COMP 6 – 1 (RC)

T.E. (Comp.) (Semester – VI) (RC) Examination, May/June 2016
MODERN ALGORITHM DESIGN FOUNDATION

Duration : 3 Hours | Total Marks : 100

Instructions : *1) Attempt **any five** questions by selecting atleast **one** from **each** Module.*
*2) Make suitable assumptions if **required**.*

MODULE – I

1. a) State the meaning of space and time complexity. 2

   b) Write a short note on debugging. 3

   c) What are the criteria for designing an efficient algorithm ? Justify your answer with suitable examples. 7

   d) Draw the step table and give the step count for the algorithm : 8

```
Algorithm Rsum (a, n)
{
    if (n ≤ 0) then return 0.0;
    else
    return Rsum (a, n – 1) + a [n];
}
```

2. a) Differentiate between the following asymptotic notations :

   i) O (Big oh) and o (Little oh). 2

   ii) Ω (omega) and ω (little omega). 2

   b) Write an algorithm for merge sort and prove that the worst case time complexity is O(n log n). 6

   c) Applying Strassen's method, show how you would multiply the following two matrices.

$$\begin{bmatrix} 1 & 2 & 3 & 4 \\ 5 & 2 & 7 & 1 \\ 2 & 7 & 0 & 5 \\ 4 & 3 & 2 & 1 \end{bmatrix} \begin{bmatrix} 5 & 6 & 7 & 8 \\ 1 & 0 & 3 & 4 \\ 6 & 2 & 7 & 0 \\ 8 & 1 & 6 & 5 \end{bmatrix}$$ 10

P.T.O.

MODULE – II

3. a) Explain what is a multistage graph. 6

b) Consider the directed graph G = (V, E) where V = {1, 2, 3, 4} and the edge length are given by a matrix below. Find the optimal tour of the graph.

$$\begin{bmatrix} 0 & 12 & 5 & 7 \\ 11 & 0 & 13 & 6 \\ 4 & 9 & 0 & 18 \\ 10 & 3 & 2 & 0 \end{bmatrix}$$ 6

c) 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} 8

4. a) Define the principle of optimality. 2

b) Construct the optimal binary search tree for the identifier set

(a1, a2, a3, a4) = (cout, float, if, while) with p(1 ... 4) = (2, 2, 1, 1) and q(0 ... 4) = (2, 2, 3, 1, 1). 8

c) Draw a simple connected weighted graph with 8 vertices and 16 edges, each with unique edge weights. Identify one vertex as a start vertex and illustrate, assuming Dijkstra's algorithm on this graph. 10

MODULE – III

5. a) Generate a state space tree for the following cost matrix using branch and bound method.

	1	2	3	4
1	∞	12	7	4
2	10	∞	13	9
3	3	8	∞	11
4	5	6	10	∞

10

b) Using the backtracking technique devise an algorithm to solve the sum of subset problem. Given S = [5, 10, 10, 25] and M = 25. Draw the search tree for fixed sized tuple as well as variable sized tuple formulation. 10

6. a) Explain the principles of FIFO branch and bound. 4

   b) Write the 8 Queen's algorithm. Demonstrate the algorithm for 8-queen's problem. Also draw the state space line. 8

   c) Derive the algorithm for m-colouring problem considering backtracking technique. 8

MODULE – IV

7. a) Write a short note on Reverse Path Forwarding. 5

   b) Write the Boyer Moore pattern matching algorithm. 5

   c) Explain the following with respect to multicast algorithms.

      i) Center Based Trees. 5

      ii) Steiner Tress. 5

8. a) Write an algorithm for Huffman-Coding. 5

   b) Write an example and explain what are suffix tries. 7

   c) Using KMP algorithm find whether the pattern P = 0010 is in the text T = 1100011010001010 or not. 8
