

MAT180 Syllabus

Special Topics: Knot Theory

Dr. Melissa Zhang

CRN 48893

Spring Quarter 2023

1 Course information

Course meetings Lectures MWF 1:10–2:00 pm, Giedt Hall 1006

Prerequisites MAT 108

- Familiarity with proof-based mathematics is necessary.
- Basic abstract algebra is recommended, though not absolutely required.

Text Colin Adams, *The Knot Book*, any edition

- This text is typically purchaseable for around \$20–\$40. Most homework problems will be assigned out of this book.
- Aside from the main text, we may supplement lectures with additional articles covering aspects of knot theory developed in the 21st century.

Instructor Dr. Melissa Zhang (mlzhang@ucdavis.edu), MSB 2145

- You may call me “Dr. Zhang”. To pronounce my last name, choose your own comfort level:
 - Level 1 *Doctor Zang* (rhymes with “hang”)
 - Level 2 *Doctor Djong* (rhymes with “gong”)
 - Level 3 [https://en.wikipedia.org/wiki/Zhang_\(surname\)](https://en.wikipedia.org/wiki/Zhang_(surname))
- I generally handle my emails once daily, on business days. As such, if you email me, you can expect a response from me within 1-2 business days.

Instructor office hour: MSB 2145, Tuesdays 3 pm – 4 pm

- If you want to speak privately during office hours (e.g. about your grades), let me know. If you want to meet with me individually outside of office hours, please make an appointment by email at least 24 hours in advance.

Teaching assistant (TA): Yuze Luan (yuzluan@ucdavis.edu), MSB 2137

TA office hours: MSB 2137, Thursdays, 9am – 12 noon

Website: <https://www.melissa-zhang.com/Teaching/SQ2023/MAT180.html>

Course Drop Date: April 28, 2023 (20 Day Drop)

2 Course description

Course Description Knot theory is one of the most concrete and hands-on subfields of modern topology, and has ties to many other parts of mathematics. Students will be introduced properties of knots, knot invariants, and topological objects related to knots. We will focus on hands-on computations and exercises involving visualizing and drawing physical objects, as well as algebraic representations of these objects.

Learning goals: In this course, students will advance various conceptual and technical skills related to reading, writing, discussing, and discovering advanced mathematics. Knowledge and skill-based goals of this course include the following:

- Exposure to an area of mathematics that combines intuition, visualization, and drawing with more abstract tools from abstract algebra and combinatorics.
- Ability to present clear, sufficiently rigorous diagrammatic or picture-based proofs and calculations.
- Working familiarity with typesetting mathematics in LaTeX, including how to insert and refer to figures and images.

Tentative course outline: Below is a rough outline of the topics covered in the course. The book chapters come from the class textbook. The topics listed are those we will focus most heavily on within the listed chapters.

Week	Book Chapters	Topics
1	1,2	introduction to knots and how to describe them
2	3	some numerical invariants of knots
3	4	surfaces and knots
4	5	classifications of knots
5	6	some polynomial invariants of knots
6	7	applications of knot theory to other scientific fields
7	8	more combinatorics
8	9, 10	more on low-dimensional topology
9	(no chapter)	more on knot theory in the 21st century
10	(no chapter)	more on knot theory in the 21st century

The **class calendar** is available at the course website and will be continually updated throughout the quarter to reflect changes in the scheduled lessons.

Disclaimer: The course syllabus is a general plan for the course; deviations announced to the class by the instructor may be necessary. It is the responsibility of the student to seek clarification of the grading policy and/or course requirements and procedures from the instructor.

3 Assignments and grading

Your numeric grade will be calculated using the following weights. Each assignment type will be discussed further below.

In-class work / participation	20%
Homework	50 %
Final Project	30%
Total	100%

In-class work / participation At the beginning of each class, there will be a short review problem to work on. You will work on this problem with your peers sitting around you, and then submit your work at the end of class. These assignments will serve as a record of your class attendance, and your effort on these assignments will be taken into consideration while grading.

- Grading of these assignments will begin at Week 3, which is after the last day to add this course.
- There is no way to make-up these collaborative assignments. If there are documented extenuating circumstances preventing you from completing these assignments or attending lectures, contact me and we can discuss a modified plan.

Homework: Homeworks will be due weekly on **Friday nights at 11:59 pm, on Gradescope**. Your solutions **must** be submitted as LaTeX'ed PDFs; images may be hand-drawn and inserted as figures.

- I will drop your lowest homework score at the end of the semester.
- You are allowed **two 24-hour extensions to use on homework(s) of your choice**; you must indicate on Gradescope that you are using this extension, on the homework you use it on. No other extensions will be granted except in documented extenuating circumstances.
- No other extensions/drops will be granted, except in documented extenuating circumstances. **All assignments must be submitted by the last day of class, June 8, 2023.**

Final project: The “final exam” for this course is scheduled for **Friday, June 9, 2023 at 10:30 AM**. This date and time is scheduled by the University and cannot be changed.

However, for this course, the final exam will be replaced by a final project, which will include a presentation component to take place on June 9 during our scheduled final exam time. The materials for your final project will be submitted before the class ends, and depending on class size, we will may also have to allot some class days for final project presentations.

- To see your personal final exam schedule, go to

<https://registrar.ucdavis.edu/registration/register-for-classes/finals>

In particular, the University policy states:

Students wishing to adjust their final exam schedule because of multiple exams on the same day must make arrangements with the instructors of the courses. Students are responsible for ensuring they do not have conflicting exams. There is no regulation mandating a change.

Letter grades: At the end of the semester, letter grades will be assigned using the following scale:

< 60	60 – 62	63 – 66	67 – 68	69 – 71	72 – 76	77 – 78	79 – 81	82 – 86	87 – 89	89 – 91	≥ 92
F	D-	D	D+	C-	C	C+	B-	B	B+	A-	A

- The assigned letter grade will be a lower bound for your final recorded grade. For example, any numerical grade x within the range $82 \leq x < 87$ translates to a grade of at least B. You should count on receiving the letter grade indicated by the chart.
- Note that “rounding up” has already been built into the grading scale. Requests to further round up at the end of the semester will be denied.

4 Course policies and procedures

Diversity and inclusion statement: In this classroom, you will be treated with respect, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class. (Source: modified from https://docs.asee.org/public/LGBTQ/Diversity_Statement.pdf)

Classroom expectations: We will discuss mathematics together on a daily basis. These discussions are important because they provide for a richer classroom discussion, and they ensure that we all encounter different ways – correct and/or incorrect – of thinking about the material. It will be important for you to listen attentively to your peers' thinking, even if you think you already have a full solution to the discussion problem. I expect you to respond respectfully and carefully to your peers' comments. When you are working in groups, I expect you to help your group members to all work at the same pace; it will be important for you to keep your peers informed about the choices you are making, and for you to check in with them to make sure they follow your thinking and are ready to move on.

Electronics policy: Cell phones may not be used in class. Laptops, tablets, etc. may be used only for note-taking or other class-related activities, during class. I understand that there may be times when you need to be connected (childcare issues, family emergencies, etc.). If such a situation arises, please step outside and address these as needed. If you repeatedly violate this policy, you will be asked to leave the room immediately.

Academic honesty: See the UC Davis Code of Academic Conduct at

<https://ossja.ucdavis.edu/code-academic-conduct>

You are encouraged to discuss homework with others, but any solution that you hand in must be thought through and worked through on your own and written down in your own words.

Accessibility For accommodations for disabilities, go to

<https://sdc.ucdavis.edu>

and begin the process as soon as possible. I will need to approve a letter from the Student Disability Center before making any accommodating changes to the policies stated on this syllabus for you. It is the student's responsibility to make sure all accommodations are set up through the SDC ahead of exams or class meetings where accommodations are needed.