UKA TARSADIA UNIVERSITY

B.Tech (CE)/B.Tech (IT) (5thSemester)

Subject :030090503/030080503-Design and Analysis of Algorithms (Theory)

Date : 05/12/2015 **Time: 10.00 AM to 1.00 PM**
Duration : 3 Hours **Max. Marks : 70.**

Instructions:

1. Attempt all questions.
2. Write each section in a separate answer book.
3. Make suitable assumptions wherever necessary.
4. Figures to the right indicate full marks allocated to that question.
5. Draw diagrams/figures whenever necessary.

SECTION - 1

Q-1 (A) Answer the following. **[05]**

I) What is an algorithm?

II) Define: Big-Oh (O) notation.

III) What is the average case time complexity of merge sort algorithm?

IV) Define : Minimum Spanning Tree.

V) Arrange these functions according to their growth, from slowest growing to fastest growing.
7^{2n}, 64, 4n, nlogn, $6n^2$, n!

Q-1 (B) Answer the following in brief. (Any 5) **[10]**

I) Differentiate divide & conquer method and dynamic programming.

II) Find out step count of following pseudo code.

```
main()
{
  int n
  while(n >1)
     {
         n=n/2
      }
}
```

III) Find the asymptotic upper bound for $f(n) = 2^n + 6n^2 + 3n$. Also compute c and n_0.

IV) Using greedy algorithm find an optimal solution for following jobs with n=7 profits(p1,p2,p3,p4,p5,p6,p7)=(3,5,18,20,6,1,38) and deadline (d1,d2,d3,d4,d5,d6,d7)=(1,3,3,4,1,2,1).

V) What are the differences between Kruskal's algorithm and Prim's algorithm?

VI) Find out time complexity of following recurrence relation using substitution method:
$T(1)= c1$
$T(n)=2T(n-1) + c$

VII) Solve following recurrence relation using master method: $T(n)=4T(n/2) + (n^2)$

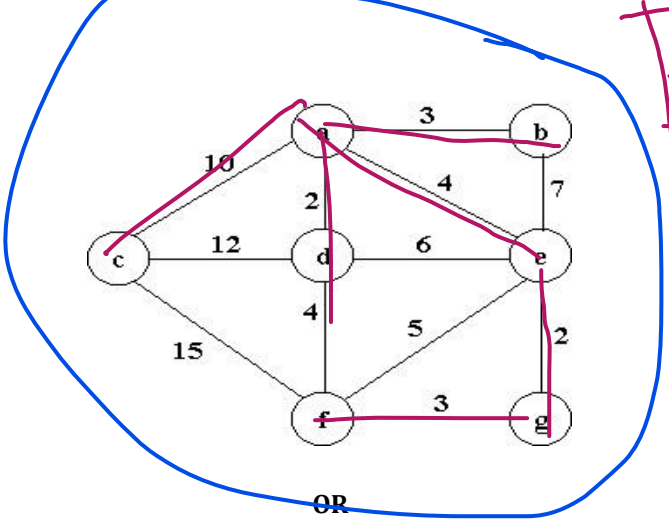
Q-2 Answer the following. **[10]**

A) Solve following recurrence relation using recursive tree method.
$T(n) = 3T(n/3) + n^2$

OR

A) Solve the following fractional knapsack problem using greedy approach. There are five items whose weights and values are given in following arrays.
Weight w[ ] = { 1,2,5,6,7 }
Value v[ ] = { 1,6,18,22,28 }
Find out the optimal knapsack items for weight capacity of 11 units.

B) Execute Prim's algorithm for the below graph to construct a minimum spanning tree.



OR

B) Explain insertion sort algorithm with worst case analysis.

Q-3 Answer the following in detail. (Any 2) **[10]**

A) Explain the asymptotic notations with example.

B) Write down algorithm of binary search. Compute its time complexity.

C) Derive the algorithm for making change using greedy approach.

SECTION - 2

Q-4 (A) Answer the following. **[05]**

I) What is articulation point?

II) Define sparse graph.

III) What is the principle of dynamic programming?

IV) Define path with respect to graph.

V) Which method is used to solve n-queen problem?

Q-4 (B) Answer the following in brief. (Any 5) **[10]**

I) Explain Finite Automata with diagram.

II) Write any two differences between Breadth First Search and Depth First Search.

III) Given an undirected graph with n=4 vertices, calculate the minimum amount of storage required for adjacency matrix.

IV) Differentiate greedy approach and dynamic programming approach.

V) Compute (4, 2) using dynamic programming with binomial coefficient.

VI) Write an algorithm for Naïve String Matching and find out the time complexity for it.

VII) Explain backtracking technique.

Q-5 Answer the following. **[10]**

A) Solve the following instance of the Assignment problem using branch and bound algorithm.

	J1	J2	J3	J4
a	9	2	7	8
b	6	4	3	7
c	5	8	1	8
d	7	6	9	4

OR

A) Explain how to find out Longest Common Subsequence of two strings using Dynamic Programming method. Find the Longest Common Subsequence of given two strings S1 = abcdaf and S2 = acbcf.

B) Explain how search space has been reduced by applying backtracking on 4-Queen problem using implicit tree.

OR

B) Solve the following knapsack problem using dynamic programming method. Number of items n = 4 and capacity of knapsack W = 7.

Item	Weight (w)	Profit (p)
1	1	1
2	3	4
3	4	5
4	5	7

Knapsack dp

Q-6 Answer the following in detail. (Any 2) **[10]**

A) Discuss Breadth-First Search along with its time complexity.

B) Given coins of denominations 1, 4 and 6 with amount to be paid is 8. Find optimal number of coins and sequence of coins used to pay given amount using dynamic method.

C) How many spurious hits does Rabin-Karp matcher encounter in the text T = 3141592653589793 when looking for the pattern P = 26, where working modulo q=11?