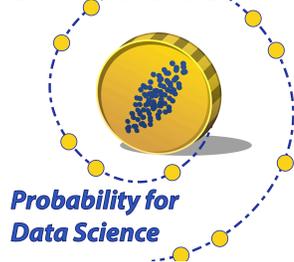


# DATA 140



Spring 2026

## 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 2/23	Tue 2/24	Wed 2/25	Thu 2/26	Fri 2/27
Regular OH 10AM - 3PM in Warren 101B	Lecture	Sections	Lecture	Mega Sections
Lab 4 (Due Mon 3/2)			Lab 3B party 3-5 PM in Warren 101B	
<b>HW 5 due 5 PM</b> HW 6 (Due Mon 3/2)				Homework 4 party 2-5 PM in Evans 330 and Evans 340
	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	<p><b>Markov Chain Monte Carlo (MCMC)</b></p> <ul style="list-style-type: none"> <li>- 11.2 solves the code-breaking problem with a tiny alphabet, by complete enumeration</li> <li>- 11.3 develops a general Markov chain Monte Carlo method that can be used to solve the problem with a large alphabet</li> </ul>	<p>Tuesday 2/24</p> <ul style="list-style-type: none"> <li>- Code breaking problem with a tiny alphabet</li> <li>- Using MCMC to solve the problem with a large alphabet</li> </ul>	<p>Wednesday 2/25</p> <ul style="list-style-type: none"> <li>- Lab 4</li> </ul>	None
Ch 12	<p><b>Variance and Standard Deviation</b></p> <ul style="list-style-type: none"> <li>- 12.1 has the basics of SD and variance; much of this should be an easy read</li> <li>- 12.2 connects variance and prediction</li> <li>- 12.3 shows how expectation and variance can be used to bound the tails of a distribution</li> <li>- 12.4 has examples of distributions with heavy tails, for students interested in economics, natural language processing, etc</li> </ul>	<p>Thursday 2/26</p> <p>SD and variance:</p> <ul style="list-style-type: none"> <li>- Definition, alternative computational method, examples</li> <li>- Use in prediction</li> <li>- Tail bounds</li> </ul>	<p>Friday 2/27</p> <p>Ch 12</p> <ul style="list-style-type: none"> <li>- Ex 4, 5, 6</li> </ul>	<p>Chapter 12</p> <ul style="list-style-type: none"> <li>- All exercises not covered in section</li> </ul>