Mathematics 611: Algebraic Topology I

Fall 2021  Tuesdays, Thursdays 12:00–1:15 pm  Physics 227

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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. My goal is to cover the official Math 611 syllabus: https://math.duke.edu/math-611-syllabus.

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: TBA and by appointment (set up in person or by email).

Assignments: There will be weekly problem sets, which I expect to typically be due on Thursdays. 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.

Course notes: A version of my course notes for Math 611, from fall 2019, are available at https://services.math.duke.edu/~ng/math611f19/ Please note that they may contain errors.