



May - June - 2011

[3963] – 369

**T.E. (Information Technology) (Semester – II) Examination, 2011**  
**DESIGN AND ANALYSIS OF ALGORITHMS**  
**(New) (2008 Pattern)**

Time : 3 Hours

Max. Marks : 100

- N.B. :** 1) Answer *three* questions from *each* Section.  
2) Answer to the *two* Sections should be written in *separate* answer-books.  
3) Neat diagrams must be drawn *whenever* necessary.  
4) Figures to the *right* indicate *full* marks.  
5) Assume suitable data, *if* necessary.

**SECTION – I**

1. a) Suppose you have algorithms with the running time listed below (Assume these are exact running time). How much slower do each of these algorithms get when you (a) Double the input size (b) increase the input size by one ?

8

- i)  $100n^2$                       ii)  $n \log n$   
iii)  $2^n$                       iv)  $n^2$

- b) A binary tree is a rooted tree in which each node has at most two children. Show by induction that any binary tree the number of nodes with two children is exactly one less than number of leaves.

10

**OR**

2. a) Suppose you have algorithms with the running time listed below (Assume these are exact running time). How much slower do each of these algorithms get when you (a) Double the input size (b) increase the input size by one ?

8

- i)  $n^2$                       ii)  $n^3$   
iii)  $2^n$                       iv)  $n \log n$

- b) What is the purpose of proof techniques to apply on the algorithms ? Explain the method of proof by contradiction in detail and how do we apply the proof by contradiction “to prove that there are infinitely many prime numbers”.

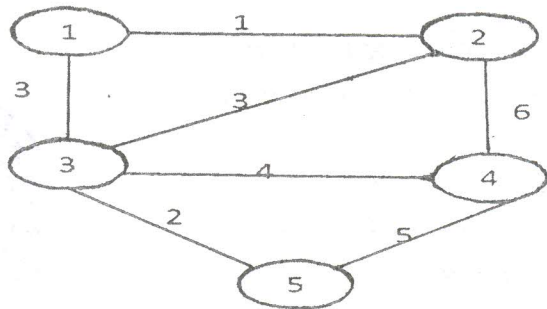
10

**P.T.O.**



3. a) Analyze Prim's algorithm of minimum spanning tree using greedy approach. Find the cost of Minimal Spanning Tree of the given graph by using Prim's Algorithm.

6



- b) Compare the sorting methods Merge sort and quick sort implemented using divide and conquer, devise data sets which compare the average and worst case complexities for these two algorithms.

10

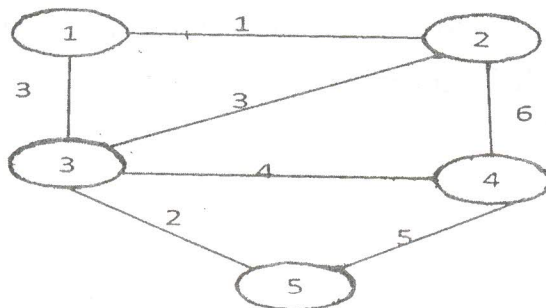
OR

4. a) Write an algorithm for finding out the maximum and minimum number in an array using divide and conquer. Devise data sets which compare the average and worst case complexities for these two algorithms. Analyze an Kruskal's algorithm of minimum spanning tree using greedy approach.

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- b) Find the cost of Minimal Spanning Tree of the given graph by using Kruskal's Algorithm.

6



What is dynamic programming approach to solve the problem ?



5. Consider the following instance of Knap sack problem :  $n = 6$ ,  
 $(p_1, p_2, p_3, p_4, p_5, p_6) = (w_1, w_2, w_3, w_4, w_5, w_6) = (100, 50, 20, 10, 7, 3)$  and  
 $M = 165$ .

Solve the problem using Dynamic programming approach.

16

OR

6. What is dynamic programming approach to solve the problem ?

$N = 3$  and  $\{a_1, a_2, a_3\} = \{\text{do, if, while}\}$  Let  $p(1:3) = (0.5, 0.1, 0.05)$

$q(0:3) = (0.15, 0.1, 0.05, 0.05)$

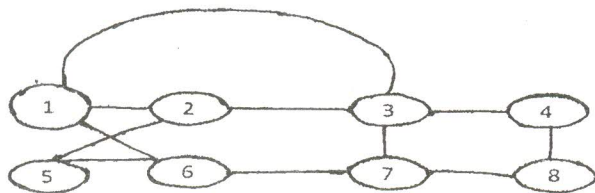
Compute and construct OBST for above values using Dynamic approach.

16

SECTION – II

7. a) Explain how to find Hamiltonian Cycle by using Backtracking in given graph.

8



- b) Analyze sum of subset algorithm on data :

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$M = 35$  and

i)  $W = \{5, 7, 10, 12, 15, 18, 20\}$

ii)  $W = \{20, 18, 15, 12, 10, 7, 5\}$

iii)  $W = \{15, 7, 20, 5, 18, 10, 12\}$

Are there any discernible differences in the computing time ?

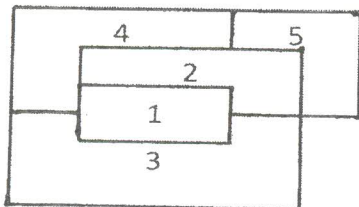
OR

8. a) Analyze the 8-queen problem using backtracking strategy of problem solving.

8

- b) Construct Planar graph for following map. Explain how to find m-coloring of this planar graph by using m-coloring Backtracking algorithm.

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9. a) Describe the following with respect to Branch and Bound. 16
- i) The methods
  - ii) Least cost search (LC Search)
  - iii) Control abstraction for LC search
  - iv) Bounding

And take an example of traveling salesman problem using branch and bound.

OR

10. a) Differentiate Backtracking and Branch and Bound Method. Illustrate with example of 4-Queen's Problem. 8
- b) What is a state space tree and with respect to state space tree explain the following terms : 8
- i) solution states
  - ii) state space
  - iii) answer states
  - iv) static trees
  - v) dynamic trees
  - vi) live node
  - vii) bounding function.
11. a) Write Non-Deterministic Algorithm for sorting of elements of an array. What is its Complexity ? 8
- b) Prove that Clique Decision Problem is NP-Hard. 8

OR

12. a) Write Non-Deterministic Algorithm for searching an item in an array. What is its Complexity ? 8
- b) What do you mean by P, NP, NP-Hard and NP-Complete Problems ? Give an example of each category. 8