Student Name: _____

Roll No: _____

Program: BCS
Semester: Spring-2021
Time Allowed: 2 hours and 45 minutes
Course: CL217-Object Oriented Programming Lab

Examination: Final Term
Total Marks: 90 Weightage: 40
Date: 1, July,2021
Instructor Name: Engr. Khuram Shahzad

NOTE: Attempt all questions.
Only submit .cpp file of each question in a folder. Anyone who submits any other format file will get straight ZERO. Each question should have a separate .cpp file. Copy Paste or other UFM will also get ZERO. Use the following format for naming the folder Roll#_Name (P18-1234_XYZ).
Comment your code properly. Use Camel and Pascal Case in programming.

QNo.1 (10 Marks): Define a class **Student** with the following specification
Private members of class student

admno	integer
sname	20 character
eng. maths, science	float
total	float
ctotal()	a function to calculate eng + math + science with float return type.

Public member function of class student

takeData()   Function to accept values from user for admno, sname, eng, maths, science and invoke ctotal() to calculate total.

showdata()   Function to display all the data members on the screen

QNo.2 (10 Marks): Write two multiply() functions i.e.
int *Multiply(int * x, int * y) and int *Multiply (int * x, int * y, int *z)
First multiply function will take two pointer variables and will return their result as a pointer , second multiply function will take three pointer variables and will return their result as a pointer .Call these functions from the main. Output will be like in a Calculation.txt file:
Identitfy is there any function Overloading happned?

```
Output is:
2*3 = 6
2*3*4= 24
```
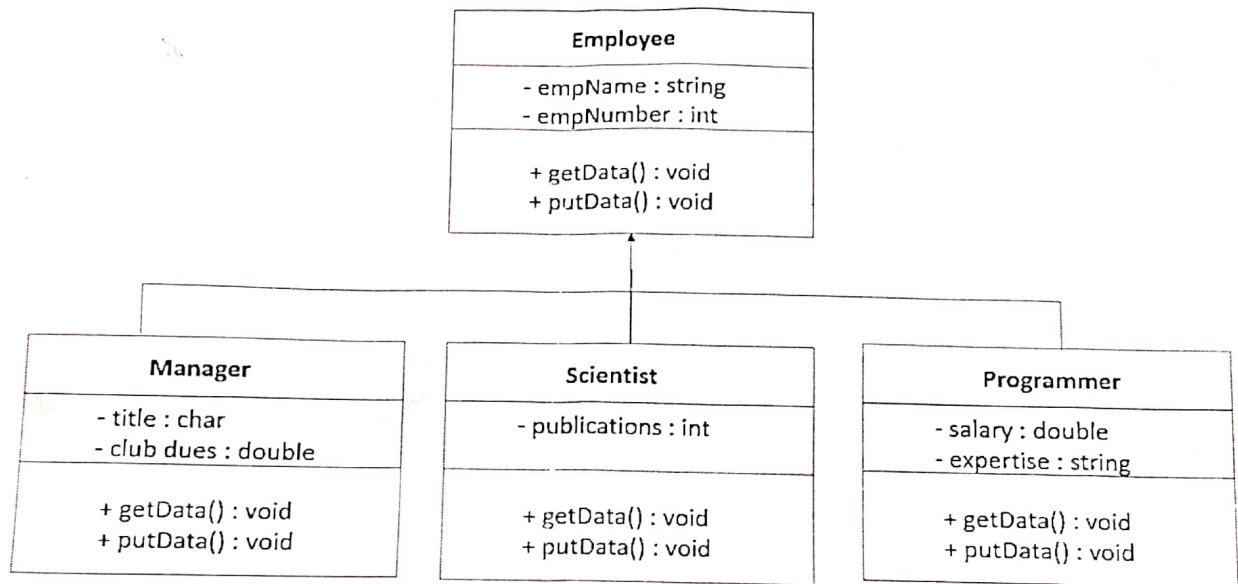
QNo.3 (25 Marks): Declare and define four Rectangle Classes namely Rectangle1, Rectangle2, Rectangle3 and Rectangle4. Each class having 2 private data members i.e. **length** and **breadth**. Initialize these data members of each class using parameterized constructors. Show the length and breadth of each rectangle and sum the length and breadth of all these rectangles using friend function **"sum()"**. Output of your program should be in the following format:

```
                        Length   Breadth
        Rectangle 1 :      5        3
        Rectangle 2 :      2        6
        Rectangle 3 :      4        6
        Rectangle 4 :      2        5
        - - - - - - - - - - - - - - - - - - -
        Sum         :     13        20
        - - - - - - - - - - - - - - - - - - -
```

QNo.3 (20 Marks): Implement the following UML Diagram using C++. First identify inheritance type w.r.t level and then code accordingly.

```
                              ┌─────────────────────────┐
                              │        Employee         │
                              ├─────────────────────────┤
                              │  - empName : string     │
                              │  - empNumber : int      │
                              ├─────────────────────────┤
                              │  + getData() : void     │
                              │  + putData() : void     │
                              └─────────────────────────┘
                                          ▲
              ┌───────────────────────────┼───────────────────────────┐
              │                           │                           │
┌─────────────────────────┐  ┌─────────────────────────┐  ┌─────────────────────────┐
│        Manager          │  │        Scientist        │  │       Programmer        │
├─────────────────────────┤  ├─────────────────────────┤  ├─────────────────────────┤
│  - title : char         │  │  - publications : int   │  │  - salary : double      │
│  - club dues : double   │  │                         │  │  - expertise : string   │
├─────────────────────────┤  ├─────────────────────────┤  ├─────────────────────────┤
│  + getData() : void     │  │  + getData() : void     │  │  + getData() : void     │
│  + putData() : void     │  │  + putData() : void     │  │  + putData() : void     │
└─────────────────────────┘  └─────────────────────────┘  └─────────────────────────┘
```

QNo.5 (25 Marks):: Write a program with **Person** as an abstract class having **name, idCard, cellPhone** as data members and only one function as **print ()**. Create **Teacher** and **Student** classes as derived classes from **Person**. **Teacher** class having **depttName** and **empId** as a data members and **Student** class having **rollNo** and **semFee** as a data members. **Publication** is a class for publishing research papers or books in a university inherited from **Teacher** and **Student**. **Publication** class having **noOfPublications**. Implement all the related functions **setters, getters** and **print** both in base and derived classes where required. **print ()** is common overwridden function for all classes, call it with **publication object** in **main** program. Identify and resolve if there is a possibility of diamond problem or ambiguity?

Implement the following concepts in your code:

a) Inheritance
b) Abstract Class
c) Pure Virtual Functions

Good Luck :)