

**MCA(6/7)/D-12**  
**DESIGN AND ANALYSIS OF ALGORITHMS**  
**Paper-MCA-303**

Time allowed: 3 hours

Maximum marks: 80

**Note:** Attempt five questions in all. Question no. 1 is compulsory.  
 Attempt four more questions selecting one question from each unit.

**Compulsory Question**

1. (a) What do you mean by satisfiable (STA)?
- (b)  $S(n) = 1^2 + 2^2 + 3^2 + \dots + n^2$ . What is the order of  $S(n)$ ?
- (c) How to discover fast algorithms?
- (d) Suppose  $F = \Phi(g)$  and  $g = O(h)$  then show that  $F = O(h)$ .
- (e) Prove that independent set is NP-complete?
- (f) What does lower bound theory prove about comparison based sorting problem?
- (g) Write an algorithm to find the median of a given array using greedy approach.
- (h) What is Recurrence equation? 3 x 8 = 24

**Unit-I**

2. (a) What do you understand by Data structure? Write a brief note on linked list and tree data structures. 7
- (b) What do you understand by module? Discuss the structured design methodology to Identify the modules in a problem. Use suitable example. 7
3. (a) What is big O notation? How the space and time complexities are computed under this notation? Discuss. 7
- (b) Give the proof of Euclid's algorithm correctness.

**Unit-II**

4. (a) What do you understand by Divide and conquer algorithm? Analyze the time taken by Quick sort. Explain various possibilities in selection of pivot element. 7
- (b) With an example, explain how the Branch and Bound technique is used to solve 0/1 knapsack problem. 7
5. (a) Design a linear time algorithm for maximal matching. 7
- (b) What is dynamic programming? How to design a dynamic programming algorithm? Write dynamic programming algorithm for knapsack problem. 7

**Unit-III**

6. (a) Lower bound theory says when to stop searching for better algorithms. Explain with example. 7
- (b) Suppose C is the longest subsequence in S. show that  $LCS(A(2\dots M), B(1\dots N))$  could be longer than C. 7
7. (a) What is the space bound for d dimensional range trees? 7
- (b) Suppose you have K sorted sequences each of length  $n/k$  show that the time required For merging them into a single length n sequence in the decision tree model is  $\Omega(n \log n)$ . 7

#### **Unit-IV**

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| 8. (a) What do you understand by NP hard problem? Show that TSP is an NP hard problem.                   | 7 |
| (b) What is cook's theorem? Discuss.   | 7 |
| 9. (a) What do you understand by state space representation of a problem? Explain using Sutable example. | 7 |
| (b) What is Approximation algorithm? Discuss its relevance in random access machine.                     | 7 |