

## Math 591: Graduate Combinatorics Spring 2010

**Instructor:** Prof. Patricia Hersh  
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Office: 3122 SAS Hall  
Office Hours: by appointment

**Class Meeting Time and Location:** TuTh 1:30-2:45pm, SAS Hall 1218.

**Text:** Lectures on Polytopes, by Günter Ziegler

**Prerequisites:** None

**Course Topics:** Geometric and Topological Combinatorics. Topics will include many of the following: polytopes, polyhedra and cones, examples of associahedra and permutohedra, Farkas Lemma, simple and simplicial polytopes, polytope duality, face numbers and face lattices, graphs of polytopes, connections to linear and integer programming, Hirsch Conjecture and  $d$ -step Conjecture, Steinitz Theorem for 3-polytopes, Schlegel diagrams, matroids and oriented matroids, geometric lattices and hyperplane arrangements, shellability (line shelling and shellability of geometric lattices), Zaslavsky's region counting formulas, neighborliness of cyclic polytopes, Stanley-Reisner rings and  $h$ -numbers as Hilbert series, constraints on face numbers including the Upper Bound Theorem and  $g$ -theorem, discrete Morse theory.

**Homework:** There will be recommended problems, some of which will be collected.

**Grading:** Course grades will be determined by homework, one take-home midterm exam, and one final exam. Each will count for  $1/3$  of your grade.

**Class Participation:** Please do not hesitate to ask questions in class. It helps everyone!

I hope you enjoy this course and learn a lot!