M12 - Algorithms and Data Structures

asks for a family of paths, each leading from the source to a different vertex in the graph

for a given vertex called the source in a weighted connected graph, find shortest paths to all its other vertices

9 Greedy Technique

The greedy approach suggests constructing a solution through a sequence of steps, each expanding a partially constructed solution obtained so far, until a complete solution to the problem is reached.

feasible, i.e., it has to satisfy the problem's constraints

locally optimal, i.e., it has to be the best local choice among all feasible choices available on that step

irrevocable, i.e., once made, it cannot be changed on subsequent steps of the algorithm

single-source shortest-paths problem

9.3 Dijkstra's Algorithm

This algorithm is applicable to undirected and directed graphs with nonnegative weights only

Dijkstra's algorithm finds the shortest paths to a graph's vertices in order of their distance from a given source.

The time efficiency of Dijkstra's algorithm depends on the data structures used for implementing the priority queue and for representing an input graph itself.

For graphs represented by their adjacency lists and the priority queue implemented as a min-heap, it is in $O(|E| \log |V|)$

$\Theta(|V|^2)$ for graphs represented by their weight matrix and the priority queue implemented as an unordered array.