

# Math 375: Introduction to Representation Theory

## Final Projects

**Goal:** To delve deeply into a topic of interest by finding and studying an article or part of a book on that topic and then writing a report. The project report and associated presentation forms 30% of your course grade, and, more importantly, is your opportunity to learn about something of interest to you that involves some aspect of representation theory. Feel free to propose a topic that is completely different from anything we have discussed, but also feel free to choose a project that looks more closely at a topic that we did examine.

**Topic suggestions:** (You are not limited to these; an internet search will yield many topics.)

- Applications to chemistry, physics, etc
- Haar measure and representations of compact groups
- Representations over fields different from  $\mathbb{C}$
- Burnside's  $p^a q^b$  Theorem
- Representations of  $GL(2, \mathbb{F}_q)$
- Representations of the symmetric group
- Representations of quivers
- Representations of Lie groups
- Clebsch-Gordon coefficients

Feel free to talk with me further about finding sources and what material should be included in the final report.

### Timeline:

- Choose a topic and email me a proposal of what you want to do (a few sentences describing your proposed project) by **5pm Friday Nov 18**.
- Submit outline of project and sources (by email is fine) by **5pm Friday Dec 2**.
- In-class 15-minute presentations start on **Thursday Dec 8**.
- Final report due **5pm Monday Dec 19**. Emailing me your file is fine.

**Report guidelines:** The report should be roughly 5–10 pages double-spaced, using Word, L<sup>A</sup>T<sub>E</sub>X, R Markdown, or some other appropriate format. The report should include significant mathematics and examples, but may also include less technical explanations and relevant historical or scientific background.

**Sources:** You should use at least two sources of information, which may include your textbook, other books, and scholarly articles. You should not rely on a website as a main source of information (since websites often contain incorrect information), but searching the web may be helpful initially as an idea-generator of interesting topics, and for basic information. Searching JSTOR and MathSciNet may also be helpful, in addition to a general Five College Library search. (Start looking for books and articles early in case you need to ask for an interlibrary loan or order an article to be delivered).

Your report should list all sources used in to writing your report. You may use any standard style to cite them, for example:

Jean-Pierre Serre, *Linear representations of finite groups*, Springer-Verlag, New York-Heidelberg, 1977.

William Beckner, *Inequalities in Fourier analysis*, Ann. of Math. (2) 102 (1975), no. 1, 159–182.

There are two purposes in citing your sources: first, to give credit to those who did the work and published it, and second, to enable readers to find these article or books if they want to read further about that topic.

When you refer to a source of information in the text of your report, cite that source using a standard style, as in the following examples:

One author: How fireflies oscillate in synchrony can be explained using a relatively simple nonlinear system (Strogatz, 1994).

Two authors: Tyson and Novak (2001) discovered a bifurcation that explains the cell cycle.

More than two authors: Tyson et al. (2004) found that something interesting occurred.