# 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:<br>n=7, W=15. | **07** |

| 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** |

**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.<br>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 | **07** |

**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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