B.E / B.Tech (Full Time) Degree End Semester Examinations, April/May 2011

Information Technology

Elective

IT531 Algorithm Design Techniques

(Regulations 2004 / 2002)

Time: 3Hrs Max Marks: 100

Answer ALL Questions

Part A – (10 * 2 = 20 marks)

1. If $f(n) = a_m n^m + \ldots + a_1 n + a_0$, then prove that $f(n) = O(n^m)$
2. Briefly describe the divide-and-conquer approach.
3. Differentiate between solving a problem based on greedy approach and dynamic programming approach
4. State the Assembly line scheduling algorithm.
5. State the principle of optimality
6. Explain the n-queens problem.
7. What are branch-and-bound algorithms?
8. State the Job Assignment problem.
9. Define a NP complete problem
10. What is the travelling salesman problem?

Part B – (5 * 16 = 80 marks)

11. i. Solve the following recurrence equations

$$T(n) = \sum_{i=1}^{n-1} T(i) + 1, if\ n \geq 2$$

$$T(n) = 1, \quad if\ n = 1$$

(4)

$$T(n) = 5T(n-1) - 6T(n-2)$$

(3)

$$T(n) = 2T\left(\frac{n}{2}\right) + n \lg n$$

(3)

ii. Prove that for any two functions f(n) and g(n), we have $f(n) = \theta(g(n))$ if and only if

$f(n) = O(g(n))$ and $f(n) = \Omega(g(n))$ (6)

12. a. (i) Write and analyse the Quicksort algorithm that uses a random function to compute the pivot element. (8)

(ii) Present the Strassen's matrix multiplication algorithm. Do you prefer Strassen's multiplication algorithm over ordinary multiplication? Justify. (8)

(OR)

b. Prove the correctness of the greedy algorithm for constructing a Huffman code. Generate Huffman code based on the following set of frequencies for the characters given below (16)

A: 56, B: 34, C : 23, D: 11, E: 89, F: 65, G: 45, H : 76

13. a. Write and explain the dynamic programming algorithm for solving the matrix-chain multiplication. Using this algorithm determine an optimal parenthesization for the chain of matrices defined by {10, 11, 2, 5, 8, 25} (16)

(OR)

b. Describe in detail a dynamic programming algorithm for the longest common subsequence problem. Determine an LCS of { 1, 0, 0, 1, 0, 1, 0, 1} and { 0, 1, 0, 1, 1, 0, 1, 1, 0} (16)

14. a. Explain with an algorithm how 0/1 knapsack problem is solved using branch and bound technique. Apply branch and bound technique to solve the following 0/1 knapsack instance if W = 10 (16)

Item	Weight	Value
1	4	40
2	7	42
3	5	25
4	3	12

(OR)

b. Explain the Hamiltonian circuit problem with an example. Explain how to solve this problem using Backtracking. (16)

15. a. What is the vertex-cover problem? Write an Approximate algorithm to solve it. Show that it is NP-complete. (16)

(OR)

b. What is the Travelling salesperson problem. Write an approximate algorithm to solve it and prove that it is NP-complete (16)