National University of Computer and Emerging Sciences
Lahore Campus

Data Structures and Algorithms (CS2002)

Date: September 23rd 2024

Course Instructor(s)

Ms. Shazia Haque, Mr. Ahmad Hamza

Sessional-I Exam

Total Time (Hrs):	1
Total Marks:	20
Total Questions:	2

Roll No _____ Section _____ Student Signature _____

Do not write below this line

Attempt all the questions.

***PLO 2, C4, CLO #1:* Analyze the efficiency of algorithms and data structures in terms of time and space complexity.**

Q1:

a. **Calculate** the time complexity expression T(n) and express it in terms of Big-O notation of the below code snippet. [6 marks]

```
int sum = 0;
for (i=1; i<=n; i=i*2)
{
        cout << i;
        for (j=1; j<=i; ++j)
        {
                sum++;
        }
        cout << sum<< endl;

}
```

b. **Calculate** the space complexity expression and express it in terms of Big-O notation of the below code snippet. [4 marks]

```
void func (int n)
{
    If (n> 0)
    {
        func(n/2);
        func(n/2);
    }
}
```

National University of Computer and Emerging Sciences

Lahore Campus

***PLO3, C5, CLO #2:* Design linear data structures and their associated algorithms.**

Q2: Suppose we have the following interface of a Doubly linked list. **Construct** the two member functions in C++ highlighted below. Please note that you are not allowed to use any other data structure than the list itself for implementing these function. DNode class is the same as discussed in your theory class. [10 marks]

```
template<class DT>
class DList
{
  public:
        DList();

        /*functions to be implemented below*/
        //removes the node passed in as parameter from the list. Performance must be O(1)
        void Delete( DNode<DT> pdel):

        //creates a new node with value passed in as parameter and makes it the first node of the list
        //taking care of all the special cases. Performance must be O(1)
        void insertAtStart(DT value);
 private:
         DNode<DT> *first; //points to the first node of the list
}
```