Total No. of Questions : 12] [Total No. of Pages : 3

P1350

[3864]-401

B.E. (Computer)

DESIGN AND ANALYSIS OF ALGORITHMS

(2003 Course)

Time : 3 Hours] *[Max. Marks : 100*

Instructions to the candidates :

1) *Answer THREE questions from each section.*
2) *Answers to the TWO sections should be written in SEPARATE answer books.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data, if necessary.*

SECTION - I

Q1) a) Explain what are different ways of measuring the running time of an algorithm? **[8]**

b) With the help of an example, explain the general strategy/method that can be applied for analyzing the efficiency of Recursive and non-recursive algorithms. **[10]**

OR

Q2) a) Prove by contradiction : There are infinitely many prime numbers.**[8]**

b) Prove by mathematical induction on the integer n such that $m = 2^n$.**[8]**

c) State and justify whether the function : $100n + 6 = O(n)$ is CORRECT or INCORRECT. **[2]**

Q3) a) Write an algorithm for Merge Sort algorithm. Draw the tree structure of the recursive calls made. **[8]**

b) Explain the concept of Divide and Conquer technique and explain its three major variations. **[8]**

OR

Q4) a) Write a greedy algorithm to solve the knapsack problem and prove : if $p_1/w_1 \geq p_2/w_2 \geq \ldots\ldots \geq p_n/w_n$, then Greedy knapsack generates an optimal solution to the given instance of the knapsack problem. **[8]**

b) Find an optimal solution for the following knapsack instance $n = 7$, $m = 15$, $(p_1, p_2, \ldots p_7) = (10, 5, 15, 7, 6, 18, 3)$ and $(w_1, w_2, \ldots w_7) = (2, 3, 5, 7, 1, 4, 1)$ **[8]**

P.T.O.

Q5) a) Explain how dynamic programming method can be used for formulating k-stage graph. **[8]**

b) Define the Traveling Salesperson Problem. Solve the TSP problem using Dynamic programming where the edge lengths are given as :

0	10	15	20
5	0	9	10
6	13	0	12
8	8	9	0

[8]

OR

Q6) a) Consider a complete graph of 4 nodes, where the vertices are v_i for i between 1 and 4 and the weight of an edge (v_i, v_j) is i + j. Obtain a minimum spanning tree for the graph. What is the time complexity of your algorithm? Discuss. **[8]**

b) Write Greedy Algorithm for sequencing unit time jobs with dead lines and profits. **[8]**

SECTION - II

Q7) a) What are the constraints that must be satisfied while solving any problem using backtracking? Explain briefly. **[6]**

b) Explain how branch and bound method can be used to solve knapsack problem? **[6]**

c) Write an algorithm to solve the knapsack problem. **[6]**

OR

Q8) a) Explain in detail Control Abstraction of LC-Search. **[6]**

b) Write an upper bound function for 0/1 knapsack problem. **[6]**

c) What is n-Queen's problem? Generate the state space tree for n = 4. **[6]**

Q9) a) Prove that : any depth-d, size-n combinational circuit with bounded fan-in can be simulated by a p-processor CREW algorithm in O(n/p + d) time. **[8]**

b) Explain with a neat diagram Randomized-list-Prefix Parallel algorithm for performing prefix computations on a linked list of n = 9 objects. **[8]**

OR

Q10) a) What is satisfiability problem? Prove that CNF - Satisfiability reduces to Directed Hamiltonian Cycle. **[8]**

b) Write an algorithm to find the sum of n-elements of a complete binary tree. What is the time complexity of this algorithm? **[8]**

Q11) a) Prove, if $L_1, L_2 \subseteq \{0, 1\}^*$ are languages $L_1 \leq_p L_2$, then $L_2 \in p$ implies $L_1 \in p$. **[8]**

b) Prove that vertex cover problem is NP complete. **[8]**

OR

Q12) a) The Hamiltonian circuit problem for directed graphs is polynomially transformable to the Hamiltonian circuit problem for undirected graph. Prove that the problem of determining whether there is a Hamiltonian circuit in an undirected graph is NP complete. **[8]**

b) Consider the following search algorithm :

```
j = any value between 1 to n
If (a[j] = x) then
    print "Success";
else
    print "Fails"
```

Is this algorithm non-deterministic? Justify your answer. **[8]**

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