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Discrete Geometry I

Homework # 6 — due ??

Two weeks time for this sheet. Please mark **three** problems that will be graded.

Exercise 1.
i) What is the diameter of the permutahedron $\Pi_{d-1} = \Pi(1, 2, \ldots, d)$?
ii) What is the diameter of a zonotope $Z = \sum_{i=1}^{k} [-z_i, z_i]$?
iii) True or false: If P is centrally-symmetric, then $\operatorname{diam}(P) = \operatorname{dist}(u, -u)$ for some $u \in V(P)$.

(?? points)

Exercise 2. Let $P \subset \mathbb{R}^3$ be a three dimensional polytope.
i) What is the f-vector of the truncation of P at a vertex v?
ii) What is the operation polar to truncating a vertex?
iii) Let

$$\mathcal{F}_3 = \{(f_0, f_1, f_2)\mathbb{Z}^3 : f_0 - f_1 + f_2 = 2, f_0 \leq 2f_2 - 4, f_2 \leq 2f_0 - 4\}$$

Show that every $f \in \mathcal{F}_3$ is the f-vector of a 3-polytope.

(?? points)