



## STAT 061: Mathematical Statistics I

### Fall 2023

#### COURSE DESCRIPTION

<b>MEETINGS:</b>	MWF	9:30-10:20 am (Section 01)
	Sci 158	10:30 - 11:20am (Section 02)
<b>PROFESSOR:</b>	Amanda Luby	<a href="mailto:aluby1@swarthmore.edu">aluby1@swarthmore.edu</a>
	Office Hours:	Mon/Wed 2:30-4pm ( <i>tentative</i> )
<b>WEBSITE:</b>	<a href="https://moodle.swarthmore.edu/">https://moodle.swarthmore.edu/</a>	
<b>TEXTBOOK:</b>	<i>Introduction to Mathematical Statistics and Its Applications</i> by Larsen and Marx (any edition online or in print is fine)	
	Supplementary: <i>Mathematical Statistics and Data Analysis</i> by Rice (any edition)	
<b>SOFTWARE:</b>	RStudio Server to access R through your browser:	
	<a href="https://rstudio.swarthmore.edu/">https://rstudio.swarthmore.edu/</a>	
	R (optional) , free download from <a href="https://www.r-project.org/">https://www.r-project.org/</a>	
	RStudio* (optional), free from <a href="https://www.rstudio.com/">https://www.rstudio.com/</a>	

This course is an introduction to the mathematical theory of frequentist and Bayesian statistical inference. Topics include parameter estimation, confidence intervals and hypothesis testing, linear models, and Bayesian inference.

Prerequisite: a grade of C or better in both Stat 051 or permission of instructor. Stat 011 or the equivalent and some experience with computing are strongly recommended.

## COURSE OBJECTIVES

Students who analyze data, or who aspire to develop new methods for analyzing data, should be well-grounded in mathematical statistics. By the end of this course, you should be able to:

- Derive estimators for parameters using maximum likelihood, the method of moments, and Bayesian techniques
- Evaluate the performance of estimators and describe their strengths and weaknesses
- Demonstrate a sophisticated understanding of the mathematics behind hypothesis tests, confidence intervals, and linear regression
- Use the statistical package R to implement basic simulations of estimation scenarios

## COURSE COMPONENTS

*COURSE MEETINGS:* There will be three course meetings per week (Monday, Wednesday, and Friday). Course meetings will combine traditional lecture, in-class group exercises, and activities using R. Some course meetings may be “flipped” style, where I will ask you to watch a short video before class and we will use class time to work through problems. Note outlines and in-class problems will be posted by 9am the day of each class if you would like to print them for class.

*ASSIGNMENTS:* Homework will be assigned once per week, due on gradescope by midnight on Wednesday (with no-questions-asked 12 hour extension). Assignment submissions should be typeset using quarto or latex; or neatly written and scanned or submitted as a PDF file. You must show all work to receive credit.

*QUIZZES:* There will be three quizzes — tentatively scheduled for Wednesdays (Sept 27, Oct 25, Nov 22). Any changes to this schedule will be communicated at least two weeks in advance. Any conflicts must be communicated to me in writing at least two weeks in advance to be eligible to schedule a make-up quiz. If an emergency arises, please contact me as soon as possible.

*FINAL EXAM:* The final exam will take place during the finals period. The exam schedule will be posted by the registrar once it is determined. Final exams are not rescheduled due to travel plans.

*FINAL PROJECT:* Details forthcoming, likely after the fall break. Due during the finals period

*COMMUNICATION:* Assignments, note sets, and grades will be posted on Moodle. We will also use Slack for announcements, discussion, and homework questions.

## GRADING POLICIES

Grades are an imperfect measure of learning, and no grading scheme will fully capture the amount of time or effort that each individual puts into the class. This course is designed to reward you for consistently participating and staying on top of the material.

Final grades will be calculated as follows:

- 40% Homework
- 30% Quizzes (10% each)
- 20% Final Exam
- 10% Final Project
- 5% Participation, in-class activities, and labs

And letter grades will be assigned based on the usual grading scale (A = 93%+, A- = 90-92.9%, B+ = 88-89.9%, B = 83-87.9, etc.)

*A NOTE ON THE “GENIUS MYTH”:* I’ve found that many Swatties buy into the “genius myth” when it comes to math/stat courses: that you need to be a “math person” and have some innate mathematical ability in order to do well or become a statistics major. **This could not be further from the truth!** The best statisticians don’t necessarily have the “best” math or programming background, but are people that are able to formulate interesting questions and *use* math and programming to answer those questions. Many of the best statisticians I know became statisticians because they were initially interested in something else (biology, public health, psychology, neuroscience, physics, etc.) and realized that being able to answer important questions with data was not only valuable but *fun* and *interesting*. Being able to perform interesting statistical analyses is a skill that is learned, not an innate ability, and working hard at developing that skill is the point of this course.

*REGRADE REQUESTS:* Grading is often a tedious task, and the grading team will sometimes make mistakes. I am always happy to fix these mistakes, and gradescope makes it easy to do so. However, it takes time to read through these requests and I’ve noticed an increase in unwarranted regrade requests in recent years. This semester, I am instituting an “NFL Coaches Challenge”-style regrade request rule. Every student will start the semester with 2 regrade requests available to them. If you submit a regrade request and I agree that there was a grading mistake, you get it back. If you submit a regrade request for something that was *not* a grading mistake, you lose that request.

## ACADEMIC INTEGRITY

I encourage you to discuss the homework problems with others and use the resources available to you to try to figure out tough problems. Write up your solutions on your own. Exams must be done by yourself without communicating with others; all work must be your own. Copying, paraphrasing, summarizing, submitting work generated by a large language model, etc., will not be tolerated. Please ask if you are unsure of whether or not your actions are complying with

the assignment/quiz/exam instructions. You are ultimately responsible for any work that you submit. If you submit anything that you do not fully understand and could explain to others, it is likely not your own work. Always ask if you are unsure, always default to acknowledging any help received or resources used. Any violations of this policy will result in a zero on the assignment/quiz/project in question and a full letter grade reduction from the final course grade. A second violation, or an especially egregious violation, will result in a failing grade for the course.

## DIVERSITY AND INCLUSION

We all come to class with different backgrounds and experiences, and this diversity makes our class environment richer. We value diversity and inclusion, and are committed to a climate of mutual respect and full participation in and out of the classroom. This class strives to be a learning environment that is usable, equitable, inclusive and welcoming, regardless of race, ethnicity, religion, gender and gender identities, sexual orientation, ability, socioeconomic background, and nationality. If you anticipate or experience any barriers to learning, please discuss your concerns with me.

## RESOURCES

*ACCOMMODATIONS:* If you believe you need accommodations for a disability or a chronic medical condition, please contact Student Disability Services via email at [studentdisabilityservices@swarthmore.edu](mailto:studentdisabilityservices@swarthmore.edu) to arrange an appointment to discuss your needs. As appropriate, the office will issue students with documented disabilities or medical conditions a formal Accommodations Letter. Since accommodations require early planning and are not retroactive, please contact Student Disability Services as soon as possible. For details about the accommodations process, [visit the Student Disability Services website](#). You are also welcome to contact me privately to discuss your academic needs. However, all disability-related accommodations must be arranged, in advance, through Student Disability Services.

*STAT CLINIC:* Stat clinics are drop-in study sessions run by friendly and knowledgeable upperclassmen every Sunday-Wednesday night 7-10 pm in SC 158. The clinicians who support our course are available on Tuesday and Wednesday evenings. Clinics are a wonderful opportunity to study, do homework, meet/work with classmates, and ask questions about statistics and math. Because clinics are drop-in, you are welcome to come and go as you please. Please write your name and course in the sign-in binder and the time you enter and leave the clinic so the Math/Stat Department has a record of your attendance. To make the most of your time at clinic, be sure to first try problems on your own, or bring questions you have from your text or lecture. Having your textbook, lecture notes, and online resources handy is essential because these are helpful resources for both you and the Clinician working with you. There will likely be other students at Clinic with questions for the Clinician, so be open to working on other problems, thinking about and trying to work through the question you have for the Clinician, working with classmates, or doing other coursework while you wait to speak with the Clinician.

Day	Clinicians	Courses supported
Tuesday	Ben Horvat	Stat 1, 11, 21, 61
Wednesday	Atesh Camurdan	Stat 1, 11, 21, 61

*ACADEMIC SUPPORT COORDINATOR:* Laura Dandridge, our department's friendly neighborhood Academic Support Coordinator, is a terrific resource - she is happy to set up appointments with you ([ldandri1@swarthmore.edu](mailto:ldandri1@swarthmore.edu)).

*TITLE IX:* Please be aware that all faculty are “responsible employees”, which means that if you tell me about a situation involving sexual harassment, sexual assault, dating violence, domestic violence, or stalking, I **must** share that information with the Title IX Coordinator. Although I have to make this notification, you will control how your case will be handled, including whether or not you wish to meet with the Title IX coordinator or pursue a formal complaint.

*COUNSELING AND PSYCHOLOGICAL SERVICES:* If you or anyone you know experiences severe academic stress, difficult life events, or feelings like anxiety or depression, I strongly encourage you to seek support. Counseling and Psychological Services (CAPS) is here to help: call [610-328-7768](tel:610-328-7768) to speak with a licensed counselor at anytime or visit their website at [swarthmore.edu/counseling-and-psychological-services](http://swarthmore.edu/counseling-and-psychological-services) to schedule an appointment. Consider reaching out to me, a friend, faculty or family member you trust for help getting connected to the support that can help.

And finally....

**Take care of yourself.** Do your best to maintain a healthy lifestyle this semester by wearing a mask if you don't feel well, eating a vegetable every day, exercising, avoiding excessive drug and alcohol use, getting enough sleep, and taking some time to relax. Your mental health is more important than your grade in this course. There are many helpful resources available on campus and an important part of the college experience is learning how to ask for help. If you are experiencing mental health symptoms as a result of coursework, please speak with me so we can address the problem together.