Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE- SEMESTER–V (NEW) EXAMINATION – WINTER 2020

Subject Code:3150703   **Date:29/01/2021**
Subject Name:Analysis & Design of Algorithms
Time:10:30 AM TO 12:30 PM   **Total Marks: 56**
Instructions:
1. Attempt any FOUR questions out of EIGHT questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

			MARKS
Q.1	**(a)**	What is an algorithm? Why analysis of algorithm is required?	**03**
	(b)	What is asymptotic notation? Find out big-oh notation of the f(n)= $3n^2+5n+10$	**04**
	(c)	Write an algorithm for insertion sort. Analyze insertion sort algorithm for best case and worst case.	**07**
Q.2	**(a)**	What is the difference between selection sort and bubble sort?	**03**
	(b)	Write iterative and recursive algorithm for finding the factorial of N. Derive the time complexity of both algorithms.	**04**
	(c)	Solve following recurrence relation using iterative method $T(n)=2T(n / 2) + n$	**07**
Q.3	**(a)**	How divide and conquer approach work?	**03**
	(b)	Trace the quick sort for data A = {6,5,3,11,10,4,7,9}	**04**
	(c)	Explain master theorem and solve the recurrence $T(n)=9T(n/3)+n$ with master method	**07**
Q.4	**(a)**	Write the characteristics of greedy algorithm.	**03**
	(b)	Trace the merge sort for data A = {6,5,3,11,10,4,7,9}	**04**
	(c)	Find minimum spanning tree for the given graph in fig-1 using prim's algorithm	**07**

Fig-1

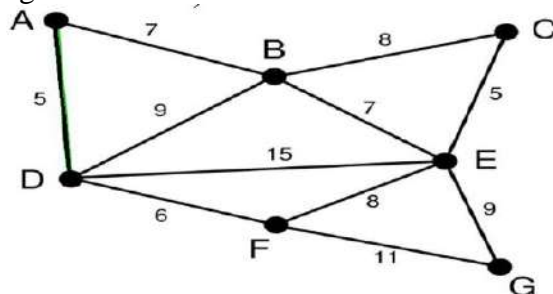|			
Q.5	**(a)**	How huffman code is memory efficient compare to fixed length code?	**03**
	(b)	Give difference between greedy approach and dynamic programming.	**04**
	(c)	Find the Huffman code for each symbol in following text ABCCDEBABFFBACBEBDFAAAABCDEEDCCBFEBFCAE	**07**
Q.6	**(a)**	What is principal of optimality? Explain its use in Dynamic Programming Method.	**03**
	(b)	Find out minimum number of multiplications required for multiplying: A[1 × 5], B[5 × 4], C[4 × 3], D[3 × 2], and E[2 × 1].	**04**
	(c)	Solve following knapsack problem using dynamic programming algorithm with given capacity W=5, Weight and Value are as follows :	**07**

1

(2,12),(1,10),(3,20),(2,15)

Q.7	**(a)**	What is finite automata? How it can be used in string matching?	**03**
	(b)	Differentiate BFS and DFS	**04**
	(c)	Explain Backtracking Method. What is N-Queens Problem? Give solution of 4-Queens Problem using Backtracking Method.	**07**
Q.8	**(a)**	Explain Minimax principal.	**03**
	(b)	Define P, NP, NP-complete, NP-Hard problems.	**04**
	(c)	Explain rabin-karp string matching algorithm.	**07**

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Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–V (NEW) EXAMINATION – WINTER 2021

Subject Code:3150703   **Date:17/12/2021**
Subject Name:Analysis and Design of Algorithms
Time:02:30 PM TO 05:00 PM   **Total Marks: 70**
Instructions:
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

|			MARKS
Q.1	**(a)**	Define algorithm. Discuss key characteristics of algorithms.	**03**
	(b)	Explain why analysis of algorithms is important? Explain: Worst Case, Best Case and Average Case Complexity with suitable example.	**04**
	(c)	Write and analyze an insertion sort algorithm to arrange n items into ascending order.	**07**
Q.2	**(a)**	Write an algorithm of Selection Sort Method.	**03**
	(b)	Sort the following numbers using heap sort. 20, 10, 50, 40, 30	**04**
	(c)	Sort the following list using quick sort algorithm: <50, 40, 20, 60, 80, 100, 45, 70, 105, 30, 90, 75> Also discuss worst and best case of quick sort algorithm.	**07**

OR

	(c)	Apply merge sort algorithm on array A = {2,7,3,5,1,9,4,8}. What is time complexity of merge sort in worst case?	**07**
Q.3	**(a)**	What is Principle of Optimality? Explain its use in Dynamic Programming Method	**03**
	(b)	Explain Binomial Coefficient algorithm using dynamic programming.	**04**
	(c)	Solve the following 0/1 Knapsack Problem using Dynamic Programming. There are five items whose weights and values are given in following arrays. Weight w [] = {1,2,5,6,7} Value v [] = {1, 6, 18, 22, 28} Show your equation and find out the optimal knapsack items for weight capacity of 11 units.	**07**

OR

Q.3	**(a)**	Compare Dynamic Programming Technique with Greedy Algorithms	**03**
	(b)	Give the characteristics of Greedy Algorithms.	**04**
	(c)	Obtain longest common subsequence using dynamic programming. Given A = "acabaca" and B = "bacac".	**07**
Q.4	**(a)**	Using greedy algorithm find an optimal schedule for following jobs with n=7 profits: (P1, P2, P3, P4, P5, P6, P7) = (3, 5, 18, 20, 6, 1, 38) and deadline (d1, d2, d3, d4, d5, d6, d7) = (1, 3, 3, 4, 1, 2, 1)	**03**
	(b)	Find Minimum Spanning Tree for the given graph using Prim's Algo.	**04**
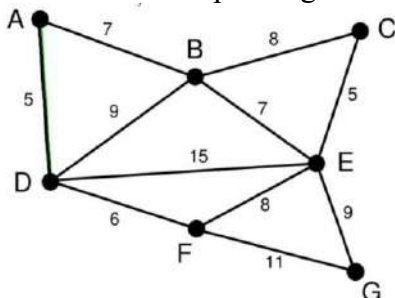
(c) Explain in brief Breadth First Search and Depth First Search Traversal techniques of a Graph with Example. **07**

OR

Q.4 **(a)** Find an optimal Huffman code for the following set of frequency. A : 50, b: 20, c: 15, d: 30 **03**

(b) Find Minimum Spanning Tree for the given graph using Kruskal Algo. **04**
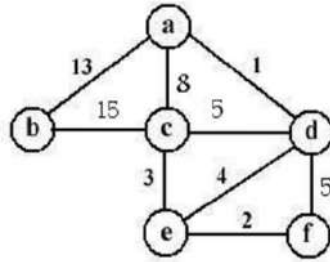
(c) Explain Backtracking Method. What is N-Queens Problem? Give solution of 4- Queens Problem using Backtracking Method **07**

Q.5 **(a)** Define Articulation point, Acyclic Directed Graph, Back Edge **03**

(b) Show the comparisons that naïve string matcher makes for the pattern p=0001 in the text T=000010001010001 **04**

(c) Explain spurious hits in Rabin-Karp string matching algorithm with example. Working modulo q=13, how many spurious hits does the Rabin-Karp matcher encounter in the text T = 2359023141526739921 when looking for the pattern P = 31415? **07**

OR

Q.5 **(a)** Explain polynomial reduction. **03**

(b) Differentiate branch and bound and back tracking algorithm. **04**

(c) Explain P, NP, NP complete and NP-Hard problems. Give examples of each **07**

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Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–V (NEW) EXAMINATION – SUMMER 2021
Subject Code:3150703   **Date:05/10/2021**
Subject Name:Analysis & Design of Algorithms
Time:10:30 AM TO 01:00 PM   **Total Marks: 70**
Instructions:
1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

			MARKS

Q.1 **(a)** Explain Asymptotic notations. **03**

(b) What is Principle of Optimality? Explain its use in Dynamic Programming Method. **04**

(c) Explain why algorithm analysis is important. Also explain Worst Case, Best Case & Average Case Complexity of algorithm. **07**

Q.2 **(a)** Explain Master method for solving Recurrence. **03**
(b) Explain Counting Sort algorithm with example. **04**
(c) Explain Quick Sort algorithm with suitable example. Also give its complexity analysis. **07**

OR

(c) Explain Binary search algorithm with divide and conquer strategy and show that the solution to the binary search recurrence $T(n)= T(n/2) + \Theta (1)$ is $T(n) = \Theta(lgn)$. **07**

Q.3 **(a)** Explain general characteristics of Greedy algorithm. **03**
(b) Write Kruskal's algorithm to find Minimum Spanning Tree. **04**
(c) Write Huffman code algorithm and Generate Huffman code for following: **07**

Symbol	a	b	c	d	e
Frequency	35	25	20	12	8

OR

Q.3 **(a)** Define amortized analysis. Briefly explain any two techniques. **03**
(b) Write algorithm to find Minimum Spanning Tree (MST) using Prim's method. **04**
(c) Using Greedy method find an optimal solution for fractional knapsack problem given below: **07**
n=7, W=15.

Weight (w)	2	3	5	7	1	4	1
Profit (p)	10	5	15	7	6	18	3

Q.4 **(a)** Explain Optimal Substructure and Overlapping sub problems with suitable example. **03**

(b) Explain All Pair Shortest Path Algorithm. **04**

(c) Given two sequences of characters, M=<A,B,C,D,B,A,C,D,F>, N=<C,B,A,F> Obtain the Longest Common Subsequence. Write equations and necessary steps. **07**

Q.4 **(a)** Explain: Articulation Point, Graph, Minimum Spanning Tree.   **03**

(b) Explain Depth First Search algorithm.   **04**

(c) Solve the following Knapsack Problem using Dynamic Method. Write the equation and steps for solving above problem. n = 5, W = 100   **07**

Object	1	2	3	4	5
Weight (w)	10	20	30	40	50
Value (v)	20	30	66	40	60

Q.5 **(a)** Explain Hamiltonian problem.   **03**

(b) Explain Knuth-Morris-Pratt string matching algorithm with example.   **04**

(c) Give state space tree after application of backtracking for Knapsack problem given below and explain it briefly.   **07**

Number of objects=4, Capacity of knapsack= W= 8 units. Objects weight are (2, 3, 4, 5) and values are (3, 5, 6, 10) respectively

OR

Q.5 **(a)** Explain Branch and Bound technique briefly.   **03**

(b) Define P, NP, NP-Hard and NP-Complete Problem   **04**

(c) Explain Rabin-Karp Algorithm for string matching with example and show all necessary steps.   **07**

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GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–V(NEW) EXAMINATION – SUMMER 2022

Subject Code:3150703   **Date:07/06/2022**
Subject Name:Analysis and Design of Algorithms
Time:02:30 PM TO 05:00 PM   **Total Marks: 70**
Instructions:
  1. **Attempt all questions.**
  2. **Make suitable assumptions wherever necessary.**
  3. **Figures to the right indicate full marks.**
 4. **Simple and non-programmable scientific calculators are allowed.**

			Marks
Q.1	**(a)**	Define Algorithm, Time Complexity and Space Complexity	**03**
	(b)	Explain: Worst Case, Best Case and Average Case Complexity with suitable example.	**04**
	(c)	Sort the following list using quick sort algorithm:< 5, 3 ,8 ,1 ,4 ,6 ,2 ,7 > Also write Worst and Best case and Average case of quick sort algorithm.	**07**
Q.2	**(a)**	Write an algorithm of Selection Sort Method.	**03**
	(b)	Demonstrate Binary Search method to search Key = 14, form the array A=<2,4,7,8,10,13,14,60>	**04**
	(c)	Write the Master theorem. Solve following recurrence using it. (i)T(n)= T(n/2) + 1 (ii) T(n)=2T(n/2) + n log n	**07**

OR

	(c)	Solve following recurrence relation using iterative method T(n) = T(n - 1) + 1 with T(0) = 0 as initial condition. Also find big oh notation	**07**

Q.3	**(a)**	What is Principle of Optimality? Explain its use in Dynamic Programming Method	**03**
	(b)	Find out LCS of A={K,A,N,D,L,A,P} and B = {A,N,D,L}	**04**
	(c)	Discuss Assembly Line Scheduling problem using dynamic programming with example.	**07**

OR

Q.3	**(a)**	Give the characteristics of Greedy Algorithms	**03**
	(b)	Give difference between greedy approach and dynamic programming.	**04**
	(c)	Consider Knapsack capacity W=15, w = (4, 5, 6, 3) and v=(10, 15, 12, 8) find the maximum profit using greedy method.	**07**

Q.4	**(a)**	Explain: Articulation Point, Graph, Tree	**03**
	(b)	Find Minimum Spanning Tree for the given graph using Prim's Algorithm.	**04**
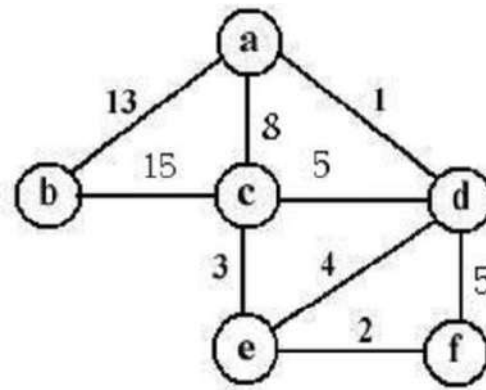
(c) Explain Breath First Traversal Method for Graph with algorithm with example.   **07**

OR

Q.4 **(a)** Explain Huffman code with Example.   **03**

(b) Write the Kruskal's Algorithm to find out Minimum Spanning Tree. Apply the same and find MST for the graph given below   **04**
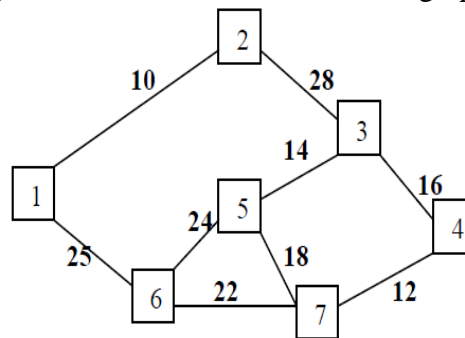
(c) Explain fractional knapsack problem with example.   **07**

Q.5 **(a)** What is string-matching problem? Define valid shift and invalid shift.   **03**

(b) Define P, NP, NP-Hard and NP-Complete Problem   **04**

(c) Explain Backtracking Method. What is N-Queens Problem? Give solution of 4- Queens Problem using Backtracking Method.   **07**

OR

Q.5 **(a)** Explain "P = NP ?" problem.   **03**

(b) Explain Minimax principal.   **04**

(c) What is Finite Automata? Explain use of finite automata for string matching with suitable example.   **07**