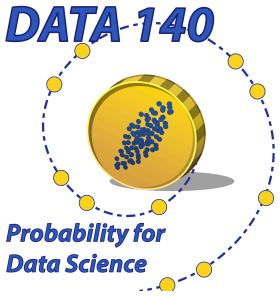

Spring 2024

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.

- 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 3/18	Tue 3/19	Wed 3/20	Thu 3/21	Fri 3/22
	Lecture	Sections	Lecture	
Lab 6B Due AT NOON Lab 7 (Part A due Mon 4/1, **the day after Spring Break**)			Lab 7A party 9 AM to 11 AM	No mega sections, office hours, or hw party. Happy Spring Break!
HW 9 Due AT NOON HW 10 (due Mon 4/1, **the day after Spring Break**)				
Midterm 2	Skim Sections 19.1, 19.2	Work through Sections 19.1, 19.2; skim Section 19.3	Work through Chapter 19	

Reading, Practice, and Class Meetings

Book	Topic	Lectures: Prof. A.	Sections: TAs	Optional Additional Practice
Ch 18 Ch 19	**Normal and gamma families** - 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 **Moment generating functions** The first two sections of Ch 19 parallel the start of Ch 14 on the pgf - 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	Tuesday 3/19 - Fundamental properties of the standard normal - The gamma family and its relation to squares of centered normals - Convolution formula for the density of a sum - Moment generating functions: definition, main properties	Wednesday 3/21 - Ch 18 Ex 2, 4 - Ch 19 Ex 3, 2ac	Ch 18 - Ex 1, 3, 5, 8 Ch 19 - Ex 1, 7
Ch 19	**Moment generating functions** 19.3 develops a sort-of proof of the CLT - 19.4 uses the mgf to develop a new tail bound	Thursday 3/21 - Moment generating functions: CLT; Chernoff's bound	Friday 3/22 No mega sections	