EC507 Statistics for Economics Spring 2018

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Room 416, Phone: 617 358 5925
Office hours: W 4:00 - 5:30 pm; F 4:00 - 5:30 pm.

Course overview:

This is an intermediate level statistics and econometrics course. Includes materials on descriptive statistics, probability theory, statistical inference and regression analysis. The course aims at providing students with the necessary background to be able to follow higher level econometrics and applied economics courses. The first part covers basic data analysis, descriptive statistics and probability theory. The second part deals with univariate and multivariate distributions and sampling distributions. The third part covers statistical inference (estimation, confidence intervals, tests of statistical hypotheses) and an introduction to linear regression. Familiarity with algebra and calculus is assumed.

All course announcements and documents will be posted on the Blackboard website.

Textbook:

Ramachandran, K. M., and C. P. Tsokos (2015), *Mathematical Statistics with Applications in R*, 2nd edition, Elsevier. The previous edition is also useful.

A possible cheap alternative, somewhat more advanced, is the classic Mood, A., Graybill, F. and D. Boes (1988), *Introduction to the Theory of Statistics*, 3rd edition, McGraw-Hill.

Teaching Assistant:

Chen Gao. E-mail: cgao14@bu.edu

Assignments, exams and grading:

There will be 10 problem sets and practices (one per topic, see the course outline). Selected problems will be solved at class and in the discussion sessions. Exams will be based on the theory covered at class and on problems and exercises similar to those assigned during the course in the problem sets and practices. Course grades will be based on two midterm exams and a cumulative final exam. Each midterm will count for 25% of the final grade and the final exam 50%.

Software

Problem sets and exams will include empirical questions that should be solved using statistical software. For these questions you will be provided with the data and you are required to use Stata. The use of Stata will be introduced in the discussion sessions.

Course outline

1. **Introduction to Statistics**

2. **Descriptive Statistics**, R&T 1, PS 1.

1. Types of Data
2. Describing Data Sets
3. Summarizing Data Sets

3. **Elements of Probability**, R&T A.I, 2.1-2.4, PS 2.

1. Set Theory
2. Probability Theory
3. Conditional probability

4. **Elements of Statistical Inference**

A. **Random Variables: Univariate Model**, R&T 2.5, PS 3.

1. Definition
2. Discrete Random Variables: Probability Mass Function, Cumulative Distribution F.
3. Continuous Random Variables: Probability Density Function

Midterm 1:Friday, February 16

B. **Multiple Random Variables**, R&T 3.3, PS 4.

1. Bivariate Distribution
2. Marginal Distribution
3. Conditional Distribution
4. Independence
5. Multivariate Distribution

C. **Expectation**, R&T 2.6, 3.3.1, PS 5.

1. Definition and properties
2. Variance
3. Covariance and Correlation

4. Conditional Expectation and Conditional Variance
5. Moments and Moment Generating Function
6. Inequalities

D. **Special Distributions**, R&T 3.2, PS 6.

1. Discrete Distributions
2. Continuous Distributions

E. **Distribution of Sampling Statistics**, R&T 4.1, 4.2, 4.4, 3.5, PS 7

1. Random Sample
2. Sampling Statistics: Sample Mean, Sample Variance
3. The Law of Large Numbers and The Central Limit Theorem

Midterm 2: Friday, March 30

5. **Statistical Inference**

A. **Point Estimation: Methods, Properties**, R&T 5.1 - 5.3, PS 8.

1. Definitions: parameter vs. estimator
2. Properties of Estimators
3. Estimation Methods: Method of Moments, Maximum Likelihood

B. **Interval Estimation**, R&T 5.4 - 5.7, PS 9.

1. Sampling results: t-Student and F Distributions
2. Confidence Intervals for the Mean
3. Confidence Intervals for the Variance

C. **Hypothesis Testing**, R&T 6.1 -6.5, PS 9.

1. Definitions: Null and Alternative Hypotheses, Types of Tests, Type of Errors, Power
2. Procedure to test hypotheses

D. **Linear Regression**, R&T 8.1 - 8.2, PS 10.

1. Relations
2. Conditional expectation in a bivariate population
3. Linear prediction in a bivariate population
4. Estimating a population relationship
5. Linear regression with multiple variables

Final Exam: Monday, May 7, 3:00 pm-5:00 pm