PROB 140

Probability for Data Science

Fall 2021

WEEK 9 STUDY GUIDE

The Big Picture

More technique!

- We know how to find expectations of a function of a random variable. We now examine how to find the density of a function of another random variable that has a known density, and notice that we have to be careful when the function isn't monotone.
- An important transformation results in the process on which simulation of random variables is based
- To study the joint behavior of two random variables, we define their joint density, which is the analog of the discrete joint distribution. Probabilities and expectations are now double integrals.
- The family of *beta* densities is crucial for machine learning, and offers a good example of how joint densities are constructed.

Week At a Glance

Mon 10/18	Tue 10/19	Wed 10/20	Thu 10/21	Fri 10/22
	Instructor's Session		Instructor's Session	
		GSIs' Sessions		GSIs' Sessions
HW 8 Party 12-2PM	**HW 8 Due** HW 9 (Due Tue 10/26)			
	Lab 5A & 5B Due Lab 6A (Due Tue 10/26)			Lab 6A Party 3-6PM
Skim Sec 16.1	Read Sections 16.1-2	Read Ch 16, skim Sec 17.1 (just some of it)	Read Sec 17.1 carefully, skim Sections 17.2-3	Read Ch 17

Reading, Practice, and Live Sessions

Sections	Topic	Live Sessions: Prof. Sahai	Live Sessions: GSIs	Recommended Practice
Ch 16	**Densities of Transformations** - 16.1 is about linear transformations; understanding this helps understand the non-linear case - 16.2 is about monotone transformations, linear or non-linear - 16.3 is **for you to read**: it's the process by which you can generate random variables with a specified distribution - 16.4 takes care of the non-monotone case, with particular reference to the square; in the typical semester, students **read this one** themselves too	Tuesday 10/19 - A discussion of undefined expectation (8.1.3 and 15.3) - Densities of transformations	Wednesday 10/20 - Ch 16 Ex 3, 4, 5	Ch 16 - All the exercises not covered in section. Be careful about signs in Ex 6. Ex 7 is a brain-teaser.
Ch 17	**Joint Densities** - 17.1-17.3 are the 2-dimensional counterparts of Ch 15 and the density version of Chapter 4. The examples in the videos aren't always the same as those in the text. - 17.4 is one of the "big name" families of densities	Thursday 10/21 - Joint densities	Friday 10/22 - Ch 17 Ex 3, 4, 7	Ch 17 - Ch 17 Ex 1, 6, 5, 9