**National University of Computer and Emerging Sciences**



**Lab Manual 09**

**Object Oriented Programming**

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| Course Instructor | Miss Abeeda |
| Lab Instructor (s) | Ms. Abiha Aftab  Mr. Dilawar Shabbir |
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Department of Computer Science

FAST-NU, Lahore, Pakistan

## Objectives

* Understand and implement inheritance among various classes.
* Understand and implement function overloading and overriding.
* Understand aggregation and composition.

**Task 1:**

**Aggregation**:

The aggregation relationship is used to represent the ownership or a whole/part relationship between classes. The aggregate object has one or more parts which may be shared with other objects of the same class or other classes. The objects that make up the parts are created and destroyed independently of the aggregate object.

***Create classes as mentioned below.***

class Tyre

{

private:

private:

int\* width;

int\* aspect\_ratio;

int\* diameter;

public:

//Constructors, Getters and Destructor

void PrintTyre();

};

class Car

{

public: private:

int\* model;

char\* company;

tyre\* t1;

public:

Constructors, Destructor

void PrintCar();

};

**main()** should contains following lines, You can add more code, but these lines should be included.

tyre tNew(12, 10, 13);

car cNew(2016,"Honda",tNew);

**TASK 2:**

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 theship’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.

**TASK 3:**

Write a program to calculate the area of following shapes by using ***Public -- Single Inheritance***.

The *base class* is “shape” and the *derived classes* are rectangle, triangle, circle, and cylinder. Attributes of all the classes are as under:

|  |  |  |  |
| --- | --- | --- | --- |
| **shape** | **rectangle** | **triangle** | **circle** |
| **protected:**  string type;  **public:**  virtual void area\_**calculator**(); | **public:**  void area\_calculator()  {  //definition  }  private:  float height;  float width; | **public:**  void area\_calculator()  {  //definition  }  private:  float base;  float height; | **public:**  void area\_calculator()  {  //definition  }float radius; |
|  | Area = Length X Width | Area = 1/2 of the base X the height | A = πr**²** |

* Your each class must have overloaded/default constructor to initialize required parameters for calculating area. ***You might have to use dummy argument in your base class overloaded constructors.***
* In main, Create objects of derived classes rectangle, triangle and circle. Create a pointer of base class “area”. With this pointer, point to the objects of derived classes one by one and calculate area of each individual shape.