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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S6 (R,S) (FT/WP/PT) Examinations April 2026 (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 $T(n) = \sqrt{2}T(n/2) + \log n$ using master method.	(3)
3		Give the algorithm for BFS traversal and its complexity.	(3)
4		With an example explain define Balancing Factor in an AVL tree.	(3)
5		Write the total number of spanning trees possible for a complete graph with 6 vertices.	(3)
6		Give the algorithm for Greedy Knapsack problem.	(3)
7		What are the main characteristics involved in solving a computational problem using the algorithm design strategy Dynamic Programming?	(3)
8		Discuss the types of constraints in Backtracking.	(3)
9		Write the verifier algorithm for the CLIQUE problem.	(3)
10		Why is polynomial-time reduction important in proving NP-completeness?	(3)

PART B

Answer one full question from each module, each carries 14 marks.

Module I

11	a)	Illustrate best case, average case and worst case complexity of Insertion sort algorithm.	(7)
	b)	Solve the following recurrence relation using Iteration method.	(7)
		i. $T(n) = 1 + T(n-1)$	
		ii. $T(n) = 3\ T(n/3) + n,\ T(1)=1$	

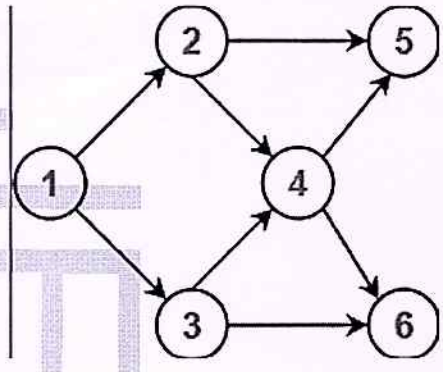
OR

12	a)	Recurrence equations can be solved by using Substitution method. Illustrate the steps used in Substitution method using following Equations $T(n) = 2\ T(n/2) + n,\ \ T(1) = 1$	(7)
	b)	Solve the following recurrence using recursion tree method. $T(n)=T(n/3) +T(2n/3)+cn$	(7)

Module II

13 a) Construct AVL tree with following nodes. 50,20,60,10, 8,15,32,46,11,48 .Explain 4 cases of AVL Tree rotations? (8)

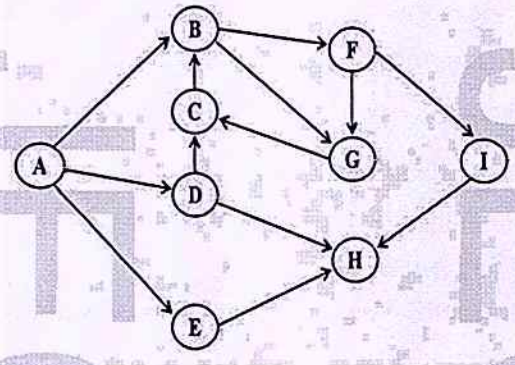
b) Find the any 3 different topological orderings possible for the given graph- (6)



OR

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

b) Perform Depth First search (DFS) traversal on the above graph starting from node A. Where multiple node choices may be available for next travel, choose the next node in alphabetical order. Classify the edges of the graph into different category (7)



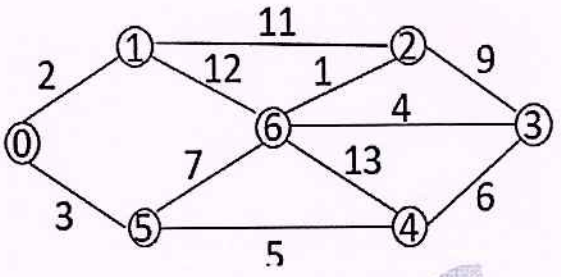
Module III

15 a) Explain 2- way merge sort algorithm with an example and derive its time complexity. (7)

b) Find the optimal solution for the following Fractional Knapsack problem. Given the number of items(n) = 7, capacity of sack(m) = 15, W={1, 3, 5, 4, 1, 3, 2} and P = {10, 15, 7, 8, 9, 4,3} (7)

OR

16 a) Apply Kruskal's algorithm for finding minimum cost spanning tree. (7)



b) Discuss about Strassens Matrix Multiplication Algorithm to multiply two matrices. (7)

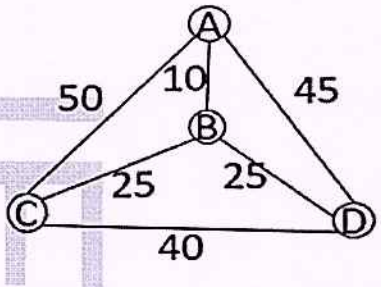
Module IV

17 a) Write Floyd Warshall's algorithm for finding all pairs shortest path algorithm. (7)

b) Given a chain of 4 matrices < A1, A2, A3, A4 > with dimensions <5X4> ,<4X6> ,<6X2> and <2X7>. Fully parenthesise the given matrices so that the number of scalar multiplications required to compute their product is minimum. What is the value of optimum number of scalar multiplications to compute the product of the given chain of matrices? (7)

OR

18 a) Define TSP problem. Apply branch and bound algorithm for solving TSP. (7)



b) Explain backtracking technique. How 4-queens problem can be solved using backtracking? (7)

Module V

19 a) Apply different Next Fit and First Fit Bin packing approximation algorithms on the following items: Bin capacity=10. Assuming the sizes of the items be {5, 7, 5, 2, 4, 2, 5, 1, 6}. (7)

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

OR

20 a) Compare deterministic and randomized algorithms. (7)

b) Explain the greedy approximation algorithm for vertex coloring with time complexity. (7)

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