MA 351: Elementary Topology I
Fall 2022
CB 335, MWF 2-2:50

Kate Ponto

Email	kate.ponto@uky.edu	Website	www.ms.uky.edu/~kate
Office	739 Patterson Office Tower	Office Hours	TBA

Course Website: www.ms.uky.edu/~kate/teaching/f22_351.html.

You've probably been in a car or a bus or a train and noticed that the fasted way to get somewhere is probably not the straight line between where you are and where you are going. This might be because there isn't a road there, or there is a mountain or a lake or some other big, immovable object in the way. One way to really see this is the following two maps that show how long it takes to travel from New York City to other parts of the United States.
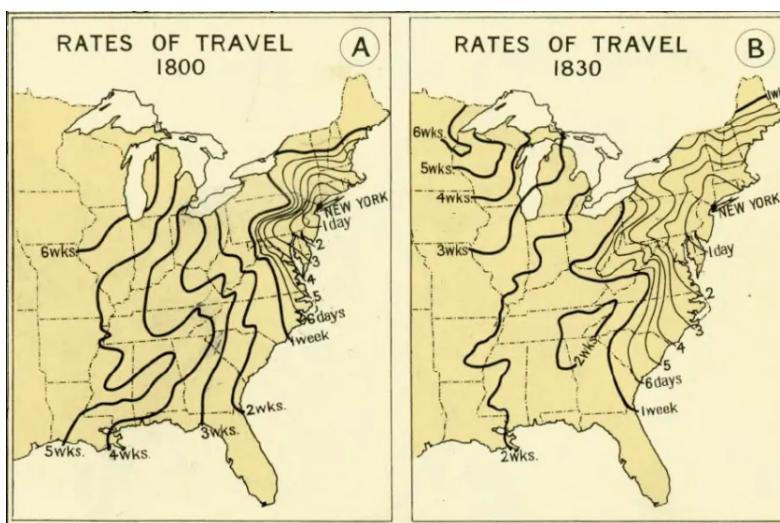
(Atlas of the historical geography of the United States) The maps don't describe miles from New York City - they describe travel time and those times are different in 1800 and 1830. (And very different now!) So how do we make sense of these three (or four) different ideas of distance? Topology has an answer! These are **metrics** - the mathematical idea of distance that doesn't have to be miles. It can be anything that satisfies a couple easy rules that we are really familiar with.

Metrics have a "big sibling" - a **topology** that doesn't measure distance. It just knows if things are close together or not. (These things don't have to be points on the surface of the earth. They can be real numbers or elements of any set you like.) Topology is about exploring when you only know if things are close together but can't assign a number to this closeness. Remarkably, you can do so much with just this information!

(If you've taken Calculus I you have seen some topology - the intermediate value theorem and extreme value theorem are both theorems from topology. IVT is a theorem about connectedness - this is a mathematical idea that is exactly what it sounds like. EVT is about compactness - this is an idea of smallness.)

Course Structure and Approach. The structure of this class might be different from your experience with math classes. We know, often from frustrating experience, that most people do not master the material (or sometimes even learn very much) merely by listening. It works better

if we are active when trying to learn! We will incorporate methods from an educational philosophy called inquiry-based learning (IBL).

IBL is a method of instruction that puts you, the material, and your interaction with that material at the center of the learning experience. My role to guide your learning process rather than hand out knowledge (that does not work well with the sort of material we will cover). In other words, this class is about you and your learning, and my goal is to support you so you can get the most out of your experience.

Most of our class time will be devoted to student-led presentations and class discussion. The details of these in terms of assessment are discussed below. I know if you are not used to these sorts of activities in a math class they can seem challenging. The goal is that we, as a class, will become a team that learns together.

Office Hours Office hours will be an important resource for this class. I will let you know once I've chosen office hours and they will be posted on the class website.

Textbook. The text for this course is *Topology Theory Through Inquiry* by Starbird and Su. This text is written specifically for courses using IBL. You will notice that nearly all theorems are missing their proofs. We will fill them in over the semester!

Presentations. A typical class will focus on student presentations/discussion regarding problems completed before class (see Daily Homework). While the atmosphere of the class should be informal and friendly, these presentations should be taken seriously as they essential to reaching the goals of this class.

Presentations will be done on a volunteer basis though all students are expected to be engaged in the process. Explicit instructions/expectations can be found in Presentation Guidelines document.

Presentations will be graded out of five points using the following rubric:

5   Completely correct and clear proof or solution. Great!
4   Essentially correct with small flaws/significant progress has been made and is
     well explained
3   Incomplete/incorrect with only minimal progress made toward a solution

You should not let the rubric deter you from presenting if you have an idea about a proof that you'd like to present, but you are worried that your proof is incomplete or you are not confident your proof is correct. You will be rewarded for being courageous and sharing your creative ideas! (You should not come to the board to present unless you have spent time thinking about the problem and have something meaningful to contribute.)

Daily Homework. Homework will be assigned each class meeting and will consist mainly of proving theorems from the textbook. You are expected to complete (or try your best to complete) each assignment before coming to the next class meeting. You are encouraged to work with other students in the class on the homework but do not consult people or resources outside of the class. All solutions you submit must be your own.

All assignments should be **carefully** and **clearly** written. Among other things, this means your work should include proper grammar, punctuation and spelling. You will almost always write a draft of a given solution before you write down the final argument, so do yourself a favor and get in the habit of differentiating your scratch work from your submitted assignment. Please see the resources on the website for suggestions for writing up proofs.

Since each class meeting will be largely devoted to presenting problems from those that are due that day, you are permitted (and encouraged!) to modify your written proofs based on these presentations; however, you must make such corrections using a different colored pen. At the end

of each class, you will submit your write-up of all proofs due that day. These will be graded using the same rubric as the presentations. I will drop two low/missing daily homework assignments.

Class Portfolio. As we are filling in the proofs of theorems from the textbook, it is vital to keep track of them carefully. Every proof in the class will be carefully typed up by one of you and compiled into a portfolio for the class. It is very important that these proofs are clearly written so you can use them to study - so you should include all feedback on daily homework and we may need to make additional revisions. These proofs should be typed using the provided template at overleaf.com. This will make it easier to combine them into a single document. Portfolio submissions will have due dates and points will be deducted for late submissions. (In exceptional circumstances submissions may be reassigned to other students.)

At the end of the course, we will have a complete and organized collection of all the proofs you have written!

Volunteering for presentations and portfolio submissions. Before each class there will be a quiz on canvas that allows you to volunteer for presentations and portfolio submissions. You get credit for each presentation or submission you volunteer for - even if you are not chosen!

I expect that many students will volunteer and so I will choose the student who has presented or submitted the fewest times.

Before each exam, I will announce how many presentations you should be aiming for to stay on track as this will depend on the number of students in the class and how quickly we make progress.

Quizzes. We will have quizzes about every three weeks. These will primarily focus on vocabulary I will announce quizzes in class at least a week in advance. (We will not have exams.)

Grading. Grades will be assigned based on the following scheme

Homework	30%
Presentations	30%
Volunteering	5%
Portfolio Contributions	15%
Quizzes	15%
Participation	5%

I will use the usual grading distribution in assigning final grades. (A: 90% - 100%, B: 80% - 89%, etc.)

Academic Policy: For policy regarding attendance, accommodation due to disability, and nondiscrimination statement please see `https://www.uky.edu/universitysenate/acadpolicy`.

Attendance. Regular attendance is expected and is vital to success in this course. While you will not be explicitly graded on attendance, repeated absences may impact your participation grade. Make up work will be accepted only in the event of an excused absence as outlined by UK Senate Rule 5.2.4.2.

If you are anticipating an absence for a major religious holiday you must notifying me in writing of anticipated absences no later than the last day in the semester to add a class. For other scheduled absences you must notify me at least a week before. For unscheduled absences, not later than a week after. I require appropriate verification for absences.

You are expected to withdraw from the class if more than 20% of the classes scheduled for the semester are missed (excused) per University policy.

You are responsible for announcements made in class as well as any emails sent to your UK email account

Academic Integrity: Please see `https://www.uky.edu/universitysenate/ao` for expectations for academic integrity.

Accommodations due to disability: If you have a documented disability that requires academic accommodations, please see me as soon as possible during scheduled office hours. In order to receive accommodations in this course, you must provide me with a Letter of Accommodation from the Disability Resource Center (DRC). The DRC coordinates campus disability services available to students with disabilities. It is located on the corner of Rose Street and Huguelet Drive in the Multidisciplinary Science Building, Suite 407. You can reach them via phone at (859) 257-2754 and via email at drc@uky.edu. Their web address is `https://www.uky.edu/DisabilityResourceCenter/`.

Diversity, Equity, and Inclusion The University of Kentucky is committed to our core values of diversity and inclusion, mutual respect and human dignity, and a sense of community (Governing Regulations XIV `https://www.uky.edu/regs/gr14`). We acknowledge and respect the seen and unseen diverse identities and experiences of all members of the university community (`https://www.uky.edu/regs/gr14`). These identities include but are not limited to those based on race, ethnicity, gender identity and expressions, ideas and perspectives, religious and cultural beliefs, sexual orientation, national origin, age, ability, and socioeconomic status. We are committed to equity and justice and providing a learning and engaging community in which every member is engaged, heard, and valued.

We strive to rectify and change behavior that is inconsistent with our principles and commitment to creating a safe, equitable, and anti-racist environment. If students encounter such behavior in a course, they are encouraged to speak with the instructor of record or the colleges diversity officer (`https://www.uky.edu/inclusiveexcellence/college-diversity-inclusion-officers/`), who is charged with addressing concerns about diversity, equity, and inclusiveness. Students may also contact a faculty member within the department, program director, the director of undergraduate or graduate studies, the department chair, or the dean. To submit an official report of bias, hatred, racism, or identity-based violence, visit the Bias Incident Support Services website (`https://www.uky.edu/biss/report-bias-incident`).