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

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

SIXTH SEMESTER B.TECH DEGREE EXAMINATION (S), AUGUST 2023
COMPUTER SCIENCE AND ENGINEERING
(2020 SCHEME)

Course Code :   **20CST306**

Course Name: **Algorithm Analysis and Design**

Max. Marks :   **100**   **Duration: 3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

1. Define the terms Best-case, Worst case and Average case time complexities.
2. State Master's Theorem.
3. Explain UNION and FINDSET operations in the linked list representation of disjoint sets.
4. List out the properties of a self-balancing tree.
5. Analyze the time complexity of merge sort algorithm using divide and conquer strategy.
6. State fractional knapsack problem using Greedy Strategy.
7. Compare Backtracking with Branch and Bound Design Techniques.
8. What are the characteristics required by problems so that they can be solved using dynamic programming approach?
9. Compare Las Vegas and Monte Carlo algorithms.
10. Define NP-Hard and NP-Complete classes.

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. a) Determine a good asymptotic upper bound on the recurrence $T(n) = 3T(\frac{n}{2}) + n$ using recursion tree method.   (7)

    b) List any 3 properties of a good algorithm. Explain the Big Oh, Omega and Theta notations with diagrams.   (7)

OR

12. a) How do you analyse recursive algorithms? Write any 2 methods to solve recurrence equation.   (7)

    b) Solve $T(n) = T(n-1) + 2$ using substitution method.   (7)

MODULE II

13. a) Define RR and RL rotations. Create a height balanced trees by successively inserting the elements in order 42, 56,24, 89,1,5,87,8,61,6,78,7,12,34.   (10)

    b) Write down DFS algorithm and analyse its complexity.   (4)

OR

14. a) Define strongly connected components of a graph, and write an algorithm to find strongly connected components in a graph. (8)

b) Differentiate between Breadth First Search and Depth First Search Methods in a graph (6)

MODULE III

15. a) Write the Strassen's algorithm for matrix multiplication and use it to compute the following matrix product, showing each step

$$\begin{pmatrix} 1 & 3 \\ 7 & 5 \end{pmatrix} \begin{pmatrix} 6 & 8 \\ 4 & 2 \end{pmatrix}$$
(8)

b) Explain the control abstraction used in Backtracking technique. How 4-Queen problem is solved using backtracking? (6)

OR

16. a) Write and explain an algorithm which find minimum cost spanning tree of a graph. (5)

b) Find an optimal solution for following fractional knapsack problem given :
No.of items, n=7. Capacity of sack, m=15.
Profit P={10,5,15,7,6,18,3}
Weight W={2,3,5,7,1,4,1} (9)

MODULE IV

17. a) State All pairs shortest path problem. How do you solve using Floyd Warshall algorithm, using an example. (10)

b) State Travelling Salesman problem. (4)

OR

18. a) State Matrix Chain Multiplication Problem. Write a dynamic programming algorithm for solving it (8)

b) What do you mean by optimality principle? How dynamic programming is differs from branch and bound? (6)

MODULE V

19. a) Prove that Clique Problem and Vertex Cover Problem in NP Complete. (14)

OR

20. a) Explain Randomized Algorithms. Analyze the randomized quick sort. (10)

b) Differentiate between tractable and intractable problems. (4)

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