

Discrete Structures

CS 2800 Spring 2023 Syllabus

General Information

Instructors

- Anke van Zuylen, Gates Hall 447.
- Renee Mirka, Gates Hall (office TBA).

Contact information:

- **Office hours:** See schedule on Canvas (includes office hours for all instructors, TAs and consultants).
- **Email:** To email the instructors or the course administrator about personal matters, please use cs2800-prof@cornell.edu. Please do not use email to ask questions about the material, policies, exam dates, etc. You can submit questions like these to Ed Discussion, where everyone can view the reply as well (and don't forget to search whether a question has been asked already).
- **1-on-1 Appointment:** You can make an appointment with one of the instructors using the Calendly 1-on-1 link on Canvas. Appointments slots are limited, and are meant for discussing topics you cannot discuss in public office hours (so not for homework questions!)
- **Website:** <https://canvas.cornell.edu/courses/48986/>

We will be using Canvas for distributing lecture materials and homework assignments. You should be enrolled automatically into Canvas, but if not (for example, because your registration has not been processed yet), please contact cs2800-prof@cornell.edu to get added manually. All other websites we use (Gradescope for homework submission, Ed Discussions for Q&A, etc.) are linked from the course Canvas site; you should automatically get added to the rosters for these other sites if you access them through the Canvas link.

Credit Hours

This is a 3-credit course, which can only be taken for a letter grade.

Time and Location

- Lectures are held MWF 10:10am-11:00am, in the Statler Auditorium (Statler 185).
- Discussion sections are held at different times and locations on WRF, and allow you to work in small groups and with course TAs on a subset of the assigned homework problems.

Pre/corequisites

The official prerequisite for course is a programming course. It is OK to take CS 1110 or CS 2110 concurrently. The course assumes familiarity with differential and integral calculus. MATH 1920 is recommended but not required; the course will offer a boot camp mid-semester to get you up to speed on the necessary calculus background.

Academic Excellence Workshop ENGRG 1028

Academic Excellence Workshop (AEW) sections are available to be taken in conjunction with this course. AEWs are optional 1-credit supplemental courses which meet for one 2-hour collaborative problem-solving session each week throughout the semester. Designed to enhance student understanding, the workshops feature group work on problems at or above the level of course instruction. In the workshops, small-group problem-solving is directed by undergraduate peer educators called facilitators. The AEWs are graded S/U, based on attendance.

For this course there are multiple sections of ENGRG 1028 available, please see student center for details. You can enroll online during the add period. Space may fill up quickly – if there are no spots available in a section that fits your schedule, use the link included with the course listing in the registration system to indicate your interest and availability. For more information about AEWs, visit <http://www.engineering.cornell.edu/aew>.

Course description

Discrete mathematics is the mathematical backbone of computer science. Contrary to continuous mathematics (which includes, for example, calculus) which deals with objects that can take on any value in a specified range, discrete mathematics deals with objects that can only take distinct, separated, values. This course gives an introduction to concepts and structures in discrete mathematics that are useful in describing and analyzing objects in computer science and information science. This course provides an introduction to the following topics:

- introduction to logic, mathematical proofs, and induction;
- sets, functions, relations, and graphs;
- combinatorics and probability theory;
- languages and finite automata.

Topics will be discussed in the context of applications to various areas of computer science.

Learning objectives

On completing this course, students should be able to:

- Use **logical notation** to define and reason about statements expressed in informal language.
- Write **mathematical proofs** using clear and precise reasoning; recognize when to use various proof techniques; find errors in faulty proofs.
- Precisely state induction hypotheses and write **inductive proofs**; write and use inductive definitions.
- Reason about **fundamental mathematical concepts** such as sets, functions, relations, graphs and their properties.
- Apply **combinatorial reasoning** to solve counting problems arising in real-world applications; use the pigeonhole principle to prove statements.
- Use **probability concepts and notation** such as conditional probability, Bayes' rule, random variables, and tail bounds to model and analyze real-world applications; compute associated quantities such as probabilities, expectations, variance, covariance, and correlation.
- Prove properties of **regular languages and automata**; design automata and regular expressions accepting or denoting a certain regular language; prove that a language is not regular.

Course Materials

The textbook for the course is *Discrete Mathematics and its Applications* by Kenneth Rosen. It is OK if you don't have the most recent edition. There will be topics covered in lecture that are not in the text and there will be topics in the text that are not covered in lecture; additional materials will be provided where necessary.

The following books and lecture notes are also useful references.

- *Lectures in Discrete Mathematics*, lecture notes by Matthew Eichhorn and Alexandra Silva.
- *A course in Discrete Structures*, lecture notes by Rafael Pass and Wei-Lung Dustin Tseng .
- *Mathematics for Computer Science* by Eric Lehmann, Albert Meyer, and Tom Leighton.
- *Essential Discrete Mathematics for Computer Science* by Harry Lewis and Rachel Zax.
- *Discrete Mathematics ZY Book* by Sandy Irani.

Grading

Your grade will be based on weekly homework and discussion exercises, participation, two prelims, and one final exam. Each of these components will be given a weight in the following ranges:

- homework: 20%
- discussion: 0 to 5%
- participation: 0 to 3%
- prelim 1: 15% to 30%
- prelim 2: 15% to 30%
- final exam (cumulative): 25% to 40%

At the end of the semester, we will compute the best possible score for each individual student using weights in the indicated ranges, by setting each weight to its lowest value (giving 75% of your score) and then repeatedly increasing the weight of the components on which you scored highest to their highest value to get to 100%.

Typically, the median score is set as the cut off for the grade of B+ (that is, 50% of the students in the course receive a B+ or higher).

Homework

This course has weekly homework assignments. All homework assignments will be posted on Canvas. Most homework assignments will be due on Wednesday at 11:59pm, and needs to be submitted on Gradescope. There will be roughly 9-10 homework assignments, and the lowest assignment grade is dropped.

It is OK if you handwrite your answers and upload a photo (converted to a single pdf), but we encourage you to learn how to typeset them using LaTeX. We will post resources to help you get familiar with LaTeX, and the LaTeX source files of the homework so you can quickly learn the important syntax and commands.

Participation and Discussion

The learning activities during lectures and discussion sections are meant to help you check your understanding, and to provide you the opportunity to work with others to synthesize concepts and apply what you have learned. For the activities we do in lecture and discussions, you are not expected to give the correct answer, but we do expect you to make an effort to learn.

Your **participation** grade consists of lecture participation (70%) and completion of the mid-semester and end-of-semester course evaluations (15% each). Lecture participation is measured using PollEverywhere; there will be approximately 1-4 polls per lecture. If the percentage of polls you complete (regardless of whether your answer is correct) is x , your score for lecture participation is $\min\{100, x/0.9\}$; in other words, you can miss 10% of the polls and still get full credit.

Your **discussion** grade will be determined based on the *completion* (not correctness) of discussion exercises. You will hand in the discussion exercises with your homework. Unlike the homework, discussion exercises are graded as “good effort” (full credit), “mediocre effort” (half credit) or “no effort” (no credit), and the TAs are encouraged to discuss the solution of the discussion exercises in detail before you submit your work.

Exams

There will be two prelims and a final exam. The prelim exams are scheduled for the following two dates: Thursday March 16, 7:30pm and Thursday April 13, 7:30pm. The date for the final exam is to be determined. The exams will be held in-person.

Exams for CS2800 are closed-book and closed-notes and do not require any equipment except pen and paper. You can expect questions on the exam to be similar to the homework problems, so a good understanding of the key ideas used in the homework problems is necessary to do well, however, exam questions are constructed to take much less time to solve than the homework problems. Review materials that include questions from previous years’ exams will be provided a week before the exam.

Exams for students with SDS accommodations are administered by SDS. Students are required to request accommodations by **February 8**. Please see the Accommodations section later in this syllabus for detailed instructions.

Course Policies

Late Submissions

Late submissions are accepted up to 24 hours after the deadline. You can submit **one** late assignment without penalty; subsequent late assignments will have a penalty of 5% for being up to one hour late, and 50% for being 1-24 hours late.

Collaboration

Collaboration and conversation is an important part of how ideas get generated. We encourage you to discuss with a small group of your peers in the course to brainstorm ideas for how to solve the assigned exercises. However, **your solution must be written up completely on your own; you are not allowed to share digital or written notes or images of your work in any form with each other.** Just like in research, your work must also include acknowledgements of all students with whom you collaborated. Both the physical or digital distribution of information about solutions and the failure to acknowledge collaborators are serious violations of academic integrity.

Admissible Resources

For the homework, **it is not admissible to use resources beyond course material and student discussions**. In particular, you may not use Wikipedia, Chegg, Coursehero, or search the Web, or look at any textbook, other than the ones assigned/recommended in the course. Using such additional resources is a violation of academic integrity. If you feel the resources available to you are insufficient, talk to course staff or ask questions on Ed.

Regrades

Regrade requests for homework assignments and exams should be submitted on Gradescope. Regrade requests are accepted for four days, starting one day after grades are released. We may regrade the entire exam or problem set, and your score may go up or down.

Academic integrity

Each student in this course is expected to abide by the Cornell University Code of Academic Integrity. Any work submitted by a student in this course for academic credit will be the student's own work. The complete code is available at <http://cuinfo.cornell.edu/Academic/AIC.html>.

In CS2800, violations of the homework collaboration policy or accessing homework solutions found online result in a score of *negative 50%* (−50%) for the assignment. Communicating with any person or accessing unauthorized resources during an exam for CS2800 results in an F in the course.

Advice for Success

Here are a few tips for succeeding in this course:

- **Start your assignments early.** Even if you aren't writing anything down yet, looking over the problem set well in advance of the due date can ensure you have enough time to brainstorm possible solutions, and to clear up confusion about how to interpret a problem. Solving homework problems requires thought and creativity, and this doesn't work well on a deadline.
- **Use your discussion section to gain confidence and get feedback.** The exercises assigned each week to be solved during your discussion section are at a similar level as the homework exercises. They give you the opportunity to work with your peers and the TAs on all aspects of solving the problems, including writing down your answer (whereas for your homework, you are required to *write your solution on your own*).
- **Talk with classmates at a similar level about ideas for the homework.** As previously stated, while you cannot share physical or digital solutions of any kind to these problems,

we actively encourage you to talk to classmates while you work through them. In particular, we recommend finding a group of students to meet with throughout the semester to talk about ideas. For best results, make sure those students are at the same level of understanding of the material as you; talking through your ideas with colleagues with a similar level of understanding will make talking through ideas with each other easier and more equitable, and is more likely to leave you prepared for course exams.

- **Ask questions in class, in discussions, in office hours, and on Ed Discussions.** The material in this class moves quickly and is often cumulative. If you find yourself scratching your head after a lecture, even after consulting the textbook and course notes, you're certainly not alone, and it's better to seek help then than to wait until you are more confused.
- **Don't panic if you're stuck and confused.** It is normal to struggle, and to be stuck sometimes and have no idea what to do! Struggling with the material helps you get a deeper understanding, so rather than panic, remind yourself you are "doing it right" whenever you spend time feeling stuck and confused (but do talk to your homework partners or the course staff if you are not able to get yourself unstuck after thinking (making up examples, thinking about what should happen on those, etc.) on your own).

Course Community

We understand that our members represent a rich variety of backgrounds and perspectives. Cornell University is committed to providing an atmosphere for learning that respects diversity. We expect students to communicate in a respectful manner with the instructors, course staff, and fellow students, in a way that honors the unique experiences, values, and beliefs represented by different members of our community.

Inclusiveness

You should expect and demand to be treated by your classmates and the course staff with respect. You belong here, and we are here to help you learn and enjoy this course. If any incident occurs that challenges this commitment to a supportive and inclusive environment, please let the instructor or a TA know so that we can address the issue. We are personally committed to this, and subscribe to the Computer Science Department's Values of Inclusion.

What to do if you get sick

If you are sick, your first priority should be getting better; that means getting a lot of rest, drinking fluids, going to see a doctor if needed, etc. If you feel well enough to come to lecture, please make sure to wear a mask so you don't infect others.

Zoom recordings of lectures are not available for absences, including absences due to illness. For any illness, you are expected to keep up with course material by working with a peer in the

course and/or accessing the lecture notes on canvas. You are allowed to miss 10% of the lectures for any reason without affecting your lecture participation credit. We do not excuse additional lecture absences for any reason, except in the case of long term illness. Please note that a single lecture counts for at most 0.08 (out of 100) towards your final grade, so absences because of a short illness will not affect your grade.

You are encouraged to use the homework drop or the penalty-free one-day late assignment when you get sick. You do not need to inform us when you choose to do this.

Getting support

We urge you to talk to the instructors or any of the TAs or consultants if you have any concerns about your learning or progress in the course, if you are sick for more than a week, or if you have other personal difficulties. Resources at Cornell are also available (caringcommunity.cornell.edu).

In case you experience major unexpected events (for instance, you being hospitalized unexpectedly, death of a close family member), please set up a meeting or send an email, and we will figure out how to handle the situation together. We cannot accommodate requests for exceptions for minor issues (leaving early for a break, forgetting to submit a homework, for example) — the course policies and grading scheme have been set up to take care of this.

Accommodations

This course complies with the university policies and equal access laws, and we provide accommodations for disability, religious observance, Title IX, varsity athletes, medical emergencies, and military service. Requests for academic accommodations should be made during no later than February 8, except for unusual circumstances, so arrangements can be made as soon as possible. Testing-related academic accommodations are organized by SDS; please carefully read the next subsection for details. If you require accommodations that are not testing related, please email cs2800-prof@cornell.edu to discuss the logistics of your accommodation(s).

Testing accommodations

This course is participating in the SDS Alternative Testing Program for the Spring 2023 semester. **Students with testing accommodations must request their accommodation letter from SDS no later than February 8. If you become registered with SDS after February 8, you must request your accommodation letter at least 7 days prior to the date of your exam.**

If you have an approved testing accommodation, you must request it for this course *and* complete an Exam Request Form for each exam in this course via the SDS student portal by **February 8th**. Failure to do so may result in the inability to use your accommodation.

The evening prelim exams arranged by the SDS Alternative Testing Program will begin at 6:30 p.m. All exam logistics will be communicated to you from SDS (look out for emails from sds@accessiblelearning.mail.cornell.edu). Please note that confirmation about the exact time

and room location for your accommodated exam will be communicated to you closer to the exam date (no later than 48 hours prior). Please do not contact the course staff with questions about exam logistics, as we will not be able to answer them. All details are being managed by SDS; therefore, **questions should be sent to sds-testing@cornell.edu.**

Course Material Copyright

Course materials posted on Canvas, gradescope, or Ed Discussions are intellectual property belonging to the author. Students are not permitted to buy or sell any course materials without the express permission of the instructor. Such unauthorized behavior constitutes academic misconduct.