COMP 6 – 1 (RC)

T.E. (Computer) (Semester – VI) Examination, Nov./Dec. 2014
(Revised Course in 2007-08)
MODERN ALGORITHM DESIGN FOUNDATION

Duration : 3 Hours | Total Marks : 100

***Instructions** : 1) Answer **any five full** questions, at least **one** from **each** Module.*

*2) Make suitable assumptions **wherever** necessary.*

MODULE – I

1. a) Write the algorithm for merge sort and prove that the worst time is O(nlogn) for merge sort algorithm. **6**

   b) Can quick sort algorithm be modified so that it performs well on every input ? Justify with an algorithm. **6**

   c) What do you understand by recursion ? How can it be used as a powerful programming technique ? Write a symbolic program code for generating the Fibonacci numbers using recursion. State the space and time complexity. **8**

2. a) Given a set of $n \geq 1$ elements, write the algorithm to print all possible permutation to this set. State the time complexity of the above algorithm. **6**

   b) Explain the divide and conquer strategy. How does binary search fit into this strategy ? **4**

   c) Analyze the quick sort algorithm for its best case, worst case and average case time complexity. **10**

MODULE – II

3. a) Using Bellman and Ford algorithm find the shortest path from node 1 to every other node for the directed weighted graph G=(V,E,W) where V={1,2,3,4,5,6}, E={<1,2>,<1,3>,<2,4>,<2,3>,<2,5>,<3,4>,<3,5>,<4,6>,<5,6>,<5,4>} and W={2,4,1,–3,5,–4,–2,8,6,4}. **6**

P.T.O.

b) Using the greedy method, write the algorithm to find the minimum cost spanning tree for a undirected weighted graph. State its time complexity. Consider a undirected weighted graph G=(V,E,W) where V={1,2,3,4,5,6}, E={<1,2>,<1,4>,<1,3>,<2,6>,<2,5>,<3,4>,<4,5>,<5,6>}and W={5,3,4,3,2,5,2,4}. Using the greedy algorithm construct the minimum cost spanning three. 8

c) Using the principle of optimality, write the algorithm to find the minimum cost binary search tree. 6

4. a) Consider a directed weighted graph G=(V,E,W), V={1,2,3,4,5}, E = {<1,2>,<1,3>,<2,3>,<3,2>,<2,4>,<2,5>,<3,5>,<4,5>,<5,4>} and weights on the corresponding edges are as W = {4, 8, 5, 4, 8, 10, 3, 7, 6}. Calculate the shortest path from vertex 1 to all the other vertices using greedy algorithm. Also write the algorithm. 8

b) Given the 0/1 knapsack instance n=5, w(1..5)={2,4,5,3,9}, p(1..5)={3,5,8,4,10}, M=20. Find the optimal solution for 0/1 knapsack problem using dynamic programming. 8

c) Consider a directed graph G(V,E) with n vertices and c(i,j) as the length (or cost) of E(i,j). Write the algorithm to determine a matrix C such that c(i,j) is the length of the shortest path from i to j. 4

MODULE – III

5. a) Write the algorithm for n-queen's problem. Draw the solution space tree for 4-queens problem. 6

b) Write the algorithm to solve the 0/1 knapsack problem with the branch and bound approach. Solve the following instance of 0/1 knapsack problem using branch and bound approach n=3, W={5,4,3}, V={6,5,4}, M=7. 10

c) Explain the principle of FIFO branch and bound. 4

6. a) Write the algorithm for sub of subset problem using backtracking algorithm. Draw the solution space tree for the set S={3,4,5,6} where M=9. 10

b) Explain the LC branch and bound method to solve TSP problem. Generate a state space tree for the following directed weighted graph G=(V,E,W) where V={a,b,c,d},E={<a,b>,<a,c>,<a,d>,<b,a>,<b,c>,<b,d>,<c,a>,<c,b>,<c,d>,<d,a>,<d,b>,<d,c>}, W={12,7,4.10,13,9,3,8,11,5,6,10} using LCBB. 10

MODULE – IV

7. a) Explain the synchronous and asynchronous algorithms for computing a leader in a tree of processors. **8**

   b) What methods are used for text similarity ? Illustrate. **4**

   c) Draw the frequency table and Huffman tree for the following string "dogs do not spot hot pots or cats". **8**

8. a) Explain the following w.r.t. multicast algorithms : **8**

      i) Center Based Trees.

      ii) Stainer Trees.

   b) Draw the suffix trie and the compact representation of the suffix trie for the string "minimize minime". **6**

   c) Write the algorithms to find whether the pattern P is in the text T. State the time complexity for each algorithm. **6**
