

Math 302: Introduction to Probability



Instructor: Yaniv Plan

Teaching Assistant: Ali Fele Paranj

Class structure

- In-person lectures
- Weekly written homework due Fridays at 10pm (starting in Week 2)
- **Midterm June 3**, Final during final exam period

Grading Scheme:

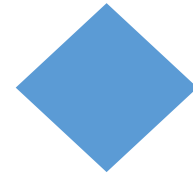
- Homework 15%
- Midterm 35%
- Final 50%

Midterm Mark = $\max(\text{Midterm}, \text{Final})$

Textbook

“Introduction to Probability” by Anderson, Seppalainen, and Valko

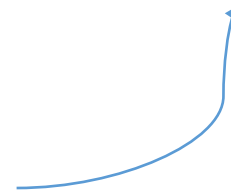
Goal: Cover (almost) all sections not marked with



or



Optional topics



Finer points



Resources

- Piazza
- Textbook
- Lecture notes
- Written homeworks
- Office hours (starting in Week 2):
 - Professor OH: 4-5pm location TBD
 - TA OH: Tu Th 12-1pm AUDX 130
- Practice problems on course website
 - Canvas quizzes (not marked)
 - Practice exams

Piazza

- Class message board (moderated)
- **Public posts:** Questions towards understanding mathematical content of the course.
- **Private posts to TA/Professor:** Questions/comments only the TA/Professor can answer.

Suggested study habits

- Read the corresponding part of the textbook before lecture
- Clarify concepts in lecture
- Active learning _____ lecture
- Do 1-2 problems after lecture

- Written homework:
 - Your homework should be original
 - Show work
 - Some test problems will be based on homework problems

- Work out practice problems on Canvas

Why Probability?

- Foundational for Machine Learning and Data Science
 - Probabilistic modeling
 - Probabilistic algorithms
- Develop “probabilistic intuition” and critical thinking
- Rich theoretical area

Highlights of this class

- Abstract and precise mathematical foundation
- Continuous and discrete random variables
- Functions of random variables
- Conditioning, expectation, variance
- Gaussian distribution

- Central limit theorem

Next: A few questions related to “probabilistic intuition”

- Symmetry
- Paradoxes
- Real-life probabilistic thinking

Symmetry in random orderings

You have a deck of 52 randomly ordered cards. You draw the cards one by one.

1. What is the probability that the **first** card you draw is the ace of spades?
2. What is the probability that the **second** card you draw is the ace of spades?
3. What is the probability that the **37th** card you draw is the ace of spades?

More symmetry

Suppose each student in class needs a number from 1-100.

Option 1: Students line up according to last name and pick a random number from a bag (and keep it).

Option 2: Students line up randomly and are given numbers in order.

In which case is it more likely that you and your two friends get the numbers 1, 2, and 3?

Ans:

Birthday Problem

Q2: In a 100 student class, what is the probability that at least 2 students share a birthday?

Ans:

Sally Clark Case (true story)

- Sally had 2 kids, both victims of sudden infant death syndrome (SIDS) (i.e., both children died in their sleep for unexplained causes)
- 1998: She is charged with murder
- Prosecution: SIDS occurs in $\frac{1}{8500}$ infants in general thus

P(2 SIDS) = _____

Perhaps jury thinks: P(Innocence) \approx _____

Verdict: _____