Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – I • EXAMINATION – SUMMER • 2014

Subject code: 710201N **Date: 13-06-2014**

Subject Name: Computer Algorithms

Time: 10.30 am – 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.**

Q.1 **(a)** Solve the following recurrences.

1. $T(n) = 3T(n/3) + n/2$ **03**
2. $T(n) = 3T(n/4) + n^2$ using recursion tree method. **04**

(b) Do as directed.

1. Let f(n) and g(n) be asymptotically positive function. Prove or disprove the following: **03**

f(n) + g(n) = ẽ (min(f(n), g(n))).

2. Prove that $1 + 2 + 3 + ... + n = ẽ (n^2)$. **03**
3. Arrange the following growth rate for algorithm in increasing order. **01**

2^n, n log n, n^2, 1, n, log n, n!, n^3

Q.2 **(a)** Mention the properties of heap tree. Prove that a max-heap can be built in linear time i.e. O(n) from an unordered array. **07**

(b) Discuss in detail the significance of rotation operation with its types with respect to red-black trees. **07**

OR

(b) Do as directed.

1. Prove that a red-black tree with n internal nodes has height at most 2lg(n+1). **04**
2. Prove that counting sort is stable sorting method. **03**

Q.3 **(a)** Do as directed.

1. Insert the keys F, S, Q, K ,C, L, H, T, V, W, M, R, N, P, A, B, X, Y in order into an empty B-tree of order 5. **05**
2. Prove or disprove that the height h of B-tree of order t is <= $\log_t$ ((n+1)/2) in the worst case. **02**

(b) Explain binomial heaps with example. Prove that the maximum degree of any node in an n-node binomial tree is lg(n). **07**

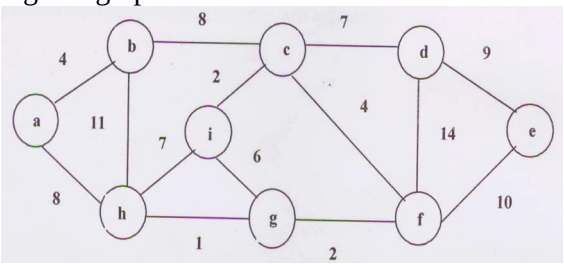
OR

Q.3 **(a)** Create a Fibonacci-heap with the following list of data: **07**
20,10,5,30,35,55,25,45,36,32,50,90,70,44,60

(b) Solve the following fractional knapsack problem. There are five items whose weights and values are given in the following arrays: **07**
Weight W[5] = {10,20,30,40,50}
Value V[5] = {20, 30, 66, 40, 60}
Find out the optimal knapsack items for weight capacity of 100 units.

Q.4 **(a)** Explain Longest Common Subsequence (LCS) using Dynamic Programming Technique with illustration. Find LCS for the following strings: **07**
X = {A, C, D, C, B, D, B} Y = {A, C, B, D, B, B}

(b) Find out minimum spanning tree and its length using kruskal's algorithm for given graph. **07**



OR

Q.4 **(a)** Write a binary search algorithm. Analyze its time complexity for best case, average case, and worst case. **07**

(b) Explain the following methods of amortized analysis with stack operations. **07**

1. Aggregate analysis
2. Accounting method

Q.5 **(a)** Explain the 8-queen problem. Also write a recursive algorithm of 8-queen problem. **07**

(b) Prove that if P ≠ NP, then for any constant ρ ≥ 1, there is no polynomial-time approximation algorithm with approximation radio ρ for the general traveling-salesman problem. **07**

OR

Q.5 **(a)** Mention the differences between DFS and BFS. Write and analyze an algorithm for BFS. **07**

(b) Write short note on the algorithms for parallel computers. **07**

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