Math 350 – Groups, Rings and Fields – Syllabus

Spring 2024

- **Instructor**: Chris Elliott (pronouns: he/him)

  You can reach me by e-mail at `celliott@amherst.edu`. Please feel free to call me Chris.

  Office Hours: Monday 2:00–3:30, Wednesday 11:15–12:15 and Friday 2:00–3:30 in Chapin Hall 018. I can also meet by appointment if none of those times work for your schedule.

- **Math Fellow**: Maryam Abuissa (`mabuissa24@amherst.edu`). Office hours: Tuesday 6:00–7:40 PM and Thursday 4:30–6:00 PM in SMUD 207.

- **Quantitative Center**: Allison Tanguay (`atanguay@amherst.edu`) (drop in office hour details to be confirmed during the first week of classes). Individual appointment scheduling: `https://calendly.com/atanguay-qcenter`.

What We'll Cover

In this course we'll learn about the theory of *abstract algebra*. We will introduce some abstract structures (as the name suggests) involving a set with a number of operations (thought of as, for instance, addition, or multiplication, or composition of functions) that are required to obey arithmetic rules. By learning facts about these abstract structures, we can make deductions about many examples all at once, even examples that on their face appear very different!

The three key mathematical objects that we will learn about are:

- *Groups*: a fundamental mathematical object that we use to study the idea of symmetry. These act as an abstraction of the idea of the set of symmetries of an object, and they come with an operation that generalizes the composition of two symmetries. Examples that we will learn about include the collection of rotations of a polygon (cyclic groups), the collection of rotations and reflections of a polygon (dihedral groups) and the collection of permutations of a finite set (symmetric groups).
- *Rings*: a more specialized kind of object that comes with two operations, that we think of as addition and multiplication respectively. Examples that we will study include the integers, the set of polynomials with real or complex coefficients, and the set of $n \times n$ real or complex matrices.
- *Fields*: a generalization of the familiar rules of arithmetic. This is a set of elements that can be added, subtracted, multiplied and divided, with these operations satisfying all their usual properties. Examples include the real numbers, the complex numbers and the rational numbers, but we'll also study fields with only finitely many elements.

Schedule

We will meet three times a week for classes:

Monday, Wednesday and Friday at 1pm in **Seeley Mudd, room 206**.

There will be two midterm exams and a final. The exams will be held on the following days.

- **Midterm 1:** Friday March 1st (in class).

- **Midterm 2:** Friday April 12th (in class).
- **Final:** TBD (During the period May 13th to 17th)

The exams will be in person, and will be closed book. Calculators will not be allowed.

Makeup Exams

If you cannot make one of the exam times, please let me know as long as possible in advance and **at least two weeks beforehand**. I can arrange make-up exams for legitimate conflicts (e.g. for academic commitments, religious observances) but two weeks advance notice is necessary.

Textbook

We'll use the textbook **Abstract Algebra: A First Course** by Dan Saracino (second edition). We'll cover some, but not all, of the material in chapters 0–13 and 16–21.

Homework

Homework will be assigned each week and due on **Fridays at 5pm**. There will not be homework due during weeks with a midterm exam. The first homework will be due on Friday February 9th.

Homeworks will consist of 4–8 problems on the material we learned in the past week. Some problems that are particularly challenging will be marked with a $(*)$. These problems are **optional**; you can earn 100% on the homework without attempting these, but good solutions will be worth extra credit!

You are encouraged to work on the homework in groups; this is often one of the best ways of learning. However, your final solution **must** be your own work; you should write up your answers on your own, without anyone else's work present (in other words, do not copy!). On the first page of your homework submission, please list the people that you worked with.

You will submit your homework online through **Gradescope** (`https://www.gradescope.com`). You should sign up for a free account using your Amherst College email address. Once you've created an account you should join the section using the following course code:

Gradescope course code: **7DNDDW**.

Homework Extensions

I know that sometimes things come up that make it difficult to complete homework on time. As such, I will grant up to two homework extensions per person during the semester (you don't need to give a reason, just ask). If you want an extension on one of the homeworks, please e-mail me no later than the **day before** the homework is due.

Assessment Structure

Your grade will be calculated as follows.

- Homeworks: 35% (lowest score dropped)
- Midterm exams:
  - Higher midterm score: 20 %
  - Lower midterm score: 15 %
- Final exam: 30%

Accessibility

As the instructor of this course, I endeavor to provide an inclusive learning environment. However, if you experience barriers to learning in this course, let's connect to discuss ways to best support your access. If you have disability-related circumstances and are seeking academic accommodations (e.g. extra-time testing, reduced distraction test area, short breaks as needed, note taking assistance, etc.), Accessibility Services is eager to assist with identifying reasonable accommodations for the course. They can be contacted at `accessibility@amherst.edu`.

Honor Code

The Amherst College honor code applies to this course. All the work you submit, both for the exams and the homework, must be entirely your own. In particular, although discussing the homework in groups is encouraged, when you write down your solutions you should not be looking at anyone else's work. Copying somebody else's work is a violation of the honor code.

If you feel stuck or lost in the course, please get in touch with me or the Math Fellow assigned to Math 350 either by e-mail or in office hours as early as possible. We will be happy to help you!