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. [4]
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.

```
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 ()

$\frac{n^2+n+2n}{2}$