

Spring Semester 2005
Topics in Computation Theory (CS700)
Discrete Geometry
Homework 4

This homework is due on *Wednesday April 13*, at the beginning of the (extra) class at 4:00 p.m.

On the top of the first sheet that you turn in, please put (a) your name and student number, (b) how much time you spent working on the homework, and (c) a little table with your self-evaluation as explained on the course webpage.

1. For a set $X \subseteq \mathbb{R}^d$, let $\text{ex}(X) := \{x \in X \mid x \notin \text{conv}(X \setminus \{x\})\}$ denote the set of extremal points of X . Find a convex set $C \subseteq \mathbb{R}^d$ with $C \neq \text{conv}(\text{ex}(C))$.
2. Prove that if $V \subset \mathbb{R}^d$ is affinely independent, then each subset $F \subseteq V$ determines a face of the simplex $\text{conv}(V)$.
3. Show that every convex polytope in \mathbb{R}^d is an orthogonal projection of a simplex in some higher-dimensional space \mathbb{R}^n (where we assume that \mathbb{R}^d is contained in \mathbb{R}^n as a d -dimensional linear subspace).