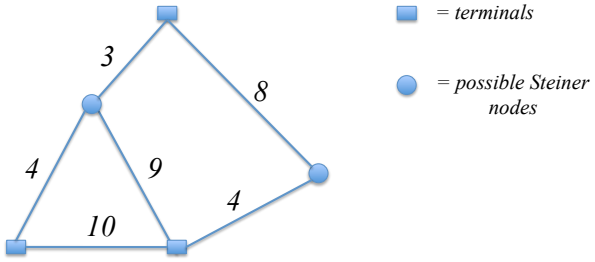
PhD Doctoral Course – Network Design – 6th October 2009

4th Assignment

1. Consider the primal-dual algorithm shown in the lecture, applied on instances of the Minimum Spanning Tree problem. Does the algorithm output an optimal solution for such instances?

2. Give an instance of the Minimum Spanning Tree problem where the integrality gap of the formulation shown in the lecture tends to 2 as the number of nodes tends to ∞.

3. Apply the primal-dual algorithm shown in the lecture to the following instance of the Steiner tree problem:



4. A function $f : 2^V \rightarrow \{0,1\}$ is called *downwards monotone* if $f(S) \leq f(T)$ for all $S \supseteq T \neq \emptyset$. Show that the primal-dual algorithm shown in the lecture is a polynomial time 2-approximation algorithm for problems that can be modeled using downwards monotone functions.

5. Show that the class of $\{0,1\}$-proper functions is incomparable to the class of $\{0,1\}$-downwards monotone functions: neither class is contained in the other.