16 November 2022

NORTH SOUTH UNIVERSITY
Department of Electrical and Computer Engineering
B.Sc. in Computer Science and Engineering Program
Mid Term Examination, Fall 2022 Semester

Course: CSE 225 Data Structure and Algorithms, Section-06
Instructor: Dr. Mohammad Rezwanul Huq (MRH1), Associate Professor (Part-time)
Full Marks: 50 (15% marks will be counted)
Duration: 1 hour and 15 minutes

Note: There are **5** (**FIVE**) questions. Answer ALL of them. The Mark of each question is mentioned at the right margin.

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1. **(a) Determine** the output of the following program. Explain your answer briefly. (6 points) [10]

```
#include <iostream>
using namespace std;
int main()
{
    int num[5];
    int* p;
    p = num;
    *p = 10;
    *(++p) = 20;
    p = &num[2];
    *p = 30;
    *(++p) = (*p)++;
    p = num;
    *(p + 4) = 50;
    for (int i = 0; i < 5; i++)
        cout << num[i] << ", ";
    return 0;
}
```

(b) Determine the runtime complexity (in Big-Oh notation) for the following operations over different data structures. Justify your answer briefly. (4 points)

Operation type	using Singly Linked List (without tail pointer)	using Doubly Linked List (with tail pointer)
accessing any elements arbitrarily		
deleting an element from the end of a list		

2. Given a two-dimensional array of size n x n, **write** a program that checks whether the given square matrix (2-D array) is symmetric or not. A square matrix A is symmetric if $a_{ij} = a_{ji}$, for all i and j or $1 \leq i \leq n$, and $1 \leq j \leq n$. [10]
Here, n is any natural number. a_{ij} is an element at position (i, j) which is i^{th} row and j^{th} column in matrix A and a_{ji} is an element at position (j, i) which is j^{th} row and i^{th} column in matrix A.
While writing the code, you must access the array elements using the concept of 'Pointers'.

3. Given a Singly Linked List of integers, **write** a function **frontChange()** that makes the last node as the head of the linked list. Suppose, the input list is 10 → 20 → 30 → 40. The output list will be 40 → 10 → 20 → 30. Consider that the head is globally declared. [10]

While writing the function, consider the following Node class.

```
class Node{
   public:
      int key;
      Node* next;
}
```

4. Consider an integer array A with the following elements. [10]

6	5	3	4	2	1

Find the number of exchange operations performed to sort the array based on Bubble Sort and Selection Sort algorithm. You must show the details of your answer.

5. (a) How does the Doubly Linked List improve the performance of a Singly Linked List (with tail)? Explain with appropriate examples. [10]

(b) **Determine** the output of the following code segment with appropriate reasoning.

```
Queue q = new Queue();
Stack s = new Stack();
s.push(5);
s.push(6);
s.push(s.peek());
s.push(7);
q.enqueue(s.pop());
q.enqueue(5);
q.enqueue(6);
System.out.print(q.peek());
s.push(q.dequeue());
System.out.print(s.pop());
s.pop();
System.out.print(s.pop());
```