National University of Computer and Emerging Sciences

School of Computing **Spring 2023** **Islamabad Campus**

CS-1004 Object Oriented Programming BS(AI/DS)

Monday, April 10, 2023

Course Instructor

Dr. Ishtiaq, Hassan Raza, Adil Majeed

Serial No:

Sessional-II

Total Time: 1 Hour

Total Marks: 73

Signature of Invigilator

Student Name | Roll No | Section | Signature

DO NOT OPEN THE QUESTION BOOK OR START UNTIL INSTRUCTED.

Instructions:

1. Attempt on question paper. Attempt all of them. Read the question carefully, understand the question, and then attempt it.
2. No additional sheet will be provided for rough work. Last pages are available for rough work.
3. If you need more space write on the last paper and clearly mark question and part number etc.
4. After asked to commence the exam, please verify that you have (**15**) different printed pages including this title page. There are total of (**3**) questions.
5. Use of calculator is strictly prohibited.
6. Use permanent ink pens only. Any part done using soft pencil will not be marked and cannot be claimed for rechecking.
7. Use **proper indentation** while writing code and make sure that your code is legible. Failing to do so can cost you marks.
8. Please read the question thoroughly and use your time **properly**, an uneven distribution of time can lead to incomplete answers.

	I	II	III	**Total**
Total Marks	48	15	10	73
Marks Obtained				

Question I . . . . . (48 Marks)

Please write proper explanation of the bug where required, without proper explanation no marks will be awarded, note there are no syntax errors (look for only logical ones) in the given set of codes.

(a) **(1 Mark)** True/False: You must declare all private members of a class before the public members.

(b) **(1 Mark)** Assume that *InventoryItem* is the name of a class, and the class has a *void* member function named *setPrice* which accepts a *double* argument. If *book* is an instance of the *InventoryItem* class, which of the following statements properly uses the *book* object to call the *setPrice* member function?

- ◯ *InventoryItem::setPrice(1.49)*
- ◯ *book.setPrice(1.49)*
- ◯ *book::setPrice(1.49)*
- ◯ *book:setPrice(1.49)*

(c) **(1 Mark)** Declare an array of three InventoryItem objects.

(d) **(2 Marks)** Modify the code given below such that the following statement o.setX(10).setY(20) can be executed without logical and syntax error:

```
#include<iostream>
using namespace std;
class Horizon {
public:
        void setX(int _x) {
                x = _x;
        }
        void setY(int _y) {
                y = _y;
        }
private:
        int x;
        int y;
};
int main() {
        Horizon o;
        o.setX(10).setY(20);
        return 0;
}
```

(e) **(2 Marks)** What will the following program display on screen. Explain the error or bug if there is any.

```
#include<iostream>
using namespace std;
class Maze {
private:
        int i;
public:
        Maze(int i) {
                this->i = i;
                cout << " C" << i << " \n";
        }
        ~Maze() {
                cout << " D" << i << " \n";
        }
```

```
};
Maze a(1);
int build() {
        Maze d(4);
        static Maze e(5);
}
int main() {
        Maze b(2);
        static Maze c(3);
        build();
        Maze f(6);
        return 0;
}
```

(f) **(3 Marks)** What would be the output produced by executing the following C++ code segment?

```
class Point{
    int x, y;
    public:
    Point(int x=0, int y=0){
        this->x=x;        Point::y=y;
        (*this)();
}
void operator()(){
    cout<<" ("<<x<<","<<y<<") " <<endl;
}
Point& operator()(int y){
    this->y=y;
    return *this;
}
~Point(){
    cout<<"Point is going";    (*this)();
    }
};
int main() {
    Point *p=new Point(5,6);
    static Point p1(p1);
    p1(9)(8);
    delete p;
    Point p2(7);
    cout<<"----------"<<endl;
return 0;
```

```
}
```

(g) **(3 Marks)** What would be the output produced by executing the following C++ code segment?

```
#include <iostream>
#include <cstring>
using namespace std;
// Given the following structure
struct Mystery{
        int *p;
        float y, z;
        void ComputeValue(int y_, int z_)
        {
                y=y_;
                z=z_;
                p[0]=2*y*z;
                p[1]=z*z;
                p[2]=y*y;
        }
        void Initalize(int y_, int z_)
        {
                p=new int [3];
                ComputeValue(y_,z_);
        }
        void Print()
        {
                cout << " Y = "<< y << " Z= "<< z
                << " Y*Y = "<< p[2]<< " Z*Z ="<< p[1] << " 2 * Y * Z = "<< p[0];
        }
        void Delete()
        {
                delete [] p;
        }
};
int main()
{
        Mystery m1, m2;
        m1.Initalize(2,3);
        m2=m1;
        m1.ComputeValue(1,4);
        m2.Print();
        m2.Delete();
        return 0;
}
```

(h) **(5 Marks)** What would be the output produced by executing the following C++ code? Identify and correct errors, and write output, if any.

```
#include <iostream>
using namespace std;
class Number {
private:
        int n;
public:
        Number() : n(0) {
                cout << n;
        }
        Number( int nn )
        : n(nn)
        {
                cout << n;
        }
        Number(Number const& otherNum)
        : n(otherNum.n+1)
        {
                cout << n;
        }
        void display() { cout << n; }
        void increase() { n += 1; }
};
int main(){
        Number a, b(1), c(b);
        b.increase();
        c.display();
        b.display();
}
```

(i) **(5 Marks)** What would be the output produced by executing the following C++ code? Identify and correct errors, and write output, if any.

```
#include <iostream>
using namespace std;
class Test{
private:
        int val;
public:
        Test(const Test& _other) : val(_other.val + 1)
{ }
        Test(int _val) : val(_val) { }
        int get_val() const{ return val;}

        const Test& operator=(Test const& _other){
                val = _other.val;
                return * this;
        }
        Test operator+(Test const& _other){
```

```
                Test t(val+ _other.val);
                return t;
        }
};
ostream& operator<<(ostream& stream, const Test & _val){
        stream << _val.get_val();
        return stream;
}
int main( ){
        Test a(1), b(2),c(a+b);
        a = b+c;
        cout << a << " " << b<<" "<<c;
}
```

(j) **(5 Marks)** What would be the output produced by executing the following C++ code? Identify and correct errors, and write output, if any.

```
#include <iostream>
using namespace std;
class Point {
private:
        double x;
        double y;
public:
        Point(int x_=0,int y_=0) { x = x_; y = y_; }

        void setX(double newX) { x = newX; }
        void setY(double newY) { y = newY; }

        double getX() const { return x; }
        double getY() const { return y; }
        ostream & operator<< (ostream & out)
        {
                out<< x<<" "<< y;
                return out;
        }
        Point operator+(const int& x_)
        {
                return Point(50, 100);
        }
};
Point operator+(const int& x, const Point &p)
{
        return Point(p.getX()+x, p.getY()+x);
}
int main()
{
        Point p(4,5),p2;
        p2=5+p;
        p<<cout<<endl;
        p2<<cout<<endl;
```

```
}
```

(k) **(5 Marks)** What would be the output produced by executing the following C++ code? Identify and correct errors, and write output, if any.

```
#include <iostream>
using namespace std;
class Mystery {
        int x, y;
public:
        Mystery(int x_ = 1, int y_ = 0) :
                y(x + y_), x(x_) {
        }
        void print(ostream & out) const {
                out << "X =" << x << " Y=" << y;
        }
        Mystery & SetX(int x_) {
                x = x_;
                return * this;
        }
        Mystery & SetY(int y_) {
                y = y_;
                return * this;
        }
};
void operator<<(ostream & out, const Mystery & m) {
        m.print(out);
}
int main() {
        Mystery m1(5, 10), m2;
        m2.SetX(-1).SetY(500);
        cout << "M2=" << m2;
        cout << endl;
        cout << "M1=" << m1;
}
```

(l) **(5 Marks)** What would be the output produced by executing the following C++ code? Identify and correct errors, and write output, if any.

```
#include <iostream>
using namespace std;
class GuessMe {
        int *p;
public:
        GuessMe(int x = 0) {
                p = new int;
                *p = x;
```

```
        }
        int GetX() {
                return *p;
        }
        void SetX(int x) {
                *p = x;
        }
        ~GuessMe() {
                delete p;
        }
};
int main() {
        GuessMe g1;
        g1.SetX(10);
        GuessMe g2(g1);
        cout << g2.GetX() << endl;
        return 0;
}
```

(m) **(10 Marks)** What would be the output produced by executing the following C++ code? Identify and correct errors, and write output, if any.

```
#include <iostream>
#include<cassert>
using namespace std;
class Point3D
{
public:
        Point3D() {
                p[0] = p[1] = p[2] = 0;
        }
        Point3D::Point3D(int x_, int y_, int z_) {
                p[0] = x_; p[1] = y_; p[2] = z_;
        }
        Point3D operator *(const int & v) {
                Point3D v1;
                v1[0] = p[0] + v;
                v1[1] = p[1] + v;
                return v1;
        }
        Point3D operator+(const Point3D &v) {
                Point3D v1;
                v1[0] = p[0] + v[0]; v1[1] = p[1] + v[1]; v1[2] = p[2] + v[2];
                return v1;
        }
        Point3D operator-(const Point3D &v) {
                Point3D v1;
                v1[0] = p[0] - v[0]; v1[1] = p[1] - v[1]; v1[2] = p[2] - v[2];
                return v1;
        }
        Point3D operator-() {
```

```
                Point3D v1;
                v1[0] = -p[0];
                v1[1] = -p[1];
                v1[2] = -p[2];
                return v1;
        }
        bool operator==(const Point3D &v) {
                return p[0] == v[0] && p[1] == v[1] && p[2] == v[2];
        }
        int operator[](const int & i) const {
                assert(i >= 0 && i <= 2); // check for index with-in range
                return p[i];
        }
        int & operator[](const int & i) {
                assert(i >= 0 && i <= 2); // check for index with-in range
                return p[i];
        }
private:
        int p[3];
};
ostream &operator<<(ostream &out, const Point3D&v) {
        out << " X = " << v[0] << " Y = " << v[1] << " Z = " << v[2] << endl
                        << flush;
        return out;
}
int main() {
        Point3D p1(10, 20, 30), p2(20, 30, 40);
        cout << " P1 : " << p1 << " P2 : " << p2 << endl;

        Point3D p3;
        p3[0] = 5;
        p3[1] = 5;
        p3[2] = 5;
        Point3D p4 = -p1 - p2 - p1 * !(p1 == p2);
        cout << " P4 : " << p4 << endl;
}
```

Question II ..... (15 Marks)

(a) **(15 Marks)** Your goal is to write a program for creating a MovieStore. Your MovieStore should allow for storage of many movie names, there (unique) IDs and ratings. Your MovieStore should allow facility of performing following operations, (minimum) data members required are given (you can add more). You need to add the necessary functions as per sequence, following the sequence will give you 2 marks:

```
    int main(){
MovieStore s1, s2(10); // create two stores of size 5 and 10

s1["Hobbit"]= 4.5;
/*   If previously not added, add a movie with average rating of 4.5
     If already exist , overwrite rating by 4.5
     If memory finished print \Memory finished overwriting rating of last movie"
     And Update accordingly */

s1["Lord of the Rings"] = 5;

cout << s1[2]<<endl;
/*  get rating for movie id 2 (Lord of the Rings => 5).
     If id not found print \id not found"
     And return -1 rating.*/

s2=s1; // copies elements from s1 to s2

s1["Lion King"] = 8;
cout << s2; // should display all the Movie store information
 return 0;
}
```

Expected Output:

5

MovieStore:

ID	Movie	Rating
1	Hobbit	4.5
2	Lord of Rings	5

```
    class MovieStore{
    string * names;
    int * ids;
    float * rating;
    int size;
    int currentSize;
    . . . . . .
```

Question III . . . . . (10 Marks)

(a) **(10 Marks)** Consider a class named "Rectangle" that represents a rectangle with a length and width. The class should have the following member functions:

1. A constructor that takes two arguments (length and width) and initializes the corresponding data members.
2. Getters and setters for both the length and width data members.
3. A function named "area()" that calculates and returns the area of the rectangle.
4. An inline function named "isSquare()" that checks if the rectangle is a square (i.e., length == width).
5. A static data member named "count" that keeps track of the number of Rectangle objects created.
6. A static function named "getCount()" that returns the value of the "count" data member.
7. A constant data member named "PI" that stores the value of pi (3.14159).
8. A function named "getCircumference()" that calculates and returns the circumference of the rectangle using the formula: 2 * (length + width).

Your task is to implement the Rectangle class and test its functionality by creating at least two Rectangle objects and calling the appropriate member functions. In your main function, you should do the following:

1. Create a Rectangle object with length = 5 and width = 7.
2. Create another Rectangle object with length = 4 and width = 4.
3. Call the "area()" function for both Rectangle objects and print the results.
4. Call the "getCircumference()" function for both Rectangle objects and print the results.
5. Call the "isSquare()" function for both Rectangle objects and print the results.
6. Call the "getCount()" function and print the result.

Your implementation should make use of the "this" pointer where appropriate and should include comments explaining the purpose of each function and data member. Your code should also follow best practices for variable and function naming conventions, as well as formatting and indentation.