Stat 134

Announcements
① download pre-lecture notes on b-courses/pages

Stat 134: Concepts of Probability, Fall 2020

Pre-lecture notes allows you more time to play an active role in class.

Instructor: Adam Lucas

Lectures: MWF 1-2 pm online
https://berkeley.zoom.us/j/95681171732

Email: alucas@berkeley.edu

OFFICE HOURS: MWF 2pm in SLC virtual drop in: bit.ly/MSDropInSignIn

TEXT: *Probability* by Jim Pitman. Students can view and download the text online at **SpringerLink** (campus network access required). An affordable paperback copy may also be purchased through this link.

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Office hours of the GSIs will be posted on the webpage.

Prerequisites: Mastery of the material in Appendices 1-4 of the text, fluency with calculus (derivatives and integrals) in two variables, and – these are crucial – clear logical reasoning and strong problem-solving skills. Test yourself on some practice problems.

Class website: The primary class website is http://www.stat134.org/. This will contain lecture notes and video links. B-courses is a secondary website for the class. I will post pre-lecture notes on b-courses/pages for you to download before class.

Piazza: There will be a student run Piazza site for this class. The top 10 student answers (i.e. students who respond to other student's questions) will get up to 1% extra credit added to their final grade total in b-courses after the curve.

Homework:

- Assignments are posted on the Homework tab here. They are due each Wednesday on Gradescope.
- Papers will be graded on a 0/1 scale. Each assignment will consist of 8 problems. A good attempt at 6 or more problems will receive the score of 1; anything else will get 0. Course staff will define what constitutes a "good attempt." We will be looking for reasoning and detailed work shown – it is assumed that you will show work or provide reasoning whether or not the question asks for it.
- Your **two lowest** homework scores will be dropped from the computation of the homework component of your final grade.
- No late homework will be accepted and cheating will not be tolerated. While you are encouraged to work with other people, you must write up your own solutions.

Quizzes:

There will be six short quizzes during the term, in section, on dates listed in the calendar below. Quizzes will not be given at any other time. You must take your quiz in the section in which you are enrolled. Students with DSP accommodations must contact Prof. Lucas to make arrangements as necessary.

Q1: Wednesday September 9
Q2: Wednesday September 16
Q3: Monday September 28
Q4: Wednesday October 21
Q5: Wednesday November 4
Q6: Wednesday December 2

Your **lowest** quiz score will be dropped from the computation of the quiz component of your final grade.

Exams:

- Midterm 1: Friday October 9, take home 24 hours
- Midterm 2: Friday November 20, take home 24 hours
- Final: Monday December 16, 7-10pm. Location TBA.

Grading:

- 10% Homework, 20% Quizzes, 20% Midterm1, 20% Midterm 2, 30% Final

  Your two lowest homework and your lowest quiz score will be dropped.

Academic Honesty: Being an online class academic honesty is of particular concern. I will do everything I can to remove incentives for you to feel like you need to cheat. For one, I won't curve the class. If someone cheats it won't affect your ability of getting a good grade. Second, I am making two midterms so that there is more chances for you to demonstrate what you know. Thirdly, the exams will be designed to be difficult to cheat on. Fourth, please know that I take the Berkeley honor code very seriously and have years of experience catching cheaters. Fifth, if we suspect someone of cheating, we reserve the right to give the student an oral quiz or exam and test if the student understands what they wrote.

Please familiarize yourself with UCBs Academic Honesty Policy (see the Center for Student Conduct website: http://sa.berkeley.edu/conduct). I encourage you to discuss homework problems with other students and to work together, but copying is never appropriate. (You should never write down anything you don't understand!) I strongly encourage you to familiarize yourself with the definition of *plagiarism*, and to avoid engaging in it. **Violations of the USB's Academic Honesty Policy, including instances of plagiarism, will be reported to the University** and an appropriate penalty will be implemented. (This may range from a failing grade on an assignment to an "F" for the course, in addition to writing letters of reflection and apology to USB's administration.)

Resources

Quick Links
Homework: http://www.stat.berkeley.edu/~ani/s134s17/rec.html The full list of assigned problems for the entire semester is posted at this link. There, you will also find helpful strategies for tackling the problems - I highly recommend you read through it at least once
Reading Guide: http://www.stat.berkeley.edu/~ani/s134s17/contents.html

introduce Mike Leong

Support
The Student Learning Center (SLC) offers extensive support for Stat 134. I highly recommended that you enroll in the SLC's Adjunct Course for Stat 134 (Stat 198). Click here to learn more.
Students with Disabilities: Students needing accommodations should speak with me after class or during office hours and see http://dsp.berkeley.edu to learn about Berkeley's policy.

M-Th 10-9 pm
F 10-5pm

SLC Math/Stat Virtual Drop-In: Sign-In

We are now using Zoom to hold Drop-In Tutoring! Before filling out this form, please consult the following guide on how to best use Zoom for our Drop-In services:

http://bit.ly/MSZoomGuide

Your email address (**alucas@berkeley.edu**) will be recorded when you submit this form. Not you? Switch account

Student comments!

> At the outset, this course is not incredibly difficult, especially if you have any prior experience with statistics or probability. However, the course definitely picks up in difficulty during the middle and towards the end of the course. I would recommend attending all the lectures, every discussion section, doing all of the homework, doing the readings, and doing the practice problems provided on the course website. Online solutions can definitely help get through some problems, but I would advise not relying on online solutions too heavily as you might not develop the intuition, understanding, and knowledge necessary to perform well on the quizzes and tests.

> Do not fall behind and write the pre lectures notes before going to lecture

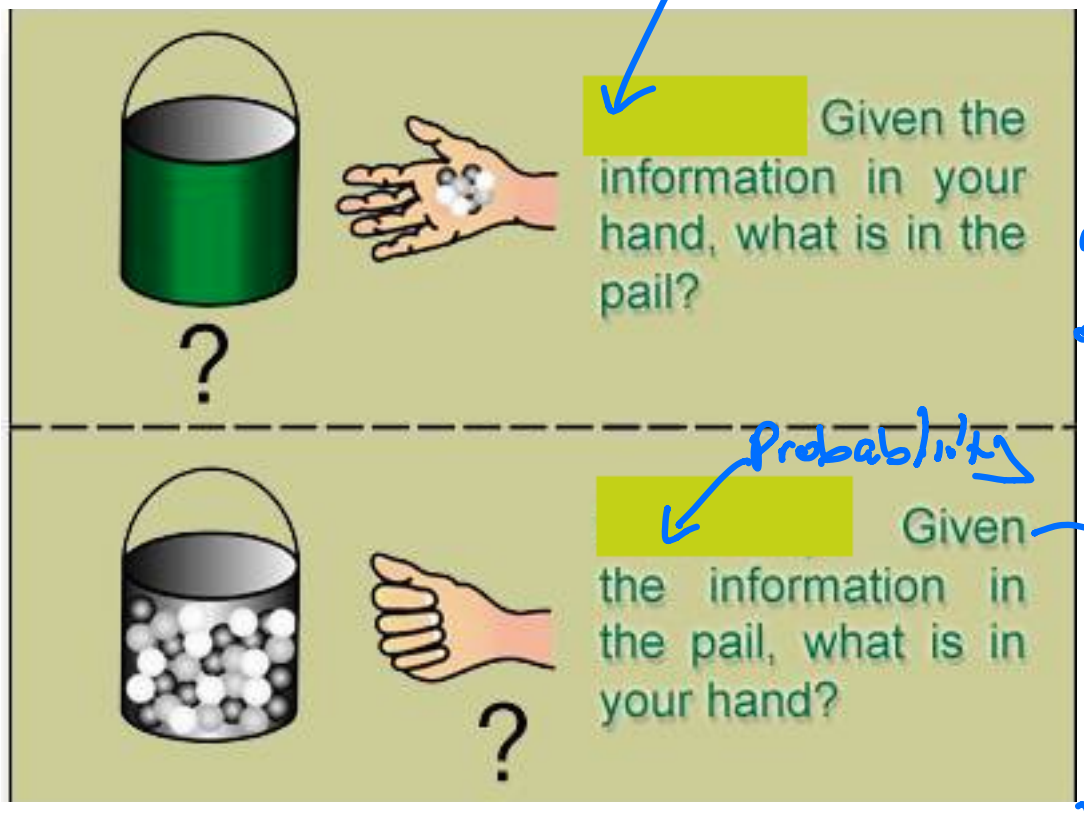
> Enroll in the adjunct section, it keeps you from falling behind. For practice, start with Minimal Practice (check your answers in the back of the textbook), then move on to homework problems, and finally work on Highly Recommended problems.

Today

1. Icebreaker
2. Sections 1.1 – 1.3

1) icebreaker

Discuss which is probability and which is statistics:



statistics = "inverse probability"

If a random sample has 1 red and 4 green make a hypothesis about proportions of red and green in population

Probability

If a random sample of 5 marbles is drawn from a population of 50% red and 50% green what is the chance you get 1 red and 1 green.

2) Sec 1.1 Equally likely outcomes

We call the set of all outcomes of an experiment Ω, the outcome space, or the Sample space.

let $A \subseteq \Omega$

$$P(A) = \frac{\#A}{\#\Omega}$$

Deck of cards: 4 suits H, C, D, S
13 ranks Ace, 2–10, J, Q, K
52 Cards

ex — #se p10

Suppose a deck of cards is shuffled and the top 2 cards are dealt. What is the chance you get at least one ace among the 2 cards

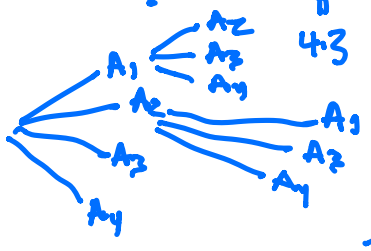
$\Omega = \{(\ast, \ast)\}$ — 52, 51

$A = \{(\text{ace}, \text{ace}), (\text{ace}, \text{nonace}), (\text{nonace}, \text{ace})\}$

$(\text{ace}, \text{ace}) = 4 \cdot 3$

$(\text{ace}, \text{nonace}) = 4 \cdot 48$

$(\text{nonace}, \text{ace}) = 48 \cdot 4$



$\#A = 4(3 + 48 + 48) = 4 \cdot 99$

$\#\Omega = 52 \cdot 51$

$$P(A) = \frac{4 \cdot 99}{52 \cdot 51} \approx .149$$

or $1 - P(A^c) = 1 - \frac{48 \cdot 47}{52 \cdot 51} = .149$

A^c: no ace in 2 cards

Ex Two draws are made at random with replacement from the box

Find the chance the 2nd number is bigger than twice the first.

Ω = all pairs of numbers $(\#\Omega = 10 \cdot 10 = 100)$

$A = \begin{cases} (1, >2) - 8 \\ (2, >4) - 6 \\ (3, >6) - 4 \\ (4, >8) - 2 \\ (5, >10) - 0 \end{cases}$

$\Rightarrow \#A = 20$

$P(A) = \frac{\#A}{\#\Omega} = \frac{20}{100} = .2$

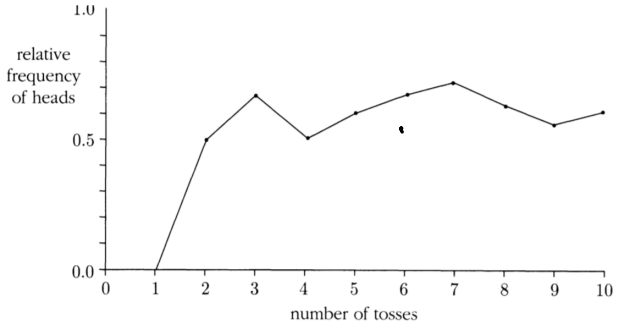
Sec 1.2 Interpretations

Probability has 2 interpretations

a) frequency interpretation.

ex what is the probability a particular coin lands heads.

— make an experiment. Law of averages.



b) Subjective interpretation. — will discuss in section 1.5

ex what is the probability a particular patient survives an operation?

Is there an answer to this question?
It depends on the health of the patient, the doctor etc.

Your opinion may change over time as you acquire new data. This will change the value of your probability.

Sec 1.3 Distributions

To define probability we start with an outcome space, Ω, and assign to each element a nonnegative number and require that all numbers add up to 1.

Axioms

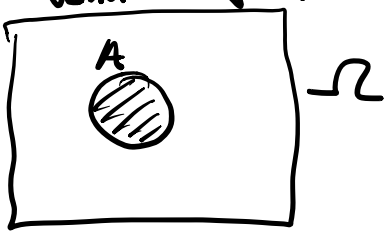
1) $P(A) \geq 0$ for all $A \subseteq \Omega$

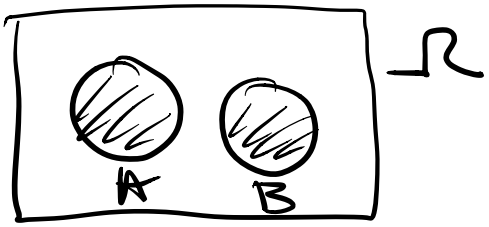
2) $P(\Omega) = 1$

3) If A and B are mutually exclusive sets then $P(A \cup B) = P(A) + P(B)$

(addition rule)

Venn Diagram

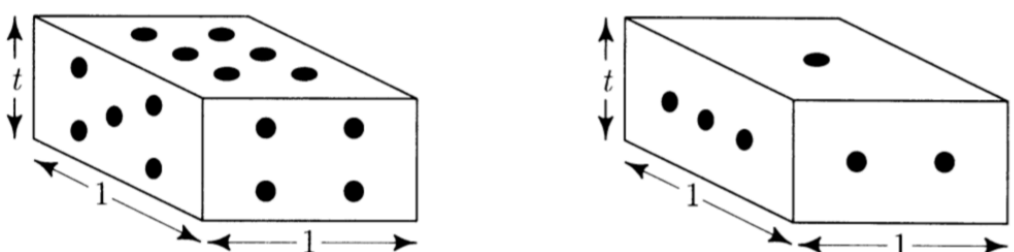




ex

Example 3. Shapes.

P24 A *shape* is a 6-sided die with faces cut as shown in the following diagram:



Suppose the thickness of the die, t, is such that the chance of landing flat (1 or 6) is 2/3.

Find the probability distribution of the shape. Draw a histogram.

From the geometry of the shape you can assume the chance of landing on any nonflat side is equal.

$1 - 2/3 = 4 \cdot x$ ← chance of getting a non flat side,

$4x = 1/3$

$x = 1/12$

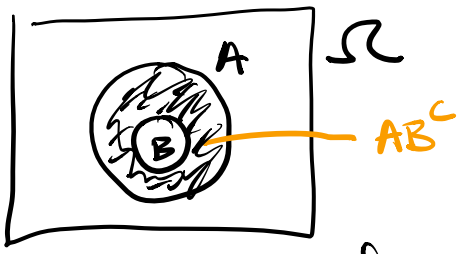
$P(1) = 1/3$

$P(2)$, $P(3)$, $P(4)$, $P(5)$ $= 1/12$

$P(6) = 1/3$

Difference rule

Suppose $B \subseteq A$



Prove a formula for $P(AB^c)$ in terms of $P(A)$ and $P(B)$.

$A \cap B^c$

$P(A) - P(B)$

$A = B \cup AB^c$ disjoint unions

$P(A) = P(B) + P(AB^c)$ $\Rightarrow P(AB^c) = P(A) - P(B)$.

Next time we will continue Sec 1.3.