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Continuous Assessment Test (CAT-I) – September 2023

Programme	: B.Tech (CSE)	Semester	: Fall 2023– 2024
Course Title	: Data structures and Algorithms	Code	: BCSE202L
		Slot	: D1+TD1
Faculty	: Dr. A. Vijayalakshmi, Dr. Bharathi Raja S, Dr. Raja Sree T, Dr. Sendhil R, Dr. Ilavendhan A, Dr. Elakiya E	Class Nbr	: CH2023240101102 CH2023240100841 CH2023240100842 CH2023240100843 CH2023240100844 CH2023240100846
Time	: 90 Minutes	Max. Marks	: 50

If any assumptions are required, assume the same and mention those assumptions in the answer script.

Answer all questions

Q.No.	Sub Sec.	Question Description	Marks

1. Solve the following recurrence relations and give the corresponding asymptotic notation.

   i. $T(n) = 3\,T\!\left(\frac{n}{3}\right) + n^2$ [Assume T(1)=1] (5 marks)

   ii. $T(n) = 2T(n-1) + 4$ [Assume $T(0) = 1$] (5 marks)

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2. Consider an array L contains 'n' positive integers. Sort the array L in increasing order based on the length of the positive numbers, where the length of the number represents a total number of digits of the number. For example, the length of 1231 is 4. While sorting, if more than one number is in same length, those numbers are to be sorted in decreasing order within them. Write a suitable pseudo code for the same and find the time complexity.

For example:
Input: L = [23,10,4566,344,123,121]
Output: L=[23,10,344,123,121,4566]

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3. Consider an array A[0,...,n-1] contains 'n' integers. A peak of an array A is defined as A[i-1] < A[i] and A[i] > A[i+1]. i.e A peak A[i] is greater than to its neighbors in an array A. Assume that first and last integers having only one neighbor (A[0] is peak, if A[0]>A[1] and A[n-1] is peak, if A[n-1] >A[n-2]). Write a pseudo code to find and print the peaks and your code should give time complexity as O(log n).
Example: A=[10,6,4,3,12,19,18]
Output: 10,19

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4.	Consider a stack contains 'n' integers. Write a pseudo code to move all negative integers to the bottom of stack and move all positive integers to the top of stack without changing the order of the elements in the stack. Your pseudo code should use stack data structure only and find it's time complexity.	10
5.	Let Q be a Queue data structure contains 'n' integers. And also consider another integer 'x'. Write a pseudo code using queue data structure (only) to determine whether there exist two elements in Q whose difference is exactly equal to 'x' or not. If yes, then display those numbers, otherwise print 'not found'.	10