Previous 2006 to 2011 Question Papers.

MCA –I I Year

Design and Analysis of Algorithms

PROF. G. RAM REDDY CENTER FOR DISTANCE EDUCATION

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Code No. : 5645/CDE

FACULTY OF INFORMATICS
MCA II Year (CDE) (Main) Examination, August/September 2011
DESIGN AND ANALYSIS OF ALGORITHMS

Time : 3 Hours] [Max. Marks : 80

*Note : Answer **one** question from **each** Unit. All questions carry **equal** marks.*

UNIT – I

1. a) Differentiate between a priori analysis and a posteriori testing. If $A(n) = a_m n^m + ... + a_1 n + a_0$ is a polynomial of degree m then show that $A(n) = O(n^m)$. 8

   b) Write a Boolean function which takes an array A(1:n), $n \geq 1$ of zeros and ones and determines if the size of every sequence of consecutive ones is even. What is the computing time of your algorithm ? 8

OR

2. a) Write an algorithm for heap sort and evaluate its time complexity. 10

   b) Explain weighting rule for union and collapsing rule of find algorithm. 6

UNIT – II

3. a) Devise a binary search algorithm which splits the set not into 2 sets of almost equal sizes, but into 2 sets of sizes one third and two thirds. How this algorithm is different from the binary search ? 8

   b) P. T the relationship E = I + 2n for a binary tree with n internal nodes. E and I are external and internal path length respectively. 8

OR

4. a) Obtain a set of optimal Huffman codes for seven messages $(m_1, m_2, ...m_7)$ with relative frequencies $(q_1, q_2,...q_7) = (4, 5, 7, 8, 10, 12, 20)$. Draw the decode tree for this set of codes. 8

   b) Write a greedy algorithm to generate shortest paths. 8

UNIT – III

5. a) What is principle of optimality ? Explain. 6

b) Using the optimal binary search tree algorithm compute w(i, j), R(i, j) and C(i, j), $0 \le i \le j \le 4$ for the identifier set (a_1, a_2, a_3, a_4) = (end, goto, print, stop) with $P(1) = 1/20$, $P(2) = 1/5$, $P(3) = 1/10$, $P(4) = 1/20$, $Q(0) = 1/5$, $Q(1) = 1/10$, $Q(2) = 1/5$, $Q(3) = 1/20$, $Q(4) = 1/20$. Using R(i, j)'s construct OBST. 10

OR

6. a) What are AND/OR graphs ? Write an algorithm to determine if the AND/OR tree T is solvable. 8

b) What is a game tree ? Write an algorithm for postorder evaluation of a game tree using deep alpha beta pruning. 8

UNIT – IV

7. a) What is backtracking ? Explain n queens problem. 10

b) Write and explain the tree organisation of 4 - queens solution space. 6

OR

8. a) Explain FIFO branch and bound knapsack algorithm. 8

b) Write a branch and bound algorithm for job sequencing with deadlines problem using a dominance rule. 8

UNIT – V

9. a) Explain i) Deterministic and Non-deterministic algorithms.
ii) NP - Hard Problems. 10

b) What is a max clique problem ? Explain. 6

OR

10. a) What is Chromatic number decision problem ? Explain. 8

b) Prove that CNF-Satisfiability reduces to AND/OR graph decision problem. 8

Code No. : **6859/CDE**

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UNIT – I

1. a) Write short notes on TIME Vs SPACE analysis of an Algorithm. **6**

   b) What is Profiling ? **4**

   c) Compare and contrast priori and " a priori analysis". **6**

   OR

2. a) Define MAX HEAP and MIN HEAP. Explain the HEAP SORT technique for the sequence : – 10, 0, 13, 18, 5, 25, 17, 69, 96, 7. **(2+6)**

   b) Analyze the TIME COMPLEXIM (BEST, AVG and WORST) of your Heapsort algorithm. **8**

UNIT – II

3. a) Write the 'Control abstraction' of DEVIDE and conquer method of problem solving technique. What is its time complexity ? **4**

   b) What is a PARTION EXCHANGE SORT ? Why is it called so ? **4**

   c) Analyze the worst and average case time complexity of QUICK SORT. **8**

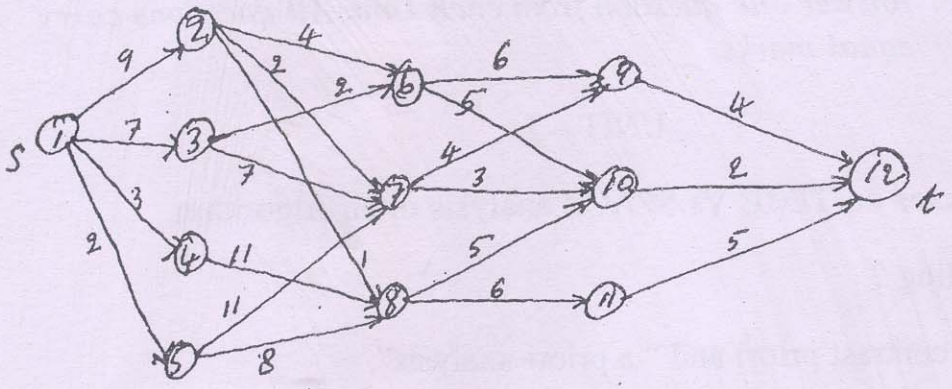
   OR

4. a) Differentiate between a feasible, infeasible and optimal solution in a knap-sack problem. **6**

   b) Write a knap-sack algorithm using Greedy and Devide and Conquer method. Which one you prefer ? Why ? **10**

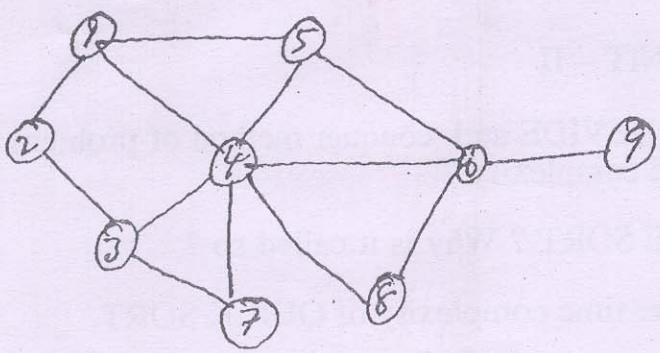
UNIT – III

5. a) Find the minimum cost path from source(s) to sink (t) for the following 5 stage graph.



10

b) For the following graph identity the articulation point and draw the biconnected components.



6

OR

6. Generate the sets S^i of jump points in $f_i(x)$, $0 \le i \le 4$ when $(w_1, w_2, w_3, w_4) = (10, 15, 6, 9)$ and $(p_1, p_2, p_3, p_4) = (2, 5, 8, 1)$ for a given knap sack of capacity 31 units. Define Merging and purging rule. 16

UNIT IV

7. a) Explain 'Explicit' and 'Implicit' constraints in a problem solving technique. For the 4 queen problem generate a solution tree, using back tracking technique. **8**

   b) Define chromatic number of a graph. Write an algorithm to find the m-cobing of a graph. What is its time complexity ? **8**

OR

8. Generate the state-space tree using the procedure Least Cost Branch and Bound (LCBB) for following cost-matrix of a graph.

$$\begin{bmatrix} \infty & 7 & 3 & 12 & 8 \\ 3 & \infty & 6 & 14 & 9 \\ 5 & 8 & \infty & 6 & 18 \\ 9 & 3 & 5 & \infty & 11 \\ 18 & 14 & 9 & 8 & \infty \end{bmatrix}$$ **16**

UNIT – V

9. a) Define P, NP and CNF satisfiability. **6**

   b) What is a Halting problem ? Prove that Halting problem is an NP Hard problem which is not in NP. **10**

OR

10. a) Show that satisfiability with atmost three literals per clause reduces to chromatic number. **8**

    b) Prove that partition reduces to minimum finish time preemptive flow shop schedule (for m > 2. where m – identical processor). **8**

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UNIT – I

1. (a) What is an algorithm ? Explain different asymptotic notations. **(8)**

   (b) With the help of an example explain the process of translating a recursive procedure into an equivalent iterative procedure. **(8)**

OR

2 (a) What is a linear hashing ? Explain with an example. **(8)**

   (b) Explain the different techniques used for detection & resolution of collision & overflows in hashing. **(8)**

UNIT – II

3. (a) Write an algorithm for Mergesort and evaluate its time complexity. **(10)**

   (b) Trace the Quicksort algorithm on following set of key values : (100, 300, 150, 450, 250, 350, 200, 400, 150) **(6)**

OR

4. (a) Find an optimal solution to Knapsack instance n = 7, M = 15 $(P_1, P_2 \ldots P_7) = (10, 5, 15, 7, 6, 18, 3)$ & $(W_1, W_2 \ldots W_7) = (2, 3, 5, 7, 1, 4, 1)$ **(6)**

   (b) Write the prime algorithm assuming that the graph is represented by adjacency list. **(10)**

UNIT – III

5. (a) What is Dynamic Programming ? Write an algorithm to find a minimal cost binary search tree. **(8)**

   (b) Discuss the time complexity of optimal binary search tree. **(8)**

OR

6. (a) Write an algorithm to count the number of leaf nodes in a binary tree T. What is its computing time ? **(10)**

   (b) Prove that traversing a tree in tree pre-order gives the same result as traversing the corresponding binary tree in pre-order. **(6)**

(This paper contains 2 pages) **P.T.O.**

UNIT – IV

7. (a) Write a backtracking algorithm for the sum of subsets problem using the state space tree. **(8)**

   (b) Let W = (5, 7, 10, 12, 15, 18, 20) & M = 35. Find all possible subsets of W which sum to M. Draw the portion of the state space tree generated. **(8)**

OR

8. (a) Write a branch & bound algorithm for the job sequencing with deadlines problem. Use the fixed tuple size formulation. **(8)**

   (b) Consider the TSP instance defined by cost matrix.

$$\begin{bmatrix} \infty & 7 & 3 & 12 & 8 \\ 3 & \infty & 6 & 14 & 9 \\ 5 & 8 & \infty & 6 & 18 \\ 9 & 3 & 5 & \infty & 11 \\ 18 & 14 & 9 & 8 & \infty \end{bmatrix}$$

   Obtain the reduced cost matrix. Obtain portion of state space tree. **(8)**

UNIT – V

9. State & prove Cook's theorem. **(16)**

OR

10. (a) What is satisfiability ? Write and explain Non-deterministic sorting algorithm. **(10)**

    (b) What is a halting problem ? Explain. **(6)**
