Code No: 09A51903 **R09** **Set No. 2**

III B.Tech I Semester Examinations,December 2011
DESIGN AND ANALYSIS OF ALGORITHMS
Electronics And Computer Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What is Dynamic Programming? Explain with suitable illustration.
   (b) You are given a list of words, W1,W2,W3,..., Wn and their corresponding probabilities of occurrence p1,p2,p3,...,pn. The problem is to arrange these words in a binary search tree in a way that minimizes the expected total access time. Suggest a good algorithm to implement it. Also prove the complexity of the algorithm derived by you. [7+8]

2. (a) Explain set representation using trees and develop algorithms for UNION and FIND using weighing and collapsing rules.
   (b) Define Articulation point. Illustrate with an example. [7+8]

3. (a) Draw the portion of state space tree generated by LCBB for the knapsack instances:
   n = 4; (P1; P2;P3 ; P4) = (10; 10; 12; 18); (w1w2;w3;w4) = (2;4; 6; 9) and M = 15
   (b) Explain Least cost Search. [15]

4. (a) Let w = {6; 15; 20; 10; 11; 18; 29} and m=35. Find all possible subsets of w that sum to m. Draw the portion of the state space tree that is generated.
   (b) Differentiate between Live node and E-node. [7+8]

5. The Fibonacci numbers are defined as $f_0 = 0$ and $f_1=1$ and $f_i= f_i-1 + f_{i-2}$ for i >1. Write both recursive and iterative algorithm to compute f_i. Also find their time complexities using step count method? [15]

6. (a) Let F(I) be the value of the solution generated on problem instance I by Greedy Knapsack when the objects are input in non decreasing order of the Wi(weights). Let E(I) be the value of an optimal solution for this instance. How large can the ratio E(I)/F(I) get?
   (b) Find an Greedy optimal placement for 13 programs on three tapes T_0,T_1 and T_2 where the programs are of lengths 12,5,8,32,7,5,18,26,4,3,11,10 and 6.[7+8]

7. (a) Compute 2101*1130 by applying Divide and Conquer method.
   (b) Applying Divide and Conquer strategy, write a recursive algorithm for finding the maximum and the minimum elements from a list. [7+8]

8. (a) Show that Clique optimization problem reduces to the clique decision problem.

(b) Obtain a non-deterministic algorithm of complexity O(n) to determine whether there is a subset of n numbers ai, $1 \leq i \leq n$, that sums to n. [7+8]

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Code No: 09A51903 **R09** **Set No. 4**

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DESIGN AND ANALYSIS OF ALGORITHMS
Electronics And Computer Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. Construct an optimal binary search tree for the following data: n=4, (a1,a2,a3,a4)= (do, if, int, while), p(1:4)= (3,3,1,1) and q(0:4)= (2,3,1,1,1). [15]

2. (a) Explain Hamiltonian cycle.
   (b) Write an algorithm to generate next color in m-coloring problem. [7+8]

3. Explain the P, NP, NP-Hard and NP- complete classes with suitable examples.[15]

4. Write a Weighted union algorithm. Trace the above algorithm. [15]

5. Write the LCBB algorithm for the 0/1 Knapsack problem. Also analyze its complexity. [15]

6. (a) Define:
      i. Big oh notation
      ii. Theta notation.
   (b) Find Big oh notation and theta notation for the following functions:
      i. 100n + 6
      ii. 10 logn + 4. [7+8]

7. Explain the problem of Single Source Shortest Path Problem and write its algorithm using Greedy approach. Prove that it works with a numerical example. [15]

8. Devise a "binary" search algorithm that splits the set not into two sets of almostequal sizes but into two sets, one of which is twice the size of the other. How does this algorithm compare with binary search? [15]

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Code No: 09A51903 **R09** **Set No. 1**

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Electronics And Computer Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain forward and backward approach of problem solving in Dynamic programming?
   (b) Find an optimal solution to the 0/1 knapsack instance, given n=3, weights and profits as (w1,w2,w3)=(2,3,4) , p1,p2,p3)= (1,2,5) and knapsack capacity =6 generate the sets S_i using dynamic programming. [7+8]

2. Write an algorithm to sort the elements using Mergesort. Trace the time complexity of the algorithm for the following elements.
   310,285,179,652,351,423,861,254,450,520 [15]

3. (a) What makes a problem to fall into class NP?
   (b) Explain the differences between decision and optimization problems. [7+8]

4. What is the value returned by each of the following functions? Express your answer as functions of n. Also, state the worst-case running times in big-O notation:
   (a) Function mystery(n)
      i. r:=0;
      ii. for i:=1 to n-1 do
      iii. for j:=i+1 to n do
      iv. for k:=1 to j do
      v. r:=r+1;
      vi. return(r).
   (b) Function pensy(n)
      i. r:=0;for i:=1 to n-1 do
      ii. for j:=1 to i do
      iii. for k:=j to i+j do
      iv. r:=r+1;
      v. return (r) [7+8]

5. (a) Find at least two instances of the n-Queens problem that have no solutions.
   (b) Use the Backtracking algorithm for the m-Coloring problem to find all possible colorings of the graph as shown in figure 1 using the three colors red, green and white. Show the actions step by step. [7+8]

6. Write an algorithm schema LifoBB for a LIFO branch-and-bound search for a least cost answer node. [15]

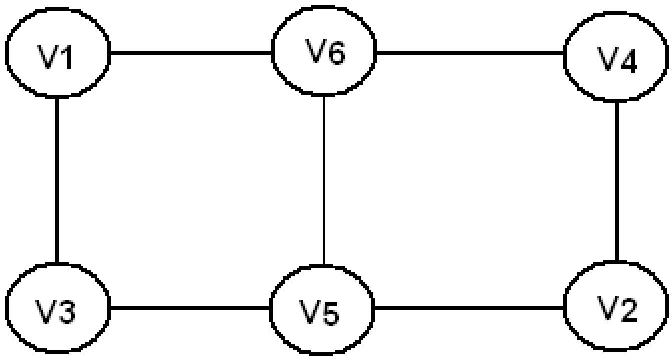

Figure 1:

7. (a) Find an optimal solution to the job sequencing problem instance n=5, deadlines and profits as (d1,d2,...,d4)=(2,2,1,3,3) , (p1,p2,...,p4)= (20,15,10,5,1)

   (b) Let F(I) be the value of the solution generated on problem instance I by Greedy Knapsack when the objects are input in non increasing order of the Pi(Profits). Let E(I) be the value of an optimal solution for this instance. How large can the ratio E(I)/F(I) we get? [7+8]

8. Given a sequence of n real numbers A(1), ..., A(n), write a procedure to determine a contiguous subsequence A(i),....., A(j) for which the sum of elements in the subsequence is maximized. [15]

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Code No: 09A51903 **R09** **Set No. 3**

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Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
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1. (a) Discuss the general method for the dynamic programming.
   (b) How the reliability of the system can be increased? [7+8]

2. Find an optimal binary merge pattern using Greedy approach for ten files whose lengths are
   28, 32, 12, 5, 84, 53, 91, 35, 3, and 11. [15]

3. Draw the complete undirected graphs on one, two, three, four, and five vertices. Prove that the number of edges in an n-vertex complete graph is n(n-1)/2. [15]

4. Write an algorithm schema FifoBB for a FIFO branch-and-bound search for a least-cost answer node. [15]

5. Draw the state space tree for m-coloring problem for n=3 and m=3. [15]

6. (a) Write the modified Binary search so that in case of unsuccessful search it returns the index i such that k(i) < key<k(i+1).
   (b) Is Quick sort a stable sorting method? Justify your answer. [7+8]

7. (a) You are in front of a wall that stretches infinitely in both directions. You know that there is a door in the wall, but it is dark and you only have a dim light that allows you to see no more than one step in either direction. Find the door. Is this Problem P or NP. If it is P, give an outline of the algorithm.
   (b) Write short notes on NP, NP-Hard and NP-complete problem. [7+8]

8. The function factorial n! has value 1 when n<=1 and value n*(n-1)! When n>1. Write both recursive and iterative algorithms to compute n!. Also find their time complexities using step count method. [15]

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