PROB 140

Probability for Data Science

Spring 2021

WEEK 2 STUDY GUIDE

The Big Picture

We continue to develop the basic toolkit: how to work with collections of random variables and collections of events.

- Pairs and larger groups of random variables have *joint distributions*, from which you find the chance of any event determined by the random variables.
- If there is a complicated dependence structure, you might not be able to calculate exact or even approximate chances. Sometimes the best you can do is find *bounds* for a chance.
- *Symmetry* in random permutations and simple random samples greatly simplifies calculations.
- There is a formula for the chance of the union of overlapping events, with a famous application.

Week At a Glance

Mon 1/25	Tue 1/26	Wed 1/27	Thu 1/28	Fri 1/29
	Instructor's Session		Instructor's Session	
		GSIs' Sessions		GSIs' Sessions
Checkpoint Week 2 (Due Wed 1/27)		**Checkpoint Week 2 Due**		
HW 1 Party 7PM **HW 1 Due** HW 2 (Due Mon 2/1)				
Lab 1A due Lab 1B (Due Mon 2/1)				Lab 1B Party 5PM
Skim Ch 4	Read/watch Ch 4	Read/watch Sec 5.1 and Sec 5.4	Read/watch Sec 5.2-5.3	Fill any holes you left in Ch 1-5

Reading, Practice, and Live Sessions

Sections	Topic	Live Sessions: Prof. A.	Live Sessions: GSIs	Recommended Practice
Ch 4	Pairs of random variables - 4.1 is the two-variable version of 3.2: joint distributions, and finding probabilities - 4.2 has examples you should study - 4.3 shows how to extract the behavior of one random variable from the combined behavior of two - 4.4 shows how to update chances for one random variable given the value of another - 4.5 looks at how joint distributions help us understand dependence and independence; note the acronym “iid”	Tue 1/26 - The key ideas in Chapter 4, focusing more on the math than the code - 5.1: Bounds on probabilities - 5.4: Symmetry in random permutations	Wed 1/27 Chapter 4 Exercises 2, 3, and parts of 4 and 5	Chapter 4 Do all five exercises.
Ch 5	- 5.1: Simple bounds for the chance of an overlapping union - 5.2: The exact chance of a union, overlapping or not (requires the chances of all the overlaps) - 5.3: One of the most famous applications of inclusion-exclusion is to *fixed points* of a *random permutation*, also known as *matches* - 5.4: Summary of results on symmetry in random permutations and simple random sampling	Thu 1/28 - 5.1: Exact chance of a union, by inclusion-exclusion - 5.4: Matching problem; towards infinitely many values	Fri 1/29 Chapter 5 Exercises 3, 1, 9, 12; comparisons with other exercises	Chapter 5 5, 6, 10, 13, 14