You will be randomly assigned groups to work on these problems in discussion section. List your group members on your worksheet and turn it in at the end of class.

**Problem 1. Dijkstra.**

(a) Execute Dijkstra’s algorithm to find a shortest path from node $s$ to rest of the nodes.

(b) Draw an edge between $a$ and $b$ with a weight of -1000. Is there such a thing as a shortest path between $s$ and $t$ in our new graph?

**Problem 2. Minimum Spanning Tree.**

Run Prim’s and Kruskal’s algorithm on the previous graph, including the negative edge that was added.

**Problem 3. Minimum Spanning Tree.**

Consider the Minimum Spanning Tree Problem on an undirected graph $G = (V, E)$, with a cost $c_e \geq 0$ on each edge, where the costs may not all be different. If the costs are not all distinct, there can in general be many distinct minimum-cost solutions. Suppose we are given a spanning tree $T \subseteq E$ with the guarantee that for every $e \in T$, $e$ belongs to some minimum-cost spanning tree in $G$. Can we conclude that $T$ itself must be a minimum-cost spanning tree in $G$? Give a proof or a counterexample.