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## CS 374 LAB 20: SPANNING TREES

Date: April 4, 2018.

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**Problem 1.** [Category: Proof] Suppose we are given both an undirected graph  $G$  with weighted edges and a minimum spanning tree  $T$  of  $G$ . In all cases, the input to your algorithm is the edge  $e$  and its new weight; your algorithms should modify  $T$  so that it is still a minimum spanning tree. Of course, we could just recompute the minimum spanning tree from scratch in  $O((|E| + |V|) \log |V|)$  time, but you can do better.

1. Describe an efficient algorithm to update the minimum spanning tree when the weight of one edge  $e \in T$  is decreased.
2. Describe an efficient algorithm to update the minimum spanning tree when the weight of one edge  $e \notin T$  is increased.
3. Describe an efficient algorithm to update the minimum spanning tree when the weight of one edge  $e \in T$  is increased.
4. Describe an efficient algorithm to update the minimum spanning tree when the weight of one edge  $e \notin T$  is decreased.

**Problem 2.** [Category: Design] Let  $G = (V, E)$  be an undirected graph where each edge has a weight from the set  $\{1, 10, 25\}$ . Describe a *linear-time* algorithm to find an MST of  $G$ .