REG.NO.:

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

NAME OF THE SCHOOL
CONTINUOUS ASSESSMENT TEST - I
WINTER SEMESTER 2024-2025

SLOT: A1+TA1

Programme Name & Branch	**:**	**B.Tech CSE**
Course Code and Course Name	**:**	**BCSE204L / Design and Analysis of Algorithms**
Faculty Name(s)	**:**	**ALL**
Class Number(s)	**:**	**ALL**
Date of Examination	**:**	**27.1.25**
Exam Duration	**: 90 minutes**	**Maximum Marks: 50**

General instruction(s):

- Answer All Questions

Q. No	Question	M	CO	BL
1.	"wearetryingtolearndesignandanalysisofalgorithm" for the given phrase construct the Huffman coding and generate the code for "Tester". Compare the length of code between fixed and variable length code for the given word "Tester".	10	1	2
2.	Develop an algorithm using divide and conquer strategy to multiply two integers 38409 and 83329. Generate the recurrence relation from the algorithm and compute the time complexity. Also compute how much time it will take to multiply the given two integers.	10	1	3
3.	a) Apply master theorem to calculate the time complexity of the recurrence relation $T(n)= 2\ T(n/4) + \sqrt{n} + 42$. Illustrate the evaluation step by steps	4	1	3
	b) Apply backward substitution to enable the time complexity for the recurrence relation $T(n) = 2T(n/2) + n\log n$.	6		
4.	Given a chain of matrix A1: 5X4 A2: 4X3 A4: 5X2 A3: 3X5 A5: 2X4 where A_i has dimensions p_{i-1}x p_i, fully parenthesize the product $A_1 \cdot A_2 \cdots A_n$ in a way that minimizes the number of scalar multiplications.	10	2	1
5.	Given a set of positive integers {3,2,5,7,6,8,10,4} and a target value "20", determine whether some subset has a sum equal to the target.	10	2	3

****

CAT I Key

1. **Online calculator: Huffman coding**

   W – 1 e – 4 a – 6 r – 4 y – 2 l – 4 n – 4 g – 3 t – 3 o – 3 l – 3 d – 2 s – 3 f – 1 h – 1 m – 1

   Based on the above online calculator for the above frequency answer is

A – 101	**l – 1111**	**r – 1110**	**n – 010**	**e – 001**	**s – 1100**
T – 1001	**g – 1000**	**l – 0111**	**o – 0110**	**d – 11011**	**y – 11010**
F – 00011	**w – 00010**	**m – 00001**	**h - 00000**		

2. **Watch the steps of Karatsuba in Karatsuba algorithm**
3. Let T(n)= 2 T(n/4) + √n + 42. What are the parameters?

   a =2
   b =4
   d =1/2
   Therefore, which condition applies?
   $2 = 4^{1/2}$, case 2 applies
   - We conclude that

$$
\begin{aligned}
\text{Example: } & T(n) = 2T(n/2) + n \lg n \\
T(n) &= n \lg n + 2 \cdot \frac{n}{2}(\lg n - 1) \\
&+ 4 \cdot \frac{n}{4}(\lg n - 2) + 8 \cdot \frac{n}{8}(\lg n - 3) \\
&+ \cdots + n \cdot \frac{n}{n}(\lg n - \lg n) \\
&= n \sum_{i=0}^{\lg n} (\lg n - i) = n\frac{\lg n(\lg n + 1)}{2} \\
&= \Theta(n \lg^2 n).
\end{aligned}
$$

4. MCM – Mark distribution – Recurrence formula – 2, steps – 6, Final parentization
5.