



Assignment 1, Selected Topics in Combinatorial Optimization, Summer term 2014

Tobias Mömke

<http://www-cc.cs.uni-saarland.de/course/44/>

Due: 23 April 2014

Exercise 1.1 (10 Points) Consider the polytope P determined by $Ax \geq b$, where

$$A = \begin{pmatrix} -1 & -1 & -1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \text{ and } b = \begin{pmatrix} -4 \\ 1 \\ 1 \\ 1 \end{pmatrix}.$$

Determine all faces of P as convex combinations and specify which of them are the vertices and facets.

Exercise 1.2 (10 Points) When formulating problems as linear programs, usually we are interested in finding integer solutions. The *integer hull* of a polyhedron P is the convex hull of the integer vectors within P , that is, the set of all points in P that are convex combinations of points from $\{x : Ax \leq b, x \in \mathbb{Z}^n\}$ where we assumed that P is determined by $Ax \leq b$ and that x is an n -vector. (More background on integer polyhedra is given in Chapter 5 of Korte, Vygen).

Show that the integer hull of $\{x \in \mathbb{R}^2 : x_2 \leq \sqrt{2}x_1\}$ is not a polyhedron.