VIT
Vellore Institute of Technology
CHENNAI

Reg. Number

Continuous Assessment Test(CAT) – I - AUG 2024

Programme	:	B.Tech(CSE-BDS,BCE,BAI)	Semester	:	FALL 2024-2025
Course Code & Course Title	:	BCSE202L - Data Structures and Algorithms	Class Number	:	CH2024250100604
Faculty	:	Dr.J.Uma Maheswari	Slot	:	A1+TA1
Duration	:	1 Hour 30 Mins	Max. Mark		50

General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information.
- Only non-programmable calculator without storage is permitted

Answer all questions

Q. No	Sub Sec.	Description	Marks

1.		a. Solve the following recurrence relation using recursion tree method and find its upper bound time complexity. [6 Marks]
		$T(n) = 3T\left(\frac{n}{2}\right) + n^2$
		b. Calculate the time complexity of the following function foo().[2 marks]
		`int foo (int n)`
		`{ for (int i = n/2; i <= n; i++) {`
		`for (int j = 1; j < n; j += i ) {`
		`// Some O(1) task`
		`} } }`
		c. Find the time complexity of the following code snippet. [2 marks]
		`sum = 0; i = n;`
		`while ( i > 0) {`
		`sum += i ;`
		`i /= 2; }`
			10

2.		Consider a matrix of size mxn which consists of positive integers. Design an algorithm that will (i) Find all the duplicate elements in the matrix and sort them (duplicate elements) in increasing order. (5 marks) (ii) Convert the sorted elements as a whole single number (5marks) For example, Input Matrix[2x5] 1 8 8 3 1 6 4 4 4 7	10

		output: Duplicate elements : 1,8,4 After sorting : 1,4,8 Whole single number :148	
3.		Mr. John is a chemist who receives ten medicine boxes with batch numbers 35, 33, 42, 10, 14, 19, 27, 44, 26, 31 printed on them. He always arranges the boxes manually and gets frustrated every time. As a good programmer, Mr. John is asking for your help. Write a sorting algorithm which has the best and average case time complexity as O(n logn) and worst case time complexity as $O(n^2)$. Illustrate the step by step process of your algorithm.	10
4.		Consider two stacks, S1 and S2 which are implemented by a single array , where S1 grows from the first position of the array and S2 grows from the last position in the opposite direction of the array . Write an algorithm for PUSH and POP operations on S1 and S2 and analyse its time complexity. Illustrate the step by step process of the following functions . • push1(int x) • push2(int y) • pop1() • pop2()	10
5.		You are given a stack of random integers, and your task is to sort the integers in ascending order using stack data structure and its operations. Write an algorithm to sort the integers in ascending order using two stacks (input stack and temporary stack). For example, input [5, 2, 9, 1] , top is pointing to 1. output [1, 2, 5, 9], top is pointing to 9. Illustrate the step by step process of stack operations until the final sorted stack is achieved.	10

********** All the best **********