Object Oriented Programming
Instructor: Natalia Chaudhry

Assignment 3: Templates and linked list

Deadline to submit the assignment is Tuesday 12th December, 2020 till 11:59 pm

Submission instructions   Marks: 35

1. Submit your file in a .zip or .rar format. Name your file with your Roll number (e.g. BSEF19M009.zip or BSEF19M009.rar)
2. Make a separate folder for each task of assignment (e.g. task1, task2…). All the headers and .cpp files must be in respective folder with a screenshot of the output of a program of the respective task.
3. Every Cpp file must contain your name and roll number(In comments) at the top of each program
4. Don't enclose your executable code in comments otherwise it will not be evaluated.

Instructions: (MUST READ)

- **No compensation or makeup assignment.**
- **Don't discuss with peers. Changing variable names/ changing for to while loop will not help you in hiding cheating attempt!**
- **You are not allowed to ask TA to verify/ prove your cheating case! Any such complaint from TAs will result in serious consequences. Don't expect any positive response from TAs in such regard.**
- **Cheating cases will result in deduction in sessionals.**
- **You are not allowed to consult Internet. Plagiarism cases will be strictly dealt.**
- **Queries are not allowed. Do whatever you are able to understand**

General instructions for all tasks: (marks will be deducted if the instructions are violated)

Note: All the programs should be implemented using class. You can take input in main() function and then call appropriate methods/ member functions of a designed class to set and get values. YOU MUST CREATE A SEPARATE CPP AND HEADER FILE(S) FOR CLASS DECLARATION AND DEFINITION.

• The attributes of class should be declared as **private** and member functions as **public**.

• All the member functions (expect constructor) should be declared inside the class and defined outside the class.

• You should not initialize the attributes while declaring them in class. The values should be assigned using member functions only. E.g. you cannot declare like:

```
Class Person
{
        Private:
        int age=25;
}
```

• The values should be initialized using a constructor. There must be a constructor in your defined class.

- All inputs should be taken in *main()* and all the final results should also be reported/ displayed in the main function.
- All the logic should be implemented in class' member functions. Main() should only input and output relevant values by calling relevant functions of the class.

Task 35 marks

You are required to design a template class of linked list. The linked list should be made generic so as to hold any class' object. The linked list should hold another pointer named "before" (apart from next pointer) that points to the previous node.

Design another class Student that has two data members: Student ID and Student CGPA. Implement getter setter methods and overloaded << >> operators. It should have a function named PRINT() that simply displays the data members.

(class declaration and data members = 2 marks)

Implement following functions for the linked list:

Add: (4 marks)

This function adds elements to the linked list. This function SHOULD check the order of elements while inserting elements. The elements are added such that the list is sorted on the basis of student ID.

Delete: (4 marks)

This function should accept the element number of the linked list that needs to be deleted. For example, if third element needs to be deleted that this function accepts 3 as an argument. All the relevant pointers should be adjusted accordingly.

Search: (4 marks)

This function should accept student ID as an input and display the record of that student using print function of relevant class.

Shuffle: (10 marks)

This function should iterate the elements of a linked list and shuffle them. While shuffling, for each element, generate a random number (you might need to generate a random number between a valid range). The generated random number will give the updated position of element. For example, for element number 3, if the generated number is 1 then the element 3 is shifted to position number 1. All the relevant pointers must be updated accordingly.

PrintLinkedList: (3.5 marks)

This function should print the contents of elements of a linked list. While displaying, the position number of each element should also be displayed. Additionally, the contents of before and next pointer should also be displayed. For printing the details of object residing in an element, use print function of the class. Make sure to print all of the mentioned things otherwise marks will be deducted.

Main (1.5x5= 7.5 marks)

1. Create an array of objects of class Student. This array should be dynamic and user should supply the size of array. While taking size as an input, perform validation check and make sure the size must be greater than 6. The program should keep on taking input from the user until correct input is given. Initialize the data members by using >> operator.

2. Add the elements to the linked list one by one and print the contents of a linked list using PrintLinkedList function at the end after adding all the elements from an array. You must also add the screenshot of output for this function while submission otherwise marks will be deducted..

3. Call delete function with argument 4. PrintLinkedList function at the end calling this function. You must also add the screenshot of output for this function while submission otherwise marks will be deducted.

4. Call search function with student ID entered for fourth object. PrintLinkedList function at the end calling this function. You must also add the screenshot of output for this function while submission otherwise marks will be deducted.

5. Call shuffle function. PrintLinkedList function should be called BEFORE and AFTER calling shuffle function. You must also add the screenshot of output for this function while submission otherwise marks will be deducted.