PROB 140

Probability for Data Science

Fall 2021

WEEK 7 STUDY GUIDE

The Big Picture

This is a non-standard week because of the midterm on Thursday. The guide has been written accordingly. We'll cover new materials in Tuesday's lecture, but it'll not in the scope of the exam. We define and establish properties of the main measure of the variability in a distribution.

- The *standard deviation*, familiar to you from Data 8 as a measure of the spread in a data distribution, is defined as a measure of spread in the distribution of a random variable.
- *Variance*, which is the mean squared error and the square of the standard deviation, has better computational properties.
- *Covariance* helps calculate variances of sums and can be normalized to become *correlation*.
- The expectation and standard deviation together help us see where the bulk of a distribution is, though the picture isn't very helpful when distributions have heavy tails.
- General properties of variance and covariance help us calculate the variances of the main distributions.

Week At a Glance

Mon 10/4	Tue 10/5	Wed 10/6	Thu 10/7	Fri 10/8
	Instructor's Session		Instructor's Session	
		GSIs' Sessions	Midterm, 7-9PM	
HW 4 Party 12-2PM **HW 6 Due** HW 7 (Due Tue 10/12)			Midterm, 7-9PM	
Lab 4 Due Lab 5 (Due Tue 10/19)			Midterm, 7-9PM	
Read Sec 12.1, skim Sec 12.2	Read/watch Chapter 12 (Sec 12.4 is optional)	Read/watch Sec 12.3, skim Sec Sec 13.1	Read/watch Sections 13.1-13.3, skim 13.4	Read/watch Chapter 13

Reading, Practice, and Live Sessions

Sections	Topic	Live Sessions: Prof. Sahai	Live Sessions: GSIs	Recommended Practice
Ch 12	**Variance and Standard Deviation** - 12.1 has the basics of SD and variance; much of this should be an easy read - 12.2 connects variance and prediction - 12.3 shows how expectation and variance can be used to bound the tails of a distribution - 12.4 has examples of distributions with heavy tails, for students interested in economics, natural language processing, etc	Tuesday 10/5 SD and variance: - Definition, alternative computational method, examples - Use in prediction - Tail bounds	Wednesday 10/6 Ch 12: - Ex 4, 5, 6	Ch 12 - All exercises not covered in section
Ch 13	**Covariance** - 13.1-2 define covariance and establish its main properties - 13.3 covers the important special case of sums of independent variables - 13.4 covers variances of dependent sums - 13.5 compares dependent and independent sums via a *correction factor*	Thursday 10/7 Variance of a sum: - Covariance and main properties - Sums of independent random variables - Handling dependence	Friday 10/8 Ch 13: - Ex 1, 11, 13 (Release video walk-through)	Ch 13 - 2, 3, 4, 6, 15, 16