



Statistical thinking will one day be as necessary for efficient citizenship as the ability to read and write.

(Statistički način mišljenja jednog će dana za svakodnevni život građana postati jednako neophodan kao znanje čitanja i pisanja.)

H.G. Wells (1866 – 1946)

**University of Novi
Sad**

**University Centre
of Applied
Statistics**

Lifelong Learning Courses in Applied Statistics



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Location

University Centre of Applied statistics

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Introduction

Statistics plays major role in almost every scientific field and in all other disciplines where data processing is required. Marketing managers are examining the trends in market and market stocks, sociologists and psychologists are studying human behaviour, financial analysts are dealing with time series and experts in medicine are monitoring factors that influence health of patients. Similar situation is in other disciplines, for example, biologists are analysing DNA sequence, managers are applying quality control and public administrators are using information about settlements and regions management etc. What is common to all of these professions is that they must rely on statistics and statistical inferences in their scientific researches.

We live in the information age, where data could be collected and manipulated almost instantly and quite easily using modern technology. The main problem arises when we need to collect appropriate and high-quality data, process it and extract relevant and accurate information upon which good decisions can be made.

Without education and professional approach to data collection and analysis, there is a risk of obtaining incorrect information, which leads to wrong decisions. It is necessary to understand importance of connection between study design, data structure, choice of appropriate statistical techniques and results interpretation. Scientists, researchers, managers, employees in the public administration and others have need for such knowledge.

To meet the needs of the statistical users, the University Centre for Applied Statistics, under the auspices of the University of Novi Sad, has established courses for lifelong learning. The main objective of the courses is to train attendees to use appropriate statistical tools and instruments with respect to specific needs in their scientific areas.

Professionals with academic background and experts in various fields, who want to learn about basic statistical techniques and to improve knowledge or to obtain new statistical skills, are encouraged to apply. The courses are designed so that new skills can be immediately tried out through modern statistical software. The knowledge gained in these courses will raise the competence of trainees and consequently make trainees employers more competitive in the market.

Courses will be held at Faculty of Sport and Physical education in contemporary equipped classrooms through active interaction between lecturers and attendees.

Attendees chose courses according to their needs and interests. At the end they have to pass the appropriate test for the obtained knowledge confirmation. The Certificates of the University Centre for Applied Statistics are provided based on successful completions of the test.

At the moment following courses are available:

- Introduction to Statistical Inference
- Introduction to Bayesian Statistics
- Official Statistics
- Introduction to Econometrics
- Linear Models
-

Statistical Software

-

Sampling Theory

-

Biostatistics

-

Legal and Industrial metrology

-

Survival Analysis

-

Survey Techniques

-

Design of Experiments

Detailed description of each course is presented below.

We hope that offered courses suite your needs. We expect your application with the desire to increase your knowledge in statistics and help you to progress in your profession!

Introduction to Statistical Inference

Description

The aim of this course is to give an overview of basic statistical principles (statistical hypothesis testing and parameter estimation). Advantages and disadvantages of statistical inference as well as common mistakes in application of statistical tools will be showed in detail through number of examples.

Course outline: Descriptive statistics (measures of central tendency and dispersion). Graphic representation of sorted data. Estimation theory. Point and interval ratings. The properties of point and interval estimates. Hypothesis testing. Null and alternative hypotheses. Errors of first and second type. The power of the test.

Classes: 16 lectures in 3 or 4 days

Credits: 2 ECTS

Who can apply?

The course is designed for anyone who is using statistics in work environment or who wants to understand the basic principles of estimation and deduction as a necessary tool in complex statistical analyses. Master and doctoral students, and researchers who want to learn the purpose and application of theory estimation and deduction are encouraged to apply.

Pre-requisite

No previous knowledge in Mathematics and Statistics is required for this course.

Exam form:

Literature:

1. Teaching material
2. J. P. Marques de Sa: Applied Statistics Using SPSS, STATISTICA, MATLAB and R, Springer, 2007.
3. Aczel-Souderpandian: Business Statistics, 7th edition, McGraw-Hill, 2008.

Introduction to Bayesian Statistics

Description

The aim of the course is to introduce Bayesian theorem: combining prior information - formal stated assumptions, with experimental data to obtain new, improved assumptions i.e. posterior information.

Course outline: Basic theorem applied in making inference for binomial and normal distribution. Bayesian approach in examining the two mean differences and determining relations between two variables. BUGS (Bayesian inference Using Gibbs Sampling) in the R statistical environment (R software environment for statistical computing and graphics). Practical applications (approval of binary choices or decisions, the degree of success on achievement tests etc.).

Classes: 16 lectures in 3 or 4 days

Credits: 2 ECTS

Who can apply?

The course is designed for anyone who is interested to learn about Bayesian statistical approach. Popularity of Bayesian approach is being increased by development of Markov Chain Monte Carlo Method, especially Gibbs sampling. These procedures allow the Bayesian methods being tested through sampling simulation, rather than strictly analytical. Therefore, this approach can now be applied in a variety of scientific disciplines, from medicine to social sciences.

Pre-requisite

Basic knowledge in Probability theory and Statistics is required for this course.

Exam form

Examination includes three short theoretical based tests and writing seminar paper.

Literature

- W. M. Bolstad: Introduction to Bayesian statistics, Wiley, 2004
- J. Albert: Bayesian Computation with R, Springer 2007
- J. K. Kruschke: Doing Bayesian Data Analysis, Academic Press, 2010
- D. S. Sivia and J. Skilling: Data Analysis: A Bayesian Tutorial, Oxford University Press, 2006
- Teaching material

Official Statistics

Description

Aim of this course is to give an overview of fundamental principles in national and international statistical systems. Naturally, question that arises is what kind of information gives us Republic Statistical Office, Eurostat, UN and similar institutions. Attention is paid on introduction and learning methodology for data collecting, processing and analysis in national and international statistical systems.

Attendees will get answers to following questions: How to find reliable statistics data? Who collects the statistical data and how? Where and how to keep data related to official statistics? How to present statistical data to the public? How to write a statistical report? How to communicate with the media in the language of official statistics? How to develop high-quality measuring instrument (questionnaire) according to Eurostat? What do most important methodologies in the field of official statistics look like? What is a geographic information system and where it can be used?

Classes: 20 lectures in 4 or 5 days

Credits: 3 ECTS

Who can apply?

The course is designed for anyone who uses or produces official statistics. Knowledge of official statistics is necessary for researchers in sociology, economics, health, ecology, demography, then for the holders and creators of social, economic and other policies at the community level. Anyone who wants to understand the official statistics data, use and production of relevant statistical data of quality official statistics is encouraged to apply.

Pre-requisite

No previous knowledge in Mathematics and Statistics is required for this course.

Exam form

Examination includes three short theoretical based tests and writing seminar paper.

Literature

- Teaching material
- Fundamental Principles of Official Statistics, Statistics Division, United Nations. New York, NY 10017, USA
- The Handbook of Statistical Organization, Third Edition. Statistics Division, United Nations. New York, NY
- 10017, USA
- Ekonomiska statistika, Mladenovic, D (red.), Ekonomski fakultet, Beograd, 2009

Introduction to Econometrics

Description:

Nowadays it is almost impossible to imagine serious work in field of economics without using statistics. Decision making based on econometric models has become essential not only in economic research but in all business operations. This course will also address questions like why statistics is essential in economic theory and what are possibilities of statistics in economy.

Course outline: Econometric methodology. Simple and multiple regressions. Violation of standard assumptions. (non-normality, autocorrelation, heteroscedasticity). Introduction to time series in economics.

Classes: 20 lectures in 4 or 5 days

Credits: 3 ECTS

Who can apply?

The course is designed for anyone who deals with econometrics tools in professional or research work. Graduate economists, master and PhD students who wish to gain a basic knowledge of econometrics and understand its basic principles are encouraged to apply.

Pre-requisite

Basic statistical knowledge (especially in estimation theory) is required for this course.

Exam form

Literature

- Teaching material
- G.S. Maddala: Introduction to econometrics, John Wiley & Sons, 3rd edition, 2001.
- W.H.Greene: Econometric analysis, 5th ed., Prentice Hall, 2003.

Linear Models

Description

Due to its simplicity, linear models compared with non-linear models are applicable in all disciplines. The aim of the course is to present the basis of linear models and linear modelling. The central part of the course takes a detailed introduction and learning methods of analysis of variance and linear regression. Through a number of real examples, using the statistical package SPSS and R, attendees will gain basic knowledge necessary to understand professional and scientific literature, as well as the possibility of using the theory of linear models in their own work.

Classes: 20 lectures in 4 or 5 days

Credits: 3 ECTS

Who can apply?

The course is designed for anyone who needs application of linear models in research or professional work.

Pre-requisite

Basic knowledge in Statistics is required for this course.

Exam form

Literature

1. Rencher, A. C. & Schaalje, G. B. (2008). Linear Models in Statistics. New York: John Wiley & Sons
2. Hocking, R. R. (2003). Methods and Applications of Linear Models. New York: John Wiley & Sons.

Statistical Software

Description

The aim of this course is to introduce attendees to the most popular statistical software used in statistical analysis. Attendees will meet environment of the following statistical software: Microsoft Excel or OpenOffice/LibreOffice Calc, Statistica, SPSS, R.

Course outline: Data matrix preparation (matrix forming, mask input, dual input, code book, codex). Input and output of different data matrices. Merging and combining of data matrices. Recoding and data transformation. Basic statistical analysis (descriptive statistics, hi squared test, t-test, correlations, graphics results presentation).

Classes: 16 lectures in 3 or 4 days

Credits: 2 ESPB

Who can apply?

The course is designed for anyone who has need for performing statistical analyses, and has little or no previous knowledge in using these statistical packages.

Pre-requisite

Basic knowledge in Statistics is required for this course (descriptive analysis, hi-squared test, correlation, analysis of variance).

Exam form

Examination includes practical test at the end of the course.

Literature

- Teaching material
- StatSoft, Inc. (2012). Electronic Statistics Textbook. Tulsa, OK: StatSoft. WEB: <http://www.statsoft.com/textbook/>
- Pallant, J. (2009) SPSS Priručnik za preživljavanje, (prevod 3. Izdanja) Mikro knjiga
- Kasum D. Legovic T. (2004) Uvod u korištenje R-a
<http://cran.r-project.org/doc/contrib/Kasum+Legovic-UvodUr.pdf> i http://cran.r-project.org/doc/contrib/Kasum-QuickRefCard_ver.1.2.pdf

Sampling Theory

Description

In studies that require data collection it's either impossible or impractical to track down every member of a population. Most commonly used strategy in those situations is sampling the population. A sample is any subset of a population on which research is performed. Sample should be small enough to be manageable by our computing power, yet large enough to give us results that can be generalized. Correct sample selection leads to reliable, accurate and useful data, also, methodology of sampling saves time, cost and effort. On the other hand, incorrect sample selection arise questions about validity of a research and relevance of conclusions. Accordingly, a good selection of the sample is one of the most important steps in scientific research design and realization.

The aim of the course is to give an overview of sampling techniques. Attention is paid on two major sampling methods: probability (simple random, stratified random, cluster) and non-probability (quota, convenience, purposive) sampling. Advantages and disadvantages of methods as well as their relationship and their dependency will be pointed out. Central part of the course is on statistical aspects of the sampling and sample analysis. The theoretical part of the lectures will be illustrated by examples.

Classes: 16 lectures in 3 or 4 days.

Credits: 2 ESPB

Who can apply?

The course is designed for researchers who are using statistics in their work.

Pre-requisite

Basic knowledge in Statistics is necessary for this course.

Exam form

Literature

- 1.Lohr, S., Sampling: Design and Analysis, Duxbury Press, 1999.
- 2.Daniel, J., Sampling Essentials, Sage Publications, Inc., 2012.

Biostatistics

Description

The aim of this course is to give an overview of basic concepts and principles in biostatistics. Furthermore, attention will be paid on basic principles in epidemiologic research. At the end of the course attendees will be able to understand and apply statistical methods in biomedical research.

Course outline: Descriptive statistics. Hypothesis testing. Analysis of variance. Parametric and nonparametric methods. Correlation. Regression. Sampling. Epidemiology basis (measures of disease frequency, measures of mortality, incidence and prevalence, risk measures, cohort (prospective studies), randomized clinical trials, diagnostic tests).

Classes: 20 lectures in 4 or 5 days

Credits: 3 ESPB

Who can apply?

This course is designed for researchers dealing with design, analysis and implementation of medical research and clinical trials.

Pre-requisite

No previous knowledge is required.

Exam form

Literature

1. Teaching material
2. Dawson and Trapp: Basic and Clinical Biostatistics, 4th edition. Lange Medical Books, 2004.
3. Statistical Advances in the Biomedical Sciences, Clinical Trials, Epidemiology, Survival Analysis and Bioinformatics, Edited by A. Biswas, S. Datta, J. P. Fine, M. R. Segal, A John Wiley and Sons, Inc. Publication 2007.

Legal and Industrial Metrology

Description

The aim of this course is to give an overview of legal and industrial metrology. Attention is paid on importance and application of statistical methods in legal and industrial metrology.

Course outline: Measurement systems and metrology. Significance of statistics in measurement systems and in metrology. Sizes and measurement units systems. General measurement methods. Properties of measurement instruments. Error theory. Blunders. Systematic errors. Random errors. Standard uncertainty of a measurement. Type "A". Type "B". Combined uncertainty of a measurement. Expanded uncertainty of a measurement. Measurement uncertainty of estimation using Monte Carlo method. Measuring information. Measurement information quality. Processing of measurement results. Applied metrology. Industrial metrology. Legal metrology. Legal metrology areas. Measurement unity. Metrology editing using regulations at national and international level. Laboratory for legal and industrial metrology. Accreditation for legal and industrial metrology.

Classes: 20 lectures in 4 or 5 days

Credits: 3 ECTS

Who can apply?

Anyone who works in metrology laboratories, quality controlling based companies, in technical orientated manufacturing companies, or who works in scientific fields related to metrology, quality control, and qualitative and quantitative analysis is encouraged to apply.

Pre-requisite

No previous knowledge in Mathematics and Statistics are required for this course.

Exam form

Examination includes 2 theoretical based tests and writing seminar paper.

Literature

- Teaching material
- Jay L. Bucher. (2004), The Metrology Handbook, American Society for Quality.
- C. R. Pennella. (2003). Managing the Metrology System, Third Edition, ASQ Quality Press.
- G. M. S. de Silva. (2002). Basic Metrology for ISO 9000 Certification, Butterworth-Heinemann.
- D. C. Montgomery, G. C. Runger, (2003): Applied Statistics and Probability for Engineers, John Wiley & Sons, Inc

Survival Analysis

Description

The aim of this course is to give an overview of different survival analyses methods. Attention is paid on statistical modelling of events in which time plays crucial role. Survival models are used in biostatistics, epidemiology, and various other studies in medicine but also in social and natural sciences. Survival analysis used in engineering is called reliability analysis.

Course outline: Survival function. Censored Data. Nonparametric methods for evaluating the survival function and for survival distributions. Parametric methods for regression models and determination of prognostic factors.

Classes: 20 lectures in 4 or 5 days

Credits: 3 ECTS

Who can apply?

This course is designed for researches dealing with design, analysis and implementation of medical research and clinical trials.

Pre-requisite

Basic knowledge in Biostatistics is required.

Exam form

Literature

1. Teaching material
2. David Collet, Modelling Survival Data in Medical Research, Chapman & Hall/CRC 2003.
3. Statistical Advances in the Biomedical Sciences, Clinical Trials, Epidemiology, Survival Analysis and Bioinformatics, Edited by A. Biswas, S. Datta, J. P. Fine, M. R. Segal, A John Wiley and Sons, Inc. Publication 2007.

Survey Techniques

Description

The aim of this course is to give an overview of basic surveys principles.

Course outline: Basic elements and stages of surveys. Target population and sampling. Errors in sampling. Sample types. Design and evaluation of survey questions and questionnaires. Methodologies for collecting data. Preparation of data for statistical analysis. Ways to motivate respondents to participate in the survey.

Classes: 16 lectures in 3 or 4 days

Credits: 2 ECTS

Who can apply?

The course is designed for anyone who has need for structure, implementation and evaluation of surveys. This knowledge is necessary for researchers in different research areas (mainly social science, and other fields of study), marketing, public relations and quality evaluation professionals, but also to all those who have the need for ordering, understanding and interpretation of the results of surveys.

Pre-requisite

No previous knowledge is required.

Exam form

Examination includes theoretical based test at the end of the course and during the course attendees are supposed to make survey simulation.

Literature

- Teaching material
- Groves, R.M. et al. (2009) Survey Methodology, John Wiley & Sons
- Hansen, Hurwitz, Madow (1997) Sample Survey Methods and Theory, Vol 1, Wiley

Design of Experiments

Description:

The aim of this course is to give an overview of standard methods in area of design and analysis of experiments.

Course outline: Design of experiments (DOE). Basic principles of planned laboratory and industrial experiments. Basic methods and strategies. Goals and benefits of DOE. Planning the whole procedure and each step of experimental situation. Avoiding large number of experiments.

Classes: 16 lectures in 3 or 4 days

Credits: ESPB

Who can apply?

The course is designed for anyone who carries out experiments in laboratory and industrial conditions with the goal of optimal and efficient experimental work, i.e. anyone who needs a maximally effective methodology at a minimum of laboratory and industrial resources in the experimental work is encouraged to apply.

Pre-requisite

Basic knowledge in Statistics is required for this course.

Exam Form

Examination includes 2 tests: 1 theoretical and 1 practical with using adequate statistical software.

Literature

1 Statistics for Experimenters Design: Innovation and Discovery, Box.G.E.P., J.S. Hunter, W.G.Hunter., Wiley (2005)

2 Design and Analysis of Experiments, Montgomery.D.C, Wiley (2005)

