CS70: Discrete Mathematics and Probability Theory, Fall 2015

Instructors:

Lecture: MWF 1:00-2:00 PM, Wheeler Auditorium

[Jean Walrand](#)
email: walrand at berkeley (.) edu
Office: 257 Cory Hall.
Office hours:
M 2:30-3:30.
W 2:30-3:30.

[Satish Rao](#)
email: satishr at cs (.) berkeley (.) edu
Office: 687 Soda Hall.
Office hours:
M 2:30-3:30.
Th 2:00-3:00.

STAFF

Please see [the GSI/uGSI page](#) for information about your Student Instructors.
Please see [the Reader/Tutor page](#) for information about your Readers.

Notes

There is no textbook for this class. Instead, there is a set of fairly comprehensive lecture notes. The notes are undergoing revisions this semester, so notes posted well in advance of lecture may change closer to the date. So make sure you revisit the notes after lecture. Note 0 is background material that you should make sure you understand before the first lecture. Each note may be covered in one or more lectures.

- [Note 0](#): Review of Math Notation
- [Note 1](#): Propositions and Quantifiers
- [Note 2](#): Proofs
- [Note 3](#): Induction
- [Note 4](#): Stable Marriage
- [Note 5](#): Graph Theory

- [Note 6](#): Modular Arithmetic
- [Note 7](#): Bijections and RSA
- [Note 8](#): Polynomials
- [Note 9](#): Error Correcting Codes
- [Note 10](#): Counting
- [Note 11](#): Infinity and Uncountability
- [Note 12](#): Self-Reference and Uncomputability
- [Note 13](#): Introduction to Discrete Probability
- [Note 14](#): Conditional Probability
- [Note 15](#): Two Killer Applications
- [Note 16](#): Random Variables: Distribution and Expectation
- [Note 17](#): Variance
- [Note 18](#): Chebyshev's Inequality
- [Note 19](#): Some Important Distributions
- [Note 20](#): Continuous Probability
- [Note 21](#): Inference
- [Note 22](#): Zipf's Law and power law distributions
- [Note 23](#): How to lie with probability

Videos

On Calcentral! The first lecture appears to be up!

Slides

Slides follow the notes, but I do try to pull out what I garner from my own close reading, re-reading, and re-reading (and occasional edit) of the notes to both prepare lectures and these slides.

- Lecture 1: [slides](#); [handout (6up)](#) [handout (1up)](#) Propositions.
- Lecture 2: [slides](#); [handout (6up)](#) [handout (1up)](#) Proofs.
- Lecture 3: [slides](#); [handout (6up)](#) [handout (1up)](#) Induction.
- Lecture 4: [slides](#); [handout (6up)](#) [handout (1up)](#) More Induction
- Lecture 5: [slides](#); [handout (6up)](#) [handout (1up)](#) Stable Marriage
- Lecture 6: [slides](#); [handout (6up)](#) [handout (1up)](#) Graph Theory to Eulerian Tour
- Lecture 7: [slides](#); [handout (6up)](#) [handout (1up)](#) Graph Theory: complete, tree, and hypercube.
- Lecture 8: [slides](#); [handout (6up)](#) [handout (1up)](#) Modular Arithmetic: Intro
- Lecture 9: [slides](#); [handout (6up)](#) [handout (1up)](#) Modular Arithmetic: Extended Euclid
- Lecture 10: [slides](#); [handout (6up)](#) [handout (1up)](#) Midterm Review
- Lecture 11: [slides](#); [handout (6up)](#) [handout (1up)](#) RSA intro/Fermate
- Lecture 12: [slides](#); [handout (6up)](#) [handout (1up)](#) RSA, Fermat, Correctness.
- Lecture 13: [slides](#); [handout (6up)](#) [handout (1up)](#) Polynomials for Secret Sharing..
- Lecture 14: [slides](#); [handout (6up)](#) [handout (1up)](#) Polynomial Reconstruction is Unique...

- Lecture 15: slides; handout (6up) handout (1up) Polynomials for Erasure Coding..
- Lecture 16: slides; handout (6up) handout (1up) Berlekamp-Welsh decoding!.
- Lecture 17: slides; handout (6up) handout (1up) Counting: first and second rules.
- Lecture 18: slides; handout (6up) handout (1up) Counting: stars and bars and combinatorial proofs.
- Lecture 19: slides; handout (6up) handout (1up) Countable and uncountable.
- Lecture 21: slides; handout (6up) handout (1up) Midterm Review 2
- Lecture 22: slides; handout (6up) handout (1up) Probability space, events.
- Lecture 23: slides; handout (6up) handout (1up) Learning from observations.
- Lecture 24: slides; handout (6up) handout (1up) Changing your mind?
- Lecture 25: slides; handout (6up) handout (1up) Collisions/Collecting
- Lecture 26: slides; handout (6up) handout (1up) Rand Variables
- Lecture 27: slides; handout (6up) handout (1up) Expectation
- Lecture 28: slides; handout (6up) handout (1up) Independence and Variance
- Lecture 29: slides; handout (6up) handout (1up) Variance and Coupons
- Lecture 30: slides; handout (6up) handout (1up) Markov, Chebyshev, Mini-Review

DISCUSSION SECTIONS

Week 1	No Discussion.	
Week 2	2A;/Sol	2B;/Sol
Week 3		3B;/Sol
Week 4	4A;/Sol	4B;/Sol
Week 5	No section nots.	5B;/Sol
Week 6	6A;/Sol	6B;/Sol
Week 7	7A;/Sol	7B;/Sol
Week 8	8A;/Sol	8B;/Sol
Week 9		9B;/Sol
Week 10	10A;/Sol	10B;/Sol
Week 11	11A;/Sol	11B;/Sol
Week 12	12A;/Sol	12B;/Sol
Week 13	13A	13B
Week 14	14A	
Week 15	15A	15B

- The discussion sections will not cover new material, but rather will give you additional practice solving problems. You can attend any discussion section you like. However, if there are fewer desks than students, then students who are officially enrolled in that section will get

seating priority.

- Short answers or solution sketches will be provided for you to check your solutions. They may not be sufficient to get full credits in homework or exams.

EXAMS

Midterm 1	Monday (Sep 21) 8:00-9:30pm
Midterm 2	Monday (Oct 19) 7:00-8:30pm
Midterm 3	Monday (Nov 16) 7:00-8:30pm
Final	Tuesday (Dec 15) 11:30-2:30pm

- You can bring 1, 2, 3, and 4 pages of single sided cheatsheet for Midterm 1, Midterm 2, Midterm 3, and Final, respectively.

HOMEWORK

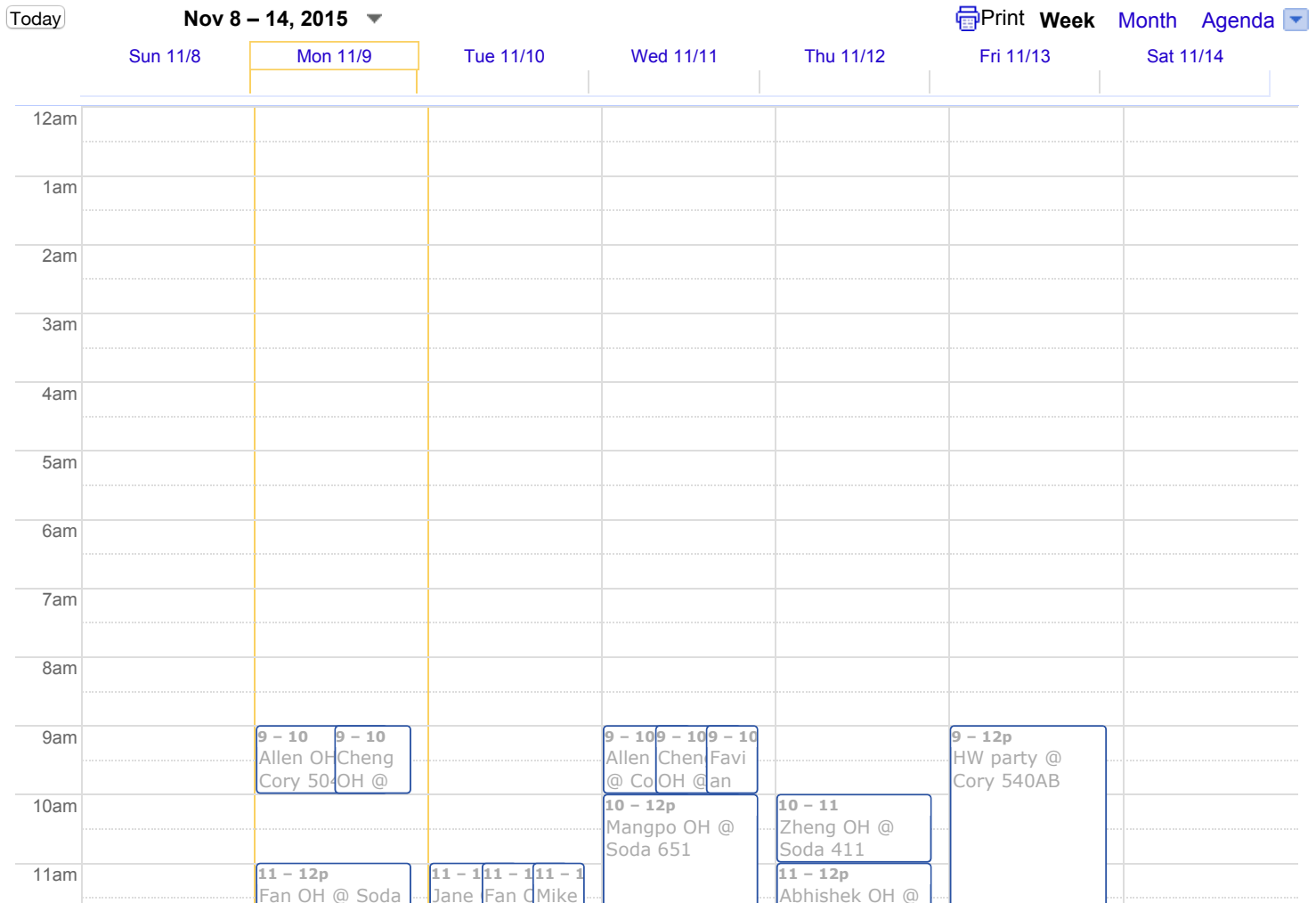| HW Problem	Due Date	HW Solution
Homework 11	Nov 11 (Wed) 10:00 PM	
Homework 10	Nov 04 (Wed) 10:00 PM	Solution
Homework 9	Oct 28 (Wed) 10:00 PM	Solution
Homework 8	Jan 26 (Mon) 12:00 PM	Solution
Homework 7	Oct 14 (Wed) 10:00 PM	Solution
Homework 6	Oct 7 (Wed) 10:00 PM	Solution
Homework 5	Sep 30 (Wed) 10:00 PM	Solution
Homework 4	Sep 23 (Wed) 10:00 PM	Solution
Homework 3	Sep 16 (Wed) 10:00 PM	Solution
Homework 2	Sep 9 (Wed) 10:00 PM	Solution
Homework 1	Sep 2 (Wed) 10:00 PM	Solution

- **No late homework is accepted.**
- Homework submission, grading, and regrading will be done through Gradescope. We may sample problems in grading.
- Lowest homework score is dropped.
- Points may be deducted for solutions that are unclear, do not show intermediate work, or are messy or improperly formatted.
- Regrades for homework assignments must be requested through Gradescope within five days after you receive your grades. Regrade requests should include a clear explanation of which grading category of the rubric you believe yourself to fall under. We reserve the right to

regrade your entire homework, and since we are taking a fresh look at it, it is possible you'll end up with a lower than you started with (though this doesn't usually happen).

- Homework parties are completely optional. TAs will be present in shifts. Students are expected to help each other out, and, if desired, form ad-hoc "pickup" homework groups in the style of a pickup basketball game. For it to succeed, you all have to be very responsible in taking care of the room, not making messes, and putting things back the way they were.
- You are encouraged to work on homework in study groups, but you must write up the solutions on your own. Please check the Department's [Policy on Academic Dishonesty](#). Any student found to be cheating risks automatically failing the class and being referred to the Office of Student Conduct.

Homework Party/Office Hour Times

CS 70 HW parties

Today	Nov 8 – 14, 2015 ▾			Print **Week** Month Agenda ▾

	Sun 11/8	Mon 11/9	Tue 11/10	Wed 11/11	Thu 11/12	Fri 11/13	Sat 11/14
12am							
1am							
2am							
3am							
4am							
5am							
6am							
7am							
8am							
9am		9 – 10 Allen OH Cory 504 / 9 – 10 Cheng OH @		9 – 10 Allen @ Co / 9 – 10 Chen OH @ / 9 – 10 Favi an		9 – 12p HW party @ Cory 540AB	
10am				10 – 12p Mangpo OH @ Soda 651	10 – 11 Zheng OH @ Soda 411		
11am		11 – 12p Fan OH @ Soda	11 – 1 Jane / 11 – 1 Fan C / 11 – 1 Mike		11 – 12p Abhishek OH @		

Events shown in time zone: Pacific Time

Calendar

COURSE OPTIONS AND CORRESPONDING ASSESSMENT

We are allowing students the choice of how to best approach the class and have designed an

assessment method for each approach.

You make the choice of how you wish proceed and to be assessed on bcourses after getting feedback on the first homework.

For all options, you are encouraged to access the course resources that are available to you all; help in hw parties, office hours that will be additionally staffed by readers, discussions, and piazza.

At that point, the die is cast and you cannot change your choice.

The Sundry item below is simply some questionaires which should take roughly half an hour. All options require them.

Test only Option.

- Midterm 1: 18%
- Midterm 2: 18%
- Midterm 3: 18%
- Sundry: 1%
- Final: 45%

Homework Option.

- Homework: 15%
- Test-only Score: 85%

Oral Quiz w/Tutor Option.

- Tutor grade: 15%
- Test-only Score: 85%

Th last option needs a bit of explaining. After each homework solution is out, each student in this category should read and understand the solutions to the homework, and then should meet with a oral quiz tutor who will test whether you understand the homework material. She or he will either check you off, or help you understand more, and ask you to try again either at that point, or after you go back and try to understand better on your own. The expectation is that the tutor option grade is 100\%.

DISCUSSION OF COURSE OPTIONS

These three configurations correspond to the European test at the end approach, the standard American approach where we force students to do homework to keep up, and the last moves

toward checking in personally which has support in the education literature. To be sure, this is a brief summary of the thinking behind this.

There are clear arguments for each approach, and it is difficult for us to know what will produce the best results for students. This is an endeavor to let you choose.

Regardless of which option you choose, the course staff will support you: put together relevant homeworks for practice, along with solutions, have sections, with section worksheets, and solutions, homework parties, office hours with additional support beyond the teaching assistants, and some tutoring support.

The Curve.

We designed the curving methodology to be such you should choose the option that best fits your preferences on how to learn the material and how to organize your time.

Still, you may visit [piazza](#) to understand the curve. My feeling is that one question on a midterm or final makes more of a difference to your grade than the specifics of the curve, so your energy is better spent on making sure your learn the material.

LINKS

- [Piazza](#): We will use Piazza as the "one-stop shop" throughout the semester: for a Q&A forum, for official announcements, and for posting content under the "Course Page" resources. **Enrollment in Piazza is mandatory.** If you have questions about anything related to the course, please post them on Piazza rather than emailing the instructor or TAs. Please do not post anything resembling a solution to a homework problem before it's due. If in doubt, you should make your post private (visible to instructors only). We always welcome any feedback on what we could be doing better.
- [Gradescope](#): All homework will be submitted through Gradescope, and all homework and exam grades will be given back through Gradescope.

ADVICE

Don't fall behind! In a conceptual class such as this, it is particularly important to maintain a steady effort throughout the semester, rather than hope to cram just before homework deadlines or exams. This is because it takes time and practice for the ideas to sink in. Make sure you allocate a sufficient number of hours every week to the class, including enough time for reading and understanding the material as well as for doing assignments. (As a rough guide, you should expect to do at least one hour of reading and two hours of problem solving for each hour of lecture.) Even though this class does not have any major projects, you should plan to spend as much time on it as on any of your other technical classes.

Take the homeworks seriously! The homeworks are explicitly designed to help you to learn the material as you go along. Although the numerical weight of the homeworks is not huge or is zero, we work hard to make them instructive and interesting. Do read the sample solutions, even for the problems on which your recieved full points. You may well learn a different way of looking at the problem, and you may also benefit from emulating the style of the solutions. (In science people learn a lot from emulating the approach of more experienced scientists.)

Don't wait until the last minute to start homeworks! Our best advice is to read through the homework problems as soon as they are available, and let them percolate in your brain. Think through possible approaches while you are waiting in line, or stuck in an elevator, or whatever. Sleeping on a problem has often helped people to come up with a creative approach to it. Definitely do not wait until the night before it is due to start working on the homework.

Make use of office hours! The instructor and TAs hold office hours expressly to help you. It is often surprising how many students do not take advantage of this service. You are free to attend as many office hours as you wish (you are not constrained just to use the office hours of your section TA). You will also likely get more out of an office hour if you have spent a little time in advance thinking about the questions you have, and formulating them precisely. (In fact, this process can often lead you to a solution yourself!)

Come to homework parties! We encourage collaboration on homeworks (but please read the homework policy above! all solutions must be your own). If you want to find a group to work with, or you and your friends want a nice place to work together, come to the homework parties.

Take part in discussion sections! Discussion sections are not auxiliary lectures. They are an opportunity for interactive learning, through guided group problem solving and other activities. The success of a discussion section depends largely on the willingness of students to participate actively in it. As with office hours, the better prepared you are for the discussion, the more you are likely to get out of it.

Form study groups! As stated above, you are encouraged to form small groups (two to four people) to work together on homeworks and on understanding the class material on a regular basis. In addition to being fun, this can save you a lot of time by generating ideas quickly and preventing you from getting hung up on some point or other. Of course, it is your responsibility to ensure that you contribute actively to the group; passive listening will likely not help you much. And recall the caveat above that you must write up your solutions on your own.

Pay attention in lectures! As the semester proceeds, many of you will no doubt feel the urge to "daydream" during lectures, or to skip them altogether, on the grounds that you can catch up by reading the lecture notes. If you follow this strategy, you should be aware that reading mathematics is NOT the same as reading a novel or a news article: each page of mathematics needs to be read many times before it is fully understood, and needs to be backed up by examples

and discussion. Following the material in class should save you several readings; even just watching it go by without fully understanding it makes your later reading easier. And you also get the benefit of student questions, examples etc. Exactly how you handle lectures is up to you. One strategy is to print out the lecture notes in advance, bring them to lecture, and add a few additional notes during class.