

# DATA 140



Fall 2025

## WEEK 10 STUDY GUIDE

### The Big Picture

The beta, normal, and gamma families are heavily used in modeling. We study these, along with a generating function that helps understand them better.

- We start by establishing some properties of the beta family.
- We establish some properties of the standard normal that we have taken for granted without proof. We notice connections with gamma distributions. By simulation, we notice key properties of sums: sums of independent normals are normal, and sums of independent gammas (with the same rate) are gamma.
- The two most important branches of the gamma family have integer or half-integer shape parameters.
- The *moment generating function* (mgf) is more powerful than probability generating functions for dealing with sums. This helps us establish the properties of normal and gamma families that we observed by simulation.

### Week At a Glance

Mon 10/27	Tue 10/28	Wed 10/29	Thu 10/30	Fri 10/31
	Lecture	Sections	Lecture	Mega sections
Lab 6B Due				HW 10 Party 2-4 PM; General OH 4-5 PM
HW 9 Due HW 10 (due 12 NOON Monday 11/3)			HW 10 Party 9-12	Past midterm walkthrough 5-7pm
Skim Section 17.4, 18.1	Work through Section 17.4, Chapter 18	Work through Chapter 18; skim Section 19.1	Work through Sections 19.1, 19.2.	Study for the midterm

## Reading, Practice, and Class Meetings

Book	Topic	Lectures: Professor	Sections: TAs	Optional Additional Practice
Ch 18	<b>Normal and gamma families</b> <ul style="list-style-type: none"> <li>- 18.1 establishes the normal density, mean, and variance, and in the process discovers an important fact about sums of squares of standard normals. You <i>have</i> to know the results even if you don't follow some of the proofs.</li> <li>- 18.2 observes by simulation that sums of independent normals are normal, and uses this in exercises</li> <li>- 18.3 observes by simulation that sums of independent gammas with the same rate are gamma, and studies one major branch of the gamma family</li> <li>- 18.4 studies the other major branch</li> </ul>	<b>Tuesday 10/28</b> <ul style="list-style-type: none"> <li>- The beta family (Section 17.4)</li> <li>- Fundamental properties of the standard normal</li> <li>- The gamma family and its relation to squares of centered normals</li> </ul>	<b>Wednesday 10/29</b> <ul style="list-style-type: none"> <li>- Ch 17 Ex 4def, 5ac</li> <li>- Ch 18 Ex 2, 4</li> </ul>	<b>Ch 18</b> <ul style="list-style-type: none"> <li>- Ex 1, 3, 5, 8</li> </ul>
Ch 19	<b>Moment generating functions</b> <p>The first two sections parallel the start of Ch 14 on the pgf</p> <ul style="list-style-type: none"> <li>- 19.1 has a formula for the density of a sum, but it's often intractable</li> <li>- 19.2-3 define the mgf and examine its uses</li> </ul>	<b>Thursday 10/30</b> <ul style="list-style-type: none"> <li>- Convolution formula for the density of a sum</li> <li>- Moment generating functions: definition, some of the main uses (to be continued after the midterm)</li> </ul>	<b>Friday 10/31</b> (Midterm review) <ul style="list-style-type: none"> <li>- Ch 18, Ex 5</li> <li>- Ch 17, Ex 6</li> <li>- Ch 14, Ex 5</li> <li>- Ch 13, Ex 13</li> </ul>	<b>Ch 19</b> <ul style="list-style-type: none"> <li>- Wait till next week</li> </ul>