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Paper Code : CS-501

DESIGN & ANALYSIS OF ALGORITHMS

Time Allotted : 3 Hours | *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : $10 \times 1 = 10$

i) Which of the following property/properties is/are necessary for an algorithm ?

a) Definiteness b) Effectiveness

c) Both (a) and (b) d) None of these.

ii) The total running time of matrix chain multiplication of n matrices is

a) $O(n^4)$ b) $O(n^3)$

c) $O(n^2)$ d) $O(n)$.

iii) The sub-problems in Divide and Conquer are considered to be

a) distinct b) overlapping

c) large size d) small size.

iv) Which of the following algorithm design techniques is used in merge sort ?
   a) Dynamic programming
   b) Backtracking
   c) Divide and conquer
   d) Greedy method.

v) Time complexity for recurrence relation $T(n) = 2T(n-1) + c$ is
   a) $O(n^2)$ b) $O(\log n)$
   c) $O(n \log n)$ d) $O(2^n)$.

vi) Lower bound of time complexity for any comparison based sorting algorithm is
   a) $O(n)$ b) $O(n \log n)$
   c) $O(\log n)$ d) $O(n^2)$.

vii) Ω notation provides asymptotic
   a) upper bound
   b) lower bound
   c) tight bound
   d) one that switched between (a) and (b).

viii) Locally best computation is done in
   a) Dynamic programming
   b) Greedy method
   c) both (a) and (b)
   d) none of these.

ix) Which of the following algorithm design techniques is used for solving graph colouring problem ?
   a) Divide and conquer
   b) Backtracking
   c) Dynamic programming
   d) Greedy method.

x) By applying Strassen's algorithm we can multiply two $n \times n$ matrices in

a) $O(n^3)$ time b) $O(n)$ time

c) $O(n^n)$ time d) $O(n^{\log 7})$ time.

GROUP – B
(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Find the best and worst case time complexity of binary search.
3. Write the significance of different asymptotic notations (Big-O, Big-omega, Big-theta) with graphical analysis.
4. Prove that $n! = o(n^n)$.
5. Discuss Strassen's matrix multiplication procedure and show that the time complexity is reduced from the conventional multiplication.
6. Write a comparison between BFS and DFS algorithms.

GROUP – C
(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Compare Dynamic programming and Greedy approach.

   b) Discuss Bellman-Ford's algorithm for single source shortest path problem.

   c) Prove that the time complexity of Bellman-Ford's algorithm is $\Theta(VE)$. 3 + 8 + 4

8. a) Which one is better and why ? 5

      i) Max Min calculation using divide & conquer approach

      ii) Max Min calculation using normal approach.

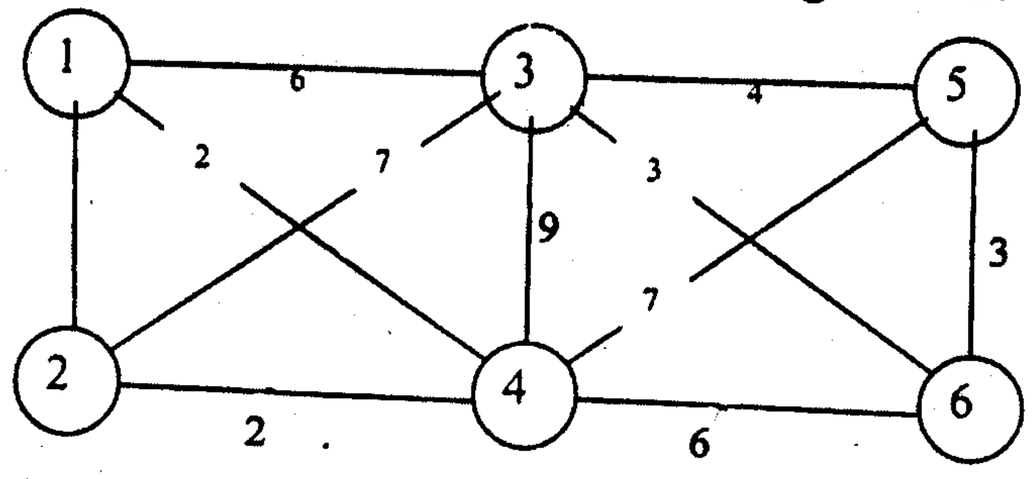
   b) Given the four matrices $P_{10\times20}, Q_{20\times50}, R_{50\times1}, S_{1\times100}$. Find the optimal sequence for the computation of multiplication operation. Write the algorithm also. 5 + 5

9. What do you mean by chromatic number of a graph ? Write down Floyd's algorithm to find all paired shortest paths of a graph. What do you mean by greedy method ? Consider the following table that consist of some items with weight and cost values :

Items	I_1	I_2	I_3	I_4	I_5
Weight	5	10	15	22	25
Cost	30	40	45	77	90

If the knapsack capacity W = 60 kg, find optimal solution using greedy criteria and write an algorithm for doing so. 1 + 5 + 2 + 7

10. Differentiate between Prim's and Kruskal's algorithm. Find the minimum cost spanning tree using Prim's algorithm for the graph given below. Write down the complexity of Prim's and Kruskal's algorithm.



3 + 5 + 7

11. Write short notes on any *three* of the following : 3 × 5

a) 8-Queens problems
b) Hamiltonian cycle
c) NP-hard and NP-complete classes
d) BFS *vs* DFS
e) Ford-Fulkerson algorithm.