United International University (UIU)

Dept. of Computer Science and Engineering (CSE)

Mid Exam Year: 2022 Trimester: Fall

Course: CSE 2215/CSI 217 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.

---

1. a) How does the **Descending Order Merge Sort** work on the following data? [3]

   y p z x r s

   Here, x=last two digits of your student id+1, y=x+3, z=x+y, p=y+z, r=x+2, s=y+9

   b) Discuss the time complexity of the following algorithm. [3]

```
sum=0;
for(i=1; i<=n; i++){
   for(j=1; j<=i; j++){
       sum=sum+i+j;
   }
}
printf("%d", sum);
```

2. a) How many times the condition of while loop in the **Ascending Order Insertion Sort Algorithm** will be executed for the following data? [3]

   Data Set-I: 10, 20, 30, 40

   Data Set-II: 40, 30, 20, 10

   Data Set-III: 30, 10, 40, 20

   b) How many element comparisons are needed for the following instance of the **Ascending Order Quick Sort Algorithm** to find the first partitioning element? [2]

   18 23 56 26 89 37 28 48

   c) Find the memory location of A[60][70] if loc(A[15][20])=x+1200, where x=last four digits of your student ID. Assume column-wise memory is allocated in the floating point type array A[80][100], where each float data is 4 bytes. [2]

3. a) How does the **Binary Search Algorithm** work on the following data? [2]

   Input Data: t r p z y x

   Search Key=y

   Here, x=last two digits of your student ID, y=x+3, z=x+y, p=y+z, r=z+p, and t=p+r

   b) If $f(n)=kn^2-5$, prove that $f(n)=\Theta(n^2)$. Here, k=last digit of your student id+2. [3]

   c) Suppose a linear linked list headed with "start" contains four nodes whose data values are 10, 20, 30, 40, respectively. Show the following operations. [4]

   i) Draw a diagram for the linked list.

   ii) Find a name for each of the nodes with respect to "start" that contain 10, 20, 30, 40, respectively?

iii) Write statements to represent 10, 20, 30, 40, respectively.
iv) Write a statement to set NULL at the end of the linked list

4. a) Show the effect of each of the statements given in the following code segment. Assume, each of the nodes in the linear linked list has two fields' **data** and **next**, where **data** is of integer type and **next** will contain the address of the next node. [4]

```
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=temp1;
start->next->next=temp;
temp->next=NULL;
start->next=temp1->next;
free(temp1);
newitem=(node*)malloc(sizeof(node));
newitem->data=34;
newitem->next=start->next;
start->next=newitem;
```

b) Show the status of a STACK implemented by a linear linked list for the operations given below. Here, x=last digit of your student id+5, y=x+3, and z=y+x. [2]

Push(x+y), Push(y+z), Pop(), Push(y*z), Push(x*y), Pop(), Pop()

c) Show the status of a QUEUE of size 3 implemented by an array for the operations given below. Here, x=last digit of your student id+5, y=x+3, and z=y+x. Here, Enqueue and Dequeue are meant by insertion and deletion, respectively. [2]

Enqueue(x+y), Enqueue(y+z), Dequeue (), Enqueue(y*z), Enqueue(x*y), Dequeue ()