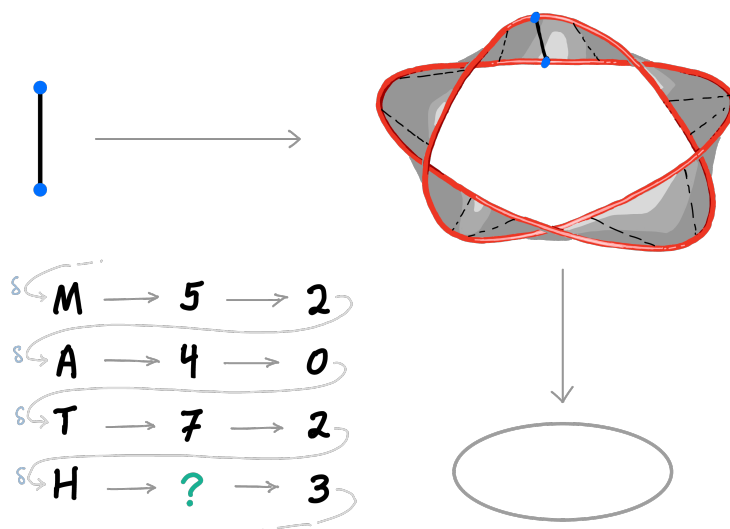


Math 547 – Algebraic Topology I – Fall 2023
David Dumas



1. THE BASICS

Course web page On UIC's Blackboard LMS

https://uic.blackboard.com/ultra/courses/_258305_1/cl/outline

Lectures MWF 2:00-2:50pm in Lincoln Hall 107

Instructor David Dumas (he/him) <ddumas@uic.edu>

Office hours Wed 11am and Fri 12pm

Any exceptions to be announced on Blackboard

Office location 722 SEO

Zoom office <https://uic.zoom.us/my/daviddumas>

Instructor home page <https://dumas.io/>

2. WELCOME STATEMENT

Welcome to Math 547. As your instructor, my main goals are:

- (1) to create a safe, inclusive, and welcoming learning environment (details in [Section 17](#)),
- (2) to provide clear and comprehensible lectures that, when paired with appropriate amounts of self-study, allow you to master the course material, and
- (3) to clearly explain the rules and expectations for the course.

This document describes essential course policies, so it is important you read it thoroughly.

In general I try to minimize the use of high-stakes assessments in my courses. In this course, where one of the goals is to prepare you for a preliminary exam, I do think some exam-taking practice is helpful. Thus we will have midterm and final exams, but each is worth just 20% of the course grade.

I look forward to working with you this semester.

3. COURSE CONTENT

This is a first course on algebraic topology, a subject concerned with constructions that associate algebraic objects to topological spaces and applications of those constructions to problems in topology.

We will introduce and study the fundamental group, covering spaces, homology, and cohomology, techniques for computing these objects, and examples of spaces and computations that help illuminate these constructions¹.

In the main textbook (Hatcher), this corresponds to the primary material of chapters 1–3 and some of the additional topics in each of those chapters. There is preparatory material in chapter 0 of the book, some of which will be familiar to students entering the course, and some of which will be discussed in lecture. Ideally, toward the end of the course we will discuss some topics that you will also see treated in a rather different way if/when you take Math 549 (Differentiable Manifolds I).

The Blackboard site for the course contains a schedule of material for the semester that may be subject to minor adjustments as the course proceeds, for example to account for the pace of lectures differing from the original plan or student interest in a specific additional topic.

4. PREREQUISITES

As stated in the UIC course catalog, Math 330 (abstract algebra) and Math 445 (topology) or equivalent background in these topics are required.

Among results in point-set topology, the constructions of the product and quotient topologies are particularly important, as are results allowing the construction of continuous maps (e.g. the pasting lemma, criteria for continuity of maps $\mathbb{R}^n \rightarrow \mathbb{R}^k$ defined by polynomial, rational, and elementary transcendental functions). Most of the spaces we study will be locally compact and Hausdorff, and in general the existence of topological spaces with pathological properties will play less of a role in this course than in a typical introductory point-set topology course.

An understanding of groups, rings, homomorphisms, vector spaces, and linear maps is essential to the course. Many students co-enroll in Math 516, which works very well, but the material from abstract algebra we require will either be contained in a typical undergraduate-level introduction or will be introduced in lecture.

Experience writing rigorous mathematical proofs is also essential for success in Math 547. Getting to know the appropriate level of detail in your proofs, and understanding instructor and/or grader expectations of these, is an important part of the early stages of the course. We will provide feedback to guide you in doing so.

5. TEXTS

There are no required textbooks. You need to have access to the primary text, but since it is available for free online, you do not need to buy a physical copy. But if you want a physical book, they are inexpensive and widely available. The secondary texts are optional resources where you can see alternate expositions of some or all course material; there is no need to buy any of them.

Primary text:

- *Algebraic Topology* by Allen Hatcher. (Springer, 2002)

Secondary texts:

- *Algebraic Topology, A First Course* by William Fulton (Springer GTM, 1995)
 - We'll use the proof of van Kampen's theorem from this book.
- *Topology* by Klaus Jänich (Springer UTM, 1984)
 - This is mostly an undergraduate point set topology book, but it is included here because it has a readable introduction to the fundamental group.
- *Topology and Geometry* by Glen Bredon (Springer GTM, 1993)

¹The UIC course catalog says that this course will cover the classification of compact surfaces. We will show that surfaces of different genus are not homeomorphic, but we will probably not give a proof that orientable surfaces of the same genus are homeomorphic.

- *Algebraic Topology* by Edwin Spanier (Springer, 1966)

6. HOW THE COURSE IS DELIVERED

This a **synchronous in-person class held on campus**. This means that unless the university requires a change in teaching modality, the course will be held at the scheduled time in Lincoln Hall 107. Any change in teaching modality will be announced on the course web page.

At present there is no plan to offer any hybrid participation option, nor to publish lecture notes.

(In case of student or instructor absence from campus, some contingency plans are described below in [Section 12.](#))

7. IMPORTANT DATES AND DEADLINES

Fixed dates. Some of these dates are taken directly from the [UIC academic calendar](#).

21 Aug	Mon	First day of class
4 Sep	Mon	No class (Labor day)
9 Oct	Mon	Take-home midterm exam posted
16 Oct	Mon	Take-home midterm exam due
23–24 Nov	Thu–Fri	No class (Thanksgiving)
1 Dec	Fri	Last day of class
4–8 Dec	Mon–Fri	Final exam week
12 Dec	Tue	Departmental deadline for instructor to submit grades
18 Dec	Mon	Course grades become available on my.uic.edu

Recurring.

- **Homework will be due once a week** in most cases, usually on Mondays. The exact deadline for assignments that have been posted can be found on Gradescope.

8. HOMEWORK

Problems sets will be posted on the course site, with each problem set indicating the date when it is due. Homework will be collected and graded online using *Gradescope*, a tool accessible through the course page on Blackboard. Homework will **not** be accepted in any physical form (e.g. please do not give paper to the instructor).

Typesetting solutions to problem sets is permitted, and learning \LaTeX is a great idea at this point in your studies, but we will use a lot of diagrams and figures which can be challenging to typeset.

Online collection means that homework written on paper will need to be scanned or photographed for upload. Hand-written solutions prepared on a tablet are also welcome. Anything submitted for credit must be legible to the course staff to receive credit, and should not contain an excessive amount of irrelevant material or scratch work.

Many problems will be taken from the textbook, but some will be written by the instructor or taken from other sources. The usual schedule will be one problem set per week, due on Monday.

Homework dropping: At the end of the semester, the **three** lowest homework grades will be dropped. This is meant to provide you leeway to handle routine variations in workload and schedule by choosing not to submit an assignment on occasion, or to submit incomplete work to get feedback on the portion you've completed.

Homework collaboration and resource policy: Collaborating on homework with other students in the course is acceptable, but you must write and understand the work you ultimately submit. Write your collaborators' names on the first page of the assignment.

9. MIDTERM

There will be a take-home midterm exam posted on or before Monday October 9 and due Monday October 16. Like the homework, midterm exams will be collected on Gradescope.

Midterm collaboration and resource policy: No collaboration is permitted on the take-home midterm exam. Course notes and the official textbooks listed on the syllabus are the only references that students are allowed to consult when solving these problems.

10. FINAL EXAM

The final exam will during the week of 4–8 December, 2023. The exact date and time are set by the registrar and will be announced when available. It is important that students avoid making plans (e.g. travel) that might conflict with the exam.

Unlike the midterm exam, the final exam will be held in person, with solutions written on paper booklets and collected for grading. Course staff will scan these booklets and grade them in Gradescope.

11. ATTENDANCE POLICY

It is important to attend the lectures whenever possible. However, following public health guidance, students who are sick or experiencing symptoms of illness should never participate in in-person activities.

Attendance in lectures will not be checked or recorded.

12. ABSENCE CONTINGENCY PLANS

12.1. **Student absent from lecture.** Any student who misses a lecture should ask another student in the course for notes from the lecture and review the associated material from the textbook.

12.2. **Instructor absent from lecture.** If the instructor cannot lead a course lecture in person, one of these things will happen:

- (1) Online synchronous lecture: Class will be held on Zoom using a meeting link provided in advance.
- (2) In-person substitute: Another instructor will lead the meeting as usual.
- (3) Cancellation: The course meeting will be canceled, with the next lecture containing the content planned for the canceled one.
- (4) Asynchronous lecture delivery: A lecture video will be recorded and provided to all students.

These options are roughly ordered from most likely to least likely. In any case, an announcement of the specific plan will be made with as much advance notice as possible. It is expected that instructor absences will be rare.

13. POLICY ON MISSED OR LATE WORK

For homework, the three lowest scores are dropped at the end of the semester. This dropping policy exists to handle occasional workload variations or other events that might affect your ability to complete an assignment on time.

If you are going to miss any other deadline or graded course activity, or if something more serious comes up affecting multiple homework assignments, please contact the instructor as soon as possible to explain the situation so we can try to work out an equitable solution.

14. ACADEMIC HONESTY

Hopefully, this will never become relevant in this course: Incidents of academic misconduct will be reported to the Dean of Students office and handled under UIC's [Student Disciplinary Policy \(https://go.uic.edu/DisciplinaryPolicy\)](https://go.uic.edu/DisciplinaryPolicy). If you are ever unsure about the rules for a graded activity in this course, please ask the course staff.

15. COURSE GRADE COMPUTATION

The course grade is computed as a weighted average of scores on the three types of work:

- **60% - Homework**
 - The **three** lowest scores are dropped
 - The remaining homework scores are converted to percentages and averaged, so each assignment accounts for the same fraction of the course grade
- **20% - Take-home midterm**
- **20% - Final exam**

And just to be clear about the meaning of weighted average, this means your final course grade is equal to:

$$0.6 \times (\text{homework average}) + 0.2 \times (\text{midterm percentage score}) + 0.2 \times (\text{final exam percentage score})$$

When final course grade percentages are available, they will be converted to letter grades using thresholds to be determined by the instructor. The grading thresholds will be *at least as generous* as the following scale, and the instructor's intention in designing the assessments is to make it possible to apply this exact scale:

- A = 85% – 100%
- B = 70% – 84.9999%
- C = 60% – 69.9999%
- D = 50% – 59.9999%
- F = less than 55%

16. COMMUNICATION WITH COURSE STAFF

Instructor office hours will be held in person (whenever the university allows this). On request, the instructor can also meet with students on Zoom during office hours. Students who cannot attend office hours but want to meet with the instructor can request an appointment.

Outside of course meetings, office hours, and scheduled appointments, email and Discord are the best ways to contact the instructor in most cases.

Keep in mind that questions received in the last few hours before a course deadline (for a homework assignment or exam) cannot necessarily be answered in time to help you with your work.

17. LEARNING ENVIRONMENT

17.1. Inclusive community. UIC values diversity and inclusion. You can read more about this at <https://diversity.uic.edu/>. Regardless of age, disability, ethnicity, race, gender, gender identity, sexual orientation, socioeconomic status, geographic background, religion, political ideology, language, or culture, we expect all members of this class to contribute to a respectful, welcoming, and inclusive environment for every other member of our class. If aspects of this course result in barriers to your inclusion, engagement, accurate assessment, or achievement, please notify the instructor as soon as possible.

17.2. Name and pronoun use. If your name does not match the name on the class roster in Blackboard, please let me (the instructor) know as soon as possible. There *is* a tool in Blackboard to set your preferred name, however technical limitations in the current version of this tool mean that information provided to it is not necessarily available to all course staff, nor is it consistently synchronized with other tools linked to Blackboard. For this reason, informing the instructor is helpful.

My pronouns are he/him. I welcome your pronouns if you would like to share them with me, and encourage including this information in your profile of communication tools we use in class (e.g. zoom, discord).

17.3. Conduct policy. Group meeting environments (like Math 547) work best when norms of behavior are explicitly spelled out. Everyone in the course is expected to:

- (1) Be present by refraining from use of electronic devices for purposes unrelated to course work.
- (2) Be respectful of the learning space by avoiding side conversations and unnecessary disruptions.
- (3) Use preferred names and personal pronouns of course students and staff.
- (4) Assume good will in all interactions, even in disagreement.
- (5) Be open to change and receptive to both positive and critical feedback from peers and course staff.
- (6) Be mindful of one another's privacy, for example by refraining from audio or video recording unless explicit permission is given by all participants.

18. UNIVERSITY WELLNESS RESOURCES

Please be aware of the following programs at UIC. All of the programs listed below are available to graduate students.

- **Counseling Services** – Free and confidential. <https://counseling.uic.edu/>
- **U & I Care Program** – University program providing assistance for students dealing with with personal hardships. <https://dos.uic.edu/student-assistance/uicare/>
- **Campus Advocacy Network** – Under Title IX, you have the right to an education free from any form of gender-based violence or discrimination. Reports can be submitted to TitleIX@uic.edu. For more information or confidential victim services and advocacy, see <http://can.uic.edu/>.

19. UNIVERSITY POLICIES

UIC requires that every syllabus mention the following university policies.

19.1. Academic deadlines. The UIC academic calendar can be found at:

<http://catalog.uic.edu/ucat/academic-calendar/>

In particular this calendar includes the deadlines for adding and dropping courses.

19.2. Standards of conduct. All UIC students are required to abide by the rules and standards of conduct described in the [Student Disciplinary Policy \(https://go.uic.edu/DisciplinaryPolicy\)](https://go.uic.edu/DisciplinaryPolicy).

19.3. Disability accommodation. The University of Illinois at Chicago UIC is committed to full inclusion and participation of people with disabilities in all aspects of university life. Students who face or anticipate disability-related barriers while at UIC should connect with the Disability Resource Center (DRC) by visiting drc.uic.edu, by emailing drc@uic.edu, or by calling (312) 413-2183 to create a plan for reasonable accommodations. In order to receive accommodations, students must disclose disability to the DRC, complete an interactive registration process with the DRC, and provide their course instructor with a Letter of Accommodation (LOA). Course instructors in receipt of an LOA will work with the student and the DRC to implement approved accommodations.

19.4. **Religious holidays.** The UIC Senate Policy on religious holidays is as follows:

“The faculty of the University of Illinois at Chicago shall make every effort to avoid scheduling examinations or requiring that student projects be turned in or completed on religious holidays. Students who wish to observe their religious holidays shall notify the faculty member by the tenth day of the semester of the date when they will be absent unless the religious holiday is observed on or before the tenth day of the semester. In such cases, the students shall notify the faculty member at least five days in advance of the date when they will be absent. In cases when the exact date(s) of the religious holiday is/are not known at the start of the semester, the student should notify the faculty member as soon as the exact date is known. Students should be asked to report if such situations might occur within the first four weeks of the semester. The faculty member shall make every reasonable effort to honor the request, not penalize the student for missing the class, and if an examination or project is due during the absence, give the student an exam or assignment equivalent to the one completed by those students in attendance. If the student feels aggrieved, they may request remedy through the campus grievance procedure.”

The University Holidays and Religious Observances calendar can be found at:

<http://oae.uic.edu/religious-calendar/>

20. REVISION HISTORY OF THIS DOCUMENT

Any change to this document will be recorded here. Such changes are expected to be rare.

- 2023-08-19 Initial publication
- 2023-08-25 Changed office hours; fixed typo in first sentence of section 2.
- 2023-09-11 Simply office hour information by removing outdated information about the schedule before Sep 5.