National University of Computer and Emerging Sciences, Lahore Campus

Course Name:	Object Oriented Programming	Course Code:	CS1004	
Degree Program:	BS(CS)	Semester:	Fall 2021	
Exam Duration:	60 Minutes	Total Marks:	30	
Paper Date:	03 - Dec - 2021	Weight:	15	
Section:	ALL	Page(s):	4	
Exam Type:	Midterm-I			

Student Name:__, _____ Roll No._ _ Section:_ —

Instruction/Notes: Attempt all questions on this answer booklet. You may use extra sheets for rough work but they will not be collected or marked. In case of any confusion, take reasonable assumption. Questions during exam are not allowed.

30 points

Question 1

Consider a class **StatisticalSample** for capturing a data distribution (e.g. students marks, household expenses, etc) for basic statistical operation and analysis, with a partial class definition given below. Complete the definition (header) as well as implementation to support the following operators:

- == operator to compare two samples based upon mean and variance

- * operator to scale the entire sample with a multiplicative factor (a double value) by multiplying all the data points with that factor. This implementation shall be commutative i.e. the factor can appear either on the left (LHS) or right (RHS) of the given sample instance.

- << operator to print the sample (all data points, along with mean and variance)

Consider the following driver program to understand its usage:

```cpp
void main()
{
        double arr1[] = {2.1,5.4,3.7,5.9,8.2};
        double arr2[] = {3.7,5.9,8.2,2.1,5.4};
        StatisticalSample s1( arr1 , 5);
        StatisticalSample s2( arr2 , 5);
        StatisticalSample s3 = s1 * 3;
        StatisticalSample s4 = 3 * s1;

        cout << s1 << endl;     // {2.1,5.4,3.7,5.9,8.2}, mean : 5.06, variance: 4.2584
        cout << s2 << endl;     // {3.7,5.9,8.2,2.1,5.4}, mean : 5.06, variance: 4.2584
        cout << s3 << endl;     // {6.3,16.2,11.1,17.7,24.6}, mean : 15.18, variance: 38.3256
        cout << s4 << endl;     // {6.3,16.2,11.1,17.7,24.6}, mean : 15.18, variance: 38.3256

        cout << (s1 == s2) << endl; // true
        cout << (s1 == s3) << endl; // false
}
```

Provide your solution below, to complete the given definition and implement all the necessary code aspects that are required for proper implementation of the above requirements:

```
class StatisticalSample{

    private:
        double* data;
        int count;
        double Mean;
        double Variance;
    public:
        StatisticalSample(double[],int);

        double mean();          // (∑ dataᵢ)/count
        double variance();      // (∑ (dataᵢ - mean)² )/count
```

bool operator == (Statistical Sample y);

SS& void operator * (double x);

friend ostream& operator << (ostream& out, SS& s);

```
        ~StatisticalSample();
};
```

```
// implementation goes here
```

StatisticalSample :: Statistical Sample (double[] x, int y) {

　　count = y;

　　for (int i=0; i<y; i++)
　　{
　　　data[i] = x[i];
　　}

}

double StatisticalSample :: mean() {

　　for (int i=0; i<this->count; i++)
　　{
　　　this->Mean = mean + this->data(i);
　　}

　　this→Mean = this→Mean / this→count

　　return this→Mean;