

# MPRI Algorithms Lab: The Steiner Tree Problem

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## 1 Problem Modeling

### 1.1 Problem Definition: Minimum Steiner Tree

The following is the standard formal definition of the Minimum Steiner Tree problem, as found in the compendium.

**Instance:** A complete graph  $G = (V, E)$ , a metric given by edge weights  $w : E \rightarrow \mathbb{Z}^+$ , and a subset of required vertices  $S \subset V$ .

**Solution:** A Steiner tree, i.e., a subtree of  $G$  that includes all the vertices in  $S$ .

**Measure:** The sum of the weights of the edges in the subtree, which is to be minimized.

**Good News:** The problem is approximable within a ratio of  $1 + \ln(3)/2 \approx 1.55$ . In your project file, this approximation ratio is simplified to 2.

**Bad News:** The problem is APX-complete.

**Garey and Johnson:** ND12.