

Math 20: Discrete Probability

Course Information

*All of the following information is posted on our course webpage, <http://www.math.dartmouth.edu/~m20f10>

Course Objectives

In this course, students will:

- Gain intuition for discrete mathematics arguments
- Develop proof-writing skills
- Apply the theory to solve real-world problems

Instructor and Course Meeting Information

Instructor: Lola Thompson

E-mail: Lauren.A.Thompson@Dartmouth.edu

MWF 1:45 - 2:50

Th 1:00 - 1:50 (X-hour)

Location: Kemeny 006

Office: 243 Kemeny Hall

Office Hours:

M: 3 - 4

W: 3 - 4

Th: 5 - 6

F: 12 - 1

*Also available by appointment.

Textbook

Introduction to Probability (2nd revised edition) by Charles M. Grinstead and J. Laurie Snell.

An online version of the textbook is available (free-of-charge) on the course webpage. A printed version is available at Wheelock Books for \$65. You can also find used editions online (ex. Amazon.com) but please check to make sure that the edition matches the one that we are using.

Grades

The grades in this course will be calculated as follows:

	number	points each	total points
Homework:	10	10	100
Proof Assignments:	10	5	50
Quizzes:	2	50	100
Midterm Exams:	1	100	100
Final Exam:	1	150	150
Total Points:			500

Attendance

The expectation is that you will attend class every day. Attendance is not officially required and is not officially a part of your grade. However, if you are on the borderline between two grades, attendance will be used to determine which grade you receive.

H1N1 and Other Serious Illness

Typically we will not accept late homework, and missed quizzes and exams cannot be made up. However, should you contract H1N1 or another serious illness, please contact your professor. We will be happy to make arrangements for you to make up late work, quizzes, and exams under these circumstances. Please do not come to class if you have H1N1 or an influenza-like illness; your professor will be happy to tell you what you've missed. For more information on what to do if you believe you have H1N1 or the flu, see the Dartmouth website.

Honor Principle

You are allowed to work with other students on the homework problems, but you must write up your solutions independently and in your own words. You may consult other people or sources other than the course text, your class notes, and the instructor, but you must acknowledge these people and/or sources when you write up your homework. You are on your honor not to talk to another student about an exam until both students have turned in their exams.

Disabilities, Religious Observances, Etc.

Students in this course with disabilities, including “invisible” disabilities such as chronic diseases and learning disabilities, and who may need disability-related classroom accommodations, are encouraged to make an appointment to see their instructor as soon as possible. They should also stop by the Academic Skills Center in Collis Center to register for support services. All discussions will remain confidential, although the Academic Skills Center may be consulted to verify the documentation of the disability and advise on an appropriate response to the need.

Some students may wish to take part in religious observances that occur during this academic term. If you have a religious observance that conflicts with your participation in the course, please meet with me before the end of the second week of the term to discuss appropriate accommodations.

Homework Policy

Every week, there will be one problem set and one proof assignment. The problem sets will consist primarily of computational exercises (similar to those found in the textbook). They are designed to test your understanding of the material that we have already covered in class. The proof assignments will each consist of 1-2 problems that require a rigorous justification of your thought process. They are designed to foreshadow future course material and to stretch your imagination.

I will post the problem sets and proof assignments on this page at the end of class every Monday. The problem sets will be due on Fridays and the written assignments will be due on the following Mondays. Both will be collected at the beginning of class. Each problem set is worth 10 points, while each proof assignment is worth 5 points. Please keep this in mind when working on the homework.

The problem sets and proof assignments can be typed or handwritten, in pencil or pen, on any type of paper that you prefer as long as I am able to read it. I reserve the right to give no credit for papers that I deem illegible.

Quizzes

There will be two 30-minute quizzes that will take place during our designated X-hour. Calculators and notes are not permitted on quizzes. Quizzes will only be given on or before the assigned date. If you know you will not be in class on one of these days, it is your responsibility to notify your instructor and arrange a time before the missed day to take the quiz.

Exams

There will be one midterm and one final exam. Calculators and notes are not permitted on exams. If you are unable to make an exam, it is your responsibility to notify your instructor at least 48 hours prior to the exam and arrange a make-up time. I will announce the exam locations as soon as they are available.

Midterm Exam:

Thursday, October 28 7:00-9:00pm, Location: Wilder 111.

Final Exam:

Saturday, December 4, 3-5 PM, Location: Carpenter 013.

Syllabus

The following is a rough syllabus for the course.

Lectures	Section In Text	Brief Description
9/22		Introduction to Probability (Heads or Tails Simulation, Coin Tosses Simulation)
X-Hour		No X-Hour
9/24	1.2	Basic Set Operations, Random Variables, Sample Spaces
9/27	1.2	Distribution Functions, Coin Toss Experiments, Probability vs. Odds
9/29	3.1	Permutations, Combinations, Birthday Problem (Birthday Problem Simulation)
X-Hour		(Optional) Proof-writing Workshop
10/1	3.1	Asymptotic Equality, Stirling's Formula, Distribution of Prime Numbers
10/4	3.2	Binomial Coefficients, Pascal's Triangle, Poker Hands
10/6	3.2	Inclusion-Exclusion, Hat Check Problem
X-Hour		Quiz #1: Basic Probability and Combinatorics (1.2, 3.1 in text)
10/8		More Topics In Combinatorics: Bernoulli Trials and "Stars and Bars" Problems
10/11	4.1	Conditional Probability, Monty Hall Problem (Monty Hall Interactive Feature)
10/13	4.1	Independent Events
X-Hour		(Optional) Proof-writing Workshop, part II
10/15	4.1	Bayes Formula, Applications to Medicine and Law (NY Times Article)
10/18	6.1	Average Value, Expected Value (Die Simulation)
10/20	6.1	St. Petersburg Paradox, Properties of Expected Values (Craps Simulation)
X-Hour		No X-Hour
10/22	6.1	Independent Random Variables, Conditional Expectation
10/25	6.2	Variance, Standard Deviation
10/27	5.1	Important Distributions I: Discrete Uniform and Binomial (Galton Board Applet)
X-Hour	5.1	Important Distributions II: Poisson Distribution, Horse-Kick Deaths
10/29		No Class - Homecoming!
11/1	5.1	Important Distributions III: Geometric, Negative Binomial and Hypergeometric
11/3	8.1	The Coupon Collector Problem, Chebyshev's Inequality
X-Hour		No X-Hour
11/5	8.1	Law of Large Numbers, Dice-Rolling Experiment
11/8	9.1	Central Limit Theorem: Geometric Motivation
11/10	9.1	Central Limit Theorem: Proof Sketch and Examples
X-Hour		Quiz #2: Important Distributions, Law of Large Numbers (5.1, 8.1 in text)
11/12	9.2	Central Limit Theorem: Generalizations, Application to Genetics
11/15		Confidence Intervals and The Embarrassing Question Experiment
11/17	11.1	Introduction to Markov Chains
X-Hour		(Optional) Linear Algebra Tutorial
11/19	11.2	Absorbing Markov Chains
11/22	11.3	Regular and Ergodic Markov Chains
11/24		No Class - Thanksgiving Break!
11/29		Markov Chains Applications: Google's PageRank Algorithm, Monopoly
12/2		Final Exam Review - Probability Theory Jeopardy!