

Mathematics 611: Algebraic Topology I

Fall 2019

Mondays, Wednesdays 4:40–5:55pm

Physics 227

Professor: Lenny Ng

E-mail: ng AT math.duke.edu

Office: Physics 216

Office hours (tentative): M 2–3, W 11–12

Course web site: I will post assignments and other information at <https://services.math.duke.edu/~ng/math611/>.

Course synopsis: Algebraic topology deals with the use of algebraic structures (such as groups, rings, and modules) to study and distinguish topological spaces. This course is essential background for research in topology and geometry as well as topological data analysis, and provides a framework that informs many other fields, including geometric analysis, number theory, and algebraic geometry.

Topics include: the fundamental group and covering spaces; simplicial, singular, and cellular homology; and the Eilenberg–Steenrod axioms of homology. Roughly speaking, we will cover Chapters 0, 1, and 2 of Hatcher. For math graduate students, my goal is to cover the material for the topology qualifying exam: https://math.duke.edu/graduate/oral-exam?qt=oral_qualifying_exam_topics=3.

Textbook: The textbook for this course is *Algebraic Topology* by Allen Hatcher. This is conveniently available for free online at <http://pi.math.cornell.edu/~hatcher/AT/ATpage.html> though I strongly recommend that you also purchase a physical copy of the book.

As supplementary texts, I recommend *Topology* and *Algebraic Topology* by James Munkres, and *A Basic Course in Algebraic Topology* by William Massey.

Office hours (subject to change): Mondays 2:00–3:00 and Tuesdays 11:00–12:00, and by appointment (set up in person or by email).

Assignments: There will be weekly problem sets, typically due on Wednesdays. Please check the course web site for posted problem sets. You can work with other students in the class on the homeworks, but please write up your problem sets on your own. Your grade is based on the problem sets and a take-home final exam.

Prerequisites: It is important that you are comfortable with both point-set topology (at the level of Math 411) and the algebra of groups and rings (at the level of Math 501). If you have not taken these prerequisites or their equivalent, please consult with me.