Leibniz Universität Hannover

WiSe 2024/25
Prof. Dr. Michael Cuntz

Algebraic and Topological Methods in Discrete Mathematics

Finite reflection groups, hyperplane arrangements, and (oriented) matroids

7. Homework sheet

Problem 1. Let $\mathbb{F}_q$ be a finite field and $\mathcal{A}$ the arrangement of hyperplanes consisting of all linear hyperplanes in $\mathbb{F}_q^\ell$. Compute the number $|\mathcal{A}|$ of hyperplanes.

Problem 2. Compute the intersection lattice and the number of chambers of the arrangement of hyperplanes in $\mathbb{R}^3$ given by

$$Q(\mathcal{A}) = xyz(x+y)(y+z)(x+z)(x+y+z).$$

Problem 3. Compare the braid arrangement in $\mathbb{R}^{\ell+1}$ with the arrangement in $\mathbb{R}^\ell$ given by

$$Q(\mathcal{A}) = \prod_{1 \leq i \leq j \leq \ell} (x_i + \ldots + x_j).$$