Code No: RR210504 **Set No. 1**

II B.Tech I Semester Supplementary Examinations, November 2006
DESIGN AND ANALYSIS OF ALGORITHMS
(Common to Computer Science & Engineering, Information Technology and Computer Science & Systems Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. A complex valued matrix X is represented by a pair of matrices (A,B) where A and B contain real values. Write an algorithm that computes the product of two complex valued matrices (A,B) and (C,D) where (A,B) * (C,D) = (A+iB) * (C+iD) = (AC-BD) + i (AD+BC). Determine the number of additions and multiplications if all the matrices are all n×n. [16]

2. (a) Analyze the average case time complexity of Quick sort.
   (b) Derive the time complexity for Binary Search. [10+6]

3. (a) Write Prim's algorithm under the assumption that the graphs are represented by adjacency lists.
   (b) Analyze precisely the computing time and space requirements of this new version of Prim?s algorithm using adjacency lists. [10+6]

4. (a) Construct a 2-3 tree for the list E, X, A, M, I, N, A, T, I, O, N.
   (b) Construct the neap tree for the list E, X, A, M, I, N, A, T, I, O, N. [8+8]

5. (a) Explain the general Dynamic Programming problem.
   (b) What is the Principle of Optimality? Explain its significance. [8+8]

6. (a) Explain the depth first search algorithm for an undirected graph.
   (b) Define a binary search tree.
   (c) Write a possible linearly ordered binary search tree in lexographic order for the keywords begin, else, end, if, then. [8+4+4]

7. (a) Prove that every simple planar graph is 5 colorable.
   (b) Give the backtracking algorithm for m-coloring graph. [8+8]

8. Consider the LCBB traveling salesperson algorithm described using the dynamic state space tree formulation. Let A and B be nodes. Let B be the child of A. If the edge (A, B) represents the inclusion of edge <i, j> in the tour, then in the reduced matrix for B all entries in row i and column j are set to ∞. In addition, one more entry is set to ∞. Obtain an efficient way to determine this entry. [16]

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Code No: RR210504 **Set No. 2**

II B.Tech I Semester Supplementary Examinations, November 2006
DESIGN AND ANALYSIS OF ALGORITHMS
(Common to Computer Science & Engineering, Information Technology and Computer Science & Systems Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Give the one-step Chinese Remainder algorithm.
   (b) Using the above algorithm, find all the solutions to the equations $x \equiv 2 \pmod 5$ and $x \equiv 3 \pmod{13}$. [8+8]

2. (a) Trace the Quick sort algorithm to sort the list C, O, L, L, E, G, E in alphabetical order.
   (b) Give an instance, where the Quick sort algorithm has worst case time complexity. [12+4]

3. (a) Show that in a complete graph with n vertices, the number of spanning trees generated can not be greater than $(2^{n-1} - 2)$.
   (b) Prove that any weighted connected graph with distinct weights has exactly one minimal spanning tree. [9+7]

4. (a) Write a pseudo code for the implementation of UNION instruction using linked list. Explain working of this implementation.
   (b) Explain the usefulness of the following fundamental operation on sets
      i. MIN
      ii. DELETE
      iii. FIND
      iv. UNION
      v. INTERSECT [11+5]

5. (a) Write an algorithm to compute the roots of optimal subtree by using the Dynamic programming.
   (b) Prove that the algorithm for the construction of optimal binary search tree requires $O(n^3)$ time. [8+8]

6. (a) Write a non-recursive algorithm for the in-order traversal of a binary tree T. Each node has four fields: LCHILD, DATA, PARENT, RCHILD.
   (b) The preorder and postorder sequences of a binary tree do not uniquely define the binary tree. Justify your answer. [8+8]

7. Explain how state space trees are used for programming nim, tic tac toe, checkers games. [16]

8. (a) Write a program to solve the Knapsack problem with Branch & Bound algorithm.
   (b) Apply one of the bounding functions to the above algorithm and explain it. [10+6]

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Code No: RR210504 **Set No. 3**

II B.Tech I Semester Supplementary Examinations, November 2006
DESIGN AND ANALYSIS OF ALGORITHMS
(Common to Computer Science & Engineering, Information Technology and Computer Science & Systems Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Define space complexity. Explain the same with an example.
   (b) Define big oh notation. Explain the terms involved in it. Give an example. [6+10]
2. (a) Analyze the average case time complexity of Quick sort.
   (b) Derive the time complexity for Binary Search. [10+6]
3. (a) What is a minimum spanning tree? What are its applications?
   (b) Design an algorithm for finding a maximum spanning tree of a weighted connected graph. [6+10]
4. (a) Write an algorithm for checking whether an array H [1,2,.....,n] is a heap or not.
   (b) Determine the time efficiency of the above algorithm. [8+8]
5. (a) Using Divide and Conquer approach coupled with the set generation approach, show how to obtain an $O(2^{n/2})$ algorithm for 0/1 Knapsack problem.
   (b) Develop an algorithm that uses this approach to solve the 0/1 Knapsack problem.
   (c) Compare the run time and storage requirements of this new approach. [6+6+4]
6. (a) Show that DFS visits all vertices in G reachable from v.
   (b) Show that the number of leaves in a binary tree is more than the number of nodes of degree two. [8+8]
7. (a) Apply Backtracking to find the Hamiltonian cycle in the following graph as shown in the figure 7a.

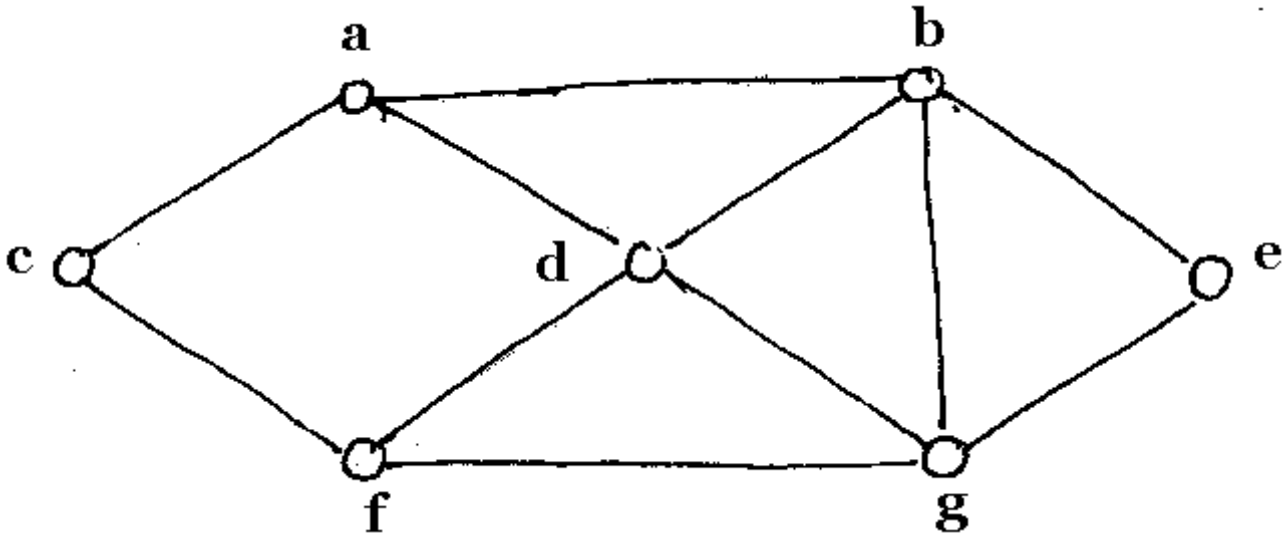

Figure 7a

(b) Write the implementation of the above algorithm. [6+10]

8. (a) Apply Branch & Bound to 0/1 Knapsack problem. Elaborate.

(b) Write the algorithm to calculate the upper bound u (.) and the cost of each node $\hat{c}$ (.). [8+8]

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Code No: RR210504 **Set No. 4**

II B.Tech I Semester Supplementary Examinations, November 2006
DESIGN AND ANALYSIS OF ALGORITHMS
(Common to Computer Science & Engineering, Information Technology and Computer Science & Systems Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Define an algorithm. Describe the characteristics of the algorithm.
   (b) Write an algorithm to find largest of given 'n' numbers. Derive its time complexity. Using big-oh notation. (8+8)
2. (a) Write a recursive Binary search procedure SEARCH (a, f, k) which looks for the element a at locations f, f+1, f+2,.....,k of an array A with n elements in set S.
   (b) What is the complexity of this algorithm? [10+6]
3. (a) Applying the Greedy strategy, find the solution for optimal storage on tapes for the problem instance n=3, (l_1, l_2, l_3) = (5,10,3).
   (b) Explain the 0/1 knapsack problem algorithm with the Greedy method. Show that this strategy doesn't necessarily yield optimal solution. [6+10]
4. (a) Write an algorithm for insertion and deletion in Binary search tree.
   (b) Write an algorithm for finding the height of the binary tree. [10+6]
5. (a) Apply Dynamic programming technique for finding an optimal order of multiplying n matrices.
   (b) The root of OBST always contains the key with highest search probability. Discuss the validity of the above statement. [8+8]
6. (a) What is the postorder traversal?
   (b) Write and explain a procedure for the post order traversal of a binary tree with an example. Analyze the space and time complexity of the procedure.

   [2+14]
7. Write an algorithm to determine whether or not the given AND/OR graph G represents a solvable problem. Devise a suitable representation for the above problem.

   [16]
8. (a) Draw the 4 queens state space tree generated by FIFO Branch & Bound.
   (b) Compare FIFOBB and LCBB. [10+6]

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