PROB 140

Probability for Data Science

The Big Picture

The week starts with another connection between the binomial and Poisson families, and moves on to **the most important concept of the course,** which is expectation. This can be thought of as a kind of center of the distribution of a random variable, or a good guess for the variable. All probabilities are expectations, the variance of a random variable is an expectation, and least squares predictors are expectations. So please pay attention!

- Randomizing parameters can have dramatic effects on dependence and independence. A Poisson number of i.i.d. success/failure trials has beautiful and powerful properties.
- Expectation is the average of the possible values, weighted by their probabilities. Care is needed for variables that have infinitely many values.
- The definition helps us calculate some expectations, but almost always we calculate expectation using its properties, just as we calculate derivatives using properties of derivatives instead of the definition.
- A simple but powerful method helps us find the expectation of a function of a random variable.

Week At a Glance

Mon 1/31	Tue 2/1	Wed 2/2	Thu 2/3	Fri 2/4
	Lecture	Sections	Lecture	Sections
HW 2 Party 9-12 **HW 2 Due** HW 3 (Due Mon 2/7)				
Lab 1A due Lab 1B (Due Mon 2/7)				Lab 1B Party 3-5
Skim 7.1, 7.2	Work through Ch 7	Finish Ch 7, skim 8.1	Work through 8.1-8.2	Finish 8.1-8.3

Reading, Practice, and Live Sessions

Book	Topic	Lectures: Prof. A.	Sections: GSIs	Optional Additional Practice
Ch 7	**Poissonization** - 7.1 has properties of the Poisson distribution - 7.2 asks the same questions as 6.1, but with a Poisson number of trials - 7.3 extends this to trials with more than two categories, analogous to 6.3	Tue 2/1 Poissonization: - Beautiful calculations with surprising results - Pay attention to the math because you'll need the methods again	Wed 2/2 - Ch 7 Ex 6, 2, 4, 8	Chapter 7 All the exercises not covered in section
Ch 8	**Expectation** - 8.1 has the definition, interpretation, and a note on existence - 8.2 calculates the expectations of some of the famous distributions, in one case by introducing a new way of calculating expectation - 8.3 shows how to calculate expectations of linear and nonlinear functions of random variables	Thu 2/3 - Focused on 8.1-8.3 - Fine points, nonlinear functions, and some surprises	Fri 2/4 - Ch 8 Ex 2, 4, 10, 6	Chapter 8 Wait till next week; you need the remaining sections of Ch 8 for the remaining exercises in the chapter