UNIVERSITY OF NOVI SAD

DOCUMENTATION FOR ACCREDITATION OF THE STUDY PROGRAM

APPLIED STATISTICS

(master academic studies)

Novi Sad, 2011.

Content:

INTRODUCTION

Name of the study programme	Applied statistics
Independent higher educational institution carrying out the program	University of Novi Sad
Higher educational institution carrying out the program	University of Novi Sad
Educational-scientific (-artistic) field	Interdisciplinary (natural sciences and mathematics, social sciences and humanities, technical-technological sciences, medical sciences)
Scientific (artistic) discipline	applied statistics
Type of studies	Master academic studies
The total value of studies in ECTS points	120 ECTS
Degree designation	Master of applied statistics
The duration of studies	2 academic years (4 semesters)
The year in which the program started	-----
The year in which the program will commence (for entirely new programs only)	2011.
The current number of students enrolled to the program	-------
The number of student projected to enroll to the program	25
The date of approval of the program by university's governing body	19 May 2011. Council of University of Novi Sad
Language in which the program is carried out	Serbian and English
The year of accreditation of the program	
Web site containing information on the program	http://stat.uns.ac.rs/, http://ucps.uns.ac.rs/ (in Serbian)

Standard 1. Structure of the study program
The study programme contains elements defined by the law.

Description of structure and content of study program
Study program APPLIED STATISTICS, according to syllabus, forms and teaching methods, enables students to acquire basic knowledge and understanding of the application of statistics in practice, in order to analyze phenomena in finance, economics, industry, medicine and psychology. By mastering the curriculum APPLIED STATISTICS, students become capable of logical thinking, formulating hypotheses and drawing conclusions in a formal or formalized way. In the course of study, using methods of general statistics, students become capable to apply these in the selected discipline (medicine, economics, finance, engineering or social sciences). Students obtain the ability to communicate with other experts in the selected areas. During the study, the student masters the skills of information technology and acquire the ability of program implementation of complex problems.

Study program of academic studies in applied statistics lasts two years or four semesters and carries a total of 120 ECTS. APPLIED STATISTICS study program consists of four modules: biomedicine, economics, social sciences and engineering. Each student at the beginning of the study opts for a particular module.
Registration of candidates is based on the competition announced by the University of Novi Sad. In order to apply for the first year of graduate academic studies in the field of Applied Statistics, a candidate should have completed the first stage of academic studies with at least 180 ECTS points, to have basic knowledge in mathematics and computer science and to use English. The order of candidates for admission is determined on the basis of entrance examinations, average grade and length of study at undergraduate studies.

Study program consists of a group of compulsory courses, elective modules, electives and a final (master) work, as follows:
• Group of 8 compulsory courses and one elective course (50 ECTS + 6 ETCS).
• Group of 4 modules with elective courses, each with 3 courses (18 ECTS). Each module contains topics that are related to specific scientific fields (biomedicine, economics, social sciences, engineering)
• 12 ECTS credits through electives courses
• 10 ECTS credits in professional practice
• final work (24 ECTS).

A study program is designed to allow a student to choose teaching subjects from other degree programs.
In the last two semesters of study, students are oriented toward research-study work in the area that is linked to the selected module. Consequently, students are further developing their previously acquired knowledge, they consult wider literature, process the selected topics, perform independent research by applying the acquired knowledge to practical, real problems, all selected in consultation with the advisor. This research effort eventually results in the final work, which represents the material studied during the study, reflects the theoretical knowledge together with practical investigation, provides solutions to some specific problems, by means of statistical methods and models, using appropriate information technology.

Teaching in this degree program is conducted through lectures and exercises, discussion and seminar works, the processing of case studies and practical work.

Courses carry a specific number of ECTS points, while the studies are considered completed when

the student has fulfilled the obligations prescribed by the study program and after the preparation and defense of thesis, in which he/she collects at least 120 ECTS.

Students, upon completion of academic studies of this master degree program in applied statistics, gain the title of Master of Applied Statistics.

Study program is implemented at the University of Novi Sad in the University Center for Applied Statistics, which is an integral part of the University and which consists of representatives from seven faculties. The organization of the Center for Applied Statistics is an example of functional integration of universities. Reasons for the foundation, the way of establishment and description of activities of the Centre can be founded at the web site http://ucps.uns.ac.rs/.

- Supplement 1.1

Evidence: www.uns.ac.rs - **Supplement 1.1;** http://ucps.uns.ac.rs/, http://stat.uns.ac.rs/

Standard 2: The purpose of the program

The study programme has clearly defined purpose and role in the educational system, publicly available.

Description (in at most 500 words)

The purpose of the master study program Applied Statistics is education of graduates in the field of statistics, according to the needs of science and society. Past practice in higher education has shown that the statistics as a scientific method found its place in various scientific fields such as economics, medicine, psychology and others. Each higher education institution has had the need to involve statisticians, both for teaching and for scientific research. In addition, in economy and generally in society there is also a great need for professionals who are experts in the field of statistical research. The problem was that there was no degree program in the Republic of Serbia, which educate experts of such profile. An additional problem is that the education of statisticians must have an interdisciplinary character, so that such a professional should possess a good knowledge of statistical methods as well as the scientific field in which statistics is supposed to be applied. The purpose of this study program is to overcome these deficiencies by educating experts in the field of applied statistics.

Today's environment calls for such experts in the field of statistics, which are capable that, using information technology resources, solve problems in various fields of science and society, using modern statistical methods and models. This study program prepares them for the mentioned task, providing them with the necessary competence for independent research, work and decision making.

This study program is designed to monitor modern world trends and the state of the art in the appropriate educational and scientific fields and is aligned with the programs of renowned foreign higher education institutions abroad, primarily to European higher education institutions. It follows that the degree program is also easily comparable with similar programs at foreign institutions of higher education, especially within the European educational area.

Mobility of students of this study is possible horizontally and vertically. Horizontal mobility is reflected in the possibility of moving on to graduate studies of a similar type in Serbia or in Europe, while vertical movement is reflected in the opportunities to enroll doctoral studies which are logical continuation of modules of this study program.

Evidence : Publication of the institution (in printed or electronic form, web site of the institution)- **Supplement 2.1 site:** http://ucps.uns.ac.rs/ http://stat.uns.ac.rs/;

Standard 3: The goals of the program

The study programme has clearly defined goals

Description (in at most 500 words)

The aims of this study program of applied statistics specialized in the field of applied statistics, are to provide appropriate skills and academic knowledge in the field of statistics on the one hand, and on the other in applications of statistical methods in various scientific fields (economics, social sciences, medicine and engineering).

The aims of the program include the acquisition of knowledge in the field of probability theory, data analysis, methodology of scientific research theory of sampling, necessary for the statisticians in any field of application. Particular aims are learning special statistical items that create an expert in the application of statistical methods in specific areas.

Our goal is to create professionals who will have a systematic and comprehensive body of knowledge in applied statistics that are required for statistical research in one of the specific areas (economics, social sciences, biomedicine and engineering).

The general objectives of education in this study program are: to develop critical thinking and ability to understand and solve economic problems, which also includes the creation of awareness on the necessity of permanent education, necessary for functioning effectively in a dynamic, changing environment. The goals of education are reflected in the formation of such professionals who are trained in team work, willing to communicate the results of their work to professional and general public in oral and written form.

Evidence : Publication of the institution (in printed or electronic form, web site of the institution)- **Supplement 1.1 site:** http://ucps.uns.ac.rs/ http://stat.uns.ac.rs/;

Standard 4: Competence of graduate students

Mastering the curriculum, students obtain general and subject-specific skills that contribute to the quality of performing professional, scientific and artistic activities.

1. Description of general and subject-specific competencies of students.

Students who complete graduate studies in applied statistics at the University of Novi Sad become masters of applied statistics - experts who are trained to use modern scientific achievements in the field of statistics, quantitative analysis, to know to apply analytical tools and to handle mathematical and statistical methods and models to apply the contemporary information technology.

The competences of students cover four main areas: statistics in the narrow sense, substantive knowledge, communication skills and IT skills. Statistics in the narrow sense contains necessary mathematical knowledge, computing and practical skills connected with the data and statistics. Substantive knowledge covers knowledge in a particular field of specialization, that is connected to a chosen module (social sciences, economy, biomedicine or engineering). Communication skills are connected with abilities to read and understand material in English, to

produce texts in English connected with statistics, presentation skills and skills to communicate effectively with other experts in the selected areas. IT skills involve practical expertise with the most used statistical software packages and with work with databases.

Graduate professionals of this study program can be employed in various economic and scientific fields and in all areas where the skills of statistical analysis are needed, especially in the economy, biomedicine, engineering, marketing, public administration or social sciences in general. The graduates of applied statistics studies can independently participate in the processes of analysis, planning, formulating strategies of development, decision-making, governing and management, and independent making of tactical and strategic decisions related to the statistical research.

2. Description of learning outcomes

After finishing graduate academic studies, a certificate which confirms completion of the acquisition of academic title - Master of Applied Statistics in accordance with the Law is issued to students. Competencies that a graduate student gains are the adopting the methodology, quantitative and qualitative knowledge of basic mathematical and statistical disciplines (probability theory, principles of statistical analysis, multivariate analysis, the theory of the samples), the necessary IT skills (databases, statistical software) and different statistical disciplines that are particularly applicable in the field of economics (time series analysis, econometrics, microeconomic models, financial engineering), biomedicine (biostatistics, epidemiology, longitudinal data analysis, Bayesian methods), engineering (quality control, experimental design, Monte-Carlo method) and the social sciences (structural equation). Students acquire knowledge and master skills necessary for highly technical, managerial and analytical work over a wide area of statistical research and statistical analysis. Jobs that an applied statistician can perform in the labor market might be tasks of planning and analysis, quantitative analysis, forecasting variations of observed phenomena in the future, and similar activities in the field of economics, medicine, engineering, social sciences, marketing and public administration. In addition, the students will be able to communicate their research to wider scientific community, to make decisions based on research results and to communicate with other experts in the selected areas.

Standard 5: Curriculum

Curriculum of the study program contains the list and the structure of mandatory and elective modules and their descriptions.

Description (at most 300 words)

Study program applied statistics is a two-year master degree.

In the first year 8 compulsory courses which total worth 50 ECTS points are scheduled, one elective course worth 6 ECTS credits and the first part of professional practice which is implemented as a compulsory subject in order to prepare students for practice and for development of a special project; this is evaluated with 4 ECTS.

In the second year, teaching is done by modules. By the program of study, four modules are provided (economic module, module engineering, biomedical module and a module of social sciences). Each module provides three compulsory subjects that are closely related to the selected

module and are evaluated by a total of 18 ECTS. In addition a student in the module select two elective subjects, obtaining thus 12 ECTS: either by choosing from the group of elective courses, or from the content of other modules. Upon the decision of the Expert Council, student can score from elective courses implemented in other academic programs at the University. In the second year, student obtains 6 ECTS credits through the second part of professional practice which includes practice in relevant institutions and the work on a project. Preparation of the final work is scheduled in the fourth semester. The final work is valued by 24 ECTS.

Evidence: Study plan - 5.1 (http://stat.uns.ac.rs/reports/StudyPlan5.1.pdf)

Standard 6: Quality, contemporariness and international compatibility of the program

The study program is consistent with contemporary global trends and the status of the profession, science and art in the appropriate educational and scientific, artistic oreducational field and is comparable with similar programs at foreign institutions of higher education, especially within the European educational space.

Description (at most 300 words)
APPLIED STATISTICS degree program offers students the latest scientific and technical knowledge in the field of applied mathematics.

The study program is developed in the framework of the Tempus project Master program in Applied Statistics (511140-TEMPUS-1-2010-RS-TEMPUS-JPCR) http://stat.uns.ac.rs/

Partners in this project which had a major impact on the formation of this program are six European universities where the studies of Applied Statistics are well developed, Republic Statistical Office of Serbia and National Bank of Serbia. In this way it is provided that the study program offers contemporary knowledge in line with market needs.

University Center for Applied Statistics, which is the main producer of this study program includes experts from seven faculties of four scientific and educational fields, which garantees interdisciplinary nature of the program.

Some other EU and other universities offering compatible programs in applied statistics are listed:

- Georg-August-Universität Göttingen (Germany): http://zfs.uni-goettingen.de/index.php?id=14
- Katholieke Universiteit Leuven (Belgium): http://lstat.kuleuven.be/masterBologna/index.htm
- Universiteit Gent (Belgium): http://www.mastat.ugent.be/
- Cornell University (USA): http://www.stat.cornell.edu/mps/
- University of Manchester (United Kingdom): http://www.ccsr.ac.uk/masters/ProgAims.htm;
- University of Oxford (United Kingdom): http://www.stats.ox.ac.uk/prospective_students/msc_in_applied_statistics
- University of Ljubljana: http://www.uni-lj.si

Standard 7: Enrollment of students

Higher education institution in accordance with social needs and its resources, admits students to the appropriate study program, taking into account their success in previous education and results of the test of their knowledge, preferences and abilities.

Description (at most 500 words)

Registration of candidates is based on the Contest announced by the University ofNovi Sad.
Applied Statistics degree program may enroll all students who have completed basicstudies that are worth at least 180 ECTS.
Knowledge necessary for entry will be checked at the entrance exam covering the following areas: mathematics, computer literacy and general knowledge of English.
Entrance exam brings 90 points as follows: mathematics (50 points), general computer literacy (20 points) and knowledge of English (20 points). Minimum number of points in the entrance exam for a candidate in order to meet the enrollment is 40 points.

The success in previous studies brings 10 points in the following way: *average mark from bachelor studies - 2x(number of years of studying - planned number of years)*

Admission criteria are precisely defined by rules of studies.
Study program of applied statistics is a new degree program and has not been realized.

Standard 8: Grading and assessment of student's progress

Assessment of students is carried out by continuous monitoring of students' work and is based on points achieved in meeting the pre-exam duties and on taking the exam.

Description (at most 500 words)

Each course of the study program is accompanied by a corresponding number of ECTS points which correspond to the necessary activity needed for its mastering. Student achieves the score when he successfully passes the exam. Each item has a clearly defined way of collecting points during classes and exam. By enrolling each course, the student is informed about the number of ETCS associated to thecourse and about the way to obtain points (maximum 100) for its successful mastering.
In addition to testing of theoretical knowledge, Applied Statistics degree program put special emphasis on evaluating the application of theoretical knowledge on relevant real problems.

Evidence: Book of courses (http://stat.uns.ac.rs/DescriptionOfCourses.html), - (in documentation and on the web site of the institution)-**Supplement 5.2**

Standard 9: Teaching staff

For the realization of the study program, teachers with the necessary scientific, artistic and professional qualifications are provided.

Description (at most 500 words)

University of Novi Sad and its integral part University Centre for Applied Statistics, have a sufficient number of high quality and competent teachers for the realisation of a study of APPLIED STATISTICS. In teaching activities of this program 44 teachers are included, of whom 38 from University of Novi Sad and 6 from other faculties of the University of Serbia. In the performance of this studies a significant number of associates and PhD students are planned to be included. In the implementation of the study program eminent experts from European universities are actively involved.

The largest number of teachers 13 (29.5% of the total number of teachers) is in the field of mathematics. Courses defined in the modules are assigned to teachers in respective fields. Courses in the biomedical module are assigned to seven teachers in the field of medicine (15.9% of total number of teachers), the engineering module engages seven teachers (15.9% of total number of teachers) in different fields of engineering, the economics module engages 10 teachers (22.7% of total number of teachers) in economics and social science module engages six teachers (13.6% of total number of teachers) in psychology and sociology.

Standard 10: Resources and equipment

To perform a study program, adequate human, physical, technical and technological, librarian and other resources are provided. These are appropriate to the character of the study program and the anticipated number of students.

Description (at most 500 words)

APPLIED STATISTICS study program takes place in a modern, well equipped space, according to the standard one student-one computer. Every day from 7 to 19 h students have access to a fully equipped library of the Department of Mathematics and Informatics, and reading room equipped with computers. The Department has 4 equipped computer labs and provides software for teaching. Textbooks, exercise, scripts, or science books are available for all subjects provided by the study program.

University of Novi Sad regularly updates the license for the software package STATISTICA, which is used both for teaching and for research. The acquisition of other statistical software (SPSS, SAS and eView) is in course, and these will be available for students of applied statistics. The funds are provided through the Tempus project.

Students have also access to the university library, as well to libraries of seven faculties of the University of Novi Sad. The process of acquisition over the Tempus project of 100 titles intended for students of the proposed study program is in course.

Each course of the study program is covered by the relevant literature, primarily in English. This is the literature used in universities with well developed studies in statistics.

Standard 11: Quality control

Quality control program of study is conducted regularly and systematically through self-assessment and external verification of quality.

Description (at most 500 words)

The study program is implemented at the University of Novi Sad at the Center for Aplied Statistics. University of Novi Sad is accredited and has developed self-evaluation process. In addition, in order to achieve European quality, Experts Council for the study program of applied statistics is appointed. It is formed of eminent experts outside the University of Novi Sad, including reresentatives of six European universities.