MCA
PCS 3001

Third Semester Special Examination – 2012

ANALYSIS AND DESIGN OF ALGORITHM (Old Course)

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 is an algorithm? What is the necessity of analyzing algorithms?

(b) What do you mean by algorithm complexity?

(c) Explain MAX-HEAP. How can you form a MAX-HEAP?.

(d) What is the time complexity of merge sort algorithm?

(e) Write divide and conquer algorithm for finding the position of the largest element in an array of N numbers.

(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) Describe the greedy approach to find the minimum spanning tree in a graph.

(i) Explain the significance of the principal of optimality in dynamic programming paradigm.

(j) Define NP-Complete and NP-Hard problems with example.

2. (a) Derive the asymptotic time complexity of a non recursive, binary search algorithm using divide and conquer approach. 5

(b) What do you mean by Amortize complexity measure of an algorithm? Why they are used to find the complexity of a algorithm? Can it be applicable to sorting problems ? 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) Explain why we expect the average case for MERGE SORT to be almost the same as the worst case? 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. Show that time complexity of average case of quick sort is T (n) = O (n log n) ; with instance characteristic n. 5

(b) In the backtracking formulation of the 8-queens problem that employs both the row and the column constraints, what are the explicit and implicit constraints? 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) Define and differentiate between P and NP-complete problems. Explain the required steps to prove a problem to be NP-complete. 5

8. (a) Compare Backtracking, Branch and Bound techniques with an example. 5

(b) Write the algorithms of BFS and DFS with their complexities. 5