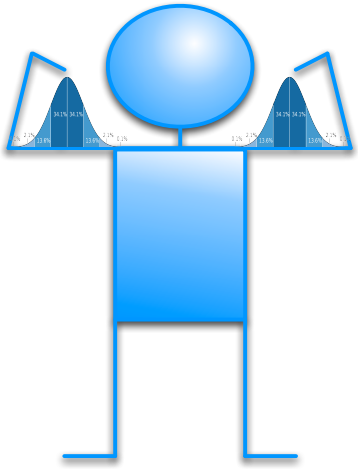
Harvard Stat E-110: Introduction to Probability Fall 2018



Conditioning is the soul of statistics.

Professor: Joe Blitzstein (blitz@fas.harvard.edu).

Lectures: Lectures will ordinarily be live-streamed Mondays and Wednesdays from 1:30 pm to 2:45 pm, with the video being available via the course website within 24 hours after the lecture.

Sections and Office Hours: There will be weekly online sections and online office hours. Sections are *optional but highly recommended*.

Course Webpage: canvas.harvard.edu/courses/52995

Twitter: @stat110

YouTube and edX: stat110.net

Quora: stat110.quora.com

Book: Introduction to Probability by Joe Blitzstein and Jessica Hwang, Chapman & Hall (2014). It is available at Amazon and elsewhere. With a Harvard login, an online version is freely available through Safari Books Online.

Prerequisites: Math E-16 or above. Calculus is needed extensively, and matrices are needed occasionally. But the emphasis is on *statistical* tools and concepts, not on technical calculus derivations. Stat E-110 is a mathematically challenging course not so much because of calculus but because it requires logical thinking and problem-solving, understanding (rather than memorizing) theorems, and going back and forth between abstract concepts and concrete examples.

Description: A comprehensive introduction to probability, as a language and set of tools for understanding statistics, science, risk, and randomness. Basics: sample spaces and events, conditional probability, and Bayes' theorem. Univariate distributions: density functions, expectation and variance, Normal, t, Binomial, Negative Binomial, Poisson, Beta, and Gamma distributions. Multivariate distributions: joint and conditional distributions, independence, transformations, and Multivariate Normal. Limit laws: law of large numbers, central limit theorem. Markov chains: transition probabilities, stationary distributions, convergence.

Shorter Description: The world is replete with randomness and uncertainty; probability and statistics extend logic into this realm. We will systematically introduce the ideas and tools of probability, which are useful in statistics, science, philosophy, engineering, economics, finance, and everyday life. Both the mathematical results of the subject and applications to solving problems will be studied, with examples ranging from gambling to genetics.

Even Shorter Description: How to understand randomness and uncertainty through probability models, random variables and their distributions, and thinking conditionally.

Grading: Grades will be based on a weighted average of scores from homework, a midterm exam on **Wednesday, October 17**, and a final exam **whenever the Registrar says it is**. The exams will be closed-book, closed-note, closed-calculator, and closed-phone, except that you may bring two pages of notes for the midterm (four sides) and four pages for the final (eight sides).

Let h, m, and f be your homework average, midterm score, and final exam score, respectively, each scaled out of 100. Then your overall score for the course is given by

$$s = \max(0.35 \cdot h + 0.25 \cdot m + 0.40 \cdot f,\ \ 0.35 \cdot h + 0.10 \cdot m + 0.55 \cdot f).$$

For students enrolled for undergraduate credit, the letter grade will be in the A range if $s \geq 85$, at least in the B range if $s \geq 65$, at least in the C range if $s \geq 55$, and at least in the D range if $s \geq 45$. Students enrolled for graduate credit will be held to a slightly higher grading standard than this.

Homework: Since actively solving problems is crucial in learning probability, there will be weekly problem sets, normally due on **Fridays at 5:00 pm**. Homework **must** be submitted via the Canvas course website; no submissions on paper or by email will be accepted. Your submission must be a **single** PDF file, no more than 20 MB in size. If you submit more than one PDF file, only one will be graded. Your homework can be typeset or scanned, but must be clear and easily legible (not blurry or faint) and correctly rotated (e.g., not upside down).

Late homework will accrue a penalty at a rate of 0.5 points per minute, e.g., homework submitted at 5:12 pm will receive a 6 point penalty. To help with various circumstances (expected or unexpected), your lowest **two** homework scores will be dropped; absolutely no extensions will be given, so use these drops wisely!

Unless otherwise specified, please show your work, simplify fully, and give clear, careful justifications for your answers (using *words and sentences* to explain your logic, not just formulas).

Academic Integrity and Homework Collaboration Policy: You are welcome to discuss the problems with others, but *you must write up your solutions yourself and in your own words.* Additionally, you must list the names of the students with whom you collaborated (if any). Copying someone else's solution, or just making trivial changes for the sake of not copying verbatim, is not acceptable. For example, in problems where you have to make up a "story" or example, two students should not have the exact same answer, or almost the same answer except one has an example with dogs chasing cats and the other has an example with cats chasing mice, with the same structure and the same numbers.

I highly recommend starting problem sets early enough so that you have time to work hard on the problems on your own first, before discussing them with friends/collaborators. But in any case, your solutions must reflect your own understanding of the material, explained in your own way.

You are responsible for understanding Harvard Extension School policies on academic integrity (see www.extension.harvard.edu/resources-policies/student-conduct/academic-integrity for information on these policies) and how to use sources responsibly. Not knowing the rules, misunderstanding the rules, running out of time, submitting the wrong draft, or being overwhelmed with multiple demands are not acceptable excuses. There are no excuses for failure to uphold academic integrity.

Accessibility: The Extension School is committed to providing an accessible academic community. The Accessibility Office offers a variety of accommodations and services to students with documented disabilities. Please visit www.extension.harvard.edu/resources-policies/accessibility-student-services for more information about accessibility.