Math 338: Topology

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Lecture: TR 1:00 - 2:15 pm, Sturges 208A
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Web Page: http://www.geneseo.edu/~heap
Textbook: *Introduction to Topology: Pure and Applied*, by Colin Adams and R. Franzosa.

Course Info: We will cover the first few chapters of the text but skip a few sections occasionally. We will also do our best to cover a couple of the later chapters as time permits. These later chapters can help us see what the study of topology truly is. Regardless of what topics we end up covering in this course, you are strongly encouraged to read through all of the later chapters. These chapters are often much more interesting than the early chapters and may pique (or peak) your interest in topology even more. Topics will include topological spaces, open and closed sets, interiors and boundaries of sets, homeomorphisms, connectedness, compactness, and manifolds. Topics are subject to change depending on the progress of the class, and various topics may be skipped due to time constraints. **An accurate reading schedule will be posted on the website, and you should check it often.**

By the time you take this course, most of you should be fairly comfortable with mathematical proofs. Although this course only has "Introduction to Mathematical Proofs" as a prerequisite, it requires a certain level of mathematical sophistication. There will be a lot of new terminology you must learn, and we will be doing a significant number of proofs. It is imperative that you keep up with the reading assignments. Be prepared to learn many new definitions and theorems. It may be useful for you to compile a list of all the new terms we learn, as well as a list of theorems. Some students find flashcards useful for doing this.

Topology is the study of spaces and sets and can be thought of as an extension of geometry. It is an investigation of both the local and the global structure of a space or set. The foundation of General Topology (or Point-Set Topology) is set theory. There are other areas of topology including Geometric Topology, Algebraic Topology, Differential Topology, Low-Dimensional Topology, High-Dimensional Topology, and various others. The motivation behind topology is that some geometric problems do not depend on the exact shape of an object but on the way the object is put together. For example, the square and the circle are geometrically different, but they have many properties in common: they are both one dimensional objects and both separate the plane into two parts. Similarly, a donut and a coffiee cup are topologically the same even though they look completely different. Much of the study of topology comes from setting aside our preconceived notions of "shape" involving size, length, flat, straight, or curved, and realizing that a circle and a square are really the same thing.

Upon successful completion of this course, a student should be able to:

- Define and illustrate the concept of topological spaces and continuous functions,
- Define and illustrate the concept of product topology and quotient topology,
- Prove a selection of theorems concerning topological spaces, continuous functions, product topologies, and quotient topologies,
- Define and illustrate the concepts of the separation axioms,
- Define connectedness and compactness, and prove a selection of related theorems, and
- Describe different examples distinguishing general, geometric, and algebraic topology.

Grading: There will be weekly homework assignments, two midterm exams, and a final exam. Each exam is 25% of your grade, with homework and class participation counting as the final 25%. More details and exam dates can be found on the course website. Your overall grade for the course will reflect how well you are doing and will be high if you are working hard on the homework and doing well on the exams. Many of the questions on the exams will be in the same spirit as the homework questions. Therefore understanding how to do all the homework questions will enable you to do well on the exams.

In addition to learning wonderful mathematics this semester, we will also be working on three academic fundamentals that are vital to success in your education and in your career: Reading, writing, and communication.

1. **Reading the textbook is extremely important.** It is required, NOT optional. I certainly won't be able to cover in class all the material you will be required to learn. As a result, you will be expected to do a lot of reading. The reading assignments will be on topics to be discussed in the following lecture to enable you to ask focused questions in the class and to better understand the material. Your chances of getting a good grade in this course are infinitesimally small unless you read the textbook in addition to attending lectures.
2. **Writing quality proofs is essential.** You are expected to be able to effectively present mathematics with a well-organized, thoughtful, neatly written argument
3. **Communication with your peers will be a focal point.** In addition to working in pairs on your homework assignments, there will also be regular presentations given in class. Students will be asked to present their solutions to homework problems to the rest of the class. The best way to truly understand a concept is to be able to explain it to someone else. Talking about math is just as important as thinking and writing math. Our goal is to become more comfortable with the necessary communication.

Exams will be given during class. Exams are closed book, closed notes, closed friends, and open brain. Cell phones, iPods, and other electronic devices will NOT be permitted in exams. **Class participation** will be based on your willingness to **ASK and ANSWER questions** in class. There will be active discussion at certain times, and you will also be required to present some proofs to the class.

In all written work, you must show your work and clearly show the process and reasoning you went through in order to solve the problem. The problems I work for you in class will provide good examples of how your homework and exam problems should be written up. All assessment will be based on your ability to communicate a correct solution and explain your reasoning. It is absolutely essential to write clearly and completely. It is your responsibility to write in a way that tells me that you understand the problem and its solution.

Homework: Pick a homework partner that you will be working with for the semester. Each student should work out every problem, but you and your partner will only turn in one combined final version of each assignment. Please note that you are welcome to work in groups of as many people as you want, but you and your partner are responsible for writing up and handing in your own pair's homework. Each pair of students should submit their own work, not a handwritten copy of someone else's. Also, you should feel free to write out your assignments by hand, but I encourage you to typeset your homework using LaTeX. Each individual student is ***STRONGLY ENCOURAGED*** to think about and attempt the problems on their own before meeting with their partner. When you are about to tackle the homework assignment, you should use this strategy: **THINK, PAIR, SHARE.** When working in groups, please be careful that you are actively participating in the process. Please be careful that you are able to work all of the problems on your own before the exam time arrives, with no coaching from a friend. Please use whatever resources aid you in learning the material, including computer assistance, office hours, other students, professors, other math books, etc. However, plagiarism will NOT be tolerated.

Extra Help: There are two obvious ways for you to get some help in this class. Ask a classmate or ask your professor. I am willing to spend a few minutes in class answering questions about homework problems. However, if you have a lot of questions, I recommend taking advantage of my office hours. My job is to help you -- come to office hours even if you have just a small question. Don't wait until you get too far behind. Please come see me as soon as you feel lost -- it is important that I know how you are doing so I can adjust the level of the class if necessary. I WANT to help you, and I WANT everyone to do well.

Please Note: *Any student with a disability requiring accommodations is encouraged to contact me after class or during office hours. All discussions will remain confidential.*