Number Theory (Math 365), Fall 2018

This course is about numbers—mainly the integers and rational numbers—and their relations to each other. We will explore prime numbers, factorization, linear and quadratic equations, congruence, and divisibility, among other topics. Number theory is an ancient area of study, and we will investigate problems spanning thousands of years of history. We will aim to cover the entirety of Weissman's book, though we may skip a chapter or two near the end if needed.

Instructor: Daniel Hast (`drh@rice.edu`)
Classroom and course times: Rayzor Hall 119, MWF 1:00–1:50pm
Office hours: Herman Brown Hall 426, Monday 3–4pm, Tuesday 3–4pm, and Wednesday 2–3pm.
Textbook: *An Illustrated Theory of Numbers* by Martin Weissman
(`http://illustratedtheoryofnumbers.com/`)

Prerequisites

Officially, the prerequisites for this course are any one of Math 221, Math 302, or Math 354. This is so you have prior experience with formal reasoning, modern standards of mathematical rigor, and proof-writing. In terms of content knowledge, this course does not require anything beyond high-school algebra, basic coordinate geometry, and the fundamentals of formal logic. 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. If you are familiar with LaTeX, you are encouraged to use it to type your assignments. (If you want to learn LaTeX, email me and I'll pass along some resources.)

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. 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. The first midterm will be in class on **Wednesday, September 26**, and the second midterm will be a take-home exam assigned on **Wednesday, October 31**. 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.

Final presentation

Whether you are going into industry, or to graduate school in math, sciences, or for a professional degree, being able to give cogent oral presentations that summarize the motivation and key *ideas* behind a theorem, an algorithm, or (more broadly) a strategy can help you advance a point of view, an agenda, and your career. One goal of this class is to give you experience with this essential skill.

As a final project, each student will prepare an 8-10 minute presentation on a topic of their choice. This will have several components: submitting a brief project proposal for approval (I'll give feedback and help you find an appropriate topic if needed), preparing slides to accompany your talk, practicing your presentations with each other, submitting a title and abstract, and finally presenting to the rest of the class.

We'll discuss the structure and expectations for the final project in more detail about halfway through the semester.

Grades

Homework will count for 30% of your grade. Each midterm will count for 15% of your grade (for a total of 30%), and the final exam will count for 25%. The final presentation will count for the remaining 15% of your grade.

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.