Introduction to Abstract Algebraic Systems (Math 0430)

University of Pittsburgh, Spring Semester 2026

Welcome to Abstract Algebra! Please read this syllabus carefully. All this information and all future announcements will be available on the course's Canvas page.

https://canvas.pitt.edu/courses/357267

1 Course information

Summary: This is an undergraduate-level course intended to introduce students to abstract algebra. Many of the objects of abstract algebra are familiar, such as the integers $\mathbb{Z}$ along with their addition and multiplication operations, while some will be new. The point of this class is to identify essential structures underpinning familiar mathematical objects, and then experience a broader array of manifestations of these structures. For instance, the same kind of axioms for $\mathbb{Z}$ with $+$ can be applied to the set of symmetries of a regular polygon or a set of invertible square matrices. The featured abstract-algebraic objects that achieve this common abstraction are called groups and rings. Abstract algebra is not just compelling in itself, but also abstract-algebraic thinking lends itself to many proximate areas of the mathematical sciences, computer science, and engineering. For instance, it is heavily used for computing and electronic communication have developed, especially in the form of cryptography and coding theory. Finally, it is also provides a deeper perspective on all of the mathematics that came before it.

The course will have weekly brief problem sets, two midterm exams, and a final exam. The course will support and emphasize improvement in writing mathematical proofs.

Pre-requisites: The typical options for pre-requisites for this course are Math 0413 or 0450 or 1185. Feel free to ask me if there are any questions about pre-requisites.

Instructor

My name is Carl Wang-Erickson. You're welcome to call me "Carl," or "Dr. Carl," or "Professor Carl." Or "Dr. Wang-Erickson" or "Professor Wang-Erickson." Let me know if you prefer me to call you by a name other than what I see in your official enrollment in the course (there will be a survey where you can tell me about that).

I am originally from Milwaukee, Wisconsin, USA. I came to college uncertain about studying mathematics. But once I took the equivalent of *this course*, introductory abstract algebra, I was hooked on math. So I decided to try to get a PhD and do research. I finished my PhD studying number theory in 2013. Since then, I worked in Boston and London, followed by moving to Pitt starting in 2019. The topics that we will discuss in this course are fundamental to my research today, and I really enjoy them. That said, I will make sure to pitch the course to balance everyone's learning goals as well as possible.

I am interested in promoting research and independent learning by undergraduates, especially taking the topics of this course as a starting point, and I welcome questions about how this could work for you.

Instructor contact information

Office: Thackeray 421
Office hours: Mon/Wed, 11am-12pm (initial time – I will survey the class about your schedules)
Email: carl.wang-erickson@pitt.edu
Webpage: https://sites.pitt.edu/~caw203/

Emailing me or stopping by office hours is the best way to start. In particular, you are welcome to set up a meeting with me. If you would like to find out more about me, you might be interested in my webpage. I am happy to speak with you after class briefly, and look forward to seeing you in office hours.

Course meeting coordinates

Thackeray Hall, room 427
Mondays, Wednesdays, and Fridays, 2:00pm-2:50pm

Course Teaching Assistant (TA), to-be-announced

There will be a TA, who will be named later.

Textbook

The textbook will be a useful resource to learn about the content of the course. Sometimes we will follow it closely, and sometimes we will use it as a resource that complements the content in lectures.

Abstract Algebra, 3rd Edition, by David S. Dummit and Richard M. Foote.

A copy of the course textbook will also be on reserve in the library. My understanding is that it is not hard to find a PDF version online. Check that it is the 3rd edition, since some numbering changed between editions.

There are other common textbooks that could be useful to give you a second (or third) look at the material. Among those that I am aware of are, listed by author,

- Thomas Hungerford
- Thomas Judson (available online at `http://abstract.pugetsound.edu`)

2 How to do well in this course

I totally endorse this description of how to do well in this course from my colleague, Dr. Thomas Gilton.

> *You can't learn how to run a five-minute mile without lacing up and hitting the pavement. You can't learn how to rip on a sax like Coltrane did without practicing for hours and hours. Similarly, to do well in this course, you need to be actively working on the material. This means trying to solve problems. Watching videos online can be helpful, but only up to a point. You do not learn math just by watching someone who is good at math do math. You learn math by by making numerous attempts at solving hard problems and by practicing on your own.*
>
> *Do as many problems as you can. Do every problem in the book, if you need to. Find another book and do the problems in that book. Practice 6 days a week (give yourself a day off too). Do lots of practice exams. Ask questions, especially the ones that seem "dumb." If you are confused, speak up. If you need clarification, ask for it. I delight in answering your questions. But how well you do in this course is your responsibility. Do not cram. Come to my office hours. Go to your TA's office hours.*
>
> *If you are passive in your learning, you will likely do poorly in this course.*

3 Coursework

The coursework is designed to give you a structure to practice and improve your mathematics and get feedback on it.

3.1 Written assignments

There will be weekly written assignments that will be focused on content that will enhance your understanding of the course material. They will usually consist of two or three problems each. These can submitted through Canvas. Assignments completed using LaTeX, which is the standard typesetting package in mathematics and many other fields, will receive a 5% bonus. LaTeX is free and can be downloaded to your computer. Alternatively, you can use a free online version such as Overleaf.[1]

The emphasis in these assignments will be to either

- argue and explain your proof clearly, or
- argue and explain your proof as far as you can, and then identify what remains that you do not understand or cannot figure out.

Written assignments will be due on Fridays unless the class prefers a different day. Weeks with a midterm exam will not have a written assignment deadline. They should leave space for comments – I will supply a LaTeX template with large margins.

Late assignments will not be accepted in general, with exceptions being available with you receive approval of an extension from me *in advance*. Any assignment not turned in by the deadline receives a grade of zero, and the lowest assignment grade is dropped.

3.1.1 Collaboration policy

You are welcome and strongly encouraged to collaborate with classmates on written assignments. When you collaborate, you are required to

- write up your explanations independently, and
- list the names of those that you collaborated with on your written assignment.

3.1.2 Sourcing policy

You may use materials from the textbook and course sessions without limitation and without citing them.

You may also seek out and use inspiration from all sources, including the internet, provided that you follow standard professional and academic practice of citing your sources, and genuinely understand what you are writing down. The key required aspect of a citation is that it is easy for someone to look up exactly what you cited.

3.1.3 Philosophy of written assignments

Written assignments are the main way that I give you a structure for practicing with the course content regularly, which is the most promising way to be successful (as discussed in Section 2, above).

[1] To access a Pitt-sponsored Overleaf account, go to https://www.overleaf.com/edu/pitt.

3.2 Midterm exams and final exam

There will be two midterm exams in class, followed by a final exam. Each exam will be cumulative up to that point and closed-book. I will aim to emphasize the most fundamental course concepts in a straightforward way on exam problems, leaving the more tricky aspects for problem sets. Here is the *tentative* schedule for exams: the midterm dates may be changed if needed.

- Midterm exam 1: Friday, February 20, in class time
- Midterm exam 2: Friday, April 3, in class time
- Final exam: Tuesday April 28, 1:00pm-2:50pm (location TBD)

4 Communication

4.1 Between me and you

Communication between me and you is key for promoting your success in this course. The standard ways I communicate *to* you are

- the lecture components of course sessions
- feedback on your midterm exam and final project, and
- other interactions, such as office hours, appointments you request, email, etc.

The standard ways you communicate with me are reciprocal to the above: showing up to course sessions, submitting all of the required grades, and showing up to office hours.

In addition, I need to and want to hear from you if you are finding it difficult to keep up with the class. *Early* discussion of such issues has made it possible for many students to be successful, and delays make this much more difficult.

4.2 Among you

Our peers can often be our best teachers. I can't force you to work together, but I encourage you to collaborate on problems sets together, set up study groups and group communication, etc.

5 Assessment

I will attempt to return assessments as quickly as possible because the feedback is an important part of the learning process. Your final numerical course grade, out of 100, will be calculated as the *maximum* of the following two scores:

$$\text{Score}_1 = \frac{3}{10} \cdot H + \frac{2}{10} \cdot M_1 + \frac{2}{10} M_2 + \frac{3}{10} F$$
$$\text{Score}_2 = \frac{3}{10} \cdot H + \frac{2}{10} \cdot \max\{M_1, M_2\} + \frac{2}{10} F + \frac{3}{10} F$$

where H = Homework, F = Final project, M_i = Midterm exam $\#i$, and where each of H, F, M_i has been scaled to an out-of-100 scale before this calculation. In other words, you can think of Score_1 as the default grade formula; but your final exam score will replace the lower of your two midterm exam scores, as in Score_2, if this helps you.

Your final letter grade for the course will be calculated on an *absolute* basis to the maximum extent that I can achieve. In other words, a student will get an A for "superior" work, no matter the performance of other students; and so forth,

according to the official grade scale.[2] While it is undeniable and natural that your peers' level of achievement may affect your grade in some sense, I use the overall class achievement level as only one calibration factor for letter grades. I welcome more discussion in person on this topic, and would be happy to occasionally provide an estimate of your letter grade based on your current grade status once the midterm exam has passed. There is not a pre-determined scale for converting numerical course grades into letter grades.

6 Other policies and procedures

- **Audit option.** Please contact me to set up a discussion of an audit option, if this interests you.
- **Attendance.** Attendance is not "taken" nor graded, but I do expect you to attend course sessions. In particular, while I will aim to put all of the most important announcements for the course online, if you miss an announcement or explanation of how to do something that happens during a course session, it will be "on you" to find out about it.
- **Electronic devices.** Slowing down your mind to think about math is absolutely crucial to getting the most out of class time. Because of this, the default policy is that you cannot use electronic devices during class. (Laptops, phones, headphones, earbuds.) A electronic tablet for note-taking is fine, provided the internet connection is turned off.
- **Email and Canvas communication.** Students will be expected to be aware of updates about the course that are sent via email to their Pitt email account or posted on the course's Canvas page. To see how to make sure you get the right Canvas notifications, see this link.
- **Disability resources.** If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and the Office of Disability Resources and Services, 140 William Pitt Union, 412-648-7890, as early as possible in the term. Disability Resources and Services will verify your disability and determine reasonable accommodations for this course. More information may be found at `http://www.studentaffairs.pitt.edu/drs/`.
- **Academic integrity.** Cheating/plagiarism will not be tolerated. Students suspected of violating the University of Pittsburgh Policy on Academic Integrity, from the February 1974 Senate Committee on Tenure and Academic Freedom reported to the Senate Council, will be required to participate in the outlined procedural process as initiated by the instructor. A minimum sanction of a zero score for the quiz or exam will be imposed. (In particular, this includes following the collaboration and sourcing policy described above.)
- **Classroom recording.** To ensure the free and open discussion of ideas, students may not record classroom lectures, discussion and/or activities without the advance written permission of the instructor, and any such recording properly approved in advance can be used solely for the student's own private use.
- **Scheduling conflicts.** Please take stock of your schedule conflicts, for example, those resulting from athletic participation or religious observance. Please discuss these with me in the first two weeks of the semester if at all possible, and we will make an arrangement.

7 Have a great semester!

Please get in touch with me to ask about any questions that arise from this syllabus! I am looking forward to working with you – all of us have a lot to learn this semester. In particular, just as I am expecting continuous improvement from you in your learning, I am expecting continuous improvement in my teaching.

[2] https://catalog.upp.pitt.edu/content.php?catoid=188& navoid=17780#grading-systems