United International University (UIU)

Dept. of Computer Science and Engineering (CSE)

Mid Exam Year: 2023 Trimester: Spring

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 **Ascending Order Merge Sort** work on the following data? [2]

   y p z x r s

   Here, x=last two digits of your student id+2, y=x+4, z=x+y, p=y+z, r=x+3, s=y+8

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

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

2nd

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]

```
Insertion Sort Algorithm:
for j=2 to n do
  t=A[j]
  i=j-1
  while ((i>=1) AND (A[i]>t))
    A[i+1]=A[i]
    i=i-1
  end while
  A[i+1]=t
end for
```

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

   b) Apply the **Ascending Order Quick Sort Algorithm** for the following instance to find the first partitioning element. [2]

   18 23 56 26 89 37 28 48

   c) Find the memory location of A[70][60] if loc(A[20][15])=x+1300, where x=last four digits of your student ID. Assume row-wise memory is allocated in the floating point type array A[80][100], where each float data is 4 bytes. [2]

   $Pos + (i-l_1)(u_2-l_1+1)x$

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

   Input Data: t r p z y x

   Search Key=r

   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

b) If f(n)=kn-4, prove that f(n)=Θ(n). Here, k=last digit of your student id+5. [2]

c) Suppose a linear linked list headed with "first" contains four nodes whose data values are 10, 20, 30, 40, respectively, where each node has two fields' **data** and **next**, where **data** is of integer type and **next** will contain the address of the next node. Show the following operations. [7]

i) Draw a diagram for the linear linked list.
ii)Find a name for each of the nodes with respect to "first" that contain 10, 20, 30, 40, respectively.
iii) Write statements to represent 10, 20, 30, 40, respectively.
iv) How can you set NULL at the end of the linked list?
v) Design a code segment to insert 35 in-between 30 and 40.
vi) How can you delete a node containing 30 from the list?
vii) Convert your linear linked list to linear circular linked list by a code segment.

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

```
start=(node*)malloc(sizeof(node));
temp=(node*)malloc(sizeof(node));
temp1=(node*)malloc(sizeof(node));
start->data =40;
temp->data=50;
temp1->data=20;
start->next=temp1;
temp1->prev=start;
start->next->next=temp;
temp->prev=temp1;
temp1->next->prev=temp1->prev;
temp1->prev->next=temp1->next;
free(temp1);
start->prev=NULL;
temp->next=NULL;
```

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+4, y=x+5, and z=y+x. [2]

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

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+4, y=x+5, and z=y+x. Here, Enqueue and Dequeue are meant by insertion and deletion, respectively. [2]

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