



WEEK 2 STUDY GUIDE

The Big Picture

We continue to develop the basic toolkit: how to work with numerical random quantities and collections of events.

- In Data 8 you saw a *statistic* defined as a number that you compute based on a sample. The more general concept is that of a *random variable*, which is a function on the outcome space.
- *Distributions* describe how probability is spread over a set of values. Every random variable has a distribution; pairs and larger groups have *joint distributions*.
- There is a formula for the chance of the union of overlapping events, with a famous application.
- If there is a complicated dependence structure, you might not be able to calculate exact or even approximate chances. Sometimes the best you can do is find *bounds* for a chance.
- *Symmetry* in random permutations and simple random samples greatly simplifies calculations.

Week At a Glance

Mon 8/31	Tue 9/1	Wed 9/2	Thu 9/3	Fri 9/4
	Instructor's Session		Instructor's Session	
		GSI's Sessions		GSI's Sessions
Checkpoint Week 2 (Due Wed 9/2)		Checkpoint Week 2 Due		
HW 1 Party 6-7PM HW 1 Due HW 2 (Due Tue 9/8)				HW 2 Party 6-7PM
Lab 1A Due Lab 1B (Due Tue 9/8)				
Skim Ch 3 and Sec 4.1	Read Ch 3 and Ch 4	Read Ch 4, skim Sec 5.1	Read Sec 5.1 and Sec 5.4, skim Sec 5.1 and Sec 5.2	Read Ch 5

Reading, Practice, and Live Sessions

Sections	Topic	Live Sessions: Prof. A.	Live Sessions: GSIs	Recommended Practice
Ch 3	<p>Random variables</p> <ul style="list-style-type: none"> - 3.1 has the definition - 3.2 defines the distribution of the random variable, and shows how to find probabilities of events based on the random variable - 3.3 shows how random variables can have two kinds of equality 			<p>Chapter 3 2, 4, 7</p>
Ch 4	<p>Pairs of random variables</p> <ul style="list-style-type: none"> - 4.1 is the two-variable version of 3.2: joint distributions, and finding probabilities - 4.2 has examples you should study - 4.3 shows how to extract the behavior of one random variable from the combined behavior of two - 4.4 shows how to update chances for one random variable given the value of another - 4.5 looks at how joint distributions help us understand dependence and independence; note the acronym "iid" 	<p>Tuesday 9/1</p> <ul style="list-style-type: none"> - The key ideas in Chapters 3 and 4, focusing more on the math than the code <p>Checkpoint is based on Chapters 3 and 4</p>	<p>Wednesday 9/2</p> <ul style="list-style-type: none"> - Exercises selected to help with assignments: <p>Chapter 2 Ex 12 Chapter 3 Ex 5, 6 Chapter 4 Ex 2</p>	<p>Chapter 4</p> <p>Do as much as you can of all five exercises.</p>

Chapters 3-4 aren't difficult technically, but they contain many basic concepts and essential terminology. You'll need the code for Lab 1B.

(continued below)

Reading, Practice, and Live Sessions

Sections	Topic	Live Sessions: Prof. A.	Live Sessions: GSIs	Recommended Practice
Ch 5	<ul style="list-style-type: none"> - 5.1: Simple bounds for the chance of an overlapping union, to be used when we can't find the chances of the overlaps - 5.2: The exact chance of a union, overlapping or not. This is called the <i>inclusion-exclusion</i> formula and requires that we be able to find the chances of the overlaps. - 5.3: One of the most famous applications of inclusion-exclusion is to <i>fixed points of a random permutation</i>, also known as <i>matches</i> - 5.4: Summary of results on symmetry in random permutations and simple random sampling, some of which we'll have used earlier 	<p>Thursday 9/3</p> <ul style="list-style-type: none"> - Some discussion of bounds and symmetry - Main focus on inclusion-exclusion and the matching problem 	<p>Friday 9/4</p> <ul style="list-style-type: none"> - Bounds, symmetry, and inclusion-exclusion: <p>Chapter 5 Exercises 3, 1, 9, 12; comparisons with other exercises</p>	<p>Chapter 5 5, 6, 10, 13, 14</p>

Chapter 5 is more technically detailed than Chapters 3-4. You'll need it (as well as Chapter 3-4) for HW 2.