Mathematics 651: Topology
Spring 2021

Instructor: John Rhodes, `j.rhodes@alaska.edu`, 208B Chapman, 474-5445

Office Hours: M 1:00-2:00, W 3:15-4:15, F 3:15-4:15, and by appointment.

Course web page: `https://jarhodesuaf.github.io/M651.html`

Prerequisites: Math 404 (undergraduate topology), or equivalent

Credit Hours: 4.0

Catalog Description: Treatment of the fundamental topics of point-set topology. Separation axioms, product and quotient spaces, convergence via nets and filters, compactness and compactifications, paracompactness, metrization theorems, countability properties, and connectedness. Set theory as needed for examples and proof techniques.

Text: Topology, 2nd ed., by J. Munkres, Prentice Hall

Class Meetings: Lectures M, W, F 2:15-3:15 , Lab M 3:30-4:30, hybrid Zoom/in-person

Midterm Exam: In-class on Monday, March 1 (tentative), followed by Take-home for the rest of the week

Final Exam: 1:30-4:00 Thursday, April 29; Take-home will given out about a week before classes end, and due the last day of class.

Course overview and learning outcomes: This course rigorously studies the notions of *topological spaces* and *continuous functions*. The first two-thirds of the course focus on *point-set topology* (also called *general topology*) progressing from basic definitions to deep theorems such as Urysohn's Metrization Theorem and the Tychanoff Theorem on compactness of products. The remaining third of the course will move into the basics of *algebraic topology*, where groups are associated to spaces as a tool for understanding their structure. Together, this should develop a solid basis of knowledge of what has become a foundational area of mathematics. Though topology arose from more concrete studies of functions of real or complex variables, its modern formulation is abstract. This course will follow the modern style, but also try to build intuition through many examples.

Strictly speaking, no previous knowledge of topology is necessary as we will begin from first principals. In practice, however, it is absolutely necessary that you have the background from an undergraduate course as we will move rapidly through what you've seen before. You should gain a much more solid understanding of that material, while greatly expanding your understanding of its implications.

Along the way you should also further develop your skills at constructing proofs, and presenting them with good written mathematical style.

Mechanics of the course: Lecture meetings will be run as interactive lectures. That means that while I will usually be lecturing — and you should be taking notes — I will also be asking for suggestions, ideas, and questions about the material as we go along. I don't expect 'correct' answers, but I do expect you to be actively following and participating.

Class attendance is expected, although I will not formally take roll. Regularly missing class is sure to make this course much harder for you. If you must miss a class, you should watch the Zoom recording of it. Homework assignments will be posted on the course web page soon after class is over.

Homework will usually be assigned daily, and should be 'essentially' completed by Monday of the following week for discussion/presentation in the Lab meeting. During this meeting, students may bring up problems for discussion, and may be called on to present the current form of their solutions to the class. Homework solutions (which must be typed using LaTeX) are due in a Dropbox folder by class time on Wednesday. Most problems will require proofs, and should be formatted using LaTeXtheorem and proof environments, as shown in the template provided on the class web page.

Examinations: The midterm exam will have two parts: An in-class hour exam will cover your knowledge of definitions, important theorems, examples, and straightforward proofs. A take-home part, which you will have several days to complete, will consist only of longer proofs and examples.

The final exam has a similar two-part format, but the take-home will be before completed before classes end, and the in-class during the exam period.

Grades: Your performance will be evaluated based on 20% homework, 15% midterm exam in-class, 25% midterm exam take-home, 15% final exam in-class, 25% final exam take-home.

Course grades will be determined according to the following cutoffs:

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\begin{aligned}
A &\geq 90 - 100\%, \\
B &\geq 80 - 89\%, \\
C &\geq 70 - 79\%, \\
D &\geq 60 - 69\%,
\end{aligned}
$$

with $+/-$ given to grades high or low in each band. I reserve the right to move the cutoff points downward if particular exams turn out to be unexpectedly difficult. Note that you are not in competition with your peers – everyone in the class may get an A, or everyone may get an F.

University and Department Policies: Every qualified student is welcome in my classroom. As needed, I am happy to work with you, disability services, veterans' services, rural student services, etc to find reasonable accommodations. Students at this university are protected against sexual harassment and discrimination (Title IX), and minors have additional protections. For more information on your rights as a student and the resources available to you to resolve problems, please go the following site: `www.uaf.edu/handbook/`.

Your work in this course is governed by the UAF Honor Code. The Department of Mathematics and Statistics has specific policies on incompletes, late withdrawals, and early final exams; see `https://www.uaf.edu/dms/policies/`.

Tentative Schedule

Week 1	Jan 11 – 15	Chapter 2
Week 2	Jan 20 – Jan 22	Chapter 2
Week 3	Jan 25 – Jan 29	Chapter 2
Week 4	Feb 1 – 5	Chapter 2/3
Week 5	Feb 8 – 12	Chapter 3
Week 6	Feb 15 – 19	Chapter 3
Week 7	Feb 22 – Feb 26	Chapter 4
Week 8	March 1– 5	Midterm Exam, Chapter 4
—	March 8 – 12	SPRING BREAK
Week 9	March 15 – 19	Chapter 4
Week 10	March 22 – 26	Chapter 5
Week 11	March 29 – April 2	Chapter 9
Week 12	April 5 – 9	Chapter 9
Week 13	April 12 – 16	Chapter 11
Week 14	April 19 – 23	Chapter 13, Final Exam (take-home)
Week 14+	April 26, 29	Chapter 13, Final Exam (in-class)