Number Theory: An Introduction to Higher Mathematics

Course Syllabus

Summer 2013

Contact

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Goals

Mathematics is the queen of the sciences, and number theory is the queen of mathematics.

-Carl Friedrich Gauss

One of the goals of this class is to understand this quotation–what is it about number theory that Gauss found so beautiful and intriguing? In addition, through problem sets, students will experience mathematics as an empirical science and become comfortable with writing mathematically rigorous proofs.

Topics to be Covered

- Methods of Proof
- Modular Arithmetic
- Divisibility
- Linear Diophantine Equations
- Chinese Remainder Theorem
- Cryptography
- Prime Factorization in $\mathbb{Z}$ and $\mathbb{Z}[i]$
- Quadratic Reciprocity

Requirements

- **Prerequisites:** You should have a strong background in algebra and good logical reasoning skills. No calculus knowledge is necessary.
- **Attendance:** Attendance is required, since a large part of the course is based on your work in class. If you anticipate missing a day, please contact me ahead of time. Your active participation in the course will help make it a success.

- **Homework:** Problem sets will be given daily, and I will collect a subset of those problems roughly every three days. I will announce in advance what problems will be collected. No late work will be accepted.

  In addition, you may give me any problems you want me to look at any time, and I will do my best to read through it and return it with comments as soon as possible.

- **Exams:** There will be two exams: a midterm on Wednesday, July 3, and a final on Friday, July 12.

A Typical Day

Each day will be centered around a problem set, in which we will explore a particular property of numbers. The day will be a combination of lecture and working on the problem set in small groups. In your groups, you will gather data, find patterns, make conjectures, and try to prove them. I will spend most of my time wandering around the room, answering questions and checking in with each group. Most of your learning will happen in these small groups - you'll learn just as much from your classmates as you will from me. This is likely different from the math classes you have taken in high school - it is more challenging, and it puts more responsibility on you to make sure you are learning (and to ask for help if you're stuck). It's also much more fun, and more like how mathematicians do math. Success in this course will require active participation in each day's activities, cooperation and communication with your group members, and frequent interactions between student and instructor. You should be able to complete a significant portion of each day's problem set in class, and you are expected to complete anything you don't finish outside of class.

Grading

- Participation: 30%
- Homework 25%
- Midterm: 15%
- Final Exam: 30%