

**MATH 533 ALGEBRAIC COMBINATORICS  
SPRING 2022 SYLLABUS**

GRETA PANOVA

**Location and meeting times:** MWF 1-1:50, THH 214 (in person, offline).

Instructor Office Hours: M 3:30-5 (in KAP), F 2:30-3:30 (in KAP), by appointment (over zoom), or via slack.

**Course description.** In the first part of the course we will study the basic objects of *Algebraic Combinatorics*, whose roots stem in the representation theory of the symmetric and general linear group – symmetric functions (especially Schur functions), standard and semi-standard Young tableaux, the RSK correspondence, the characters of  $S_n$ , permutation enumeration etc.

In the second part of the course we will discuss recent developments including Littlewood-Richardson and Kronecker coefficients, LLT and Macdonald polynomials, chromatic symmetric functions etc. Applications of these topics range from Geometric Complexity Theory to Integrable Probability, Statistical Mechanics.

**Prerequisites.** Math 532 or equivalent and Abstract Algebra.

**Textbooks and sources.** Richard P. Stanley, *Enumerative Combinatorics* Volume 2, 1999 (first and only edition) and Bruce Sagan, *The Symmetric group* (second edition). These will be the main sources for 2/3 of the course.

For the second part of the course we will use more recent research papers and other sources, available online.

Other useful sources are

Ian Macdonald, *Symmetric functions and Hall polynomials*, second edition.

William Fulton, *Young tableaux*.

**Grading.** For the first two months there will be problem sets, one every 2 weeks. Students will be expected to present some of these problems in class. In lieu of a final exam there will be a final project – a 10 page expository paper on a recent research topic within Algebraic Combinatorics.

**Schedule.** The daily course schedule including contents of each lecture, and homework assignments will be regularly posted on the blackboard course website.