United International University (UIU)

Dept. of Computer Science and Engineering (CSE)

Mid Exam Year: 2021 Trimester: Fall

Course: CSE 2215/CSI 217 Data Structure and Algorithms I

Total Marks: 30, Time: 1 hour 45 min

(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 Quick Sort algorithm work on the following data? [4]

   y p z x r

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

   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);
```

2. a) Find the memory location of A[15][20] if loc(A[5][5])=8000+c, where c=last four digits of your student id. Assume row-wise memory is allocated in the integer array A[50][60], where each integer data is 4 bytes. [2]

   b) How does the Binary Search algorithm work for the following data? Also find the total number of element comparisons needed in this case. [3]

   Input Data: t r p z y x

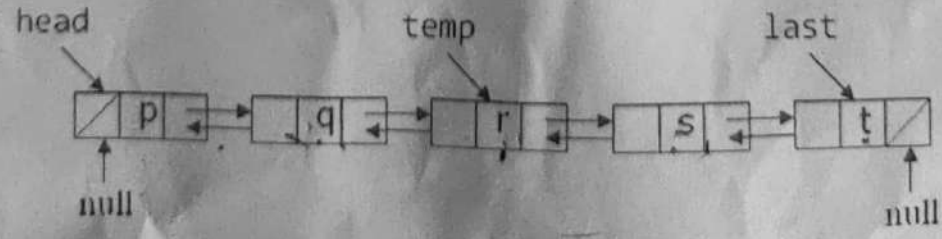
   Search Key=y

   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

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

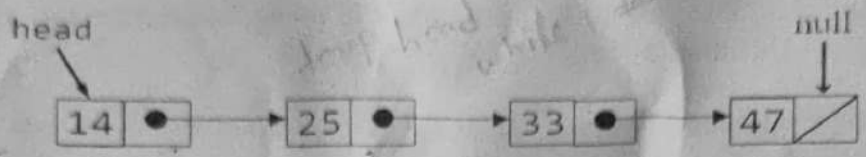
3. a) Answer the following questions for the doubly linked list as shown below, where p = last two digits of your student id + 5, q = p+3, r = p+q, s = r-1, t = r+s. [3]

   a) head -> next ->next-> value = ?
   b) last -> prev -> next->value = ?
   c) temp -> prev -> prev -> prev= ?
   d) temp -> next-> prev ->prev->value = ?
   e) last -> prev -> prev ->next-> value = ?



b) Assume that you are given a single linked list as shown below. Write the statements to perform the following: [5]

i) To insert 30 in between 25 and 33.
ii) To delete 47 from the list.
iii) To make a linear circular linked list from the current list.



4. a) 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]

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

b) Show the status of a Queue implemented by an array of size, m=2 for the following operations. Here, Enqueue and Dequeue mean insert and delete respectively, and x=last digit of your student id+4, y=x+1, and z=y+x. [2]

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

c) Show the manual tracing of the following algorithm using a Stack; [3]

```
#include<stdio.h>
#include<string.h>
int top=-1;
char Stack[6]={'\0'};
int main(){
        char Str1[6]={'\0'};
        char Str2[6]={'\0'};
        int i;
        strcpy(Str1, "WORLD");
        for(i=0; i<5; ++i){
            Push(Str1[i]);
        }
        for(i=0; i<5; ++i){
            Str2[i]=Pop();
        }
        printf("%s", Str2);
        return 0;
}

void Push(char x){
    Stack[++top]=x;
    return;
}

char Pop(void){
  return Stack[top--];
}
```