Syllabus DTSC 8110-Statistics for Data Science

Fall 2025

Thursday 5:30-8:15PM

Instructor information

Name: Shaoyu Li
Office: 345-F Fretwell
Email: sli23@charlotte.edu
Office Hours: TR 1:00-2:30PM
If you cannot make it to my regularly scheduled office hours, email me to set-up a different time that works for both of us.
My Visual Office:
https://charlotte-edu.zoom.us/my/sli23?pwd=MGZ5YWhpc09URlVYc2FiamdnaE9FQT09

Course information:

DTSC 8110:	Statistics for Data Science
Semester/Year:	Fall 2025
Class Time:	5:30-8:15PM
Place:	Colvard 5096
Reference books:	**Statistical Inference** (2nd Edition) by George Casella and Roger L. Berger-For theoretical foundation **The Elements of Statistical Learning** by Hastie, Tibshirani, and Friedman-For statistical learning and modern techniques.

Prerequisite: Enrolled in the Ph.D. program in Data Science or permission of the instructor.

Course Overview

The course equips students with essential statistical concepts and practical skills, illustrated through examples solved using statistical software in the context of data science. Topics include probability theory, random variables, probability distributions, random samples and statistical models, point estimation, interval estimation, hypothesis testing, variance analysis, regression models, and statistics in machine learning.

Software used: R https://www.r-project.org/

Grading Policies:

Your grade of the course will be based on the following:

Homework Assignments (30%): Roughly one homework assignment per week.
Exams: There will be one midterm exam and the final exam **(50%)**

Midterm Exam:	Thursday, October 16th, 5:30-7:00PM
Final Exam:	Tuesday, December 9th, 5:00-7:30PM

LAB assignments (20%): There will be several LAB assignments throughout the semester. Lab assignments will be about implementing probability and statistical methods learned in class using a software, for example R. Lab assignments worth 20% of your final grade,

Course grades follow the scale listed below **(not curved):**

90-100%	4.0 (Excellent)
80-89%	3.0 (Good)
70-79%	2.0 (Fair)
60-69%	1.0 (Passing)
0-59%	0.0 (Failing)

Class Policies:

Late homework policy: Homework is due at the beginning of class on Thursday. No late homework will be accepted.

Exam Make-up Policy: *NO make-up* will be given unless a valid reason is presented before the time of the exam or after it in the case of an emergency. Only extreme situations with an official documented excuse will allow a student to be "excused" from an exam.

Attendance Policy:

Attendance is VERY IMPORTANT for this class and **is mandated** (see grading policy below). To be eligible to receive credits for each attendance, you **should not come in late or leave early for the class**. Students are responsible for the loss from the class which you are absent from, including all class participation activities. Excused absence must be accompanied by official documentation that clearly states that you are physically unable to make the class.

Grade-change Policy: if you have any questions regarding the grading of any of your graded material, you should return the graded material to your instructor and attach a short note with your questions *before leaving* the classroom. This must be done on the day that the instructor hands back the material in class. Once the graded material has left the classroom, no grading changes will be made.

Academic Integrity:

Please see the college handbook on academic dishonesty. Anyone caught cheating, at best, will fail the course, and worst, taken in front of the Academic Integrity Board (AIB) for a hearing on the merits of the offense and with a conviction, removed from the university with a mark on their permanent record. The full text of University Policy 407, The Code of Student Academic Integrity, can be found at http://legal.uncc.edu/policies/up-407.

All your work should reflect your own thinking. You can ask your classmates questions to clarify your thinking process, however, your work should be your own and not look like your classmates' work. If you get help at the tutoring center, try to understand the general outline and then try to work through the problem on your own, rather than have the tutor just work the problem out for you. Being an independent thinker will give you the confidence to teach the material later. It is your responsibility to be familiar with the UNCC Honor Code and abide by it in all your classes. All work turned in on tests and assignments must be exclusively your own, unless explicitly asked to be done in a group.

Copyright:

My lectures and course materials, including presentations, tests, exams, outlines, and similar materials, are protected by copyright. I am the exclusive owner of copyright in those materials I create. I encourage you to take notes and make copies of course materials for your own educational use. However, you may not, nor may you knowingly allow others to reproduce or distribute lecture notes and course materials publicly without my express written consent. This includes providing materials to commercial course material suppliers such as CourseHero and other similar services. Students who publicly distribute or display or help others publicly distribute or display copies or modified copies of an instructor's course materials may be in violation of University Policy 406, The Code of Student Responsibility. Similarly, you own copyright in your original papers and exam essays. If I am interested in posting your answers or papers on the course web site, I will request your written permission.

Electronic video, image capture, and/or audio recording is not permitted during class, whether conducted in person or online, unless the student obtains permission from the instructor. If permission is granted, any distribution of the recording is prohibited. Students with specific electronic recording accommodations authorized by the Office of Disability Services do not require instructor permission; however, the instructor must be notified of any such accommodation prior to recording. Any distribution of such recordings is prohibited.

Special Needs:

UNC Charlotte is committed to access to education. If you have a disability and need academic accommodations, please send me your accommodation letter as early as possible. You are encouraged to meet with me privately to discuss the accommodations outlined in your letter. For more information on accommodations, contact the Office of Disability Services at 704-687-0040 (Fretwell 230).

Religious Accommodation for Students:

The University of North Carolina at Charlotte is committed to nondiscrimination and inclusiveness and to supporting its students, regardless of religious affiliation or non-affiliation, in accordance with state and federal laws and regulations. In general, state entities such as The University of North Carolina at Charlotte may enforce neutral rules of general applicability even if the rule may affect someone's religious practice or belief. However, the University makes good faith efforts to accommodate a student's religious practice or belief, unless such accommodation would create undue hardship (https://legal.charlotte.edu/policies/up-409).

Some Important Days:

Date	Events
August 18, 2025	First day of classes.
August 25, 2025	Last day to add, drop a course with no grade.
August 26, 2025	Second Cancellation for nonpayment.

Date	Events
September 1, 2025	Labor Day - No Classes
October 9-10, 2025	Student Recess-No Classes
October16, 2025	Last day to change Grade Type (P/NC or Audit) Last day to withdraw from course(s); grade subject to Withdrawal Policy.
November 11, 2025	Veteran’s Day-No Classes.
November 26-29, 2025	Thanksgiving Break-No Classes.
December 2, 2025	Last day of classes.

Tentative schedule

Week	Date	Topics

1	August 21	• **Probability Theory**
		  ○ Set Theory
		  ○ Basics of Probability Theory
		  ○ Conditional Probability and Independence
		  ○ Bayes' Theorem and Bayesian Thinking
		  ○ Random Variables
		  ○ Distribution Functions
		  ○ Density and Mass Function

2	August 28	• **Transformations and Expectations**
		  ○ Distribution of Functions of a Random Variable
		  ○ Expected Values
		  ○ Moments and Moment Generating Functions
		  ○ Differentiating Under an Integral Sign

3	September 4	• **Multiple Random Variables**
		  ○ Joint and Marginal Distributions
		  ○ Conditional Distributions and Independence
		  ○ Covariance and Correlation

4	September 11	• **Random Sample**
		  ○ Basic Concepts of Random Samples
		  ○ Sampling from the Normal Distribution
		  ○ Order Statistics
		  ○ Convergence Concepts
		  ○ LAB 1: Generate random samples and demonstrate the convergence of sample mean.

5	September 18 (Zoom Meeting)	• **Hypothesis testing**
		  ○ Methods of Finding Tests-LRT
		  ○ Methods of Evaluating Tests
		• **Multiple testing and false discovery rate**

6	September 25	• **Point Estimation**
		  ○ MOM
		  ○ MLE
		  ○ Bayes Estimators
		  ○ The EM Algorithm

7	October 2	• **Hypothesis Testing**
		  ○ Methods of Finding Test (LRT)
		  ○ Methods of Evaluating Tests (type I/II errors, etc.)
		• **Interval Estimation**

		○ LAB 2: simulation to summarize type I and type II error rates.
8	*October 9*	*Fall Break, no class*
9	October 16	• Midterm Exam (One and a half hour) • Analysis of Variance ○ One-Way ANOVA
10	October 23	• **Simple Linear Regression** ○ Least squares ○ BLUE ○ Testing and Prediction
11	October 30	• **Regression Models** ○ Logistic Regression ○ Ridge Regression ○ LASSO
12	November 6	• **Modern Statistical Methods** ○ Bootstrap and Resampling Methods ○ Bayesian Inference (Intro to MCMC) ○ Causal Inference: ATE, propensity scores, DAGs ○ Missing Data Methods
13	November 13	• **Statistics Meets Machine Learning** ○ Model Evaluation (Bias-Variance, Cross-validation, AUC, Precision/Recall) ○ Unsupervised Learning: PCA, Clustering with statistical perspective
14	November 20	• **Applications & Projects** ○ Guest lectures from statisticians or data scientists in academia/industry ○ Real-world data analysis project presentations
15	November 27	Thanksgiving
16	Final Exam	

Note: It is your responsibility to stay informed about all class announcements made in class, via email, or on Canvas. The instructor reserves the right to adjust the policies outlined above if deemed academically necessary. You are responsible for attending classes and noting any changes. Exceptions to these policies will only be considered with approved official documentation.