Math 431–01 Spring, 2012
Topology
CRN: 22457
TR 8:00—9:15am
Kennedy 208

Instructor:	Dr. Christopher Seaton	
Office:	320 Ohlendorf Hall	
Office Hours:	M 3:00pm—4:00pm	
	W 2:00pm—3:00pm	
	TR 11:00am—12:15pm	*or by appointment*
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Text:	C. Wayne Patty, Foundations of Topology, 2nd Ed., Jones and Bartlett Publishers	

Course Description:

In Calculus, you made frequent use of results such as the Intermediate Value Theorem, the Extreme Value Theorem, etc., that state properties of continuous functions on an interval $[a, b]$. Since taking Calculus I, you have met functions with a variety of different sets as domains and ranges. Some of these sets may seem similar to the real numbers or a closed interval of real numbers in one way or another. Hence, it makes sense to ask: for which of these functions do results such as the Intermediate Value Theorem and the Extreme Value Theorem hold?

The area of Topology is the mathematical formulation of these questions and their answers. In topology, sets such as the real numbers are stripped of their "unnecessary" structures that do not play a fundamental role in these questions. For instance, the real numbers come equipped with several operations (addition, multiplication, etc.), a linear order, the structure of a real, 1-dimensional vector space, etc. However, many of these structures can be forgotten or simplified, and the remaining object is still sufficiently rich in order to prove the Intermediate Value Theorem and the Extreme Value Theorem. What remains is a *topological space*, which we can think of as a set with "just enough" structure to define what it means for a function from that space to be continuous.

You may have heard topology described as "a kind of geometry where you are allowed to stretch and deform objects." As is the case for most intuitive descriptions of mathematical concepts, this is both helpful and misleading. It is true that topological spaces cannot be distinguished if they are the same "up to stretching and deforming," but the reason for this is that stretching an object doesn't affect whether functions from that object are continuous. Another way of thinking about topology is *the study of continuity*. And in order to study *continuity* rather than continuity of functions from the real numbers, continuity of functions from a field, continuity of functions in the presence of other structures, etc., topology considers only those features of a space that are required in order to make sense of continuity. Rather surprisingly, you don't need to know very much about a space in order to decide when functions are continuous. You just need to

know which subsets of the space are considered open. So a topological space is nothing more than a set equipped with a collection of subsets that are called "open sets."

At this level of abstraction, we will develop many familiar properties of continuous functions and spaces as well as a number of surprising, counterintuitive examples. We will learn to ask and answer questions about exactly what properties are required for spaces and continuous functions to exhibit certain behaviors.

Content:

We will cover most of Chapters 1—4 and some of the main concepts from Chapter 5. If time permits, we may cover portions of Chapters 6 and 7.

Course Prerequisites:

The prerequisites for this class are MATH 201: Transition to Advanced Mathematics, and MATH 223: Calculus III. The mathematical prerequisites for the class are outlined in the appendices of the text. Students will be expected to be familiar with the material contained in Appendices A, B, C, D, E, and F and should review these concepts as necessary. In particular, the study of topology requires you to be **extremely dexterous** with the language of sets, functions, and images and preimages of sets; this material is summarized in Appendices B and C.

Office Hours:

Students are **strongly** encouraged to take advantage of my office hours **and to make appointments when my office hours are not convenient**. My schedule is posted online at http://faculty.rhodes.edu/seaton/schedule.htm and on the door of my office. Please consult this schedule before suggesting an appointment time via e-mail.

Skype:

When I am not in my office but am working somewhere else, I am frequently logged into Skype and listed as available. Students are welcome to add me as a contact on Skype in order to ask questions about the material at these times. Skype is free and easy to install, so please to contact me if you have any questions about setting it up.

Web Page:

This syllabus and the summary of past homework assignments will be posted on my web page. I will announce anything I posted in class, but students are encouraged to consult my web page periodically, particularly if they have missed a class. The homework summary on my web page is for your reference when studying for an exam. It is subject to change until the assignments have been given in class.

Attendance Policy:

I will take attendance. You are permitted **two** unexcused absences throughout the semester; if you are absent two or fewer times, you will be allowed to skip one problem on the final for which you will receive full credit (one tenth of the test). An excused absence must be discussed with me **in advance if possible**, and the proper documentation must be made available when appropriate. If I decide that excessive absences are

jeopardizing your ability to pass the course, I will take action as outlined in the catalogue. It is your responsibility to obtain notes and assignments when you are absent.

Grading:

Your letter grade for the course will be based on the following scale:

A	[93, 100]	B-	[80, 83)	D+	[67, 70)
A-	[90, 93)	C+	[77, 80)	D	[63, 67)
B+	[87, 90)	C	[73, 77)	D-	[60, 63)
B	[83, 87)	C-	[70, 73)	F	[0, 60)

This scale is "worst case scenario"; I may choose to uniformly reduce the numerical requirements for a grade, but will not increase them.

The total percentage will be computed as follows:

Homework and Quizzes:	20%
Tests:	2 × 25%
Final Exam:	30%

Homework:

At the end of each lecture, I will assign practice problems and hand-in problems (usually, there will be at most 6 practice and 5 hand-in). Students are expected to complete **all** of these problems. The hand-in problems assigned one week are due **in class** on the second lecture day of the following week (usually a Thursday); on exam and holiday weeks, the schedule will be modified. On the first lecture day of each week (usually a Tuesday), class will start with a brief quiz on which you will be asked to complete one of the practice problems from the previous week; this quiz will be open-book and open-note, and it will be expected that you will have already completed the problem. The quiz will count as one half of one homework assignment.

The homework you hand in must be your own work; you may work on the problems with other students, but they **may not aide in the final write-up**. **Late homework will not be accepted.**

Tests:

There will be two tests during the semester. The in-class portion will be given **in Kennedy 201 from 7:00pm to 8:30pm on Thursday, February 16th and Thursday, March 29th.** In addition, there will be a **take-home** portion of each test, which will be handed out during the test and due the following **Monday at noon.**

If you have to be absent for an exam, you **must** make arrangements with me as early as possible **before** the day of the exam, and you will be expected to document your absence. Otherwise, you will not be allowed to make up the test. **In most circumstances, I will not make arrangements for you to make up an exam unless I have been notified one week before the day of the exam.**

Final Exam:

The final exam is scheduled for Wednesday, May 2nd at 8:30am. It will be a closed-book, closed-notes, cumulative exam with a slight emphasis on material covered after the second test.

Calculators and Technology:

Calculators will not be allowed on the tests. You may use calculators or software packages on your homework, though you likely won't need them very much.

LaTeX:

Students in this class are **strongly encouraged** to learn and use the typesetting software LaTeX, the standard typesetting language for mathematical publishing. Homework prepared in LaTeX will receive 5% extra credit. Resources for learning LaTeX will be made available to students by request.

Honor Code:

All students are expected to conduct themselves within the guidelines of the College's Honor Code. Please ask me if you have any questions about what is allowed. I reserve the right to reduce a student's grade in the event of plagiarism whose intent cannot be verified.

Students With Disabilities:

If you have or think you may have a documented disability, please contact me and the Office of Student Disability Services as early in the semester as possible.

Addition:

The Student MAA Section will be showing the movie Moneyball in AfterMath on Friday, March 1st, 2012 (3:30pm, Ohlendorff 225). Students are encouraged to attend.