Spring 2024

WEEK 6 STUDY GUIDE

The Big Picture

We develop an algorithm that uses a Markov chain to simulate a probability distribution on an intractably large outcome space. We then move on to the variability in distributions, necessary for assessing the accuracy of estimates.

- *Monte Carlo* methods use simulation to address problems that are intractable by math or by complete enumeration.
- *Markov Chain Monte Carlo* (MCMC) can be used to simulate probability distributions on intractably large outcome spaces, even when the normalizing constant of the distribution can't be calculated.
- The *standard deviation*, familiar to you from Data 8 as a measure of the spread in a data distribution, is defined as a measure of spread in the distribution of a random variable.
- *Variance*, which is the mean squared error and the square of the standard deviation, has better computational properties.

Week At a Glance

Mon 2/19	Tue 2/20	Wed 2/21	Thu 2/22	Fri 2/23
	Lecture	Sections	Lecture	Mega Sections
Lab 4 (Due Mon 2/26)			Lab 4 Party 9 AM - 11 AM	
HW 6 (Due Mon 2/26)				HW 6 party 2 PM - 4 PM
Holiday	Work through Sections 11.2 and 11.3	Complete Lab 4; skim Sections 12.1, 12.3	Work through Sections 12.1, 12.2, 12.3	Complete Sections 12.1, 12.2, 12.3; do some midterm problems you missed.

Reading, Practice, and Class Meetings

Sections	Topic	Lectures: Prof. A.	Sections: TAs	Optional Additional Practice
Ch 11	**Markov Chain Monte Carlo (MCMC)** - 11.2 solves the code-breaking problem with a tiny alphabet, by complete enumeration - 11.3 develops a general Markov chain Monte Carlo method that can be used to solve the problem with a large alphabet	Tuesday 2/20 - Code breaking problem with a tiny alphabet - Using MCMC to solve the problem with a large alphabet	Wednesday 2/21 - Lab 4	None
Ch 12	**Variance and Standard Deviation** - 12.1 has the basics of SD and variance; much of this should be an easy read - 12.2 connects variance and prediction - 12.3 shows how expectation and variance can be used to bound the tails of a distribution - 12.4 has examples of distributions with heavy tails, for students interested in economics, natural language processing, etc	Thursday 2/22 SD and variance: - Definition, alternative computational method, examples - Use in prediction - Tail bounds	Friday 2/23 Ch 12 - Ex 4, 5, 6	Chapter 12 - All exercises not covered in section