

MATH-UA.0343-003 ALGEBRA

Fall 2019

Instructor:	Margaret Bilu	Time:	MW 9:30-10:45 am
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Office:	WWH 604		

Course website: <https://cims.nyu.edu/~bilu/teaching.html>

References: I do not require a textbook for this course, but Judson's *Abstract Algebra: Theory and Applications* is a good reference, and is available online at <http://abstract.ups.edu>

Office hours: M 10:45-11:45am, Th 10:30-11:30 or by appointment (only if you cannot make it to the usual office hours!).

Course description: This is a course in Abstract Algebra. It will be centered on the notion of *group*, with examples coming from number theory, linear algebra and geometry. After some reminders on set theory, we will start with a chapter on arithmetic and congruences in order to introduce a very important example of group, $\mathbf{Z}/n\mathbf{Z}$. We will go on to give the definition of a group and derive some of its main properties. Then we will give a whole other new set of examples, called *permutation groups*. After that, we will introduce more advanced topics, among which cosets, normal subgroups, quotient groups.

Lectures and participation: Abridged lecture notes will be posted on the course website. Students are advised to review lecture notes and examples soon after class. If you miss class, obtain lecture notes from another student. Participation during class is strongly encouraged.

Homeworks: Homework problem sets designed to expand and solidify concepts discussed in class will be posted to the course website one week in advance of the due date. **Homework write-ups are due Wednesdays at the beginning of class**, unless otherwise announced. Students must submit their work in the beginning of the lecture. In case of absence, a PDF version of the homework sent by e-mail *before the lecture* will be accepted (please do NOT send multiple heavy jpg files). The homework can also be put in the instructor's mailbox (number 38 on the right side of the mailboxes behind the guard's desk in the lobby of WWH) *before the lecture*. Late homeworks are usually not accepted, except with a valid excuse which the instructor should be notified about in advance.

Quizzes There will be short quizzes during recitation on the following dates: October 4th, November 15th, December 6th.

Grading policy: Grades for homeworks and quizzes will be posted on NYU Classes as soon as they become available. It is the students' responsibility to check that they correspond to the grades on the papers which are handed back to them. No homework or quiz grade change requests will be accepted three weeks after posting or after the final exam.

The final grade will be computed with the following weights:

20% Homeworks 20% Quizzes 30% Midterm 30% Final

Exams There will be one Midterm exam during the semester, on **Wednesday October 23th** during usual lecture hours. The final exam will be on **Wednesday, December 18th, 8-9:50am**. An excused absence for an exam requires notification to the instructor *before* the exam starts, followed by valid documentation. Otherwise, you will receive a “0” for any missed exam.

Make-up quizzes or exams: An excused absence for a quiz or exam requires notification to the instructor *before* the exam starts (unless your absence is due to an emergency situation, in which case you still need to let the instructor know about it as quickly as possible), followed by valid documentation. Otherwise, you will receive a “0” for any missed exam. We are only able to accommodate a limited number of out-of-sequence exams due to limited availability of rooms and proctors. For this reason, we may approve out-of-sequence exams in the following cases:

1. A documented medical excuse.
2. A University sponsored event such as an athletic tournament, a play, or a musical performance, in which case please have your coach, conductor, or other faculty advisor contact your instructor. Please note that athletic practices and rehearsals do not fall into this category.
3. A religious holiday.
4. Extreme hardship such as a family emergency.

In any case, make-up exams must occur within one week of the scheduled exam.

Other course policies I expect students to contribute to our positive learning environment: **arrive on time** to class, **pay attention** for the duration of the class, **participate** meaningfully during class and **learn from one another**.

I will reply to most e-mail within 24 hours. If not, please send me a reminder.

This course will abide by NYU CAS academic policies and honor code.

General advice

- Review the material from the previous lecture before coming to class: it is hard to follow if you don't remember what has been said last time.
- Ask questions and try to propose answers to questions asked by the instructor even if you're not sure: making mistakes is part of the normal process of learning. One remembers something very well if one got it wrong the first time.
- Please raise your hand if you think you have the answer to a question asked in class, and only answer the question if you've been prompted to do so, so as to let the others think. Not everyone has the same speed.
- Come to office hours, even if you don't think you have that many questions. You can come by anytime during the specified time range.
- This is a proof-based course. Make sure to go over each proof actively, asking yourself: what would I do if I wanted to prove this? How many steps are there, what is the structure of this proof? Why do we need to do this? Why are we done at the end? Knowing the proof of a theorem helps you get a deep understanding of the theorem itself, I therefore strongly recommend that you learn the proofs at the same time as you learn the theorems.

- Work in groups! It's much more fun doing maths with other people than on one's own.

Weekly breakdown of topics covered

Week starting	Topics
9/2	Introduction, reminders on set theory
9/9	Arithmetic
9/16	The group $\mathbf{Z}/n\mathbf{Z}$ and its properties.
9/23	Laws of composition, groups, subgroups
9/30	Cyclic groups, products of groups, homomorphisms
10/7	Classification of groups of small order
10/14	Permutation groups
10/21	Midterm review, Midterm
10/28	Permutation groups
11/4	Cosets, Lagrange's theorem
11/11	Subgroups of $\mathbf{Z}/n\mathbf{Z}$, Euler's theorem
11/18	Normal subgroups
11/25	Quotient groups, Thanksgiving break
12/2	Classification of finitely generated abelian groups
12/9	Review