Representation Theory

Course: MATH 6333

Semester: Fall 2025

Instructor: Yorck Sommerhäuser

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Class meetings: Monday, Wednesday 3:30 pm–4:45 pm, HH 3013

Office hours: Monday 5:00 pm–6:00 pm, Wednesday 5:00 pm–6:00 pm, Friday 3:00 pm–5:00 pm and by appointment.

Textbook: B. E. Sagan: The Symmetric Group, 2nd ed., Grad. Texts Math., Vol. 203, Springer, Berlin, 2001 (required resource)

Course description: The course discusses the representation theory of finite groups, with special emphasis on the symmetric group. Topics treated are group characters and their orthogonality relations as well as the notion of a character table. We will then illustrate these concepts in the case of the symmetric group, whose representations will be constructed with the help of Young tableaux and Specht modules. We will also compute the characters of the symmetric group with the help of various character formulas, such as the Frobenius character formula.

Coverage: We cover the first two chapters of the textbook completely and the third chapter in part. The presentation will be supplemented by including material from other sources. We will not cover representations of other algebraic objects, such as Lie groups, Lie algebras, or finite-dimensional associative algebras.

Examinations: There will be a midterm examination and a comprehensive final examination. The midterm examination takes place on Monday, October 20 during regular class time in the usual classroom. The final examination takes place during the examination period from December 8 to December 16 at a time and in a room determined by the registrar's office.

Homework: Beginning on Monday of the second week, a weekly exercise sheet will be handed out. This has to be submitted in class on the following Monday. There will be no exercise sheet during the week of the midterm examination and no exercise sheets during the last two weeks of the semester. In addition, a reading assignment from the textbook will be given in every lecture.

Policies: Eating, drinking, and smoking is not permitted in the classroom. While attendance is not required, it will be recorded. The use of electronic devices, especially cellphones, calculators, and laptop computers, is not permitted without explicit permission of the instructor. Electronic devices have to be turned off completely. While the use of artificial intelligence is permitted, it is not allowed to copy its answers verbatim.

Memorial University accommodates students with disabilities and demands academic integrity. The corresponding university policies can be found at http://www.mun.ca/policy/site/policy.php?id=239 and in the Academic Calendar in Paragraph 6.12, respectively.

In case of natural or man-made disasters, the course may transition to remote delivery. In case of emergency, this transition might be communicated only via e-mail.

Prerequisites: There are no formal prerequisites. However, the course requires knowledge of basic group theory and a good understanding of linear algebra. Concepts from multilinear algebra, such as tensor products and symmetric powers, will be needed only occasionally. Also, no advanced group theory will be required.

Marking weights:

Homework:	25 %
Midterm examination:	25 %
Final examination:	50 %