Introduction to Probability

About me

Grew up in Lincoln, Vermont

BA: Columbia

Math

PhD: Carnegie Mellon

Computer Science

Faculty: Stanford

Research:

- *Machine learning*
- *Algorithm design*

What is probability?

The math of uncertainty and chance

- A universal language for uncertainty

Understanding probability helps us make better decisions

- Turns randomness into measurable risk
- Distinguishes luck from skill

Applies across finance, consulting, sports, ...

Goals of this course

Learn to understand randomness across **diverse applications**

Learn how to **model randomness** in science and engineering

Finance

Healthcare

Consulting

Sports

My goal: you enjoy probability and find it interesting/useful 😊

Finance and venture capital

Does investing in ten companies protect you from risk?

What if their outcomes tend to move together?

How should new information change your assessment?

Sports and probability

A player makes five shots in a row.

How much evidence is that of a change in ability?

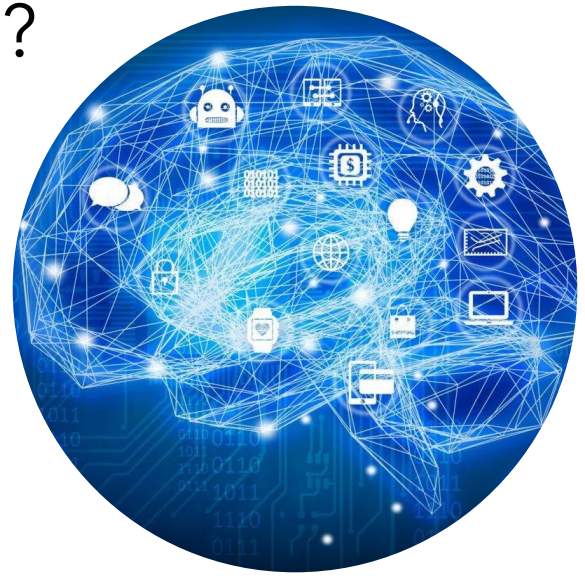
What would you expect to see from chance alone?

Machine learning, AI, and probability

A model says it is 80% confident.

How would we tell whether that confidence is trustworthy?

What would we expect across many predictions?



Course assistants

Hannah Treehan

MS student in MS&E

Nidhi Sonwalkar

MS student in AA

Maria Emilia Bullano

MS student in MS&E

See course webpage for office hours, which start **next week**

Additional calculus for engineers (ACE)

Students participating in ACE will:

- Attend an **additional weekly section**
  - Tuesdays, 3:30-4:50pm
- Enroll in MS&E 120ACE for **1 additional unit**
- Receive access to:
  - Additional **exam review** sessions
  - Individual **tutoring**
  - Other **study resources**

Clara Lu
MS student in CS

See Canvas announcement for application link

Deadline is **this Friday**

Course mechanics

Course webpage

https://vitercik.github.io/probability/

Link is on Canvas

Office hours, syllabus, course schedule, …

Course reader

https://vitercik.github.io/120notes

Use the reader to revisit definitions and examples.

Follow the course schedule for the relevant sections.

I developed it to cover exactly what we discussed in class.

Prerequisites

Math 51 or CME 100

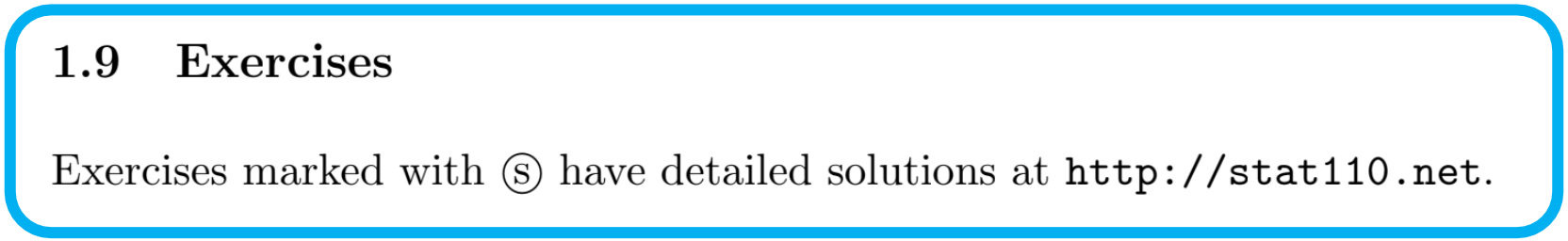
Skills to review before we use calculus:

- (Multi-variable) differentiation $\frac{dy}{dx}$
- Single-variable integration $\int x\,dx$

Textbook

"Introduction to Probability" by Blitzstein and Hwang

- Main textbook for readings and additional practice
- Freely available online! See course webpage for link



1.9 Exercises

Exercises marked with Ⓢ have detailed solutions at `http://stat110.net`.

Optional books for extra practice:

A first course in probability by Ross

The art of chance by Sun, Kim and Sood

How the course elements fit together

Lectures: Build concepts and work through examples.

Homework: Practice independently.

Quizzes: Solve a problem related to last week's homework.

Tutorials: Discuss and work with a CA.

Class breakdown

24%: Weekly tutorials (Best 6 of 8; 4% each)

42%: Weekly quizzes (Best 6 of 8; 7% each)

34%: Final exam (Wednesday, 12/9)

Ungraded: Weekly homework

Ungraded weekly homework

- Ungraded homework will prepare you for the quizzes
- Try each problem yourself before seeking help.
- After getting help, solve it again without hints.

Why ungraded?

- Two years ago, 89% got a homework question correct.
- Three days later, ~39% got the same question correct on the exam.

Weekly quizzes

- Mondays beginning 10/5
- Arrive at 1:30; quiz runs 1:45-2:05
- 1 question closely related to the previous week's homework
- Your best 6 of 8 scores count; we drop the lowest 2
  - Plan to attend all eight; save the drops for unexpected disruptions
- Arriving after 1:45pm counts as a missed quiz
- So does leaving the room before submitting, even briefly

Exceptions: approved accommodations

Weekly tutorials

- Begin in Week 3 (week of October 5)
- Each student assigned to one 30-min weekly tutorial
  - Tutorial includes 2-3 other students and one CA
- CA will guide the students through practice problems

Tutorial preparation and grading

Full credit is for preparation & engagement, not perfect answers.

4/4 – Prepared, participates, and tries the new material.

- Review the lectures and the previous week's homework.
- Explain an attempt, ask a question, or say where you got stuck.

1/4 – Unprepared or doesn't participate

0/4 – Doesn't attend

Your best 6 of 8 scores count; we drop the lowest 2.

Plan to attend all eight; save drops for unexpected disruptions.

Lectures

- Wednesdays and Fridays, 1:30 - 2:50 PM

- Please ask questions during class!!

- Class format: Whiteboard!
- We'll build arguments step by step, with time for questions.
- Take notes and work through the examples with us.

2-minute anonymous surveys

- Watch out for an email about a 2-min anonymous survey
- Random set of students asked each week
  - You'll be asked 2-3 times during the quarter to fill it out
- It's so useful for us!

Please use it to tell us:

- What's going well 😀
- What you're confused about 🤔
- How we can best help you learn!

OAE

Send me your OAE letter as soon as possible

Using AI to learn

- You're welcome to use AI to help you learn material
- AI is not allowed during quizzes, tutorials, or exams.
  - Violations will be reported to the Office of Community Standards
- Try first; then ask for a hint or feedback on your reasoning.

  Example: "Which step in my argument is unjustified?"

- Check the response against the course materials.
- Close the response and solve the problem independently.

Why learn probability?

- Yes, AI can solve the homework problems

- If you rely on AI too early:
  - You get less practice developing your own reasoning skills
  - You'll be less prepared for real-world problem solving

- Many students tell me 120 prepared them well for 121, 125
- Mastering 120 helps set you up for success in those courses

Why learn probability?

- Skills to build for your career:
  - Understand fundamentals deeply
  - Adapt to new tools quickly
  - Have strong reasoning skills
  - Work *with* AI
- Students report that 120 helped with technical interviews
  - Course evals: *“Although not the main focus of this class, it will prepare you extremely well for probability questions on technical interviews!”*
  - *“Allows you to solve most probability questions you might be asked in interviews etc.”*

Getting started

- Read the syllabus on the course webpage.
- Review today's textbook and course-reader sections.
- Watch for instructions about your tutorial assignment.
- Let me know privately about any OAE letter.