Course Description

Topologies are used to define continuous functions. This notion of continuity is quite general and extends the concept of continuity you have seen before for metric spaces. Although the definition of a topology is very simple, the framework it provides is surprisingly powerful. In particular, a topology describes a set's "shape", both locally and in terms of its global structure.

There are two distinct branches of topology: point-set topology and algebraic topology. This course will contain elements of both branches (with my bias as a differential geometer influencing the material). We will start with basic concepts from point-set topology, and will spend about half of the course studying this foundation-level material. The second half of the class will be devoted to elementary algebraic topology, a fascinating field that studies the relations between topological spaces and natural algebraic objects associated them. In this part of the class we will study homotopy theory, the fundamental group, homology, covering spaces, and the classification of compact surfaces.

Essential Information

Professor:	David Maxwell
Office:	Chapman 308C
Phone:	474-1196
Email:	`damaxwell@alaska.edu`
Web:	`damaxwell.gihub.io`
Required Text:	**Introduction to Topological Manifolds**, *John M. Lee*, Springer-Verlag
Recommended Text:	**Essential Topology**, *Martin D. Crossley*, Prentice Hall

Prerequisites

MATH F401 (Advanced Calculus) **or** MATH F404 (Topology) **or** permission of instructor. It will be helpful if you have seen a bit of group theory before, but I will summarize the basic group theoretic concepts and theorems as we go along

Student Learning Outcomes

Students will:

- prove facts about topological spaces, including those related to compactness, connectedness, product and quotient structures.
- prove facts about topological manifolds, especially those that exhibit the naturalness of the definition of these spaces,
- prove facts about elementary algebraic topology concerning the fundamental group of a topological space,
- acquire skills needed to pass the master's comprehensive exam.

Class Time

There will be three hours of class lecture each week. We will also have a one hour problem

session on a day and a time yet to be determined. The problem sessions will be an opportunity for you to discuss with each other (with occasional guidance from me) the homework problems due that week.

Lecture Times
MWF 10:30–11:30 Chapman 107

Office Hours

I will schedule 2 hours a week of formal office hours after consultation with my students. I am also available via Discord for help throughout the week.

Discord

A Discord server has been set up for this class. We will use it as the primary means of group communication.

Communication in Discord will be on-topic, polite and collegial as is suitable for a workplace setting.

As a courtesy to everyone you are communicating with, please sign in to the server with a handle that identifies yourself. As much as I am fond of my dog Frog, a handle of `RedFrog2016` would not be a great user id.

Homework

There will be a homework assignment due roughly every week, usually on Wednesdays. Each week's assignment and due date will be announced in class and will be posted on my web page. I will also post solutions after each homework has been handed in (see below for more information concerning solutions).

Regarding late homework, I will accept from each student a single late homework with no questions asked. Simply hand in a note indicating you are using your free late homework in place of your actual assignment. You must notify me no later than the time the homework is due that you intend to take advantage of this opportunity, and you must hand in the homework no later than one week after it was due. Subsequent late homeworks will be accepted only under extenuating circumstances to be determined at my discretion.

The late homework freebie cannot be used for the first two homework sets, nor can it be used for the final assignment.

Midterm

There will be one in-class midterm exam. It is tentatively scheduled to be held on Friday, March 7. Associated with this midterm, there will also be a take-home midterm to be handed out on Friday, February 28.

Final Exam

There will be a two-hour final exam at 10:15am on Thursday, May 1. There will also be a take-home portion of the final exam to be handed out in the last week of class and due on May 1. Details on the take-home exam will be announced closer to the end of the semester.

Evaluation

Course grades will be determined as follows:

Homework	40%
Midterm	30%
Final	30%

Letter grades will be assigned according to the following scale. This scale is a guarantee; I also reserve the right to lower the thresholds.

A+	97–100%	C+	77–79%	F	≤ 59
A	93–96%	C	73–76%		
A-	90–92%	C-	70–72%		
B+	87–89%	D+	67–69%		
B	83–86%	D	63–66%		
B-	80–82%	D-	60–62%		

Tentative Schedule

The following is a tentative list of the topics to be covered in this class. As we proceed in the course, the course web page will list specific sections to be read for each week.

Week	Topics and Events
1/13 – 1/17	Review of Metric Spaces, Topologies
1/20 – 1/24	Convergence, Continuity, Hausdorf spaces Monday: Holiday
1/27 – 1/31	Bases, Manifolds
2/3 – 2/7	Subspace and Product Topologies
2/10 – 2/14	Quotient Topology, Adjuction
2/17 – 2/21	Connectedness, Compactness
2/24 – 2/28	Flavours of Compactness
3/3 – 3/7	Nets, Topological Groups
3/10 – 3/14	Spring Break (no classes) Friday: Midterm
3/17 – 3/21	Homotopy, Fundamental Group, Homotopy Equivalence
3/24 – 3/28	More on Homotopy, Retractions
3/31 – 4/4	Fundamental Group of the Circle Friday: Last day to withdraw with a 'W'
4/7 – 4/11	Fundamental Group
4/14 – 4/18	Free Groups
4/21 – 4/25	Seifert-Van Kampen Theorem
4/28 – 5/2	Exam week Monday: Last day of class

Rules and Policies

Collaboration
You are encouraged to work together in solving homework problems. But each student must write up his or her own solutions independently. If you receive significant help solving a problem, it is customary to make a note in your homework to give the person who helped you credit.

Makeup Exams
You can make up an exam if certain extenuating circumstances prevent you from taking it and if you inform me in advance. Contact me as soon as possible if you are going to miss an exam.

Attendance
Attendance is not included directly as part of your grade.

Cell Phones
Turn off your cell phone before you come to class.

Incomplete Grade
Incomplete (I) will only be given in Computer Science, Mathematics or Statistics courses in cases where the student has completed the majority (normally all but the last three weeks) of a course with a grade of C or better, but for personal reasons beyond his/her control has been unable to complete the course during the regular term. Negligence or indifference are not acceptable reasons for the granting of an incomplete grade. (Note: this is essentially the old University policy.)

Late Withdrawals
A withdrawal after the university deadline from a Department of Mathematical Sciences course will normally be granted only in cases where the student is performing satisfactorily (i.e., C or better) in a course, but has exceptional reasons, beyond his/her control, for being unable to complete the course. These exceptional reasons should be detailed in writing to the instructor, department head and dean.

Academic Dishonesty
Academic dishonesty, including cheating and plagiarism, will not be tolerated. It is a violation of the Student Code of Conduct and will be punished according to UAF procedures.

Artificial Intelligence (AI)
These are very, very interesting times. AI is an incredible tool with the potential to both enhance and undermine your education. You are strongly encouraged to have conversations with AI models about the course material. You cannot use AI, however, to author work that you present as your own.

This policy may be amended as the semester progresses.

Official UAF Syllabus Addendum

Student protections statement: UAF embraces and grows a culture of respect, diversity, inclusion, and caring. Students at this universi ty are protected against sexual harassment and discrimination (Title IX). Faculty members are designated as responsible employees which means they are required to report sexual misconduct. Graduate teaching assistants do not share the same reporting obligations. For more information on your rights a s a student and the resources available to you to resolve problems, please go to the following site: https://catalog.uaf.edu/academics-regulations/students-rights-responsibilities/.

Disability services statement: I will work with the Office of Disability Services to provide reasonable accommodation to students with disabilities.

Student Academic Support:

- Speaking Center (907-474-5470, uaf-speakingcenter@alaska.edu, Gruening 507)
- Writing Center (907-474-5314, uaf-writing-center@alaska.edu, Gruening 8th floor)
- UAF Math Services, uaf-traccloud@alaska.edu, Chapman 305 (https://www.uaf.edu/dms/mathlab/, for math fee paying students only)
- Developmental Math Lab, Gruening 406
- The Debbie Moses Learning Center at CTC (907-455-2860, 604 Barnette St, Room 120, https://www.ctc.uaf.edu/student-services/student-success-center/)
- For more information and resources, please see the Academic Advising Resource List (https://www.uaf.edu/advising/students/index.php)

Student Resources:

- Disability Services (907-474-5655, uaf-disability-services@alaska.edu, Whitaker 208)
- Student Health & Counseling **[6 free counseling sessions]** (907-474-7043, https://www.uaf.edu/chc/appointments.php, Gruening 215)
- Office of Rights, Compliance and Accountability (907-474-7300, uaf-orca@alaska.edu, 3rd Floor, Constitution Hall)
- Associated Students of the University of Alaska Fairbanks (ASUAF) or ASUAF Student Government (907-474-7355, asuaf.office@alaska.eduas uaf.office@alaska.edu, Wood Center 119)

Nondiscrimination statement: The University of Alaska is an affirmative action/equal opportunity employer and educational institution. The University of Alaska does not discrimina te on the basis of race, religion, color, national origin, citizenship, age, sex, physical or mental disability, status as a protected veteran, marita l status, changes in marital status, pregnancy, childbirth or related medical conditions, parenthood, sexual orientation, gender

identity, political a ffiliation or belief, genetic information, or other legally protected status. The University's commitment to nondiscrimination, including against sex discrimination, applies to students, employees, and applicants for admission and employment. Contact information, applicable laws, and complaint proce dures are included on UA's statement of nondiscrimination available at www.alaska.edu/nondiscriminatio n. For more information, contact:

UAF Office of Rights, Compliance and Accountability
1692 Tok Lane, 3rd floor, Constitution Hall, Fairbanks, AK 99775
907-474-7300
uaf-orca@alaska.edu