National University of Computer and Emerging Sciences

FAST School of Computing **Fall-2022** **Islamabad Campus**

Question 1 [6 + 4+ 5=15 Marks]

What would be the output produced by executing the following C++ code? Identify errors, if any (Either write output or error, both will not be acceptable).

S no.	Question	Output

1.1	`#include <iostream>`
	`using namespace std;`
	`class C {`
	`public:`
	
	`C() : a(10) {cout << a << endl;}`
	`~C() { cout << a+5 << endl;}`
	`void seta (int a) { this -> a = a; }`
	`void multiply (int a)`
	`{`
	`this -> a = this->a * a;`
	`}`
	
	`private:`
	`int a;`
	`};`
	
	`int main ()`
	`{`
	`C c1, c2;`
	`c1.seta(20);`
	`C c3;`
	`int i = 7;`
	`c3.multiply(i-2);`
	`return 0;`
	`}`
		10 (1 mark)
		10 (1 mark)
		10 (1 mark)
		55 (1 mark)
		15 (1 mark)
		25 (1 mark)
		Sequence matters a lot. These numbers should be in this sequence.

1.2	`#include <iostream>`
	
	`using namespace std;`
	
	`class Budget`
	
	`{`
	
	`private:`
	
	`static double corpBudget;`
		ERROR
		We cannot use the non static variable divisionBudget in the static function `getDivisionBudget()`
		correct reason (4 mark)

```
  double divisionBudget;
 public:
 Budget()
 { divisionBudget = 0; }
void addBudget(double b)
 {
 divisionBudget += b;
 corpBudget += b; }

 static double getDivisionBudget()
 { return divisionBudget; }

 static double getCorpBudget()
 { return corpBudget; }
 };
double Budget::corpBudget = 0;
int main()
 {
 int count;
 const int NUM_DIVISIONS = 4;
 Budget divisions[NUM_DIVISIONS];
 for (count = 0; count < NUM_DIVISIONS; count++)
 {
 divisions[count].addBudget(2000);
 }
```

```
for (count = 0; count < NUM_DIVISIONS; count++)
{
cout << Budget::getDivisionBudget() << endl;
}
cout << Budget::getCorpBudget() << endl;
return 0;
}
```

1.3

```
#include <iostream>
using namespace std;
class Integer {
 private:
 int *n;
 int w;
 public:
   Integer() : n(new int), w(0)
    { *n = 25;}
   Integer( int nn , int ww):n(new int), w(ww)
     {   *n=nn;
          w = 72;
     cout << *n<<" " <<endl;   }
     Integer(const Integer& Num )
     {
         n = new int;
         n = Num.n;
```

There was a small mistake in setter functions. The function should be void instead of int and since there is no returning statements in setter function so, this is an error in visual studio (other compilers deal it as a warning).

If student detect this error then give him **full 5** marks for it.

If student mentioned the output then check the output with following criteria:

61 (1 mark)
90 (1 mark)
72 (1 mark)
56 (1 mark)
72 (1 mark)

Sequence matters a lot. These numbers should be in this

	w = Num.w;
	}
	void getn() { cout << *n<<" " <<endl; }
	void getw() { cout << w << endl;}
	int setn(int i) { *n = i; }
	int setw(int i) { w = i; }
	void display(){ getn(); getw(); }
	};
	int main(){
	Integer a, b(61,53), c(b);
	c.setn(90);
	b.display();
	b.setn(56);
	c.display();
	}
		sequence.
		
		If student mentioned both error and output then **2.5 mark** for correct reason and 2.5 mark for output **(0.5 mark for each output)**

Question 2 []

Write output of the following program.
Note: Please ignore missing semicolon, header files/libraries, spaces etc.

S no.	Question	Output

2.1.	#include <iostream>
	using namespace std;
	class Test2
	
	{
	int y;
	};
	class Test
	{
		fun(int) called

	int x;
	Test2 t2;
	public:
	operator Test2 () { return t2; }
	operator int () { return x; }
	};
	void fun (int x)
	{
	cout<<"fun(int) called";
	}
	int main()
	{
	Test t;
	fun(t);
	return 0;
	}	

2.2	#include<iostream>
	using namespace std;
	
	class Rectangle {
	private:
	int x, y;
	public:
	Rectangle () : x(0), y(0) { }
	Rectangle& operator()(int dx, int dy);
	void show() {
	cout << "Length= " << x << ", Width = " << y; }
	};
	
	Rectangle& Rectangle::operator()(int dx, int dy)
	{
	x = dx;
	y = dy;
	return *this;
	}
	
	int main()
	{
	Rectangle r;
	r(3, 2)(4,5)(2,1);
	r.show();
	return 0;
		Length = 2, Width = 1

	}	

Question 2.3 []

Complete the code below by adding postfix decrement operator (please note the prototype is similar to that of post increment operator except the symbol --)

Following Output should be displayed:
Before decrement: i = 3
After post decrement: i = 3

```
#include <iostream>
using namespace std;

class Integer {
private:
    int i;

public:
    // Parameterised constructor
    Integer(int i = 0)
    {
        this->i = i;
    }

    // Overload the postfix decrement operator here

Integer operator--(int)
{
Integer temp;

temp.i = i;
i--;
return temp;
}
```

```
int main()
{
    Integer i1(3);
    cout << "Before decrement: ";
    i1.display();
   // Using the post-decrement operator
    Integer i2 = i1--;
   cout << "After post decrement: ";
    i2.display();
}
```

```
    // Function to display the value of i
    void display()
    {
        cout << "i = " << i << endl;
    }
};
```

Question 3 [15 Marks]

Consider the following code for class ***Numbers*** and ***main()*** method.

Overload the following operators for ***Numbers*** such that the given code compiles without any error.

1) **Unary minus operator**: negate (change sign) of all member variables
2) **Binary minus operator**: it will subtract two Numbers (x from x, y from y, z from z) in such a way that there is no negative member variable in the object that is being returned by this operator.
3) **Unary multiplication operator**: multiply each member variable of the **Number** class by itself i.e. (x with x, y with y, and z with z)
4) **Stream insertion operator <<**: print the values of x, y, and z.
5) **Stream extraction operator >>**: asked user to enter the values of x, y, and z.

```
class Numbers
{
    private:
            int x,y,z;
    public:
            Numbers ()
            {  x=0, y=0, z=0; }
//Operator function implementation









};
```

```
int main()
{
 Numbers num,num2,num3;
      cin>>num;
      cin>>num2;
      -num;
      num3=num-num2
      cout<<num;
       *num;
      cout<<num;
      return 0;
}
```

Question 4 [15 Marks]

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In ocean navigation, locations are measured in degrees, minutes and seconds of latitude and longitude. For example, if you're at Tahiti Harbour, your location is 149 degrees 34 minutes 45 seconds longitude, and 17 degrees 31 minutes 30 seconds latitude, written as:

149° 34' 25'', 17° 31' 30''.

Longitude is measured from 0 to 180 degrees, Latitude is measured from 0 to 90 degrees. Create a class ***Location*** that includes six member variables: an int for latitude degrees, an int for latitude minutes, and int for the latitude seconds, an int for longitude degrees, an int for longitude minutes, and an int for the longitude seconds. The class will include two member function that convert latitude and longitude values to decimal and then radians using the following formula:

Degrees = degrees + (minutes/60) + (seconds/3600)

Radians = degree(in decimal) * (pi/180)

The class shall also have a member function to calculate the distance between two locations. Using the following formula.

Distance = 3963.0 * acos[(sin(lat1) * sin(lat2)) + cos(lat1) * cos(lat2) * cos(long2 – long1)]

The formula assumes latitude and longitude values are in radians. Your class must also follow the object oriented principle of encapsulation and include appropriate setter and getter functions along with constructor(s) as needed. Write a main() function that displays the working of your program by calculating distance between two locations.

Correct Class	**1**
All data members with data types	**3**
Encapsulation (private + Setters & Getters)	**3**
Convert to latitude function	**1.5**
Convert to longitude function	**1.5**
Calculate distance function	**3**
Program demostrated in Main func	**2**

Rough Work