National University of Computer and Emerging Sciences, Lahore Campus

Course:	Data Structures and Algorithms	Course Code:	CS2002
Program:	BS (Electrical Engineering)	Semester:	Fall 2021
Assessment Tool	Programming Assignment # 1		
Total Marks:	50		

Submission Guidelines:
Archive your files (.h and .cpp) in a zip file named as your roll number(s). Upload this file on slate under the assignment submission section till Friday 15th Oct 2021 till 4pm.
Code should be documented and well written in C++. It must compile.

VERY IMPORTANT

Academic integrity is expected of all the students. Plagiarism or cheating in any assessment will result in negative marking or an **F** grade in the course, and possibly more severe penalties.

PROBLEM 1 CLO [2]

(i)
(Recap of Programming Fundamentals course and application of singly linked list)
A university needs a software system that would allow them to keep track of all the students. There is no limit on the number of students that could be there.

You are NOT ALLOWED to use arrays for this assignment.

```
//sample class structure of University and Student classes
#include<string>
#include "SList.h"
class Student
{
   public: //add any needed functions yourself

  private:
        string name;
        int rollnumber;
}
class University
{
        public: //add any needed functions yourself

       private:
           int numberOfStudents;
           SList<Student*> * list; // singly linked list you developed in the lab
}
```

1) Please implement the above classes. You just need to plug in the singly linked list that you have already implemented in the lab and call their functions (insert/delete etc) on need basis. You should add any getter/setter functions needed yourself. You might need to overload

certain operators in these classes e.g. overload the stream insertion operator (<<) to work with the print function in the linked list.

2) The code for the above structure should include the option to
   i. add a new Student (you must add a student with your rollnumber so if your rollnumber is 20L-1447 you would just use the integer part as rollnumber i.e. 201447).
   ii. delete a student (you must delete the student with your own rollnumber)
   iii. print the students,
   iv. report on the number of current students etc. (add a member function no worse than O(n) in the List ADT for this)
   v. search for a student in the list. (add a member function no worse than O(n) in the List ADT for this)

   You may write a client, menu based, program (described above) that will do as stated.

(ii)

You are given the following ADT of a singly linked, please implement the following non-member function that checks whether the list is circular or not. The time complexity of your function should not be worse than O(n) and your are not allowed to use any other data structure other than the list itself.

```
template <typename T>
class List
{
   public:
           // constructor of the Singly Linked List
           List();
           //returns pointer of the first node in the list
            Node<T>* getFirst();//
           //prints the contents of the list
             void printList();

   private:
           Node<T> *first ;

};

//non-member function to implement
template <typename T>
bool isCircular (List<DT> * plist);
//returns true if plist is circular in nature and false otherwise
```

(iii)

You are given the following ADT of a doubly linked, please implement the following member function that checks whether the list is carrying a palindrome or not. The time complexity of your function should not be worse than O(n) and your are not allowed to use any other data structure other than the list itself.

```
template <typename T>
class DList
{
   public:
           // constructor of the doubly Linked List
           DList();
```

```
        // function to implement
        //returns true if the list is carrying palindrome and false otherwise
             bool isCarryingPalindrome();

   private:
           Node<T> *first ;

};
```

Examples of doubly linked lists carrying palindrome data for which your function should return true.

Example of doubly linked list carrying non-palindrome data for which your function should return false