MAT445H1: Representation Theory
Winter 2026
University of Toronto

I. Instructor

Course Instructor Name:
Daniel Litt
Email: daniel.litt@utoronto.ca
Office Hours: 10am Wednesdays, Huron 1018

TA: Alexander Mirabella
Email: alexander.mirabella@mail.utoronto.ca

II. Course Overview

Course Description
A selection of topics from: Representation theory of finite groups, topological groups and compact groups. Group algebras. Character theory and orthogonality relations. Induced representations. Structure theory and representations of semisimple Lie algebras. Determination of the complex Lie algebras.

Prerequisites
MAT347Y1

Course Objectives
The primary goal of this course will be to learn the basics of representation theory of finite groups and semisimple Lie algebras. We will likely cover some additional sporadic topics at greater depth, e.g. the representation theory of the symmetric group.

Textbooks/ Course Readings
Serre, Linear representations of finite groups
Kirllov, Introduction to Lie Groups and Lie Algebras
Okounkov, Vershik, A new approach to representation theory of symmetric groups
Fulton and Harris, Representation theory: a first course

How this course is organized:
This course will consist of two weekly meetings and a regular tutorial, starting the week of January 20. Homeworks will be disseminated via Crowdmark.

II.   Evaluation/ Grading Scheme

Mark Breakdown

Assignments	40%
Term Test	25%
Final Assessment	35%

Assignments
There will be 5 assignments, of which the one with lowest grade will be dropped (late submissions will receive a mark of zero unless an extension is received from the instructor). Tentative due dates can be found in the lecture schedule at the end of this document.

Term Test
There will be one term test, which will be 2 hours long, on February 26 in class.

Final Assessment
The final assessment will be held during the final assessment period in April 2026 and will be scheduled by the registrar.

III.   Course Policies

Policy on Missed Term Work

Late work will receive a 0, unless an extension is given by the instructor beforehand.

Students who are absent from class for prolonged periods and who require consideration for missed academic work *should contact the instructor* and *verify their absence(s) through either the Absence Declaration tool, Verification of Illness or Injury (VOI) form, College Registrar Letter, or Letter of Academic Accommodation from Accessibility Services, as appropriate to their situation*.
https://www.artsci.utoronto.ca/current/academics/student-absences

The absence declaration can be used once per term. Outside of the one time absence declaration use, students must adhere to the alternate processes for absences listed above, as well as the missed work policy as set out in each course's syllabus.

If you miss a term test, then you must inform your course Instructor within 72 hours of the test. No exceptions. If your request is approved, you may receive an accommodation. The accommodation to be used will be decided by your instructor. Some examples of accommodations may include: an oral exam, written make-up test, or a re-weighting of your assessments. *(Academic Handbook Section 7 Missed Term Work or Tests)*

Re-marking Policy
A student who believes an individual item of work has been incorrectly or unfairly marked may ask the person who marked it for a re-evaluation. With evidence to back their appeal, students should make such requests as soon as reasonably possible after receiving the work back, but no later than 2 weeks after it was returned.
(Academic Handbook Section 5.14 Requests to Re-mark Assignments & Term Tests)

Email Policy
Should you have a question that is not answered on the course site (please check there first!) please note that all communications with the Course Instructor or TA's must be sent from your official utoronto email address, with the course number included in the subject line. If these instructions are not followed, your email may not be responded to. Please write in a professional manner.
(Academic Handbook Section 2.21 Online Communication Policy)

IV.   Institutional Policies and Support

Academic Integrity
All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behaviour on Academic Matters (https://governingcouncil.utoronto.ca/secretariat/policies/codebehaviour-academic-matters-july-1-2019). If you have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, please reach out to your Course Instructor. Note that you are expected to seek out additional information on academic integrity from me or from other institutional resources (for example, the University of Toronto website on Academic Integrity http://academicintegrity.utoronto.ca/).
(Academic Handbook Section 12 Academic Integrity)

Accessibility
The University provides academic accommodations for students with disabilities in accordance with the terms of the Ontario Human Rights Code. This occurs through a collaborative process that acknowledges a collective obligation to develop an accessible learning environment that both meets the needs of students and preserves the essential academic requirements of the University's courses and programs.
Students with diverse learning styles and needs are welcome in this course. If you have a disability that may require accommodations, please feel free to approach your Course Instructor and/or the Accessibility Services office as soon as possible. The sooner you let us know your needs the quicker we can assist you in achieving your learning goals in this course.

Link to Accessibility Services website: https://studentlife.utoronto.ca/department/accessibility-services/
(Academic Handbook Section 13 Accessibility/Disability Issues)

Equity, Diversity and Inclusion
The University of Toronto is committed to equity, human rights and respect for diversity. All members of the learning environment in this course should strive to create an atmosphere of mutual respect where all

members of our community can express themselves, engage with each other, and respect one another's differences. U of T does not condone discrimination or harassment against any persons or communities.

Important Academic Dates & Deadlines
The academic dates include enrolment dates, drop deadlines, exam periods, petition deadlines and more.
https://www.artsci.utoronto.ca/current/dates-deadlines/academic-dates

Other Academic and Personal Supports
- Writing Centre https://writing.utoronto.ca/writing-centres/arts-and-science/
- U of T Libraries https://onesearch.library.utoronto.ca/
- Student Code of Conduct:
  https://governingcouncil.utoronto.ca/secretariat/policies/code-studentconduct-december-13-2019
- Feeling Distressed? https://studentlife.utoronto.ca/task/support-when-you-feel-distressed/
- Academic Success Centre https://studentlife.utoronto.ca/department/academic-success/
- College/Faculty Registrars https://future.utoronto.ca/current-students/registrars/

V. Schedule of Lectures

Week 1 (Jan 5-9) Basics of representation theory of groups, semisimplicity, beginnings of character theory
Week 2 (Jan 12-16) Character theory, examples, induction and restriction, tensor products, first homework due
Week 3 (Jan 19-23) Group algebra, field of definition, Brauer's theorem, examples
Week 4 (Jan 26-30) Symmetric groups, homework 2 due
Week 5 (Feb 2-6) SL_2(F_p)
Week 6 (Feb 9-13) Lie algebras, sl_2, homework 3 due
Week 7 (Feb 16-20) Reading week
Week 8 (Feb 23-27) sl_2 continued, and an application to combinatorics, term test
Week 9 (March 2-6) More Lie algebras, ideals, semisimplicity, Killing form, homework 4 due
Week 10 (March 9-13) Complete reducibility
Week 11 (March 16-20) Representations of semisimple Lie algebras
Week 12 (March 23-27) Classification of semisimple Lie algebras
Week 13 (March 30-April 3) Classification continuted