FIFTH SEMESTER EXAMINATION-2012

DESIGN & ANALYSIS OF ALGORITHMS

[CS 502]

Full Marks: 60 Time: 3 Hours

Answer any SIX questions including Question No.1 which is compulsory.
The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable and all parts of a question should be answered at one place only.

1. a) Where in a max-heap of size n might the smallest element reside, assuming that all elements are distinct? What is the maximum number of comparison required to find the smallest element in a max-heap? [2 × 10]

   b) Solve the recurrence $T(n) = 4T(n/2) + n$

   c) $f(n)=O(g(n))$ implies $0 \le f(n) \le cg(n)$ for all $n \ge n_0$ and

   A. For some c and any n_0 are +ve integers

   B. For some c and some n_0 are +ve integers

   C. For any c and some n_0 are +ve integers

   D. For any c and any n_0 are +ve integers

   d) What is content of the given array <6,4,10,5,7,1,8,4> after 4-iterations of Insertion-sort?

   e) Maximum number of comparisons required to find any element in a given array of length n is 4. Each element is distinct and occurs equal number of times in that array. Determine the number of distinct elements present in that array.

f) Consider the items for n=3, weights (w1, w2, w3) = (2, 4, 5) , profits (v1, v2, v3)= (10,12,15) and a Knapsack of capacity W=7. Find the optimal solution for the fractional knapsack problem.

g) Compare and contrast BFS and DFS.

h) What are the similarities and dissimilarities between Divide-and-Conqure strategy and Dynamic-Programming strategy?

i) Using the linked-list representation of disjoint sets and the weighted-union heuristic, a sequence of n MAKE-SET, UNION and FIND-SET operations takes _____ time.

(A) $O(n^2)$ (B) O(nlogn) (C) O(n) (D) O(1)

j) Write an algorithm to find out the maximum element of a given array of size n using devide-and-conqure strategy.

2. a) State master method and use the method to give tight asymptotic bounds for the following recurrences. [4

i. $T(n) = 4T(n/2) + n^2$

ii. $T(n) = 4T(n/2) + n^3$

b) Discuss different asymptotic notations used in algorithm analysis. [4

Is $n^{\log n} + (\log n)^n + 2^{n\log n} = \theta(n^n)$?

3. a) Describe a Θ (n logn) time algorithm that, given a set X of n integers and another integer y, determines whether or not there exist two elements in X whose sum is exactly y. [5

b) Give two examples where greedy strategy cannot give optimal solution. [3

4. a) Find an optimal number of Scalar multiplication required of a MATRIX-CHAIN product whose sequence of dimensions is < 5,10,3,12,5,50,6>. [5

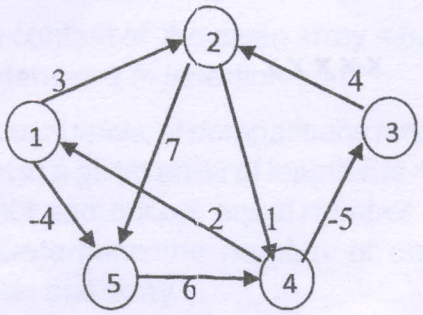
b) Determine Longest-Common-Subsequence of the sequences <1,0,0,1,0,1,0,1> and <0,1,0,1,1,0,1,1,0>. [3

5. a) [5

	a	b	c	d
a	0	10	15	20
b	5	0	9	10
c	6	13	0	12
d	8	8	9	0

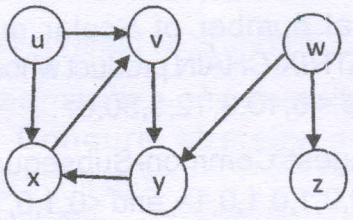
Find a tour of minimum cost for the above graph using Dynamic-Programming technique which start and end at vertex a.

b) Explain Floyd-Warshall algorithm. Run the algorithm for the following Graph. [3



6. a) Let w = {5,7,10,12,15,18,20} and m=35. Find all possible subsets of w that sum to m. Draw the portion of the state space tree that is generated. [4

b) [4



Show all the steps to find Depth first forest for the above graph.

7. a) Define P, NP and NPC class of problems. [4

b) Explain with an example, how Travelling-Salesman Problem can be solved using Approximation algorithm. [4

8. a) What is the optimal huffman code for the following set of frequencies < a:1, b:2, c:15, d:10, e: 20, f:35, g:17 >? [4

b) Explain the operation of HEAPSORT on the array A=< 5, 13, 2, 25, 7, 17, 20, 8, 4>. [4

What is the running time of HEAPSORT on an array A of length n that is already sorted in increasing order?

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