

# Math 154: Probability Theory

**Instructor.** Kevin Yang (kevinyang@math.harvard.edu), Science Center 333i

**Course details.** Tuesday, Thursday: 9-10:15am. (Location: Science Center 111)

Course Assistants:

- Eric Tang (etang@college.harvard.edu)
- Glen Liu (glenliu@college.harvard.edu)
- Peter Luo (pluo@college.harvard.edu)

**Note:** Thursday March 7, 2024 and Thursday April 18, 2024 will be Zoom lectures.

## Office Hours.

- Kevin Yang: Thursday 10:30-11:30am, SC 333i (may have to change location)
- Eric Tang: Friday, 8pm, Quincy DHall
- Glen Liu: Saturday, 3pm, Cabot Library
- Peter Luo: Monday, Math Night (8pm), Leverett Dining Hall

**Prerequisites.** Calculus, linear algebra, and a familiarity with writing proofs. Recommended previous math courses: Math 21a/b and Math 101, or equivalent. Students who did well in Math 22a, Math 25a, or Math 55a in the fall are welcome. Please do not hesitate to discuss with me (Kevin Yang) regarding prerequisites.

**Course website.** We will use Canvas (<https://canvas.harvard.edu/courses/126602>). All assignments, announcements, and files will be posted there. Please check this course site regularly.

**Text.** We will roughly follow the book “Probability and Random Processes (3rd ed)” by Geoffrey Grimmett and David Stirzaker. My ultimate goal is to cover Chapters 1-5 of this text and then move on to other topics. See below.

**Course objectives.** The goal of this course is to provide a rigorous introduction to mathematical probability theory (without a loss of emphasis on statistical intuition).

- (1) Weeks 1-6 (pre-midterm): Chapters 1-5 of the text
  - probability and sample spaces, independence, conditional probability, discrete and continuous random variables, probability distributions, characteristic functions, law of large numbers
- (2) Weeks 7-12 (post-midterm): Concentration inequalities, central limit theorem, Markov chains, models from physics/statistics

**Homework.** There will be weekly problem sets. The goal of these problem sets is to help you practice the material discussed in lecture, since this is the only way to gain a feeling for using and doing probability theory. Homework for material taught in Week “X” will be posted by Tuesday of Week “X”, and it will be due the following Tuesday. *Late homework will not be accepted* without the permission of the instructor. (Please try to avoid late submission as best as you can, since this can only negatively impact one’s learning.) It is suggested that you typeset your homework in LaTeX (for some reason, this also significantly helps one’s understanding). In any case, this is not required, although homework submissions must be in PDF format. For example, if you write your solutions by hand, please scan them, e.g. using a scanner app. Please see me (Kevin Yang) if there are any issues or concerns with this.

**Exams.** There will be one in-class midterm exam and a final take-home exam. The midterm will take place on **Tuesday, March 5, 2024**. The final take-home will be cumulative, in that knowledge from the entire semester will be assumed, but with emphasis on the second half. More information concerning these exams will be posted in the first few weeks of the semester.

**Grading.** Grades will be computed via homework (60%), one in-class midterm (10%), and a final take-home exam (30%).

**Special rule about the use of AI (such as ChatGPT).** You are not allowed to use AI tools to solve any questions (homework, exam, midterm), nor ask it to suggest resources to solve these questions. Doing so is a violation of Harvard Honor Code.