Roll No. | | | | | | | | | | |

B.E / B.Tech (Full Time) DEGREE EXAMINATIONS, APR / MAY 2013

COMMON TO CSE / IT BRANCHES

III Semester

CS 9201 Design and Analysis of Algorithms

(Regulation 2008)

Time : 3 Hours **Answer ALL Questions** **Max. Marks 100**

PART-A (10 x 2 = 20 Marks)

1. How is an algorithm's complexity measured?
2. State the recurrence relation for the towers of Hanoi algorithm.
3. State any two sorting algorithms that sorts in linear time.
4. Write the recursive binary search algorithm.
5. State the elements of greedy strategy.
6. State the following properties of matrix; i) Tridiagonal and ii) Permutation.
7. Write an algorithm to find the number of occurrence of each character in a given string.
8. What does the prefix function in KMP algorithm calculate?
9. Define Polynomial reduction.
10. State the 3-CNF-SAT problem and its complexity class.

Part – B (5 x 16 = 80 marks)

11. i) Solve the following recurrence equations. (8)
    a. $T(n) = 2T(n/2) + n$
    b. $T(n) = 2T(n/4) + \sqrt{n}$, where $T(1) = 1$ and n is input size.

    ii) Write any randomized search algorithm and analyze its time complexity. (8)

12. a) i) Write a randomized sort algorithm and analyze its expected running time. (8)

    ii) Write an algorithm that solves the problem of optimal parenthesization in matrix multiplication with chain order of increasing length using dynamic programming. And analyze its running time. (8)

    OR

    b) i) Write a selection algorithm and show that its selection in worst case is linear time. (8)

    ii) Find all the optimal Longest Common Subsequence from the given two input strings A = {O,V,E,R,L,O,A,D} and B = {L,O,U,D,E,R} (8)

13. a) i) Give a dynamic-programming algorithmic solution to the 0-1 knapsack problem that runs in O(n W) time, where n is number of items and W is the maximum weight of items that the thief can put in his knapsack. (8)

ii) Write a greedy fractional Knapsack algorithm where, n is number of items, V is the value per item and W is the maximum weight of items that the thief can put in his knapsack. Analyze the running time of this algorithm (8)

OR

b) i) Write the algorithm to compute LUP decomposition of a matrix. (8)

ii) Solve the given matrix equation using LUP decomposition (8)

$$\begin{bmatrix} 1 & 5 & 4 \\ 2 & 0 & 3 \\ 5 & 8 & 2 \end{bmatrix} \begin{bmatrix} x1 \\ x2 \\ x3 \end{bmatrix} = \begin{bmatrix} 12 \\ 9 \\ 5 \end{bmatrix}$$

14. a) i) Solve the following linear program using Simplex: (8)

Maximize 3x1 + 2x2 + x3

subject to x1 - x2 + x3 < = 4

2x1 + x2 + 3x3 < = 6

-x1 + 2 x3 < = 3

x1 + x2 + x3 < = 8

x1 >= 0; x2 >= 0; x3 > = 0

(ii) State the duality of the problem. (4)

(ii) State the rules for converting linear programming into slack form. (4)

OR

b) i) Write the KMP and naïve string matching algorithm and tabulate its best, average and worst cases running time. (8)

ii) Compute the Prefix function that is used by the KMP algorithm for the pattern P P = abd on Text T = addbabddbabdd and provide the total number of comparisons made to find P in T. (8)

15. a) i) Prove that the circuit-satisfiability problem is NP-hard. (16)

OR

b) Write an approximation algorithm for the traveling salesman problem and demonstrate it with an example. Prove that it is a polynomial time 2-approximation algorithm (16)