Syllabus for MATH 353
Introduction to Representation Theory
Fall 2018

1. About the Course

Representation theory studies symmetries of various structures. It is a beautiful mathematical subject that has applications in combinatorics, geometry, number theory, and physics.

Major topics to be covered:

- Group theory and Ring theory
- General results of representation theory: Schur lemma, Density theorem, semisimple algebras, finite dimensional algebras, characters, Jordan-Hölder theorem, Krull-Schmidt theorem
- Representations of finite groups I: Maschke's theorem, characters, Frobenius determinant
- Representations of finite groups II: Frobenius-Schur indicator, algebraic numbers and integers, Frobenius divisibility, Burnside's theorem
- Induced representations: construction, Frobenius character formula, Frobenius reciprocity
- Representations of S_n: construction, Frobenius character formula, hook length formula
- Schur-Weyl duality and Double Centralizer theorem
- Algebraic $\mathrm{GL}(V)$-representations: classification, Schur polynomials, Weyl character formula
- Representations of $\mathrm{GL}_2(\mathbb{F}_q)$: character table
- Representations of $\mathrm{SL}_2(\mathbb{F}_q)$ and alternating group A_n

2. Lectures

Location: LOM 202
Time: TTh 9:00–10:15am
First class: August 30, 2018

Instructor: Sasha Tsymbaliuk
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Office: LOM 219-C
Office hours: Tue 3:00–4:00pm, Wed 11:00–12:00am

3. Prerequisites

A good knowledge of linear algebra and some knowledge of abstract algebra may be helpful. There is no required textbook for this class.

4. Grading

The grade will be based on Homework (75%) and the take-home Final Exam (25%).
A weekly homework will be assigned every Thursday and will be due next Thursdays in class.