TCS 503

Roll No. [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

Odd Semester Examination, 2019-20
B.Tech (CSE/IT, 5th Semester)
Design & Analysis of Algorithms

Time: 3 Hours

Max. Marks: 100

Total no. of printed pages: 2

Note: (i) Attempt **ALL** questions.
(ii) All Questions carry equal marks.
(iii) Be precise in your answer.

$(5 \times 4 = 20)$

Q1. Attempt *any four* parts of the following:
(a) Explain Heap sort with suitable examples.
(b) Use recursion tree to solve the following recursive equation also prove it correct using substitution method.
$$T(n) = 4T(n/3) + n$$
(c) Write the algorithm for Max-Heapify procedure. Illustrate the functioning of Heap Sort on the following array: $A = <55, 62, 41, 27, 15, 20, 5, 60>$
(d) Write a pseuducode for multiplying two matrices of size n * n also derive the running time complexity of your algorithm?
(e) Solve the following recurrence relations
$T(n) = T(n-1) + T(n-2)$ for $n>1$ and $T(0)=0$, $T(1)=1$
$T(n) = n + T(n/10) + T(9n/10)$
(f) Explain Master's Theorem.

$(5 \times 4 = 20)$

Q2. Attempt *any four* parts of the following:
(a) Prove that a red-black tree with n internal nodes has height almost $2\log(n+1)$?
(b) Define following asymptotic notations
a) Θ (Theta)
b) O (Big-Oh?)
(c) Write quick sort algorithm and discuss its worst case and best case complexity. Apply quick sort algorithm on array $A = <76, 22, 50, 79, 98, 87, 16, 3, 25, 100>$
(d) Explain searching operation in B-tree.
(e) What is a B-Tree? Draw a B-tree of order 3 inserting the following elements in sequence – 92 19 6 7 11 8 22 4 5 16 36 20 78?
(f) Explain Data Structure for Disjoint Sets.

$(10 \times 2 = 20)$

Q3. Attempt *any two* parts of the following:
(a) Discuss the dynamic programming solution to largest common subsequence (LCS) problem. Write an algorithm to compute an LCS of two given strings.
(b) What is 0/1 knapsack problem? Does greedy method effective to solve the 0/1 knapsack problem?
(c) When and how dynamic programming approach is applicable? Discuss the matrix chain multiplication with respect to dynamic programming technique.

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Q4. Attempt *any two* parts of the following: (10 × 2 = 20)
    (a) Explain prims algorithm to find the minimum cost spanning tree of an n-vertex undirected network with example.
    (b) Write the algorithm for Bellman Ford algorithm. Also find the shortest path using the same.
    (c) Explain greedy algorithms with the help of suitable examples?

Q5. Attempt *any two* parts of the following: (10 × 2 = 20)
    (a) Explain backtracking why it is required? Also explain B trees
    (b) What is string matching algorithm? Explain Boyer-Moore algorithm for string matching for: abcaabccaabbabcaacacbbbss
        Compute worst time complexity of this algorithm?
    (c) Explain in detail travelling salesman problem?