VIT

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

Continuous Assessment Test - 1 – September 2023

Programme	:	B. Tech (BRS, BPS, BAI, BCE, CSE)	Semester	:	Fall Semester 2023-24
Course Title	:	Data Structures and Algorithms	Code	:	BCSE202L
			Class Nbr(s)	:	CH2023240101210, CH2023240100642, CH2023240100647, CH2023240100649, CH2023240100651
Faculty (s)	:	Dr. J Uma Maheswari, Dr. Vijayaprabakaran K, Dr. Karthikeyan N, Dr. Sudheer Kumar E, Dr. Avuthu Aninash Reddy	Slot	:	A1+TA1
Time	:	90 minutes	Max. Marks	:	50 marks

Answer all the Questions

1. Find the running time of the given algorithm and also discuss the running time in terms of three bounds (upper bound, lower bound and tight bound). 10

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FindMaxElement (arr [ ] ):
    1. max_element = arr[0]
    2. for i from 1 to n – 1
    3.         if arr[i] > max_element
    4.             max_element = arr[i]
    5. return max_element
```

2. Consider the following statement: 10

"The time complexity of recurrence relation T(n) = 8T(n/2) + O(1) is greater than T(n) = 4T(n/8) + O(1)".

Check whether the statement is true or false and justify your answer.

3. You are given a sorted array of integers and a target value. Your task is to implement a function that finds the first and last occurrence of the target value in the array. Write a function **findFirstLastOccurrence** that takes in an array of integers **nums** and an integer **target**, and returns a pair of indices [first, last] where first is the index of the first occurrence of the target value, and last is the index of the last occurrence of the 10

target value. If the target value is not found in the array, return [-1, -1].

Example:

Input : 1, 2, 2, 2, 3, 4, 4, 4, 5

target = 4

Output:

First Occurrence: 5

Last Occurrence: 7

4. The 'N' integer numbers in the list are not necessarily sorted. Write an algorithm (**findKpostLarg(arr[0,1,…,N-1], K)**) applying all the constraints listed below to find the **K**th largest element: Sort the list by choosing the smallest member from the unsorted position and shifting it to the sorted position. Analyse the (findKpostLarg(arr[0,1,…,N-1], K))'s **worst-case time complexity**. 10

5 Mr Carlo is conducting a game between two players using two stacks namely **stack1** and **stack2**. Initially, both stacks are empty. At the starting of the game Mr Carlo has to load two stacks with n integers each. Assume n is an even number. Mr.X has to play the game using **stack1** and Mr.Y has to play the game using **stack2**. Both players have to play n/2 rounds. In each round two elements are popped (top element and element next to top) and the following conditions have to be checked to provide the score.

If (top element of **stack1**) > (top element of **stack2**) and (next to top element of **stack1**) > (next to top element of **stack2**) then Player1(Mr.X) gets 2 points

If (top element of **stack2**) > (top elemnt of **stack1**) and (next to top element of **stack2**) > (next to top element of **stack1**) then Player2(Mr.Y) gets 2 points 10

In all other conditions, no points will be given for both players. The same procedure is repeated for **n/2 times**. Write an algorithm for this game starting from loading of stack and calculate the cumulative score of Mr.X and Mr.Y after playing **n/2 rounds**. Announce the winner based on the highest score. If two players have got the same score either 0 or some other integer, then announce it as "**Game Draw**". Analyse the time complexity of your algorithm.

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