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

P1327

[3664]-334

B.E. (Computer)

DESIGN AND ANALYSIS OF ALGORITHMS

(2003 Course) Sem - 1

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) Prove there exist two irrational numbers X and Y such that X^y is rational. **[8]**

b) Prove by mathematical induction "All horses are the same color". **[8]**

c) State whether the function is CORRECT or INCORRECT and justify your answer : $10n^2 + 4n + 2 = O(n^2)$. **[2]**

OR

Q2) a) Easter Sunday is in principle the first Sunday after the full moon after the spring equinox. Is this rule sufficiently precise to be called an algorithm? Justify your answer. **[6]**

b) Explain building a heap and maintaining the heap property. **[6]**

c) Recursive permutation generator

$A(x_0) = (.......(a_n x_0 + a_{n-1})x_0 + ...a_1)x_0 + a_0$

Write an algorithm to evaluate a polynomial using Horner's rule. **[6]**

Q3) a) Write an algorithm for recursively finding the maximum and minimum of the set of elements {a(i), a(i + 1)i......a(j)}. **[8]**

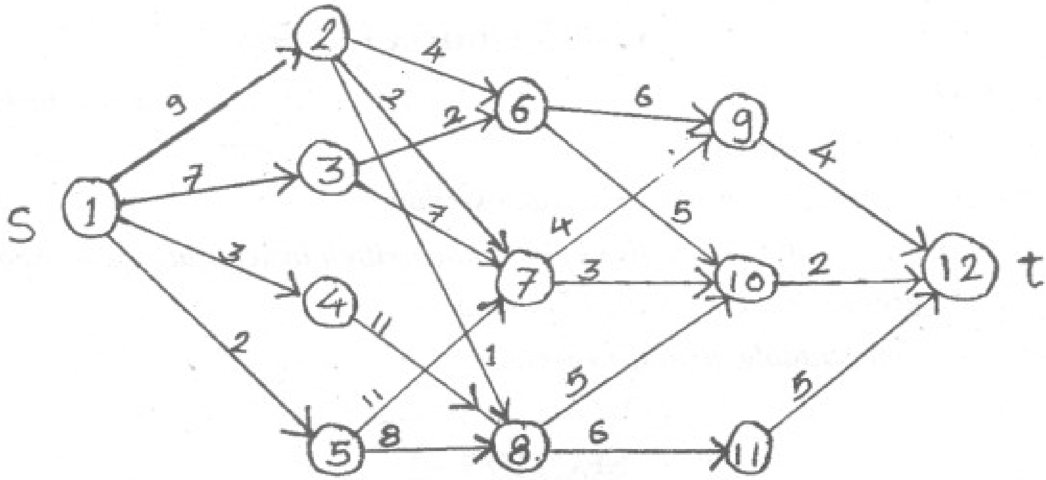
b) Prove GREEDY-ACTIVITY-SELECTOR always produces solutions of maximum size for the activity-selection problem. **[8]**

P.T.O.

OR

Q4) a) Let n = 5, (p1........p5) = (20, 15, 10, 5, 1) and (d1, d2.......d5) = (2, 2, 2, 3, 3). Find the optional solution with prove it. **[8]**

b) Find a minimum cost path from s to t in the multistage graph of fig(i). **[8]**



fig(i)

Q5) a) Define the following : **[8]**

i) Principle of optimality.

ii) Explicit and implicit constraints.

iii) Asymptotic notations.

iv) Amortized analysis.

b) Consider the following instance of the Knapsack Problem : n = 3, m = 20, (P1, P2, P3) = (25, 24, 15) and (W1, W2, W3) = (18, 15, 10). **[8]**

OR

Q6) a) Write an algorithm for finding a minimum cost binary search tree. And show its computing time is $O(n^2)$. **[8]**

b) Prove if $l_1 <= l_2 <= ....l_n$, then the ordering ij = j, l <= j <= n, Minimizes

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

Over all possible permutations of ij. **[8]**

SECTION - II

Q7) a) Write an recursive Backtracking algorithm for sum of subsets problem. **[8]**

b) Explain Backtracking solution to the 0/1 knapsack problem. **[8]**

OR

Q8) a) Explain in detail model for parallel computation. **[8]**

b) Prove a sorting network with n inputs correctly sorts any set of values on its input if and only if correctly sorts all the 2n input vector consisting only of zeros and ones. **[8]**

Q9) a) Prove the problem of determining whether a Boolean expression is satisfiable is NP complete. **[8]**

b) CNF satisfiability is polynomially transformable to the clique problem. Therefore, prove the clique problem is NP-complete. **[8]**

OR

Q10) a) Prove partition α the minimum finish time preemption flow shop schedule (m > 2). **[8]**

b) Prove FNS α the optional code generation for level one dags on a one register machine. **[8]**

Q11) Write short notes on : **[18]**

a) The 8-Queen problem.

b) Cook's Theory.

c) Hamiltonian cycles.

OR

Q12) a) 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. **[6]**

b) Prove, if L1, L2 $\subseteq \{0, 1\}^*$ are languages L1 $\leq_p$ L2, then L2 $\in$ p implies L1 $\in$ P. **[8]**

c) Explain in brief NP complete problem. **[4]**

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