Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(IT)(N)/SEM-5/IT-501/2012-13

2012

DESIGN AND ANALYSIS OF ALGORITHM

Time Allotted : 3 Hours *Full Marks :* 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : 10 × 1 = 10

   i) $O(g(n))$ [Small o] is

      a) Asymptotically Loose b) Asymptotically Tight

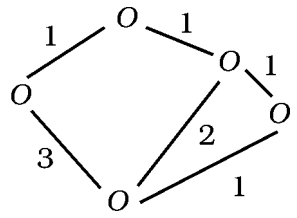
      c) Same as Big O d) None of these.

   ii) Time complexity of Insertion sort Worst Case is

      a) $O(n)$ b) $O(n2)$

      c) $O(n \log n)$ d) None of these.

   iii) What is the cost of minimum spanning tree of the following graph ?



      a) 5 b) 4

      c) 1 d) MST not possible.

iv) Divide and Conquer strategy is used in which of the following algorithms ?
   a) Merge sort and Selection sort
   b) Quick sort and Computation of xn
   c) Both (a) and (b)
   d) None of these.

v) Feasible solution in fractional Kanpsack problem with Knapsack size M refers to a solution that is
   a) Maximum profit with Weight less than M
   b) Maximum profit with Weight less than or equal to M
   c) Maximum profit only
   d) Any of these.

vi) Single source shortest path in a graph having negative edge can be solved by
   a) by Greedy method
   b) bt Greedy method and Dynamic programming
   c) by Dynamic programming only
   d) none of these.

vii) A matrix chain having 5 matrices can be parenthesized in
   a) 14 different combinations
   b) 15 different combinations
   c) 13 different combinations
   d) none of these.

viii) Best case time complexity for Binary search in unsuccessful case is
   a) $O(l)$ b) O (log n)
   c) O (n) d) None of these.

ix) Minimum number of colours to colour a graph having $n > 3$ vertex is
   a) 2 b) 3
   c) 1 d) 4.

x) Travelling salesman problem solution using dynamic programming has time complexity
   a) order of $n!$ b) order of $n^2 2^n$
   c) order of $n2^n$ d) order of n^4.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. What do you mean by dynamic programming ? Write an algorithm of matrix chain multiplication. 5

3. Find the optimal solution for the fractional Knapsack problem given below : 5

   i = ($i1$, $i2$, $i3$, $i4$, $i5$)

   w = (5, 10 , 20, 30, 40)

   v = (30, 20, 100, 90, 160)

   The knapsack capacity W = 70.

4. Write down the difference between the following : $2\frac{1}{2} + 2\frac{1}{2}$

   a) Prim's algorithm and Kruskal's algorithm.

   b) Linear search and Binary search.

5. Prove that if $f(n) = a_m\ n^m + a_{m-1}\ n^{m-1} + \ldots\ldots\ldots + a_1 n + a_0$, then $f(n) = O(n^m)$. 5

6. Find the best and worst case time complexity of quick sort. 5

7. a) Determine the complexity of the recurrence relation $T(n) = 2T(n/2) + n$.

   b) What is the basic characteristic of a Greedy algorithm ?

   3 + 2

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

8. a) What are the basic characteristics of dynamic programming ?

   b) Write an algorithm for matrix chain multiplication.

c) Find the optimal solution using Greedy criteria for a knapsack having capacity 100 kg for the following lists of items having values and weights as shown in the table. 3 + 4 + 8

Item	Value	Weight
I_1	10	15
I_2	20	25
I_3	30	35
I_4	40	45
I_5	50	55

9. a) Solve 8 Queen problem using Backtracking approach.

   b) Write down an algorithm for all pair shortest path also compute its complexity. 8 + 7

10. a) What is Heap property ?

    b) Write an algorithm to make a Max-heap containing the following elements :

    1, 2, 3, 7, 17, 19, 25, 36, 100.

    c) Write the algorithm of Heap sort and find the running time of this algorithm. 2 + 5 + 8

11. Give a non-deterministic graph colouring algorithm. Define classes *P*, *NP* and *NP* complete. Describe Clique Decision Problem. Prove *CDP* is *NP* complete. 4 + 5 + 2 + 4

12. Write short notes on any *three* of the following : 3 × 5

    a) Divide and Conquer Algorithm

    b) Dijkstra's Algorithm

    c) Union-Find Algorithm

    d) DFS and BFS.