

Syllabus for MATH 461: Probability Theory

Spring 2021

Section B13 and C13

1 Course Logistics

Instructor. Daesung Kim, [daesungk\(at\)illinois.edu](mailto:daesungk@illinois.edu).

Times and Places. MWF 9-9:50am (Section B13) and MWF 10-10:50am (Section C13) via Zoom. Course videos and Zoom links are available at Moodle.

Course Website. <https://daesungk.github.io/math461-s21-uiuc/>. Course information available at the Moodle site as well.

Contact. By email from your @illinois.edu email, [daesungk\(at\)illinois.edu](mailto:daesungk@illinois.edu), with “MATH 461” in the subject line.

Office Hours. TBA. Ask me questions immediately before, during and after class. Otherwise by appointment: schedule a time with me by email.

Textbook. Lecture notes and homework problems will be posted on the the course website.

- I will follow the textbook [A First Course in Probability](#) by Sheldon Ross, 9th Edition. A digital version is available for rental or purchase by individuals through the [Illini Union Bookstore](#). Unfortunately, the publisher has chosen not to license the digital version of this textbooks to libraries and a library copy is not available at this time.
- It is okay to use a different edition for studying. The 8th edition is viewable digitally through the HathiTrust ETAS at [this url](#) using uiuc credentials. However only one user can view the book at a time, and downloading and printing is not possible.
- You can use the freely downloadable book [Introduction to Probability](#) by Grinstead & Snell.
- or the freely viewable book [Introduction to Probability](#) by Blitzstein & Hwang.
- The books [Introduction to Probability Theory](#) by Hoel, Port and Stone; and [Probability and Statistics](#) by Morris DeGroot and Mark Schervish are optional as reference texts.

Prerequisite. Math 241 or the equivalent. We will use important topics from calculus, such as infinite series with positive terms (most calculations involve the geometric series and series derived from it), improper integrals and double integrals (change of variables formula, manipulating Gaussian integrals).

2 Course Syllabus

Description. This is an introduction to mathematical probability. We will cover most of the material in the first eight chapters of the textbook. Topics include:

- Combinatorial Analysis
- Conditional Probability and Independence
- Continuous Random Variables
- Properties of Expectations
- Law of large numbers and inequalities
- Axioms of Probability
- Discrete Random Variables
- Jointly Distributed Random Variables
- Moment Generating Functions
- Central Limit Theorems

Why study probability? Two main reasons: **Uncertainty** and **Complexity**.

- **Uncertainty** is all around us and is usually modeled as randomness: it appears in call centers, electronic circuits, quantum mechanics, medical treatment, epidemics, financial investments, insurance, games (both sports and gambling), online search engines, for starters. Probability is a good way of quantifying and discussing what we know about uncertain things, and then making decisions or estimating outcomes.
- Some things are too **complex** to be analyzed exactly (like weather, the brain, social science), and probability is a useful way of reducing the complexity and providing approximations.

Objective. After completing this course a successful student will be able to understand and apply the topics listed above. He/she will also be able to apply numerical, computational, and theoretical techniques. Through exploration, a successful student will be able to use probability models to analyze physical phenomena. He/she will also have the necessary tools to formulate and solve problems in mathematical situations and connect concepts to other disciplines. Most importantly, a student completing this course will be able to communicate ideas through descriptive language as well as mathematical symbols.

What I Expect from You

- Attend the class or watch the class video; and be engaged in your own education.
- Pay attention and take as good of notes as you are able, speak up if you are confused - likely others are as well! **It is important to write your own notes.**
- Spend about 5-8 hours a week on homework or studying for this class.
- Do homework on time.
- Come to online office hours at least when you need to.

What You can Expect from the instructor

- Explain the topics and methods as well as I am able.
- Be available for you in office hours.

- Get your exams and quizzes back in a timely manner.

What you can Expect from the TA

- Grade your homework in a fair and timely manner.

Learning Outcomes. Upon successful completion of the course:

- The ability to solve a variety of probabilistic problems using a variety of methods.
- Students will be comfortable modeling real life problems using probabilistic techniques

3 Course Policies and Grading

Homework - 20% will be assigned weekly on Friday on the course website (except when there is an exam), to be uploaded the beginning of the next Friday lecture (links will be provided).

You are encouraged to work together on the homework, but I ask that you write up your own solution (and write name/s of collaborators) and turn them in separately.

Late homework will not be graded. I will drop the lowest one homework score.

Online Quiz - 20% will be scheduled biweekly for 20 minutes. Problems will be based on that week's homework material. I will drop the lowest one quiz score.

Two Midterm Exams - 35% are scheduled tentatively on Wednesdays March 10 and April 21. The lower midterm score will be 15% and the other 20%. They will be technically comprehensive, but emphasizing recent material up to the most recent graded and returned homework assignment.

Final Exam - 25% is comprehensive and the schedule will be announced later.

Grading Policy Check your grades at Moodle. Grades will be computed by a weighted average:

| | |
|----------|-----|
| Homework | 20% |
| Quiz | 20% |
| Midterms | 35% |
| Final | 25% |

All grades are numerical. The final letter grades will be assigned on the usual scale:

A(+/-): 90-100%; B(+/-): 80-89%; C(+/-): 70-79%; D(+/-): 60-69%.

I may slightly adjust the curve later to see it fit.

Make-up exams will not be given.

Contesting Grades and Retrieving Graded Work If you wish to contest a grade, you must speak to the professor within one week of the date the assignment grade is announced. After this deadline, the grade will be final.

Accommodation for Students with Disabilities To obtain disability-related academic adjustments and/or auxiliary aids, students should contact both the instructor and the Disability Resources and Educational Services (DRES) as soon as possible. You can contact DRES at 1207 S. Oak Street, Champaign, (217) 333-1970, or via e-mail at disability@illinois.edu.