

DATA-140



Fall 2023

WEEK 7 STUDY GUIDE

The Big Picture

We define and establish properties of the main measure of the variability in a distribution.

- 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.
- *Covariance* helps calculate variances of sums and can be normalized to become *correlation*.
- General properties of variance and covariance help us calculate the variances of the main distributions.

Week At a Glance

| Mon 10/2 | Tue 10/3 | Wed 10/4 | Thu 10/5 | Fri 10/6 |
|--|---------------------------------------|-----------------|-------------------------|-------------------------|
| | Lecture | Sections | Lecture | Mega sections |
| HW 6 Due 5PM HW 7 (due 5PM Oct 9) | | | | HW 7 party 2PM - 4PM |
| Lab 4 Due 5PM Lab 5 (due 5PM Oct 9) | | | Lab 5 party 10AM - noon | |
| Skim Sections 12.1, 12.3 | Work through Sections 12.1, 12.2 12.3 | Skim Chapter 13 | Work through Chapter 13 | Work through Chapter 13 |

Reading, Practice, and Class Meetings

| Book | Topic | Lectures: Instructors | Sections: TAs | Optional Additional Practice |
|-------|--|--|--|---|
| Ch 12 | Variance and Standard Deviation <ul style="list-style-type: none"> - 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 | Tuesday 10/3 SD and variance: <ul style="list-style-type: none"> - Definition, alternative computational method, examples - Use in prediction - Tail bounds | Wednesday 10/4 Ch 12: <ul style="list-style-type: none"> - Ex 4, 5, 6 | Ch 12 <ul style="list-style-type: none"> - All exercises not covered in section |
| Ch 13 | Covariance <ul style="list-style-type: none"> - 13.1-2 define covariance and establish its main properties - 13.3 covers the important special case of sums of independent variables - 13.4 covers variances of dependent sums - 13.5 compares dependent and independent sums via a <i>correction factor</i> | Thursday 10/5 Variance of a sum: <ul style="list-style-type: none"> - Covariance and main properties - Sums of independent random variables - Handling dependence | Friday 10/6 <ul style="list-style-type: none"> - Ch 13 Ex 1, 11, 15 - A midterm problem | Ch 13 <ul style="list-style-type: none"> - 2, 3, 4, 6, 13 |