GURU NANAK INSTITUTE OF TECHNOLOGY

An Autonomous Institute under MAKAUT

2022-2023

ADVANCED ALGORITHMS

PGCSE103

TIME ALLOTTED: 3 HOURS FULL MARKS: 70

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable

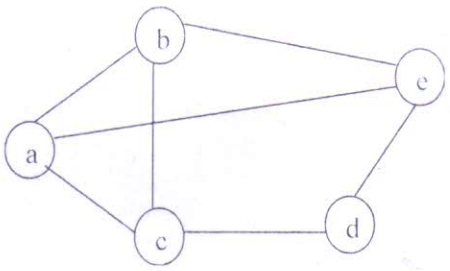
GROUP – A
(Multiple Choice Type Questions)

Answer any *ten* from the following, choosing the correct alternative of each question: 10×1=10

			Marks	CO No
1.	(i)	The problem of finding a list of integers in a given specific range that meets certain conditions is called? a) Subset sum problem b) Constraint satisfaction problem c) Hamiltonian circuit problem d) Travelling salesman problem	1	CO1
	(ii)	Optimal substructure property is exploited by a) Dynamic programming b) Greedy method c) Both (a) & (b) d) None of these	1	CO2
	(iii)	Time complexity of recurrence relation $T(n) = 2T(n/2) + n$ a) $\Theta(\log n)$ b) $\Theta(n^2)$ c) $\Theta(n \log n)$ d) $\Theta(n)$	1	CO3
	(iv)	What is the objective of the knapsack problem? a) To get maximum total value in the knapsack b) To get minimum total value in the knapsack c) To get maximum weight in the knapsack d) To get minimum weight in the knapsack	1	CO5
	(v)	Placing n-queens so that no two queens attack each other is called? a) n-queen's problem b) 8-queen's problem c) Hamiltonian circuit problem d) subset sum problem	1	CO2

(vi)	If an optimal solution can be created for a problem by constructing optimal solutions for its sub problems, the problem possesses _____ property. a) Overlapping sub problems b) Optimal substructure c) Memorization d) Greedy	1	CO1
(vii)	Which of the following methods can be used to solve the longest common subsequence problem? a) Recursion b) Dynamic programming c) Both recursion and dynamic programming d) None of the mentioned	1	CO4
(viii)	What is the time complexity of the brute force algorithm used to find the longest common subsequence? a) O(n) b) $O(n^2)$ c) $O(n^3)$ d) $O(2^n)$	1	CO3
(ix)	Which of the following methods can be used to solve the matrix chain multiplication problem? a) Dynamic programming b) Brute force c) Recursion d) All of the mentioned	1	CO2
(x)	Which of the following algorithms is the best approach for solving Huffman codes? a) exhaustive search b) greedy algorithm c) brute force algorithm d) divide and conquer algorithm	1	CO5
(xi)	Bellman Ford algorithm provides solution for _____ problems. a) All pair shortest path b) Sorting c) Network flow d) Single source shortest path	1	CO4
(xii)	What approach is being followed in Floyd Warshall Algorithm? a) Greedy technique b) Dynamic Programming c) Linear Programming d) Backtracking	1	CO2

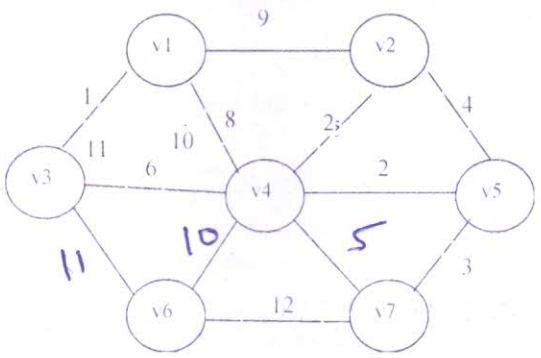
GROUP – B
(Short Answer Type Questions)
Answer any ***three*** from the following: **3×5=15**

			Marks	CO No
2.		State Master's Theorem and find the time complexity for the following recurrence : $T(n) = 2T(n^{1/2}) + \log n$	5	CO1
3.		Compare and contrast the best and worst case time complexity of Quick Sort.	5	CO3
4.		What is the significance of Big-oh (O), Big-theta (Θ), and Big-omega (Ω)?	5	CO1
5.		Apply backtracking technique to solve the 3-colouring problem for the following graph: 	5	CO2
6.		Write an algorithm of Matrix Chain Multiplication.	5	CO4

GROUP – C
(Long Answer Type Questions)
Answer any ***three*** from the following: **3×15=45**

			Marks	CO No
7.	(a)	Explain the basic concept of a divide-and-conquer algorithm.	3	CO1
	(b)	Write the quick sort algorithm for sorting a set of numbers.	5	CO4
	(c)	Trace it for the given set of numbers 25, 15, 40, 55, 10, 30.	3	CO2
	(d)	What are the characteristics of greedy programming? Differentiate between divide-and-conquer and dynamic programming.	4	CO1
8.	(a)	Write the algorithm for finding the longest common sub-sequence.	5	CO4
	(b)	Find the longest common sub-sequence of the following two sequences S1= BDCABA and S2= ABCBDAB, using dynamic programming.	7	CO5
	(c)	What is the time complexity of longest common sub-sequence algorithm?	3	CO3

9.	(a)	Define minimal spanning tree.	2	CO1
	(b)	State Prim's algorithm.	5	CO4
	(c)	Find the minimal spanning tree of the weighted graph of the following figure using Prim's algorithm.	6	CO2



	(d)	What is the time complexity of Prim's algorithm?	2	CO3
10.	(a)	Obtain a set of optimal Huffman codes for the eight messages $(M_1, M_2, \ldots, M_8)$ with access frequencies $(q_1\ q_2 \ldots q_8)$ = (5, 10, 2, 6, 3, 7, 12, 14). Draw the decode tree for this set of code.	8	CO2
	(b)	Use a recursion tree to give an asymptotically tight solution to the recurrence : $T(n) = T(n/4) + T(3n/4) + cn$ where $a \geq 1$ and $c > 0$ are constants.	7	CO3
11.		Write short notes on the following (any three):	3X5=15	
	(a)	Job sequencing problem with example	5	CO2
	(b)	Stable Marriage	5	CO4
	(c)	Merge sort	5	CO5
	(d)	Graph Coloring Problem	5	CO2
	(e)	NP Completenes-P class, NP class, NP hard class	5	CO1