

# Homework 5 Optional Problems

Consider an undirected graph  $G = (V, E)$  with nonnegative edge costs. You are given a set  $T \subseteq V$  of  $k$  vertices called terminals. A Steiner tree is a subset  $F \subseteq E$  of edges that contains a path between each pair of terminals. For example, if  $T = V$ , then the Steiner trees are the same as the connected subgraphs. It is a fact that the decision version of the Steiner tree problem is NP-complete. Give a dynamic programming algorithm for this problem (i.e., for computing a Steiner tree with the fewest number of edges) that has running time of the form  $O(c^k \cdot \text{poly}(n))$ , where  $c$  is a constant (like 4) and  $\text{poly}$  is some polynomial function.

**ANSWER:** Dreyfus-Wagner's algorithm can compute a Steiner tree in  $O(3^k n^2)$  time. See [this](#) paper.

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