

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

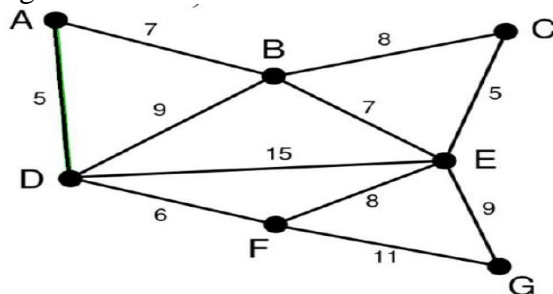


Fig-1

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: $A[1 \times 5]$, $B[5 \times 4]$, $C[4 \times 3]$, $D[3 \times 2]$, and $E[2 \times 1]$.	04
	(c) Solve following knapsack problem using dynamic programming algorithm with given capacity $W=5$, Weight and Value are as follows :	07

(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 |
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 | | | |
| 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 |

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 |

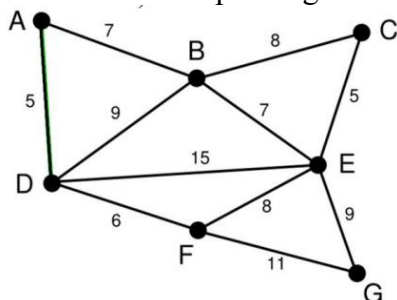
- Q.2**
- | | | |
|-----|--|-----------|
| (a) | Write an algorithm of Selection Sort Method. | 03 |
| (b) | Sort the following numbers using heap sort.
20, 10, 50, 40, 30 | 04 |
| (c) | Sort the following list using quick sort algorithm: <50, 40, 20, 60, 80, 100, 45, 70, 105, 30, 90, 75> Also discuss 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

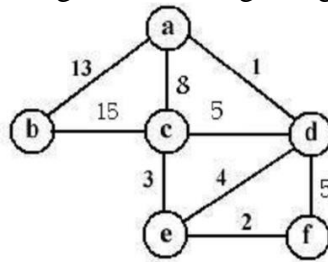
- Q.3**
- | | | |
|-----|---|-----------|
| (a) | Compare Dynamic Programming Technique with Greedy Algorithms | 03 |
| (b) | Give the characteristics of Greedy Algorithms. | 04 |
| (c) | Obtain longest common subsequence using dynamic programming. Given A = "acabaca" and B = "bacac". | 07 |
- Q.4**
- | | | |
|-----|--|-----------|
| (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**

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 $T(n) = \Theta(\lg n)$. **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, $M = \langle A, B, C, D, B, A, C, D, F \rangle$, $N = \langle C, B, A, F \rangle$ Obtain the Longest Common Subsequence. Write equations and necessary steps. **07**

OR

- 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

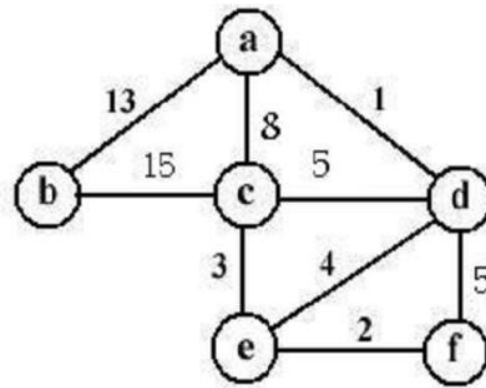
OR

- 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**

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.

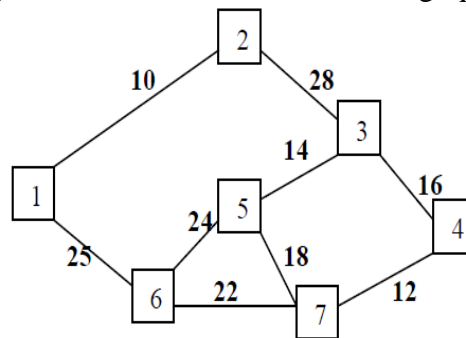
		Marks
Q.1	(a) Define Algorithm, Time Complexity and Space Complexity	03
	(b) Explain: Worst Case, Best Case and Average Case Complexity with suitable example.	04
	(c) Sort the following list using quick sort algorithm: < 5, 3, 8, 1, 4, 6, 2, 7 > Also write Worst and Best case and Average case of quick 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