National University of Computer and Emerging Sciences, Lahore Campus

	Course Name:	**Object Oriented Programming**	**Course Code:**	**CS1004**
	Program:	**BS Electrical Engineering**	**Semester:**	**Spring 2024**
			Total Marks:	**100**
	Out Date:	**22-Mar 2024**	**Weight:**	**4**
	Submission Date:	**2-Apr 2024**	**Page(s):**	**1**
	Exam Type:	**Assignment- 2**	**CLO #**	**2**

Submission Guidelines:
Archive your files (.cpp) in a zip file named as your roll number. Upload this file on slate as well as Google classroom under the assignment submission section till **Monday 2-Apr-2024 till 11AM**. Code should be documented and well written in C++. It must compile.

Academic integrity is expected of all the students. Plagiarism or cheating in any assessment will result in negative marking or an **F** grade in the course, and possibly more severe penalties.

Question No. 1 (CLO 2, PLO 1, C5) **Marks: 100**

Design and develop solutions to the following problems in C++ using your knowledge of object-oriented programming:

A. [**Marks 25**] In ocean navigation, locations are measured in degrees and minutes of latitude and longitude. Thus, if you're lying off the mouth of Papeete Harbor in Tahiti, your location is 149 degrees 34.8 minutes west longitude, and 17 degrees 31.5 minutes south latitude. This is written as 149°34.8' W, 17°31.5' S. There are 60 minutes in a degree. (An older system also divided a minute into 60 seconds, but the modern approach is to use decimal minutes instead.) Longitude is measured from 0 to 180 degrees, east or west from Greenwich, England, to the international dateline in the Pacific. Latitude is measured from 0 to 90degrees, north or south from the equator to the poles. Create a class angle that includes three member variables: an int for degrees, a float for minutes, and a char for the direction letter (N, S, E, or W). This class can hold either a latitude variable or a longitude variable. Write one member function to obtain an angle value (in degrees and minutes) and a direction from the user, and a second to display the angle value in 179°59.9' E format. Also write a three-argument constructor. Write a main () program that displays an angle initialized with the constructor, and then, within a loop, allows the user to input any angle value, and then displays the value.

B. A package delivery system is needed for a courier service operating within Pakistan. Every package that needs to be delivered has the name, address and mobile number of the sender and receiver. The address consists of the street number (e.g. 312) suburb (e.g. abubakar block, garden town), city (e.g. Lahore) and province (e.g. Punjab). Every Package also has a weight (in kgs) and standard cost per kg to ship the package. The total cost of shipping a normal package is obtained by multiplying the standard cost with the weight.

   There are two special kinds of packages. The **overnight delivery** package that has an additional cost per kg of delivering the package. The total cost of an overnight package is obtained by adding standard cost and additional cost and multiplying the result with weight of the package. The **two-day delivery** package has a flat fee that is charged in addition to the cost of the normal package to calculate the total cost.

i. [**Marks 10**] Identify the classes needed to implement the above system and the relationship between those classes. Please give the interface (prototype) of the classes you have decided in this part.

ii. Demonstrate Polymorphism: The cost of normal package, overnight delivery and two-day delivery packages are to be calculated differently.

- [**Marks 20**] Please implement the classes that you decided in part (i) and

- [**Marks 20**] Write a client program that should instantiate and loop through a dynamic array of packages demonstrating polymorphism. For every package it should print all the details of the sender and receiver in addition to the total delivery cost.

C. [**Marks 25**] A showroom owner needs an inventory program. Showroom deals with two types of vehicles: Trucks and Cars. Each vehicle has a name and make. Each car has a specific number of seats. Each truck has a number of wheels and loading capacity. Write C++ classes in a proper hierarchy which enables the driver given below to compile and produce the given output. You cannot change the driver program at all. Your code also must not have any memory leaks.

```
int main()
{
        Int vehicle_count=4;
        ShowRoom sr(vehicle_count); //sr has 4 vehicles here

        sr. AddTruckInList("Hino", "Jumbo Ranger", 14, 100);// Here Truck's make=Hino
        // Name=Jumbo Ranger, NoOfWheels=14, LoadingCapacity=100 Tons

        sr.AddCarInList("Honda", "City", 4); // Here Car's make=Honda
        // Name=City, NoOfSeats=4

        sr.AddCarInList(Suzuki, "Mehran", 4);
        sr. AddTruckInList("Nissan", "Atlas", 8, 50);

        sr.DisplayVehicles();

return 0;}
```

Sample Output:

```
Vehicle 1:
Truck Info:
Hino – Jumbo Ranger
No of Wheels : 14
Loading Capacity: 100 Tons

Vehicle 2:
Car Info:
Honda – City
No of seats: 4

Vehicle 3:
Car Info:
Suzuki – Mehran
No of seats: 4

Vehicle 4:
Truck Info:
Nissan – Atlas
No of Wheels : 8
Loading Capacity: 50 Tons
```