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	:	Bhuvaneswari, Richa, Joshan, Tamilarasi, Hasmath Farhana, Kirthica, Mansoor Husain D, Valarmathi, Rajakumar, Sindhia Lingaswamy, Sahaya Beni Prathiba, Vinothini A, Balaji, Saleena	Class No.	:	CH2022231001424, 1459, 1453, 1471, 1447, 1445, 1457, 1425, 1423, 1450, 1427, 1426, 1454, 1472
			Slot	:	A2+TA2
Time	:	90 minutes	Max.Marks	:	50

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

Q.No	sub Q.No	Question Description	Marks
1		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. (a). $T(n) = 3T(n/2) + n^2$ (5 marks) (b). $T(n) = 16T(n/4) + n$ (5 marks)	10
2		Given two arrays A and B of positive integers, write an algorithm to list out all pairs (x, y) such that $x^y > y^x$, where x is an element from A and y is an element from B. Compute the running time of your algorithm.	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 equation if $ax_1 + by_1 + c = 0$. For example, $10x - 2y + 4 = 0$ is a line equation and $P(x = 1, y = 7)$ is a point on the line equation. **Farthest pair problem:** Given a line $L(x,y)$ and let $P_0 = (x_0, y_0)$ be a point on the line. 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 farthest (in the sense of Euclidean distance) point among n points from the point P_0. Write a recursive algoritthm to solve the Farthest pair problem (as defined above). 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		Let $L = \{a_i\}, 1 \leq i \leq n$ and let k be a positive integer. Write an algorithm to arrange elements of L in increasing order where the index of elements in L are divisible by k and other elements need not be sorted. Illustrate your algorithm for any sample input. For example, If $L = \{1, 9, 4, 6, 3, 5, 8\}$ and $k = 2$ then result is $L = \{1, 9, 3, 6, 4, 5, 8\}$	10
5		Assume you are given a number X and two sorted lists A and B of n numbers such as $A = \{a_1 \leq a_2 ... \leq a_i \leq ... \leq a_n\}$ and $B = \{b_1 \leq b_2 ... \leq b_i \leq ... \leq b_n\}$. Write an algorithm to determine the total number of pairs (i, j) such that $a_i + b_j \leq X$. Illustrate your algorithm for any sample input.	10