Elements of Abstract Algebra (Math 306), Spring 2019

This course is a one-semester survey of abstract algebra. We will investigate three types of algebraic structures: groups, rings, and fields. Clear, cogent, and complete mathematical arguments will be emphasized. Groups capture the notion of *symmetry*; groups typically arise as collections of symmetries of a mathematical object. Rings are generalizations of the familiar settings in which we can add, subtract, and multiply; prototypical examples include the integers, polynomials, and square matrices. Fields are special rings satisfying additional properties so that all four arithmetic operations are defined and behave as expected; prototypical examples include the rational numbers, real numbers, complex numbers, and the integers modulo a prime number.

Instructor: Daniel Hast (`drh@rice.edu`)
Classroom and course times: Herman Brown Hall 453, MWF 10:00–10:50am
Office hours: Herman Brown Hall 426, Monday 11–12, Wednesday 1–2, Thursday 1–2
Textbook: *Abstract Algebra: Theory and Applications* by Thomas Judson
(freely available at `http://abstract.ups.edu/`)

Prerequisites

This course assumes that you have background in linear algebra and formal, proof-based reasoning. The linear algebra prerequisite can be met with either Math 354 (Honors Linear Algebra) or Math 355 (Linear Algebra). The proof prerequisite can be met with Math 354 (Honors Linear Algebra), Math 302 (Elements of Analysis), or Math 221 (Honors Calculus 3). Talk to me if you are unsure whether you are ready to take this class.

Expectations

In my experience as a student, most people do not follow all the details of a math lecture in real time. During lecture, you should expect to witness the big picture of what's going on. You should pay attention to the lecturer's advice on what is important and what isn't. A lecturer spends a long time thinking about how to deliver a presentation of a large amount of material; they do not expect you to follow every step, but they do expect you to go home and fill in the gaps in your understanding. Not attending lecture really hurts your chances at a deep understanding of the material.

We will not cover every single topic in lecture, so you will also be expected to do a fair amount of reading and problem-solving outside of class.

Homework

Homework will be due each week on Friday at the beginning of class. You are encouraged—but not required—to use LaTeX to type your assignments. (If you want to learn LaTeX, email me and I'll pass along some resources.)

You may redo any homework problem for which you submitted a solution that lost more than one point. The redone problems must be submitted within two weeks of when I return

the graded homework assignment to you. You can earn back all but one point on any such problem. (For example, if you originally got 1 out of 4 points on a problem, your redone solution can earn up to 3 points.)

Collaboration with other students on the homework is encouraged, but only after you've made a serious attempt at the problems on your own. If you work with others on the homework, you must note the names of any collaborators on each problem. You should write up your solutions individually. You may not look up solutions online or in any written form. (For problems from the textbook that have hints in the back of the book, you may use the hints, but only after making a serious attempt to solve the problem on your own.) Adhering to these policies is part of your duty under the Honor Code.

Effective communication is essential in mathematics. All work you submit should be written in complete sentences and will be graded on clarity as well as correctness.

Getting stuck on problems is normal and to be expected. Much of the learning in this course will happen in the process of getting yourself unstuck. (Speaking from personal experience, you will almost certainly have gaps in your understanding that you won't notice until you work on the homework.) Please feel free to come to my office hours to discuss the homework problems.

Exams

There will be two midterms and a final exam; all three will be take-home exams. The first midterm will be assigned on **Wednesday, February 13**. The second midterm will be assigned on **Wednesday, March 20**. If you have a conflict with one of these dates, please let me know within the first week of class.

The date for the final exam is set by the Registrar's office and is not available at this time. It is the policy of the Mathematics Department that no final may be given early to accommodate student travel plans. If you make travel plans that later turn out to conflict with the scheduled exam, then it is your responsibility to either reschedule your travel plans or take a zero in the final.

Grades

Homework will count for 40% of your grade. The exams will count for 60% of your grade, distributed among Midterm 1/Midterm 2/Final as 17/17/26, 8/17/35, or 17/8/35, whichever benefits you the most.

Disability support

Any student with a documented disability seeking academic adjustments or accommodations is requested to speak with me during the first two weeks of class. All such discussions will remain as confidential as possible. Students with disabilities will also need to contact Disability Support Services in the Allen Center.