

## Exercises for Lecture 7

March 22, 2024

*Exercise 1.* Given a weighted, directed graph  $G = (V, E, W)$  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.

*Exercise 2* (Cormen 24.3-4). Professor Gaedel has written a program that he claims implements Dijkstra's algorithm. The program produces  $d[v]$  and  $\pi[v]$  for each vertex  $v \in V$ . Give an  $O(|V| + |E|)$ -time algorithm to check the output of the professor's program. It should determine whether the  $d$  and  $\pi$  attributes match those of some shortest-paths tree. You may assume that all edge weights are nonnegative.