PROB 140

Probability for Data Science

Fall 2022

WEEK 4 STUDY GUIDE

The Big Picture

The most important week of the course. It's about expectation, which 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 careful attention this week.

- 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.
- The two most powerful properties are additivity and the method for finding the expectation of a function of a random variable.
- Expectation is used in the definition of the bias of an estimator, and hence also in the construction of unbiased estimators.

Week At a Glance

Mon 9/12	Tue 9/13	Wed 9/14	Thu 9/15	Fri 9/16
	Lecture	Sections	Lecture	Sections
HW 3 Due HW 4 (Due Mon 9/19)				Lab 2B Party 10AM - 12 noon
Lab 2A Due Lab 2B (Due Mon 9/19)				HW 4 Party 3PM - 5PM
Work through 8.1, skim 8.2	Work through 8.1-8.3	Skim 8.4	Work through 8.4, 8.5	Review Chapter 8

Reading, Practice, and Class Meetings

Book	Topic	Lectures: Prof. A.	Sections: GSIs	Optional Additional Practice
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 - Introduction to 8.4: The key property of additivity	Tuesday 9/13 - Focused on 8.1-8.3 - Fine points, nonlinear functions, and some surprises	Wednesday 9/14 - Quiz 1 recap - Ch 8 Ex 2, 4, 6, hints for 13	Chapter 8 All the exercises not covered in section
	- 8.4 is about additivity: the expectation of a sum is the sum of the expectations, regardless of dependence or independence. Hugely powerful. - Additivity helps us construct unbiased estimators based on averages - 8.5 uses additivity to develop the method of indicators for finding expected counts	Thursday 9/15 - Additivity and some consequences: - Constructing unbiased estimators - Finding expected counts	Friday 9/16 - Ch 8 Ex 8, 9, 11, 12	

This is one of the few weeks in which we cover just one chapter.