PVP 23

Code: 23IT3301

II B.Tech - I Semester – Regular Examinations - DECEMBER 2024

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.

BL – Blooms Level CO – Course Outcome

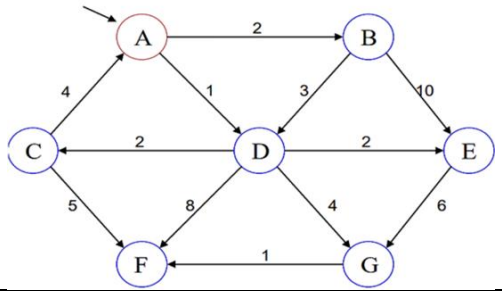
PART – A

		BL	CO
1.a)	Define Big O, Big omega, and Theta notations.	L1	CO1
1.b)	Illustrate Left Right (LR) rotation with an example.	L3	CO1
1.c)	List several operations performed on Heap trees.	L2	CO1
1.d)	Define in-degree and out-degree.	L1	CO1
1.e)	Write the recurrence relation for Merge sort.	L2	CO1
1.f)	Write time and space complexities of Kruskal's algorithm.	L2	CO1
1.g)	Define optimal sub-structure property.	L2	CO1
1.h)	List any three problems that can be solvable by using Dynamic programming approach.	L1	CO1
1.i)	Discuss general method of Branch and Bound.	L1	CO1
1.j)	Define NP-Complete.	L1	CO1

PART – B

			BL	CO	Max. Marks
UNIT-I					
2	a)	Why are asymptotic notations important in analyzing algorithms? How would you determine the Big O notation of the following function: f(n) = $5n^3 + 3n^2 + 2n + 10$?	L2	CO1	5 M
	b)	List and explain different operations of B-Trees.	L2	CO3	5 M
OR					
3	a)	Compare the time complexity of searching in an AVL tree with that of an unbalanced binary search tree with an example.	L2	CO3	5 M
	b)	Show the process of constructing an AVL-Tree with the following elements. 50, 65, 55, 40, 80, 25, 75, 35, 30.	L3	CO3	5 M
UNIT-II					
4	a)	How can a binary heap be used to implement a priority queue?	L2	CO1	5 M
	b)	Insert the following elements into Max-Heap tree: 50, 25, 75, 35, 10, 60, 45, 80, 40,20. After inserting all elements, delete two elements from the Max-Heap tree and draw resultant Max-Heap Tree after every deletion.	L3	CO3	5 M
OR					
5	a)	Discuss about adjacency matrix and adjacency list in detail.	L2	CO1	5 M
	b)	Outline the steps of the DFS algorithm. Discuss how Stack is used in DFS algorithm.	L2	CO3	5 M

UNIT-III

6	a)	For the given graph apply Dijkstra's algorithm by choosing **A** as a source node. 	L3	CO2	5 M
	b)	Write an algorithm to solve Min-Max problem using Divide and Conquer approach and analyze its time complexity.	L3	CO4	5 M
		OR			
7	a)	Given five jobs with the following profits and deadlines: Job | 1 | 2 | 3 | 4 | 5 Profit | 1 | 1 | 2 | 2 | 3 Deadline | 3 | 4 | 2 | 4 | 3 Find the optimal job sequence and the maximum profit using the greedy algorithm. Also analyze the time complexity of the job sequencing problem.	L3	CO2	5 M

	b)	Consider the following quick sort algorithm:
		`QSort(A[], p,r):`
		`  if p < r then:`
		`  q <- Partition (A, p, r)`
		`  QSort (A, p, q-1)`
		`  QSort (A, q+1, r)`
		`Partition(A[], p, q):`
		`  x<-A[p] //x is a pivot element.`
		`  i<-p`
		`  for j<- p+1 to q:`
		`  do if A[j] <= x then:`
		`  i<-i+1`
		`  exchange A[i] <-> A[j]`
		`  exchange A[p] <-> A[i]`
		`  return i`
		Find the recurrence relation by analyzing each statement of the above algorithm and solve the recurrence relation using Master's theorem.
			L2	CO3	5 M

UNIT-IV					
8	a)	Write an algorithm for 0/1 knapsack problem and analyze its time complexity.	L2	CO4	5 M
	b)	Define 0/1 knapsack problem. Find the solution for the given data using 0/1 knapsack problem, where number of items are four and bag size is 40. Profits (p1, p2, p3, p4) = (11, 21, 31, 33) and weights (w1, w2, w3, w4) = (2, 11, 22, 15).	L3	CO2	5 M
OR					
9	a)	Describe the step-by-step process of the Bellman-Ford algorithm. How does the algorithm ensure that the shortest path is found?	L2	CO1	5 M
	b)	Explain how dynamic programming helps in finding an optimal binary search tree?	L2	CO2	5 M
UNIT-V					
10	a)	Write steps involved in solving N-Queen's problem using backtracking approach and draw state space tree to solve 4-Queen's problem.	L2	CO2	5 M
	b)	Write the pseudocode for solving the Assignment Problem using the Branch and Bound method.	L2	CO2	5 M
OR					
11	a)	Provide an example of a graph with 4 vertices and show how backtracking would solve the graph coloring problem.	L3	CO2	5 M
	b)	Discuss about P, NP, NP-Hard, and NP-Complete problems. Give examples of each class.	L2	CO1	5 M