

# READING COURSE IN GROUPS AND REPRESENTATIONS FOR UNDERGRADUATES

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I will give a reading course on groups and their representations in spring semester 2018. This will have two phases. Phase 1 will be a 3 to 4 week introduction to groups, designed for people currently taking Honors Algebra I, and its only prerequisite is basic linear algebra, through invertible linear transformations. Phase 2 will be an introduction to representations of groups, and relies on an elementary understanding of groups (from the Phase 1 or from another source). The Center for Mathematics at Notre Dame will run a one week summer school for undergraduates (June 11-15 of 2018), and one of the purposes of this reading course is to encourage students to consider the summer school (but neither is required for the other).

Groups give mathematicians a way to think about symmetries. One of the first thing one learns about groups is that the best way to understand them is through their actions on other sets. Representation theory focuses on homomorphisms from a given group to the invertible  $n$  by  $n$  matrices over a field, or in other language, ways to represent the elements of your group as matrices in a manner consistent with their product structure. The number of irreducible representations of a finite group coincides with the number of conjugacy classes, and there is already interesting structure apparent in the study of the irreducible representations of the symmetric group. Group representations arise naturally in physics and chemistry, as symmetry groups of physical systems or crystal structures.

Students who have already had Honors Algebra III (or otherwise know what groups are) need not attend Phase 1. The entire sequence will use linear algebra extensively. Partly I will lecture, but I will also expect some student participation in lectures also. Feel free to contact me (sevens at nd.edu, HH 222, 631-7165) if you have questions.