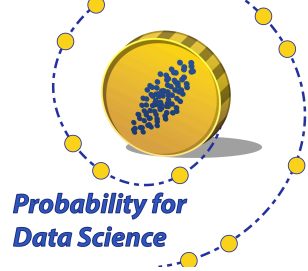


# DATA 140



## Spring 2024 WEEK 9 STUDY GUIDE

### The Big Picture

More technique! And establishing some normal distribution results we have taken for granted without proof.

- To study the joint behavior of two random variables, we define their joint density, which is the analog of the discrete joint distribution. Probabilities and expectations are now double integrals.
- The family of *beta* densities is important for machine learning and offers a good example of how joint densities can be constructed.
- We establish some basic properties of the standard normal. 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.

### Week At a Glance

Mon 3/11	Tue 3/12	Wed 3/13	Thu 3/14	Fri 3/15
	Lecture	Sections	Lecture	Mega Sections
<b>Lab 6A Due</b> Lab 6B ( <b>Due NOON Mon 3/18</b> )			Lab 6B Party 10 AM to noon	
<b>HW 8 Due</b> HW 9 ( <b>Due NOON Mon 3/18</b> )				HW 9 Party 2 PM to 5 PM
Skim Sec 17.1	Work through Sec 17.1 carefully, skim Sections 17.2-3	Work through Chapter 17	Work through Chapter 17	Review for midterm

## Reading, Practice, and Class Meetings

Book	Topic	Lectures: Prof. A.	Sections: TAs	Optional Additional Practice
Ch 17	<p><b>Joint Densities</b></p> <ul style="list-style-type: none"> <li>- 17.1-17.3 are the 2-dimensional counterparts of Ch 15 and the density version of Chapter 4. The examples in the videos aren't always the same as those in the text.</li> <li>- 17.4 is one of the "big name" families of densities</li> </ul>	<p><b>Tuesday 3/12</b></p> <ul style="list-style-type: none"> <li>- Joint densities</li> <li>- The beta family</li> </ul>	<p><b>Wednesday 3/13</b></p> <ul style="list-style-type: none"> <li>- Ch 17 Ex 2, 4, 7</li> </ul>	<p>Ch 17</p> <ul style="list-style-type: none"> <li>- Ex 1, 9</li> </ul>
Ch 18	<p><b>Normal and gamma families</b></p> <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>	<p><b>Thursday 3/14</b></p> <ul style="list-style-type: none"> <li>- Fundamental properties of the standard normal</li> <li>- The gamma family and its relation to squares of centered normals</li> </ul>	<p><b>Friday 3/15</b></p> <ul style="list-style-type: none"> <li>- Past midterm questions</li> </ul>	<p>Postponed till next week. Study for the midterm.</p>