# VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY (VSSUT), ODISHA

**Even Mid Semester Examination for session 2025-26**

COURSE NAME: B. Tech

SEMESTER: 4th

BRANCH NAME: **Computer Science and Engineering/Information Technology**

SUBJECT NAME: **Design and Analysis of Algorithms**

FULL MARKS: **30**

TIME: **90 Minutes**

Answer **All** Questions.

The figures in the right hand margin indicate Marks. *Symbols carry usual meaning.*

Q1. Answer all Questions. **[2 × 3]**

a) Consider the array representation of a binary min-heap containing 2046 elements. Calculate the minimum number of comparison required to find the maximum in the heap - CO1

b) Solve the recurrence equation $T(n) = T(\sqrt{n}) + 1$ - CO2

c) Assume that a merge sort algorithm in the worst case takes 30 seconds for an input of size 64. Find the maximum input size of a problem that can be solved in 6 minutes? - CO3

Q2 a) Consider the following recurrence and obtain the asymptotic bound. [4] CO1

$T(n) = 2T(\sqrt{n}) + \log n$

b) Consider the following recurrence and obtain the asymptotic bound using recursion tree method. [4]

$$T(n) = 2T(n/3) + T(2n/3) + n$$

OR

a) Consider the following recurrence using master method [4]

(i) $T(n) = 2T(3n/4) + 1$ and $T(1) = \theta(1)$

(ii) $T(n) = 4T(n/2) + n$

(iii) $T(n) = T(n) + 1$

(iv) $T(n) = T(n/4) + n^2$

b) Consider the following recurrence and obtain the asymptotic bound using recursion tree method. [4]

$T(n) = 4T(\lfloor n/2 \rfloor) + n$

Q3. a) Write the principle of Divide and conquer. Sort the following elements using quick sort procedure and also calculate the best case and average case for sorting of n number of elements. **[4]**

List of elements are 9 7 8 3 2 1

b) What the difference between divide and conquer and dynamic programming. Find the optimal solution for the 0/1 knapsack problem making use of dynamic programming approach. Consider n = 4, w = 5 kg, (w1, w2, w3, w4) = (2, 3, 4, 5), (b1, b2, b3, b4) = (3, 4, 5, 6). [4] CO2

OR

a) Write the principle of Divide and conquer. Sort the Sort the following elements using merge sort procedure and explain the best and worst case analysis for sorting of n elements. List of elements are 9 7 8 3 2 1. [4] CO2

b) Write the property of Binary heap. Explain the algorithm to sort the following elements in ascending order using heapsort and calculate the time complexity of heapsort. [4]

Elements: 4, 1, 3, 2,16, 9, 10,14,8,7

Q4. a) What is matrix chain multiplication problem? Write the algorithm for matrix chain multiplication. Find the m and s table computed by the algorithm for the following matrix dimensions: **[8]** CO3

| Matrix | Dimension |
|---|---|
| A1 | 25 X 35 |
| A2 | 35 X 15 |
| A3 | 15 X 5 |
| A4 | 5 X 40 |

OR

a) Compute the optimal cost matrix and optimal parenthesization for chain matrix multiplication of the matrices have size 4 x 10, 10 x 3, 3 x 12, 12 x 20, 20 x 7. [8] CO3