National University of Computer and Emerging Sciences

Lab Manual
Object Oriented Programming

Course Instructor	Ms. Saira Karim
Lab Instructor (s)	Ms. Mamoona Akbar Ms. Sonia Anum
Section	BCS-2A
Semester	Fall 2022

Department of Computer Science
FAST-NU, Lahore, Pakistan

Lab Manual 8

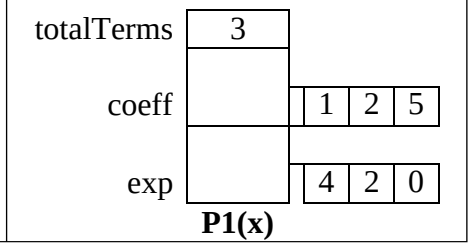
Objectives:

Operator overloading using non-member functions
Overloading assignment operator
Static data member and member function
Concept of composition

TASK 1:

A polynomial P1(x) = x^4+2x^2+5 has three terms: x^4, $2x^2$ and 5. Coefficients of these terms are 1, 2 and 5 respectively while exponents are 4, 2 and 0 respectively. To work with Polynomials, a definition of class Polynomial is given below and memory configuration for P1 is shown as follows:

```
class Polynomial
{
private:
int totalTerms;//Total terms in a Polynomial
int* coeff;//to save array of coefficients
int* exp; //to save array of exponents
};
```



Your task is to complete the definition of Polynomial class such that the main program runs successfully. Make sure that your program doesn't consume extra memory space and it should not leak any memory.

```
void main()
{
        int coeff_P1[] = {1,2,5};       //Coefficients for Polynomial P1
        int exp_P1[] = {4,2,0};         //Exponents for Polynomial P1

        int coeff_P2[] = {4,3};         //Coefficients for Polynomial P2
        int exp_P2[] = {6,2};  //Exponents for Polynomial P2

        Polynomial P1(3, coeff_P1, exp_P1);//Creates P1 with 3 terms (P1 = 1x^4 + 2x^2 +
5x^0 )
        Polynomial P2(2, coeff_P2, exp_P2);//Creates P2 with 2 terms (P2 = 4x^6 + 3x^2)

        cout<<"P1 = "<<P1<<endl; //Prints P1 = x^4+2x^2+5
        cout<<"P2 = "<<P2<<endl; //Prints P2 = 4x^6+3x^2
    if(!P1)
cout<<"P1 is zero"<<endl; /*if polynomial has only 1 term and its coeff and exp are zero. i.e.
if p1 = 0.*/
if(P1 != P2)
cout<<"P1 is Not Equal to P2"<<endl;
```

```
cout<<++P1<<endl; //adds 1 in all the coefficient.
cout<<P1<<endl;
cout<<P1++<<endl; //adds 1 in all the coefficient.
cout<<P1<<endl;
        Polynomial P3 = P1+P2;        //Adds P1 and P2 and saves result in P3.You may
consume extra space for resultant Polynomial in Add function
        cout<<"P3 = "<<P3<<endl;    //Prints P3 = 4x^6+x^4+5x^2+5

P3 = 2 + P1; //Assume P1 already has a constant term, add 2 in it.
cout<<"P3 = "<<P3<<endl;
P4 = P1;
cout<<"P4 = "<<P4<<endl;
}
```

TASK 2: (Static member and Function)

Implement a class called **Box**. The Box class will have three data members:

- int length;
- int breadth;
- int height;

You have to implement the following:

1. Implement all getters/setters.

2. There should be a static data member
    - static int objectCount; // Increases every time object is created

3. Write an overloaded and default constructor.

4. Write member functions as follow:
    - static int getCount();
    - double Volume();
    - double Area();

5. Write a suitable main() function to test the functionality of the static members and functions.

TASK 3: (Composition)

a) Define and implement a class Point in files Point.h and Point.cpp, respectively. This class should provide:

- Two private integer data members x and y which will store the x and y coordinates of a point

- A default constructor which takes two parameters to initialize the x and y coordinates and prints “Point() called” on the screen.
- A function print() which prints out the point on the screen in the format (x,y)
- A destructor which prints “~Point() called” on the screen.

b) Now define and implement a class Circle in files Circle.h and Circle.cpp. This class should contain:

- A private data member center which will be an instance of the Point class
- A private float data member radius that will store the radius of the circle
- A constructor which takes three parameters (x and y coordinates of the center of the circle, and the radius) and initializes the data members accordingly and also prints “Circle() called” on the screen.
- A destructor which prints “~Circle() called” on the screen.
- A function print() which prints the information (center and radius) of the circle on the screen

To call the constructor of class Point from the constructor of class Circle, you can use the following syntax.

```
Circle::Circle(int x, int y, float r): center(x,y) { … };
```

Add another file Lab.cpp in your project. Copy the following piece of code in that file, compile and then execute. Note down the output of the program and write it in comments in the code.

```
#include "Circle.h"

void main()
{
	Circle c (3,4,2.5);
	c.print();
}
```