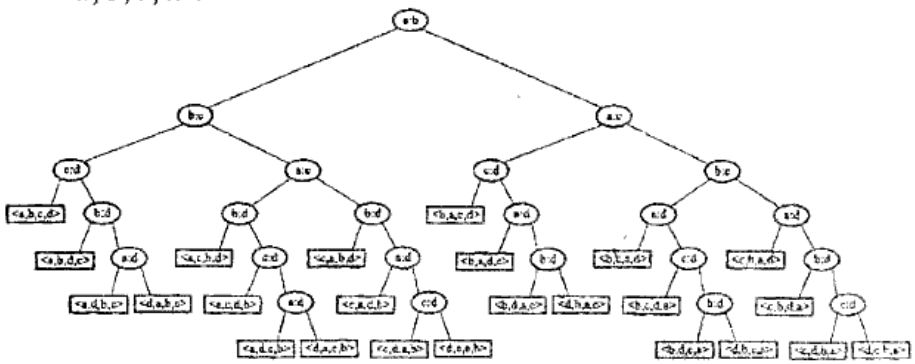
creating the solution tables. Show the table used for the solution. What is the optimal parenthesization :

Matrix	: A_1	A_2	A_3	A_4	A_5
Size	: 30×35	35×15	15×5	5×10	10×20

Or

8. The following comparison tree sorts the four values a, b, c, d :



(a) What is the worst-case number of comparisons performed by the comparison tree ?

(b) What is the best-case number of comparisons performed by the comparison tree ?

(c) What is the average-case number of comparisons performed by the comparison tree, assuming that any permutation of the five inputs is equally likely ?

Unit – V

9. (a) Prove that P = NP.

(b) Explain the strategy to prove that a problem is NP hard.

Or

10. (a) Explain about Cook's theorem.

(b) Explain the classes of NP-hard and NP-complete.

Total No. of Questions : 10] [Total No. of Printed Pages : 4

Roll No. .....

MCA–404

M. C. A. (Fourth Semester) EXAMINATION, June, 2012

(Grading/Non-Grading)

DESIGN AND ANALYSIS OF ALGORITHM

(MCA – 404)

Time : Three Hours

Maximum Marks : $\begin{cases} GS : 70 \\ NGS : 100 \end{cases}$

Note : Attempt *one* question from each Unit. All questions carry equal marks.

Unit – I

1. (a) Prove by induction, for all $n \geq 1$:

$$\sum_{i=1}^{n} i(i-1) = \frac{n(n-1)(n+1)}{3}$$

(b) Define the asymptotic notations used for best case, average case and worst case of algorithms.

Or

2. (a) Give asymptotic upper bounds for T (n). Make your bounds as tight as possible. You may assume that n is a power of 2 :

(i) $T(1) = T(2) = 1$

$T(n) = T(n-2) + 1$ if $n > 2$

(ii) $T(1) = 1$

$T(n) = T(n/2) + 1$ if $n > 1$

(b) Derive the recurrence equation for Fibonacci series. Perform complexity analysis for the same.

Unit – II

3. (a) The adjacency list representation of a graph G, which has 7 vertices and 10 edges, is :

$a : \rightarrow d, e, b, g$

$b : \rightarrow e, c, a$

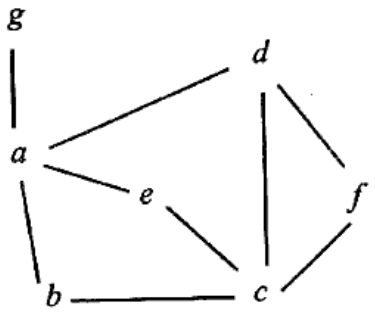
$c : \rightarrow f, e, b, d$

$d : \rightarrow c, a, f$

$e : \rightarrow a, c, b$

$f : \rightarrow d, c$

$g : \rightarrow a$



(i) Show the tree produced by depth first search when it is run on the graph G, using vertex a as the source. You must use the adjacency list representation given above.

(ii) In the DFS of item (i), show the edges of the graph G which are not present in the DFS tree by dashed lines.

(b) Write an algorithm to find mean and variance of an array perform best, worst and average case complexity, defining the notations used for each type of analysis.

Or

4. (a) Explain the merge sort.

(b) Perform the quick sort to sort the following numbers :

20, 40, 50, 15, 10, 05, 80, 90

Unit – III

5. (a) Discuss about LC search.

(b) Discuss about non-deterministic algorithms.

Or

6. (a) Give an example of a weighted undirected graph G and a starting vertex S in G such that the minimum spanning tree of G is not the same as the shortest path tree (starting from S). Show both trees.

(b) Discuss the 011 knapsack problem.

Unit – IV

7. (a) In the Huffman coding problem, we are given a set of n characters along with their frequencies. We are required to represent each character by a unique codeword using 0's and 1's, such that no codeword is a prefix of another. The goal is to find such codewords that achieve maximum compression.

Construct the optimal code for the four characters a, b, c, d with frequencies 14, 3, 6, 10 resp. How many bits are needed to encode a string containing 14 a's, 3 b's, 6 c's and 10 d's ? How many bits could be needed if we use 2 bits for each character ? Which code is better ?

(b) Apply the dynamic programming algorithm to the following instance of the matrix chain multiplication problem. Give the recurrence formula used for