

Discrete and Algorithmic Geometry

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Sheet 2

due on Monday, November 28, 2016

WRITING

- (1) Matoušek, *Lectures on Discrete Geometry*, Exercises 5.1.2, 5.1.3
- (2) Let $Q = C_4(7)^\Delta$, the polar dual of the 4-dimensional cyclic polytope on 7 vertices.
 - (a) Calculate $f(Q) = (f_0, f_1, f_2, f_3)$, the f -vector of Q .
 - (b) How many combinatorially distinct facets does Q have? Draw one example of each combinatorial type. Now select a vertex $q \in Q$ and draw all facets incident to q .
- (3) Let P be the *24-cell*, $P = \text{conv}\{\pm e_i \pm e_j : 1 \leq i, j \leq 4, i \neq j\}$ where (e_1, \dots, e_4) is the standard basis of \mathbb{R}^4 . Describe the face lattice of P , and prove that P is *self-polar-dual* (it has the same combinatorial type as its polar dual).