COMP 6 – 1 (RC)

T.E. (Computer) (Semester – VI) Examination, May/June 2014
(Revised Course)
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) What is a randomized algorithm ? Mention its characteristics. **2**

   b) Explain the divide and conquer strategy to compute the product of two nxn matrices. Give the recurrence relation and analyze for the worst case time complexity. **10**

   c) Write an efficient algorithm for finding maximum and minimum element for a given array. Determine the time and space complexity of the above algorithm. **8**

2. a) Solve the recurrence relation T(n) = aT (n/b) + f(n) where a = 28, b = 3 and $f(n) = cn^3$. **3**

   b) Analyse the merge sort algorithm using divide and conquer for best case, worst case and average case time complexity. **8**

   c) Explain the control abstraction for divide and conquer. **3**

   d) Given the set of numbers S = { 10, 2, 4, 6, 15, 1}, draw the recursive quick sort tree. **6**

MODULE – II

3. a) Consider the following directed weighted graph G = (V, E, W) where V = { s, a, b, c, d, e, f}, E = {< s, a >, < s, b >, < b, a >, < b, f >, < c, a >, < c, b >,< c, d >, < c, e>, < d, e >, < e, f >}, W = {3, 2, – 2, 3, 4, 5, – 3, 2,1, – 2}. Find the shortest path from s to f using dynamic programming. Also write the algorithm. **(6+4)**

P.T.O.

b) Consider the directed weighted graph G = (V, E, W) where V = { 1, 2, 3, 4},

E = {< 1, 2 >, < 1, 3 >, < 1, 4 >, < 2, 1 >, < 2, 3 >, < 2, 4 >, < 3, 1 >, < 3, 2 >, < 3, 4 >, < 4, 1 >,< 4, 2 >, < 4, 3 >}, W = {5, 2, 3, 4, 2, 3, 4, 2, 3, 7, 6, 8}. Find the optimal tour of the graph using dynamic programming technique. **6**

c) Using greedy method, write the algorithm to find the optimal solution to the fractional knapsack problem. **4**

4. a) Write the algorithm to find all pair shortest path for the directed weighted graph G = (V, E, W), where V = {1, 2, 3, 4}, E = {< 1, 2 >, < 1, 4 >, < 4, 3 >, < 4, 2 >,< 2, 3 >, < 3, 1 >}, and corresponding weights on the edges are W = {5, 4, 1, 3, 6, 3}. Solve the instance. **6**

b) Explain how dynamic programming is applied to solve 0/1 knapsack problem. Consider the knapsack instance n = 4, $(w_1, w_2, w_3, w_4, w_5) = (2, 3, 4, 5, 9)$, $(p_1, p_2, p_3, p_4, p_5) = (3, 4, 5, 8, 10)$, m = 20. Determine the optimal solution for the 0/1 knapsack problem. **8**

c) Write the algorithm to obtain the optimal solution for the problem of job sequencing with deadlines. State its time complexity. **6**

MODULE – III

5. a) Draw the state space trees generated by LCBB and FIFO branch and bound method for the 0/1 knapsack instance n = 5, p (1..5) = (10, 15, 6, 8, 4), w (1..5) = (4, 6, 3, 4, 2), m = 12. **10**

b) Explain the implicit and explicit constraints for the 8-queens problem and subset-sum problem. **4**

c) Using backtracking technique, write the algorithm to solve the 4-queen problem. Draw the state space solution tree for the 4-queen problem. **6**

6. a) Compare backtracking and branch and bound techniques with examples. **6**

b) Develop the backtracking algorithm which finds all the Hamiltonian cycles in a graph. **4**

c) Using backtracking technique, write the algorithm to solve the 0/1 knapsack problem. Using the algorithm draw the state space solution tree for fixed sized tuple, for the following instance of 0/1 knapsack problem n = 4, w(1..4) = (2, 5,10, 5), v(1..5) = (40, 30, 50,10), m = 16. **10**

MODULE – IV

7. a) Write the Knuth Morris Pratt algorithm for finding patterns in text. Find if pattern "abab" is in text "bbaabbabaaabab" using the above algorithm. **8**

   b) Explain and analyze the asynchronous algorithm for computing the breadth first search tree in a connected network of processors. **8**

   c) Draw the compressed trie and the compact representation of a compressed trie for the set of strings given below : **4**

   S = {abab, baba, ccccc, bbaaaa, caa, bbaacc, cbcc, cbca}

8. a) Write the algorithm to find the longest common subsequence. Also analyze the algorithm. **6**

   b) Explain and analyze the following algorithms : **10**

      i) Flooding algorithm for broadcast routing

      ii) Link-state algorithm for unicast routing.

   c) Obtain a set of optimal Huffman codes for the messages m(1..7) with relative frequencies q(1..7) = (4, 5, 7, 8, 10, 12, 20). Also write the algorithm. **4**
