

Geometric Group Theory

Prof. Josh Barnard
ILB 306, MW 9:30-10:10, 4-4:30; TR 10:20-11
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Math 490-101
MW 12:20-1:10, ILB 360
460-6755

Prerequisite: A proofs course in Mathematics (MA 320 or MA 334, for example)

Textbook: *Groups, Graphs and Trees*, by John Meier (LMS Student Texts 73, Cambridge)

Course Description: An introduction to the geometry of infinite groups. We will cover Chapters 1–5 of the text, plus more if time permits. The chapters alternate, with the odd-numbered chapters covering general techniques and theorems, while the even-numbered chapters introduce standard examples. The material we aim to cover is the following:

- (1) Cayley’s Theorems (define and describe Cayley graphs associated to group presentations as well as the natural left action of the group on such a graph)
- (2) Groups generated by reflections
- (3) Groups Acting on Trees (free groups, free products, free products of finite groups are virtually free, Serre’s property FA)
- (4) Baumslag-Solitar groups
- (5) Words and Dehn’s Word Problem (normal forms, the word problem as seen in Cayley graphs)

Additional chapters include:

- A Finitely Generated, Infinite Torsion Group
- Regular Languages and Normal Forms
- The Lamplighter Group
- The Geometry of Infinite Groups
- Thompson’s Group
- The Large-Scale Geometry of Groups

The book is written specifically with undergraduates in mind, so that the only prerequisites are “a single-semester exposure to groups and a naive familiarity with the combinatorial theory of graphs.” In an attempt to make even the single semester of group theory unnecessary as a prerequisite, we will begin the course with an introduction to the concepts of group, subgroup, group isomorphism, and group presentation. More sophisticated group theory concepts are not needed in this course (even normal subgroups and quotients are unnecessary). Also note that no topology is assumed, although a student familiar with the action of the fundamental group on the universal cover of a space will see much that is familiar.

Homework and Grades: Student performance will be based on graded homework assignments. Problems of particular interest and/or difficulty may be discussed in class with student participation. Depending on class size, student presentations are also possible, especially for the later optional topics.

Policies: If you have any questions or problems, you are encouraged to come by my office during office hours, or make an appointment to come by some other time. Email is the best way to contact me. The last date to withdraw from a course is Friday, October 23. Please speak to me if you are getting behind. If you have a specific disability that qualifies you for academic accommodations, please notify me and provide certification from the Office of Special Student Services, located in the Student Center, room 270, phone 460-7212. Students are assumed to be familiar with the current Academic Misconduct Code, to which we will strictly adhere.