Math 317 - Number Theory

Course Information

Instructor and Course Meeting Information

Instructor: Lola Thompson
E-mail: lola.thompson@oberlin.edu
MWF 2:30 PM - 3:20 PM
Location: King 239/Math Library
Office: King 200
Office Hours:
W 1:30 - 2:30
F 3:30 - 4:30
*And by appointment.

Course Objectives

By the end of this course, you will be able to:

- Build up the basic theory of the integers from a list of axioms
- Improve your written and oral communication skills
- Compose clear, precise mathematical proofs
- Learn to work collaboratively
- Apply your theoretical knowledge to problems in computer security
- Explore some current research problems in number theory

Course Structure

This course will be taught using an Inquiry-Based Learning (IBL) model. The format will be very different from that of a typical math course. In particular, there will be very few lectures and no assigned reading. A typical class period in Math 317 will consist of working on problems in small groups or presenting solutions at the blackboard in front of your classmates. Rather than being presented with neatly-packaged theorems and proofs, in this course you will be asked to devise your own conjectures and then prove them for yourself!

Textbook

There is no textbook for this course! Students will write their own number theory textbooks over the course of the semester... (for more info, see the "Textbook Project" section)

Is Math 317 right for me?

- The official pre-requisites for Math 317 are Math 220 and Math 232. That said, if you have not taken one of these courses but have strong proof-writing skills, you should be fine.
- This is a Writing Advanced course, so you will receive a W-Adv credit upon successful completion. Accordingly, there will be a substantial amount of writing in Math 317. If you take this course, you should be prepared to complete all of the writing assignments.
- The goal of this course is to discover the major ideas from number theory through carefully-scaffolded worksheets. If you already have a significant background in elementary number theory, then this course will not be ideal for you. It is no fun "discovering" concepts that you have already learned elsewhere!

If you have any concerns about whether Math 317 is an appropriate course for you to take this semester, please speak with me ASAP!

Grades

The grades in this course will be calculated as follows:

	Weight
Class Participation	20%
Homework	25%
Quiz #1	12%
Quiz #2	13%
Textbook Chapter 1	5%
Textbook Project	25%

Class participation

Class participation is essential in a course of this nature. When you miss class, you are not only affecting your own progress in the course but you are also causing your working group to be short one member. Your class participation grade (worth 20% of your course grade) will be calculated using the following formula:

- Group work (5 points)
- Student presentations (5 points)
- Peer grading (6 points)
- Chapter 1 peer feedback (4 points)

Attendance: Each student is granted three "unexcused" absences. After that, each additional absence will result in a 1 point deduction from your Group Work grade. There is no need to e-mail me to explain an unexcused absence. If you have a legitimate academic reason for missing a class (or a documented illness), please e-mail me as soon as possible. All "excused" absences must be cleared with me before the start of the missed class period.

Group work: Working groups will be assigned. They will normally consist of 3-4 students. Groups will be shuffled (approximately) every two weeks. That way, you will have the opportunity to work with everyone in the class by the end of the semester. If you are having a serious problem with someone in your group, please contact me ASAP. Your Group Work grade will be calculated using a peer-assessment survey and a self-assessment survey, which will be handed out at the end of the semester.

Student presentations: Each student is expected to regularly present solutions to the problem sets in front of the class. That said, I will always ask for volunteers before calling on students. The grade will be based solely on how often a student volunteers and not on the correctness of the solutions. Each presentation is worth 1% of your final grade, up to a maximum of 5%

Peer Grading: See the *Peer Grading* section below.

Chapter 1 Peer Feedback: See *Textbook Project* section below.

Peer Grading

One of the primary objectives of this course is to help you hone your mathematical writing skills. There is no better way to improve your own proofs than to read those of your classmates! To that end, homework will be *peer-graded* by groups of $\approx n/4$ students each week, where n is the number of students in the course. Together with the instructor, students will be responsible for grading the assignments and offering **useful** and **respectful** feedback. Afterwards, students will be required to submit a feedback report which comments on one specific problem that you encountered while grading. Feedback reports will be made available to the entire class on the Blackboard site.

Each student will be required to attend **three** peer grading sessions over the course of the semester. Students will have the opportunity to sign up for peer grading sessions at the beginning of the semester. If plans change and you can no longer attend a peer grading session that you have signed up for, you must find another student who is willing to switch with you and then e-mail the instructor (and CC the other student) to inform her about the change.

Each peer grading session is worth 2% of your final grade. In order to receive credit for peer grading, you must: (1) attend your assigned sessions and participate fully; and (2) submit a feedback report within

1 week of when the peer grading took place. I reserve the right to remove any students from the peer grading session who are behaving in a disrespectful or distracting manner.

During the weeks when you are serving as a peer grader, you will automatically receive a grade of 100% on the homework assignment. That way, you will not be able/forced to evaluate your own group's work.

Homework Assignments

Students will work on problem sets in small groups. Problem sets from each week will be due on the following Monday. Each group must turn in *one* typed copy of their homework to be graded. You are welcome to add details to your solutions based on what you learn from your classmates' presentations (this will help with the end-of-semester final project). However, you will only be graded on the typed work that was completed prior to the class period.

Groups are strongly encouraged to use ShareLaTeX in order to write up the homework. This has the advantage of allowing students to collaborate on the write-up in real time. It also will make your textbook project MUCH easier to complete.

Quizzes

There will be two 25-minute in-class quizzes. These will test your ability to solve routine problems and write basic proofs.

Textbook Project

At the end of the term, every student will author their own textbook. This will involve revising all of your work from over the course of the semester, organizing it into chapters, and inserting appropriate exposition to explain the flow of ideas. Points will be awarded based on a number of criteria, including: mathematical completeness/correctness, clarity of explanations, quality of exposition, organization of content. The first chapter of the textbook will be due on April 6th. You will receive feedback (from the instructor as well as your peers) on the first chapter. Each student will be required to write a Peer Feedback report on one of their classmates' Chapter 1 drafts. The full textbook will be due on May 19th. It is STRONGLY recommended that you set aside time each week to revise your work, rather than waiting until these deadlines.

Guest Lectures

I have arranged for several guest lectures on topics related to our course. These visitors are accomplished mathematicians who are donating their time to share their knowledge with you. It is my expectation that you will choose to attend all of the guests' talks (except in cases where the talk directly conflicts with your other academic obligations). I will make sure to announce all guest lectures early in the semester so that you can mark them in your calendars. Please make these talks a priority – they provide a unique opportunity to supplement our course with research-level mathematics!

Blackboard

Copies of the problem sets will be posted at the end of each class period on our course Blackboard site. Go to `http://blackboard.oberlin.edu` to access these materials.

Share LaTeX

Beginning in the second week of classes, all students will be required to type up their homework using Share LaTeX. I will offer a LaTeX tutorial early in the second week to help you get up to speed. You can find Share LaTeX at `https://www.sharelatex.com`

Course Policies

Academic Honesty

Homework
Each week, your homework assignment will be to finish and carefully write up solutions to the in-class problem sets. You are welcome to consult with your class notes, your classmates and the instructor. However, you *may not* consult any textbooks or internet resources – otherwise, you run the risk of ruining the surprise of discovering the course content for yourself. Your experience in Math 317 will be much richer (and your intuition for the subject far greater) if you arrive at the solutions without the aid of a book.

You are encouraged to work with your group members outside of class. You are also welcome to work with other students in the course who are not in your assigned group, but each group must write up their solutions independently.

Quizzes
You are not allowed to use any electronic device or consult any source other than the instructor during the quizzes. In particular, this means *no calculators, smartphones, regular cellphones, iPods, eReaders, laptops, notes, textbooks, etc.*

Note: Information about the Honor Code at Oberlin can be found at the following website: `http://www.oberlin.edu/students/links-life/honorcode.html`. Please familiarize yourself with its content. All students are responsible for maintaining the highest standards of honesty and integrity in every phase of their academic careers. The penalties for academic dishonesty can be severe and ignorance is not an acceptable defense.

Disabilities

Students in this course with disabilities, including "invisible" disabilities such as chronic diseases and learning disabilities, and who may need disability-related classroom accommodations, are encouraged to make an appointment to see their instructor as soon as possible.

Make-up Policy

Homework: Late homework cannot be made up, due to the peer grading structure. It is your responsibility to ensure that someone in your group is able to turn in the problem set on time.

Quizzes: If you know ahead of time that you have an academic conflict with one of our quiz dates, you must make arrangements with me ahead of time to make up the quiz. Should you contract a serious illness or find yourself in an emergency situation, please contact me *immediately* so that we can discuss reasonable accommodations.

Textbook: Your textbook project is your final exam in this course. In accordance with college policy, there will be substantial point deductions for late textbook projects.

Religious Observances

Some students may wish to take part in religious observances that occur during this academic term. If you have a religious observance that conflicts with your participation in the course, please meet with me before the end of the second week of the semester to discuss appropriate accommodations.

Important Dates

Add/Drop Deadline	February 14th (Wednesday)
Spring Break!	March 17th (Saturday) - March 25th (Sunday)
Withdraw and P/NP Deadline	April 2nd (Monday)
Classes End	May 11th (Friday)
Reading Period	May 12th (Saturday) - May 15th (Tuesday)
Textbook Project Due	May 19th (Saturday) at 9 PM

Course Schedule

The following is an estimated schedule for the course. Please note that the quiz dates are tentative.

Lectures	Course Plan	Homework Due
2/5	Problem Set #1	
2/7	Problem Set #2	
2/9	Problem Set #3	
2/12	Presentations	Sets #1 & 2
2/14	Problem Set #4	
2/16	Problem Set #5	
2/19	Presentations	Sets #3 & 4
2/21	Problem Set #6	
2/23	Problem Set #7	
2/26	Presentations	Sets #5 & 6
2/28	Problem Set #8	
3/2	**Quiz #1**; Problem Set #9	
3/5	Presentations	Sets #7 & 8
3/7	Problem Set #10	
3/9	Problem Set #11	
3/12	Presentations	Sets #9 & 10
3/14	Problem Set #12	
3/16	Problem Set #13	
3/17 - 3/25	**No Class – Spring Break!**	
3/26	Presentations	Sets #11 & 12
3/28	Problem Set #14	
3/30	Problem Set #15	
4/2	Presentations	Sets #13 & 14
4/4	Problem Set #16	
4/6	Problem Set #17	**Chapter 1**
4/9	Presentations	Sets #15 & 16
4/11	Problem Set #18	
4/13	**Peer Conferencing**	**Chapter 1 peer feedback**
4/16	Presentations	Sets #17 & 18
4/18	Problem Set #19	
4/20	**Quiz #2**; Problem Set #20	
4/23	Presentations	Set #19
4/25	Problem Set #21	
4/27	Problem Set #21 (continued)	
4/30	Presentations	Set #20
5/2	Special Set*	
5/4	Special Set*	
5/7	Special Set*	Set #21
5/9	Special Set: Cryptography	
5/11	**Cryptography Scavenger Hunt!**	
5/19	**Textbook project due at 9 PM**; Class Party!	

*Possible topics: cyclotomic polynomials, analytic number theory, elliptic curves, your suggestions???