Math 445: Statistical Theory

Adam Loy

Spring 2017

E-mail: adam.m.loy@lawrence.edu
Office Hours: M 3:00-4:30 p.m., T 2:00-4:00 p.m., W 8:30-9:30 a.m., F 1:50-3:00 p.m., and by appointment
Office: 410 Briggs Hall

Web: math445-lu.github.io/sp17
Class Hours: MWF 11:10 a.m. - 12:30 p.m.
Class Room: 416 Briggs Hall

Overview

This course will help you develop an understanding of statistical inference and the mathematical theory that underlies it. While the name of this course refers only to the theoretical aspect of statistics, this course will balance this theory with applications that show how inference can be implemented in practice. This term we will explore estimation and testing using nonparametric, frequentist, and Bayesian methods.

Course Logistics

Prerequisites: Math 240 or a comparable course in probability.

Required textbook: *Mathematical Statistics with Resampling and R*, Laura M. Chihara and Tim C. Hesterberg, 2011, Wiley, ISBN 978-1-118-02985-5.

Computing: Modern statistical analysis is done in a computing environment, so this course has a strong computational focus. We will use the R language with the RStudio interface, which are both free and open-source. You have two options for using RStudio:

1. The **server** version of RStudio on the web at (http://rstudio.lawrence.edu/). The advantage of using the server version is that all of your work will be stored in the cloud, where it is automatically saved and backed up. This means that you can access your work from any computer on campus using a web browser. The downside is that you can't access the server off campus (yes, this includes Bjorklunden) and that you have to share limited computational resources with each other!
2. A **local** version of RStudio installed on your machine. This is recommended due to the computational resources this course demands. The downside to this approach is that your work is only stored locally, but I get around this problem by keeping all of my work in a Dropbox folder. I will also show you how to use GitHub for version control.

Note that you do not have to choose one or the other, you may use both. However, it is important that you understand the distinction so that you can keep track of your work. Both R and RStudio are free and open-source.

Course Components

Preparation and study: You must read the assigned sections of the text before we discuss them in class so that you are already working with the ideas in advance of hearing about them from me. In addition, review your lecture notes after each lecture, carefully reconstructing for yourself the ideas, arguments, and overall story that is developing. Coming to class for 70 minutes 3 times a week is not sufficient to learn statistics and reorganize your thought processes.

Class attendance: During class we will explore the statistical thought process through lecture, discussion, and in-class exercises. Office hours are not substitutes for class attendance.

Homework: Homework will be due on (most) Wednesdays by 4:30 p.m. All analyses should be completed in R and summaries should be written using R markdown. Derivations may be completed by hand.

Exams: There will be two out-of-class exams for this course: Wednesday 4/19 and Wednesday 5/10.

The final exam will be held Monday, June 5 from 11:30 a.m. to 2:00 p.m. The date and time of the final exam is set by the registrar, and under no circumstances will you be allowed to take the final at a different time due to early travel plans.

Course Policies

Assessment Procedure: Homework assignments will be worth a total of 40% of your final grade and each exam will be worth 20% of your final grade.

Homework Policies: Homework will be due on (most) Wednesdays by 4:30 p.m., allowing you to submit your homework and enjoy some treats at Math Tea! I will accept late homework until 4 p.m. the day after the due date, but a 20% penalty will be assessed on these assignments.

I will allow you to discuss homework problems with your fellow classmates, but I insist that you write up and submit your own solutions. I am allowing you to discuss problems so that you can share problem solving strategies, not so that you can avoid doing the problems yourself. Remember that copying another student's work is a violation of the honor code.

You will be graded on the correctness of your solutions and how easy they are to read and understand. You will receive full credit for a solution to a problem if and only if a randomly selected student in the class would understand how to do the problem after having read your solution. No late homework will be accepted, but your lowest grade will be dropped.

Classroom Culture: If you would rather be talking, sleeping, reading the news, listening to music, or texting, I suggest that you do that somewhere much more comfortable than the classroom. When you attend class, please arrive on time and stay engaged throughout the entire class.

Honor Code:

> *No Lawrence student will unfairly advance their own academic performance or in any way limit or impede the academic pursuits of other students of the Lawrence community.*

All students are expected to uphold Lawrence University's Honor Code. All work on exams must be your own. You may collaborate on homework, but you must submit your own assignment that reflects your own thinking, work and organization. Any assignment you submit for a grade should be your own work, and not a facsimile of a classmate's work, which would constitute academic dishonesty. To check if your homework meets this standard, imagine I asked you to explain your reasoning for each problem—you should be able to do so with ease using language similar to your submission. All written work must be accompanied by a reaffirmation of the Honor Code. Finally, cell phones will be prohibited during exams.

Disability Policy: Lawrence University is committed to providing reasonable accommodations for students with disabilities. Students establish eligibility and request accommodations through the Center for Academic Success. View the Accessibility Services web page at go.lawrence.edu/cas for more information.

Healthy Balance: All members of the Lawrence community—students, staff, and faculty—have the responsibility to promote balance in their lives by making thoughtful choices. Balance results from two skills: avoiding imbalance through careful planning, and managing and containing imbalance when it occurs. This course will be demanding, but should not overwhelm your academic (let alone whole) life. If it threatens to, come talk to me, a tutor, friend, counselor, or advisor.