STATISTICS

Module 2, 2020–2021

Professor: Andrei Savochkin
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Course information

Course Website: my.nes.ru

Instructor's Office Hours: TBD

Class Time: TBD

Room: TBD

TA: Group A Roman Solntsev
Group B Sergei Golovan sgolovan@nes.ru

Course description

This course in Statistics is an obligatory course serves as a prerequisite for the sequence of courses in Econometrics. Its primary objective is to make sure that everyone has mastered concepts (such as an estimator and a statistical test) and methods (e.g., maximum likelihood) that serve as a foundation for both statistical and econometric analyses. Besides the basics, the course introduces a few theoretical topics to expand horizons, and covers selected practical topics that may be useful for those who decide to pursue career in the private sector.

Course requirements, grading, and attendance policies

Student's achievements will be evaluated on the basis of problem sets, pop quizzes, and the final exam. The exam and the problem sets are graded on the 0–100 scale; the final score is computed on the same scale and then converted to transcript grades (from 2 to 5+). There will be four problem sets (possibly, of unequal size and weight) with the total weight of 20% in the final score. Then, there will be two pop quizzes given without warning during class time that have the weight of 5% each. The remaining weight goes to the final exam. The exam score of at least 20 points is required for getting a passing grade.

The format of the exam is "A4." Each student is allowed to bring to the exam one sheet of paper of A4 size (double-sided) with notes, handwritten or typed.

Course contents

The course covers the following topics.

1. General statistical methods
    - Parameter estimation. Examples. Estimators for parameters of well-known distributions.
    - Confidence intervals. Examples.
    - Properties of estimators. Methods of estimation. Method of Moments.
    - Maximum Likelihood method. Information inequality.
    - Statistical tests. Type-I and Type-II errors. Significance level and power of a test.
    - Likelihood ratio test.
2. Important theoretical concepts
    - Sufficient statistics. Rao-Blackwell theorem.
    - Introduction to Bayesian statistics. Conjugate families of distributions.
3. Selected practical topics
    - Goodness-of-fit tests. Contingency tables.
    - Testing pseudo-random number generators.
    - The Analysis of Variance (ANOVA).
    - Introduction to multidimensional analysis. Principal components.
    - Introduction to the problem of classification.

Description of course methodology

All course material will be presented in lectures and sections meetings. Taking notes in class is strongly recommended. Reading textbooks in addition to class attendance may be helpful but is not absolutely necessary.

Sample task for course evaluation

There is a testing kit that measures the concentration of a certain chemical in a solution. When one kit is used repeatedly, it is known that its precision falls according to the law $V(X_k) = k\sigma^2$, where X_k is the measurement error in the use $k = 1, 2, \ldots$. It is also known that $E(X_k) = 0$ for all k.

The kit was used successively four times on solutions with known concentrations, and the obtained measurement errors were 0.4, -1.1, -0.6, 1.5.

(a) Estimate σ^2.

(b) Give a 90% confidence interval for σ.

(c) State the assumptions that you are using.

Course materials

Required textbooks and materials

A useful textbook that covers most of the topics of the course is

- Hogg, R. V., J. W. McKean, and A. T. Craig, *Introduction to Mathematical Statistics*

Additional materials

The following books can be used to complement lectures on some of the topics

- Casella, G., and R. L. Berger, *Statistical Inference*
- Айвазян С.А., Мхитарян В.С., *Прикладная статистика и основы эконометрики*

Academic integrity policy

Cheating, plagiarism, and any other violations of academic ethics at NES are not tolerated.