Data Structures - Summer 2023
Assignment #1

Sorting Algorithms

Assuming that you have a class, Student:

```
class Student
{
    string id;
    string name;
    double gpa;

    public:
    Student(string, string, double);
}
```

1. Implement the student class with its constructor.
2. Overload the operator < such that it compares the names of two student objects.
3. Read student objects from a file named **students.txt**, which will have the number of students followed by their information as follows:
4. Implement Insertion Sort, Selection Sort, Bubble Sort, Shell Sort, Merge Sort, and Quick Sort algorithms.
    a. Each algorithm should be a separate function implemented using templates to allow sorting of different types of data.
5. Sort the array of students' objects with each of the previous algorithms.
    a. Sort the data one time by Name and another time by GPA.
6. You should count comparisons for each of the sorting algorithms you implemented (The number of comparisons made by each sorting algorithm).
7. Calculate the running time of each algorithm for each array.
8. The output will be two files, **SortedByGPA.txt** and **SortedByName.txt.** Each file contains:
    a. Algorithm name.
    b. Number of comparisons.
    c. Running Time.
    d. Sorted Student Elements.

```
4
Sara Ahmed
78697
3.1
Ali
3541
3.5
Mariam
69712
3.7
Mohamed Kamal
97848
2.2
```

students.txt

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```
Algorithm: Insertion Sort
No. of Comparison: 16
Running Time: 50 milliseconds
Ali
3541
3.5
Mariam
69712
3.7
Mohamed Kamal
97848
2.2
Sara Ahmed
78697
3.1

Algorithm: Selection Sort
No. of Comparison: 12
Running Time: 45 milliseconds
Ali
3541
3.5
Mariam
69712
3.7
Mohamed Kamal
97848
2.2
Sara Ahmed
78697
3.1

And so one for each algorithm
```

SortedByName.txt

```
Algorithm: Insertion Sort
No. of Comparison: 16
Running Time: 50 milliseconds
Mariam
69712
3.7
Ali
3541
3.5
Sara Ahmed
78697
3.1
Mohamed Kamal
97848
2.2

Algorithm: Selection Sort
No. of Comparison: 12
Running Time: 45 milliseconds
Mariam
69712
3.7
Ali
3541
3.5
Sara Ahmed
78697
3.1
Mohamed Kamal
97848
2.2

And so one for each algorithm
```

SortedByGPA.txt

Grading:

Insertion Sort	10
Selection Sort	10
Bubble Sort	10
Shell Sort	10
Merge Sort	10
Quick Sort	10
Read/Write From File	10
Number of Comparison	10
Running Time	10
Main (contains reading from file, running the algorithms, and writing the output)	10

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Rules:

1- All the code must be in C++.

2- The solution should compile, run without run-time errors, and handle all the cases.

3- Assignment is submitted in teams of 3 from any group.

4- You will upload a zipped folder that contains your code (Don't include any .exe files in your submission).

5- Assignment submission is on Google Classroom (No submission through mail).

6- Follow this convention for naming your folder: ID1_ID2_ID3_A#_G# (i.e 20200111_20200222_20200333_A2_G5_G6)

7- Deadline of the Assignment: Next Saturday, 5 August, 2023, at 11:59 p.m.

Any cheating in any part of the assignment is the responsibility of the whole team, and all of the team members will be punished.

Failure to follow any of the above rules will result in your submission being discarded and your team being considered to have not submitted.