PROB 140

Probability for Data Science

Fall 2020

WEEK 1 STUDY GUIDE

The Big Picture

We begin the course with a formal mathematical framework for defining and combining probabilities.

- The basic rules of probability are the same as those for proportions. To find a probability, you have to figure out an appropriate combination of rules to use.
- Numerical calculations quickly get large. Even in this age of powerful computers, mathematical approximation is often important for computation and insight.
- One of the rules enables you to update probabilities in the light of new information. This is a fundamentally important skill in data science.
- Assumptions matter, for identifying the right methods to use as well as for interpreting results.

Week At a Glance

Wed 8/26	Thu 8/27	Fri 8/28
	Instructor's Session	
		GSIs' Sessions
HW 1 (Due Mon 8/31)		
Lab 1A (Due Mon 8/31)		
Read 1.1-1.2 Skim 1.3-1.5	Read 1.3-1.5 Skim 2.1, 2.3, 2.5	Read Chapter 2, especially the examples

Reading, Practice, and Live Sessions

<table>
<tr><th>Sections</th><th>Topic</th><th>Live Sessions: Prof. A.</th><th>Live Sessions: GSIs</th><th>Recommended Practice</th></tr>
<tr><td>1.1, 1.2</td><td>Probability as a function
- 1.1 defines the domain
- 1.2 shows how to find probabilities under the assumption of equally likely outcomes</td><td rowspan="6">Thursday 8/27

1.3-1-5 with an emphasis on the math more than the computation

2.1, 2.3, 2.5: The relation between axioms and rules; conditioning</td><td rowspan="6">Friday 8/28

- “Balls in boxes”: how this helps with visualization in numerous problems
- Exponential approximation
- Conditioning and Bayes: points to notice
- Discussion will be based around Chapter 1 Ex 7 and 4 (yes, in that order), and Chapter 2 Ex 8.</td><td rowspan="2">Chapter 1
2, 5, 8, 9</td></tr>
<tr><td>1.3, 1.4</td><td>An example of an exact calculation, using the product rule of counting
- 1.3 has the general calculation
- 1.4 has the numerical computation in a special case, and a graph that inspires a search for an identifiable functional form</td></tr>
<tr><td>1.5</td><td>The first of many exponential approximations in the course</td><td rowspan="4">Chapter 2
1, 4, 5, 6, 13

If you have time, try 14. It’s popular with quant interviewers.</td></tr>
<tr><td>2.1, 2.3</td><td>The axioms and basic rules
- 2.1 is about addition, and hence also subtraction
- 2.3 is about multiplication, and hence also division which is a way to calculate conditional probabilities</td></tr>
<tr><td>2.5</td><td>Bayes’ Rule: updating probabilities by conditioning</td></tr>
<tr><td>2.2, 2.4</td><td>Examples. Don’t just read them – work them out</td></tr>
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