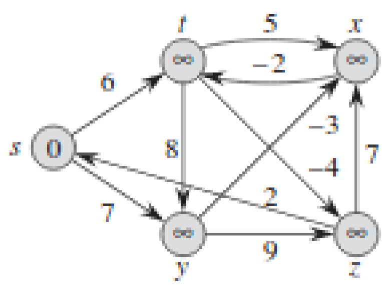
Practice Questions

Single Source Shortest path
Data Structures

March 23, 2018

Problem 1.



Run Bellman-ford algorithm on the above graph with node Z as the source, you may relax the edges in a fixed order, however fix keep the same order for all iterations
Modify the edge weight of edge (z,x) to 4 and run the algorithm with node s as the source.

Problem 2. Modify the Bellman-Ford algorithm so that it sets distance as - ∞ for all vertices for which there is a negative-weight cycle on some path from the source to that vertex.

Problem 3. For a weighted directed graph, write an algorithm to find all the vertices which are part of a negative edge cycle.

Problem 4. We know that the Bellman Ford algorithm relaxes all edges of the graph in every iteration. Consider the scenario wherein in every iteration of the BF algorithm, a new ordering of the edges is to be used to relax them. Would this provide a correct result to the shortest path finding algorithm ?

Problem 5. For a directed graph having V vertices and having no negative cycles, if instead of running the outer loop of Bellman Ford Algorithm for V - 1 iterations, it is run for V iterations, the distances computed by the algorithm may be wrong. State True / False.

Problem 6. Run Dijkstra's algorithm on the same graph as in question 1, with vertex s as source in one instance and with vertex z as source in another.

Problem 7. Give a simple example of a directed graph with negative-weight edges for which Dijkstras algorithm produces incorrect answers

Problem 8. Suppose Dijkstra is modified to pick in each iteration one of the reachable nodes at maximum distance instead of minimum distance. Is it possible to find the longest path from the source to all vertices in the graph using the modified Dijkstras algorithm in case of non-negative edge weights. Either prove or provide a counter-example

Problem 9. Give an efficient algorithm to count the total number of paths in a directed acyclic graph.

Problem 10. True/False : Dijkstras algorithm relaxes the edges of every shortest path in the graph in the order in which they appear on the path. If false give counter example, prove the claim if true.

Problem 11. Give an example of a weighted, directed graph which satisfies the following property : For every edge (u,v), there is a shortest path tree rooted at a source vertex s such that (u,v) contains s and another shortest path tree rooted at s that doesn't contain edge (u,v) .