

PROB 140

Spring 2021



Probability for Data Science

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 2/8	Tue 2/9	Wed 2/10	Thu 2/11	Fri 2/12
	Instructor's Session		Instructor's Session	
		GSI's Sessions		GSI's Sessions
Checkpoint Week 4 (Due Wed 2/10)		Checkpoint Week 4 Due		
HW 3 Party 7PM HW 3 Due HW 4 (Due Mon 2/15)				
Lab 2A Due Lab 2B (Due Mon 2/15)				Lab 2B Party 5PM
Read/watch 8.1, skim 8.2	Read/watch 8.1-8.3	Skim 8.4	Read/watch 8.4, 8.5	Review Chapter 8

Reading, Practice, and Live Sessions

Sections	Topic	Live Sessions: Prof. A.	Live Sessions: GSIs	Recommended Practice
Ch 8	<p>Expectation</p> <ul style="list-style-type: none"> - 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 <ul style="list-style-type: none"> - 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 	<p>Tue 2/9</p> <ul style="list-style-type: none"> - Focused on 8.1-8.3 - Fine points, nonlinear functions, and some surprises <p>Checkpoint is based on Sections 8.1-8.3</p> <p>Thur 2/11</p> <ul style="list-style-type: none"> - Additivity and some consequences: - Constructing unbiased estimators - Finding expected counts 	<p>Wed 2/10</p> <ul style="list-style-type: none"> - Ch 8 Ex 2, 4, 6, hints for 13 <p>Friday 2/12</p> <ul style="list-style-type: none"> - Ch 8 Ex 1, 7, 11, 12 	<p>Chapter 8</p> <p>All the exercises not covered in section</p>

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