NATIONAL INSTITUTE OF TECHNOLOGY, KURUKSHETRA
THEORY EXAMINATION
Question Paper

Month and year: **NOV., 2021**
Program: **B.Tech** Semester: **3rd**
Subject: **Design and Analysis of Algorithms** Course code: **ITPC21**
Maximum Marks: **50** Time allowed: **02 Hours**

Note: Attempt all questions. All questions carry equal marks. Unless stated otherwise, the symbols have their usual meanings in context with subject. Assume suitably and state, additional data required, if any. The candidates, before starting to write the solutions, should please check the question Paper for any discrepancy, and also ensure that have been delivered the question paper of right **course no.** and right **subject title.**

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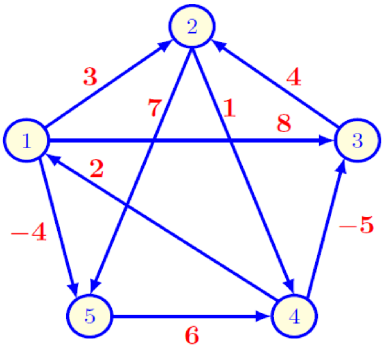
1. (a) Using the master method, you can show that the solution to the recurrence $T(N) = 4T(n/2) + n^2$ is $T(N) = \theta(n^2)$. Show that a substitution proof with the assumption $T(n) \leq cn^2$ fails. Then show how to subtract off a lower-order term to make a substitution proof work.

2. a) Explain the heap-sort algorithm along with its time complexity. Is the array with values <23, 17, 14, 6, 13, 10, 1, 5, 7, 12> a max-heap?
   b) Explain the insertion and deletion algorithm in B-tree along with its time complexities. Explain how to find the minimum key stored in a B-tree and how to find the predecessor of a given key stored in a B-tree.

3. Consider a modification of the rod-cutting problem in which, in addition to a price p_i for each rod, each cut incurs a fixed cost of c. The revenue associated with a solution is now the sum of the prices of the pieces minus the costs of making the cuts. Give a dynamic-programming algorithm to solve this modified problem.

4. Explain the Kruskal and Prim's algorithm with suitable example. Also, discuss their time complexities.

5. Explain Floyd-Warshall Algorithm to find all pair shortest path. Find all pair shortest path of following problem also analyze its complexity.



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