



**United International University (UIU)**  
Dept. of Computer Science and Engineering (CSE)  
Mid Exam    Year: 2023    Trimester: Fall  
Course: CSE 2215   Data Structure and Algorithms-I  
Total Marks: 30, Time: 1 hour 45 minutes

**(Any examinee found adopting unfair means will be expelled from the trimester / program as per UIU disciplinary rules)**

**There are FOUR questions. Answer all of them. Figures in the right-hand margin indicate full marks.**

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1. a) How does the **Descending Order Insertion Sort** work on the following data? [3]  
y p z x r s  
Here,  $x$ =last two digits of your student id+3,  $y=x+3$ ,  $z=x+y$ ,  $p=y+z$ ,  $r=x+2$ ,  $s=y+9$   
  
b) Find a recurrence for time using the recursive **Merge Sort** and solve the recurrence. [3]  
  
c) How many element comparisons are needed for the following instance of the **Ascending Order Quick Sort** to find the first partitioning element? [2]  
  
18 23 56 26 89 37 28 48
  2. a) Find the memory location of  $A[70][80]$  if  $\text{loc}(A[15][20])=x+1400$ , where  $x$ =last four digits of your student ID. Assume column-wise memory is allocated in the double type array  $A[90][100]$ , where each double data is 8 bytes. [3]  
  
b) If  $f(n)=kn^2-3n+5$ , prove that  $f(n)=\Theta(n^2)$ . Here,  $k$ =last digit of your student id+4. [3]  
  
c) How does the **Binary Search Algorithm** work on the following data?  
Input Data: t r p z y x  
Search Key=y  
Here,  $x$ =last two digits of your student ID,  $y=x+4$ ,  $z=x+y$ ,  $p=y+z$ ,  $r=z+p$ , and  $t=p+r$  [3]  
Also find the total element comparisons for the given instance of the **Binary Search**.
  3. a) An array contains 10, 20, 30, 40, 50. Now we want to insert 15 in-between 10 and 20. Remember that it will maintain the ascendancy after insertion. What is the difficulty for this insertion? How this problem can be resolved by a linked list easily? [2]  
  
b) Suppose a linear linked list headed with "start" contains four nodes whose data values are 40, 50, 30, 20, respectively. Show the following operations. [6]
    - i) Draw a diagram for the linked list.
    - ii) Find a name for each of the nodes with respect to "start" that contain 40, 50, 30, 20, respectively?
    - iii) Write statements to represent 40, 50, 30, 20, respectively.
    - iv) Write a statement to set NULL at the end of the linked list.
    - v) Write statements to delete the node that contains 30.
    - vi) Write statements to insert a node "temp" in-between 50 and 20 that contains 28.

4. a) Show the effect of each of the statements given in the following code segment. [3]  
Assume, each of the nodes in the doubly linked list has three fields' **data**, **next** and **back**, where **data** is of integer type, and **next** and **back** will contain the addresses of the next and previous nodes, respectively.

```
start=(node*)malloc(sizeof(node));  
temp=(node*)malloc(sizeof(node));  
temp1=(node*)malloc(sizeof(node));
```

```
start->data =10;  
temp->data=40;  
temp1->data=30;
```

```
start->next=temp;  
temp->next=temp1;  
temp1->next=NULL;
```

```
temp1->back=temp;  
temp->back=start;  
start->back=NULL;
```

```
temp->back->next=temp->next;  
temp->next->back=temp->back;  
free(temp);
```

- b) How can you reverse a string using a STACK implemented by an array? Show push() and pop() operations in this regard. [2]