PVP 23

Code: 23IT3301

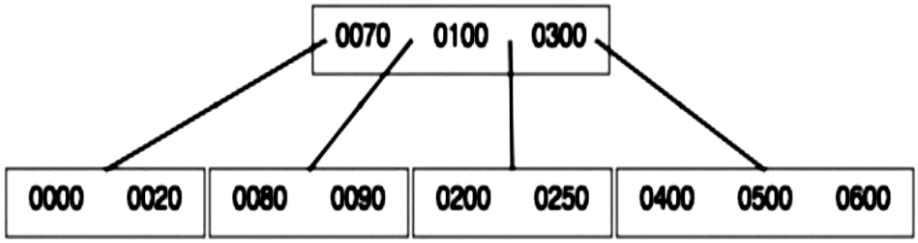
II B.Tech - I Semester – Supplementary Examinations - MAY 2025

ADVANCED DATA STRUCTURES AND ALGORITHMS
(INFORMATION TECHNOLOGY)

Duration: 3 hours Max. Marks: 70

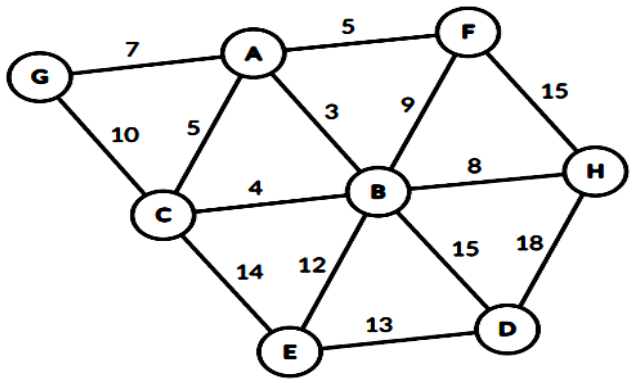
Note: 1. This question paper contains two Parts A and B.
2. Part-A contains 10 short answer questions. Each Question carries 2 Marks.
3. Part-B contains 5 essay questions with an internal choice from each unit. Each Question carries 10 marks.
4. All parts of Question paper must be answered in one place.

PART – A

1.a)	List the characteristics of an algorithm.
1.b)	Delete 250 from the following B Tree and draw resultant B Tree. 
1.c)	List graph traversal techniques.
1.d)	Write the importance of priority queue.
1.e)	Write recurrence relation for Quick sort in both best and worst cases.
1.f)	Write time and space complexities of Prim's algorithm.
1.g)	Define Travelling salesman problem.
1.h)	How can we say that a particular problem can be solvable by using Dynamic programming?
1.i)	List any two valid differences between back tracking and branch and bound.
1.j)	Define non-polynomial time algorithm.

PART – B

					Max. Marks
UNIT-I					
2	a)	Discuss the role of asymptotic notations in analyzing algorithms. Determine the following function using different notations: f(n) = $4\,n^2 + 2\,n + 5$.			5 M
	b)	List and explain different operations of AVL Trees.			5 M
OR					
3	a)	Compare the time complexity of searching in a B-tree with that in a binary search tree with an example.			5 M
	b)	Construct a B Tree of order 4 from the following elements. 1,4,7,10,17,21,31,25,19,20,28,42			5 M
UNIT-II					
4	a)	Construct Min-Heap tree for the following elements: 20, 15, 25, 10, 5, 30, 22, 28, 7, 14, 19, 9			5 M
	b)	Write an algorithm to demonstrate the working of Heapify process and analyze its time complexity.			5 M
OR					
5	a)	Discuss how graphs be represented in data structures?			5 M
	b)	Outline the steps of the BFS algorithm. Discuss how Queue is used in BFS algorithm.			5 M
UNIT-III					
6	a)	Find the minimum cost spanning tree (MST) from the given graph using Kruskal's algorithm. Clearly			5 M

		demonstrate each step in the process with proper explanation.  	
	b)	Write an algorithm for Merge sort and analyze its time and space complexities.	5 M
		OR	
7	a)	Consider the following list of item weights and its profits. Item | 1 | 2 | 3 | 4 | 5 | 6 | 7 Weight (Kg) | 6 | 5 | 4 | 7 | 4 | 7 | 2 Profit | 10 | 5 | 15 | 10 | 6 | 18 | 3 Also consider a knapsack with maximum capacity of 20kgs and apply the fractional knapsack algorithm to fill the knapsack with the list of items and their weights for getting maximum profit. Finally, find the maximum possible profit.	5 M
	b)	Define Master's theorem. Solve the following recurrence relation using Master's theorem. $T(N) = 2\,T\left(\frac{N}{2}\right) + \left(\frac{N}{log^2 N}\right)$	5 M
		UNIT-IV	
8	a)	Given three keys with associated search probabilities, construct the DP table for an optimal	5 M

		binary search tree. Use the keys K = {10, 20, 30} with probabilities P = {0.2, 0.5, 0.3}. Show the process and the final DP table.	
	b)	Define shortest path algorithm? How all pair shortest path is different from single-source shortest path? Explain with example.	5 M
OR			
9	a)	Analyze the time and space complexity of the dynamic programming solution to the travelling salesman problem.	5 M
	b)	Derive the recurrence relation used in the dynamic programming approach to solve the travelling salesman problem. Explain how it helps in constructing the solution.	5 M
UNIT-V			
10	Solve the travelling salesman problem using Branch and Bound algorithmic approach for the following adjacency matrix. Draw state space tree. $\begin{Bmatrix} \infty & 18 & 28 & 8 & 9 \\ 13 & \infty & 14 & 2 & 1 \\ 1 & 3 & \infty & 1 & 2 \\ 17 & 4 & 16 & \infty & 1 \\ 14 & 2 & 5 & 16 & \infty \end{Bmatrix}$		10 M
OR			
11	a)	Explain the backtracking algorithm for solving the Graph Coloring problem. Discuss the efficiency of the algorithm.	5 M
	b)	Analyze the time and space complexities of the Branch and Bound approach when applied to the Assignment Problem?	5 M