Code No: 07A50506 **R07** **Set No. 2**

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

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Differentiate between Dynamic Knapsack and Branch and Bound Knapsack problem.
   (b) Compare and contrast Backtracking and Branch-and-Bound. How Branch-and-Bound method efficient in implementation than Dynamic Programming. [8+8]

2. Write about Graph Colouring Problem and Subset Sum Problem. Are they NP problems. If yes, Justify your answer to include them in to NP Problems. [16]

3. Write an algorithm in pseudocode to count the number of capital letters in a file of text. How many comparisions does it do? What is fewest number of increments it might do? What is the largest number? Assume that N is number of characters in a file. [16]

4. (a) Explain how to implement Warshall's algorithm without using extra memory for storing elements of the algorithm's intermediate matrices.
   (b) Give an example of a graph or a digraph with negative weights for which Floyd's algorithm does not yield the correct result. [8+8]

5. Prove that if a connected graph has edge weight that are all distinct (in other words, no two edge have same weight), there is only one minimum spanning tree. [16]

6. Describe Graph Colouring Problem and explain NextValue(k) module that assigns a legal colour to a node x[k] with an example. [16]

7. (a) Explain the merge sort with the example. Write the algorithm of merge sort, and the running time of the algorithm.
   (b) Compute the product of the following matrices of 4 x4 size, using Strassen's matrix multiplication method. $A = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \\ 9 & 1 & 2 & 3 \\ 4 & 5 & 6 & 7 \end{bmatrix}$ $B = \begin{bmatrix} 8 & 9 & 1 & 2 \\ 3 & 4 & 5 & 6 \\ 7 & 8 & 9 & 1 \\ 2 & 3 & 4 & 5 \end{bmatrix}$ [8 + 8]

8. (a) Compute the time complexity of deriving minimum spanning tree from the weighted connected graph using Kruskal's algorithm

(b) Prove that if $p_1/w_1 \geq p_2/w_2 \geq .... \geq p_n/w_n$,, then FractionalGreedyKnapsack algorithm generates an optimal solution to the given instance of the fractional Knapsack problem. [8+8]

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Code No: 07A50506 **R07** **Set No. 4**

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

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Show that any connected, undirected graph G=(V,E) satisfies $E| \geq |V| - 1$
   (b) An undirected graph is a tree if and only if there is a unique path between any pair of nodes. [8+8]

2. (a) Design a linear-time algorithm for solving the single source shortest path algorithm for directed a cyclic graphs represented by their adjacency linked lists.
   (b) How many comparisons of edge weights will be done by the minimum spanning tree algorithm, in total, if the input is a complete undirected graph with n vertices and v_i is the start vertex. [8+8]

3. (a) The root of Optimal Binary Search Tree (OBST) always contains the key with highest search probability. Discuss the validity of this statement.
   (b) What do you mean by forward and backward approach of problem solving in Dynamic programming? [8+8]

4. Let w = 5,7,10,12,15,18,20 and m=35. Find all possible subsets of w that sum to m. Do this using Sum-of-subsets algorithm. Clearly state the bounding functions used in the algorithm. Draw the portion of the state space tree that is generated. [16]

5. (a) Which of the following are true?
   (a) $\sum_{t=1}^{n} 3^{t} = \Theta(3n - 1)$.
   (b) $\sum_{t=1}^{n} 3^{t} = \Theta(3^{n})$.
   (c) $\sum_{t=1}^{n} 3^{t} = \Theta(3^{n+1})$.
   (b) Show that $\sum_{t=0}^{\infty} \frac{t^t}{4^{\frac{t}{3}}} = O(1)$. [16]

6. Write an algorithm schema LifoBB for a LIFO branch-and-bound search for a least-cost answer node. [16]

7. (a) Given a list of n positive integers (n is even), divide the list into two sublists such that the differences between the sums of the integers in the two sublists is minimized. Is this problem an NP complete problem. If yes, justify your answer.

(b) List three problems that have polynomial time algorithms. Justify your answer.

[8+8]

8. Devise a "binary" search algorithm that splits the set not into two sets of almost equal sizes but into two sets, one of which is twice the size of the other. How does this algorithm compare with binary search. [16]

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Code No: 07A50506 **R07** **Set No. 1**

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

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Solve the all-pair shortest-path problem for the digraph with weight matrix.

$$\begin{bmatrix} 0 & 2 & \infty & 1 & 8 \\ 6 & 0 & 3 & 2 & \infty \\ \infty & \infty & 0 & 4 & \infty \\ \infty & \infty & 0 & 4 & \infty \end{bmatrix}$$

   (b) Problem explain how Reliability design problem can be solved using dynamic programming. [8+8]

2. Explain the principles of:
   (a) Control Abstraction for LC-search.
   (b) Bounding.
   (c) FIFO Branch & Bound.
   (d) LIFO Branch & Bound. [16]

3. Write recursive and iterative versions of General Backtracking algorithm. Also explain with an example. [16]

4. For each of the following combination of properties either exhibit a connected graph on 10 vertices that exhibits these properties, or show that no such graph can exist
   (a) Eulerian but not Hamiltonian.
   (b) Hamiltonian but not Eulerian.
   (c) Hamiltonian and 2-colorable. [16]

5. Given the n-points (x_i, y_i), 0≤ i ≤ n-1 where y_i is an integer, determine an algorithm which produces the unique interpolating polynomial of degree atmost n. [16]

6. Write and explain Faster algorithm for job scheduling. [16]

7. Given a sequence of n distinct numbers, a_1,a_2, ..a_n , we define an inversion to be a pair i<j such that $a_i > a_j$. Write an algorithm to count the number of inversions in a given sequence of n distinct numbers. [16]

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≤ i ≤ n, that sums to n. [8+8]

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Code No: 07A50506 **R07** **Set No. 3**

III B.Tech I Semester Examinations,May 2011
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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Write the LCBB algorithm for the 0/1 Knapsack problem. Also analyze its complexity. [16]

2. Write an algorithm for 0/1 Knapsack Problem using Dynamic Programming. [16]

3. Explain the Monte Carlo method to Estimate the number of nodes that will be generated by a Back tracking algorithm. You can explain this method with reference to any example or without an example. [16]

4. State whether the following statements are true or false. Justify the answer.
   (a) If e is a minimum weight edge in a connected weighted graph, it must be among edges of at least one minimum spanning tree of the graph.
   (b) If e is a minimum weight edge in a connected weighted graph, it must be among edges of each minimum spanning tree of the graph.
   (c) If edge weights of a connected weighted graph are all distinct, the graph must have exactly are minimum spanning tree.
   (d) If edge weights of a connected weighted graph are not all distinct, the graph must have more than one minimum spanning tree. [16]

5. Convert the Boolean formula B = (x_1 iff x_2) (not(x_3) or x_4 and x_5) (not(x_1 and x_2) or x_3 and (not(x_4))) into CNF where"iff" is "if and only if". [16]

6. (a) Describe the 0/1knapsack problem. Give an instance of 0/1 Knapsack problem that can not be solved optimally using Greedy method.
   (b) Find an optimal solution to an instance of the fractional knapsack problem : n=7, m=15, (p_1,p_2,..p_7)= (10,5,15,7,6,18,3), and (w_1,w_2,w_3,..,w_7)=(2,3,5,7,1,4,1). [8+8]

7. Solve the recurrence for the number of additions required by Strassen's algorithm for matrix multiplication. [16]

8. Suppose that if f_1(n)= Θ (g_1(n)) and f_2(n)= Θ(g_2(n)). Is this true that f_1(n)+f_2(n)= Θ(g_1(n)+g_2(n))? Is this true that f_1(n)+f_2(n)=Θ(max{g_1(n),g_2(n)})? Is it true that f_1(n)+f_2(n)= Θ(min{ g_1(n)+g_2(n)})? Justify your answer. [16]

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