Total number of printed pages – 6

MCA

PCS 3001

Third Semester Examination – 2008

ANALYSIS AND DESIGN OF ALGORITHM

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*

The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10

(a) What are the general characteristic of greedy algorithm ?

(b) Construct a MAX-HEAP with the following elements {A, L, G, O, R, I, T, H, M}.

P.T.O.

(c) Explain why instance characteristic is an important consideration for algorithm complexity ?

(d) What is the complexity of Prim's algorithm for finding a minimum spanning tree ? Explain.

(e) How does the principle of optimality reduce the number of decision sequences in dynamic programming algorithms ?

(f) Using big-O notation, state the average time and space complexity of binary search.

(g) Solve the following recurrence relation :

$T(N)=4T(N-1)+1$ with $T(1)=1$ and $T(2)=3$

(h) What do you mean by combinatorial problem? Can you find an optimal solution to this problems using dynamic programming ?

(i) What do you mean by relaxation in the process of designing an approximation algorithm for NP-Hard problem ?

(j) Define NP-Complete problem with example.

2. (a) What do you mean by complexity of an algorithm ? Derive the asymptotic time complexity of a non recursive, binary search algorithm using divide and conquer approach. 5

(b) Define approximation algorithms for a problem P. How do you characterize approximation algorithms ? 5

3. (a) State an algorithm to find a minimum-cost path from source to shrink in a multistage graph, using backward approach using ***dynamic programming*** paradigm. 5

(b) What is brute-force method ? Write a brute-force string matching algorithm. Analyze its complexity. 5

4. (a) Define ***subset paradigm*** and ***ordering paradigm*** in the context of greedy approach. Write a greedy algorithm for solving the 0-1 knapsack problem. 5

(b) Explain the Boyer-Moore algorithm for string matching to match a pattern P in a given string T. 5

5. (a) Write an recursive algorithm for quick sort to. Show that time complexity of average case of quick sort is **T (n) = O(n log n)** ; with instance characteristic **n**. 5

(b) Discuss the working of FIFO BANCH AND BOUND algorithm, considering 4-queen problem. 5

6. (a) Explain the role of a criteria function in problem solving process with backtracking algorithm. Suggest the structure of a recursive backtracking algorithm. 5

(b) Write an algorithm to compute shortest path on a weighted, undirected, and connected graph. Comment on complexity of the algorithm. 5

7. (a) Describe and justify Kruskal's algorithm for finding the minimum spanning tree of an undirected graph. What is the time complexity of Kruskal's algorithm ? 5

(b) What are the four factors that decides the efficiency of the Backtracking Algorithm? Explain the role of rearrangement of search space in performance of Backtracking. 5

8. (a) Arrange the following functions from the lowest asymptotic order to the highest asymptotic order :

$10n$, $\log n$, 2^{n3}, $5n^2$, $2 \log n$, $e^n - 2n^3$, $7 \log n^2$ 2.5

(b) Suppose you insert n numbers into an initially empty priority queue (implemented as a heap), what is the worst-case running time ? 2.5

(c) Let G be a weighted, undirected, connected graph with n vertices and at most 100 n edges, where all the edges have the same weight. Given two vertices u and v in G, how fast can you find a shortest path from u to v ? 2.5

(d) What is the solution of the recurrence $T(n) = 16\,T(n/4) + n$, $T(1) = 1$ (assuming n is a power of 4) ? 2.5