East China Normal University

GEC International Summer School

MAT204: Intermediate Statistical Methods

Term: June 16th to July 18th, 2025
Class Hours: Monday through Friday, 110 minutes each day (2,750 minutes in total)
Instructor: TBD
Home Institution: TBD
Office Hours: TBD
Email: TBD

Course Description

This course covers the fundamentals of theoretical statistics. Topics include: concentration of measure, basic empirical process theory, convergence, point and interval estimation, maximum likelihood, hypothesis testing, Bayesian inference, nonparametric statistics and bootstrap resampling. This course is excellent preparation for advanced work in Statistics and Machine Learning.

Prerequisite: MAT202.

Course Objectives

1. To conceptually understand the use of multiple linear regression, ANOVA for fixed, random, and mixed designs, logistic and poisson regression, and log-linear models for statistical inference.
2. To properly apply these methods to real world problems using statistical software and draw valid conclusions.
3. To present (both written and oral) these conclusions in a concise and clear manner.

Required Text

Probability and Statistics for Engineering and Science, by Devore, Jay, Edition 9, Cenage.

Course Hours

The course has 25 class sessions in total. Each class session is 110 minutes in length, for a total of 2750 minutes of in-class time. The course meets from Monday to Friday. ECNU awards 3 credits for this course. Different universities may count course credits differently. Consult officials at your own home institution.

Attendance

Summer school is very intense and to be successful, students need to attend *every class*. Occasionally, due to illness or other unavoidable circumstance, a student may need to miss a class. ECNU policy requires a medical certificate to be excused. Any absence may impact on the student's grade. Moreover, ECNU policy is that a student who has more than 3 absences will fail the course. Arriving late or leaving early will count as a partial absence.

Grading Policy

ECNU awards grades of A, A-, B+, B, B-, C+, C, D, and F. Most colleges and universities do not award transfer credit for grades of D or F.

In this course, grading will be based on the following:

Quizzes*2	10%*2=20%
Participation	10%
Midterm Exam	30%
Final Exam	40%

General Expectations

Students are expected to:

- Attend all classes and be responsible for all material covered in class and otherwise assigned. Any unexcused absence may impact a student's grade.
- Arrive to class on-time: Late arrivals are disruptive to your fellow students and to the conduct of the class.
- Complete the day's required reading and assignments before class.
- Review the previous day's notes before class; make notes about questions you have about the previous class or the day's reading.
- Refrain from texting, phoning or engaging in computer activities unrelated to class during class (不要用手机). It is highly disrespectful to the professor and to the class.
- Participate in class discussions and complete required written work on time.

Course Schedule

The planned schedule sketched out below may be modified to suit the interests or abilities of the enrolled students or to take advantage of special opportunities or events that may arise during the term.

Week 1

- Day 1
  o Overview of the course
  o Concentration Inequalities

- Day 2
  o Probability Axioms
  o Tool for Calculating Probabilities
  o Dependence and Conditional Probability

- Day 3
  o Convergence
  o Continuous Random Variables

- Day 4
  o Binomial Distribution
  o Hypergeometric Distribution

- Day 5

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- o *Tutorial/Discussion*

Week 2

- − *Day 1*
  - o *Central Limit Theorem*
  - o *Covariance and Correlation*
- − *Day 2*
  - o *Uniform Laws and Empirical Process Theory*
  - o *Data Sources and Describing Data*
- − *Day 3*
  - o *Measures of Location, Spread*
  - o *Hypothesis Testing for a Population Expectation*
- − *Day 4*
  - o *Tests for a Single Population Expectation*
  - o *One-sample binomial testing*
- − *Day 5*
  - o *Tutorial/ Discussion*
  - o *Quiz 1*

Week 3

- − *Day 1*
  - o *Likelihood and Sufficiency*
  - o *Estimation and Confidence Intervals*
- − *Day 2*
  - o *Confidence Interval as Inversion of Test*
- − *Day 3*
  - o *Power and Sample Size Selection*
  - o *Two-sample inference: Independent Samples*
  - o *Two-sample inference: Matched pairs*

- *Day 4*
  - *Midterm Review Session*
- *Day 5*
  - *Midterm*

Week 4

- *Day 1*
  - *Point Estimation (MLE)*
  - *Single-Factor Analysis of Variance*
- *Day 2*
  - *Multi-Factor Analysis of Variance Without Replicates*
  - *Multi-Factor Analysis of Variance With Replicates*
- *Day 3*
  - *Point Estimation (Method of Moments, Bayes)*
  - *Least Squares Estimation*
- *Day 4*
  - *Decision Theory*
  - *Asymptotic Theory*
- *Day 5*
  - *Tutorial/Discussion*
  - *Quiz 2*

Week 5

- *Day 1*
  - *Hypothesis Testing*
  - *Multiple Testing*
- *Day 2*
  - *Transformation to linearity*
  - *Multiple Regression*

- *Day 3*
  - o *Polynomial Regression*
  - o *Confidence Intervals*
  - o *Categorical Variables*
- *Day 4*
  - o *Final Exam Review Session*
  - o *Tutorial/Discussion*
- *Day 5*
  - o *Final Exam*

Academic Honesty

Students are expected to maintain high standards of academic honesty. Specifically, unless otherwise directed by the professor, students may not consult other students, books, notes, electronic devices or any other source, on examinations. Failure to abide by this may result in a zero on the examination, or even failure in the course.