

Instructor: Peter Webb

350 Vincent Hall, 625 3491, webb@math.umn.edu, <http://www.math.umn.edu/~webb>

Office Hours: MWF 12:00 - 1:15 or by appointment.

Syllabus

1. Examples: representations of groups, posets, quivers and, more generally, categories.
2. The radical, semisimplicity, correspondence between indecomposable projective and simple modules
3. Torsion pairs. Tilting. Gabriel's theorem. Morita theory.
4. Auslander-Reiten theory: irreducible morphisms, dualities, the AR translate, almost split sequences, the AR quiver.
5. Representation type. Applications to finite representation type and Brauer-Thrall questions.
6. Representations of the module category: correspondence between AR sequences and projective resolutions of functors, Auslander algebras.
7. The bounded derived category and Auslander-Reiten triangles.

Texts and sources

There will be no text to purchase: I will distribute notes, which will be available on my home page. The following books are helpful.

P. Webb, A course in finite group representation theory, Cambridge 2016.

M. Auslander, I. Reiten and S. Smalø, Representation Theory of Artin Algebras, Cambridge 1995.

I. Assem, D. Simson and A. Skowronski, Elements of the representation theory of associative algebras, Cambridge 2006.

D.J. Benson, Representations and cohomology I, Cambridge 1991.

S. MacLane, Categories for the Working Mathematician, Grad. Texts in Math. 5, Springer-Verlag, New York 1971.

S. Awodey, Category theory. Second edition. Oxford Logic Guides 52, OUP, Oxford 2010.

Course Assessment

There will be between 4 and 6 homework assignments during the course of the semester. If you make a genuine attempt at 50% or more of the questions you will get an A for the course. You do not have to obtain correct solutions to these questions, only make genuine attempts (in my opinion). I believe that it is extremely difficult to obtain a sound and permanently lasting command of the material presented without doing some work which actively involves the student. It should be possible for everyone who wishes to obtain an A on this course.

Expectations of written work

Most of the time in the homework problems, to satisfy my criterion of making a genuine attempt you will need to write down explanations for the calculations and arguments you make. Where explanations need to be given, these should be written out in sentences i.e. with verbs, capital letters at the beginning, periods at the end, etc. and not in an abbreviated form.

I encourage you to form study groups. However everything to be handed in must be written up in your own words. If two students hand in identical assignments, they will both receive no credit.

Prerequisites

Math 8201/2 or possibly Math 5284/5. There are various books explaining the basic material, for instance:

D.S. Dummit and R.M. Foote, *Abstract Algebra*, Wiley.

J.J. Rotman, *Advanced modern algebra*, Prentice Hall, 2002.

Incompletes

These will only be given in exceptional circumstances. A student must have satisfactorily completed all but a small portion of the work in the course, have a compelling reason for the incomplete, and must make prior arrangements with me for how the incomplete will be removed, well before the end of the quarter.

Date of this version of the schedule: 9/3/2019