

## MATH 595 SPRING 2016: POLYHEDRA IN THE WILD

**Instructor:** Ruth Davidson, redavid2@illinois.edu, <http://www.math.uiuc.edu/~redavid2>

**Meeting Time/Place:** 143 Henry Building, TR from 12:30 pm to 1:50 pm.

**Course Description:** This course covers methods for using basic tools from theoretical polyhedral geometry and linear programming to attack problems in other areas of pure and applied mathematics. Take this course if you are interested in any or all of these goals:

- (1) learning about a fun, useful topic in pure and applied mathematics
- (2) getting a basic foundation in theoretical polyhedral geometry and its connections to optimization/operations research
- (3) using polyhedra in your **own research** for forming conjectures and proving theorems. (towards this end, we'll cover some connections to active areas of research at UIUC)

For item (2), we'll cover background topics such as  $H$ - and  $V$ -representations of polyhedra, polyhedral fans, recession cones, lineality spaces,  $f$ -vectors and  $h$ -vectors of polyhedra, polytopal complexes and shellability, and Weird, Important, and Famous polyhedra.

For item (3), we'll look at topics such as

- Polyhedra commonly associated to other combinatorial structures
- Polyhedra from graphs and graphs from polyhedra
- Polyhedra and algebraic geometry: toric ideals and Newton polytopes
- Useful connections between polyhedra and number theory
- Polyhedra from problems in biology and algebraic statistics (polyhedral methods in phylogenetics, characteristic imset polytopes, polyhedra from bayesian networks, ....)

**Course content will be tailored to the backgrounds and interests of students who enroll.**

**Text:** *Lectures in Geometric Combinatorics* by Rehka Thomas. In the AMS Bookstore Student Mathematical Library: 2006; 143 pp; softcover Volume: 33 ISBN-10: 0-8218-4140-8, ISBN-13: 978-0-8218-4140-2 List Price: \$ 25.60, as well as survey articles and papers relevant to item (3).

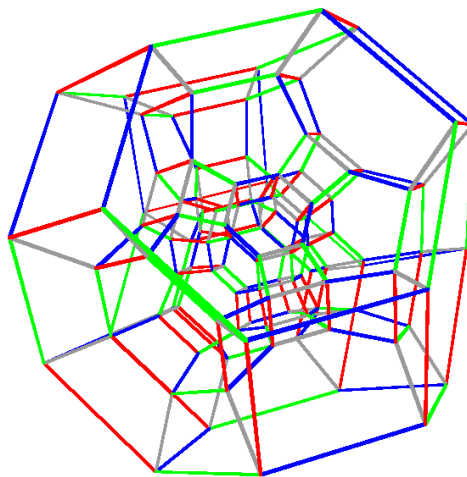


Image Courtesy Alexander E. Holroyd of Microsoft Research