This is a "genericized" version of my MAT327 syllabus.

The purpose of this document is to convey a sense of what my syllabus looks like for an instance of my course. All the information that would be specific to a given instance (room numbers, names of TAs, etc.) has been stripped out, leaving some of the sections below looking more sparse than they would normally be.

MAT327 - Introduction to Topology

1 Information at a Glance

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Course website	http://ctrl-c.club/~ivan/327

Contents

2 Goals and expectations

The first goal of this course is to provide a through and engaging introduction to point-set topology; its core concepts, its major theorems, and some of its other more interesting results. This subject is often maligned or thought of as boring, but I find fascinating and elegant. As a set theorist "by trade", I also intend to sprinkle some set theoretic flavouring over the proceedings.

The secondary, broader goal of this course is to convey how mathematicians think about creating an abstract theory like the theory of point-set topology; how we decide on definitions, how we formulate and prove theorems, and how we look past the technicalities of the definitions and understand the intuition behind them. Point-set topology is uniquely well-suited to this sort of exploration.

This course will necessarily delve into some deep, elaborate, and tricky mathematics, and you should expect the course to ramp up in difficulty throughout the summer. I am very excited to present this material to the students, and share my enthusiasm with them. My expectations for students are reasonable though. I expect students to engage with the course material thoughtfully, to talk to me and the TAs regularly, to develop a working understanding of the relevant definitions, statements major theorems, and their applications within the subject. In particular, I am not expecting to only pass research-ready, elite mathematicians. My goal is that students who engage actively with the material should do well.

The most important thing I expect of students entering this course is some degree of *mathematical maturity*. This is a tricky concept to define, but for example I expect students to be able to understand and manipulate mathematical definitions, to be comfortable manipulating sets, functions and other familiar objects, and to be able to write clear, correct proofs of simple things. Of course, we will exercise and hopefully substantially strengthen these skills as we go.

3 Topics

What follows is a list of planned topics for this course, in approximately chronological order. Covering all of these topics is an ambitious goal, and the list is subject to modification due to time constraints. Lecture notes will be grouped roughly in the same way.

- Topological spaces
- Bases of topologies
- Closed sets, closures, and density
- A crash course in countability in general, and second countability
- Sequence convergence, the Hausdorff property, and first countability
- Continuous functions, homeomorphisms, and topological invariants
- Subspaces
- Finite products of topological spaces
- The separation axioms (in particular, regularity and normality)
- Orders, order topologies, and ω_1
- The Axiom of Choice, and Zorn's Lemma
- Metric spaces, metrizability and Urysohn's Lemma
- Arbitrary products of topological spaces, and Urysohn's Metrization Theorem
- Compactness and the Heine-Borel Theorem
- Filters, ultrafilters, and Tychonoff's Theorem
- Connectedness
- Compactifications (one-point and Stone-Čech)

4 Textbooks

There is **no required textbook** for this class. I have created my own lecture notes and will be posting them publicly on the course website. With that said, please be aware of the following two books:

- *Topology (Second Edition)*, by James Munkres.

  The standard textbook for this course. It is easy to read and an excellent text for self-study. Note however that it orders topics and does some proofs differently than I intend to. I will not be following this book, but it will undoubedly be a useful resource. The other downside of this book: it costs about $125 (new from the bookstore).

- *Counterexamples in Topology*, by Steen and Seebach.

  A sort of "dictionary" of topological spaces that contains almost every definition from this course and much more. This is an invaluable reference that I still use frequently. A colleague and I used to joke that one should have this book on them at all times, in case a topological trivia question needs answering. That said, it is absolutely *not* suited for learning this material from scratch, and contains almost no proofs. The best part: it costs under $20.

5 Office hours

While you are never required to attend office hours, I consider them one of the most important aspects of the course. The students who do best tend to be the ones who come to office hours the most. You should attend whenever you can.

If you are unable to attend scheduled office hours you are welcome to email me and set up a special appointment.

6 The Big List of Problems

Point-set topology is a subject *rife* with "standard problems". Most of the problems and proofs you *must* complete in order to understand this material are very easily Googled, and solutions are very easily found (for example, one can easily obtain the solution to most any problem in Munkres' *Topology* in minutes). As a result it is extremely difficult to curtail cheating on homework. For this and a few other reasons, there will be **no graded homework assignments** in this course.

Instead, I will be providing a **Big List of Problems** on the course website, which will grow over time, sorted by topic and approximate difficulty. These are problems I have gathered from many sources, and will include most (but not all) exercises from the lecture notes. They will range in difficulty from easy to very hard. They will serve as topics of discussion in tutorials, and **will constitute a significant percentage of the problems appearing on quizzes, the midterm, and the final exam.**

I will not post solutions to all of these problems, because doing so would defeat the purpose of assigning them. I expect that students enrolling in this course will have understood by this point in their undergraduate mathematical careers that the valuable part of doing problems is sitting and thinking about them, not in reading their solutions. You will see solutions to some of them during tutorials and in quiz solutions, however. You are welcome (and encouraged) to work on these problems collaboratively, and to talk to me about them. I ask you not to post full solutions to problems on Piazza, as doing so would ruin the problems for people who have not thought about them yet.

7 Tutorials

Tutorials will constitute an essential part of this course, and should be thought of as no less important than the lectures. They begin **during in the second week** of the course. In particular, quizzes will be written during tutorials.

8 Quizzes

Along with a midterm test and a final examination, students will be evaluated via **four, 50-minute quizzes, written in tutorials.** Students must write quizzes in the tutorials in which they are enrolled.

9 Midterm

We will have one midterm test, two hours in length.

10 Grading Scheme

The marking scheme for the course is as follows:

- 15% - highest quiz mark
- 5% - lowest quiz mark
- 10% each - remaining two quiz marks
- 20% - midterm test
- 40% - final examination, three hours in length

11 Accessibility

Accessibility Services collaborates with students, instructors, volunteers and staff to provide accommodations to students with documented disabilities in order that they may participate as equals in all academic matters. If you have any accessibility-related questions or concerns, you are encouraged to contact and/or register with Accessibility Services. For more information, please visit:

http://www.accessibility.utoronto.ca

12 Academic integrity

All students at the University of Toronto are expected and required to be familiar with this institution's policies on academic integrity. In this course in particular, any student found guilty of academic misconduct during a quiz will be penalized with a grade of 0% on the quiz in question, and that quiz will count for 10% of his or her final course mark (irrespective of the grades on the other quizzes).

Students are encouraged to refresh themselves on the details of what constitutes academic misconduct at the following two links:

http://www.artsci.utoronto.ca/newstudents/transition/academic/plagiarism
http://www.artsci.utoronto.ca/osai/The-rules/what-is-academic-misconduct