

Instructor: Dr. Elisa Bellah
Meetings: MWF 2-2:50pm
Location: Porter Hall 226A

Office: Wean Hall 8119
Office Hours: M 1-1:50pm, Tu [by appointment](#)
Email: ebellah@andrew.cmu.edu

Resource: Lecture notes will be updated throughout the course and posted on my site.

Course Description: Broadly, number theory studies the additive and multiplicative properties of the integers. In this course, we will explore this subject from elementary, analytic, and algebraic perspectives. Tentatively, we will look at the following topics:

- The Fundamental Theorem of Arithmetic
- The Structure of $(\mathbb{Z}/n\mathbb{Z})^\times$
- Quadratic Residues
- Arithmetic Functions
- Prime Numbers
- Diophantine Analysis
- Diophantine Approximation
- Algebraic Number Theory

Learning Objectives: A successful student will gain familiarity with the topics listed above, and will demonstrate a capacity to participate in professional mathematical activity. In particular, a successful student will:

1. Demonstrate understanding of course material and mathematical literacy through solving problem sets and giving a professional presentation of their work;
2. Engage in research-type activity such as literature review and example driven experimentation through a semester long project, culminating in an expository article and final presentation.
3. Engage with their classroom community through peer review and community discussion activities.

Prerequisite: Algebraic structures (21-373) and either Matrix Algebra (21-241) or Matrix Theory (21-242). Note that I will assume familiarity with some of the basic definitions and results from a first course on groups and rings.

Canvas: Course documents and information can all be found on the [course webpage](#), which is housed on my website (andrew.cmu.edu/user/ebellah). Canvas will be used for announcements, discussion, peer review, project assignments, and to post grades. You will be expected to access both Canvas and the course webpage frequently. I suggest you change your notification settings on Canvas to receive emails when course announcements are posted, as this will be my primary means of communication.

Assessment and Grades

There are three basic kinds of graded work you will be doing, which will be weighted according to the following scheme:

Course Engagement (10%): I expect you to spend about three hours each week engaging with the course outside of working on your problem sets and projects. The easiest way to do this is to attend lecture, for which I will take attendance. If you are unable to attend lecture outside of three excused absences, I expect you to makeup engagement in one of the following ways: make at least one meaningful post or response on our course Piazza (this can be an interesting remark related to the day's lecture you caught up on, a response to a question someone posted, etc), volunteer to be "on call" for one additional peer review that week, or review my notes for typos/errors and send me an itemized list. I'm also open to other ideas you have that are roughly equivalent in workload, but this needs to be arranged with me before hand. To makeup credit for a missed lecture, please email me the work you've done within two weeks of the absence(s). In addition to attendance, there will be a small number of engagement activities and surveys posted on Canvas throughout the course.

Semester Projects (45%): Throughout the semester, you will undertake independent study on a topic not covered in the course lecture notes, which will culminate in an expository paper and presentation. You may work alone or with at most two other students. Note that if you do plan to work with a group, I will expect each individual to clearly indicate their contribution, and for the project scope to be appropriately scaled. **Each Friday**, you will submit a summary of the progress you've made on your project to Canvas, which I will personally read and review, and will contribute to your overall project grade. Additionally, you will need to meet with me for a short individual meeting during Weeks 4 or 5 of the semester to discuss your project plans. Details about scheduling these meetings will come sometime in Week 3 of the semester, and instructions for each week's summary assignment will be provided as the deadlines approach.

Problem Sets (45%): Problem sets will be assigned each Wednesday and will first undergo a peer review process before being submitted to Gradescope. Each problem set will be worth 12 points, and will be calculated as follows: thoroughness of peer review (2/12) and presentation/correctness of solutions (10/12). Note that all problem sets must be typed using LaTeX (here's a [guide](#)). The submission schedule for the semester is outlined below:

Problem Set Submission Schedule:

Week 1	Wed	PS1 assigned	Week 8	Mon	PS6 peer review completed
Week 2	Wed	PS1 due on Canvas for peer review PS2 posted	Week 9	Wed	Final PS6 due on Gradescope PS7 due on Canvas for peer review PS8 posted
Week 3	Mon	PS1 peer review completed	Week 10	Mon	PS7 peer review completed
	Wed	Final PS1 due on Gradescope PS2 due on Canvas for peer review PS3 posted	Week 11	Wed	Final PS7 due on Gradescope PS8 due on Canvas for peer review PS9 posted
Week 4	Mon	PS2 peer review completed	Week 12	Mon	PS8 peer review completed
	Wed	Final PS2 due on Gradescope PS3 due on Canvas for peer review PS4 posted	Week 13	Wed	Final PS8 due on Gradescope PS9 due on Canvas for peer review PS10 posted
Week 5	Mon	PS3 peer review completed	Week 14	Mon	PS9 peer review completed
	Wed	Final PS3 due on Gradescope PS4 due on Canvas for peer review PS5 posted	Week 15	Wed	Final PS9 due on Gradescope PS10 due on Canvas for peer review PS11 posted
Week 6	Mon	PS4 peer review completed	Week 16	Mon	PS10 peer review completed
	Wed	Final PS4 due on Gradescope PS5 due on Canvas for peer review PS6 posted	Week 17	Wed	Final PS10 due on Gradescope PS11 due on Canvas for peer review
Week 7	Mon	PS5 peer review completed	Week 18	Mon	PS11 peer review completed
	Wed	Final PS5 due on Gradescope PS6 due on Canvas for peer review PS7 posted	Week 19	Wed	Final PS11 due on Gradescope

Course Policies

Course Flexibility: If you are having a personal emergency and need to miss a deadline, please let me know as soon as possible so that we can make arrangements. Otherwise, I expect you to generally meet assignment deadlines. This is especially important in our classroom due to the collaborative nature of our assignments, so please do your best to stay on schedule. The flexibility built into the course includes the following:

1. Three excused absences;
2. Ability to makeup further absences through other course engagement activities (see previous section);
3. Lowest two problem set grades will be dropped.

Note that further flexibility is not guaranteed, but I will do my best to accommodate when appropriate.

Use of Resources: You are allowed to use whatever resources necessary to complete problem sets, but ultimately the work you submit must be your own. If you lookup solutions, I expect you to rework the problem in your own words, and to include a bibliography citing all resources used in your writeup. Any verbatim copying will be reported to the university as plagiarism. If you are unsure if you've used a resource properly, please ask.

Regrade Requests: You may submit regrade requests for any of the problem sets submitted over the semester. When submitting your request, please clearly indicate a justification for the regrade (e.g. points haven't been added correctly, mark does not match the rubric, etc). All regrade requests must be made on Gradescope ([here is a tutorial](#)) **within one week** of the assignment being returned to you.

Email: I will aim to respond to emails within two business days. Please note that I typically will not respond to emails outside of normal working hours (around 9am to 5pm) or on weekends. All emails must be sent through your CMU email address.

Community Agreement: To facilitate a productive work culture, we will create a [community agreement](#) documenting how we plan to conduct ourselves in the course. I expect us all to follow these guidelines throughout the semester. Anyone violating our community agreement will be asked to speak with me. Students are encouraged to hold the instructor accountable for violations of our community agreement through our [anonymous course survey](#), which is also linked on our Canvas page and course website.

Additional Information

Important Dates: Here are some dates you may want to keep in mind:

Mon Aug 28:	Classes begin
Mon Sep 4:	Labor Day (no classes)
Mon Oct 9:	Drop deadline (W assigned after this date)
Oct 16-20:	Fall break (no classes)
Tues Nov 7	Democracy Day (no classes)
Mon Nov 13:	Withdraw deadline
Oct 13-17:	Spring registration week
Nov 22-24	Thanksgiving Break
Fri Nov 8:	Last day of classes

Accommodations for Students with Disabilities: If you have a disability and have an accommodations letter from the Disability Resources office, I encourage you to discuss your accommodations and needs with me as early in the semester as possible. I will work with you to ensure that accommodations are provided as appropriate. If you suspect that you may have a disability and would benefit from accommodations but are not yet registered with the Office of Disability Resources (cmu.edu/disability-resources), I encourage you to contact them at access@andrew.cmu.edu.

Respect for Diversity: It is my intent that students from all diverse backgrounds and perspectives be well served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is my intent to present materials and activities that are respectful of diversity: gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. Your suggestions are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups. In addition, if any of our class meetings conflict with your religious events, please let me know so that we can make arrangements for you.

Student Academic Success Center: The SASC provides various programs to support student learning. Checkout the SASC's site (cmu.edu/student-success) for a full list of programs. In particular, I encourage you to consider their [peer tutoring](#). This is a tutoring service available to all CMU students at no additional cost.