MATH 506 REPRESENTATION THEORY, SPRING 2022

PROFESSOR RINAT KEDEM

This course will cover the basics of representation theory of groups, algebras, and certain geometric objects.

Representation theory is a vast subject and comes in many flavors. This course will emphasize combinatorial representation theory, and aspects of representation theory useful in or motivated by mathematical physics.

We will start with the standard theory of representations of finite groups: Group homomorphisms from G into the general linear group $GL(V)$ where V is any finite dimensional vector space. The most important example is the symmetric group S_N for any finite N. This is best studied in conjunction with the representation theory of the general linear group itself, via the Schur-Weyl duality. This part of the course corresponds to the first six chapters of Fulton and Harris, together with a deep dive into the material in the appendices, particularly symmetric function theory.

In the rest of the course, we will cover select topics beyond finite groups: Lie algebra representations, quiver representations, and some affine algebras, as well as quantum deformations, as time allows.

References will be distributed throughout the semester, generally materials available online.

Expectation from the students: There will be suggested homework problems, and students are encouraged to work out the basic examples for themselves each week. It is highly recommended that solutions to selected problems designated to be handed in should be LaTex-ed. Students should be prepared for in-class discussion of the suggested problems. Group work is highly encouraged. At the end of the semester, each student will prepare and deliver a short in-class presentation about material related to the course.

Prerequisites: Knowledge of math 500 and prior review of linear algebra is assumed. The material in Math 501 is not assumed.