

Representation Theory of Symmetric Groups (L24)

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The representation theory of symmetric groups is a classical subject with many connections across mathematics, computer science and physics. The rich interplay between algebra and combinatorics in the representation theory of symmetric groups has led to the development of a deep yet versatile theory, which has kept the topic at the forefront of modern research.

In this course, we will develop some of the techniques underpinning both the proof of the McKay Conjecture for symmetric groups, as well as other key results in the area from the last few years. Time permitting, we will cover:

- Combinatorics of partitions I: Young diagrams and tableaux.
- Specht modules and simple modules for symmetric groups.
- Standard basis for Specht modules.
- Hook length formula for dimensions.
- Combinatorics of partitions II: Olsson's approach.
- McKay numbers for symmetric groups.
- Representation theory of the Sylow subgroups of the symmetric groups.

Pre-requisites

Part IB Groups, Rings and Modules and Part II Representation Theory (or equivalent).

Literature

1. G. D. James, *The Representation Theory of the Symmetric Groups*. Lecture Notes in Mathematics **682**, Springer, Berlin, 1978.
2. G. D. James and A. Kerber, *The Representation Theory of the Symmetric Group*. Encyclopedia of Mathematics and its applications vol. 16, Addison-Wesley, 1981.
3. J. Olsson, *Combinatorics and Representations of Finite Groups*, Vorlesungen aus dem Fachbereich Mathematik der Universität GH Essen, Heft 20, 1994.

Additional support

Four examples sheets will be provided and four associated examples classes will be given. There will be a revision class in the Easter Term.