab # 11

Objectives:

- Polymorphism
- Virtual, pure virtual function
- Abstract and concrete classes
- Three file structure

Note: Carefully read the following instructions (*Each instruction contains a weightage*)

1. There must be a block of comments at start of every question's code by students; the block should contain brief description about functionality of code.
2. Comment on every function about its functionality.
3. Use understandable name of variables.
4. Proper indentation of code is essential
5. Write a C++ statement(s) for each of the following task one after the other, in the same order.
6. Make a Microsoft Word file and paste all of your C++ code with all possible screenshots of every **task outputs in MS word and do not submit .cpp file with word file**.
7. First think about statement problems and then write/draw your logic on copy.
8. After copy pencil work, code the problem statement on MS Studio C++ compiler.
9. At the end when you done your tasks, attached C++ created files in MS word file and make your submission on Microsoft teams. (Make sure your submission is completed).
10. Please submit your file in this format 19F1234_L9.
11. Do not submit your assignment after deadline.
12. Do not copy code from any source otherwise you will be penalized with negative marks.

Problem 1: (Polymorphism, Virtual function, abstract and concrete classes)

Design a **Ship** class that has the following members:

- A member variable for the name of the ship (a string)
- A member variable for the year that the ship was built (a string)
- A constructor and appropriate **accessors** and **mutators**
- A **virtual print** function that displays the ship's name and the year it was built.

Design a **CruiseShip** class that is derived from the Ship class. The **CruiseShip** class should have the following members:

- A member variable for the maximum number of passengers (an int)
- A constructor and appropriate **accessors** and **mutators**

- A print function that overrides the print function in the base class.

The **CruiseShip** class's print function should display only the ship's name and the maximum number of passengers. Design a **CargoShip** class that is derived from the Ship class. The **CargoShip** class should have the following members:

- A member variable for the cargo capacity in tonnage (an int).
- A constructor and appropriate **accessors** and **mutators**.
- A print function that overrides the print function in the base class.

The **CargoShip** class's print function should display only the ship's name and the ship's cargo capacity. Demonstrate the classes in a program that has an array of Ship pointers. The array elements should be initialized with the addresses of dynamically allocated Ship, The program should then step through the array, calling each object's print function.

Problem 2: (Polymorphism, Pure Virtual function, abstract and concrete classes)

Finding the areas of Polygon family (Square, Rectangle and Triangle) using Polymorphism and Pure Virtual function.

Define a base class Polygon having the following attributes:

1. Float length
2. Float width

Pure Virtual Member functions:

1. Float Area() to calculate Area
2. Float Perimeter() to calculate Perimeter
3. Void Display() to display the calculated Area and Perimeter

Inherit the following classes from Polygon publically (Inherit all data members and member functions):

1. Square
2. Rectangle
3. Triangle

Task:

1. Write default constructor and Overloaded constructor to overload the values of Length and Width.
2. Calculate the Areas and Perimeters of Polygon family.
3. Show the results on the console using Display () function.
4. Write base class pointer “*Bptr” which points to the objects of derived classes one by one and display the area and perimeter of subclasses using Dynamic Binding

Hints:

- Square Area/Perimeter=4*L
- Rectangle $A=2*(L \times W)$ $P=2*(L+W)$
- Triangle $A= (L \times W)/2$ $P= (L+W)$

Problem 3: (Polymorphism, abstract and concrete classes)

Design a software system for FESCO-WAPDA for 2020 from which they calculate the monthly bill of Electricity.

Write a class Bill having the following attributes and behavior

1. Int Units
2. Int per_unit_cost
3. Float calBill
4. Monthly_bill()
5. Bill_display()

Derived the following classes from the base class Bill:

1. January_bill
2. February_bill
3. March_bill
4. April_bill
5. May_bill

Inherit the attributes and behavior of base class.

Perform the following tasks.

Task:

1. Calculate the monthly bills for every month.
2. Display the total bill using function Bill_display() method.
3. From main() use base class pointer to point to derived classes objects to calculate the total bill for each month.
4. Call destructor when you realize that the objects are no more needed.
5. Use virtual destructor concept in the above hierarchy.

Note:

- Use virtual Member functions for derived classes.
- Use appropriate values for per unit cost of monthly bills.
- User appropriate data types.