EC507 A Statistics for Economics Spring 2023

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Office hours: T 5:00 pm-6:00 pm; Th 5:00 pm-6:00 pm.

Course overview:

This is an intermediate level statistics course. Includes materials on descriptive statistics, probability theory, statistical inference and an introduction to regression analysis. The course aims at providing students with the necessary background to follow higher level econometrics and applied economics courses. The first part covers descriptive statistics, probability theory and the univariate model of random variables. The second part deals with multivariate distributions, expectations 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.

Course Website:

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 free 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:

Seoyun (Stella) Hong is the teaching fellow. E-mail: seoyun@bu.edu.

Assignments:

You must work about 100 problems, breakdown into 10 problem sets and practices (one per topic, see the course outline). Selected problems, and those that you ask for, will be solved in class and in the discussion sessions.

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 or similar software of your choice. The use of Stata will be introduced in the discussion sessions, but an intense practice by oneself is the best way to become proficient.

Exams and Grading:

There are two midterms and a cumulative final exam. Exams will be based on problems similar to those assigned during the course. The goal of the exam is that you show skills in the management of the learned statistical tools, acquired by working in the resolution of the problem sets.

Exams take place during class time in the specified dates.

Each midterm will count for 25% of the final grade and the final exam 50%. To pass the course a minimum average of 50 points out of 100 is required.

Especial situations:

There will be no makeup exams. Any student who goes through an especial situation (e.g. medical emergency) must report the situation by email before the exam takes place and contact me as soon as possible to set a solution.

Academic Conduct:

You should understand and observe the CAS Academic Conduct Code. It is available at http://www.bu.edu/academics/resources/academic-conduct-code.

Course outline
(Numbers refer to the chapter and section of the textbook where the topic is covered; PS X means problem set number X)

1. **Introduction to Statistics**

2. **Descriptive Statistics**, PS 1.

1. Types of Data 1.2, 1.3
2. Describing Data Sets 1.4
3. Summarizing Data Sets 1.5

3. **Elements of Probability**, PS 2.

1. Set Theory Appendix A
2. Probability Theory 2.1, 2.2, 2.3
3. Conditional probability 2.4

4. **Elements of Statistical Inference**

A. **Random Variables: Univariate Model**, PS 3.

1. Definition 2.5
2. Discrete Random Variables: Probability Mass Function, Cumulative Distribution F. 2.5
3. Continuous Random Variables: Probability Density Function 2.5
4. Functions of Random Variables 3.4

Midterm 1: Thursday, February 9.

B. **Multiple Random Variables**, PS 4.

1. Bivariate Distribution 3.3
2. Marginal Distribution 3.3
3. Conditional Distribution 3.3
4. Independence 3.3
5. Multivariate Distribution 3.3
6. Functions of Several Random Variables 3.4

C. **Expectation**, PS 5.

1. Definition and Properties 2.6
2. Variance 2.6
3. Covariance and Correlation 3.3
4. Conditional Expectation and Conditional Variance 3.3
5. Moments and Moment Generating Function 2.6
6. Inequalities 3.5

D. **Special Distributions**, PS 6.

1. Discrete Distributions 3.2
2. Continuous Distributions 3.2

E. **Distribution of Sampling Statistics**, PS 7

1. Random Sample 4.1
2. Sampling Statistics: Sample Mean, Sample Variance 4.2
3. Order Statistics 4.3
4. The Law of Large Numbers and The Central Limit Theorem 4.4

Midterm 2: Thursday, April 6.

5. **Statistical Inference**

A. **Point Estimation: Methods, Properties**, PS 8.

1. Definitions: Parameter vs. Estimator 5.1, 5.2
2. Properties of Estimators 5.3
3. Estimation Methods: Method of Moments, Maximum Likelihood 5.2

B. **Interval Estimation**, PS 9.

1. Sampling results: t-Student and F Distributions 4.2, 4.3
2. Confidence Intervals 5.4
3. Confidence Intervals for the Mean 5.5
4. Confidence Intervals for the Variance 5.6

C. **Hypothesis Testing**, PS 9.

1. Null and Alternative Hypotheses, Types of Tests, Type of Errors, Power 6.1, 6.2
2. Procedure to test hypotheses 6.4

D. **Linear Regression**, PS 10.

1. Relations 8.1
2. Conditional expectation in a bivariate population 8.2
3. Linear prediction in a bivariate population 8.2
4. Estimating a population relationship 8.3
5. Linear regression with multiple variables 8.6

Final Exam: TBA by the university.