

[Answer *all* the questions; in some questions, there are options; you will solve any one of them; Figures in the right-hand margin indicates full marks. Separate answer script must be used for Group-A and Group-B]

Group-A**1.**

- a) When would you prefer to use a *friend function* over a *member function* for operator overloading, and vice versa? Provide example to support your answer. 2 CO2 U
- b) Create a class **Vector2D** that represents a two-dimensional vector with x and y coordinates. Overload the following operators for this class:
- +: Vector addition (adding two Vector2D objects)
 - : Vector subtraction (subtracting one Vector2D object from another)
 - *: Scalar multiplication (multiplying a Vector2D object by a scalar value)

[OR]

Create a class **Time** that represents a time of day in hours, minutes, and seconds (all stored as integers). Overload the following operators for this class:

- +: Time addition (adding two Time objects)
- : Time subtraction (subtracting one Time object from another)
- ++: Pre-increment (incrementing a Time object by one minute)

- c) In binary operator overloading, why only the right-side operand is passed as an argument? 2 CO2 U
Explain.

2.

- a) Explain the behavior of public and private members when a base class is inherited publicly by the derived class. 2 CO2 U
- b) The music streaming service's class hierarchy includes a base class, "**Media**", with attributes like title and duration. Subclasses "**Song**" and "**Podcast**" add details such as artist, genre, and episode information. Further subclassing refines with "**MusicTrack**" for songs and "**AudioBook**" for podcasts. By instantiating instances and displaying details, the hierarchy efficiently organizes media offerings. 3 CO3 App

[OR]

The class hierarchy for a vehicle rental system features a base class, "**Vehicle**", with properties like make, model, and year. Subclasses "**Car**" and "**Truck**" provide specific vehicle types, each with unique attributes such as seating capacity or payload capacity. Further subclassing includes "**ElectricCar**" for environmentally-friendly options and "**SemiTruck**" for heavy-duty transport. By creating instances and displaying details, the hierarchy efficiently manages diverse vehicle options within the rental system.

- c) Why is *private inheritance* significant while using C++? How does it affect the accessibility of the members of the base class in the derived class? Please provide a relevant example. 2 CO2 U

- d) Find errors (if any) and write down the corrected code's output:

```
#include <iostream>
using namespace std;
class Vehicle {
public:
    void start() { cout << "Vehicle starts" << endl; }
    void stop() { cout << "Vehicle stops" << endl; } };
class Car: public Vehicle {
public:
    void start() { cout << "Car starts" << endl; }
    void stop() { cout << "Car stops" << endl; } };
class SportsCar : public Car {
public:
    void start() { cout << "SportsCar starts" << endl; }
    void turbo() { cout << "Turbo boost!" << endl; }};
```

```
int main() {
    Vehicle v;
    Car c;
    SportsCar s;
    v.start();
    v.stop();
    c.start();
    c.stop();
    s.start();
    s.stop();
    s.turbo();
    c = s;
    c.start();
    c.turbo();
    return 0;
```

Group-B

uni
Em

3.

- a) What is the necessity of *abstract class*? How to make a class abstract? Explain with code. 3 CO2 U
- b) Design a class hierarchy for a university's personnel management system, including base classes for employees and derived classes for faculty and staff. Demonstrate the use of virtual functions to handle salary calculation for different types of employees. 4 CO2 A

[OR]

Create a C++ program that simulates a simple banking system using inheritance and polymorphism. Design base classes for accounts and derived classes for different types of accounts (e.g., savings, checking). Implement virtual functions to handle account transactions.

- c) Find out output of the following code:

3 CO3 A

```
#include <iostream>
using namespace std;
class Shape {
public:
    virtual void draw() { cout << "Drawing Shape" << endl; }
    void info() { cout << "This is a shape" << endl; } };
class Circle : public Shape {
public:
    void draw() { cout << "Drawing Circle" << endl; }
    void info() { cout << "This is a circle" << endl; } };
class Rectangle : public Shape {
public:
    void draw() { cout << "Drawing Rectangle" << endl; }
    void info() { cout << "This is a rectangle" << endl; } };
```

```
int main() {
    Shape sh;
    Circle c;
    Rectangle r;
    Shape *sptr;
    sh.draw(); ←
    sh.info(); ←
    c.draw(); ←
    c.info(); ←
    r.draw(); ←
    r.info(); ←
    sptr = &c;
    sptr->draw(); ←
    sptr->info(); ←
    sptr = &r;
    sptr->draw(); ←
    sptr->info(); ←
    return 0; }
```

4.

- a) A program that determines the *median* of an array's items for characters, integers, and floating-point values is given to you. *CalculateMedian* for integers, *CalculateMedian* for doubles, and *CalculateMedian* for characters are the distinct functions for each data type in the original program. 4 CO2 App

It is your responsibility to rewrite the code using the *CalculateMedian* generic function. For each sortable data type, the *CalculateMedian* function should be able to determine the median of the items.

[OR]

Implement a **class template** for a **generic array** and demonstrate its functionality of finding summation of the all the n members with **various data types**.

- b) Write a program that initializes a Vector with the values {5, 10, 2, 55, 60, 3} 3 CO3 App
Perform the following operations:
Remove the element at index 2, Insert 15 at index 1, Remove the first element from the list.
c) What is an *exception*? What are the advantages of using exception handling mechanism in a program? 3 CO2 U

5.

- a) Write a C++ program demonstrating number representations with width, fill, and precision: 3 CO1 App

- I. Display hexadecimal 255 with width 10 and fill '0'.
- II. Show octal 493 with width 10 and fill '0'.
- III. Present the float value 123456.789 with width 10 and precision 2.

[OR]

Design a single manipulator to provide a following output specification for printing float value.

- I. 12 column widths
- II. Right justified
- III. Two precisions
- IV. Filling unused place with sign

- b) Differentiate between formatting using the *ios* class and formatting using *manipulators*. 3 CO3 U

Provide examples to demonstrate each approach.

- c) Write a program to write 100 integers to a *file* called RAND.TXT. And then read the contents of the file and display them on the screen. 4 CO3 App

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International Islamic University Chittagong
 Department of Computer Science & Engineering
B. Sc. in CSE Semester Final Examination, Spring-2024
Course Code: CSE-1223 Course Title: Discrete Mathematics
 Total marks: 50 Time: 2 hours 30 minutes

[Answer **all** the questions; in some questions, there are options; you will solve any one of them; Figures in the right-hand margin indicates full marks. Separate answer script must be used for Group-A and Group-B]

Group-A

CO DL

1.

- a) Proof the following theorem:

"Let m be a positive integer. The integers a and b are congruent modulo m if and only if there is an integer k such that $a = b + km$."

[OR]

Show that if n is an integer greater than 1, then n can be written as the product of primes.

- b) Express $\gcd(84, 119)$ as a linear combination of 84 and 119. Show the steps.

[OR]

Find an inverse of 101 modulo 4620.

- c) Encrypt the message "Welcome to IIUC" by translating the letters into numbers, applying the given encryption function, and then translating the numbers back into letters:

$$f(p) = (p + 14) \bmod 26$$

[OR]

✓ Use the sieve of Eratosthenes to find all primes not exceeding 50.

- d) Find the value of x using the *Chinese remainder theorem*:

$$x \equiv 1 \pmod{4}$$

$$x \equiv 2 \pmod{5}$$

$$x \equiv 3 \pmod{7}$$

3 CO2 App

2.

- a) State the 1st and 2nd principles of mathematical induction. Why is mathematical induction valid?

- b) Prove that $\sqrt{3}$ is irrational by giving a *proof by contradiction*.

[OR]

✓ Give a direct proof that if m and n are both perfect squares, then nm is also a perfect square. (An integer a is a **perfect square** if there is an integer b such that $a = b^2$)

- c) Use *mathematical induction* to prove that $3 + 3.5 + 3.5^2 + \dots + 3.5^n = (3.(5^{n+1}-1))/4$ whenever n is a nonnegative integer.

3 CO1 U

3 CO2 App

Group-B

3.

- a) In a simplified version of the C programming language, variable names consist of one to three alphanumeric characters, where uppercase and lowercase letters are distinguished. The first character of a variable name must be a letter (from the 26 English letters), and subsequent characters can be letters or digits. Additionally, there are 10 reserved keywords that cannot be used as variable names. How many different variable names are there in this version of C?

4 CO2 A

$$N = k(n-1)^2$$

- b) In a company's IT department, there are four different programming languages used: Python, Java, C++, and JavaScript. Each project team is assigned one programming language to work with. What is the minimum number of project teams required to be sure that at least ten will be assigned the same programming language? Explain.
- c) A bookstore has five different genres of books: fiction, non-fiction, mystery, science fiction, and fantasy. How many different ways can a customer choose eight books, selecting from these genres? Assume that only the genre of the book matters, not the specific titles or the order in which they are chosen.

[OR]

The English alphabet contains 21 consonants and five vowels. How many strings of six lowercase letters of the English alphabet contain

- i. exactly one vowel?
- ii. exactly two vowels?
- iii. at least one vowel?

$$\begin{matrix} Vc & 1 \\ Sc & + \end{matrix} \quad \dots \quad \dots \quad \dots$$

$$N = k(n-1) + 1$$

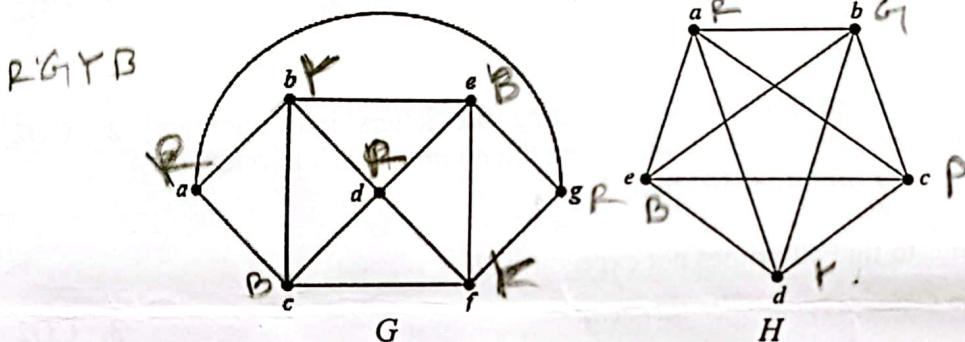
4.

a) Define Complete graph and Complete Bipartite graph. Draw the graphs: K_6 , $K_{2,6}$

3 CO1 U

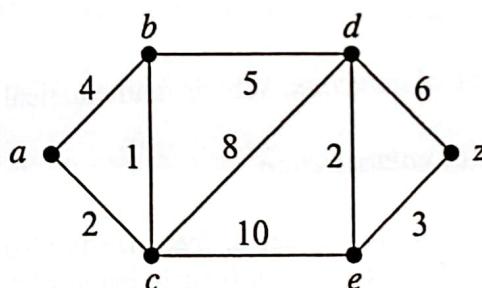
b) State the four-color theorem. What is the chromatic number of graphs G & H?

3 CO1 U



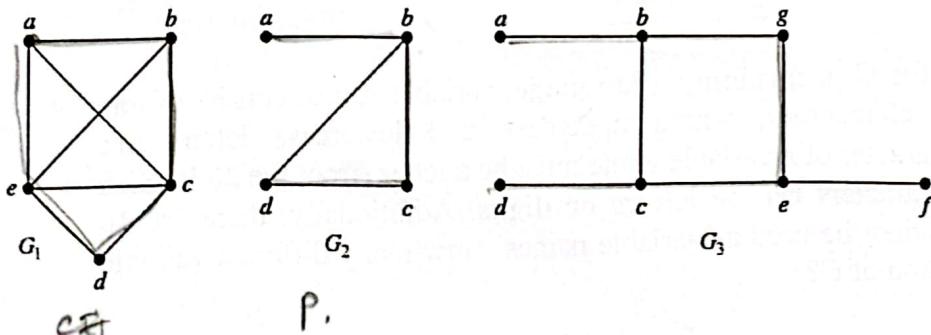
c) Find the shortest path from a to z of the following graph using Dijkstra's algorithm.

4 CO2 App



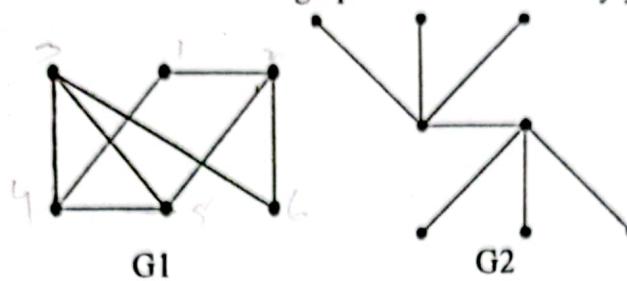
[OR]

Define Hamilton Path and Circuit. Which of the simple graphs has a Hamilton circuit or, if not, a Hamilton path?

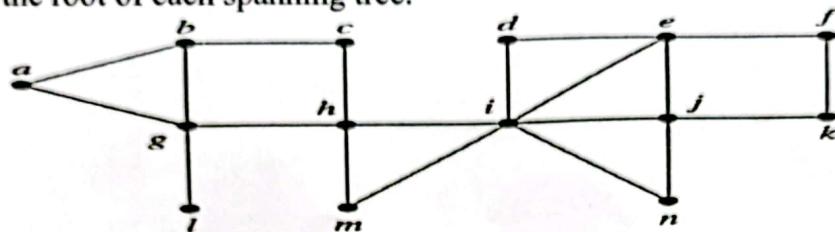


- a) Define *Tree*. Which of these G1 and G2 graphs are trees? Justify your answer.

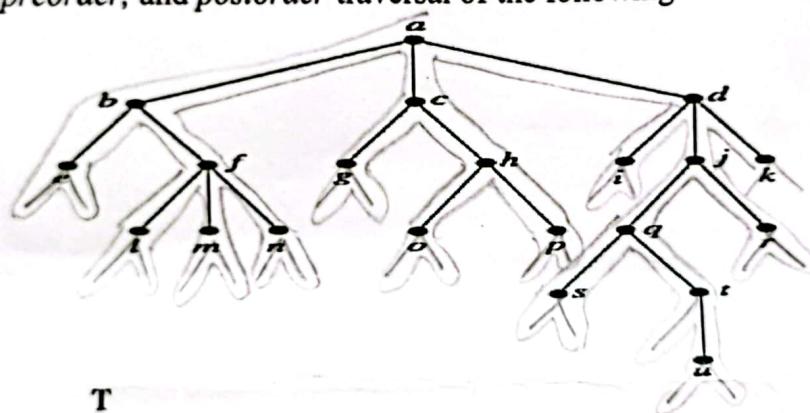
3 CO1 U



- b) Use *Depth-first search* to produce a *spanning tree* for the following simple graph G. 3 CO2 Ap
Choose *a* as the root of each spanning tree.

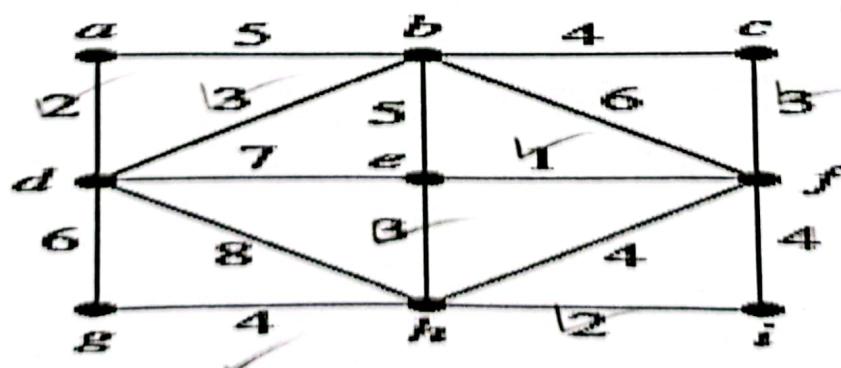


[OR]

Find *inorder*, *preorder*, and *postorder* traversal of the following tree T.

- c) Define *minimum spanning tree*. Construct a minimum spanning tree of the following graph. 4 CO2 A

graph di 1



[Answer **all** the questions. Figures in the right hand margin indicate full marks.
Separate answer script must be used for Group A and Group B]

Group - A

- | | | Marks | CLO | DL |
|-----|--|-------|------|----|
| 1. | a) Define order and degree of a differential equation. Form the differential equation whose solution is given by $y = A \cos px + B \sin px$ | 5 | CLO2 | U |
| | b) Define ordinary differential equation with example. Solve the differential equation $(x + y)^2 \frac{dy}{dx} = a^2$ | 5 | CLO2 | U |
| Or) | Define homogeneous differential equations. Solve the homogeneous differential equation, $y^2 + x^2 \frac{dy}{dx} = xy \frac{dy}{dx}$ | | | |
| 2. | a) Define Bernoulli's differential equation. Solve the Bernoulli's differential equation, $x \frac{dy}{dx} + y = x^4 y^3$ | 5 | CLO2 | U |
| Or) | Define integrating factor. Test whether the differential equation $(2x \log x - xy) dy + 2y dx = 0$ is exact or not. If not then make it exact. Hence solve it. | | | |
| b) | Define linear differential equation with constant coefficients. Find the particular integral of the following differential equation
$\frac{d^3y}{dx^3} + 3 \frac{d^2y}{dx^2} + 3 \frac{dy}{dx} + y = e^{-x} + 1 + \sin 2x.$ | 5 | CLO2 | U |

Group - B

- | | | | | |
|----|--|---|------|---|
| 3. | a) Define Bessel's equation. | 5 | CLO2 | U |
| | Using Bessel's function prove that, $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \sin x$ | | | |
| b) | Define Legendre's equation. | 5 | CLO2 | U |
| | Show that, $\int_{-1}^1 [P_n(x)] dx = 0$, when $n \neq 0$
$= 2$, when $n = 0$ | | | |

4. a) Solve the linear differential equation by the method of variation of parameters $(D^2 + 3^2)y = \sec x$ 5 CLO2 U
- Or) Using the method of undetermined coefficients to solve the differential equation, $(D^2 + 2)y = e^x + 2$
- b) Solve the linear partial differential equation by Lagrange's method, $(x^2 - yz)p + (y^2 - zx)q = z^2 - xy$ 5 CLO2 U
- Or) Solve the non-linear partial differential equations by Charpit's method, $(p^2 + q^2)y = qz$
5. a) The body of a murder victim was discovered at 11:00 pm. The doctor took the temperature of the body at 11:30 p.m. which was $94.6^\circ F$. He again took temperature after one hour when showed $93.4^\circ F$ and noticed that the temperature of the room was $70^\circ F$. Form a differential equation and by solving it estimate the time of death. [Normal temperature of human body is $98.6^\circ F$] 5 CLO3 Ap
- b) Bacteria in a certain culture increases at a rate proportional to the number present. If the number doubles in one hour, how long will it take for the number to triple? 5 CLO3 Ap

International Islamic University Chittagong
Morality development program (MDP)
Semester End Examination,
Spring -2024
Course Code: MDP-1202
2nd Semester
Tajweedul Qur'aan Part-II

Marks: 50

Duration: 2:30 Hours

Answer the following questions

Question No- 1

5 X 2 = 10

Write the meaning of following Surahs. (Any tow)

- A) Suratul Humazah
- B) Suratut Takasur
- C) Suratul Feel

Q No- 2

5 X 2 = 10

- a. Write a brief explanation on Salah and its impact on human life.
- b. Write some Azkar after Far'z Salah in your mother language.

Q No- 3

5 + 5 = 10

- a. Write down the different types of women rights in Islam in details.
- b. Mention the statement of Islam about equal rights of men and women.

Q No- 4

10

Write the rules of time of Salah in details.

Or

- a. How to perform Salatul Vit'r
- b. Write down the importance of reciting the Holy Quran.

5 X 2 = 10

Q No- 5

10

Explain Halaal, Haraam, Farj, Wajib and Sunnah.

Or

Write the definition of Aqeedah, Ibaadah and Muamalah.

International Islamic University Chittagong
Center for General Education (CGED)
 Semester End Examination, Spring-2024

Course Code: URED-1201

Course Title: Basic Principles of Islam

Full Marks: 50

Time: 2 Hours 30 Minutes

(Answer all questions. The right side columns contain marks, CLOs, and Bloom's taxonomy domain for each question):

#	Questions	Marks	CLOs	Bloom's taxonomy domain
1	<p>a) "Ibadah is a comprehensive phenomenon and it includes all aspects of human life"- evaluate this statement by explaining the definition and some types of Ibadah elaborately.</p> <p style="text-align: center;">Or,</p> <p>b) Who are the believers of Allah ('Ibadur Rahman)? Explain their important signs in the light of the holy Qur'an.</p>	10	3	Remember, Evaluate & Create
2	Define Salah literally and terminologically. Draw a picture regarding how the Salah changes our individual and collective lives smoothly.	10	3	Remember & Create
3	Draw a picture of the Zakah distribution culture of your society. Summarize a proper method of distribution of Zakah with a view to eradicating poverty from your society.	10	3	Apply & Create
4	"Fasting is only for me and I will give the reward for it"- evaluate this Hadith explaining the importance of fasting elaborately.	10	3	Evaluate & Create
5	"Take the method of Hajj from me"- explain this Hadith mentioning some teachings of Hajj and comparing them with our present lives.	10	3	Evaluate & Create

=====

[Answer **all** the questions. Figures in the right hand margin indicate full marks.
 Separate answer script must be used for Group A and Group B]

Group-A

1. a) Define: i) Crystal ii) Lattice CLO1 R 2
 b) Define packing fraction. Show that the packing fraction for an fcc lattice is ~ 0.74 and hence write the meaning of this number. CLO1 U 5

or

1. c) Define coordination number. Explain coordination number for NaCl structure. CLO2 A 3
 Lead is face-centered cubic with an atomic radius of $r=1.746 \text{ A.U.}$ Find the spacing of (i) (200) planes (ii) (220) planes (iii) (111) planes.

2. a) Define Miller indices and draw the plane of (101), (001), (001) and (011). CLO1 U 5
 b) Show that in a crystal of cubic structure, the distance between the planes with Miller indices h, k, l is equal to $d = \frac{a}{\sqrt{h^2+k^2+l^2}}$, where a is the lattice parameter. CLO1 U 5

or

Distinction between metal, insulator and semiconductor in terms of energy band.

Group-B

3. a) State the postulates of the special theory of relativity. Also Explain "A moving clock always appears to go slow". CLO1 U 7
 b) The length of a spaceship is measured to be exactly half its actual length. CLO2 A 3
 Calculate

- (i) the speed of the spaceship
 (ii) The time dilation corresponding to one second on the spaceship.

4. a) Calculate the following properties of alpha particle (4_2He): CLO1 A 7

- i. Nuclear Mass
- ii. Nuclear Size
- iii. Nuclear Density
- iv. Nuclear Charge
- v. Nuclear Mass defect
- vi. Nuclear Binding Energy
- vii. Nuclear Binding Energy per nucleon.

$$no = 2 \cdot 1$$

4. b) Photo-electrons are emitted with a maximum speed of $7 \times 10^5 \text{ m/sec}$ from a metal surface when light of frequency $8 \times 10^{11} \text{ Hz}$ falls on it. What is the threshold frequency of the metal. CLO2 A 3

5. a) Show that, the mean life of a radioactive atom is the reciprocal of the radioactive constant. CLO1 U 7

or

Write short note on:

- (i) Photoelectric effect
- (ii) Compton effect

5. b) The half life of a radioactive substance is 30 days. Calculate CLO2 A 3

- (i) The radioactive decay constant
- (ii) The mean life
- (iii) The time taken for $\frac{1}{4}$ of the original number of atoms to disintegrate.

or

A beam of X-ray is scattered by a free electron at 45° from the direction of incidence. The scattered X-ray has a wave-length of 0.022 \AA . What is the wave-length of the incidence X-ray?

International Islamic University Chittagong
 Department of Computer Science and Engineering
B. Sc. in CSE Final term Examination, Spring 2024
Course Code: CSE 1222 Sec: 2CF
Course Title: Computer Programming 2 Lab

Total marks: 50

Time: 3 hours

[Answer all the questions. Figures in the right-hand margin indicate full marks.]

Course Outcomes (COs) of the Questions	
CO1	Apply basic input/output system
CO2	Apply the basic features of OOP such as polymorphism, inheritance etc.
CO3	Demonstrate the use of Class library of a standard OOP language
CO4	Develop an application using the knowledge of OOP.

Bloom's Levels of the Questions						
Letter Symbols	R	U	Ap	An	E	C
Meaning	Remember	Understand	Apply	Analysis	Evaluate	Create

Group A (Marks -30)

1. Defines a **Distance** class and overload “==” operator to perform operator overloading on distances. 10 Ap CO4

Or Defines a **Distance** class and overload “&&” operator to perform operator overloading on distances.

2. We want to store the information of different vehicles. Create a class named **Vehicle** with two data members named mileage and price. Create its two subclasses 10 Ap CO3

***Car** with data members to store ownership cost, warranty (by years), seating capacity and fuel type (diesel or petrol).

***Bike** with data members to store the number of cylinders, number of gears, cooling type (air, liquid or oil), wheel type (alloys or spokes) and fuel tank size (in inches). Make another two subclasses **Audi** and **Ford** of Car, each having a data member to store the model type.

Now, store and print the information of an **Audi** and a **Ford** car (i.e. model type, ownership cost, warranty, seating capacity, fuel type, mileage and price.)

- Or** Create two classes named **Mammals** and **MarineAnimals**. Create another class named **BlueWhale** which inherits both the above classes. Now, create a function in each of these classes which prints "I am mammal", "I am a marine animal" and "I belong to both the categories: Mammals as well as Marine Animals" respectively. Now, create an object for each of the above class and try calling
- function of Mammals by the object of Mammal
 - of MarineAnimal by the object of MarineAnimal
 - function of BlueWhale by the object of BlueWhale
 - function of each of its parent by the object of BlueWhale

Group B (Marks – 30)

5. Final Project, Presentation, Report

15+5+5

C

CO4