You may discuss these problems with your classmates, but you must write up your solutions independently, without using common notes or worksheets. You must indicate at the top of your homework who you worked with. Your write up should be clear, and concise. You are trying to convince a skeptical reader that your answers are correct. Your homework should be submitted via Autolab (https://autolab.cs.cmu.edu/02713-s13/) as a typeset PDF. A LaTeX tutorial and template are available on the class website if you choose to use that system to typeset.

AD = “Algorithm Design” by Kleinberg&Tardos

1. Solve problem 4.1 in AD.

2. Solve problem 4.8 in AD.

3. Solve problem 4.10 in AD.

4. Solve problem 4.19 in AD.

5. You are given an undirected graph $G = (V, E)$ with edge weights $d(u, v)$, which you can assume are all distinct, and you are given a minimum spanning tree $T$ on $G$. You expect one of the edges of $G$ to disappear at some time in the future, but you don’t know which edge it will be, and when the edge does disappear, you’ll need to find another minimum spanning tree very quickly. For example, the MST represents a communication network for stock traders, and if a link fails, you have to fix it as fast as possible.

Give an efficient algorithm to preprocess $T$ and $G$ to label each edge $e$ in $T$ with another edge $r(e)$ of $G$ so that if $e$ disappears, adding $r(e)$ to the tree creates a new minimum spanning tree in the modified graph.