

MATH 503: Mathematical Statistics

Course Information and Syllabus

- Instructor:** Dr. Kimberly Sellers
306 St. Mary's Hall
202-687-8829
kfs7@georgetown.edu
- Teaching Assistant:** Mr. Tian Guo
Note: Contact me with any questions or concerns regarding grading.
- Lecture:** Mondays, 6:30-9pm (STM G40)
- Prerequisite¹:** MATH 501 or equivalent
- Office hours:** KFS: Mondays, 4-6pm (STM 306 and on Zoom)
TG: Thursdays, 5-6pm (Zoom)
- Required Text:** Casella and Berger (2002) *Statistical Inference, Second Edition*.
- Recommended Text:** Hogg, McKean, Craig (2013) *Introduction to Mathematical Statistics, Seventh Edition*.

Course Overview:

This is a first course in the mathematical theory of statistical inference. The emphasis is on classical methods, with appropriate attention also to Bayesian methods. Topics include principles of data reduction (sufficiency and sufficient statistics, likelihood, invariance); point estimation (method of moments, maximum likelihood, Bayes estimators) and associated criteria (mean squared error, unbiasedness, consistency); some asymptotic properties of point estimators; construction of and criteria for hypothesis tests (error probabilities and power, most powerful tests, bias); asymptotics of some large sample tests; construction of and criteria for interval estimate; and elements of decision theory and applications to statistical inference (Bayes rules, minimax), analysis of variance (one-way ANOVA, F-test, contrasts), linear regression (least squares, tests for model parameters, pointwise and simultaneous estimation and prediction), and nonparametric methods (e.g., sign test, rank sum test, Wilcoxin test, Mann-Whitney test).

Course Organization:

- 1. Lecture:** Class time will include concepts from the textbook (*Statistical Inference, Second Edition*) in lecture format and discussion of R , where appropriate. You will be expected to learn the concepts found in both the lectures *and* assigned/associated readings.

Lecture notes are to be downloaded **in advance** of the scheduled lecture. For optimal use, it is advised that they be printed, or made available electronically (e.g. on a tablet); this will aid you in following the lecture presentation. Copies of lecture notes will not be supplied in class; therefore, it is your responsibility to come prepared. Note that you will not be able to truly benefit from the lecture notes merely by downloading them from the web. The notes are designed to be interactive during class time.

Completed lecture notes (and possible pre-recorded lectures to allow for instructional continuity) will be available on Canvas following the designated lecture period. You are, however, encouraged to consult other students to learn if any in-class discussion likewise resulted in additionally shared information.

¹ If you do not (or are unsure of whether or not you) meet the pre-requisite, contact the instructor as soon as possible. The instructor reserves the right to nullify the enrollment of students that ignore the pre-requisite requirements.

2. **Homework:** There will be weekly homework assignments that include mathematical problems, proofs, and data analysis. Some assignments will make use of the statistical computational package, *R*. The assignments will be found on Canvas and usually due on Tuesdays by 11:59pm, unless otherwise noted on the website. Your homework should be submitted electronically (in Word or PDF format), directly on Canvas. Make sure you have your name on your assignment. Late homework submissions will be penalized, depending on the degree to which the submission is tardy.

You are allowed and even encouraged to discuss the assignments with each other, but the work that you hand in **MUST BE YOUR OWN**. This means that each student must perform all analyses on his/her own computer, and must independently write up the analysis. Plagiarism will be swiftly dealt with to the full extent allowed under Georgetown policies on cheating and plagiarism (see http://gervaseprograms.georgetown.edu/hc/standards_of_conduct.html).

3. **Exams:** There are two midterm exams (tentatively scheduled to be in-class; projected dates are October 18, 2021 and November 22, 2021) and an in-class final exam scheduled for **Friday, December 10, 2021 (7-9pm)**. The complete final exam schedule is provided at <https://registrar.georgetown.edu/scheduling/final-exams/final-exam-schedule/#>; exam locations are determined by the Office of the Registrar at a later time.
4. **Web page:** The course outline, lecture notes, necessary data, homework assignments and solutions, labs, and supplementary material for this course can be found on Canvas (located at <http://canvas.georgetown.edu>). Lecture notes are to be downloaded and copied prior to class lecture so that you may easily follow the discussion. Homework assignments will be available for retrieval at least one week prior to their due date. Any additional announcements that are made over the course of the semester will also be found/updated on the website.

5. Grading:	Homework:	30% total
	Midterm exam 1:	20%
	Midterm exam 2:	20%
	Final exam:	30%
	Total:	100%

6. Title IX/Sexual Misconduct

Georgetown University and its faculty are committed to supporting survivors and those impacted by sexual misconduct, which includes sexual assault, sexual harassment, relationship violence, and stalking. Georgetown requires faculty members, unless otherwise designated as confidential, to report all disclosures of sexual misconduct to the University Title IX Coordinator or a Deputy Title IX Coordinator. If you disclose an incident of sexual misconduct to a professor in or outside of the classroom (with the exception of disclosures in papers), that faculty member must report the incident to the Title IX Coordinator, or Deputy Title IX Coordinator. The coordinator will, in turn, reach out to the student to provide support, resources, and the option to meet. [Please note that the student is not required to meet with the Title IX coordinator.]. More information about reporting options and resources can be found on the Sexual Misconduct Website: <https://sexualassault.georgetown.edu/resourcecenter>.

If you would prefer to speak to someone confidentially, Georgetown has a number of fully confidential professional resources that can provide support and assistance. These resources include:

- Health Education Services for Sexual Assault Response and Prevention: confidential email sarp@georgetown.edu
- Counseling and Psychiatric Services (CAPS): 202.687.6985 or after hours, call (833) 960-3006 to reach Fonemed, a telehealth service; individuals may ask for the on-call CAPS clinician

More information about reporting options and resources can be found on the [Sexual Misconduct Website](#).

7. COVID-19 Protocols

During these unusual times in the midst of a pandemic, it is important for us to work together to help ensure campus safety. This includes wearing masks, social distancing, and logistics for contact tracing.

Current DC and University guidance requires wearing masks indoors; students are required to wear masks while in class, unless one has a University-approved disability accommodation, and no eating or drinking in class will be permitted, unless one has a medical accommodation. **Please contact me as soon as possible if you have been granted such accommodations.** Free surgical-style masks are available at entrances to University buildings; if you forget a mask or are wearing a cloth mask, please take a free mask and put it on before entering any University building. Hand sanitizer and disinfecting wipes should likewise be available in the classroom. While there is currently no physical distancing required in classrooms, such measures may likewise be implemented, depending on classroom accommodations, class size, etc.

Attendance will be taken during all face-to-face lectures to allow for contact tracing should anyone in the classroom test positive for COVID-19. If you feel ill, have COVID-19 symptoms or a positive test result, PLEASE STAY HOME and report your symptoms via the [COVID-19 Check-In survey](#). Do not worry about missing a class; completed lecture notes and/or recorded lectures will be made available on Canvas to allow for instructional continuity.

If you are not vaccinated and have been exposed to someone who has tested positive for COVID-19, you must stay home and contact the University's Care Navigator Team. A member of the University's Care Navigator Team will get in touch with you and help you through any next steps. You can also email other COVID-19 questions or concerns to covidcarenavigator@georgetown.edu.