Discrete Mathematics (CSE 20) Syllabus

Welcome to the Course

This section sets the tone for the course and the syllabus. In addition to containing the basic information about the course (e.g. description, learning outcomes), the course information section contains an introduction, sets expectations, and characterizes the format for the course.

Course Information

Course Description	If you ever wondered "What sort of mathematics do I need for computer science?", this course will provide some of the answers. In particular, you will have the opportunity to learn basic concepts about algorithms, computer arithmetic, number systems, Boolean algebras, logic, proofs, program correctness, loop invariants, modular arithmetic, linear and partial orders, recurrences, and induction, amongst other things. These are some of the essential ingredients in the toolkit of every computer scientist.
Prerequisites	There are no strict prerequisites but students should have a basic understanding of elementary computer programming, mathematics (algebra, geometry, trigonometry and calculus.)
Credits	4units recommended: 10-15/wk. on assignments/reading/discussion sessions
Instructor	Fatemeh Asgarinejad
IA/TA	Joshua Burrows (TA), Sharon Yang (Tutor), Oleg Bychenkov (Tutor)

Course Learning Outcomes

Upon completion of this course, you will be able to:

1. Use multiple representations of numbers to illustrate properties of the numbers and develop algorithms.
2. Understand the logical structure and meaning of a sentence expressing a property, fact, or specification.
3. Prove propositional equivalences.
4. Relate Boolean operations to applications, e.g. logic puzzles, set operations, combinatorial circuits.

5. Reason about the truth or falsity of complicated statements using Boolean connectives, quantifiers, and basic definitions.
6. Apply proof techniques, including direct proofs and proofs by contradiction.
7. Distinguish valid from invalid arguments.
8. Reason about modular arithmetic.
9. Prove algorithm correctness using loop invariants.
10. Use induction to prove statements about mathematical identities and inequalities.
11. Apply structural induction to prove statements about recursively defined objects.
12. Identify and be able to prove basic properties of sets, functions, and relations.
13. Distinguish between finite, countable, and uncountable sets.

Course Format
The class will be held in-person. Attendance is not mandatory but highly recommended.

Time and Location of Lecture, Discussion and exams

Lecture	MTWTh	9:30-10:50 DIB* 121
Discussion	TTH	2-2:50 DIB 121
Midterm	08/20/2024	1-2:50 Warren Lecture Hall (WLH) 2207
final	09/06/2024	8-10:59 Warren Lecture Hall (WLH) 2207

Time and Location of office hours

Fatemeh	M W Thurs	12 – 1 PM (In-person CSE 2210) 3 – 4 PM (Zoom) 12 – 1 PM (Zoom)
Joshua	Thurs Fri	11 AM- 1 PM (CSE In-person B215) 3 – 5 PM (CSE In-person B215)
Sharon	Tue	11:30 – 12:30 (In-person CSE B260A) 4 – 5 PM (Zoom)
Oleg	Sat Sun	11 – 12 (Zoom) 3 – 4 (Zoom)

*Design and Innovation Building [Address](#)

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Course Schedule

Week	Title / Topic	Activities, Assessments, and Due dates	Learning Outcome *By the end of this week, you will be able to*
1	• Intro / Math objects • Computer representations of numbers • Number systems • Functions • Recursively defined Sets • Algorithms	Read: Rosen 1.1, 1.2, 1.3, 2.3, 3, 4.1 and 4.2. To Do: HW1 To Do: Daily Exit Tickets To Do: Test and Retest 1	• Understand and use basic mathematical objects and computer representations of numbers. • Explain and work with different number systems. • Define sets recursively and understand simple algorithms.
2	• Propositional Logic • Quantifiers • Proofs • Sets • Logical equivalence and consistency • Circuits • Fixed-width operations in circuits • Truth tables • CNF / DNF	Read: Chapters 2 and 12 To Do: HW2 To Do: Daily Exit Tickets To Do: Test and Retest 2	• Apply propositional logic and quantifiers in problem-solving. • Prove logical equivalences and assess consistency. • Create and analyze truth tables and logical circuits. • Translate statements into CNF/DNF.
3	• Sets proof • Divisibility and modular arithmetic	Read: Chapters 2 and 4 To Do: HW2 To Do: Daily Exit Tickets To Do: Test and Retest 3 Midterm	• Prove properties of sets and relationships between them. • Solve problems involving divisibility and modular arithmetic.
4	• Induction • Proof by contradiction • Cardinalities • WOP	Read: chapters 5 and 2.5 in Rosen's. To Do: HW4 To Do: Daily Exit Tickets To Do: Test and Retest 4	• Apply induction and proof by contradiction in solving problems. • Analyze cardinalities of sets and apply the Well-Ordering Principle (WOP).

5	• Cardinalities • Relations • Equivalence relations • Modular arithmetic • Diagonalization / uncountability • Mod applications • Cryptography (if time permits)	Read: chapters 8, 9, 4.1 and 2.5 in Rosen's. To Do: HW5 To Do: Daily Exit Tickets To Do: Test and Retest 5	• Demonstrate understanding of relations and equivalence relations. • Analyze modular arithmetic applications in cryptography. • Explore diagonalization and the concept of uncountability.

Lectures

- The lecture slides/notes will be posted before class on the content calendar link.
- You may interrupt lecture to ask questions, make comments or express doubts.
- All lectures will be recorded and posted for students to watch when they want. Lectures will be accessible via UCSD podcasts.
- There will be a question each lecture (exit ticket), open until the Sunday of that week, with the same due date for all Monday, Tuesday, Wednesday and Thursday's lecture. You will have unlimited attempts.

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Overall Course Expectations

What you can do to support your success in the course:	What I will do to support your success in the course:
Read the syllabus and stay current with course information	Be prepared and bring my enthusiasm for teaching to each session
Submit exit ticket in the end of each class or before the end of the week (a question from previous lecture for extra points)	Respond to emails within a few hours, and provide timely feedback on assignments / submissions.
Contribute to the learning environment with fairness, cooperation, and professionalism	Establish a learning environment with fairness, cooperation and professionalism, and will take action if these principles are violated.
Treat your classmates, instructional assistants and myself honestly and ethically	Treat you honestly and ethically, and will address any concerns you might have
Commit to excel with integrity[1]. Have the courage to act in ways that are honest, fair, responsible, respectful & trustworthy.	Uphold integrity standards and create an atmosphere that fosters active learning, creativity, critical thinking, and honest collaboration.
Manage your time, so you can stay on track with the course and complete tasks on time	Only assign work that is vital to the course, and will work to meet the standard credit hour allotment for the course.
Communicate with me if you determine that a deadline cannot be met due to extenuating circumstances	Consider requests for adjustments and will make reasonable exceptions available to all students when approved

1. Please read UC San Diego's Policy on Integrity of Scholarship and take the integrity pledge

Text/Readings/Other Material

The textbook for this course is:

Discrete Mathematics and its Applications, Kenneth Rosen, McGraw Hill, 7th edition. This book has online self-assessment problems that is recommended.

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Technology Requirements / important course websites/apps

canvas.ucsd.edu is our material repo and gradebook.

gradescope.com is our homework submission site.

piazza.com is our discussion and Q&A forum

course syllabus and schedule: https://canvas.ucsd.edu/courses/58077/assignments/syllabus

Assignment and Grading

Summary of Grade Criteria

Option 1	Option 2	Option 3
2 Review quizzes 5%	2 Review quizzes 5%	2 Review quizzes 5%
HWs 35% (best 4 of 5)	HWs 35% (best 4 of 5)	HWs 35% (best 4 of 5)
Tests 15% (best 3 of 4)	Tests 20% (best 3 of 4)	Tests 5% (best 3 of 4)
Midterm 15%	Midterm 0%	Midterm 15%
Final 30%	Final 40%	Final 40%

Grade Scale: Your final grade will be based on the following scale. (You will earn the grade in the table based on your numerical score or higher.)

A+	A	A-	B+	B	B-	C+	C	C-
98	93	90	86	82	78	74	70	64

We encourage you to work on homework in groups of up to four CSE 20 classmates. To find group members: reach out to people sitting around you in class, in discussion section, or during office hours. Working within the campus safety guidelines, you may choose to meet with your group mates in person (find ideas for where to study on campus), or online. If you're working with one another remotely, we highly recommend meeting synchronously so that you can work through the homework problems *together*.

Typesetting (LaTeX) Resources

All submitted homework for this class must be typed. Diagrams may be hand-drawn and scanned and included in the typed document. You can use a word processing editor if you like (Microsoft Word, Open Office, Notepad, Vim, Google Docs, etc.) but you might find it useful to take this opportunity to learn LaTeX. LaTeX is a markup language used widely in computer science and mathematics. The homework assignments are typed using LaTeX and you can use the source files

as templates for typesetting your solutions. You can earn +0.25 points for typing each HW in Latex (up to 1 point for 4 HWs)

If you have never used LaTeX, we recommend cloud resources that don't require you to download and install LaTeX on your local machine. A good example is Overleaf, which has lots of documentation. Overleaf works similar to Google Docs in that all members can edit the file in parallel and changes are updated in real time. There is a way to directly invite group members to your document, but the free version of Overleaf only allows two people to work at the same time. To get around this, turn on link sharing: Click on "Share" in the top right, Click "Turn on link sharing", Copy the displayed link and share it with your group members. To export your work, click on the "Download PDF" button on the right-hand side If you want to export the raw source files, click on the "Menu" button in the top-left, then click on "Source".

This open source LaTeX can be helpful when getting started, and you can use the .tex source of all the files we use in class as templates.

Alternatively, you can use Google Docs, which is available through your @ucsd.edu account. You can create documents and then share them with your group members with manual invites or a shareable link. Google Docs has a LaTex add-on that lets you type formulas in a math typesetting environment: search for "Auto-LaTeX Equations" if you want to try this option. You'll need to use the display environment (start and end with $) for all the portions you want rendered with LaTeX.

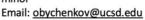# Instructional Team: Who Are My Instructors?

Instructor
Fatemeh Asgarinejad (she/her)
Final year PhD Candidate at ECE
email: fasgarinejad@ucsd.edu
Research: Machine Learning and
Brain-inspired Computing

Teaching Assistant
Joshua Burrows (he/him)
M.S. Student in Bioengineering
Email: jtburrow@ucsd.edu
Research: Microbial
Pangenomics

Tutor
Oleg Bychenkov (he/him)
Rising junior CS major, CogSci
minor
Email: obychenkov@ucsd.edu

Tutor
Sharon Yang (she/her)
Rising sophomore CS major
Email: shy038@ucsd.edu

Instructor

Hi! Nice to see you!
I'm Fatemeh Asgarinejad, your instructor and a PhD candidate in ECE majoring in Machine Learning and Data Science (MLDS). But, my office, life and home is in CSE :)
You can call me Fatemeh (Faa te meh). My email is fasgarinejad@ucsd.edu. Feel free to connect and talk about anything!

I have previously TAed this course 5 times at UCSD!
Discrete math was my strongest subject in highschool, bachelors and masters national examination! And that all was because of an amazing teacher I had in highschool. I try to follow his steps and be as good as him (Dr Ali Mirsalehi)!

Yes! I'm a first-gen university student. Well, kind of. My parents attended university when I was in middle school and university so I guess that counts!
I'm the first girl and person in my family perusing a PhD!
I'm also the first girl in my high school class perusing a PhD and one of the three!
I believe you just need to show up (and ask for help if it is hard to), and things will get better and better, especially in the great country we are lucky to live in.

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Teaching Philosophy

We rise together! We need to build a supportive community where every human being is welcomed.

Campus Resources for Support and Learning

There are a variety of resources available to students at UC San Diego, which are designed to address needs and enhance the student experience. In this section, the course is connected to the broader university community by services and programs for students

Learning and Academic Support

Ask a Librarian: Library Support
Chat or make an appointment with a librarian to focus on your research needs

Course Reserves, Connecting from Off-Campus and Research Support
Find supplemental course materials

First Gen Student Success Coaching Program

Peer mentor program that provides students with information, resources, and support in meeting their goals

Office of Academic Support & Instructional Services (OASIS)
Intellectual and personal development support

Support for Well-being and Inclusion

Basic Needs at UCSD
Any student who has difficulty accessing sufficient food to eat every day, or who lacks a safe and stable place to live is encouraged to contact: foodpantry@.ucsd.edu | basicneeds@ucsd.edu | (858) 246-2632

Counseling and Psychological Services
Confidential counseling and consultations for psychiatric service and mental health programming

Triton Concern Line
Report students of concern: (858) 246-1111

Office for Students with Disabilities (OSD)
Supports students with disabilities and accessibility across campus

Community and Resource Centers
Office of Equity, Diversity, and Inclusion
As part of the Office of Equity, Diversity, and Inclusion the campus community centers provide programs and resources for students and contribute toward the evolution of a socially just campus
(858).822-.3542 | diversity@ucsd.edu

Get Involved
Student organizations, clubs, service opportunities, and many other ways to connect with others on campus

Undocumented Student Services
Programs and services are designed to help students overcome obstacles that arise from their immigration status and support them through personal and academic excellence

Campus Policies
UC San Diego policies and statements to include within your syllabus.

- **UC San Diego Principles of Community**
- **UC San Diego Policy on Integrity of Scholarship**
- **Religious Accommodation**
- **Nondiscrimination and Harassment**