

**Winter 2022 Math 351 Point-Set Topology**  
**M-Th, 1:00 - 1:50 pm**

**Instructor:** Dr. Jim Bisgard

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**Office Hours:** M-Th 11:00 am to noon and by appointment, in-person or Zoom

**Course Goals:** This is a first course in “point-set topology.” If you’ve never heard of topology, don’t worry. (There is another important area of topology, called algebraic topology, but every course in algebraic topology presumes that you’ve had a course in point-set topology.) Our main goal is to practice good mathematical reasoning and thinking. We will do this by giving a list of rules (or axioms), and then investigating their consequences. From the course catalog, the outcomes for this class are:

- Use definition of topology to determine what collections are topologies.
- Test functions to determine their continuity.
- Construct correct proofs utilizing axioms and definitions of topology.
- Formulate necessary and/or sufficient conditions guaranteeing the truthfulness of mathematical statements.

The most important of those is the third: construct proofs. You will do a lot of writing in this class — there will rarely be long calculations with lots of algebra. That makes it important that you describe how you know certain things. In many situations, you will “know” the “right” answer ahead of time, and so the main point is to explain why that answer is in fact correct. This rarely a matter of a simple calculation (although sometimes it is). Notice that explanation involves words, and as a result, solutions that don’t involve any words will never earn full credit! Another difference between this course and calculus is that it is perfectly normal to not immediately know how to do a problem. For example, in calculus, if you were asked to calculate a derivative, you immediately know that you need to calculate a derivative. In more proof-based courses, we often may not immediately know what needs to be done. Indeed, one of the difficult parts of writing proofs is figuring out exactly what we need to do. One of our meta-goals in the course will be to gain valuable experience in figuring out what we need to do in different problems.

**Text:** We will be using the free textbook Topology Without Tears, available at [Topology Without Tears](http://Topology Without Tears). More information about the book (as well as some possibly helpful videos) may be found at [www.topologywithouttears.net](http://www.topologywithouttears.net).

## 1 Grades/Homework/Exams

### Grades

Grades will be calculated using the following weighting system:

Homework: 50% total, broken up as 5% outlines and 45% solutions;

Exams: 50% total, broken up as follows: 20% for the mid-term and 30% for the final.

I will use the following formula to determine your final percentage

$$.45 \left( \frac{\text{total solution points earned}}{\text{total solutions points possible}} \right) + .05 \left( \frac{\text{total outline points earned}}{\text{total outline points possible}} \right) \\ + .2 (\text{Exam \#1 percentage}) + .3 (\text{Final Exam percentage})$$

and then the following scale:

	87 – 89.9 : B+	77 – 79.9 : C+	67 – 69.9 : D+	below 60 : F
93 – 100 : A	83 – 86.9 : B	73 – 76.9 : C	63 – 66.9 : D	
90 – 92.9 : A–	80 – 82.9 : B–	70 – 72.9 : C–	60 – 62.9 : D–	

## Homework

Homework will be assigned every week, except for those weeks when we have an exam. Homework will be assigned on Tuesdays. Outlines for each problem will be due the following Thursday at 4 pm, and solutions will be due the following Tuesday at 4 pm. For the outlines, you will need to write down the assumptions, what you need to prove, the relevant assumptions, and a sentence or two about what you might try to relate. An outline should be a fairly quick thing to do, which is why outlines will be due two days after you get the assignment.

I encourage you to work with other students, but you should write up your solutions in your own words. **DO NOT COPY!** A very common sure sign of copying is to have the same very odd mistake or typo. In addition, notice that by simply changing a few symbols here or there, a perfect solution can become completely incomprehensible. A good way to make sure you are not copying is to figure out how to do a problem on scratch paper, and then write it up nicely. There will be a homework assignment due during the last week of class. Because life is likely to happen to all of us this quarter, your lowest homework score will be dropped.

**Submitting Work Electronically:** Outlines and Solutions to homework must be submitted electronically through Canvas.

1. Outlines and Solutions may only be submitted in .pdf format. Your outlines must be submitted as a **SINGLE FILE**, and your solutions must be another separate **SINGLE PDF FILE. DO NOT submit a separate file for each page of your work! You must combine all parts of your submission into a single pdf prior to submission!** Your submission must be less than 20 MB, and fewer than 15 pages. Submissions that do not meet these guidelines will earn zero points.
2. If you choose to hand-write your homework, you have a couple of options for submission:
  - (a) You can scan it to a PDF document using a cell phone camera. Some apps that do this (there are many others if you don't like these): Adobe (free) or CamScanner (free version) for Android phones; the Notes App (built-in) or CamScanner (free version) for iPhone.
  - (b) You can take a well-lit, in-focus photograph, insert it into a Microsoft Word or OpenOffice Writer document (making sure that the photo is oriented correctly and easy to read), and then save the document as a .pdf file for upload to Canvas.

Whichever method you choose, please double-check that your image is oriented correctly. Images not oriented correctly, images that are not well-lit, or images that are out of focus will lead to the assignment being returned without being graded.

## Late Policy

Outlines for each homework are worth a total of 5 points, and will be due at 4 pm on Thursdays. Outlines submitted after 4 pm on Thursdays will receive no credit. Solutions will be due at 4 pm on Tuesday. Solutions submitted after its due date will have a 20% point deduction, and another 20% reduction for every 24 hours after. That means: if you submit solutions worth 40 points at 4:30 pm on Tuesday, you will have an automatic deduction of eight points. If you submit your solutions Wednesday at 4:30 pm, you have 16 points deducted, since over 24 hours will have passed. In addition, no credit can be earned for solutions submitted after graded work is returned to the class. This will typically be before class on Monday.

## Exams

There will be two exams: a mid-term and a final, which will be done in person. The first mid-term will be a take-home, and will be handed out in the first half of February. There will be two parts to the Final Exam: a take-home portion, handed out the last week of class, and an in-class portion on Wednesday, March 16. The Final Exam will be cumulative, and the in-class portion will consist primarily of definitions and true-false-plus-explanation questions.

## 2 Important Dates

January 10 - Last Day for Add/Drop

February 18 - uncontested withdrawal deadline

March 16, noon to 2 pm - In-class portion of Final Exam

## 3 General Class Policies

Come to class — attendance is considered necessary for success! You are responsible for all material covered in class, even from days that you are unable to attend! Do your own work. Work really hard; this class is likely to be quite difficult, but you will leave it with a useful set of skills that will be applicable in your future math and computer science courses.

### **Covid Statement and Face Coverings:**

Cloth face coverings **MUST** be worn indoors by **ALL** CWU students, employees, and visitors, **regardless of vaccination status**. The mask must cover both the mouth and nose, fitting as snugly as possible against the sides of the face. Students not wearing a mask will be asked to put one on, if they refuse, students will be asked to leave the classroom and building. Your mask protects me; my mask protects you. Masks with one-way valves for exhalation do not provide protective value for others — please don't use them as your face covering for any in-person interactions. Thank you for helping keep all of us safe!

**Class Recordings:** Attendance is considered mandatory, and you should plan to attend on an ongoing basis. Because of the ongoing pandemic, class will be recorded using Zoom, and those recordings will automatically be posted on Canvas (in the Panopto tab). It will not be edited, and I may point to portions of the board that aren't in the view of the camera. (Everybody in class is able to see the entire board, unlike the restricted viewing angle of the camera.) We all benefit from the conversations in-class, and they will be richer for having you there! One of the points of attending classes is to have an expert in the content area provide you with guidance in that content area, and be able to respond to any questions you may have. In addition, we may have some period of class where you will work with your neighbor to solve problems. If you do not attend, you miss out on the substantial benefit these small group interactions provide.

**Academic Honesty:** The integrity of students and their written and oral work is a critical component of the academic process. Consult university policies (CWUP 5-90-040(22), CWUR 2-90-040(22), and WAC 106-125-020) for student conduct, cheating, plagiarism, and other academic expectations. CWU's policies and recommendations for academic misconduct will be followed, leading to disciplinary action up to and including failing the course.

**Inclusivity Statement:** As a member of a peer learning community, a high degree of professionalism is necessary. **CWU expects every member of the university community to contribute to an inclusive and respectful culture across its entire campus including within its classrooms, offices, and at all campus events.**

**Classroom Conduct:** Students in this class are expected to interact with students and the professor professionally. Instances of disruptive conduct, obstructive conduct, or harassment (see definitions from the Washington Administrative Code: WAC 106-125-020) will be referred to the Dean of Student Success. Refusal to wear a face-covering will be considered disruptive conduct.

**Disability Support Services:** Central Washington University is committed to creating a learning environment that meets the needs of its diverse student body. Students with disabilities should contact Disability Services to discuss a range of options to removing barriers, including accommodations: Hogue Hall 126, 509.963.2214, DS@cwu.edu

**Religious Obligations and Schedule Conflicts:** In compliance with RCW 28B.137.010, Central Washington University makes every effort to deal reasonably and fairly with students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. Students must present written notice to their instructor *within the first two weeks of class* listing the specific dates on which accommodations are required. Contact the Dean of Student Success at (509) 963-1515 for further information or questions.

**Switching to Online:** If I (or a substantial proportion of class) need to quarantine during the quarter or if CWU decides that the safest way to conduct classes is completely online, class will be run as a synchronous online course, which will meet at its regularly scheduled day and time using Zoom. The Zoom link will be posted in Canvas.

I reserve the right to change the policies contained in this syllabus as dictated by developments during the quarter.