Register No.: ..... Name: .....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

THIRD SEMESTER MCA DEGREE EXAMINATION (R), DECEMBER 2023

(2021 SCHEME)

Course Code: **21CA302**

Course Name: **Design and Analysis of Algorithms**

Max. Marks: **60** **Duration: 3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

1. Compare and contrast Big oh, Omega and Theta, the three major asymptotic notations.
2. Solve T (n) = 2T (n/2) + cn, where n= 2^k using substitution method.
3. Write down the control abstraction of divide and conquer technique. Explain.
4. Write down the Strassen's equation for finding the multiplication of two matrices and use it to compute the following matrix product.

$$\begin{bmatrix} 1 & 3 \\ 7 & 5 \end{bmatrix} \begin{bmatrix} 6 & 8 \\ 4 & 2 \end{bmatrix}$$

5. Find a sequence of jobs that will be completed within the deadline with maximum profit. Let n=5, (p1, p2, p3, p4, p5) = (60,100,20,40,20) and (d1, d2, d3, d4, d5) = (2,1,3,2,1).
6. State the principle of optimality and polynomial breakup.
7. How does backtracking differ from branch and bound?
8. Let W [1:6] = (5,10,12,13,15,18) and M=30. Find all possible subsets of W which sum to M. Draw the portion of the state space tree which is generated.
9. Draw the comparison-based tree for sorting and searching.
10. Explain vertex cover problem with a suitable example.

PART B

(Answer one full question from each module, each question carries 6 marks)

MODULE I

11. How do you analyze recursive algorithms? Elaborate the methods for solving recurrence equations. (6)

OR

12. Define algorithm. What do you understand by the term 'space complexity' and 'time complexity' in the context of an algorithm? (6)

MODULE II

13. Prove that ((3n/2)-2) comparisons are sufficient to obtain the minimum and maximum elements from a list of n elements. (6)

OR

14. Consider the following array with eight numbers {40,70,20,60,10,80,30,50}. Sort these numbers using quick sort. Write down the algorithm and also compute its time complexity. (6)

MODULE III

15. Find an optimal solution to the knapsack instance n=3, m=20, (p1, p2, p3) = (25,24,15) and (w1, w2, w3) = (18,15,10). Explain the knapsack problem. (6)

OR

16. Solve the following distance matrix for the traveling salesperson problem using dynamic programming. (6)

$$\begin{bmatrix} 0 & 2 & 9 & 10 \\ 1 & 0 & 6 & 4 \\ 15 & 7 & 0 & 8 \\ 6 & 3 & 12 & 0 \end{bmatrix}$$

MODULE IV

17. Explain how 4 queen's problem can be solved using backtracking. Draw the portion of state space tree corresponding to the 4 queen's problem. (6)

OR

18. Briefly describe 8 puzzle problem with a suitable example. (6)

MODULE V

19. Prove that clique problem is in NP complete. (6)

OR

20. Briefly describe P, NP, NP-hard, and NP-complete. (6)

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