

DATA 140



Fall 2024

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 10/28	Tue 10/29	Wed 10/30	Thu 10/31	Fri 11/1
	Lecture	Sections	Lecture	Mega sections
Lab 6B Due				Office Hours 2-4 PM
HW 9 Due HW 10 (due 12 NOON Monday 11/4)			HW 10 Party 2PM - 5PM	Past midterm walk-through, review: 4PM - 6PM
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: Prof. A.	Sections: TAs	Optional Additional Practice
Ch 18	<p>Normal and gamma families</p> <ul style="list-style-type: none"> - 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. - 18.2 observes by simulation that sums of independent normals are normal, and uses this in exercises - 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 - 18.4 studies the other major branch 	<p>Tuesday 10/29</p> <ul style="list-style-type: none"> - The beta family (Section 17.4) - Fundamental properties of the standard normal - The gamma family and its relation to squares of centered normals 	<p>Wednesday 10/30</p> <ul style="list-style-type: none"> - Ch 17 Ex 4def, 5ac - Ch 18 Ex 2, 4 	<p>Ch 18</p> <ul style="list-style-type: none"> - Ex 1, 3, 5, 8
Ch 19	<p>Moment generating functions</p> <p>The first two sections parallel the start of Ch 14 on the pgf</p> <ul style="list-style-type: none"> - 19.1 has a formula for the density of a sum, but it's often intractable - 19.2-3 define the mgf and examine its uses 	<p>Thursday 10/31</p> <ul style="list-style-type: none"> - Convolution formula for the density of a sum - Moment generating functions: definition, some of the main uses (to be continued after the midterm) 	<p>Friday 11/1 (Midterm review)</p> <ul style="list-style-type: none"> - Ch 18, Ex 5 - Ch 17, Ex 6 - Ch 14, Ex 5 - Ch 13, Ex 13 	<p>Ch 19</p> <ul style="list-style-type: none"> - Wait till next week