ST 421 Introduction to Mathematical Statistics I

Semester: Fall 2024

Lecture days/times: Mondays/Wednesdays 13:30–14:45

Location: 2229 SAS Hall

3 credit hours

Instructor: Dr. Jonathan Williams
Email: jwilli27@ncsu.edu
Course website: `https://jonathanpw.github.io/ST421`
Office location: 5218 SAS Hall
Office hours: 12:00–14:00 Fridays or by appointment
Office phone: 919.513.0191

Teaching Assistant: Prithwish Ghosh
Email: pghosh4@ncsu.edu
Office hours: TBD

Course Description: First of a two-semester sequence of mathematical statistics, primarily for undergraduate majors in Statistics. Introduction to probability, univariate and multivariate probability distributions and their properties, distributions of functions of random variables, random samples and sampling distributions. Credit is not allowed for both ST 421 and MA 421.

Prerequisite: Calculus 3 (MA 242)

Required Text:
Wackerly, Mendenhall, and Scheaffer (2008). *Mathematical statistics with applications*, 7th edition. Brooks/Cole, Cengage Learning.

Digital Course Components:
Course website: `https://jonathanpw.github.io/ST495`

Grade Distribution:

Exam 1	10%
Exam 2	25%
Exam 3	25%
Final exam	40%

Letter Grade Distribution:

≥ 93.00	A	73.00 - 76.99	C
90.00 - 92.99	A-	70.00 - 72.99	C-
87.00 - 89.99	B+	67.00 - 69.99	D+
83.00 - 86.99	B	63.00 - 66.99	D
80.00 - 82.99	B-	60.00 - 62.99	D-
77.00 - 79.99	C+	≤ 59.99	F

For students taking the course as credit-only, S is equivalent to C- or better; otherwise U.
No expectations beyond attendance apply to students choosing to audit the course.

Exam 1: 13:30–14:45 on Wednesday, 11 September 2024 in 2229 SAS Hall
Exam 2: 13:30–14:45 on Wednesday, 2 October 2024 in 2229 SAS Hall
Exam 3: 13:30–14:45 on Wednesday, 23 October 2024 in 2229 SAS Hall
Final exam: 12:00–14:30 on Friday, 6 December 2024 in 2229 SAS Hall

Personal note to students: Please do not feel intimidated about interacting with the me. Regardless of how busy or stressed I may appear to you, teaching your class is a part of my job, and I take that very seriously. I care deeply about the quality of your learning. Please always reach out to me if you have questions, concerns, or need help. I understand that it can be difficult and can even feel embarrassing to ask for help. However, I was once in your position, and I promise to always treat you with respect, empathy, and kindness. Nobody that ever did anything meaningful did so without first failing over and over again.

Course policies and commentary:

- **Assignments**
  - **Practice homework problems will be assigned each Monday evening. These problems will be relevant (if not identical) to the exam questions**.
  - Take responsibility for understanding solutions to all practice problems. For example, if you find a solution on StackExchange, then convince yourself that the solution is actually correct.
  - **Learn to distinguish between the things you *do* know and the things you *do not* know** (this is one of the most important results of all education). To understand, to *a* particular degree, that a given statement is true means that you can explain why the statement is true, to *the* particular degree.
- **Attendance**
  - Attendance is not recorded.
  - Use lecture time as you feel most productive, but do not use it in a way which is distracting to others.
  - Lecture time is not for answering homework questions; please attend the lab or office hours for homework questions.
- **Class recording statement**
  - No components of this course will be recorded.

Tentative Course Outline:

- Get up to speed in R (2 weeks)
- Linear algebra and singular value decomposition (1 week)
- Least squares problems and projection matrices (1 week)
- Gram-Schmidt orthonormalization, QR factorization, and linear models (1 week)
- Likelihood inference and maximum likelihood estimator (2 weeks)
- Introduction to logistic regression (1 week)
- Gradient descent, ROC curves (1 week)
- Confidence and prediction intervals for linear regression (1 week)
- Hypothesis testing and permutation tests (1 week)
- Bootstrapping (2 weeks)
- Simulation and Monte Carlo methods (2 weeks)
- Missing data and the EM algorithm (1 week)

NCSU Polices, Regulations, and Rules: Students are responsible for reviewing the NC State University Policies, Rules, and Regulations (PRRs) which pertain to their course rights and responsibilities, including those referenced both below and above in this syllabus:

- Equal Opportunity and Non-Discrimination Policy Statement `https://policies.ncsu.edu/policy/pol-04-25-05` with additional references at `https://oied.ncsu.edu/divweb/policies/`
- Grades and Grade Point Average `https://policies.ncsu.edu/regulation/reg-02-50-03`
- Credit-Only Courses `https://policies.ncsu.edu/regulation/reg-02-20-15`
- Audits `https://policies.ncsu.edu/regulation/reg-02-20-04`

Policy on Academic Integrity: Cheating, plagiarism and other forms of academic dishonesty will not be tolerated. Violations of academic integrity will be handled in accordance with the Student Discipline Procedures (NCSU REG 11.35.02). Be aware of the Code of Student Conduct (NCSU POL11.35.01) and Pack Pledge.

Disability Services for Students: Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, students must register with the Disability Resource Office at Holmes Hall, Suite 304, 2751 Cates Avenue, Campus Box 7509, 919-515-7653. For more information on NC State's policy on working with students with disabilities, please see the Academic Accommodations for Students with Disabilities Regulation (NCSU REG 02.20.01).

Privacy: Students may be required to disclose personally identifiable information to other students in the course, via digital tools, such as email or web-postings, where relevant to the course. Examples include online discussions of class topics, and posting of student coursework. All students are expected to respect the privacy of each other by not sharing or using such information outside the course.