

CSE208: Data Structures and Algorithms II Sessional

Offline 2: Single source shortest path

Date: 08/12/2021

You have the road network of Bangladesh and the cost to travel each road. You want to find the least-cost path from some city (say Dhaka) to all other cities. You will implement Dijkstra's algorithm for the single source shortest path problem to solve this.

Now, you may be able to earn money by traveling some roads i.e. **costs to travel some roads may be negative**. In this case, you'll need to use the Bellman-Ford algorithm. **You are also interested in checking whether there is any negative weight cycle.**

Task 1: Implement Dijkstra's algorithm for the single source shortest path problem (**all edges have non-negative weights**)

Task 2: Implement Bellman Ford algorithm for the single source shortest path problem **when edges may have negative weights and to check whether a graph has a negative cycle reachable from the source**

Input: The first line of the input file will contain the number of vertices n (≤ 1000) and the number of edges m (≤ 10000) followed by m lines each containing origin u , end v and weight w (≤ 100000) of an edge of the **directed graph**. **The last line will contain a source vertex s and a destination vertex d .**

Deadline: : 14/12/2021 11:55 pm

Sample input and output (for Dijkstra's algorithm):

9 17 0 7 60 7 1 150 4 8 70 6 4 80 5 1 4000 8 0 100000 2 3 200 8 2 1000 0 3 300 3 8 50000 3 7 200 2 5 120 6 3 1500 4 0 90 5 7 50 1 6 100 4 1 90 0 5	Shortest path cost: 1580 0 -> 7 -> 1 -> 6 -> 4 -> 8 -> 2 -> 5
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Sample input and output (for Bellman-Ford algorithm):

9 17 0 7 60 7 1 -150 4 8 -70 6 4 80 5 1 4000 8 0 100000 2 3 -200 8 2 1000 0 3 300 3 8 50000 3 7 -200 2 5 120 6 3 1500 4 0 90 5 7 -50 1 6 100 4 1 -90 0 5	The graph does not contain a negative cycle Shortest path cost: 1140 0 -> 7 -> 1 -> 6 -> 4 -> 8 -> 2 -> 5
4 4 0 1 1 1 2 -1 2 3 -1 3 0 -1 0 3	The graph contains a negative cycle