



मोतीलाल नेहरू राष्ट्रीय प्रौद्योगिकी संस्थान इलाहाबाद
प्रयागराज-211004 (भारत)

Motilal Nehru National Institute of Technology Allahabad
Prayagraj-211004 [India]

Computer Science & Engineering Department
Mid Semester Examination 2022-23 (ODD)

Programme Name: ~~B.Tech./M.Tech./MBA/M.Sc./MCA~~

Semester: 3th

Course Code: CS33104

Course Name: Analysis of Algorithms

Branch: --

Student Reg. No

2021CA075

Duration: 90 Minutes

Max. Marks: 25

Instructions:

1. This question paper comprises 4 (four) compulsory questions.
2. Try to answer the questions serially.
3. It is advisable to design a solution in rough before writing the final algorithm.
4. All the algorithms should be written in steps with proper indentation on conditions and loops.

Marks

- Q1 Prove that: $(n + a)^b = \theta(n^b)$ (4)
- Q2 Given an array A of n random elements. Write algorithms, along with complexity analysis, for the following problems: (4)
- a Find k largest elements in the array using Max Heap. (4)
 - b Find k largest elements in the array using Min Heap. (4)
 - c Find k largest elements in the array using i^{th} Order Statistics. (4)
- Q3 Along with its complexity analysis, write an algorithm to merge k sorted lists, each of length n . (4)
- Q4 Write *Shell Sort* algorithm. Analyze the best and worst case complexity of *Shell Sort*. (2+3)



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Motilal Nehru National Institute of Technology Allahabad
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Computer Science & Engineering Department
End Semester Examination 2022-23 (ODD)

Programme Name: ~~B.Tech./M.Tech./MBA/M.Sc./MCA~~

Semester: 3th

Course Code: C533104

Course Name: Analysis of Algorithms

Branch: --

Student Reg. No

2 0 2 1 C A 0 7 5

Duration: 150 Minutes

Max. Marks: 50

Instructions:

1. This question paper comprises 6 (six) compulsory questions. Try to answer all questions serially.
2. All the algorithms should be written in steps with proper indentation on conditions and loops.

Marks

- Q1 In context of order statistics and "Data Structure Augmentation", write the algorithms with complexity analysis for the following problems:
- a Find the i^{th} order static. (4)
 - b Given order static, find i . (4)
 - c Given a pointer to the order static find i . (4)
 - d Show how to use an order-statistic tree to count the number of inversions in an array of size n . (4)

- Q2 In the context of dynamic programming, answer the following questions:
- a What is Dynamic Programming (DP)? Explain DP with the help of assembly line scheduling problem. (4)
 - b Write the algorithm for the optimal rod cutting problem to maximize the revenue (r) for a given size (s). (4)
 - c Solve the rod cutting problem for the following data: (4)

i	0	1	2	3	4	5	6	7	8	9	10
$r[i]$	0	1	5	8	10	13	17	18	22	25	30
$s[i]$	0	1	2	3	2	2	6	1	2	3	10

Pos. Length

- Q3
- a Explain with example, what do you understand by an algorithm? (4)
 - b Explain with example, what do you understand by a *correct* algorithm? (4)
 - c Explain the concept of asymptotic notations, used to express the complexity of an algorithm. (4)

- Q4 Using "Divide Conquer and Combine" strategy, write an algorithm to find the closest pair of points in a plane. (4)

- Q5 The diameter of a tree $T=(V, E)$ is the largest of all shortest-path distances in the tree. Give an efficient algorithm to compute the diameter of a tree, and analyze the running time of your algorithm. (4)

- Q6 Write Shell Sort algorithm. (2)