

Representation Theory (Math 681)
Fall 2016 and following

Meeting times: Mon., Wed., and Fri. 11–11:50am in 107 Peterson Hall
Instructor: Ben Elias
Office: Fenton 210, x6-5629
Office hours: TBD.
E-mail: belias@uoregon.edu
Course website: <http://pages.uoregon.edu/~belias/681-2016/>
Midterm: None.
Final: None.

Textbook: See website.

Grading and Exams: By default, everyone will get a B+. I will assign weekly homeworks, with certain problems marked as mandatory. If you do those problems, you'll get an A-. If you do more problems, you'll get an A. There are no exams.

Prerequisite: 600 Algebra sequence. (Note: 500 and 600 topology sequence will help!)

Homework: I will assign homeworks on Wednesday, and expect them to be handed in the following Wednesday, but there is some leniency here. I don't expect people to latex their homework, because it can be quite hard in this class. I have a personal problem where I assign too many homework problems (it's an addiction... it also helps me organize my thoughts the first time I teach a class) but to remedy this I have marked certain ones as mandatory, and others as being very hard and extremely optional.

Learning Outcomes: The goal of this course is to cover the standard material in a first year representation theory course. Specific goals are to understand and be able to use the following concepts.

- (1) Finite and affine Dynkin diagrams. Root systems.
- (2) Topological groups, compactness and complete reducibility, Peter-Weyl theorem.
- (3) Lie groups and Lie algebras. The exponential map.
- (4) Finite-dimensional representations of Lie groups and Lie algebras. Killing form. Weights and roots. Highest weight theory.
- (5) More on representations. Weyl character formula. Plethysm.
- (6) Diagram algebras: Temperley-Lieb algebra, webs.
- (7) Weyl groups, Coxeter groups, classification of finite Coxeter groups.
- (8) Infinite dimensional representations, category \mathcal{O} .
- (9) Quantum deformations, quantum groups, Hecke algebras. Hopf algebras.
- (10) Representation theory of the symmetric group. Schur-Weyl duality.
- (11) Additional topics.

Learning Environment: The University of Oregon strives for inclusive learning environments. Please notify me if the instruction or design of this course results in disability-related barriers to your participation. You are also encouraged to contact the Accessible Education Center in 164 Oregon Hall at 541-346-1155 or uoaec@uoregon.edu. If you are entitled to extra time on exams, make sure to contact the AEC more than one week prior to the exam!

Academic Conduct: The code of student conduct and community standards is at:

<http://conduct.uoregon.edu>

Any type of academic dishonesty will not be tolerated.

In this course, you are encouraged to work on the homework problems with your colleagues. Math is a collaborative activity, and one which is easier to learn as a team. However, when it comes time to write up your homework answers, this should be done individually, without reference to any common solution or the work of others. By writing it up individually, you can really isolate those things you thought you understood in the group, but which did not make sense later. For example:

Ok: a study group works a problem on the blackboard, gets the answer. Erases the answer, each member tries to write up the solution individually, asks questions of the group when something goes wrong.

Not ok: a study group works a problem on the blackboard, gets the answer. Members copy the answer from the board to their homework sheet, or write up the solution while referencing the solution on the board. This is cheating, even if credit is given to your collaborators (otherwise it is also plagiarism).

Definitely not ok: looking up answers to a problem online, even if one does not copy them.

There will be no collaboration on the take-home portions of any exam.

Attendance and Participation: If you miss a class, it is your responsibility to find out what happened in this class from your colleagues. Not all class material is in the book (nor is all material in the lecture either - homeworks are essential). If your grade is borderline between one grade and another, then attendance and participation will be taken into account.

OFFICE HOURS ARE A VASTLY UNDERUSED RESOURCE. I am stuck in my office, waiting to answer your questions, so please use the opportunity!

Please, do not hesitate to ask questions, either in class or in office hours. Chances are that if you are confused, so are many of your colleagues, and they will thank you for speaking up. Office hours should be very helpful. If you can't make office hours, email me to set up an appointment.