COSC 302: Analysis of Algorithms — Spring 2018

Problem Set 7 — Minimum Spanning Trees and Single Source Shortest Paths Due by 4:30pm Friday, March 30, 2018 as a single pdf via Moodle (either generated via LaTeX, or concatenated photos of your work). Late assignments are not accepted.

This is an *individual* assignment: collaboration (such as discussing problems and brainstorming ideas for solving them) on this assignment is highly encouraged, but the work you submit must be your own. Give information only as a tutor would: ask questions so that your classmate is able to figure out the answer for themselves. It is unacceptable to share any artifacts, such as code and/or write-ups for this assignment. If you work with someone in close collaboration, you must mention your collaborator on your assignment.

Suggested practice problems, from CLRS: 23.1-3; 23.1-6; 23.2-4; 23.2-5; 24.1-1

1. Problem 23.1-1 from CLRS. Let $G = (V, E)$ be a connected undirected graph. Let (u, v) be a minimum weight edge. Let there be T which is some subset of E that does not contain a vertex u. Since (u, v) is a minimum weight edge, it is a safe edge. And a minimum spanning tree must contain all vertices including v the edge (u, v) will be added.

2. Problem 23.2-8 from CLRS.
   Invariant: G_1 and G_2 are minimim spanning trees.
   Maintenance: if G_1 and G_2 are one vertex, Then add the edge between them that's in E. Otherwise, search for an minimum weight edge (u, v) such that $(u, v) \notin E_1$ and $(u, v) \notin E_2$. Recall that both G_1 and G_2 are components since they are two seperate minimum spanning trees and (u, v) is a light edge. So by Corollary 23.2, a light edge connecting two components that are minimum spanning trees is considered safe and thus creates a larger minimum spanning tree.
   Termination: Terminates when G_1 and G_2 are combined and the result contains all vertices in V.

3. Problem 24.1-6 from CLRS. *Hint: Consider running Bellman-Ford more than once.*

4. Problem 24.3-4 from CLRS.