Probability Theory and Mathematical Statistics

Fudan University

Department: School of Economics

Date: 2024-01-02

Course Code	ECON130264.01		
Course Title	Probability Theory and Mathematical Statistics		
Credit	5	**Credit Hours**	90
Course Nature	□Specific General Education Courses □Core Courses □General Education Elective Courses □Basic Courses in General Discipline Professional Compulsory Courses □Professional Elective Courses □Others		
Course Objectives	After you finish the course, you are supposed to - Develop a deep understanding of probability and statistics and a solid intuition for statistical concepts. - Learn how the mathematical ideas of statistics carry over into the world of applications in economics and finance.		
Course Description	Why do we need to teach probability and statistics to undergraduate students in economics? Put it simply, it provides necessary probability and statistics background for undergraduate for their courses in econometrics, microeconomics, and macroeconomics. Statistics and mathematics are two basic analytic tools in economics. Statistics is an essential tool to study situations involving uncertainties, in the same way as calculus is essential to characterize optimizing behaviors in economics. For example, probability theory is needed in study of game theory. In macroeconomics, as Robert Lucas points out, the introduction of stochastic factors can provide much new insights into dynamic economic systems. Indeed, probability and statistics are necessary analytic tools in every field of economics. Of course, the demand for probability and statistics varies from field to field in economics, with econometrics most heavily using it. The analysis will be conducted in a relatively rigorous manner. Formal proofs will be given for some important theorems, because the proofs themselves can aid understanding and in some cases, the proof techniques or methods have practical value. In addition to developing a fundamental understanding of probability		

and mathematical statistics that are most relevant to modern econometrics, this course also tries to develop a sound intuition for statistical concepts from economic perspective. For example, why are statistical concepts (e.g., mean and variance) useful in economics? What are economic intuition and interpretation for the probability and statistical relations?

Course Requirements:

Prerequisites: Economic Mathematics I (EC103). The course is self-contained.

Teaching Methods:

Lectures and homework assignments.

Instructor's Academic Background:

Xiaohu (frank) WANG is an associate professor at the School of Economics, Fudan University. He graduated from Singapore Management University with a Ph.D. degree in Economics. Before joining Fudan University, he worked at the Chinese University of Hong Kong for many years. His main research interests are financial econometrics and empirical asset pricing.

Course Schedule
Chapter 1: Introduction to Econometrics (1 hours)

Chapter 2: Foundation of Probability Theory (9 hours)
 2.1 Random Experiments
 2.2 Basic Concepts of Probability
 2.3 Fundamental Probability Laws
 2.4 Conditional Probability and Independence
 2.5 Bayes' Rule

Chapter 3: Random Variables and Probability Distributions (9 hours)
 3.1 Random Variables and Distribution Functions
 3.2 Discrete Random Variable
 3.2 Continuous Random Variables
 3.3 Functions of a Random Variable
 3.4 Joint Probability Distribution

3.5 Conditional Probability Distribution

3.6 Independence

Chapter 4: Mathematical Expectations (8 hours)

4.1 Univariate Mathematical Expectations

4.2 Moments and Moment Generating Function

4.3 Multivariate Mathematical Expectations

4.4 Covariance and Correlation

4.5 Conditional Expectations and Conditional Moments

Midterm Exam

Chapter 5: Introduction to Sampling Theory and Statistics (9 hours)

5.1 Normal Distribution

5.2 Student's t Distribution

5.3 Snedecor's F Distribution

5.4 Chi-square Distribution

5.5 Central Limit Theorem

5.6 Population and Random Sample

5.7 Sampling Distribution of Sample Mean

5.8 Sampling Distribution of Sample Variance

Chapter 6: Parameter Estimation and Evaluation (12 hours)

6.1 Population and Parameter Estimation

6.2 Point Estimators and Mean Squared Error Criterion

6.3 Best Unbiased Estimators

6.4 Confidence Interval Estimators

Chapter 7: Hypothesis Testing (9 hours)

7.1 Introduction to Hypothesis Testing

7.2 Hypothesis Testing for Population Mean

7.3 Hypothesis Testing for Population Variance

Chapter 8: Conclusion (6 hours)

Final Exam

The design of class discussion or exercise, practice, experience and so on:

No class discussion. TA session will be given for problem solving and practice. Homework is assigned weekly.

If you need a TA, please indicate the assignment of assistant:

TA: Liyuan Shang

Grading & Evaluation (Provide a final grade that reflects the formative evaluation process):

Homework: 20%
Midterm: 35% , closed-book
Final: 45% , cumulative, closed-book

Teaching Materials & References (Including Author, Title, Publisher and Publishing time):

Pishro-Nik, "Introduction to probability, statistics, and random processes", available at https://www.probabilitycourse.com, Kappa Research LLC, 2014.

Hong, "Probability and Statistics for Economists", World Scientific, 2017

Walpole, Myers, Myers and Ye., Barry, "Probability and Statistics for Engineers and Scientists", Pearson, 2016.