STA 303 Mathematical Statistics

Winter 2024

Course Credits: 4
Contact Hours: 56 hours
Instructor: TBA
Email: TBA

COURSE OBJECTIVES

This course provides an introduction to the fundamental concepts and techniques of mathematical statistics. In this course, classical statistical inference procedures in estimation and testing are explored extensively. Topics include multivariate distributions, the normal distribution, sampling and statistics, hypothesis testing, consistency and limiting distributions, maximum likelihood methods, Rao–Cramér lower bound and efficiency, and point estimation and interval estimation. Additionally, this course enhances students' comprehension and retention through numerous illustrative examples and exercises.

Upon completion of this course, students will be able to:

1. Comprehend the relevant theories of mathematical statistics

2. Appreciate the connection between statistical theory and statistical practice

3. Demonstrate knowledge of the applicable large sample theory of estimators and tests

4. Explain the concept of likelihood and derive the likelihood and associated functions of interest for simple models

5. Explain the principles of Bayesian statistical inference

6. Apply mathematical techniques to real-world statistical problems

PREREQUISITES

STA 201 Introduction to Statistics

GRADING

Grades will be determined by accumulating points, with 100 points being the maximum, as follows:

ITEM	POINTS
Quizzes	20 Points
Assignments	20 Points
Midterm 1	15 Points
Midterm 2	15 Points
Final Exam	30 Points
Total	100 Points

Late submissions will be graded at the end of the course. Grades will be assigned according to the following rule:

A ≥ 90 > B ≥ 80 > C ≥ 70 > D ≥ 60 > F.

We reserve the right to make adjustments to the overall grading policy.

COURSE MATERIALS

Required Texts:

Robert V. Hogg, Joseph W. McKean, Allen T. Craig, *Introduction to Mathematical Statistics*, 8th Edition, Pearson, 2019.

Recommended (Optional) Texts or Other Materials:

None

COURSE TOPICS

MODULE	TASKS
Module 1	**Topics:** Topic 1: Introduction to Probability Theory Topic 2: Random Variables and Probability Distributions Topic 3: Multivariate Distributions Topic 4: Some Special Distributions **Assessments:** Quiz#1

Module 2	**Topics:**
	Topic 5: The Normal Distribution;
	        The Multivariate Normal Distribution
	Topic 6: Some Elementary Statistical Inferences
	        Sampling and Statistics
	Topic 7: Confidence Intervals
	Topic 8: Hypothesis Testing
	Assessments:
	Quiz#2
	Assignment#1

Module 3	**Topics:** Topic 9: Consistency and Limiting Distributions Topic 10: Central Limit Theorem Topic 11: Maximum Likelihood Methods Topic 12: Maximum Likelihood Estimation Rao-Cramér Lower Bound and Efficiency **Assessments:** Midterm#1
Module 4	**Topics:** Topic 13: Sufficiency Topic 14: Optimal Test of Hypotheses Topic 15: Inferences About Normal Linear Models Topic 16: Nonparametric and Robust Statistics **Assessments:** Midterm#2 Assignment#2
Module 5	**Topics:** Topic 17: Bayesian Statistics Topic 18: Bayesian Procedures Topic 19: Modern Bayesian Methods Topic 20: Final Exam Reviews **Assessments:** Final Exam

ATTENDANCE

1) Class attendance is required. Missing classes without permission will lead to decrease in overall grade.

Missing less than two classes: no penalty.

Missing more than two classes: 7% will be taken off from the overall grade.

If the instructor reports a student's frequent missing of class to the Soochow University Academic Administration Office, the student might get a written warning and might be prohibited from attending final exam.

2) Participants in this course are expected to arrive in class promptly and adequately prepared. The primary objective of this course is to critically engage with the readings and the subject matter. Therefore, course participants are expected to have completed the reading prior to class and prepare thoughtful reflections/commentaries to share with fellow colleagues.

LEARNING REQUIREMENTS

1) Late assignments are not acceptable and are subjected to grade deductions.

2) Assignments submitted in the wrong format will be counted as not submitted.

3) Failure to submit or fulfill any required course component results in failure of the class.

4) Make-up for midterm and final exams only with valid excuses, as defined by the University.

5) In order to earn a Certificate of Completion, participants must thoughtfully complete all assignments by stated deadlines and earn an average quiz score of 50% or greater.

TECHNOLOGY POLICY

The use of electronic devices in class is distracting, both for the user and for the rest of the class. Only non-programmable calculators can be used in the tests and exam. Any attempts to use cell phones and other electronic communication devices will be seemed as cheating. Laptops are discouraged, unless you use them for activities DIRECTLY related to the course (e.g., note taking, reading course documents).

ACEDEMIC INTEGRITY POLICY

Soochow University highly values the academic integrity and aims to promote the academic fairness, honesty and responsibility. Any academic dishonesty behaviors and any attempts to cheats and plagiarism will be reported to the university administration office. A written warning and the relevant penalties will be imposed.

The record might be shown on the official university transcript.

DISABILITY ACCOMMODATION

Soochow University is committed to maintaining a barrier-free environment so that students with disabilities can fully access programs, courses, services, and activities at Soochow University. Students with disabilities who require accommodations for access to and/or participation in this course are welcome.

Note:

Please contact the University Administrative Office immediately if you have a learning disability, a medical issue, or any other type of problem that prevents professors from seeing you have learned the course material.