

What's CS22?

Suppose you have 9 identical donuts to distribute amongst a group of 4 friends, including you. You wonder to yourself: How many ways could we distribute these donuts amongst the 4 friends? You could end up with all the donuts or none whatsoever or anywhere in between, and the same goes for each of your other friends.

Suppose we tell you the number of ways to distribute the donuts is exactly equal to the number of samples of 3 donuts you could take from a box of a dozen different donuts. Would you believe us? What would we need to do to convince you it's true?

In this class, we consider assertions about the world of discrete mathematics, and we think about how we can convince each other that these assertions are true or false. It's one thing to be told that an assertion is true or false: it's another to be convinced of it. Convincing other people that an assertion is true or false requires understanding *why it is*. Understanding why things are true in the world of discrete mathematics is therefore a major part of this class.

The math in this class has a very different flavor from math in high school like algebra or trigonometry. It is much less mechanical than that, much more creative than that, and much more about understanding than that.

In this class, our world will consist of Logic, Set Theory, Number Theory, Combinatorics, and Probability. If you've never heard of these before, not to worry: **you're in exactly the right place**. This course assumes no prior experience with these topics, and we'll be building the ideas within these topics from the bottom up.

What sort of skills will I develop in this course?

First and foremost, you will develop the skill of writing good proofs. What is a good proof? We'll talk about that a lot, but for now, we'll say this: a good proof for a claim makes all members of the 22 community understand why the claim is true.

Writing a good proof is a skill that requires:

1. Being able to communicate aloud with other people about mathematical ideas,
2. Having a toolbox of techniques you can draw from to approach a question,
3. Being fluent in reading and using different notations, and,
4. Being able to write arguments that engage a diversity of individuals.

This course is not a traditional computer science course, in that you won't be doing a huge amount of programming. But there are two very different languages that you'll develop some skills with over the semester. The first, \LaTeX , is a markup language that you'll use to write up most of your homework assignments. (This is a common tool for communication in mathematics and computer science. The missive you are reading now was written in this language.) The second, Lean, is a formal language for writing proofs and exploring mathematical concepts.

What do I need to know going in?

Nothing—just come with an open mind about learning some math! There are many courses at Brown that teach mathematical reasoning, and thus overlap to some degree with this one. None of them are prerequisites for 22 and we do not assume that you've taken any of them. To the contrary, taking 22 is likely to help you with more advanced proof-based courses.

Time

Getting the most out of this course will take up a lot of your time. Everyone is different, and we therefore can't tell you exactly how much time you'll end up spending on this course. However, we'll just say this: the critical reviews for this course are not exaggeratory. Please keep this in mind as you're planning out your schedule for this semester! Also, if you don't have the time to put in the work this semester, please remember that it's offered every spring, and we recommend taking it when you have more time on your hands. Between lectures and recitations, expect to spend at least 180 hours over the course of the semester.

Course Components

Lectures

Rob will hold lectures on Mondays, Wednesdays, and Fridays from 1:00pm to 1:50pm in Solomon DECI. Course-related announcements may be made in class, and, while you are not required to attend, you are responsible for anything covered in lecture. We will release lecture slides, but they are meant to reinforce what you learned in lectures, not replace them. The lectures will be recorded and available on Canvas and the course website for those who prefer asynchronous attendance. Another available resource to reinforce the material from lecture is the course textbook, which can be found (for free!) on our website.

Homework

Homeworks will be released by Thursday mornings, and they are due the following Wednesday at 11:59pm Eastern time on Gradescope. You get a total of **6** late homework days to be used on any homework of your choosing throughout the semester. You may use a maximum of **2** late homework days on any single assignment. The late deadline is thus Friday, at 11:59pm EDT. Any subsequent late homework will receive no credit.

Extensions on assignments *can only be requested to the professor*; please use the [form](#) linked on the course website to request an extension. You will need to provide a medical or dean's note. By default, approved extensions will be for two extra days. If your circumstances are exceptional and you need more time than this, note it in the form.

After the second homework, all submissions must be typed up using something called **L^AT_EX**. To give you some time to learn it, we will allow non-L^AT_EX submissions for the first two assignments. Starting from Homework 3, **any handwritten or non-L^AT_EXed submissions will receive no credit**. Resources for learning L^AT_EX are available on the course website, and we will have a L^AT_EX gearup session in the first two weeks. Note that you may hand-draw diagrams on your submission.

Regrade Requests

Regrade requests will be available on Gradescope for 7 days after homework grades are released. Please refrain from reaching out to TAs directly about grading unless explicitly instructed to do so.

Lean

There will be an experimental component of this course this year, where we will use the Lean proof assistant as a guide through many of the mathematical topics that we cover. Lean is a programming language, but unlike any programming language you've used before.

Many homework assignments will have a Lean component to them. Over the first days of class, we'll give directions for setting up a Lean development environment and accessing these assignments. As far as deadlines and grading are concerned, these are part of the regular assignment. You will submit them to a separate assignment on Gradescope, though, since there is a Lean-specific autograder.

Exams

There will be one midterm and one final exam. These exams will be in person and you are expected to be present for both.

The midterm will take place in class on **March 15**. The final will take place on **May 9** at 9:00am in the location designated on CAB. If you have any conflicts with these dates, please inform Rob and the HTAs as soon as possible, at least two weeks before the exam. Travel plans are *not* a valid excuse for missing an exam.

Hours

Hours will be held throughout the week in person and on Zoom (see the calendar on our course website for times and locations). If any changes are made to the hours schedule, these changes will be reflected in the calendar.

Like all writing, writing good proofs is a social act and you will benefit from communicating with other folks in the class. Hours provides a space that allows you to collaborate with other students in the class on homework problems with the guidance of a TA. More on collaboration can be found in our collaboration expectations document. TAs are there to help you discover the answers to your questions and help you develop strategies that you can use to solve future problems. **While attending TA hours is not required in this course, it is often the key ingredient to succeeding.**

See [this document](#) for more details about TA hours.

Recitation

Each week, there will be several identical recitation sessions (see the calendar for times and locations). At recitation, you'll have the chance to work with your TAs to hone your understanding of concepts learned in lecture, practice solving problems related to the homework, and explore any questions related to the course material that excite you.

Recitations are required. Each week, you will be randomly assigned a group of 4-5 people within your recitation section and then you will submit your work in each week's recitation session as a group. Yes, one submission per group!

For the first recitation, you can attend any section you would like. (Schedules are in flux and we want to keep things simple.) After that, we'll ask you to sign up for a specific weekly time slot. We'll have a "makeup" recitation Sunday evenings each week. If you can't make your normal timeslot, fill out the [absence form](#) on our website. You can attend the makeup session instead, or complete the recitation packet on your own and get it checked off the next week.

See [this document](#) for more details about recitation.

EdStem

When you have questions about an assignment or the course material in general, we encourage you to use EdStem! It's an online forum that allows you to ask questions either publicly to the class (including the TAs) or privately to just the TAs. More details about EdStem will be covered on Homework 0.

Here are our EdStem guidelines:

1. Any post containing part of your solution to a problem should be private, while high-level conceptual questions can be public; we reserve the right to change a post to private if it reveals too much information!
2. Answering posts will operate similarly to hours; as such, do not ask questions like "is my solution correct" or "will this get points counted off"; this also means that we will not answer questions about mind benders in posts.

3. Check pinned FAQs or search for closely related posts (some students may have asked the same questions before)
4. Categorize your post under the correct assignment to decrease the chances of it being lost.
5. Be respectful! to fellow students and TAs.

Grading

The following is an approximate guide to the grading breakdown:

<i>Type</i>	<i>Percentage</i>
Homework	45%
Recitation	15%
Midterm Exam	15%
Final Exam	25%

Students taking the course S/NC will receive a grade of “S with distinction” if they pass the course with a grade that would otherwise earn a high A.

Accommodations

Please inform Rob early on in the term if you have a disability or other condition that might require accommodations or modification of any of the course procedures. If you would like to discuss the process for requesting accommodations, you can contact Student and Employee Accessibility Services at 401-863-9588 or seas@brown.edu.

Further Resources

We recognize that being a student is not easy and wish to provide support however we can. Beyond our staff, here are some resources that are available to you here at Brown:

- Counseling and Psychological Services:
<https://www.brown.edu/campus-life/support/counseling-and-psychological-services/home>
- CS Health and Wellness Resources:
<https://docs.google.com/document/d/1pHLq14jN0GvutTY0sjHJs188eWvc6vGGLf183yHt2ak/edit>
- Student Advocates for Diversity and Inclusion:
<https://cs.brown.edu/about/diversity/student-advocates-diversity-and-inclusion/>

Contacting Us

If you have any administrative questions about the course, you can email the TA list at cs0220tas@lists.brown.edu at any time. If you'd like for your question to be read only by the HTAs and the professor, or if you have thoughts on how to improve the class, you can reach us at cs0220headtas@lists.brown.edu, or Rob directly at robert_lewis@brown.edu.

We also have a form for anonymous feedback, which you can find [here](#). We are all passionate about ensuring that all students have a positive experience in this course, so your suggestions are absolutely welcome!