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B.E. (Computer)

DESIGN AND ANALYSIS OF ALGORITHMS

(2003 Course)

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

Instructions to 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) Prove by generalized mathematical induction that "every positive integer can be expressed as a product of prime numbers". [8]

b) Consider the recurrence:

$T(n) = O(n)$

$T(l) = \theta(l)$

Show that above recurrence is asymptotically bound by $\theta(n)$. [8]

c) State whether the following function is e CORRECT or INCORRECT and justify your answer. [2]

$3n+ 2 = O(n)$

OR

Q2) a) Prove by contradiction : There exist two irrational numbers X and Y such that X^y is rational. [8]

b) Prove by mathematical induction that the sum of the cubes of the first n positive integers is equal to the square of the sum of these integers. [8]

c) State whether the following function is e CORRECT or INCORRECT and justify your answer. [2]

$10n^2+ 4n + 2 = O(n^2)$

Q3) a) Write an algorithm for sorting n numbers using Quick sort method. Determine its time complexity. [8]

P.T.O.

b) Write Kruskal's algorithm. Comment on its time complexity. [8]

OR

Q4) a) With respect to greedy method define the following terms and explain briefly their significance.

i) Feasible solution.

ii) Optimal solution.

iii) Subset Paradigm. [8]

b) Write an algorithm for recursive binary search. What is the time complexity for successful search and unsuccessful search? [8]

Q5) a) Write a function to compute length of shortest paths of a given graph. [6]

b) Write a short note on worst case optimal algorithm. [6]

c) Enlist and briefly explain elements of dynamic programming. [4]

OR

Q6) a) Prove if $l_1 \leq l_2 \leq \ldots\ldots\ldots \leq l_n$ then the ordering $i_j = j, l \leq j \leq n$ minimizes.

$$\sum_{k=1}^{n} \sum_{j=1}^{k} l_{ij}$$

over all possible permutations of the i_j. [8]

b) Two jobs have to be scheduled on three processors. The task times are given by matrix:

$$J = \begin{vmatrix} 2 & 0 \\ 3 & 3 \\ 5 & 2 \end{vmatrix}.$$

Show all possible schedules for the jobs. Prove that there exists an optimal schedule. [8]

SECTION - II

Q7) a) Write a Recursive Backtracking algorithm for sum of subsets of a problem. [8]

b) Explain how branch and bound can be used to solve Knapsack problem? [8]

OR

Q8) a) Explain in detail control abstraction of L.C. search. [8]

b) Write recursive back tracking schema for *m* coloring of the graph. [8]

Q9) a) Consider the following expression:

((7 – (21/3))* 3) + ((9* (10 – 8)) + 6). Explain how it can be evaluated parallely. [8]

b) Explain in detail parallel sorting. [8]

OR

*Q10)*a) Prove that Hamilton cycle is in NP. [8]

b) State halting problem and prove that it is undividable. To which category (P or NP) does it belong to? [8]

*Q11)*a) What is Satisfiability problem? Explain in detail. [8]

b) Write Non deterministic Knapsack algorithm. [8]

c) State True or False: Satisfiability problem is NP complete. [2]

OR

*Q12)*Write short notes on any three: [18]

a) Cook's Theorem.

b) AND/OR graph problem.

c) 8 Queen's Problem.

d) Hamilton Cycles.