CS—503

B.Tech.

FIFTH SEMESTER EXAMINATION, 2004-2005

DESIGN AND ANALYSIS OF ALGORITHMS

Time : 3 Hours   *Total Marks : 100*

Note :   (i)   *Attempt ALL the questions.*

   (ii)   *All questions carry equal marks.*

1.   Attempt *any four* parts of the following :   **[5x4=20]**

   (a)   Show that for any real constants a and b, where b >0, $(n + a)^b = q(n)^b$

   (b)   Solve the recurrence relation by iteration :

   $$T(n) = T(n - 1) + n^4$$

   (c)   Explain how can we modify almost any algorithm to have a good best case running time ?

   (d)   Can the Master Method be applied to solve recurrence

   $$T(n) = 4T(n/2) + n^2 \log n ? \text{ Why or why not ?}$$

03044

CS—503   1   *[Turn Over*

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Raj Kumar Goel Institute of Technology
GHAZIABAD   CS—503

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(e)   How can you adapt 'Quicksort' algorithm to find the mth order statistics in a given list of size n ?

(f)   Write the pseudo code for heapity algorithm.

2.   Answer *any four* parts of the following :   [5x4=20]

(a)   Give the properties of Red – Black Tree . Show that the longest simple path from a node x in a RB – tree to a descendent leaf has length at most twice that of the shortest simple path from node x to a descendent leaf.

(b)   Augment a linked list data structure, where each node maintains the number of preceding nodes.

(c)   Show the result of inserting the following items in an initially empty B-tree of order 5.

25, 31, 38, 76, 05, 60, 38, 08, 30, 15, 35, 17, 23, 53, 27, 43, 65, 48.

(d)   What operations are supported on disjoint sets ?

(e)   Write an algorithm HEAP_DELETE (A, i) , which deletes the item in node I from heap A.

3.   Attempt *any two* parts of the following :   [10×2=20]

(a)   What is "Greedy Algorithm"? Write its pseudo code prove that the fractional Knapsack problem has a greedy-choice property.

(b) Explain Dynamic programming. Apply it on Matrix Chain-Multiplication problem.

(c) What is the sum of subsets problem ? Let

w= {5,7,10,12,15,18,20} and m=35

Find all possible subsets of w that sum to m using recursive backtracking algorithm for it.
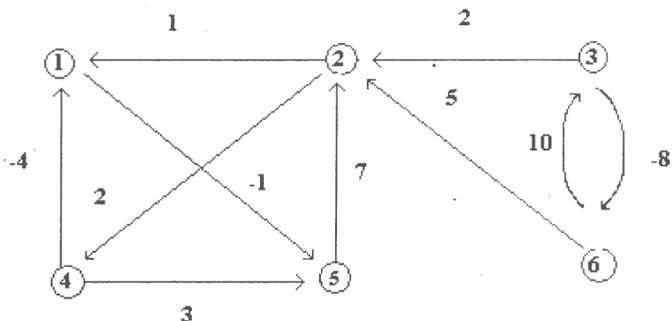
Draw the portion of the state-space tree that is generated.

4. Attempt *any two* parts of the following :   [10×2=20]

(a) What are single source shortest paths ? Write down Dijekstra's algorithm for it.

(b) Give an algorithm that determines whether or not a given undirected graph G= (V,E) contains a cycle. Your algorithm should run in O(V)time.

(c) For the graph (weighted, direct)

Apply Floyd- Warshall Algorithm for constructing shortest path. Show the Matrix $D^{(K)}$ that results each iteration.

5. Attempt *any two* parts of the following :   [10×2=20]

   (a) Define approximation algorithms. What is approximation ratio ? Approximate the Travelling Salesman problem with triangle Inequality.

   (b) Discuss the relationship between the class P. NP. NP-complete and NP-hard problems with suitable example of each class.

   (c) Give the randomized version of Quicksort. Analyse it for finding the expected running time.

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