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KAMALA INSTITUTE OF TECHNOLOGY & SCIENCE, SINGAPUR
23IT28PC602

III.B. Tech. II. Semester Regular Examinations, April/May- 2026
ALGORITHMS DESIGN AND ANALYSIS
(IT)

Time: 3 Hours

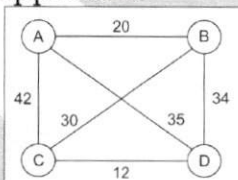
Max. Marks: 60

Note: Question paper consists of Part-A & Part-B.

i) **Part-A** for 10M, ii) **Part-B** for 50marks

- **Part A** is compulsory, consisting of 10 sub questions from all units carrying equal marks.
- **Part-B** consists of **10 questions** (numbered from 2 to 11) carrying **10marks** each. From each unit there are 2 questions and the students should answer one of them. Hence the student should answer **5 questions** from **Part-B**.

PART-A (10Marks)			
Q. No	Questions	Marks	BTL
1.a)	Define an algorithm. What are its key characteristics?	1M	1
1.b)	What is the main idea behind Strassen's Matrix Multiplication?	1M	1
1.c)	What is a Disjoint Set? Mention its basic operations.	1M	1
1.d)	What is Backtracking? Give one example problem.	1M	1
1.e)	What is Dynamic Programming? How is it different from Divide and Conquer?	1M	1
1.f)	What is an Optimal Binary Search Tree (OBST)?	1M	1
1.g)	Define Minimum Spanning Tree (MST).	1M	1
1.h)	What are Connected Components in a graph?	1M	1
1.i)	What is the Branch and Bound method?	1M	1
1.j)	Define NP-Hard and NP-Complete problems.	1M	1
PART-B (50Marks)			
Q.No	Questions	Marks	BTL
2. a)	Explain performance analysis of algorithms. Discuss both time complexity and space complexity with suitable examples.	5M	2
b)	Discuss Quick Sort algorithm. Explain partitioning, best case, worst case, and average case complexities.	5M	3
OR			
3. a)	Describe different Types of asymptotic notations with examples.	5M	2
b)	Write an algorithm to perform a merge sort. Show various stages in merge sorting over the following data: 11, 2, 9, 13, 57, 25, 17, 1, 90, 3.	5M	1
OR			
4. a)	Explain Disjoint Set data structure with Union and Find operations.	5M	2
b)	Solve the 4-Queens Problem by using the Backtracking approach.	5M	3
OR			

5. a)	Consider the following list of unsorted numbers to be sorted using Heap Sort: 82, 90, 10, 12, 15, 77, 55, 23	5M	3
b)	Given the set $W = \{5, 10, 12, 13, 15, 18\}$ and a target sum $m = 30$, find all possible subsets whose sum equals m . Also, construct the corresponding state space tree for the solution.	5M	3
6. a)	Explain the general method of Dynamic Programming. Discuss its key characteristics such as overlapping subproblems and optimal substructure with examples.	5M	2
b)	Explain the All-Pairs Shortest Path Problem using the Dynamic Programming approach (Floyd-Warshall algorithm).	5M	2
OR			
7. a)	Illustrate how to construct Optimal Binary Search Tree with a suitable example and compute its cost.	5M	2
b)	Explain the Traveling Salesperson Problem (TSP) using the Dynamic Programming approach.	5M	2
			
8. a)	Discuss briefly about the minimum cost spanning tree.	5M	3
b)	What are Biconnected Components in a graph? Explain clearly.	5M	1
OR			
9. a)	State the Job – Sequencing with deadlines problem. Find an optimal sequence to the $n = 5$ Jobs where profits $(P_1, P_2, P_3, P_4, P_5) = (20, 15, 10, 5, 1)$ and deadlines $(d_1, d_2, d_3, d_4, d_5) = (2, 2, 1, 3, 3)$.	5M	3
b)	Difference between Breadth First Search (BFS) and Depth First Search (DFS)	5M	4
10.a)	Explain the Branch and Bound technique in detail.	5M	2
b)	Explain the following: (i) Class P (ii) Class NP	5M	2
OR			
11.a)	Compare LC Branch and Bound and FIFO Branch and Bound methods.	5M	4
b)	Explain NP-Hard and NP-Complete problems in detail.	5M	2