

**COURSE SYLLABUS
FOR FULL-TIME UNDERGRADUATE PROGRAMS**

(Issued under Decision No.1380/QĐ-ĐHKTQĐ on 15/8/2016 by the University President)

1. COURSE NAME: Mathematical Statistics

Code: TOKT1110

Number of Credit: 03

2. DEPARTMENT IN CHARGE OF INSTRUCTION

Office: Faculty of Mathematics for Economics

Office Hours: Working hours, the working day

Office Telephone: (84) 04 3628 3007

3. PRE-REQUISITE

Probability Theory

4. COURSE DESCRIPTION

This is a basic module for Applied Mathematics subjects in economics. This module provides mathematical methods in statistics.

The course provides students with the theory of random sampling method, estimation and hypothesis testing for the parameters of the probability distribution of the theoretical approach to make decisions.

This module is the basis for the statistical programs expert analysis: multivariate statistical analysis, econometrics and other subjects using statistical tools and mathematical models for the statistics.

5. COURSE OBJECTIVES

Students should be able to:

- Understand the theory of sampling, estimation and hypothesis testing; Do research on common statistical models.
- Model economic and social problems in the form of statistical problems.
- Master skills of solving estimations and test the basic hypothesis with the help of an Excel spreadsheet.
- Set simple automatic sheet, use functions and procedures for statistical problems.

6. COURSE CONTENTS

TENTATIVE SCHEDULE

<i>No</i>	<i>Contents</i>	<i>Total hours</i>	<i>In details</i>		<i>Notes</i>
			<i>Theory</i>	<i>Practice, Discussion, Exams</i>	
1	Chapter 1	10	6	4	<i>Students need to practice on the computer all the exercises</i>
2	Chapter 2	14	10	4	
3	Chapter 3	12	8	4	
4	Chapter 4	9	6	2+1	
	Total	45	29	16	

CHAPTER 1– RANDOM SAMPLES

This chapter introduces random sampling methods in statistical analysis. Students have to understand:

- The difference between population and random samples
- Statistical concepts, the statistical characteristics of samples and their distribution.
- Methods of describing samples and the difference between the value of a statistical observation and the value reflected by this statistics.

In terms of skills, students are required to:

- Calculate the values of the characteristics observed in the cases statistically different figures
- Use the Microsoft Excel spreadsheets to calculate directly the characteristics; use Excel functions and utilities to describe statistical data for one table.

In addition, students should know the random simulation to better understand the nature of convergence of some important statistics.

1.1. Sampling methods

1.1.1. Random samples

1.1.2. Define

1.1.3. Sampling distribution

1.2. Statistics

1.2.1. Define

1.2.2. Statistics of random samples

1.3. Sample means

- 1.3.1. Expectation and variance
- 1.3.2. Sample mean distribution - normal distribution
- 1.3.3. Sample mean distribution – other distribution and large sample size
- 1.4. Statistics S_0^2
 - 1.4.1. Expectation and variance
 - 1.4.2. Probability distribution - normal distribution
- 1.5. MS and sample variance S^2
 - 1.5.1. Expectation and variance
 - 1.5.2. Independence and probability distribution – normal distribution
- 1.6. Descriptive statistics
 - 1.6.1. Frequency and relative frequency
 - 1.6.2. Observed statistics
- 1.7. The value of sample characteristics with statistics softwares
- 1.8. Multidimensional random samples
 - 1.8.1. Sample description
 - 1.8.2. Sample characteristics of variables
 - 1.8.3. Sample characteristics of relationships

Exercises for chapter 1

Practice:

- Use Excel spreadsheets, formulas, functions
- Calculate the basic statistics
- Simulate random distribution
- Surveying the convergence of the point estimate of the real value
- Set up simple spreadsheet automation.

References of the chapter:

1. Ngo Van Thu, 2010, The Mathematical Statistics, Science and Technology Publisher, Chapter 1.
2. Nguyen Cao Van, Tran Thai Ninh, and Ngo Van Thu, 2011, Probability Theory and Mathematical statistics, NEU, Chapter 6.
3. Nguyen Cao Van, Tran Thai Ninh, 2009, Exercise of probability theory and mathematical statistics, NEU.
4. Ngo Van Thu, 2015, Statistics Practicing, NEU, Chapter 2.
5. Ronald J. Thomas H. Wonnacott and Wonnacott, 1990, Introductory statistics for business and economics, Wilay. Chapter 5-6.
6. Dale J. Piorier, 1995, Intermediate Statistics and Econometrics, Prentice - Hall International, Chapter 2-3.
- Allen Webster 7, 1992, Applied Statistics for Business and Economics, Chapter 4-5.

CHAPTER 2 - PARAMETER ESTIMATION

This chapter presents theory of parameter estimation, including point estimates and confidence interval estimates.

2.1. Estimation problems

2.2. Point estimate

2.2.1. Decision making theory

2.2.2. Properties of estimators

2.2.3. Maximum likelihood estimators

2.2.4. Posterior maximum likelihood estimators

2.3. Interval estimate

2.3.1. Confidence intervals

2.3.2. Confidence intervals of p in the $A(p)$

2.3.3. Confidence intervals of μ in the $N(\mu; \sigma^2)$

2.3.4. Confidence intervals of σ^2 in the $N(\mu; \sigma^2)$

2.3.5. Microsoft Excel using

Exercises for Chapter 2

References of chapter

1. Ngo Van Thu, 2010, The Mathematical Statistics, Science and Technology Publisher, Chapter 2.
2. Nguyen Cao Van, Tran Thai Ninh, Ngo Van Thu, 2011, Probability Theory and Mathematical Statistics, NEU, Chapter 7.
3. Nguyen Cao Van, Tran Thai Ninh, 2009, Probability Theory and Mathematical Statistics Exercise, NEU.
4. T.W. Anderson, 1984, An introduction to multivariate statistical analysis, Wiley, Chapter 6
5. Ronald J. Thomas H. Wonnacott and Wonnacott, 1990, Introductory statistics for business and economics, Wilay, Chapter 5-6.

CHAPTER 3 - HYPOTHESIS TESTING

This chapter introduces the theoretical basis of the construction process to make a hypothesis testing for parameters.

3.1. Basic concepts

3.1.1. Hypothesis testing problems

- 3.1.2. Loss function
- 3.1.3. Decision function
- 3.1.4. Risk function
- 3.1.5. The action probabilities
- 3.1.6. The error probabilities
- 3.1.7. Hypothesis – rejected area
- 3.1.8. Examples
- 3.1.9. Lemma Neyman - Pearson
- 3.2. Parameter hypothesis testing
 - 3.2.1. Testing μ in $N(\mu; \sigma^2)$
 - 3.2.2. Testing p in $A(p)$
 - 3.2.3. Testing σ^2 in $N(\mu; \sigma^2)$
 - 3.2.3. Testing two parameters
- 3.3. Testing for restrictions
 - 3.3.1. Wald test
 - 3.3.2. Maximum log-likelihood test
- 3.4. Microsoft Excel using
- Exercises for Chapter 3

References of the chapter

1. Ngo Van Thu, 2010, The Mathematical Statistics, Science and Technology Publisher, Chapter 3.
2. Nguyen Cao Van, Tran Thai Ninh, and Ngo Van Thu, 2011, The curriculum theory of probability and mathematical statistics, NEU, Chapter 8.
3. Nguyen Cao Van, Tran Thai Ninh, 2009, Probability Theory and Mathematical Statistics Exercise, NEU.
4. T.W. Anderson, 1984, An introduction to multivariate statistical analysis, Wiley, Chapter 8.
5. Ronald J. Thomas H. Wonnacott and Wonnacott, 1990, Introductory statistics for business and economics, Wilay. Chapter 4.10.
6. Dale J. Piorier, 1995, Intermediate Staistics and Econometrics, Prentice - Hall International. Chapter 6.
7. Allen Webster, 1992, Applied Statistics for Business and Economics, Chapter 9.

CHAPTER 4 – NON-PARAMETRIC TESTING

This chapter provides students with a new approach on non-parametric testing, solving some problems which would be used for other subjects such as Econometrics and Multivariate statistics.

- 4.1. Chi-squared tests
 - 4.1.1. Testing Probability distribution
 - 4.1.2. Testing independence
- 4.2. Normality testing
 - 4.2.1. Kolmogorov tests
 - 4.2.2. Jacque- Bera tests
- 4.3. Rank correlation tests
 - 4.3.1. Wilcoxon tests
 - 4.3.2. Spearman rank correlation tests
 - 4.3.3. Mann-Whitney tests

Exercises for Chapter 4

References of the chapter:

1. Ngo Van Thu, 2010, Mathematical Statistics, Science and Technology Publisher, Chapter 3.
2. Nguyen Cao Van, Tran Thai Ninh, and Ngo Van Thu, 2011, Probability Theory and Mathematical Statistics, NEU, Chapter 9-10.
3. Nguyen Cao Van, Tran Thai Ninh, 2009, Probability Theory and Mathematical Statistics Exercise, NEU.
4. T.W. Anderson, 1984, An introduction to multivariate statistical analysis, Wiley. Chapter 11.
5. Dale J. Piorier, 1995, Intermediate Staistics and Econometrics, Prentice - Hall International. Chapter 8.
6. Allen Webster, 1992, Applied Statistics for Business and Economics, Chapter 12-13.

7. REQUIRED TEXTBOOKS & COURSE MATERIALS

Ngo Van Thu, 2011, Mathematical Statistics (with the aid of Excel spreadsheets). Science and Technology Publisher, Hanoi.

Study data:

- VHLSS data 2002-2004-2006-2008-2010-2012
- Firms data from 2000 to now.
- Data on the stock market from 2000.

8. RECOMMENDED TEXTS & OTHER READINGS

1. Nguyen Cao Van, Tran Thai Ninh, and Ngo Van Thu, 2011, Probability Theory and Mathematical Statistics, NEU er, Chapter 8.

2. Nguyen Cao Van, Tran Thai Ninh, 2009, Probability Theory and Mathematical Statistics Exercise, NEU publisher.
4. Ngo Van Thu, 2015, Statistics Practicing, NEU, Chapter 2.
5. T.W. Anderson, 1984, An introduction to multivariate statistical analysis, Wiley. Chapter 5, 8.
6. Thomas H. Wonnacott and Ronald J. Wonnacott, 1990, Introductory statistics for business and economics, Wilay. Chapter 4.10.
7. Dale J. Piorier, 1995, Intermediate Statistics and Econometrics, Prentice - Hall International. Chapter 6.
8. Allen Webster, 1992, Applied Statistics for Business and Economics, Chapter 12-13.

9. ASSESSMENT

- Scale (point) : 10
- Structure of points:
 - + Discussion point: 10%
 - + The exercise, check out: 30%
 - + The final examination period: 60%
- Conditions of the final exam:
 - + Must attend at least 80% of the course

HEAD OF DEPARTMENT

(signed)

PhD. Nguyen Manh The

Hanoi, 2016

PRESIDENT

(signed)

Prof.Dr. Tran Tho Dat