COMP 6 – 1 (RC)

T.E. (Computer) (Semester – VI) (RC) Examination, Nov./Dec. 2016
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) Arrange the following growth rates in increasing order :

   $O(n^3)$, $O(1)$, $O(n^2)$, $O(n \log n)$ $O(n^2 \log n)$, $\Omega(n^{0.5})$, $\Omega(n \log n)$, $\theta(n^3)$, $\theta(n^{0.5})$. **4**

   b) Prove the following :

   i) Given $f(n) = 5n^3 + 2n^2 - 5$ show that $f(n) = O(n^3)$. **2**

   ii) Given $f(n) = 3n^2 + 4n - 2$ show that $f(n) = O(n^2)$. **2**

   c) Write an algorithm for quick sort. **6**

   d) What is the working principle behind divide and conquer methodology. Explain with an example. **6**

2. a) Differentiate between an algorithm and a pseudocode. **4**

   b) What are the criteria for designing an efficient algorithm ? Justify your answer with suitable examples. **6**

   c) Show the Strassen's matrix multiplication process on the matrix A and B given below :

$$A = \begin{bmatrix} 4 & 2 & 0 & 1 \\ 3 & 1 & 2 & 5 \\ 3 & 2 & 1 & 4 \\ 5 & 2 & 6 & 7 \end{bmatrix} \quad B = \begin{bmatrix} 2 & 1 & 3 & 2 \\ 5 & 4 & 2 & 3 \\ 1 & 4 & 0 & 2 \\ 3 & 2 & 4 & 1 \end{bmatrix}.$$

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P.T.O.

MODULE – II

3. a) Define the principle of optimality. 2

   b) i) Write an appropriate algorithm to obtain the optimal solution for the problem of job sequencing with deadlines. 5

   ii) Explain the working of the above algorithm with the following data. n = 4,

   $(P_1, P_2, P_3, P_4) = (70, 12, 18, 35)$ and

   $(D_1, D_2, D_3, D_4) = (2, 1, 2, 1)$ 5

   c) Solve the following 0/1 knapsack problem using dynamic programming P = (11, 21, 31, 33), W = (2, 11, 22, 15), C = 40, n = 4. 8

4. a) Write the single source shortest path algorithm and perform the analysis on the same. 10

   b) Demonstrate the sum of subsets algorithm for the following problem W = {5, 7, 10, 12, 15, 18, 20} m = 35. Draw the state space line for the same. 10

MODULE – III

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

   b) With the help of an example explain the concept of Hamiltonian cycle in a graph. Develop a backtracking algorithm which finds all the possible Hamiltonian cycles in a graph. 8

   c) Write the backtracking algorithm for subset sum problem. Given S = {1, 3, 4, 5} and X = 8, obtain the subset sum using backtracking approach. 8

6. 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	∞

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   b) Solve the following instance of the 0/1 knapsack problem by using branch and bound technique where n = 4, W(1... 4) = (9, 5, 7, 2), V(1...4) = (15, 6, 5, 1), m = 16. Also devise the algorithm to solve 0/1 knapsack problem by using branch and bound technique. 10

MODULE – IV

7. a) Compute a table representing the KMP failure function for the pattern string

   c g t a c g t t c g t a c. 6

   b) Write a short note on Steiner tree. 6

   c) Implement the Boyer Moore algorithm on the given text and pattern.

   T = 2 1 3 2 3 4 2 2 1 3 4 5 6 1

   P = 2 3 4 2 8

8. a) What are the complexity measures for network algorithms ? 4

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

   c) Explain and analyze the following algorithms.

   i) Flooding algorithm for broadcast routing. 5

   ii) Link-state algorithm for unicast routing. 5
