

Pure Math 945

Combinatorial Representation Theory

Class times and place: WF from 11:30-12:50 in MC 5403

Instructor: Ben Webster

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Office Hours: Wednesday 1–2PM, Friday 10–11AM

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Description

This course covers certain connections between representation theory and combinatorics. The first and most familiar example we'll cover is the representation theory of symmetric groups following the approach of Vershik and Okounkov. This allows to understand the representations of all symmetric groups simultaneously, by studying the structure of induction and restriction functors. In particular, this gives a natural and simple explanation of the connection of symmetric groups to tableaux.

Then, we'll discuss generalizations of this approach, to (affine) Hecke algebras, and then allow this to lead us to a much more recent topic in representation theory, Khovanov-Lauda-Rouquier algebras. These algebras are closely tied to the categorification of representations of Lie algebras, and we will develop their theory to consider topics like Lusztig's canonical basis, and Broué's conjecture in the context of symmetric groups.

Background

The main background expected is solid knowledge of basic group and ring theory. Familiarity with the representation theory of finite groups (as in PMATH 745) will be a big plus, as will a little knowledge of Lie algebras (for example, root systems), but concepts from these domains will be introduced when they are needed.

Texts

This class will have no official text; we'll mostly read directly from the literature in addition to notes I'll provide. Kleshchev's book "Linear and Projective Representations of the Symmetric Groups" could be a useful adjunct.

Grades and assignments

The grade will be based on a final paper and class presentation.

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