ANNA UNIVERSITY

B.E / B.Tech. (Full Time) DEGREE EXAMINATIONS, APRIL / MAY 2012

BRANCH: Information Technology

VI Semester - R-2004

IT 531 Algorithm Design Techniques

Max. Marks : 100 **Time: 3 Hrs.**

Part A (10 X 2 = 20 marks)

1. Prove that $n^5 + 300\ n - 512$ is $\Theta(n^5)$.
2. Write the algorithm MAX that finds the maximum in a given list of numbers.
3. List the basic steps involved while solving any problem using the Divide-and-Conquer strategy.
4. Give an example of a problem that can be solved using Dynamic Programming design technique.
5. What is a Greedy algorithm?
6. Output the stations used in the assembly-line scheduling problem given the following l table and $l^* = 1$.

j	2	3	4	5	6
$l_1[j]$	2	1	2	1	2
$l_2[j]$	1	2	2	1	1

7. Compare the two techniques, backtracking and branch-and-bound.
8. What data structure would be used to keep track of live nodes in a depth-first branch-and-bound algorithm?
9. Define class P, NP problems.
10. State a classical NPComplete problem.

Part B (5 X 16 = 80 marks)

11. Write the Binary-Search algorithm that searches for an element in a sorted list. Use a list of 8 elements and illustrate its working. Compute its worst case running time. (16)

12. (a) Write the complete Merge-sort algorithm including any algorithm it uses. Assume two sorted sub lists with 4 and 3 elements respectively and explain its working. Do a worst case analysis of it. (16)

(OR)

(b) Explain the **Activity-selection** problem. Write an algorithm to solve it. What is its worst-case running time? Solve the following problem where, for each activity the start and the finish times are given: Activity 1 (3, 5), Activity 2 (6, 7), Activity 3 (3, 6), Activity 4 (8, 10), Activity 5 (0, 2). (16)

13. (a) Find an optimal parenthesization of a matrix-chain product whose sequence of dimensions is (4, 10, 5, 3, 5). How many scalar multiplications are done in that case? Show the **m** table and **s** table generated by the MATRIX- CHAIN_ORDER algorithm. (16)

(OR)

(b) Write an iterative algorithm to find a Longest Common Subsequence (LCS) of two given sequences. Compute its worst-case running time. Determine a LCS of <1, 0, 0, 1, 0, 1> and <0, 1, 0, 1, 0, 0, 1>. (16)

14. (a) State the n-queens problem. Write down an algorithm that solves the n-queens problem using the backtracking technique. Draw the portion of the state space tree that is generated while finding a solution to the 4-queens problem. (16)

(OR)

14. (b) Solve the following instance of the assignment problem by the branch- and-bound technique. Show the state space tree that is generated. Indicate the order in which the nodes are generated by numbering them.

	job 1	job 2	job 3	job 4
person a	4	8	3	7
person b	7	6	5	3
person c	3	6	7	8
person d	9	5	9	5

(16)

15. (a) List the sequence of steps that are carried out to prove a problem is NPComplete. Assume any NPC problem of your choice and show that it is NPC. (16)

(OR)

(b) (i) Let T be defined for all powers of 2 and given as :

$T(n) = 4T(n/2) + n$ and $T(1) = 0$

Find the closed form for T. (8)

(ii) What is optimal Huffman code for the following set of frequencies, a:30, b:15, c:25, d:9, e:5, f:20, g:10, h:40 ? (8)