

Syllabus

Math 350/Com S 350: Number Theory Section 1

Spring 2021 – 3 credits

MWF 1:10pm – 2:00pm Atanasoff Hall B0029

Instructor	Dr. Jason McCullough 452 Carver Hall Phone: 4-8150 Email: jmccullo@iastate.edu <- best way to contact me
Grader	Alex Riasanovsky awnr@iastate.edu
Online Office Hours	M 10:30-11:30 pm, Tu 1:10pm-2:00pm, Th 2:15pm-3:05 pm or by appointment
Textbooks	An Introduction to Number Theory and Cryptography by Kraft and Washington

Content

This class is an introduction to number theory. We will focus on some questions about the integers, prime numbers, rational numbers, and modular arithmetic. We'll also discuss applications to cryptography, primarily RSA encryption. Number theory is engaging because many deep questions (Fermat's Last Theorem, the Twin Primes Conjecture) are easy to state but difficult to prove. We will sample a number of different topics in number theory including Diophantine equations, quadratic reciprocity, distribution of prime numbers, unique factorization, among others.

Referring to the textbooks, we will cover most of Chapters 2-6, 8-11, 13, 17-20.

Prerequisites: Math 201 / Com S 230. In particular, I will assume familiarity with basic proof techniques (including induction), set theory, functions, binary relations, integer arithmetic,

and basic calculus.

Assessment

There will be weekly homework assignments, including one during prep week. While you are encouraged to work with the other students (in a physically distant manner), it is important that you **write up your own solutions independently**. Duplicate solutions will be penalized. It is very important that you do the homework conscientiously and consistently.

Homework will be assigned and collected on Canvas. You have 3 options for completing your homework assignments:

1. Type your solutions in Microsoft Word. Save and upload a word DOC or PDF file.
2. Use a mobile phone scanning app (like these <https://support.apple.com/en-us/HT210336> or <https://support.google.com/drive/answer/3145835?co=GENIE.Platform%3DAndroid&hl=en>) and upload a PDF of your **neatly written solutions**.
3. Type your solutions with LaTeX and upload a PDF. (This might be a good idea if you are contemplating graduate school in mathematics or you just enjoy pretty type setting but be warned: there is a steep learning curve.)

Your lowest **1** homework score will be dropped at the end of the semester.

There are **NO** exams in this class. Instead, you will be required to **write a 4-6 page paper** on a number theory topic of your choice. Further details of this project will be posted on Canvas, but take note of the following deadlines:

Friday, February 26 - Last day to confirm your topic choice. (Email me your choice. Suggested topics will be listed on Canvas but all topics must be distinct. You may suggest your own topic - subject to my approval.)

Friday, March 26 - Last day to meet with me virtually to discuss the outline of your paper and agree on its scope and focus. This can be done during normal office hours or you may email for another time.

Friday, April 16 - Last day to hand in your rough draft of your paper.

Friday, April 30 - Last day to hand in your final draft of your paper.

Learning Outcomes

Upon completion of this course, students...

1. Will be able to construct proofs of basic number theory statements.
2. Will understand the basics properties and applications of modular arithmetic.
3. Will learn properties of integer equations and prime numbers.

Course Websites

Grades and homework will be available via Canvas. There is a tentative schedule below.

Grading scheme

Homework	60%
Topic Selected/Outline Meeting	5%
Rough Draft	5%
Final Draft	30%

Letter grades will be assigned based on your overall percentage and will be no stricter than a straight-scale (90+ = A, 80+ = B, etc.). If I deem it necessary, I may lower this scale based on homework and exam scores.

Mathematics Department Policy Statements (Academic Misconduct, Accessibility, Religious Accommodations, etc.)

See <https://math.iastate.edu/syllabus-and-class-policies/>

In particular, regarding disability accommodations:

If you have a disability and require accommodations, please contact the instructor early in the semester so that your learning needs may be appropriately met. You will need to provide documentation of your disability to the Student Accessibility Office, located on the main floor of the Student Services Building, Room 1076, 515-294-7220.

Tentative Schedule

Week (week of)	Monday	Wednesday	Friday
1 (January 25)	Chapter 1	2.1,2.2	2.4,2.5

2 (February 1)	2.6	2.7	3.1,3.2
3 (February 8)	4.1,4.2	5.1,5.2	5.3
4 (February 15)	5.4	5.5,5.6	5.7
5 (February 22)	6.1	6.2,6.3	6.4
6 (March 1)	6.5,6.7	8.1	8.2,8.3
7 (March 8)	9.1	9.1	9.2
8 (March 15)	10.1	10.2,10.3	11.1
9 (March 22)	11.2	11.5	11.6
10 (March 29)	13.1	13.2,13.3	13.4,13.5
11 (April 5)	Chapter 18		
12 (April 12)	Chapter 19		
13 (April 19)	Chapter 20		
14 (April 26)	Chapter 17*		

* if time allows

Covid-19 Health and Safety Requirements

COVID-19 health and safety requirements Students are responsible for abiding by the university's COVID-19 health and safety expectations. All students attending this class in-person are required to follow university policy regarding health, safety, and face coverings:

- wear a cloth face covering in all university classrooms, laboratories, studios, and other in-person instructional settings and learning spaces. Cloth face coverings are additionally required to be worn indoors in all university buildings, and outdoors when other people are or may be present where physical distancing of at least 6 feet from others is not possible. Students with a documented health or medical condition that prevents them from wearing a cloth face covering should consult with Student Accessibility Services in the Dean of Students Office.
- ensure that the cloth face covering completely covers the nose and mouth and fits snugly against the side of the face.
- practice physical distancing to the extent possible.
- assist in maintaining a clean and sanitary environment.
- not attend class if you are sick or experiencing symptoms of COVID-19.
- not attend class if you have been told to self-isolate or quarantine by a health official.
- follow the instructor's guidance with respect to these requirements. Failure to comply constitutes disruptive classroom conduct. Faculty and teaching assistants have the authority to deny a non-compliant student entry into a classroom, laboratory, studio, conference room, office, or other learning space.

Class Decorum and other items

- Please arrive on time and avoid congregating in the hallway.
- Cellphones should be silenced and stowed – not on your desk/lap.
- No food/drink in class (with the possible exception of water bottles).
- Not every class is in-person so please use this opportunity to ask questions!

Iowa State University supports and upholds the First Amendment protection of freedom of speech and the principle of academic freedom in order to foster a learning environment where open inquiry and the vigorous debate of a diversity of ideas are encouraged. Students will not be penalized for the content or viewpoints of their speech as long as student expression in a class context is germane to the subject matter of the class and conveyed in an appropriate manner.