L165100   Algebraic Combinatorics, Fall 2010

Instructor: Shih-Wei Yang

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Office Hours: By appointment.

Prerequisites: Basic knowledge of linear algebra and group theory.

Course description:

This course is an introductory course in algebraic combinatorics. There are almost no combinatorial prerequisites, while on the algebraic side one needs working knowledge of basic linear algebra.

The subject of algebraic combinatorics is interplay between algebra and combinatorics. This is beneficial for both disciplines. On the one hand, algebraic methods can be used with much success for studying classical combinatorial objects such as graphs, posets, etc. On the other hand, there are many algebraic questions that can be stated in combinatorial terms and solved by combinatorial methods, sometimes bringing to life new combinatorial concepts of independent interest. This course discusses both kinds of development.

The choice of topics to be discussed is flexible and will take into account students' interests. Here is a list of possible topics:

- Catalan numbers, triangulations, noncrossing partitions.
- Symmetric group, statistics on permutations.
- Partially ordered sets and lattices, Sperner's and Dilworth's Theorems.
- q-binomial coefficients, Gaussian coefficients and Young diagrams.
- Young's lattice, tableaux, and Schensted's correspondence.
- Partitions, Euler's pentagonal theorem, Jacobi triple product.
- Noncrossing paths, Lindstrom lemma (Gessel-Viennot method).
- Matrix-Tree theorem, electrical networks, walks on graphs.
- The Möbius function and Möbius inversion on posets.
- Rational (ordinary) and exponential generating functions.

Grading: The grade will be based on homework assignments, and possibly students' presentations.