PROB 140

Probability for Data Science

Fall 2020

WEEK 5 STUDY GUIDE

The Big Picture

This is a non-standard week because of the midterm on Friday. The guide has been written accordingly, but the material covered this week is a workout in conditioning and will help you with confidence in using conditioning in the exam. The first topic is finding probabilities and expectations by conditioning, and the next is the examination of a random process indexed by time.

- Conditioning is a great way of finding expectations, just as it is for finding probabilities.
- In many situations involving i.i.d. trials, there is a recursive structure that can be used to simplify calculations.
- A *stochastic process* is a random process indexed by time. A Markov chain is a stochastic process with a particular dependence structure that allows it to be used as a simple model in many settings.
- Markov chains run for a long time have very interesting and useful properties.

Week At a Glance

Mon 9/21	Tue 9/22	Wed 9/23	Thu 9/24	Fri 9/25
	Instructor's Session		Instructor's Session	Midterm 1, 8AM
		GSIs' Sessions		Midterm 1, 8AM
Checkpoint Week 5 (Due Wed 9/23)		**Checkpoint Week 5 Due**		Midterm 1, 8AM
HW 4 Party 6-7PM **HW 4 Due**				Midterm 1, 8AM
Lab 2B Due				Midterm 1, 8AM
Skim Ch 9	Read Ch 9	Skim Sec 10.1, study for midterm	Study for midterm	Midterm 1, 8AM

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>Ch 9</td><td>Expectation by conditioning

- 9.1 is the old multiplication rule combined with recursion, to find probabilities quickly
- 9.2 shows how to find expectation by conditioning, building on the familiar calculation of finding an overall average as a weighted average of group averages
- 9.3 has examples in the context of i.i.d. Bernoulli trials</td><td rowspan="2">Tuesday 9/22

- Probabilities and expectation by conditioning and recursion

Checkpoint is based on Chapter 9

Thursday 9/24

- Introduction to Markov chains
- Long run behavior</td><td rowspan="2">Wednesday 9/23
- One example to help with the checkpoint
- Midterm Q&A

Friday 9/25
- No section</td><td rowspan="2">Review HWs, checkpoints and chapter exercises for the midterm</td></tr>
<tr><td>Ch 10</td><td>Markov chains

- 10.1 introduces terminology, notation, and basics, along with a computational approach to the long run
- 10.2 narrows down the type of chain we'll be studying, but even the narrowed-down group is pretty large
- 10.3 takes a more theoretical approach to the long run
- 10.4 has examples and applications</td></tr>
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