Information on 18.701, Algebra I, Fall 2020

Website: `https://canvas.mit.edu/courses/3782`

About the subject: Algebra is a fundamental math subject that is essential for many advanced math classes, especially in algebraic geometry, number theory, and representation theory. It is also widely used in applications in computer science, engineering, physics, quantum chemistry, etc. A major theme of 18.701 is symmetry, which is studied via group theory and linear algebra.

Required text: Artin, *Algebra*, second edition [2018 reissue], Pearson,
ISBN-13: 9780134689609 paper, 9780321998033 digital. If you have an older version, that should be fine for most things, but to be on the safe side, check with someone who has the 2018 reissue to make sure that the assigned exercises are the same. If you find an error in the book, send it to me; I'll add it to this list, and I think that Professor Artin will reward you with $5 at the end of the semester.

Prerequisite: Experience with writing clear proofs at the level of 18.100 is *essential* — the class moves too quickly for you to learn how to write proofs while also learning the new material. If you have not taken 18.100, but nevertheless think that 18.701 is right for you, please request permission to take 18.701 in a comment in the pre-semester questionnaire.

Anti-prerequisite: If you already know most of the material in Chapters 1–9 of Artin's book, probably you should be taking some other math class. (Generally you can request to substitute a more advanced class for any class required for the math major.)

How to prepare:

- Please fill out the pre-semester questionnaire.
- Read Sections A.1, A.2, A.4 and Chapter 1 and Sections 2.7, 2.9, 3.1, 3.2, 3.3 in the textbook before classes start; we will spend little or no class time on these. Self-check by trying some exercises in these sections. If you want to prepare even more, get a head start by looking at Chapter 2 or the rest of Chapter 3.
- Sign up on Piazza, the forum we will be using for asking and answering questions. Note: Piazza sends an email to the whole class each time you edit a post, so try to get it right the first time! Email the Piazza developers if you have technical problems or feedback for them.
- Find a study group to join at psetpartners.mit.edu.
- You could consider learning how to use LaTeX (I recommend Grätzer, *More math into LaTeX*, Springer-Verlag, 2016). LaTeX is not required for this class, however.
- On the Canvas website, please do not change your notification setting for Announcements — it should be "Notify me right away".

Topics: In an ordinary semester, we would cover through Chapter 9: matrices, groups, vector spaces, linear operators, applications of linear operators, symmetry, more group theory, bilinear forms, and linear groups. We'll find out how much is possible in a virtual semester!

A few other good books on algebra:

- Herstein, *Abstract algebra*, Wiley.
- Dummit and Foote, *Abstract algebra*, Wiley.
- Lang, *Algebra*, Springer. This is a graduate-level text, in case you want to look up something more advanced.
- Isaacs, *Finite group theory*, AMS. This is another graduate-level text, focusing on finite groups.

Artin's book is the only one you are expected to buy. Lang's book, like most books published by Springer, is available electronically for free through MIT.

Instructor: Bjorn Poonen (he, him, his), 617-258-8164, `poonen@math` (add `.mit.edu` if off-campus). It is fine to address me simply as Professor Poonen.

Undergraduate assistant: Merrick Cai, `mercai` (add `@mit.edu` if off-campus).

Class meetings: Live via Zoom, MWF 11am-12 Eastern; barring technical difficulties, recordings will be available on Panopto Video for the sake of those in inconvenient time zones, though it is usually harder to learn from a recording, and it might take several hours before recordings are available. Almost-real-time notes are on Dropbox. Attendance is recommended, though not required. Office hours via Zoom are at times listed there. Some Zoom notes:

- The Zoom meetings require MIT authentication.
- You must display *the name that you usually go by* (preferred) or *official name*. (Optionally, you may include pronouns too.)
- To improve the sense of community, it's nice if you can leave your video on, or at least display a photo. This is not required, however.
- Mute yourself during class when not speaking.
- To ask questions during class, unmute and speak, or type questions in the Zoom chat.

Asking questions: Math is easier to explain live, so for math questions outside class it is best to come to office hours! Another possibility: Ask math questions on Piazza. Administrative questions too can be asked on Piazza, especially if other students might be able to answer them or might learn from the answer. If you need to contact me privately, then email me. If you do email me, please include your full name.

Assignments:

- Weekly problem sets will be posted online.
- Only students who are or are expecting to be officially enrolled for credit should submit assignments. If you are intending to remain a listener, do not submit assignments; instead you can self-grade them using the posted solutions.
- You should not expect to be able to solve every single problem on your own; instead you are encouraged to discuss questions with each other or to come to office hours, so that when you submit an assignment you are pretty sure that it is complete and correct. If you meet with a study group, you will learn best if you do as many problems as you can on your own before meeting. **Write-ups must be done independently.** (This means that it is OK for other people to explain their solutions to you, but you must not be looking at other people's solutions as you write your own.)
- Please do not post solutions or significant hints on Piazza before a problem is due.

- LaTeX is preferred but not required. If you are writing solutions by hand, please scan them into PDFs.
- Write in complete sentences with correct grammar, using the textbook as a model.
- Solving the problem is nice, but the *real* challenge is to make your solution as clear as possible, impossible to misunderstand or misinterpret. Some writing suggestions are here.
- At the top of each problem set you submit, write either the text "Sources consulted: none" or a list of all sources consulted other than the textbooks listed above. **This is required.** (Examples of things that should be listed if consulted: a classmate, a tutor, a friend, a website, a textbook, solutions from a previous semester, etc. And remember, if you consult these, you must write your solutions afterwards while not looking at them.)
- Completed assignments should be submitted in Gradescope on the Canvas site before 11:59 P.M. Eastern Time on the due date, which will usually be a Sunday. For each problem, indicate which pages of your PDF it appears on, following page 3 of these instructions.
- Solutions will generally be posted at 11:55 A.M. the next day.
- Assignments submitted after the due date but before solutions are posted will be marked late. If this occurs only once during the semester, say because of an internet outage, then it will be accepted for full credit, but you should expect that unexcused late submissions beyond that will lose credit.
- Assignments submitted after solutions are posted will receive zero credit; Gradescope will not even permit them to be uploaded.
- Extensions beyond when solutions are released will not be granted, even with a recommendation from S^3. But with such a recommendation you might be *excused* from completing part or all of the assignment.
- Once the solution set is posted, reading it is recommended even if you solved all the problems, since there are usually many different ways to present a solution.
- If a correct and clearly written solution of yours was not awarded credit, please first read the posted solution set for comparison, and then submit a regrade request through Gradescope. If after submitting a regrade request, you are denied credit but you still feel that your solution is 100% correct, then you may appeal to me via email. I will not hear appeals requesting partial credit.

Exams and quizzes: There will be no midterm or final exams, but there will be a low-stakes quiz each Thursday, from September 3 to December 3, except Thanksgiving:

- Each quiz is to be completed online on MITx on Thursday. It should not take long. There is no time limit, except that it must be completed during the 24-hour period (Eastern Time).
- Quiz 0 on September 3 is a practice quiz — its grade will not be counted.
- Quiz problems will generally be more straightforward than problems on the assignments.
- You may view any books or websites while taking the quiz, but you may not post questions on online forums.

- **You must complete the quiz on your own** (this is different from the problem set policy). This means that you may not discuss 18.701 content with any people (inside or outside the class) between the moment you open the quiz and the moment you finish submitting your answers. Moreover, you may not discuss the quiz problems with anyone until after the quiz period is over for everyone. Exception: If a quiz problem has an error, you may email me to notify me!
- Corollary: If you need help understanding a topic, ask about it before Thursday!

Grading: 85% homework, 15% quizzes. Your grade does not depend on how others are doing; the percentage of students who will get an A, B, etc. is not predetermined. Applying a to-be-determined function to your numeric grade yields your letter grade.

- A numeric grade of 90% or above guarantees an A- or above.
- A numeric grade of 80% or above guarantees an B- or above.
- A numeric grade of 70% or above guarantees an C- or above.

The actual function may be more generous than this, depending on the difficulty level of the homework and quizzes. A grade of I (incomplete) will be given only when circumstances beyond your control have prevented you from completing a minor part of the work for the course, and you have been doing passing work up until the circumstances arose; in addition, you must have notified me of the difficulty as early as possible.

MIT help resources: Your friendly lecturer, the Math Learning Center, Mathematics Academic Services 2-110, the MIT Division of Student Life, and the Talented Scholars Resource Room. See this chart for an even longer list of help resources at MIT.

If a personal or medical issue is interfering with your studies:

- Contact your medical provider if you need medical attention.
- Email me.
- If you are dealing with a personal or medical issue that is impacting your ability to attend class, complete work, or take a quiz: undergraduates should contact a dean in Student Support Services (S^3) at s3-support@mit.edu or 617-253-4861, and graduate students should contact a dean in GradSupport at gradsupport@mit.edu or 617-253-4860. These offices are here to help you. The deans will verify your situation, provide you with support, and help you work with me to determine next steps. In most circumstances, undergraduates will not be excused from coursework without verification from a dean. (These procedures are as suggested by MIT Student Support and Wellbeing for this semester.) If you have some other kind of conflict, email only me (not a dean) as far in advance as possible, and I will make a decision on how to proceed.
- In case of financial hardship, consider consulting the ARM Coalition.

Note: Generally, you are expected to choose a manageable courseload and to manage your time, so work in other classes is usually not a reason to be excused from 18.701 coursework. If in a particular week you are truly overwhelmed or there are other extenuating circumstances, you must go through a dean at S^3 to request an exemption.

If you need disability accommodations: Please speak with Disability and Access Services (DAS), ideally before the semester begins or early in the semester. If you have a disability

but do not plan to use accommodations, it is still recommended that you meet with DAS staff to familiarize yourself with the services and resources of the office. If you have already been approved for accommodations, please email a PDF copy of the accommodation letter to Elise Brown in Mathematics Academic Services 2-110 early in the semester or as soon as you receive it.

Other important things:

- It is your responsibility to email me as far in advance as possible in case of an extended absence, or in case you find yourself struggling with the course for any reason.
- If you have emergency medical information you wish to share with me, or if you need special arrangements, please inform me immediately: schedule a time to talk with me privately.

Final comment: This is a difficult time for just about everybody, and we all have different mathematical backgrounds and living situations, so please be patient with your fellow classmates (and with me, since surely there will be technological difficulties, if not mathematical ones!) Also, 18.701 is not a contest, but a community of people trying to learn together, so please join study groups, join Piazza, etc., and help each other learn!