Mathematics 411 (and 711): Topology

Spring 2023 Tuesdays, Thursdays 10:15–11:30 am Physics building 119

Professor: Lenny Ng
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Course web site: Assignments and other information will be posted to Sakai, https://sakai.duke.edu/. There is also a rudimentary public course web page at https://services.math.duke.edu/~ng/math411/ where you can find this syllabus and a link to lecture notes from a previous iteration of Math 411.


Munkres’ book is very detailed and on the dry side. For those who prefer a more informal treatment that emphasizes geometric intuition, I recommend Basic Topology by M. A. Armstrong as a supplementary text. I’ll be teaching somewhere in between the two books, roughly speaking.

Office hours: (updated 1/20) Mondays 1:00–2:30, Thursdays 11:30–12:30, and by appointment (set up in person or by email). If you want to set up an appointment via email outside of scheduled office hours, please keep in mind that I can’t usually answer email immediately; on occasion it may take a day for me to respond.

Course synopsis: This course is a broad introduction to point set topology, differential topology, and algebraic topology. Topics that I plan to cover include:

- Topological spaces, open and closed sets, limit points, continuous functions, product topology, metric topology.
- Compactness, connectedness, quotient spaces, quotient topology.
- Homotopy, the fundamental group, Brouwer Fixed Point Theorem.
- (if time permits:) Triangulations, classification of surfaces, Euler characteristic.

Assignments: There will be homework sets due most weeks on Tuesdays, as well as exams (two midterms and a final). You are allowed and encouraged to work with fellow students on the homework; if you do collaborate, please indicate the name(s) of your collaborator(s) on your problem set. Each student must write up their problem sets on their own.

Your grade will be based on a weighted average of your grades in these components: homework 15%, each midterm 25%, final 35%.
Special note for Math 711 students: You will also be required to write a short essay (under 1 page) explaining the relevance or potential relevance of this course to your particular course of study. This will be due at the time of the final exam.

Prerequisites: Officially, the only prerequisite for this course is Mathematics 221, and I expect to provide any necessary mathematical background beyond this level. However, you will find the course to be more fulfilling and pleasant if you have a reasonable familiarity with proofs (on the level of Math 245, 401, 431, or essentially any course > 400). It may also help to be acquainted with the notion of a group (Math 401 again) and some basic real analysis (Math 431 again). Specifically, a fair amount of the concepts in this course will seem vastly more motivated if you’ve already taken, or if you’re concurrently taking, a real analysis course.

Also, I will assume basic knowledge about functions, logic, and sets. The Munkres textbook has a nice treatment of all of this. I recommend that you look at Munkres Part I, Chapter 1, sections 1–7 to make sure that you’re up to speed, and to brush up on anything that looks unfamiliar.

Please consult with me if you have questions about whether this course is appropriate for you.