
MA-INF 1203 Discrete and Computational Geometry

Wintersemester 2019/20

Assignment 2

To be discussed: **22/23**. October 2019

1 Affine Hull

- For any set $X \subseteq \mathbb{R}^d$, let $\text{aff}_\cap(X)$ denote the intersection of all affine subspaces of \mathbb{R}^d containing X .
- For any set $X \subseteq \mathbb{R}^d$, let $\text{aff}_c(X)$ denote the set of all affine combinations of points of X .

Prove that $\text{aff}_\cap(X) = \text{aff}_c(X)$.

2 Convex Hull

- Prove that the set of all convex combinations of $x_1, \dots, x_n \in \mathbb{R}^d$ is a convex set.
- Prove by induction on n that the set of all convex combinations of $x_1, \dots, x_n \in \mathbb{R}^d$ is contained in the convex hull of the set $\{x_1, \dots, x_n\}$.
- Prove that for any closed set X the convex hull $\text{conv}(X)$ is equal to the intersection of all closed halfspaces that contain X .

3 Translated copies

Let $K \subset \mathbb{R}^d$ be a convex set and let $C_1, \dots, C_n \subseteq \mathbb{R}^d$, $n \geq d+1$, be convex sets such that the intersection of every $d+1$ of them contains a translated copy of K . Prove that the intersection of all sets C_i also contains a translated copy of K that is $\exists t \in \mathbb{R}^d : \{t+x \mid x \in K\} \subseteq \bigcap_{i=1}^n C_i$.