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VIT

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

Continuous Assessment Test I - September 2022

Programme	:	B.Tech. CSE	Semester	:	Fall 2022-2023
Course	:	Data Structures and Algorithms	Code	:	BCSE202L
Faculty	:	Srinivasa Rao, Kavya, Ramesh, Manimegalai, Sangeetha, Abinaya, Kalaipriyan, Suguna, Mercy, Muthukumarn, Pavithra, Rishikeshan, Vijayalakshmi	Class No	:	CH2022231001081, 1203, 1206, 1082, 1210, 1084, 1078, 1080, 1205, 1077, 1079,1207, 1083
			Slot	:	D2+TD2
Time	:	90 minutes	Max.Marks	:	50

- **Anwer ALL Questions.**
- **Answer the Questions with your Intelligence Only.** 0 20
- **If some information is required for answering any question, assume the same.**

Q.No	sub Q.No	Question Description	Marks
1		Write a recursive algorithm to list out all pairs of palindrome numbers within a given range (n, m), where $m > n$ and both are positive integers. Compute the running time of your algorithm. For example, $n = 10$ and $m = 50$. The pair of palindromes are $\{(12, 21), (13, 31), (14, 41), (23, 32), (24, 42), (34, 43)\}$	10
2		Let L_1 be a sorted array in increasing order of size n and L_2 be a sorted array in decreasing order of size m. Write an algorithm with $O(n)$ running time to compute k^{th} smallest element in $L_1 \cup L_2$ for a given L_1, L_2 and k. Illustrate your algorithm for any sample input. For example, $L_1 = \{10, 11, 15, 16, 17\}$, $L_2 = \{14, 13, 9, 8\}$ and 4^{th} smallest element in $L_1 \cup L_2$ is 13	10

3		An equation is said to be line in two variables if it is written in the form of $L(x,y) = ax + by + c = 0$, where a, b & c are real numbers and the coefficients of x and y are $a(\neq 0)$ and $b(\neq 0)$ respectively. A point $P = (x_1, y_1)$ is on the line if $ax_1 + by_1 + c = 0$. For example, $10x - 2y + 4 = 0$ is a linear equation and $P(x = 1, y = 7)$ is a point on the line equation. **Closet pair problem**: Given a line $L(x,y)$, and assume $P_1 = (x_1, y_1), P_2 = (x_2, y_2), ..., P_n = (x_n, y_n)$ are n points on the line L. Find the pair of points which are closet (in the sense of Euclidean distance) of all such pairs. Write an algoritthm to solve the closet pair problem(as defined above) and illustrate your algorithm for any sample input. [Hint: The Euclidean distance of P_1 and P_2 is $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$]	10
4		Give asymptotic upper and lower bounds for $T(n)$ in each of the following recurrences. Assume that $T(n)$ is constant for $n \leq 2$. Make your bounds as tight as possible, and justify your answers. 1. $T(n) = 2T(n/2) + n^3$ (5 marks) 2. $T(n) = 2^n T(n/2) + n^n$ (5 marks)	10
5		Let $S = \{A_1, A_2, A_3, ..., A_n\}$ be a finite set, where A_i, $1 \leq i \leq n$, is a sorted set. The size of each set is not unique. Write an algorithm to compute the total number of sets where a given integer k is presented. Illustrate your algorithm for any sample input.	10

$T(n/2)$

$T(n/4)$

$n + \frac{n}{2} + \frac{n}{4}$

$\sqrt{2 \times 2}$ $\rightarrow \frac{4n + 2n + n}{4}$

$\sqrt{2} \times \sqrt{2} = 2$

$2\sqrt{2}$

$2 \times 2 \times 2$

$\sqrt{2 \times 2 \times 2}$