COMP 6 – 1 (RC)

T.E. (Computer) (Semester – VI) (RC)
Examination, November/December 2015
MODERN ALGORITHM DESIGN FOUNDATION

Duration : 3 Hours Total Marks : 100

Instructions *: 1) Answer* ***any five full*** *questions, atleast* ***one*** *from* ***each*** *Module.*
2) Make suitable assumptions ***wherever*** *necessary.*

MODULE – I

1. a) Define an algorithm. **6**

   b) Using step count method determine time complexity of the following algorithm : **4**

```
Algorithm add (a, b, c, m, n)
{
    for i = 1 to m do
        for j = 1 to n do
            c[i, j] = a[i, j] + b[i, j] ;
}
```

   c) Can quick sort be modified so that it performs well on every input ? Justify with an algorithm. **5**

   d) Demonstrate merge sort on the following data set : [310, 285, 179, 652, 351, 423, 861, 254, 450, 520]. **5**

2. a) Define little "oh" notation and little omega notation. **2**

   b) What is 'a priori' estimates and 'a posteriori' testing ? **2**

   c) Explain recursion. Write a recursive algorithm to calculate the factorial of a number. **6**

   d) Write the algorithm for iterative binary search and state its time complexity. **6**

   e) Write the algorithm for Insertion Sort. **4**

P.T.O.

MODULE – II

3. a) Explain the greedy method. 5

   b) Find the optimal solution using greedy method for the following job sequencing problem : number of jobs = 7, profits (p1...p7) = (3, 5, 18, 20, 6, 1, 38) and deadlines (d1...d7) = (1, 3, 3, 4, 1, 2, 1). 5

   c) Write Dijkstra's algorithm to generate shortest paths and state its complexity. 6

   d) Write the multistage graph pseudo code corresponding to backward approach. 4

4. a) Provide three greedy strategies to obtain feasible solutions for the knapsack problem. State which strategy is optimal ? 4

   b) Define a spanning tree. What are the applications of a spanning tree ? Why are we interested in finding a minimum cost spanning tree ? 4

   c) What is the optimal storage on a single tape problem ? 3

   d) Write the algorithm to compute lengths of shortest paths. Find the shortest paths between all the pairs of the graph G = (V, E, W) where V = {1, 2, 3}, E = { <1, 2>, <1, 3>, <2, 1>, <2, 3>, <3, 1>}, W = {4, 15, 8, 2, 3}. 7

   e) Define the finish time of a job and the finish time of a schedule. 2

MODULE – III

5. a) Write the algorithm for the general iterative backtracking method. 6

   b) Explain the concept of Hamiltonian cycle in a graph with the help of an example. 3

   c) Show how backtracking is used to solve 4-queens problem. Draw the solution space tree. 7

   d) Write a short note on the Branch-and-Bound Technique. 4

6. a) Write the algorithm for the backtracking solution to the 0/1 knapsack problem. 8

   b) Draw the state space tree for the graph colouring problem when the number of vertices n = 3 and the colours m = 3. 3

   c) What is bounding ? 4

   d) Explain how the branch and bound technique can be used to solve the 0/1 knapsack problem ? 5

MODULE – IV

7. a) What is the pattern matching problem on strings ? Give an example. 5

   b) What is a trie ? What are the types of tries ? 5

   c) What is the synchronous model and asynchronous model in distributed algorithm design ? 2

   d) Write a short note on the Center-based trees method. 4

   e) Define the following with respect to the network protocol stack : physical layer, data-link layer, network layer, transport layer. 4

8. a) Explain the KMP pattern matching algorithm. 5

   b) Illustrate standard trie for the following set of strings :

   {bear, bell, bid, bull, buy, sell, stock, stop} 5

   c) How is a leader elected in a tree under the asynchronous model ? 5

   d) Explain distance vector algorithm for unicast routing. 5