PROB 140

Probability for Data Science

Spring 2022
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 3/14	Tue 3/15	Wed 3/16	Thu 3/17	Fri 3/18
	Lecture	Sections	Lecture	
HW 8 Party 9AM to noon **HW 8 Due** HW 9 (Due Mon 3/28)				
Lab 4A Due Lab 4B (Due Mon 3/28)				
Skim Sec 16.1	Work through Sections 16.1, 16.2, 16.4	Review Lab 4A Part 3, do Lab 4B Part 4, and work through Section 16.3	Work through Sec 17.1 carefully, skim Sections 17.2-3	**Happy Spring Break!**

Reading, Practice, and Live Sessions

Book	Topic	Lectures: Prof. A.	Sections: 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, referring to Parts 3 and 4 of Lab 4**: 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 3/15 - A discussion of undefined expectation (8.1.3 and 15.3) - Densities of transformations	Wednesday 3/16 - Ch 16 Ex 1, 4, 6a	Ch 16 - All the exercises not covered in section. Be careful about signs in Ex 6b. 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 3/17 - Joint densities	Friday 3/18 No sections	Ch 17 - Ch 17 Ex 1, 4, 5, 7, 9