

NATIONAL INSTITUTE OF TECHNOLOGY, KURUKSHETRA
THEORY EXAMINATION
MID-2, Question Paper

Month and year: **Oct, 2021**

Program: **B. Tech**

Subject: **Design and Analysis of Algorithms**

Maximum Marks: **15**

Semester: **3rd**

Course code: **ITPC21**

Time allowed: **50 minutes**

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.

Q-1: The square of a directed graph $G = (V, E)$ is the graph $G^2 = (V, E^2)$ such that $(u, v) \in E^2$ if and only if G contains a path with at most two edges between u and v . Describe efficient algorithm for computing G^2 from G for both the adjacency list and adjacency matrix representation of G . Analyze the running times of your algorithms.

Q-2: Given a weighted, directed graph $G = (V, E)$ with no negative-weight cycles, let m be the maximum over all vertices $v \in V$ of the minimum number of edges in a shortest path from the source s to v . (here, the shortest path is by weight, not the number of edges.) Suggest a simple change to the bellman-ford algorithm that allows it to terminate in $m+1$ passes, even if m is not known in advance.

Q-3: Consider a graph $G = (V, E)$ represented as an adjacency matrix, show prim's algorithm for the same which runs in $O(V^2)$ time.