

# Statistics 111 Syllabus

## Spring 2017

- Instructor: Kevin Rader  
Email: [krader@fas.harvard.edu](mailto:krader@fas.harvard.edu)  
Office Hours (SC-614): Tues 2:30-3:30pm & Thurs 11am-12pm
- Lectures: Tuesday & Thursday, 1-2:30pm in SC-Hall C. Lectures will be videotaped and posted online about 24 hours later.
- Web Site: <https://canvas.harvard.edu/courses/21569>
- Textbook: *Probability and Statistics*, DeGroot & Schervish, 4th edition. (**Not required**)  
(Amazon Link: <http://www.amazon.com/Probability-Statistics-Edition-Morris-DeGroot/dp/0321500466/>)  
<https://www.amazon.com/Probability-and-Statistics/dp/1292025042>
- Other possible texts as reference:  
*Mathematical Statistics and Data Analysis*, Rice, 3<sup>rd</sup> edition:  
<http://www.amazon.com/Mathematical-Statistics-Analysis-Duxbury-Advanced/dp/0534399428>
- Statistical Inference*, Casella and Berger, 2<sup>nd</sup> edition (GREAT BOOK! at a higher level):  
<http://www.amazon.com/Statistical-Inference-George-Casella/dp/0534243126>
- Software: R, free for download:  
Download Link: <https://cran.r-project.org/>

### **Course Objective:**

Basic concepts of statistical inference from Frequentist and Bayesian perspectives. Topics include, but not limited to: maximum likelihood methods, confidence and Bayesian interval estimation, hypothesis testing, least squares methods and categorical data analysis.

### **Prerequisites:**

Mathematics 21a and 21b or equivalent, and Statistics 110 (Multivariable Calculus, Linear Algebra, and Theoretical Probability...these are HARD requirements). Concurrently taking Math 21b, 23b, etc... is fine.

### **Sections:**

Optional (but **strongly** suggested) TF-led sections will be held throughout the course starting the 2<sup>nd</sup> week of class. Sections will be held mostly on Tuesdays, Wednesdays, and Thursdays. Sections will go over practice problems and review difficult material. You will be assigned to a section mostly for administrative purposes: feel free to attend any section (or sections) that fit your schedule.

### **Computing:**

We will be using the statistical software package, *R*. *R* is available to download for free for both Macs and PCs (and on Unix) here: <http://cran.us.r-project.org/>

Some students prefer to use *R* through the interface *R Studio*. *R studio* is not required, but it does help organize your computing projects. It can be downloaded here: <http://www.rstudio.com/>

No previous knowledge of the computer programming or the software is required; though having some programming experience would be very helpful, like having taken CS 50 or Stat 102, 107, or 139.

### **Accommodations for students with disabilities:**

Students needing academic adjustments or accommodations because of a documented disability must present their Faculty Letter from the [Accessible Education Office](#) (AEO) and speak with Kevin by the end of the third week of the term: Friday, February 10. Failure to do so may result in us being unable to respond in a timely manner. All discussions will remain confidential.

### **Collaboration:**

You are encouraged to discuss homework with other students (and with the instructor and TFs, of course), but you must write your final answers yourself, in your own words. Solutions prepared “in committee” or by copying or paraphrasing someone else’s work are not acceptable; your handed-in assignment must represent your own thoughts. All computer output you submit must come from work that you have done yourself. **Please indicate on your problem sets the names of the students with whom you worked.** All exams (midterm and final) are individual work.

### **Grading Guidelines:**

Your final score for the course will be computed using the following weights. Your overall score will be the maximum of 2 computed scores, based on the following 2 weighting schemes:

<u>Component</u>	<u>Weight1</u>	<u>Weight2</u>
Homeworks	40%	40%
Midterm	15%	30%
Final Exam	45%	30%
Total	100%	100%

### **Homework:**

There will be 9 homework assignments (they are essentially weekly). The assignments will be posted on the course website at least one week before they are due (usually on Friday). No HW scores will be “dropped.” You are allowed one late homework submission up to 72 hours later. Any other late homework submissions will not be accepted without a written note from UHS or your resident dean’s office.

### **Exams:**

There will be one midterm (on Tues, March 7, 1-2:30pm) and one final exam (tentatively scheduled for Friday, May 12, at 9am). You will be given a sheet distributions (like the one seen in Stat 110), plus you will be allowed one reference sheet of notes, front-and-back, for the midterm and two sheets for the final exam.

## Projected Course Schedule

Week	Day	Date	Topic / Event	
1	Tuesday	Jan 24	Introduction to Inference, Stat 111 vs. 110	1
	Thursday	Jan 26	Parameters, Estimates, Sampling	2
2	Tuesday	Jan 31	Inference for $\bar{X}$ and $\hat{p}$ (Stat 104 style)	3
	Thursday	Feb 2	Intro to Estimation and Method of Moment	4
	Friday	Feb 3	HW 1 Due	
3	Tuesday	Feb 7	Simulations in R	5
	Thursday	Feb 9	Maximum Likelihood Theory and Estimation	6
	Friday	Feb 10	HW 2 Due	
4	Tuesday	Feb 14	More Maximum Likelihood Estimation	7
	Thursday	Feb 16	Confidence Intervals	8
	Friday	Feb 17	HW 3 Due	
5	Tuesday	Feb 21	Frequentist vs. Bayesian	9
	Thursday	Feb 23	Bayesian Estimation	10
	Friday	Feb 24	HW 4 Due	
6	Tuesday	Feb 28	Bayesian Credible Intervals	11
	Thursday	Mar 2	Midterm Review	12
	Friday	Mar 3	HW 5 Due	
7	<b>Tuesday</b>	<b>Mar 7</b>	<b>Midterm (covers all lectures and up to HW #5)</b>	
	Thursday	Mar 9	No Class! [built in snow day]	
Spring Recess (March 11-19)				
8	Tuesday	Mar 21	Transformations	14
	Thursday	Mar 23	Introduction to Hypothesis Testing	15
9	Tuesday	Mar 28	Likelihood Ratio Tests	16
	Thursday	Mar 30	Score and Wald Tests	17
	Friday	Mar 31	HW 6 Due	
10	Tuesday	Apr 4	Review of Likelihood Based Tests	18
	Thursday	Apr 6	Bayesian Approach to Hypotheses	19
	Friday	Apr 7	HW 7 Due	
11	Tuesday	Apr 11	$t$ -tests and $F$ -tests	20
	Thursday	Apr 13	Linear Models	21
	Friday	Apr 14	HW 8 Due	
12	Tuesday	Apr 18	Likelihood Based Models	22
	Thursday	Apr 20	More General Modeling	23
13	Tuesday	Apr 25	General Statistical Modeling	24
	Friday	Apr 28	HW 9 Due	
Reading Period	(Apr 27-May 3)		Final Exam Review Session (Date TBD)	
Finals Period	(May 4-13)		<b>Final Exam (Scheduled for Fri, May 12)</b>	