

PROB 140 Fall 2020

WEEK 8 STUDY GUIDE



The Big Picture

We move to random variables with a continuum of values, via one of the most important theorems in probability.

- We know how to find expectations and variances of sums of random variables. To find the distribution of a sum, we can use partitioning as before. But a more abstract math technique called *probability generating functions* lets us quickly calculate distributions of sums in special cases.
- The exact distributions or the simulations in Data 8 are evidence of the *Central Limit Theorem* in action: the distribution of the sum of a large i.i.d. sample is roughly normal. We use this to construct confidence intervals for the population mean.
- The normal is a continuous curve that acts a probability distribution. We formally define the *density* of a random variable with a continuum of values, and extend the concepts of cdf and expectation to this situation.
- Along with the normal, we study two major distribution families: the uniform and the exponential.

Week At a Glance

Mon 10/12	Tue 10/13	Wed 10/14	Thu 10/15	Fri 10/16
	Instructor's Session		Instructor's Session	
		GSI's Sessions		GSI's Sessions
Checkpoint Week 8 (Due Wed 10/14)		Checkpoint Week 8 Due		
HW 6 Party 6-7PM HW 6 Due HW 7 (Due Mon 10/19)				HW 7 Party 6-7PM
Lab 4A Due Lab 4B (Due Mon 10/19)			Lab 4B Party 6-7PM	
Skim Sections 14.1-14.2	Read Sections 14.1-14.2, skim the rest of Ch 15	Read Ch 14, skim Section 15.1	Read Sections 15.1-15.3	Read Chapter 15 (you can postpone 15.5 till next week)

Reading, Practice, and Live Sessions

Sections	Topic	Live Sessions: Prof. A.	Live Sessions: GSIs	Recommended Practice
Ch 14	<p>Sums and the CLT</p> <ul style="list-style-type: none"> - 14.1-14.2 cover an abstract math method for understanding probability distributions; 12.2 finds exact distributions of i.i.d. sample sums. - 14.3 states the Central Limit Theorem and formally defines the normal curve - 14.4 shows how to work with the normal curve in Python; this is for you to read by yourself - 14.5-14.6 cover the probability theory of the i.i.d. sample mean, and hence the use of the sample mean in confidence intervals 	<p>Tuesday 10/13</p> <ul style="list-style-type: none"> - Our first generating function: a math technique for understanding distributions - The CLT and some consequences <p>Checkpoint is based on Chapter 14</p>	<p>Wednesday 10/14</p> <p>Ch 14:</p> <ul style="list-style-type: none"> - Ex 1, 4, 5 	<p>Ch 14</p> <ul style="list-style-type: none"> - All exercises not covered in section
Ch 15	<p>Random Variables with Densities</p> <ul style="list-style-type: none"> - 15.1-15.2 define a “continuous” probability histogram, and generalize the concept of density from Data 8 histograms - 15.3 covers expectation (including variance) and has examples including the uniform distribution family - 15.4 covers the exponential distribution family - 15.5 shows how to do calculus in SymPy, for your next lab 	<p>Thursday 10/15</p> <p>Random variables on a continuum of values: extending all previous concepts to this case, and recognizing a benefit of the continuous world: single points affect probability calculations</p>	<p>Friday 10/16</p> <p>Ch 15:</p> <ul style="list-style-type: none"> - Ex 7, 2, 6 	<p>Ch 15</p> <ul style="list-style-type: none"> - 1, 3, 5, 9, 10