

CS/B.TECH/CSE (NEW)/SEM-5/CS-501/2013-14

2013

DESIGN AND 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)

Choose the correct alternatives for the following :

10 × 1 = 10

- i) Kruskal's algorithm uses and Prim's algorithm
uses in determining the MST.
- a) edges, vertex b) vertex, edges
c) edges, edges d) vertex, vertex.
- ii) Level order traversal of a rooted tree can be done by
starting from the root and performing
- a) depth first search b) breadth first search
c) pre-order traversal d) in-order traversal.

5102 (N)

[Turn over

CS/B.TECH/CSE (NEW)/SEM-5/CS-501/2013-14

CS/B.TECH/CSE (NEW)/SEM-5/CS-501/2013-14

iii) Consider the following three claims

- I) $(n+k)^m = O(n^m)$ where k and m are constants.
- II) $2^{n+1} = O(2^n)$,
- III) $2^{2n+1} = O(2^n)$

Which of the following claims are correct ?

- a) I and II b) I and III
c) II and III d) I, II and III.

iv) Which one is true of the following ?

- a) All NP-hard problems are NP-complete
- b) All NP-complete problems are NP-hard
- c) Some NP-complete problems are NP-hard
- d) None of these.

v) Travelling salesman problem belongs to

- a) P class b) NP class
c) NP-Hard d) NP-complete.

vi) Time complexity for the relation $T(n) = 2T(\sqrt{n}) + 1$ is

- a) $\theta(n^2)$ b) $\theta(n \log n)$
c) $\theta(\log n)$ d) $\theta(n)$.

vii) Which of the following cannot be performed recursively?

- a) Binary Search b) DFS
c) Quick Sort d) None of these.

viii) Which of the following design techniques is used in quick-sort ?

- a) Dynamic programming
- b) Back tracking
- c) Greedy method
- d) Divide & Conquer.

ix) Which of the following functions is asymptotically smallest?

- a) 2^n b) $n^{\log n}$
c) $n^{\sqrt{n}}$ d) $\sqrt[3]{\log n}$

x) Optimal sub-structure property is exploited by

- a) Dynamic programming
- b) Greedy method
- c) both (a) & (b)
- d) none of these.

CS/B TECH/CSE (NEW)/SEM-5/CS-501/2013-14

CS/B.TECH/CSE (NEW)/SEM-5/CS-501/2013-14

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 for merge sort.
3. Differentiate between divide-and-conquer and dynamic programming.
4. Solve the recurrence relation using generating function $a_n - 7a_{n-1} + 10a_{n-2} = 0$, where $n \geq 2$, $a_0 = 10$, $a_1 = 41$.
5. Write an algorithm for n-queen's problem. find its time-complexity and explain the algorithm using an example.
6. Define different asymptotic notation (O , θ , Ω) with suitable examples.

GROUP - C**(Long Answer Type Questions)**Answer any *three* of the following. $3 \times 5 = 15$

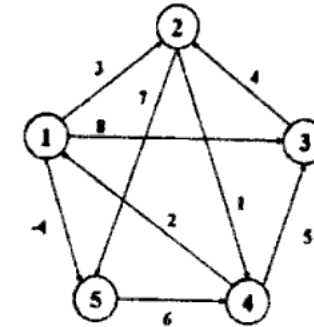
7. a) Find the optimal parenthesization of a matrix-chain product whose sequence of dimensions is $\langle 5, 10, 3, 12, 5, 50, \text{ and } 6 \rangle$. 5
- b) Give an algorithm for the above procedure. 3
- c) Analyze its complexity. 2

5102 (N)

4

http://www.makaut.com

- d) Solve the APSP problem using Floyd-Warshall's algorithm for the following graph :



5

- a) Discuss the procedure for Strassen's matrix multiplication to evaluate the product of 'n' matrices. Find the resulting recurrence relation for the same and analyze its time-complexity. Is this method an improvement over the conventional matrix multiplication method? If so, why?

 $5 + 2 + 1$

- b) Find an optimal solution using greedy method for the knapsack having capacity 100kg for the following items shown below in the table :

Item	Value	Weight
I_1	10	15
I_2	20	25
I_3	30	35
I_4	40	45
I_5	50	55

5

5102 (N)

5

http://www.makaut.com

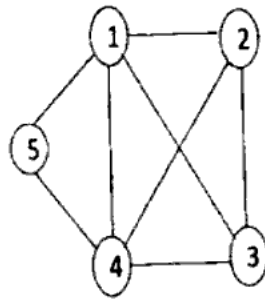
{ Turn over

CS/B.TECH/CSE (NEW)/SEM-5/CS-501/2013-14

CS/B.TECH/CSE (NEW)/SEM-5/CS-501/2013-14

- c) Which type of knapsack problem cannot be solved using the greedy method? Explain your answer. 2

9. a) Apply backtracking technique to solve the following graph-coloring problem and also generate the state space tree : 5



- b) Explain the graph coloring problem and write the algorithm for it. 2 + 3
- c) What is meant by union by rank? Explain with an example. 5
10. a) Write the Knuth-Morris-Pratt algorithm for pattern matching and analyze its complexity. 4 + 2
- b) Apply the KMP algorithm for the pattern $p = \text{"ababaca"}$ and string $s = \text{"bacbabababacaab"}$. Show every step. 7
- c) What is meant by LUP decomposition? 2

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

- Max-Flow-Min-Cut Theorem
- 15-Puzzle Problem
- 8-Queen's Problem
- Amortized Analysis
- Dijkstra's Algorithm.
