# CS325: Analysis of Algorithms, Winter 2024

## Practice Assignment 3

## Due: Thur, 2/22/24

**Homework Policy:**

1. Students should work on practice assignments individually. Each student submits to CANVAS one set of *typeset* solutions in pdf format.
2. Practice assignments will be graded on effort alone and will not be returned. Solutions will be posted.
3. The goal of the assignments is for you to learn solving algorithmic problems. So, I recommend spending sufficient time thinking about problems individually before discussing them with your friends.
4. You are allowed to discuss the problems with others, and you are allowed to use other resources, but you *must* cite them. Also, you *must* write everything in your own words, copying verbatim is plagiarism.

**Problem 1.**

(a) Find a graph that has multiple minimum spanning trees.

(b) Prove that any graph with distinct edge weights has a unique minimum spanning tree.

(c) Find a graph with non-distinct edge weights that has a unique minimum spanning tree (can you generalize (b)?).

**Problem 2.** A number maze is an $n \times n$ grid of positive integers. A token starts in the upper left corner; your goal is to move the token to the lower-right corner. On each turn, you are allowed to move the token up, down, left, or right; the distance you may move the token is determined by the number on its current square. For example, if the token is on a square labeled 3, then you may move the token three steps up, three steps down, three steps left, or three steps right. However, you are never allowed to move the token off the edge of the board. Describe and analyze an efficient algorithm that either returns the minimum number of moves required to solve a given number maze, or correctly reports that the maze has no solution. For example, given the number maze in the figure below, your algorithm should return the integer 8.