United International University

B.Sc. in Data Science (BSDS)

CSE 2215: Data Structure and Algorithms-I

Final Exam: Fall 2024 Time: 1 Hour 30 mins Marks: 30

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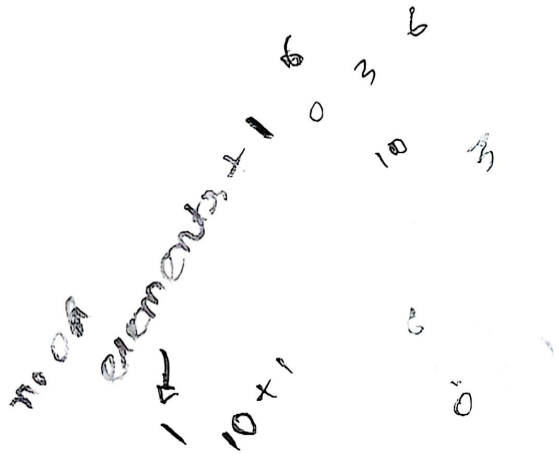
Answer all of the following questions.

1. Consider the following function "FuncA". Find the time Complexity of the function using asymptotic notation. [4]

```
def FuncA(n):
sum = 0
for i in range(0, n):
    for j in range(0, n, 3):
        for k in range(0, n, 2):
            sum=sum+1
for i in range(0, sum+1):
    sum=sum+1
    break
if sum>n*n:
    print(sum)
return sum
```



2. (a) How many element comparisons are needed for the following instance of the Descending Order Quick Sort to find the first and second partitioning elements? [3]

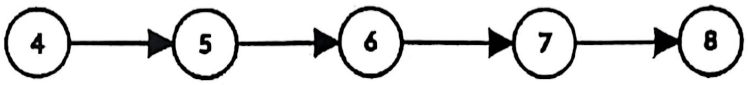
16 3 19 28 7 11 19 12 21

(b)Show the simulation for ascending order Merge Sort for the input in question 2(a). Using a recurrence relation, determine the time complexity of Merge Sort and show the calculation in detail. [3+3]

(c)Consider the following List. Show, how does Binary search and Linear search work for search key 76(Show the simulation). Find the total number of comparisons each requires. [3]

2 5 19 27 32 56 76

3. The initial state of a linked list is given below: [6]



Show the effect of executing the following function in details. Assume, that each of the nodes has two fields; data and next. Where data is of integer type and next will contain the address of the next node.

```
def function():
temp1 = head
temp2 = head
while temp2 != None or temp2.Next != None:
        temp1 = temp1.Next
        temp2 = temp2.Next.Next
temp1.Next = temp1.Next.Next
```

4. Suppose you are designing a text editor where you want to implement two features: [3]

(a) Undo operations: remove the last typed character

(b) Redo operations: restore the most recently undone character

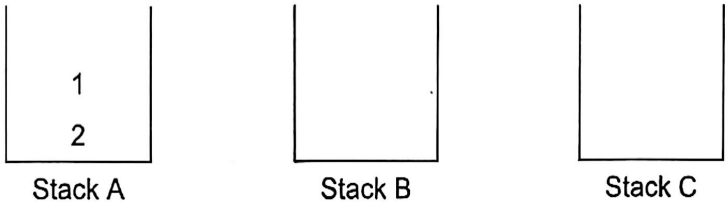
Which data structure(s) will you prefer to implement these two features? Briefly explain.

5. (a) You have three stacks, A, B, and C. Each stack can perform two operations: push and pop.

For example: [3]

pushA(1) means insert 1 at top of Stack A

popA() means remove top element from stack A



Now, show the status of the three stacks for each of the following operations:

(a) pushC(popA())

(b) pushB(popA())

(c) pushB(popC())

(b) Show the status of a QUEUE (consider initial queue is empty) of size 3 implemented by a list for the operations given below: [2]

enqueue(a), enqueue(b), dequeue(), enqueue(c), dequeue(),
enqueue(d), dequeue(), dequeue()