Nankai University

Undergraduate Course Syllabus

1. Course Information

Course Name	Mathematical Statistics						
Course Number	FINA0110						
Course Type	☐Compulsory course -- Liberal Arts Education ☐Elective course -- Liberal Arts Education ■Compulsory course -- Professional ☐Elective course -- Professional						
Credit	2.5	**Lecture Hours**	48	**Practicum Hours**	0	**Total Hours**	48
Grading Structure	■Percentage system ☐Pass/Fail System						
Course Provider	School of Finance						
Prerequisite courses	Calculus, Linear Algebra, Probability						
Course Director	Min Song, Haibin Wang, Jiening Pan						

Course Textbooks and Reference Materials

	Authors	**Title**	**Publishing House**	**ISBN**
Textbooks	David R. Anderson; Dennis J. Sweeney; Thomas A. Williams; Jeffrey D. Camm; James J. Cochran	Statistics for Business & Economics	Cengage Learning	9781337901062
Reference Materials	**Authors**	**Title**	**Publishing House**	**ISBN**
	Junping Jia; Xiaoqun He; Yongjin Jin	Statistics	China Renmin University Press	9787300253510
	Xiaotong Zhang	Applied Econometrics	China Machine Press	9787111265757

2. Course Introduction

As a science of methodology studying on how to collect, clean, display and analyze data, Mathematical Statistics aims to teach students how to use scientific statistical theories and methods to understand quantitatively the regularity of development and the changes of objective things. This course will provide students with basic knowledge, theory and methods to lay the foundation for other courses and related work. This course is mainly for second-year undergraduate students. The main content of the course includes:

- Random sampling and several important distributions;
- Point estimation including moment approach, percentile matching, and maximum likelihood;
- Bias, variance, MSE, Fisher information matrix, Cramér-Rao lower bound, consistency, efficiency, and UMVUE;
- Confidence intervals estimation, including the mean of samples from a normal population, differences of means of samples from two normal population, variances, and proportions;
- Neyman-Pearson lemma, significance and power, and information criteria;
- Hypothesis test, including mean, variance, χ^2 test on contingency tables and goodness-of-fit and likelihood ratio test;
- Linear regression, least square estimation, t-test and F-test, prediction and analysis of residuals;
- Analysis of variance.

Through the teaching process, on the one hand, students are required to understand the basic principles of statistics and master the basic ideas of statistics. On the other hand, students should develop habits of thinking and use statistical knowledge to "discover problems, analyze problems, and solve problems" to improve students' professional application skills.

3. Course Content and Teaching Arrangements

Num	Content	Hours	Type
1	**Chap 1:** Sampling distributions ● Concept of random sampling; ● Concept of statistical inference; ● Normal, t, F and χ^2 distribution.	6	Lecture, discussion
2	**Chap 2:** Point estimation ● Moment matching; ● Percentile matching; ● Maximum likelihood method, Fisher information matrix, Cramér-Rao lower bound ● Properties of an estimator: bias, variance, MSE, consistency, efficiency, and UMVUE.	12	Lecture, discussion, online quiz
3	**Chap 3:** Confidence Interval ● Mean from one normal population;	7	Lecture, online quiz

	● Differences of two means; ● Variances from one normal population; ● Variance proportions.		
4	**Chap 4:** Hypothesis test ● Basic problems of hypothesis test; ● Neyman-Pearson lemma, significance and power, and information criteria; ● Test on mean and variance; ● χ^2 test on contingency tables and goodness-of-fit; ● Likelihood ratio test.	6	Lecture, discussion, online quiz
5	**Chap 5:** ANOVA ● Introduction to ANOVA; ● One-way ANOVA; ● Two-way ANOVA.	7	Lecture, online quiz
6	**Chap 6:** Univariate linear regression ● Least square estimator; ● T-test and F-test; ● Prediction using linear regression; ● Analysis of residuals	10	Lecture, discussion, online quiz

4. Course Assessment

The course assessment consists of two main parts, one part is quiz and homework, accounting for 30%. The other part is a closed-book examination, which assesses students' knowledge mastery and accounts for 70% of the total.