



MATH 701: STATISTICAL INFERENCE

Fall 2021

Instructor:	Hadi Safari K.	Meeting:	Thursday 9:30 AM - 12:00 PM
Email:	hsafarik@stevens.edu	Place:	ABS Engineering Center 301

Office Hours: Monday 3:45-4:45 PM; Thursday 12:15-1:15 PM

Office: Kidde 229,

Main References:

- *Statistical inference*, 2nd edition, by George Casella and Roger L. Berger.

Objectives:

- Principles of data reduction (sufficiency, completeness, ancillarity), Point estimation (method of moments, maximum likelihood, mean square error), Hypothesis testing (likelihood ratio test, uniformly most powerful tests), Interval estimation (confidence intervals, coverage probability), Asymptotic evaluation (consistency, efficiency, delta method, convergence in distribution, convergence in probability).
- After successful completion of this course, students will be able to select suitable statistical model for a data set; understand sufficient and minimal statistics; develop parameter estimations using moment method, likelihood principle; construct confidential interval for parameter; perform statistical hypothesis testing and correctly interpret the testing result; find asymptotic properties and distributions of estimators; figure out convergence in probability and convergence in distribution.

Prerequisite(s): Calculus, Elementary probability, Intermediate statistics

Grading Policy:

- Grades will be based on the following:
 - Homework: (30%)
 - Quiz: (10%)
 - Three Class Tests: (30%)
 - Final Exam: (30%)
- Grading will be based on the total points accumulated in the course and the following *approximate* scale will be used:
A: 85% or more B: 73% or more C: 60% or more D: 50% or more F: less than 50%

Course Requirements:

- **Attendance:** Students are encouraged to attend each session and to participate in the discussion. Attendance will be taken into account in borderline cases.
- **Homework:** The homework is supposed to be submitted online in time, and no late homework will be accepted. Homework sets are assigned periodically, with due dates given in the Course Calendar. Homework submissions are due on the due date (in class) before 9:40 am.
- **Quiz:** Quizzes are given weekly based on the homework and class material.
- **Exams:** Three class tests and the Final Exam, which are closed-book. Non-programmable calculators are allowed. Computers/tablets/cell phones/smart watches, and any other electronic devices, especially the ones with wireless communication, are not permitted. Students are not allowed to work with or talk to other students during the exam.

Academic Integrity: All Stevens graduate students promise to be fully truthful and avoid dishonesty, fraud, misrepresentation, and deceit of any type in relation to their academic work. A student's submission of work for academic credit indicates that the work is the student's own. All outside assistance must be acknowledged. Any student who violates this code or who knowingly assists another student in violating this code shall be subject to discipline. All graduate students are bound by the Graduate Student Code of Academic Integrity by enrollment in graduate coursework at Stevens. It is the responsibility of each graduate student to understand and adhere to the Graduate Student Code of Academic Integrity. More information including types of violations, the process for handling perceived violations, and types of sanctions can be found at www.stevens.edu/provost/graduate-academics.

Learning Accommodations: Stevens Institute of Technology is dedicated to providing appropriate accommodations to students with documented disabilities. The Office of Disability Services (ODS) works with undergraduate and graduate students with learning disabilities, attention deficit-hyperactivity disorders, physical disabilities, sensory impairments, psychiatric disorders, and other such disabilities in order to help students achieve their academic and personal potential. They facilitate equal access to the educational programs and opportunities offered at Stevens and coordinate reasonable accommodations for eligible students. These services are designed to encourage independence and self-advocacy with support from the ODS staff. The ODS staff will facilitate the provision of accommodations on a case-by-case basis.

Disability Services Confidentiality Policy: Student Disability Files are kept separate from academic files and are stored in a secure location within the Office of Disability Services. The Family Educational Rights Privacy Act (FERPA, 20 U.S.C. 1232g; 34CFR, Part 99) regulates disclosure of disability documentation and records maintained by Stevens Disability Services. According to this act, prior written consent by the student is required before our Disability Services office may release disability documentation or records to anyone. An exception is made in unusual circumstances, such as the case of health and safety emergencies. For more information about Disability Services and the process to receive accommodations, visit <https://www.stevens.edu/oce-disability-services>. If you have any questions please contact: Phillip Gehman, the Director of Disability Services Coordinator at Stevens Institute of Technology at pgehman@stevens.edu or by phone (201) 216-3748.

Name and Pronoun Usage: As this course includes group work and in-class discussion, it is vitally important for us to create an educational environment of inclusion and mutual respect. This includes the ability for all students to have their chosen gender pronoun(s) and chosen name affirmed. If the class roster does not align with your name and/or pronouns, please inform the instructor of the necessary changes.

Inclusion Statement: Stevens Institute of Technology believes that diversity and inclusiveness are essential to excellence in academic discourse and innovation. In this class, the perspective of people of all races,

ethnicities, gender expressions and gender identities, religions, sexual orientations, disabilities, socioeconomic backgrounds, and nationalities will be respected and viewed as a resource and benefit throughout the semester. Suggestions to further diversify class materials and assignments are encouraged. If any course meetings conflict with your religious events, please do not hesitate to reach out to your instructor to make alternative arrangements. Students are expected to treat the instructor and all other participants in the course with courtesy and respect. Disrespectful conduct and harassing statements will not be tolerated and may result in disciplinary actions.

Mental Health Resources: Part of being successful in the classroom involves a focus on your whole self, including your mental health. While you are at Stevens, there are many resources to promote and support mental health. The Office of Counseling and Psychological Services (CAPS) offers free and confidential services to all enrolled students who are struggling to cope with personal issues (e.g., difficulty adjusting to college or trouble managing stress) or psychological difficulties (e.g., anxiety and depression). Appointments are strongly encouraged and can be made by phone (201-216-5177) or in-person (on the 7th floor of the Howe Center). CAPS is open from 9:00 AM till 5:00 PM Mondays, Wednesdays, Thursdays and Fridays and from 9:00 AM till 7:00 PM on Tuesdays during the Fall and Spring semesters.

Emergency Information: In the event of an urgent or emergent concern about the safety of yourself or someone else in the Stevens community, please immediately call the Stevens Campus Police at 201-216-5105 or on their emergency line at 201-216-3911. These phone lines are staffed 24/7, year round. Other 24/7 resources for students dealing with mental health crises include the National Suicide Prevention Lifeline (1-800-273-8255) and the Crisis Text Line (text "Home" to 741-741). If you are concerned about the wellbeing of another Stevens student, and the matter is not urgent or time sensitive, please email the CARE Team at care@stevens.edu. A member of the CARE Team will respond to your concern as soon as possible.

Refresh Links:

- http://www.mathwords.com/d/derivative_rules.htm
- http://www.mathwords.com/i/integral_rules.htm
- <https://homedir.jct.ac.il/~naiman/la1/>
- <https://homedir.jct.ac.il/~naiman/la2/>

Tentative Weekly Schedule:

- **Week 1-2:** Chapters 5, 6
Statistical models, exponential family distributions, sufficiency, location and scale family, sampling distribution,
- **Week 3-4:** Chapter 7
Auxiliary statistics, completeness, Basu's theorem, point estimation, method of moments, method of maximum likelihood, unbiasedness, mean squared error,
- **Week 5:** Exam 1 (chapters 5-7); chapter 7
UMVUE, Cramer-Rao lower bound, Lehman-scheffe theorem
- **Week 6-7:** Chapter 8
Hypothesis testing and evaluation: Neyman-Pearson lemma, likelihood ratio test, Bayesian test, p-value, power, UMP test
- **Week 8:** Chapter 9
Interval estimation and evaluation: pivotal method, Bayesian method,

- **Week 9:** Exam 2 (chapters 8-9); chapter 9 coverage in probability
- **Week 10-11:** Chapter 9 consistency, coverage in distribution, Slutsky's theorem
- **Week 12-13:** Chapter 10 Asymptotic evaluations: consistency, efficiency, robustness, delta method, asymptotics of likelihood ratio test
- **Week 14:** Exam 3 (chapters 9-10)

GO DUCKS!

