

# MATH-UA 233-003: Theory of Probability

Fall 2019    Miranda Holmes-Cerfon    Meeting Time: Tues., Thurs., 11am-12:15pm    Warren Weaver Hall 102

Registrar's syllabus: An introduction to the mathematical treatment of random phenomena occurring in the natural, physical, and social sciences. Axioms of mathematical probability, combinatorial analysis, binomial distribution, Poisson and normal approximation, random variables and probability distributions, generating functions, the Central Limit Theorem and Laws of Large Numbers.

Prerequisites: MATH-UA 123 Calculus III or MATH-UA 213 Math for Economics III (for Economics majors) with a grade of C or better and/or the equivalent. MATH-UA 140 Linear Algebra or MATH-UA 148 Honors Linear Algebra with a grade of C or better and/or the equivalent.

*Note: a grade of B or higher in Calc III is recommended; students with a grade of C should consider taking "Probability and Statistics" instead, an easier course.*

## Teaching Staff and Logistics

---

Instructor:	Miranda Holmes-Cerfon	E-mail: <a href="mailto:holmes@cims.nyu.edu">holmes@cims.nyu.edu</a>
		Tel: 212.998.3262
		Office: WWH 1107
		Office Hours: Mon 5-6, Tues 5:15-6:15

---

Website:	<a href="https://piazza.com/nyu/fall2019/mathua233003/home">https://piazza.com/nyu/fall2019/mathua233003/home</a>
----------	---

---

## Course goals

This is an undergraduate course on probability theory for mathematics majors. The goals are:

- (i) to learn the key mathematical concepts in probability theory, such as probability spaces, random variables, mean, variance, conditional expectation, joint distributions, law of large numbers, central limit theorem, and markov chains;
- (ii) to become familiar with important distributions, such as binomial, poisson, normal, exponential, etc.;
- (iii) to be able to interpret, set up and solve problems involving uncertainty;
- (iv) to write clearly about your mathematical reasoning.

The course will emphasize both the mathematical foundations as well as how to solve specific problems. It will also be appropriate for students in non-math majors who who need to use probability theory in their work/studies, but want a more rigorous foundation.

## Textbook

There are two textbooks for the course:

- (1) *A First Course in Probability*, by Sheldon Ross. (*Strongly recommended.*)
- (2) *Probability with Applications and R* by Robert P. Dobrow. (*Optional, but strongly recommended.*)

The course material most closely follows (1), however (2) is an excellent source of problems and more accessible examples. Each week readings will be posted from each of the two textbooks. You are encouraged to read these *before* coming to class. Older editions of the textbooks are fine, as long as you convert the readings to the pages appropriate for your edition.

## Homework

Homework will be posted *every week* and will be based on the previous week's lectures. *You are expected to do all the homework.* You *do not* need to hand it in. However, you should practice writing up your solutions *neatly* and *clearly*, so you can practice organizing your thoughts and be ready for exam situations, as well as build skills for

communicating your math solutions in real life.

You are encouraged to work with other students to complete the homework questions. They can give you ideas for new ways to solve the problems, as well as feedback on your written responses. However, remember that you must complete the exams on your own, so you should eventually internalize the ideas so you can do the problems on your own.

The homework is meant to help you practice working with key concepts and to give you a chance to practice writing up your solutions. Learning math requires solving many more problems than will be assigned on the homework. You are strongly encouraged to seek out other problems; for example in the textbooks, or in other textbooks that you may find in the library.

## Quizzes

In lieu of graded homework, we will have quizzes every 2-3 weeks. The quizzes will be 20-30 minutes long and will take place at the beginning of your recitation. The quizzes will cover the homework you did since the previous quiz. The questions will be either directly from the homework, or will be small modifications of the homework questions.

You are expected to be present for all quizzes. No absences will be accommodated, except for emergencies or school-sanctioned events (such as athletics.) There are 5 quizzes total, weighted equally, and the lowest quiz score will be dropped.

## Recitations

You are each registered for a recitation, and are expected to attend each week. The recitation is an opportunity to practice solving more problems, and to go over solutions to the homework problems. Every 2-3 weeks you will have a quiz, at the beginning of the recitation.

## Office Hours

The instructor will have 2 hours of office hours per week (time TBD during the first day of class.) This is your chance to ask questions, get help with the homework, go over your homework solutions. Please come to her office during this time, to talk about anything class-related. All students are welcome to come in the office at once (as many as can fit!), and you are encouraged to just come and hang out and listen to other students' questions.

If you wish to meet privately, please send the instructor an email to set up a time to meet. This will probably be scheduled during office hours; other students will be asked to respectfully leave during this time.

The TA will also have office hours, time TBD during the first recitation.

## Communication

Class-related information will be posted to Piazza (<https://piazza.com/nyu/fall12018/mathua233001/home>.) If you have questions about the homework, or a general question about the lecture material, please **post this publicly** on Piazza. This way everyone in the class will benefit from the answer as it is likely that several people have a similar question. If you see a question for which you know or have an idea about the answer, please do **post to respond** – another goal of the Piazza is to generate discussion, as there may be several different (yet equally valuable) interpretations of the course material. The instructor will monitor the posts frequently and indicate whether they are correct. Even if they aren't, it's ok! It's much better to have an incorrect idea and find out soon, than to keep thinking the incorrect idea and make mistakes on the test, or further along in your career.

The NYU Classes website will be used to post grades, via Gradebook.

## Important Dates

### Exams

Midterm 1    Thursday, October 10 (in class)  
Midterm 2    Thursday, November 21 (in class)  
Final Exam    Tuesday December 17, 10-11:50am

### Quizzes

Quiz 1    Sept 20  
Quiz 2    Oct 4  
Quiz 3    Oct 25  
Quiz 4    Nov 8  
Quiz 5    Dec 6

### Grades

Grades will be calculated using the following weights:

Final Exam	40%
Midterm 1	25%
Midterm 2	25%
Quizzes	10%

The quizzes are weighted equally, and the lowest quiz score will be dropped.

There is no standard conversion from your final percentage to your final letter grade, but the instructor will give an idea after each exam of the rough letter grade it corresponds to.