PROB 140

Probability for Data Science

Fall 2022

WEEK 9 STUDY GUIDE

The Big Picture

We move to random variables with a continuum of values and develop some techniques for working with them.

- We are used to the normal as a continuous curve that approximates a probability distribution. Now we formally define the *density* of a random variable with a continuum of values, and extend the concepts of cdf and expectation to this situation.
- Along with the normal, we study two major distribution families: the uniform and the exponential.
- We 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

Week At a Glance

Mon 10/17	Tue 10/18	Wed 10/19	Thu 10/20	Fri 10/21
	Lecture	Sections	Lecture	Sections
HW 8 Due HW 9 (Due Mon 10/24)				HW 9 Party 3PM - 5PM
Lab 4 Due Lab 5A (Due Mon 10/24)				Lab 5A Party 10AM - 12 noon
Skim Sections 15.1 and 15.3	Work through Sections 15.1, 15.2, 15.3, 15.4	Skim Sec 16.1	Work through Sections 16.1, 16.2	Work through Ch 16

Reading, Practice, and Class Meetings

Book	Topic	Lectures: Prof. A.	Sections: GSIs	Optional Additional Practice
Ch 15	**Random Variables with Densities** - 15.1-15.2 define a “continuous” probability histogram, and generalize the concept of density from Data 8 histograms - 15.3 covers expectation (including variance) and has examples including the uniform distribution family - 15.4 covers the exponential distribution family - 15.5 shows how to do calculus in SymPy, as in the lab	Tuesday 10/18 Random variables on a continuum of values: extending all previous concepts to this case, and recognizing a benefit of the continuous world: single points affect probability calculations	Wednesday 10/19 - Ch 15 Ex 7, 2, 3	Ch 15 - 1, 5, 9, 10
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 nonlinear - 16.3 is **for you to read as you do the lab**: 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	Thursday 10/20 - A discussion of undefined expectation (8.1.3 and 15.3) - Densities of transformations	Friday 10/21 - 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.