VIT

Vellore Institute of Technology

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

Continuous Assessment Test (CAT-I) – September 2023

Programme	: MCA		Semester	: Fall 2023– 2024
Course Title	: **Data structures and Algorithms**		Code	: **PMCA501L**
			Slot	: **A1+TA1**
Faculty	: **Dr. M. Jayasudha**		Class Nbr	: **CH2023240101712**
Time	: **90 Minutes**		Max. Marks	: **50**

Answer all questions

Sub Q.No. Sec.	Question Description	Marks

1. a) Compute the time complexity of the following recursive function using master method (6 Marks)

(i) $T(n) = 64T(n/8) - n^2 \log n$

(ii) $T(n) = 7T(n/3) + n^2$

(iii) $T(n) = 4T(n/2) + \log n$

10

b) Write an algorithm to find the number of unique elements in an integer array and discuss the time complexity analysis of the algorithm. (4 Marks)

2. a) Convert the given infix to postfix expression with an appropriate algorithmic routines using stack: $(a + b - c) * d - (e + f)$. (4 Marks)

b) Consider a smart calculator that can perform four binary operations namely addition, subtraction, multiplication and division. The smart calculator has the capability to store three latest operations performed to support "Undo" operation. Write a pseudo code/algorithm to implement the "Undo" operation of the above smart calculator using appropriate data structure. (6 Marks)

10

3. Consider the data of car manufacturing organization which produces cars with limited colours (Eg: white, blue, red) and models. The car names, colours are stored in the linked list whenever the car is produced. Write a pseudo code/algorithm for the following procedure

(i) Create a list to store the data. (3 marks)

10

       (ii)   Remove the identical car names in the above list and create a new list. (7 marks)

4.   Consider an array of integers. Write a pseudocode/algorithm to sort the array in ascending order using the appropriate data structure concept. Once sorted, print the following three lines:

i) Array is sorted in **numSwaps** swaps. where **numSwaps** is the number of swaps that took place.
ii) First Element: where First Element is the *first* element in the sortedarray.
iii) Last Element: where Last Element is the *last* element in the sortedarray.   **10**

Example:
a=[6,4,1]
Array is sorted in 3 swaps.
First Element: 1
Last Element: 6

5.   Given a sorted array with repeating integers. Use only binary search to find the first or last occurrences of the element and the count of a given key in the array. Write a pseudocode or algorithm to determine if it should run in logN time. If an element is not present, print NULL.

Example: **10**

Sorted array={1 2 2 2 3 3}
Key=2
First occurrence=1
Last occurrence=3
Count=3