

## Problem sheet 9

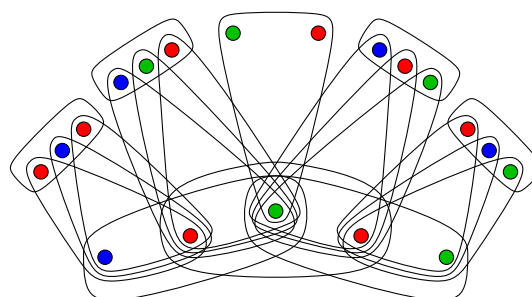
Problems will be discussed at the problem class on **January 11, 2017**.

### Problem 18.

Prove a  $d$ -dimensional Erdős-Szekeres Theorem, i.e., prove that for all positive integers  $k$  and  $d$  there exists  $N \in \mathbb{N}$  such that every set of  $N$  points in  $\mathbb{R}^d$  in general position (no  $d+1$  points lie on a common  $(d-1)$ -dimensional hyperplane) contains  $k$  points in convex position.

### Problem 19.

Determine all pairs  $(c, k)$  for which the hypergraph on the right admits a  $k$ -good  $c$ -coloring.



A 2-good 3-coloring of a hypergraph on 19 vertices and 20 edges.

### Puzzle 9.

Imagine two pyramids, one with triangular base and one with square base, but both with all edges of length 1. If you glue the two pyramids along a triangular facet, how many edges does the resulting object have?

### Puzzle 9+. (Let's hope for many pens from Santa Claus...)

How many cylinders with infinite length and unit width can be placed in the space  $\mathbb{R}^3$  so that they are pairwise touching but interiorly disjoint?