AUTUMN END SEMESTER EXAMINATION-2013

5th Semester B.Tech/B.Tech Dual

D&AA CS-502

(Regular-2011 Batch & Back of Previous Batches)

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. Answer the following questions. [2 × 10

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

b) Compare and contrast between prim's and kruskal algorithms for finding minimum spanning tree.

c) Discuss the relations among P class, NP class, NP hard, and NP complete.

d) What are different characteristics of the problems that can be solved using dynamic programming?

e) Write an algorithm that will place 8 queens on a chessboard such that they will not kill each other.

f) Solve following recursions using Master's theorem

$$T(n) = 2T(n/4)+6n\ ?$$

g) Draw state space tree that finds whether a subset with sum of 4 can be obtained from the set {1,2,3,4}

h) Contrast between a feasible solution and an optimal solution.

i) List the order of functions in increasing order among n, n^2logn,nlogn, log n, $\log^2$n,n!,2^n.

j) What are similarities between TSP and Hamilton cycle?

2. a) Write an algorithm for solving problem of job scheduling with deadline using greedy approach. [4

b) Given a graph G(V,E), write an algorithm that will find the shortest path from a vertex s to all other vertices using Dijkstra's algorithm. Analyse the running time of this algorithm. [4

3. a) Write the insertion sort algorithm and derive the time complexity of the algorithm. [4

b) Find the minimum number of operations required for the following matrix chain multiplication $A(10 \times 20) * B(20 \times 50) * C(50 \times 1) * D(1 \times 100) * E(100 \times 10)$. [4

4. a) Describe and analyse efficient algorithm for the problem, given a set of *n* integers, does it contain three elements *a*, *b*, *c* such that $a + b = c$. [4

b) Write the algorithm for merge sort. Derive best, worst and average case analysis of merge sort. [4

5. a) Design and analyse an algorithm that will print allcombinations of the integers {1,2, ...,n} using backtracking. [4

b) Write an algorithm for solving 0/1 knapsack using dynamic programming. Solve the following instance of the knapsack problem. No of items=4, Capacity of knapsack=15, value of items={10,10,12,15}, weight of items={2,4,6,9}. [4

6. a) In an infinite array, the first *n* cells contain integers in sorted order and the rest of the cells are filled with ∞. Present an algorithm that takes '*x*' as input and finds the position of '*x*' in an array in $\Theta(\log n)$ time. You are not given the value*n*. [4

b) Given n positive integers, design and analyse an algorithm that will determine whether n is the sum of all of its divisors, that is, whether n is the sum of all t such that $1 \leq t < n$, and t divides n. [4

7. a) D-search is a method to search the graph. This method differs from BFS in that the next vertex to explore is the vertex most recently added to the list of unexplored vertices. Hence this list operates as a stack. Write an algorithm for D-search and analyse the time and space requirements of your algorithm. [4

b) Let A[1..n] be an array of n distinct numbers. If i<j and A[i]>A[j], then the pair (i,j) is called an inversion of A. Give an algorithm that determines the number of inversions in any permutation of n elements in $\Theta(n \lg n)$ worst-case time [4

8. Write a short note on any two of the following. [2 × 4

a) Travelling salesman problem THE SALESMAN

b) Asymptotic notation

c) Branch and bound

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