

Reg. No.: 21BPS1364  
Name : Mobin Chinnuwalter



**VIT**  
Vellore Institute of Technology  
(Deemed to be University under section 3 of U.C.A. Act 1956)

**Continuous Assessment Test I- May 2023**

Programme	: B.Tech.(CSE)	Semester	: Fall Inter 2022-2023
Course Title	: Design and Analysis of Algorithms	Code	: BCSE204L
Faculty (s)	: Dr. Manimegalai T Dr. Kalai priyan T Dr. Om Kumar C.U. Dr. A.R Revathi Dr. Muthukumaran K Dr. Pavithra L K	Class Nbr(s)	: CH2022232501098 CH2022232501099 CH2022232500927 CH2022232500935 CH2022232500937 CH2022232500928
		Slot	: C2 +TC2
Time	: 90 Mintues	Max. Marks	: 50 marks

**INSTRUCTIONS:**

- ✓ Answer all the FIVE questions.
- ✓ If any assumptions are required, assume the same and mention those assumptions in the answer script.
- ✓ Your answer for all the questions should have both the 'design' component and the 'analysis component'
- ✓ The 'Design' component should consist: understanding of the problem, logic to develop the pseudocode, illustration, pseudocode.
- ✓ The 'Analysis' component should consist: Proof-of-Correctness(PoC), Computation of T(n), Time-complexity.

1. In an array of distinct elements, a pair of elements (A[i], A[j]) is said to be reverse\_ordered if  $A[i] > A[j]$  and  $i < j$ .
  - a. Write a pseudocode to find all pairs in A that are reverse\_ordered.
  - b. For an array of size 'n' what would be the largest number of pairs that are reverse\_ordered?
  - c. Derive the time complexity of your algorithm.

10

**Rubrics:**

Logic (2 Marks), Pseudocode (3 Marks), Illustration (2 Marks) Finding array size(1 Marks), Time Complexity (2 Marks)

2. Given an integer array A of size n, and the elements in the array A are arranged in the following fashion:

- a. The values of array A from  $A[1], \dots, A[n/2]$  are arranged in descending order.
  - b. The values of the array A from  $A[(n/2) + 1], \dots, A[n]$  are arranged in ascending order.
  - c. Design two different algorithms X and Y to sort a given array A in ascending order.
- Also perform time complexity analysis for the algorithms X and Y

10

**Rubrics :**

Logic (2 Marks), Pseudocode (2 Marks), Illustration (1 Mark), PoC (2 Marks), Computation of T(n) (2 Marks), Time Complexity (1 Mark)

3. A transportation company operates a fleet of vehicles that need to be scheduled for maintenance. Every vehicle will have downtime during the maintenance process. A cost proportionate to the mileage is incurred for every vehicle during its downtime. You have been assigned the task of developing an algorithm to automate the maintenance scheduling in such a way to minimize the loss.

10

Design an iterative algorithm that takes the current mileage of each vehicle as input and determines the order in which the vehicles should be scheduled for maintenance.

**Rubrics:**

Logic (2 Marks), Pseudocode (2 Marks), Illustration (1 Mark), PoC (2 Marks), Computation of  $T(n)$  (2 Marks), Time Complexity (1 Mark)

4. OddDigitGreater ( $n1, n2$ ) = true if number of odd digits in  $n1$  is greater than  $n2$  and false otherwise. For example, oddDigitGreater(1189, 3478) is true. Given an integer array of 'n' elements, design a divide-conquer-combine algorithm to sort them in ascending order based on the number of odd digits in it. For example if  $A = [3478, 1926, 1189, 1046]$  then the sorted array is 1046, 1926, 3478, 1189.

10

**Rubrics:**

Logic (2 Marks), Pseudocode (2 Marks), Illustration (1 Mark), PoC (2 Marks), Computation of  $T(n)$  (2 Marks), Time Complexity (1 Mark)

5. Consider the following algorithm

Algorithm ABC(s)

$n = \text{length}(s)$

    for  $i = 1$  to  $n/2$

        If  $s[i] \neq s[n-i-1]$

            return false

    return true

End for

Stop.

10

Understand the above algorithm and answer the following:

- Compute the output of the algorithm ABC if the input is "NOON", input="abcd"  
[3 Marks]
- Describe the functionality of the Algorithm ABC [2 Marks]
- Compute the time-complexity of the Algorithm ABC [2 Marks]
- Modify the Algorithm ABC into another Algorithm PQR such that the functionality of Algorithms ABC and PQR remains the same but the time-complexity of the Algorithms ABC and PQR are not same. [3 Marks]