

PROB 140 Spring 2021

WEEK 10 STUDY GUIDE



The Big Picture

The 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 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, and indicates why the CLT is true.
- The mgf and *Chernoff's bound* improves on the tail bounds of Markov and Chebyshev.

Week At a Glance

Mon 3/29	Tue 3/30	Wed 3/31	Thu 4/1	Fri 4/2
	Instructor's Session		Instructor's Session	Midterm 2 (8 AM)
		GSIs' Sessions		Midterm 2 (8 AM)
Checkpoint Week 10 (Due Wed 3/31)		Checkpoint Week 10 Due		Midterm 2 (8 AM)
HW 8 Party 7PM HW 8 Due				Midterm 2 (8 AM)
Lab 5A Due Lab 5B (Due Mon 4/5)				Midterm 2 (8 AM)
Read Sections 18.1-18.2	Read Ch 18	Skim Section 19.1; study for the midterm	Study for the midterm	Take some time off. But read Ch 19 over the weekend.

Reading, Practice, and Live Sessions

Sections	Topic	Live Sessions: Prof. A.	Live Sessions: GSIs	Recommended Practice
Ch 18	Normal and gamma families <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 	Tuesday 3/30 <ul style="list-style-type: none"> - Fundamental properties of the standard normal - The gamma family and its relation to squares of centered normals Checkpoint is based on Chapter 18	 Wednesday 3/31 <ul style="list-style-type: none"> - Ch 18 Ex 4 (simple but crucial) - Midterm prep 	Ch 18 <ul style="list-style-type: none"> - Ex 1, 2, 3, 5, 8
Ch 19	Moment generating functions <p>The first two sections parallel the start of Ch 14 on the pgf</p> <ul style="list-style-type: none"> - 18.1 has a formula for the density of a sum, but it's often intractable - 18.2-3 define the mgf and examine its uses including a sort-of proof of the CLT - 18.4 uses the mgf to develop a new tail bound 	Thursday 4/1 <ul style="list-style-type: none"> - Convolution formula for the density of a sum - Moment generating functions: definition, main uses, Chernoff's bound 	 Friday 4/2 <p>No sections</p>	Ch 19 <ul style="list-style-type: none"> - Ex 1, 2, 3