

# Math 553a/353a - Introduction to Representation Theory

**Instructor:** Anna Lachowska, 404 DL. **Schedule:** TTH 2:30 - 3:45pm, 205 LOM.

We will study the following topics:

- (1) **Associative algebras.** Examples. Generators and relations. Ideals. Tensor products.
- (2) **Representations of associative algebras.** Basic notions: subrepresentation, quotient, direct sums, tensor products, dual representation. Irreducible and indecomposable representations. Schur's lemma. Density theorem. Filtrations. The theorems of Jordan-Holder and Krull-Schmidt.
- (3) **Complex representations of finite groups.** Complete reducibility. Characters, orthogonality relations. Tables of characters. Degrees of irreducible representations. Burnside's theorem. Induced representations. Frobenius reciprocity. Representations of the symmetric group. Schur-Weyl duality.
- (4) (time allowing) **Further examples of representations.** Compact groups. Lie algebras. Quivers.

Depending on the background and interest of the audience, we will review basic elements of the group theory: homomorphism theorems, normal subgroups, conjugacy classes, solvable and nilpotent groups.

The **main text** for the course is

P. Etingof et. al., *Introduction to Representation Theory*, AMS, Student Mathematical Library, volume 59.

Other useful references include:

J.-P. Serre, *Linear Representations of Finite Groups* (Parts I and II).

M. Artin, *Algebra* (Chapters 2 and 6).

C. Teleman, *Representation Theory*,

<http://math.berkeley.edu/%7Eteleman/math/RepThry.pdf>

Andrew Baker, *Representations of Finite Groups*,

<http://www.maths.gla.ac.uk/~ajb/dvi-ps/groupreps.pdf>

Peter Webb, *Finite Group Representations for the Pure Mathematician*,

<http://www.math.umn.edu/~webb/RepBook/index.html>

**Grading policy:** There will be several homework assignments (60%) and a final exam (40%).