Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER– I (OLD course) • EXAMINATION – SUMMER 2015

Subject Code: 710201 **Date: 11/05/2015**

Subject Name: **Computer Algorithm**

Time: 10:30 am to 1:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Do as directed. **07**

1. Given two positive functions f(n) and g(n). Prove or disprove the relation max(f(n), g(n)) = Ū(f(n) + g(n)).
2. $f(n) = 10n^2 - 3n + 8$. Find the asymptotic tight bound for f(n). Also compute c_1, c_2 and n_0.

(b) Solve the following recurrences. **07**

1. $T(n) = 2T(n/2) + n^2$ using recursion tree method.
2. $T(n) = 9T(n/3) + n$ using master method.

Q.2 **(a)** Write down the algorithm of counting sort. Illustrate the operation of counting sort on the array A = {6, 0, 2, 0, 1, 3, 4, 6, 1, 3, 2}. **07**

(b) Mention properties of Red-Black tree. Insert the following elements into Red-Black tree. **07**

<10, 5, 8, 3, 2, 15>

OR

(b) Given n-key B-tree T of height h and minimum degree t Ó2, where n Ó1. Prove that h Ò $\log_t \frac{n+1}{2}$. **07**

Q.3 **(a)** Mention the properties of Binomial trees. Prove each property by mathematical induction. **07**

(b) Insert the following elements in order into an empty B-tree of order 4. **07**

<100, 350, 200, 50, 400, 900, 650, 150, 550, 800>

OR

Q.3 **(a)** Write down equation for Matrix-Chain Multiplication using Dynamic programming. Find an optimal parenthesization of a matrix-chain product whose sequence of dimensions is (30, 35, 15, 5, 10, 20, 25). **07**

(b) Given 6 jobs to be scheduled on a single processor. Job j requires t_j units of processing time and is due at time d_j. Job j starts at s_j and finishes at $f_j = s_j + t_j$. Lateness $l_j = \max\{0, f_j ï d_j\}$. Schedule all the jobs on a single processor to minimize the lateness using greedy approach. **07**

	j_1	j_2	j_3	j_4	j_5	j_6
t_j	3	2	1	4	3	2
d_j	6	8	9	9	14	15

Q.4 **(a)** Explain accounting method of amortized analysis. Extend the explanation using stack operations. **07**

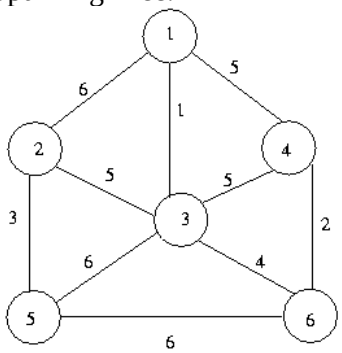
(b) Explain Dijkstraôs algorithm using example to find single-source shortest paths in directed acyclic graph. **07**

OR

Q.4 **(a)** Solve the following Knapsack problem using Dynamic Programming method. Number of items n = 4 and capacity of knapsack W = 5. **07**

Item	Weight (w)	Profit (p)
1	2	3
2	3	4
3	4	5
4	5	6

(b) Execute Kruskalôs algorithm for the below graph to construct a Minimum Spanning Tree. **07**



Q.5 **(a)** Design and analyze an algorithm to solve 8-queen problem using backtracking **07**

(b) Explain P and NP-class problems using example. The problem of visiting every vertex of a graph exactly once is NP-complete or NP-hard problem? **07**

OR

Q.5 **(a)** Define spurious hits in Rabin-Karp string matching algorithm. Working modulo q = 11, how many spurious hits and valid hits does the Rabin-Karp matcher encounter in the text T = 3141592653589793 when looking for the pattern P = 26? What is worst case processing and matching time complexities of this algorithm? **07**

(b) Answer the following questions. **07**

1. Given an undirected graph with n=7 vertices. Calculate the minimum amount of storage required for adjacency matrix.
2. The Shortest Path problem satisfies the Principle of Optimality. Justify this statement.

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