# GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–V (NEW) EXAMINATION – WINTER 2023

Subject Code:3150703   **Date:20-12-2023**
Subject Name: Analysis and 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)**	What is an algorithm? Explain various properties of an algorithm.	**03**
	(b)	Solve the following using Master's theorem:	**04**
		a. $T(n) = 2T(n/4) + 1$	
		b. $T(n)=3T(n/4) + n\lg n$	
	(c)	Write selection sort algorithm and compute running time of algorithm.	**07**
Q.2	**(a)**	Explain general characteristics of greedy algorithms.	**03**
	(b)	What is asymptotic notation? Find out big-oh notation of the $f(n) = 3n^2+5n+10$	**04**
	(c)	Illustrate the working of the quick sort on input instance: 25, 29, 30, 35, 42, 47, 50, 52, 60. Comment on the nature of input i.e. best case, average case or worst case. Also discuss worst and best case of quick sort algorithm.	**07**

OR

	(c)	Give the properties of Heap Tree. Sort the following data using Heap Sort Method: 20, 50, 30, 75, 90, 60, 80, 25, 10, 40.	**07**
Q.3	**(a)**	Sort the List "G,U,J,A,R,A,T,S,A,R,K,A,R" in alphabetical order using merge sort.	**03**
	(b)	Following are the details of various jobs to be scheduled on multiple processors such that no two processes execute at the same on the same processor. Show schedule of these jobs on minimum number of processors using greedy approach.	**04**

Jobs	J_1	J_2	J_3	J_4	J_5	J_6	J_7
Start time	0	3	4	9	7	1	6
Finish time	2	7	7	11	10	5	8

	(c)	Using algorithm find an optimal parenthesization of a matrix chain product whose sequence of dimension is (5,10,3,12,5,50,6) (use dynamic programming).	**07**

OR

Q.3	**(a)**	Apply counting sort for the following numbers to sort in ascending order. 3, 1, 2, 3, 3, 1	**03**
	(b)	Find the Optimal Huffman code for each symbol in following text ABCCDEBABFFBACBEBDFAAAABCDEEDCCBFEBFCAE	**04**
	(c)	Solve following knapsack problem using dynamic programming algorithm with given capacity W=5, Weight and Value are as follows (2,12),(1,10),(3,20),(2,15)	**07**
Q.4	**(a)**	Solve the following Task Assignment problem for minimization using following cost matrix. (Cost matrix represents cost of Task T performed by Person P).	**03**

	T_1	T_2	T_3
P_1	10	20	25
P_2	20	23	26
P_3	12	16	25

(b) Given coins of denominations 2, 3 and 4 with amount to be pay is 5. Find optimal no. of coins and sequence of coins used to pay given amount using dynamic method. **04**

(c) Write an algorithm to find out the articulation points of an undirected graph. Find out articulation points for the following graph. Consider vertex 0 as the starting point. **07**
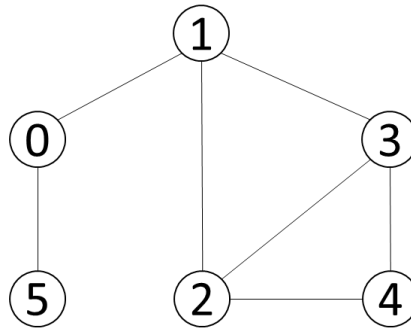

OR

Q.4 (a) Find out the NCR $\binom{5}{3}$ Using Dynamic Method. **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**
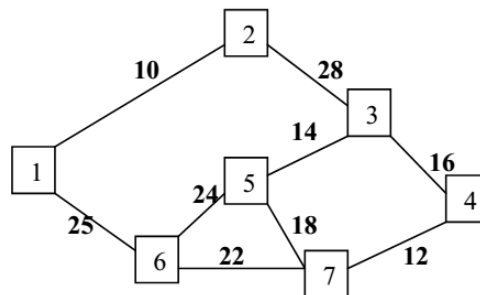
(c) Explain Backtracking Method. What is N-Queens Problem? Give solution of 4-Queens Problem using Backtracking Method. **07**

Q.5 (a) Demonstrate Binary Search method to search Key = 14, form the array A = <2,4,7,8,10,13,14,60>. **03**

(b) Solve the following knapsack problem using greedy method. Number of items = 5, knapsack capacity W = 100, weight vector = {50,40,30,20,10} and profit vector = {1,2,3,4,5}. **04**

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

OR

Q.5 (a) Explain in Brief: Polynomial reduction. **03**

(b) Traverse the following graph using Breadth First Search Technique. Also draw BFS Tree for a given graph. **04**
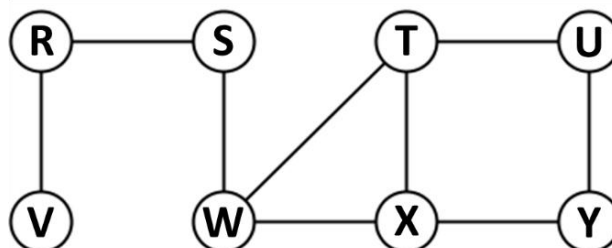
(c) Explain spurious hits in Rabin-Karp string matching algorithm with example. Working modulo q=13, how many spurious hits does the Rabin-Karp matcher encounter in the text T = 2359023141526739921 when looking for the pattern P = 26739? **07**

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