Reg No.:_____ Name:_____

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S6 (S, FE) / S6 (PT) (S) Examination January 2024 (2019 Scheme)

Course Code: CST306

Course Name: ALGORITHM ANALYSIS AND DESIGN

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks. Marks

1		What are the characteristics of a good algorithm?	(3)
2		Solve $T(n)=4T(n/2) + n^3$ using master method.	(3)
3		Can we use DFS to detect cycles in a graph? Justify your answer.	(3)
4		Define AVL tree. What is the advantage of AVL tree? Give an example	(3)
5		Strassen's multiplication method is used to multiply two nxn matrices when n is a power of 2. How it can be modified when n is not a power of 2?	(3)
6		Define spanning tree of a graph. Write the total number of spanning trees possible for a complete graph with 4 vertices.	(3)
7		Write a recurrence to represent the number of ways to parenthesize a chain of n matrices.	(3)
8		Define Travelling Salesman problem.	(3)
9		What do you mean by tractable problem? Give an example.	(3)
10		Define graph colouring problem.	(3)

PART B

Answer onefull question from each module, each carries 14 marks.

Module I

11	a)	Solve the following recurrence using iteration method. $T(n)=2T(n/2) + n$	(6)
	b)	Define the asymptotic notations: Big Oh, Big Omega, Theta and little omega.	(8)

OR

12	a)	Illustrate best case, average case and worst-case complexity with insertion sort algorithm.	(7)
	b)	Solve the following recurrence using recursion tree method. $T(n)=T(n/3) + T(2n/3)+cn$	(7)

Module II

13 a) Explain the different operations possible on disjoint sets. Implement UNION using linked list representation of disjoint sets. (7)

b) Give Breadth First Search algorithm for graph traversal. Perform its complexity analysis. (7)

OR

14 a) Write an algorithm to find strongly connected components of a graph. Illustrate with an example. (7)

b) Give Depth First Search algorithm for graph traversal. How the edges of a graph are classified based on DFS? (7)

Module III

15 a) Write the control abstraction for Greedy design technique. Give a greedy algorithm for fractional knapsack problem. (7)

b) Illustrate the divide and conquer approach by applying 2 way merge sort for the input array: [15,12,14,17,11,13,12,16]. Write the recurrence for merge sort and give the complexity. (7)

OR

16 a) Find an optimal solution to the fractional knapsack instance n=5, m=60, $(p_1,p_2,.....p_5)$ = (30,20,100,90,160) and $(w_1,w_2,.....w_5)$ = (5,10,20,30,40), Where m is the knapsack capacity, p_i is the profit of ith item and w_i is the weight of i^{th} item. (8)

b) Write Dijkstra's algorithm for single source shortest path. Perform its complexity analysis. (6)

Module IV

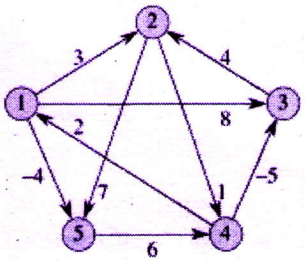
17 a) Find an optimal paranthesization of a matrix-chain product whose sequence of dimensions is 4x10,10x3,3x12,12x20,20x7 using dynamic programming (8)

b) Explain how Travelling Salesman Problem can be solved using Branch and Bound method. (6)

OR

18 a) Explain backtracking technique. How 4-queens problem can be solved using backtracking? (6)

b) Explain Floyd-Warshall Algorithm. Using the algorithm find all pair of shortest paths in the following graph. (8)



Module V

19 a) Discuss the advantages of randomized algorithms over deterministic algorithms. Discuss Las Vegas and Monte Carlo algorithms with a suitable example. (7)

b) Give a randomized version of quicksort algorithm and perform its expected running time analysis. (7)

OR

20 a) Define bin packing problem. Discuss the first fit strategy for solving it. State the approximation ratio of the algorithm. (7)

b) Prove that vertex cover problem is NP Complete. (7)

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