Math 55 Discrete Mathematics, Summer 2016

Instructor: Arash Farahmand	Contact by email (no phone)	arash86@berkeley.edu
Lecture: 740 EVANS Hall	Class Hours: MTWTF 12 - 1 PM	Course Control Number: 39840
Discussion: 740 EVANS Hall	Class Hours: MTWTF 1 - 2 PM	Course Control Number: 39842
Office: 868 EVANS Hall	Office Hour: TWTF 10:15 - 11:45 AM	

Prerequisite: Mathematical maturity appropriate to a sophomore math class. 1A-1B recommended.

Topics: (4 units) Logic, mathematical induction sets, relations, and functions. Introduction to graphs, elementary number theory, combinatorics, algebraic structures, discrete probability theory.

Description: This course provides an introduction to logic and proof techniques, basics of set theory, elementary number theory and cryptography, combinatorial enumeration, discrete probability, and graph theory, with a view towards applications. It is designed for majors in mathematics, computer science, statistics, and other related science and engineering disciplines.

Required textbook: Kenneth H. Rosen, Discrete Mathematics and Its Applications, McGraw Hill, custom UC Berkeley paperback edition. More specifically, it is identical to the 7th edition except a few chapters are missing; as a result, it is somewhat less expensive than the full-length version.

Note: There is not sufficient time in lectures for treatment of all topics plus examples. You will need to read the text. The lecture notes do not replace the text. The textbook contains additional discussion and examples.

Note: While the topics of the previous editions of the textbook may be similar, the homework problems are from the 7th edition. You have to look at the 7th edition in order to find out what problems to do.

Computer use: Outside of class, you are responsible for:

- checking your UC Berkeley email daily.
- monitoring posts at `https://math.berkeley.edu/~arash/`

Grading: All assignments and exams will be cumulative. Following are approximate percentages.

- (15%) Homework: due weekly in discussion section. No late homework can be accepted. Your TA will verify that you are working the assigned problems, but only one or two of the problems is fully graded.All solutions that you submit must be your own work and must not be copied from somewhere else. A solution that is blatantly copied from another source will receive zero credit. There will be serious consequences for repeat offenders. You are allowed to discuss the homework problems with other students, but if you do this, you must list at the top of your homework the names of any collaborators. If you used sources besides the textbook, you must list those as well. In this and all courses, you should acknowledge the contributions of others to your written work. (e.g. "I worked with Alice and Bob" or (not advised) "I copied the solution of problem 2 from source x on the Internet", or (unproductive for multiple reasons) "I emailed Professor Knuth of Stanford University.") Each correct assignment is worth 2 points. The lowest homework score is dropped, that is, the total homework points is the sum of the highest seven out of eight homework assignments.
- (15%) Quiz (weekly): Each correct quiz is 2 points. A correct quiz must have correct solution as well as correct final answer. The lowest quiz score is dropped, that is, the total quiz points is the sum of the highest seven out of eight quiz assignments.
- (30%) Two Midterm Exams: (Each midterm exam is 15%.) Will consist of all material that was presented up to the exam day.

  Note: No books, notes, calculators, scratch paper or collaboration are permitted at any exam.

  The first midterm exam is on Friday July 1 from 1 PM to 2 PM.

  The second midterm exam is on Friday July 22 from 1 PM to 2 PM.

- (40%) **Final exam is on Friday August 12 from 12 PM to 2 PM at 740 EVANS Hall.** The final exam is comprehensive. Note that there are no makeups for the final exam. You must bring your ID card. Apart from pencils, eraser, and pens, no other materials are allowed or required.

  The final exam score will override the lower minimum midterm score. This means that, a posteriori, your final exam may count as 55% instead of 40%.

Scale: The approximate percentages and grades associated with them are: 90% and above are A, eighties are B, sixties and seventies are C, 45% to 59% are D, and all percentages below 45% are F. The grades and exam scores will be curved to follow approximately the grade distribution at University of California at Berkeley:

`https://schedulebuilder.berkeley.edu/explore/courses/SP/2016/516`

Late work policy: Please note that makeup homework/quiz/test/final is not given for any reason. Missed assignments/tests count as 0 score.

Acceptable in-class behavior: Please save the social conversation for outside of class. I also expect you to behave respectfully toward anyone in the classroom (including the other students and the teacher). If I feel I need to move you to another seat, then I expect your cooperation. Violations of these rules can result in a reduction of your grade and/or referral to the college administration.

Disability policy: Students requiring special examination arrangements, note takers, or other accommodations should please consult the Disabled Students Program (DSP) office and notify their instructor promptly at the beginning of the semester. DSP will provide assistance and will communicate specific recommendations to Mr. Farahmand. For more information, please refer to `http://dsp.berkeley.edu/`.

Plagiarism/cheating policy: Dishonesty such as cheating, plagiarism, or knowingly furnishing false information to the College and its officials is prohibited and may lead to appropriate disciplinary action.

Course Outline: The following page is a tentative schedule for this course, subject to modification as necessary, by the instructor.

Date	Topics	Book	Homework Problems
6/20	propositional logic	§1.1, 1.2	§1.1 (12, 16, 26, 28)
6/21	equivalences, predicates, quantifiers	§1.3, 1.4	§1.3 (22, 30, 63, 66), §1.4 (8, 16, 44)
6/22	rules of inference	§1.5, 1.6	§1.5 (8, 10, 20), §1.6 (14, 16)
6/23	introduction to proofs	§1.7, 1.8	§1.7 (4, 14, 18, 22), §1.8 (3, 27)
6/24	sets and set operations	§2.1, 2.2	§2.1 (7, 8, 23, 32, 41, 46), §2.2 (2, 14, 16, 26, 42)
6/27	functions, sequences	§2.3, 2.4	§2.3 (6, 8, 12, 20, 37, 44), §2.4 (26, 32, 34)
6/28	cardinality, modular arithmetic	§2.5, 4.1	§2.5 (2), §4.1 (9, 16, 20, 35)
6/29	integer representations, primes, GCD	§4.2, 4.3	§4.2 (4, 7, 10, 31), §4.3 (15, 24, 32, 33, 40, 49, 52)
6/30	solving congruences, cryptography	§4.4, 4.6	§4.4 (5, 8, 11, 19, 21, 29, 30, 38)
7/01	review and **midterm 1**		
7/04	No class		
7/05	mathematical induction	§5.1	§5.1 (4, 6, 10, 18, 32, 54)
7/06	strong induction	§5.2	§5.2 (4, 10, 26)
7/07	recursive definitions	§5.3	§5.3 (4, 6, 8, 12, 20, 25)
7/08	counting	§6.1	§6.1 (8, 16, 26, 32, 37, 67)
7/11	the pigeonhole principle	§6.2	§6.2 (9, 16, 18, 26, 27, 28)
7/12	permutations and combinations	§6.3	§6.3 (5, 12, 18, 22, 35, 36)
7/13	Binomial Coefficients	§6.4	§6.4 (4, 8, 20, 22, 24, 33, 34)
7/14	generalized permutations and combinations	§6.5	§6.5 (10, 15, 16, 22, 34, 47)
7/15	introduction to discrete probability	§7.1	§7.1 (10, 20, 21, 24, 34, 38, 40)
7/18	probability theory	§7.2	§7.2 (2, 6, 10, 16, 23, 35)
7/19	Bayes' theorem	§7.3	§7.3 (2, 4, 6, 10, 15, 16)
7/20	expected value and variance	§7.4	§7.4 (4, 5, 13, 14, 28, 30, 32)
7/21	recurrence relations	§8.1	§8.1 (9, 11, 20, 21, 26, 30)
7/22	review and **midterm 2**		
7/25	solving linear recurrence relations	§8.2	§8.2 (4, 8, 11, 12, 15)
7/26	generating functions	§8.4	§8.4 (30, 32, 34, 39)
7/27	inclusion-exclusion	§8.5	§8.5 (8, 11, 24)
7/28	applications of inclusion-exclusion	§8.6	§8.6 (1, 3, 4, 13, 18, 26)
7/29	relations	§9.1	§9.1 (22, 34, 36, 40)
8/01	representing relations	§9.3	§9.3 (10, 14, 26, 36)
8/02	closures of relations	§9.4	§9.4 (2, 3, 9, 29)
8/03	equivalence relations	§9.5	§9.5 (8, 16, 24, 36, 41, 62)
8/04	graphs and graph models	§10.1	§10.1 (12, 28)
8/05	special types of graphs	§10.2	§10.2 (4, 5, 18, 20, 22, 60)
8/08	graph isomorphism	§10.3	§10.3 (6, 23, 29, 37, 41, 55)
8/09	connectivity	§10.4	§10.4 (1, 11, 15, 21, 23, 29, 43)
8/10	Eulerian circuits and paths	§10.5	§10.5 (3, 5, 13, 14)
8/11	review		
8/12	**final exam**		

Homework Assignments: Following are the deadlines for homework assignments.

1. Homework 1: (all problems assigned on 6/20-6/23) due Friday, June 24
2. Homework 2: (all problems assigned on 6/24-6/30) due Friday, July 1
3. Homework 3: (all problems assigned on 7/05-7/07) due Friday, July 8
4. Homework 4: (all problems assigned on 7/08-7/14) due Friday, July 15
5. Homework 5: (all problems assigned on 7/15-7/21) due Friday, July 22
6. Homework 6: (all problems assigned on 7/25-7/28) due Friday, July 29
7. Homework 7: (all problems assigned on 7/29-8/04) due Friday, August 5
8. Homework 8: (all problems assigned on 8/05-8/10) due Thursday, August 11

Course Organization: New material will be covered in the daily lectures. The discussion sections will be devoted to going over homework problems, directed activities, presentation of some new material, quizzes, and exams. Expect a short quiz to be given in each discussion section. Attendance of the discussion section is mandatory.

Important Deadlines: Please see the university policies for important dates regarding DROPPING, WITHDRAWING & GRADING OPTION PROCEDURES at `http://summer.berkeley.edu/`.