

Institutionen för matematik **KTH**
Svante Linusson
790 94 44

Hand-in-problems for Convex Polytopes VT13
First set of problems

This list of problems will be extended during the course.

Cooperation regarding the hand-in-problems is not permitted.

You must have written your solution on your own. Any external source used must be cited.

List of Hand-in problems

- 1) Draw the face lattice of the $Pyr(\Delta_1 \times \Delta_1)$.
- 2) Is $(\Delta_2 \times \Delta_2)^\Delta \simeq C_4(6)$?
- 3) Construct a small poset that satisfies the conditions (i), (iii) and (iv) of Theorem 2.7 but is not the face lattice of a convex polytope (verify this). Does your example correspond to some geometric object?
- 4) Assume that one is given the vertex-facet incidence matrix $M(P) \in \{0, 1\}^{m \times n}$ of a polytope P with n facets and m vertices. How can the face lattice of the polytope P be uniquely reconstructed from the knowledge of $M(P)$ alone? How does the dimension of P appear in the computation? How does your algorithm fail if the matrix you apply it to is not the vertex-facet matrix a polytope? What is the relation between the matrices of P and P^Δ ?
- 5) Study the combinatorics of the traveling salesman polytope $Q_{TSP}(5)$. How many vertices does it have? What is its dimension? (The answer is in the book, but you should prove it.) Which vertices are connected by edges?

Problems 1-5 are **due 15/2**

Good Luck!!

Svante