Table 5.2 Specification of subjects

<table>
<tr><td colspan="4">Study program: Advanced Data Analytics in Business</td></tr>
<tr><td colspan="4">Name of the subject: Academic writing</td></tr>
<tr><td colspan="4">Teacher(s): Marija Džunić</td></tr>
<tr><td colspan="4">Status of the subject: Elective</td></tr>
<tr><td colspan="4">Number of ECTS credits: 7</td></tr>
<tr><td colspan="4">Conditions:</td></tr>
<tr><td colspan="4">Subject goal
To develop and strengthen academic and professional writing skills of students. To improve reading, critical reasoning and research skills. To enable students to write academic and professional articles with confidence and skill. To introduce fundamental concepts of academic writing, text analysis and critical reasoning.</td></tr>
<tr><td colspan="4">Outcome of the subject
Students will be able to:
- compose individual essays, based on evidence, sources and appropriate writing strategies to support topic statements;
- demonstrate critical thinking and reading skills;
- enhance the ability of text summarization and analysis;
- evaluate and use academic sources, avoid plagiarism and cite accurately.</td></tr>
<tr><td colspan="4">Subject content
Theory
Strategies and skills of academic reading; The writing process: topic selection, developing ideas and focus; Paper structure; Drafting and revising; Text analysis; Academic and professional sources; Literature review; Avoiding plagiarism; Clarity and exactness; Critical presentation.
Practical learning
Research assignment: research proposal, outline, draft; paragraph form and substance; citation practice and plagiarism; source evaluation; research analysis. Critical review - critical reading, analysis and writing evaluation of a scientific text.</td></tr>
<tr><td colspan="4">Literature
1. Harvard College Writing Program (2022) Harvard Guide to Using Sources: A Publication of the Harvard College Writing Program. One Bow Street: Cambridge.
2. Barnet, S., Stubbs, M. and Bellanca, P. (2018) A Short Guide to College Writing, 5th edition. Vancouver, B.C.: Langara College</td></tr>
<tr><td>Number of active teaching classes</td><td colspan="2">Theoretical teaching: 30</td><td>Practical teaching: 45</td></tr>
<tr><td colspan="4">Method of carrying out the teaching
Discussion, mini projects, reading strategy practice, writing assignments, presentations</td></tr>
<tr><td colspan="4">Evaluation of knowledge (maximum number of points 100)</td></tr>
<tr><td>Pre-exam obligations</td><td>points</td><td>Final exam</td><td>Points</td></tr>
<tr><td>Participation in lecturing classes</td><td>10</td><td>Written exam</td><td>50</td></tr>
<tr><td>Participation in practical course work</td><td>10</td><td></td><td></td></tr>
<tr><td>Reading assignments</td><td>10</td><td></td><td></td></tr>
<tr><td>Writing assignment (essay)</td><td>20</td><td>Total</td><td>100</td></tr>
</table>

Table 5.2 Specification of subjects

<table>
<tr><td colspan="4">Study program: Advanced Data Analytics in Business</td></tr>
<tr><td colspan="4">Name of the subject: Accounting information for decision making</td></tr>
<tr><td colspan="4">Teacher(s): Tadija Đukić, Milica Đorđević, Bojana Novićević Čečević</td></tr>
<tr><td colspan="4">Status of the subject: Elective</td></tr>
<tr><td colspan="4">Number of ECTS credits: 7</td></tr>
<tr><td colspan="4">Conditions: None</td></tr>
<tr><td colspan="4">Subject goal:
Acquiring knowledge and skills in the field of financial accounting, as well as costing for business decision making. Students will be able to make short-term business decisions based on a well-mastered information base.</td></tr>
<tr><td colspan="4">Outcome of the subject:
The student will be able to:
- keep business books,
- compile financial reports,
- organize company accounting and prepare accounting information for the needs of a wide range of users,
- explain the information needs of company managers and recognize them in the appropriate reports,
- illustrate the process of individual business decisions making.</td></tr>
<tr><td colspan="4">Subject content
Theory: Introduction to double-entry bookkeeping (balance sheets, invoices, bookkeeping documents, business books, chart of accounts, inventory, closing of business books, annual calculation). Methodology of financial accounting (fixed assets, short-term receivables, cash, capital, long-term provisions and liabilities, expenses, income and financial result). Traditional cost accounting systems, New systems, concepts, methods and techniques for cost treatment and performance measurement, Information basis for short-term business decision making, Individual business decision making based on activity costing information, Theory of constrains and business decision making.
Practical learning
Solving tasks with analysis of the obtained results; examples of different cost calculations, study research work, seminars, case studies from the practice of domestic and foreign companies, debates and interactive workshops on specific topics</td></tr>
<tr><td colspan="4">Literature:
1. Drury, C. (2015) Management and Cost Accounting. Cengage Learning EMEA.
2. Kushwaha, J., Pallavi, J. (2020) Advanced Cost & Management Accounting: Excellence in Accounting. Kindle Edition.
3. Wild, J., Shaw, K. (2015) Financial and Managerial Accounting, Infromation for decision. Mc Graw Hill.
4. Marugan, A., Marquez, F. (2017) Decision-Making Management, A Tutorial and Applications. AP</td></tr>
<tr><td>Number of active teaching classes</td><td colspan="2">Theoretical teaching: 30</td><td>Practical teaching: 45</td></tr>
<tr><td colspan="4">Method of carrying out the teaching:
Lectures, exercises, consultations with the active participation of students. Analysis of case studies and journal articles. Discussions, direct application, seminar papers.</td></tr>
<tr><td colspan="4">Evaluation of knowledge (maximum number of points 100)</td></tr>
<tr><td>Pre-exam obligations</td><td>points</td><td>Final exam</td><td>points</td></tr>
<tr><td>Activity during lectures</td><td>10</td><td>Written exam</td><td>50</td></tr>
<tr><td>Practical teaching</td><td>10</td><td>Oral exam</td><td></td></tr>
<tr><td>colloquium</td><td>30</td><td></td><td></td></tr>
<tr><td>Seminar(s)</td><td></td><td>Total</td><td>100</td></tr>
</table>

Table 5.2 Specification of subjects

Study program: Advanced Data Analytics in Business

Name of the subject: Advanced Big Data Analytics

Teacher(s): Ognjen Radović, Jovica Stanković, Alessio Farcomeni

Status of the subject: Elective

Number of ECTS credits: 7

Conditions: Programming for business applications 1

Subject goal

In today's time of rapid development of information and communication technologies, the generation and collection of large amounts of raw data, represents an undisclosed source of information. In this sense, students will master the architecture of big data analytics, gain knowledge about the latest trends in data analysis and based on that, be able to define the key elements of a big data analytics strategy and use it for making business decisions.

Outcome of the subject

Students will be able to:

- recognize and extract valuable and significant information from a set of big data, so that it can be used for decision-making;
- identify and solve problems which fall into the domain of big data sets;
- with the help of programming languages Python and R, use methods of advanced data analysis and the Big Data concept.

Subject content

Theory

Business data analytics: Fundamentals of Big Data analytics, data analytics life cycle, advanced analytical models: clustering, classifications, time series.

Application of Python language: Business analytics and simulation models. Introduction to the PySpark library.

Advanced data analytics in R: Introduction to MapReduce and Hadoop, work with large databases, supervised and unsupervised learning.

Practical learning

Exercises in the computer center. Examples will be processed and implemented in accordance with the theoretical teaching.

Literature

1. EMC Education Services, Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, John Wiley & Sons, Inc., 2015.
2. G. Ciaburro, 2020, *Hands-On Simulation Modeling with Python*, Packt Publishing Ltd,.
3. Saiz A. Z. et al., 2020, *An Introduction to DataAnalysis in R: Hands-on Coding, Data Mining, Visualization and Statistics from Scratch*, Springer.

Number of active teaching classes	**Theoretical teaching:** 30	**Practical teaching:** 45

Method of carrying out the teaching

Interactive lectures and exercises in the computer classroom.

Evaluation of knowledge (maximum number of points 100)

Pre-exam obligations	points	**Final exam**	points
Activity during lectures	10	Written exam	50
Practical teaching	10	Oral exam	0
colloquium	20	Project presentation	0
Seminar(s)	10	**Total**	**100**

Table 5.2. Specification of subjects

<table>
<tr><td colspan="4">Study program: Advanced Data Analytics in Business</td></tr>
<tr><td colspan="4">Name of the subject: Applied Econometrics</td></tr>
<tr><td colspan="4">Teacher(s): Žarko Popović, Jelena J. Stanković</td></tr>
<tr><td colspan="4">Assistant(s): Ivana Marjanović</td></tr>
<tr><td colspan="4">Status of the subject: Core subject</td></tr>
<tr><td colspan="4">Number of ECTS credits: 8</td></tr>
<tr><td colspan="4">Conditions: completed course Programming for business applications 2</td></tr>
<tr><td colspan="4">Subject goal
Acquiring knowledge of econometric methods and models which used in business and economics and acquiring skills needed for independent empirical research in this field of science.</td></tr>
<tr><td colspan="4">Outcome of the subject
Students will be able to:
- apply econometric modeling in micro and macroeconomics;
- conduct independent econometric research;
- use of appropriate programming language on empirical data;
- interpret the results of implemented models.</td></tr>
<tr><td colspan="4">Subject content
Theory
Classical econometric analysis: classical linear regression model - assumptions, estimation methods, testing of deviations from the assumptions of the classical linear regression model and model stability tests.
Econometric analysis of panel data: fixed and random effects models - assumptions and evaluation methods, tests and model selection, testing of deviations from the assumptions, methods of instrumental variables, dynamic panel models.
Econometric analysis of models with discrete dependent variable: binary choice models, probit and logit, marginal effects, specification tests and multiple-choice models.
Practical learning
Application of econometric methods and models on empirical data in the computer centre where students would learning to obtain adequate conclusions useing the programming language R.</td></tr>
<tr><td colspan="4">Literature
1. Asteriou, D., Hall, S. G. (2015) Applied econometrics. Macmillan International Higher Education.
2. Wooldridge, J. M. (2015). Introductory econometrics: A modern approach. Cengage learning.
3. Croissant, Y., Millo, G. (2019) Panel data econometrics with R. John Wiley and Sons, Incorporated.
4. Heiss, F. (2020). Using R for Introductory Econometrics (2nd edition). Independently published.</td></tr>
<tr><td>Number of active teaching classes</td><td colspan="2">Theoretical teaching: 30</td><td>Practical teaching: 45</td></tr>
<tr><td colspan="4">Method of carrying out the teaching
Interactive lectures, presentation, dialouge, individual work</td></tr>
<tr><td colspan="4">Evaluation of knowledge (maximum number of points 100)</td></tr>
<tr><td>Pre-exam obligations</td><td>points</td><td>Final exam</td><td>points</td></tr>
<tr><td>Activity during lectures</td><td>10</td><td>Written exam</td><td>50</td></tr>
<tr><td>Practical teaching</td><td>10</td><td>Oral exam</td><td>0</td></tr>
<tr><td>Colloquium</td><td>20</td><td>Project presentation</td><td>0</td></tr>
<tr><td>Seminar(s)</td><td>10</td><td>Total</td><td>100</td></tr>
</table>

Table 5.2 Specification of subjects

Study program: Advanced Data Analytics in Business

Name of the subject: Business process management

Teacher(s): Marija Radosavljević

Status of the subject: elective

Number of ECTS credits: 7

Conditions: None

Subject goal

Business process management is a discipline of recent date, intended for managers who will direct the business of a company in a dynamic environment. The goal of the course is to show the importance of process orientation, but also acquisition of knowledge from the business processes management field, study of methods and techniques of business process management, training students to apply the knowledge acquired through the application and dealing with specific problems in economic practice.

Outcome of the subject

Students will be able to:

- identify the key business processes, links between them, as well as to monitor business processes as a link between organizational units based on an understanding of the principles and elements of business processes;
- identify the causes of problems, inconsistencies and inefficiencies of business processes, through methods of observation, data collection and analysis;
- use tools for analysis and optimization of business processes, as well as for the application of modern business process management (SAP, Balance);
- apply modern models and methods to increase the efficiency of business processes.

Subject content

Theory

The concept of process orientation; Definition and characteristics of business processes; Elements and principles of business process management; Business process management phases; Structuring business processes; Social networks as a prerequisite for the functioning of business processes; Implementation of modern applications for business process management (SAP, Balance); Business process management maturity model.

Practical learning

Analysis of the case studies in the field of business process management, solving problems based on hypothetical examples, students' discussions, visiting enterprises to learn about the way of functioning of modern applications and applicability of certain tools (SAP, Balance), Individual and group presentations of specific topics, solving tasks by using appropriate applications (SAP, Balance) in the Laboratory for Operations Management.

Literature

1. Chang, J. F. (2016). *Business process management systems: strategy and implementation*. Auerbach Publications (Chapter 1).
2. Jeston, J. (2014). *Business process management: practical guidelines to successful implementations*. Routledge. (Chapters 1-4).
3. Dumas, M., La Rosa, M., Mendling, J., & Reijers, H. A. (2013). *Fundamentals of business process management*. Heidelberg: Springer.
4. Sproull, B. (2019). *Theory of Constraints, Lean, and Six Sigma Improvement Methodology: Making the Case for Integration*. Productivity Press.

Number of active teaching classes	**Theoretical teaching:** 30	**Practical teaching:** 45

Method of carrying out the teaching

Interactive lectures and exercises in the computer classroom.

Evaluation of knowledge (maximum number of points 100)

Pre-exam obligations	points	**Final exam**	points
Activity during lectures	10	Written exam	0

Practical teaching	10	Oral exam	50
colloquium	20	Project presentation	0
Seminar(s)	10	**Total**	**100**

Table 5.2 Specification of subjects

<table>
<tr><td colspan="4">Study program: Advanced Data Analytics in Business</td></tr>
<tr><td colspan="4">Name of the subject: Data Acquisition in Business Intelligence</td></tr>
<tr><td colspan="4">Teacher(s): Ognjen Radović, Jovica Stanković</td></tr>
<tr><td colspan="4">Status of the subject: Elective</td></tr>
<tr><td colspan="4">Number of ECTS credits: 7</td></tr>
<tr><td colspan="4">Conditions: Programming for business applications 1</td></tr>
<tr><td colspan="4">Subject goal
Well-prepared and generated data is a powerful tool to manage business and customer relationships. In this sense, the aim of this course is to acquire students with theoretical and practical knowledge about the ways in which they can generate more relevant and reliable information. Students develop competencies such that they with the help of data acquisition and application of programming languages Python and R to users of information provide information which they need and in the form which they request.</td></tr>
<tr><td colspan="4">Outcome of the subject
With the help of Python and R students will be able to:
- collect information and analyze it;
- personalize data and deliver it through different channels;
- manage knowledge by taking certain actions.</td></tr>
<tr><td colspan="4">Subject content
Theory
Basics of data acquisition: The importance of data acquisition in business intelligence, basics of data analytics and machine learning, introduction to different Hadoop models.
Application of Python language in business data acquisition: data extraction from different formats SQL, XLS, HTML.
Application of R language in business data acquisition: Introduction to Hadoop, data analytics in R programming language, data extraction from MySQL, Excel, MongoDB, Hive.
Practical learning
Exercises in the computer center. Examples will be processed and implemented in accordance with the theoretical teaching.</td></tr>
<tr><td colspan="4">Literature
1. Bahga, A., Madisetti, V. 2016, Big Data Analytics: A Hands-On Approach, Arshdeep Bahga & Vijay Madisetti.
2. EMC Education Services, 2015, Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, John Wiley & Sons, Inc.
3. Prajapati, V. 2013, Big Data Analytics with R and Hadoop, Packt Publishing.</td></tr>
<tr><td colspan="2">Number of active teaching classes</td><td>Theoretical teaching: 30</td><td>Practical teaching: 45</td></tr>
<tr><td colspan="4">Method of carrying out the teaching
Interactive lectures and exercises in the computer classroom.</td></tr>
<tr><td colspan="4">Evaluation of knowledge (maximum number of points 100)</td></tr>
<tr><td>Pre-exam obligations</td><td>points</td><td>Final exam</td><td>points</td></tr>
<tr><td>Activity during lectures</td><td>10</td><td>Written exam</td><td>50</td></tr>
<tr><td>Practical teaching</td><td>10</td><td>Oral exam</td><td>0</td></tr>
<tr><td>colloquium</td><td>20</td><td></td><td></td></tr>
<tr><td>Seminar(s)</td><td>10</td><td>Total</td><td>100</td></tr>
</table>

Table 5.2 Specification of subjects

Study program: Advanced Data Analytics in Business			
Name of the subject: F**inal paper - Subject**			
Teacher(s): All teachers in the study program			
Status of the subject: Core			
Number of ECTS credits: 10			
Conditions: Passed all exams from the study program			
Subject goal The aim of the course is to enable students to understand the research flow on selected topic; interpretations of research processes and results; check the accuracy and validity of user data and their analysis; application of statistical, experimental, and other research methods; conduct consequential - comparative research; creating research by selected research subject; conducting of research, chronological analysis and identifying evolutionary changes and trends of the observed subject of research; making and interpreting conclusions based on the obtained research results.			
Outcome of the subject Competence for planning, organizing, and implementation of a professional project that meets specific initial goals. Ability to present project work through written documentation and oral presentation. The student is trained to think critically in research work, to apply scientific research methods as well as different ways of collecting information for research work; to understand different phases and levels of research, to define research hypotheses, and interpretation of obtained results, as well as to make conclusions.			
Subject content After passing the exams, the student is ready for the final paper preparation. These activities are research and practical work, where a student faces the practical problem as well as the methodology that will be applied in the preparation of the final paper. The student is engaged in collecting, grouping, arranging, and analyzing quantitative and qualitative data, both from primary and secondary sources. Also, he presents and explains the results of the research in writing and orally and leads discussions on the topic of the obtained results with the application of a logical and critical way of thinking.			
Literature Literature of relevant fields, professional periodicals, Internet, etc.			
Number of active teaching classes	**Theoretical teaching:**	**Practical teaching:**	
Method of carrying out the teaching Study research work, consultation discussions, comparative analysis, individual presentations, and presentations of collected material and ideas by mentoring, interactive, practical, laboratory, individual work.			
Evaluation of knowledge (maximum number of points 100)			
Pre-exam obligations	points	**Final exam**	points
Study research	50	Discussion and defense of research results	50

Table 5.2 Specification of subjects

<table>
<tr><td colspan="4">Study program: Advanced Data Analytics in Business</td></tr>
<tr><td colspan="4">Name of the subject: Final paper</td></tr>
<tr><td colspan="4">Teacher(s): All teachers in the study program</td></tr>
<tr><td colspan="4">Status of the subject: Core</td></tr>
<tr><td colspan="4">Number of ECTS credits: 17</td></tr>
<tr><td colspan="4">Conditions: Previously achieved 103 ECTS in the study program</td></tr>
<tr><td colspan="4">Subject goal
To show that the student has mastered the knowledge and acquired competencies needed for independent work in the field of data analytics in business. Introducing students to the realization of the project from idea to implementation, and final confirmation of student competencies in the selected field of economics. Training students for independent research and practical work in the field of data analytics, training for the use of scientific and professional literature.</td></tr>
<tr><td colspan="4">Outcome of the subject
The final work is a professional work of the student in which he shows that he can integrate and apply the acquired knowledge in solving specific problems in the field of data analytics. The outcome of the final work is reflected in the following:
- developing competencies for dealing with issues in the field of data analytics in business,
- acquisition of academic skills for the application of acquired theoretical knowledge,
- development of creative abilities and mastering specific practical skills needed to perform tasks in the field of economics,
- the ability to apply the knowledge acquired by studying the literature in solving a specific problem,
- ability to present the results of the final work to the professional and general public,
- understanding and application of knowledge in the field of data analytics in business in solving specific issues in this field,
- ability to collect, interpret and process empirical data, as well as the implementation and application of market research results</td></tr>
<tr><td colspan="4">Subject content
The final work is a research work of the student in which he meets the research methodology in the field of data analytics in business. After the research, the student prepares a final paper in the form that contains the following chapters: Introduction, Theoretical part, Empirical part, Results and discussion, Conclusion, Literature review.
The abstract of the paper is written in Serbian and English. The introduction presents the theoretical foundations of the problem, issues needed to be discussed or hypotheses to be tested, methodological foundations of the work, and presents the content of the work in parts. The student deals with the topic of the paper in the main part (elaboration) of the final paper. It contains an overview of theoretical settings and practical (illustrative examples, usually original) results related to a given topic. Each chapter of the final work contains a certain introductory consideration, as well as the corresponding conclusions. The material should be presented concisely, with the use of appropriate literature. The literature used is clearly stated, it is used adequately, with constant determination according to the statements from the literature. The conclusion presents the results obtained in the paper, its originality, limitations, as well as possible directions for further consideration of the problem and some possible controversies related to the discussed topic. This is followed by a list of references that includes a summary of all bibliographic sources used in the preparation of the final paper.
After completing the work, the candidate submits the work to a mentor who evaluates the work, gives possible remarks, and suggests corrections. After a positive report from the mentor, a commission is formed and the public defense of the final paper is approved.</td></tr>
<tr><td colspan="4">Literature
Literature of relevant fields, professional periodicals, Internet, etc.</td></tr>
<tr><td>Number of active teaching classes</td><td colspan="2">Theoretical teaching:</td><td>Practical teaching:</td></tr>
<tr><td colspan="4">Method of carrying out the teaching
Study research work, consultation discussions, comparative analysis, individual presentations, and presentations of collected material and ideas by mentoring, interactive, practical, laboratory, individual work.</td></tr>
<tr><td colspan="4">Evaluation of knowledge (maximum number of points 100)</td></tr>
<tr><td>Pre-exam obligations</td><td>points</td><td>Final exam</td><td>points</td></tr>
<tr><td>Answer questions</td><td>30</td><td>The written part of the paper</td><td>40</td></tr>
<tr><td></td><td></td><td>Project presentation</td><td>30</td></tr>
</table>

Table 5.2. Specification of subject

Study program: Advanced Data Analytics in Business

Name of the subject: Introduction to Machine Learning in Business

Teacher(s): Marko Milojković, Miroslav Milovanović, Ronald Hochreiter

Status of the subject: Core subject

Number of ECTS credits: 8

Conditions: Programming for business applications 1

Subject goal

Modern business heavily depends on extracting commercial value from the vast amount of available data. This course aims to provide students an introduction to machine learning techniques that are the core of modern data analytics.

Outcome of the subject

Students will be able to:

- recognize an adequate machine learning method for performing business activities;
- on the basis of the data, they can be predict and evaluate the movement of economic phenomena;
- conduct independent research using various machine learning methods, focusing on economic applications.

Subject content

Theory

The course will cover leading machine learning methods, emphasizing the challenges and opportunities of integrating these methods in empirical economics. The various topics are illustrated through applications, reading empirical articles, and doing applied work. Students will be trained in the following specific topics: big data analytics, preparing data for modeling, basics of machine learning, and various machine learning methods (regression methods, nearest neighbors classifiers, decision trees, random forest, neural networks).

Practical learning

All computing in class will be conducted in Python. Students will be trained in case studies in the domain of economics: predicting economic growth, estimating the price of real estate, predicting trends in the stock market, loan default prediction.

Literature

1. Atin Basuchoudhary, James T. Bang, Tinni Sen (2017) Machine-learning Techniques in Economics -New Tools for Predicting Economic Growth, Springer, ISBN 978-3-319-69013-1
2. Matthew F. Dixon, Igor Halperin, Paul Bilokon (2020) Machine Learning in Finance - From Theory to Practice, Springer, ISBN 978-3-030-41067-4
3. Sebastian Raschka, Vahid Mirjalili (2017), Python Machine Learning - Second Edition: Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow, Packt, ISBN 978-1787125933

Number of active teaching classes	**Theoretical teaching:** 45	**Practical teaching:** 30

Method of carrying out the teaching

Presentation, dialogue, graphics, programming language demonstration, indvidual work.

Evaluation of knowledge (maximum number of points 100)

Pre-exam obligations	Points	**Exam results**	Points
Activity during lectures	10	Written exam	25
Practical teaching	10	Oral exam	25
Colloquium	0	Project presentation	0
Paper work - case study	30	**Total**	**100**

Table 5.2 Specification of subjects

<table>
<tr><td colspan="4">Study program: Advanced Data Analytics in Business</td></tr>
<tr><td colspan="4">Name of the subject: Marketing intelligence</td></tr>
<tr><td colspan="4">Teacher(s): Vinko Lepojević, Vesna janković-Milić</td></tr>
<tr><td colspan="4">Status of the subject: Elective</td></tr>
<tr><td colspan="4">Number of ECTS credits: 7</td></tr>
<tr><td colspan="4">Conditions: Methods of Statistical Analysis</td></tr>
<tr><td colspan="4">Subject goal
Enabling students to apply the most commonly used statistical tools in market research and marketing research and preparing students, who have already mastered the logic of statistical thinking, to independently conduct marketing research and data analysis.</td></tr>
<tr><td colspan="4">Outcome of the subject
Students will be able to:
- apply specific methods and techniques for analyzing data collected in marketing research;
- conduct appropriate analyzes in order to make adequate managerial decisions;
- use the programming languages R and Python for marketing research and analysis.</td></tr>
<tr><td colspan="4">Subject content
Theory
Marketing research, Data, samples and statistical tests, Relationships between variables, Multivariate analysis methods, Multivariate analysis of variance, Principal component analysis, Exploratory factor analysis, Confirmatory factor analysis, Discriminant analysis, Cluster analysis.
Practical learning
Application of multivariate analysis methods on concrete data using programming languages R and Python.</td></tr>
<tr><td colspan="4">Literature
4. Winston, L., W., (2014). Marketing Analytics, John Wiley & Sons, Inc
5. Chapman, C., Mc Donnell Feit, E. (2015). R for Marketing research and Analytics, Springer International Publishing Switzerland.
6. Schwarz, J., Chapman, C., Mc Donnell Feit, E. (2020). Python for Marketing research and Analytics, Springer International Publishing Switzerland.
7. Miller, W., T., (2015). Marketing Data Science – Modelling Techniques in Predictive Analytics with R and Python, Pearson.</td></tr>
<tr><td>Number of active teaching classes</td><td colspan="2">Theoretical teaching: 30</td><td>Practical teaching: 45</td></tr>
<tr><td colspan="4">Method of carrying out the teaching
Presentation, dialogue, graphics, programming language demonstration, indvidual work.</td></tr>
<tr><td colspan="4">Evaluation of knowledge (maximum number of points 100)</td></tr>
<tr><td>Pre-exam obligations</td><td>points</td><td>Final exam</td><td>points</td></tr>
<tr><td>Activity during lectures</td><td>10</td><td>Written exam</td><td></td></tr>
<tr><td>Practical teaching</td><td>10</td><td>Oral exam</td><td></td></tr>
<tr><td>Colloquium</td><td>20</td><td>Project presentation</td><td>50</td></tr>
<tr><td>Seminar(s)</td><td>10</td><td>Total</td><td>100</td></tr>
</table>

Table 5.2. Specification of subjects

<table>
<tr><td colspan="4">Study program: Advanced Data Analytics in Business</td></tr>
<tr><td colspan="4">Name of the subject: Mathematics in Business Analysis</td></tr>
<tr><td colspan="4">Teacher(s): Žarko Popović</td></tr>
<tr><td colspan="4">Status of the subject: Elective</td></tr>
<tr><td colspan="4">Numebr of ECTS credits: 7</td></tr>
<tr><td colspan="4">Conditions: Mathematics (Mathematics 1)</td></tr>
<tr><td colspan="4">Subject goal
The goal of this course is to improve students' knowledge of modern models and methods in mathematics and to enable students to independently apply and interpret the acquired knowledge to data from various fields of economics.</td></tr>
<tr><td colspan="4">Outcome of the subject
Students will be to:
- use different theories for the purposes of discrete data analysis;
- master combinatorial optimization models;
- solve specific economic and organizational problems by applying appropriate software packages.</td></tr>
<tr><td colspan="4">Subject content
Theory
Mathematical logic, Set theory, Number theory, Combinatorics, Graph theory, Network theory, Optimization methods, Combinatorial optimization, Algorithm theory, Automata theory, Formal language theory.
Practical learning
Solving appropriate tasks and examples from practice with active work on the computer and application of appropriate mathematical software packages (MATHEMATICA, Matlab).</td></tr>
<tr><td colspan="4">Literature
1. Epp, S. S., (2018) Discrete Mathematics with Applications, Cangage Learning Inc.
2. Rosen, H. K. (2019) Discrete Mathematics and its Applications, Mc Graw-Hill.
3. Rosen, H. K. (2018) Discrete and Combinatorial Mathematics, Chapman and Hall, CRC Pres.
4. Linz, P. (2016) An Introduction to Formal Languages and Automata, Jones & Barlett Learning.</td></tr>
<tr><td>Number of active teaching classes</td><td colspan="2">Theoretical teaching: 30</td><td>Practical teaching: 45</td></tr>
<tr><td colspan="4">Method of carrying out the teaching
Presentation, dialogue, graphics, indvidual work.</td></tr>
<tr><td colspan="4">Evaluation of knowledge (maximum number of points 100)</td></tr>
<tr><td>Pre-exam obligations</td><td>points</td><td>Final exam</td><td>Points</td></tr>
<tr><td>Activity during lectures</td><td>10</td><td>Written exam</td><td>0</td></tr>
<tr><td>Practical teaching</td><td>10</td><td>Oral exam</td><td>0</td></tr>
<tr><td>Colloquium</td><td>20</td><td>Project presentation</td><td>50</td></tr>
<tr><td>Seminar(s)</td><td>10</td><td>Total</td><td>100</td></tr>
</table>

Table 5.2 Specification of subjects

<table>
<tr><td colspan="4">Study program: Advanced Data Analytics in Business</td></tr>
<tr><td colspan="4">Name of the subject: Methods of Statistical Analysis</td></tr>
<tr><td colspan="4">Teacher(s): Vinko Lepojević, Vesna Janković-Milić</td></tr>
<tr><td colspan="4">Status of the subject: Elective</td></tr>
<tr><td colspan="4">Number of ECTS credits: 7</td></tr>
<tr><td colspan="4">Conditions:</td></tr>
<tr><td colspan="4">Subject goal
Practical and theoretical training of students to understand modern models and methods in statistical analysis and their training to apply adopted methods to data from different areas of economics. This course offers students to upgrade their knowledge and learn how to apply them in solving practical problems by analysis and critical interpretation data, by building statistical models and using the latest software packages for statistical analysis.</td></tr>
<tr><td colspan="4">Outcome of the subject
Students will be able to:
- calculate and correctly interpret statistical indicators;
- apply modern statistical methods;
- comment on the optained results;
- use appropriate software packages (SPSS, STATISTICS).</td></tr>
<tr><td colspan="4">Subject content
Theory
Data types and measurement scales, Data visualization, Descriptive measures, Sampling, sample types and sampling distributions, Statistical inference, Parametric tests, Non-parametric tests, Time series components.
Practical learning
Solving simple tasks and examples from practice with active work on the computer.</td></tr>
<tr><td colspan="4">Literature
5. Sharma, J.K. (2012) Business Statistics – second edition, Pearson Education.
6. Freund, R., J., Wilson, W., J., Mohr, D., L. (2021) Statistical Methods – fourth edition, Elsevier. USA.
7. Holmes. A., T., Illowsky, B., Dean, S. (2017) Introductory Business Statistics, Openstax.</td></tr>
<tr><td>Number of active teaching classes</td><td colspan="2">Theoretical teaching: 30</td><td>Practical teaching: 45</td></tr>
<tr><td colspan="4">Method of carrying out the teaching
Presentation, dialogue, graphics, individual work.</td></tr>
<tr><td colspan="4">Evaluation of knowledge (maximum number of points 100)</td></tr>
<tr><td>Pre-exam obligations</td><td>points</td><td>Final exam</td><td>points</td></tr>
<tr><td>Activity during lectures</td><td>10</td><td>Written exam</td><td>0</td></tr>
<tr><td>Practical teaching</td><td>10</td><td>Oral exam</td><td>0</td></tr>
<tr><td>Colloquium</td><td>20</td><td>Project presentation</td><td>50</td></tr>
<tr><td>Seminar(s)</td><td>10</td><td>Total</td><td>100</td></tr>
</table>

Table 5.2 Specification of subjects

Study program: Advanced Data Analytics in Business			
Name of the subject: **Obligatory professional practice in companies**			
Teacher(s): All teachers in the study program			
Status of the subject: Core			
Number of ECTS credits: 3			
Conditions: Enrolled 4th semester			
Subject goal The goal of the professional practice for the student is to apply the knowledge he/she acquired during the teaching and preparation for the exam in the study program. Also, this course aims to improve students' abilities for successful application of academic knowledge and skills in performing more complex tasks. Detailed introduction of students with a certain field through a thorough elaboration of a topic on the example of a specific company, organization, or institution. Gaining practical experience working in a specific company.			
Outcome of the subject The ability of students to successfully perform key business functions in economic entities, manage affairs in the organization of domestic and international projects, adequately use planning documents and create conditions for their development, successfully use modern information technologies, and practically apply business negotiation skills.			
Subject content The student receives a topic from the teacher, which he will cover during the stay in a specific company, bank, consulting company, insurance organization, agency (tourist and others), non-profit organization, state administration body, and local self-government. After that, the student prepares a paper that contains the following parts: Introduction, Theoretical part, Practical part, Conclusion, and Literature. As proof, the student attaches confirmation of time spent in the selected organization. The mentor reviews the work, gives suggestions, finally accepts and evaluates it.			
Literature Literature of relevant fields, professional periodicals, Internet, etc.			
Number of active teaching classes	**Theoretical teaching:**	**Practical teaching:**	
Method of carrying out the teaching Empirical research in companies, organizations, and institutions, analysis of examples from practice, making conclusions by induction and deduction.			
Evaluation of knowledge (maximum number of points 100)			
Pre-exam obligations	points	**Final exam**	points
Activity in the company	50	The written part of the paper	50

Table 5.2. Specification of subject

Study program: Advanced Data Analytics in Business

Name of the subject: Online Business and Web Analytics

Teachers: Marko Milojković, Miroslav Milovanović

Status of the subject: Elective

Number of ECTS credits: 7

Conditions: Programming for business applications 1

Subject goal

Today's business success is tremendously dependent on accurate data analysis using specific statistical methods and intelligent optimization techniques that have significantly changed the way modern businesses operate. This course focuses on presenting key concepts of an online business, as one of the main pillars of modern business approaches. Special attention will be made to proper analysis of digital marketing results and web analytics.

Outcomes of the subject

Students will be able to perform an independent analysis of web data and create conclusions and business decisions related to potential improvements in sales, product range, customer relations, and digital marketing strategies.

Subject content

Theoretical lectures

The course will cover basic types and fundamental concepts of three domains of analytics: web, business, and digital marketing analytics. Some of the specific topics that will be included within the course are big data, probability and statistics, social media analytics, marketing metrics, search engine optimization, data mining, web analytics and collecting web data, predictive and text analytics, and generating delivery reports. The various topics will be illustrated through applications, reading empirical and theoretical articles, and doing applied work.

Practical course work

All computing in class will be conducted in Excel, Python, and Tableau, where students will be educated to make effective presentations of marketing analytics findings by using modern analytical tools. Additionally, students will be trained in case studies in the domain of economics such are: paid advertising, ad effectiveness testing, A/B testing, website analytics, social media marketing, collecting social media data, and social listening.

Literature

1. Himanshu Sharma (2015), Maths and Stats for Web Analytics and Conversion, Blurb, ISBN 1364849186
2. Eric Siegel (2016), Predictive Analytics: The Power to Predict who Will Click, Buy, Lie, or Die, Wiley, ISBN 9781119145677
3. Jeff Larson, Stuart Draper (2017), Digital Marketing Essentials: A comprehensive Digital Marketing Textbook, Stukent, ISBN 0998713813

Number of active teaching classes	**Theoretical teaching:** 30	**Practical teaching:** 45

Method of carrying out the teaching

Presentation, dialogue, graphics, programming language demonstration, indvidual work.

Evaluation of knowledge (maximum number of points 100)

Pre-exam obligations	points	**Exam results**	Points
Activity during lectures	10	Written exam	25
Practical teaching	10	Oral exam	25
Colloquium	20	Project presentation	0
Paper work - case study	10	**Total**	**100**

Table 5.2 Course specification

Study programme: Advanced Data Analytics in Business			
Course name: Optimization and Business Decision-Making			
Lecturers: Jelena J. Stanković, Jason Papathanasiou			
Course status: Core subject			
Numberof ECTS credits: 8			
Precondition: None			
Aims of the course Students will acquire knowledge related to operation research and decision theories methods used in business and economics. Based on the mastered approaches and concepts of decision-making, students will be able to conduct independent and autonomous empirical research in this area.			
Learning outcomes Students will be able to: – apply linear programming modelling in the field of business management; – apply multi-criteria analysis methods in the field of finance; – conduct independent research and solve case-study problems through practical examples and the use of Python as an appropriate programming language.			
Content of the course *Theoretical lectures* *Linear programming optimization*: Course starts with the concept and formulation of linear programming, followed by optimization methods and sensitivity analysis. During the course, some linear programming examples are explored, starting with some very basic mathematical theory behind the simplex method and moving on to some real-world examples. During the course we'll be using Python and a linear programming optimization packages PuLP and Pyomo. *Multi-criteria analysis*: The course studies the basic concepts of multicriteria analysis, model formulation and three methods for solving this type of problem - AHP, TOPSIS and VIKOR. During the classes, practical examples will be solved using the Python programming language. *Practical course work* Application of optimization and business decision-making methods and models on empirical data by employing the programming language Python in order to provide practical knowledge that will enable students to solve real-case problems and obtain adequate conclusions.			
Literature 8. Barry Render, Ralph M. Stair Jr., Michael E. Hanna, Trevor S. Hale (2017)Quantitative Analysis for Management, Global Edition, Pearson, ISBN-13: 978-1292217659 (Chapter 7 and Chapter 8) 9. Jason Papathanasiou, Nikolaos Ploskas (2018) Multiple Criteria DecisionAid - Methods, Examples andPython Implementations, Series Springer Optimization and Its Applications, ISBN 978-3-319-91646-0, Springer International Publishing (Chapter 1, Chapter 2 and Chapter 5) 10. Hart, W.E., Laird, C.D., Watson, J.-P., Woodruff, D.L., Hackebeil, G.A., Nicholson, B.L., Siirola, J.D. (2017) Pyomo — Optimization Modeling in Python, Series Springer Optimization and Its Applications, Springer International Publishing (Part I An Introduction to Pyomo)			
Number of active teaching classes	**Lecturing:**45	**Practical course work:** 30	
Learning activities methods Presentation, dialogue, graphics, programming language demonstration, indvidual work.			
Knowledge assessment (maximum100 points)			
Pre-exam activities	Points	**Exam results**	Points
Participation in lecturing classes	10	Written exam	40
Participation in practical course work	10	Oral exam	0
Colloquium	20	Project presentation	10
Paper work-case study	10	**Total**	**100**

Table 5.2. Specification of subjects

<table>
<tr><td colspan="4">Study program: Advanced Data Analytics in Business</td></tr>
<tr><td colspan="4">Name of the subject: Programming for business applications 1</td></tr>
<tr><td colspan="4">Teacher(s): Marko D. Petković, Ronald Hochreiter</td></tr>
<tr><td colspan="4">Status of the subject: Core subject</td></tr>
<tr><td colspan="4">Numebrs of ECTS credits: 8</td></tr>
<tr><td colspan="4">Conditions: none</td></tr>
<tr><td colspan="4">Subject goal
Acquiring knowledge about basic and advanced elements of programming algorithmic approach to problem solving in the Python programming language. Enabling students to successfully follow other courses in which contet there is elements of programming in Python.</td></tr>
<tr><td colspan="4">Outcome of the subject
Students will be able to:
- apply object-oriented programming to optimization problems and decision theory;
- perform basic and intelligent data processing;
- independently solve programming problems using the syntax and semantics of the Python.</td></tr>
<tr><td colspan="4">Subject content
Theory
Introduction: Basics of programming, precise formulation of the problem and methods for its solving, splitting the complex problem to easier subproblems, notion of algorithms and basic characteristics.
Introduction to programming inPython: installation of Python and additional packages (pip), python IDEs (PyCharm, Spyder, Jupyter), variables and data types, assignment statement, parsing variables from input, output formats for different data types, If statement, loops, tuples and lists, basic operations with tuples and lists, functions, function parameters, recursion, global variables, lambda expressions, sets and dictionaries with basic operations, file management.
Applications of Python in business analytics: Numerical computations (numpy andscipy), optimization problems (scipy.optimize, mip), decision theory, statistics and elementary data processing (pandas), advanced and intelligent data processing (skilearn), documents manipulation (Word, Excel, PDF).
Practical learning
Practical work in computer classroom. Practical exercises on the topics covered by lectures.</td></tr>
<tr><td colspan="4">Literature
1. Al Sweigart, Automate the Boring Stuffwith Python, No Starch Press, San Francisco, 2015.
2. Jaan Kiusalaas, Numerical methods in engineering with Python 3, Cambridge University Press, 2013.
3. John Hunt, Advanced guide to Python 3 programming, Springer, 2019.</td></tr>
<tr><td>Number of active teaching classes</td><td colspan="2">Theorethical teching: 45</td><td>Practical teaching: 30</td></tr>
<tr><td colspan="4">Method of carrying out the teaching
Interactive lectures using screen sharing in the computer classroom.
In order to fulfill pre-examination obligations and the final exam, students need about 60 hours of independent study and practice, of which 2 hours a week during the semester and about 30 hours of preparation during the exam period.</td></tr>
<tr><td colspan="4">Evaluation of knowledge (maximum number of points 100)</td></tr>
<tr><td>Pre-exam obligations</td><td>points</td><td>Final exam</td><td>points</td></tr>
<tr><td>Activity during lectures</td><td>10</td><td>Written exam</td><td>0</td></tr>
<tr><td>Practical teaching</td><td>10</td><td>Oral exam</td><td>50</td></tr>
<tr><td>Colloquium</td><td>20</td><td>Project presentation</td><td>0</td></tr>
<tr><td>Seminar(s)</td><td>10</td><td>Total</td><td>100</td></tr>
</table>

Table 5.2. Specification of subjects

<table>
<tr><td colspan="4">Study program: Advanced Data Analytics in Business</td></tr>
<tr><td colspan="4">Name of the subject: Programming for business applications 2</td></tr>
<tr><td colspan="4">Teacher(s): Marko D. Petković, Jovica Stanković, Ronal Hochreiter</td></tr>
<tr><td colspan="4">Status of the subject: elective</td></tr>
<tr><td colspan="4">Numebrs of ECTS credits: 7</td></tr>
<tr><td colspan="4">Conditions: none</td></tr>
<tr><td colspan="4">Subject goal
Acquiring knowledge about advanced programming techniques for statistical data analysis. Training students to use the R programming language in the analysis of data from the field of economics.</td></tr>
<tr><td colspan="4">Outcome of the subject
After mastering the R programming language, students will be able to:
- perform statistical data processing;
- generate data at the request of decision makers;
- use of R to write efficient and structured programs.</td></tr>
<tr><td colspan="4">Subject content
Theory
Introduction: Introduction to R, installation and packages, IDE-s (RStudio, PyCharm, etc.), variables and data types. assignment statement and loops, functions and parameters, strings and operations on strings.
Data analysis in R: File manipulations, data cleaning, basic distributions and corresponding R functions, descriptive statistics, linear regression, hypothesis testing, ANOVA, data visualization.
Advanced data analysis in R: clusterization, decision trees, Bayesian analysis, neural networks.
Practical learning
Practical work in computer classroom. Practical exercises on the topics covered by lectures.</td></tr>
<tr><td colspan="4">Literature
1. G. Grolemund, H. Wickham, R for Data Science, O'Reilly 2017.
2. Y. Xie, J.J. Allaire, G. Grolemund, R Markdown: The Definitive Guide, CRC Press 2020.
3. A. Field, J. Miles, Z. Field, Discovering Statistics Using R, SAGE Publications Ltd 2012.</td></tr>
<tr><td>Number of active teaching classes</td><td colspan="2">Theoretical teaching: 30</td><td>Practical teaching: 45</td></tr>
<tr><td colspan="4">Learning activities methods
Interactive lectures using screen sharing in the computer classroom.
In order to fulfill pre-examination obligations and the final exam, students need about 60 hours of independent study and practice, of which 2 hours a week during the semester and about 30 hours of preparation during the exam period.</td></tr>
<tr><td colspan="4">Evaluation of knowledge (maximum number of points 100)</td></tr>
<tr><td>Pre-exam activities</td><td>points</td><td>Exam results</td><td>Points</td></tr>
<tr><td>Activity during lectures</td><td>10</td><td>Written exam</td><td>0</td></tr>
<tr><td>Practical teaching</td><td>10</td><td>Oral exam</td><td>50</td></tr>
<tr><td>Colloquium</td><td>20</td><td>Project presentation</td><td>0</td></tr>
<tr><td>Seminar(s)</td><td>10</td><td>Total</td><td>100</td></tr>
</table>

Table 5.2. Specification of subject

<table>
<tr><td colspan="4">Study programme: Advanced Data Analytics in Business</td></tr>
<tr><td colspan="4">Name of the subject: Quantitative Finance</td></tr>
<tr><td colspan="4">Teacher(s): Srđan Marinković, Mirjana Jemović, Jelena Radojičić, Jelena Z. Stanković</td></tr>
<tr><td colspan="4">Status of the subject: Obligatory</td></tr>
<tr><td colspan="4">Numbers of ECTS credits: 8</td></tr>
<tr><td colspan="4">Conditions: basic or intermediate knowledge in the theory of financial markets, mathematical and computation literacy (linear algebra), ability to use Excel and Python.</td></tr>
<tr><td colspan="4">Subject goal
The aim of the course is to extend undergraduate students' knowledge about financial market analytics as well as practitioners' understanding of various segments of financial markets: bond, stock and derivative assets market.</td></tr>
<tr><td colspan="4">Outcome of the subject
Capability to do analysis and based investment and financial decision making on quantitative data. Ability to extract information about transaction prices, yields and turnover data from relevant markets and data vendors, as well as to process information for making decisions related to securities investments (time series models, linear models, numerical procedures).</td></tr>
<tr><td colspan="4">Subject content
Theoretical lectures:The role of finance and financial instruments (direct and intermediary finance, exchange and OTC markets); Types of financial instruments, securities and contracts (short-term securities, bonds, stocks and derivatives); Financial market data (closing prices, volume and return data, data sources and vendors); Basic concept in financial assets valuation (PV, IRR); Interest rates and bond valuation (yield curve, bond price, bond duration and convexity); Portfolio management (security market line, portfolio optimization); Introduction to option theory (European call and put options, American options, option pricing).
Practical learning: Data visualisation (plotting price and volume charts, daily percentage returns and cumulative returns,histograms and volatility charts); Time series analysis (Q-Q plots, correlation matrix, moving averages); Basic concept in valuation (calculation of NPV, IRR); Fixed-coupon mathematics (valuing zero-coupon and coupon bond using Excel and Python, bootstrapping yield curves, calculating forward rates from the yield curve, calculating the yield to maturity, proce of a bond and duration). Portfolio optimization (solving for the security market line using regression, multivariate linear regression, and linear optimization in portfolio allocation); Pricing european options.
(While the lectures are devoted to discussing mainstream theory, the assignments serve to solve specific computational problems. It is advisable to work in groups closely monitored by course instructors).</td></tr>
<tr><td colspan="4">Literature
1. James Ma Weiming (2019) Mastering Python for Finance, Packt Publishing, 2nd edition.
2. Yan Yuxing (2014) Python for Finance: Build real-life Python applications for quantitative finance and financial engineering. Packt Publishing.
3. David Blake (2002) Financial market analysis, John Willey and Sons, Chichester;
4. John Hull (2017) Option, futures and other derivatives, Pearson, 10th edition.</td></tr>
<tr><td>Number of active teaching classes</td><td colspan="2">Theoretical teaching: 30</td><td>Practical teaching: 45</td></tr>
<tr><td colspan="4">Method of carrying out the teaching: Presentations, Program language demonstrations, individual work</td></tr>
<tr><td colspan="4">Evaluation of knowledge (maximum100 points)</td></tr>
<tr><td>Pre-exam obligations</td><td>points</td><td>Exam results</td><td>Points</td></tr>
<tr><td>Activity during lectures</td><td>10</td><td>Written exam</td><td>50</td></tr>
<tr><td>Practical teaching</td><td>10</td><td>Oral exam</td><td>-</td></tr>
<tr><td>Colloquium</td><td>30</td><td>Project presentation</td><td>-</td></tr>
<tr><td>Seminar(s)</td><td>-</td><td>Total</td><td>100</td></tr>
</table>

Table 5.2 Specification of subjects

<table>
<tr><td colspan="4">Study program: Advanced Data Analytics in Business</td></tr>
<tr><td colspan="4">Name of the subject: Research Design and Data Visualization Techniques</td></tr>
<tr><td colspan="4">Teacher(s): Slavoljub Milovanović, Ognjen Radović, Jovica Stanković</td></tr>
<tr><td colspan="4">Status of the subject: Elective</td></tr>
<tr><td colspan="4">Number of ECTS credits: 7</td></tr>
<tr><td colspan="4">Conditions: Programming for business applications 1</td></tr>
<tr><td colspan="4">Subject goal
Mastery of certain methods of big data visualization (tables, diagrams, advanced diagrams, dashboards) in order to observe relationships and regularities. Students will be training to modelling real problems, analysing and visualization. Also, they will be taught to use Python and R programming languages for research planning, graphical presentation of data and results of researches.</td></tr>
<tr><td colspan="4">Outcome of the subject
Students will be able to:
- create summary tables and diagrams in order to be able to interpret, analyze and conclude on the basis of available data;
- identify wrong data, reduce sets and discover the significance of relationships and trends;
- independently plan research and transfer to others analyzes done in the programming languages Python and R.</td></tr>
<tr><td colspan="4">Subject content
Theory
Research planning: selection, collection and verification of data for qualitative and quantitative research methods.
Basics of data visualization: Defining data visualization, data visualization process, development of interactivity and composition of visual solution for data presentation.
Application of Python language in the presentation of business data: creation of basic chart types, creation of advanced charts, introduction to pygal, Matplotlib, Plotly library.
Application of the R language in the presentation of business data: development of basic chart types, development of advanced charts, introduction to the ggplot2 library.
Practical learning
Exercises in the computer center. Examples will be processed and implemented in accordance with the theoretical teaching.</td></tr>
<tr><td colspan="4">Literature
1. Kirk, Andy, 2019, Data Visualisation: A Handbook for Data Driven Design, 2nd Edition, SAGE Publications Ltd.
2. Embarak, Ossama, 2018, Data Analysis and Visualization Using Python, Apress.
3. Eric Goh Ming Hui, 2019, Learn R for Applied Statistics, Apress.</td></tr>
<tr><td>Number of active teaching classes</td><td colspan="2">Theoretical teaching: 30</td><td>Practical teaching: 45</td></tr>
<tr><td colspan="4">Method of carrying out the teaching
Interactive lectures and exercises in the computer classroom.</td></tr>
<tr><td colspan="4">Evaluation of knowledge (maximum number of points 100)</td></tr>
<tr><td>Pre-exam obligations</td><td>points</td><td>Final exam</td><td>points</td></tr>
<tr><td>Activity during lectures</td><td>10</td><td>Written exam</td><td>50</td></tr>
<tr><td>Practical teaching</td><td>10</td><td>Oral exam</td><td>0</td></tr>
<tr><td>colloquium</td><td>20</td><td>Project presentation</td><td>0</td></tr>
<tr><td>Seminar(s)</td><td>10</td><td>Total</td><td>100</td></tr>
</table>

Table 5.2 Specification of subjects

<table>
<tr><td colspan="4">Study program: Advanced Data Analytics in Business</td></tr>
<tr><td colspan="4">Name of the subject: Risk management</td></tr>
<tr><td colspan="4">Teacher(s): Jelena Z. Stanković</td></tr>
<tr><td colspan="4">Status of the subject: elective</td></tr>
<tr><td colspan="4">Number of ECTS credits: 7</td></tr>
<tr><td colspan="4">Conditions: Basic knowledge of finance and economics is necessary.</td></tr>
<tr><td colspan="4">Subject goal
The aim of studying this subject is to acquire the necessary theoretical knowledge for making decisions related to the management of financial risks of the entities in modern business conditions. Based on knowledge and understanding of problems related to risk identification, specifics of their manifestation in different entities, assessment of probability and economic consequences of their occurrence for both the entity and the system as a whole, students will be able to decide on the choice of adequate risk management strategy. The offered new knowledge will enable students to comprehend and implement national and supranational regulatory requirements regarding risk management of financial and non-financial institutions.</td></tr>
<tr><td colspan="4">Outcome of the subject
Students will be able to:
- identify potential financial and specific risks of the entities;
- perform their quantification and evaluate the effects of their manifestation;
- choose an adequate risk management strategy;
- manage risks in a way that contributes to the creation of the entity's value.</td></tr>
<tr><td colspan="4">Subject content
Theory
The concept of risk in a globalized financial market; Types and characteristics of financial risks; Specific risks of insurance companies; Extreme risks in finance and insurance; Traditional and modern approaches to risk assessment; Risk management strategies; Risk management regulatory frameworks.
Practical learning
Analysis of financial flows and risk identification (case study); Analysis of the effects of the application of different models for risk evaluation (case study); Choice of risk management strategy (case study analysis); Discussion on the effects of the application of regulatory requirements in risk management (lecture of invited experts)</td></tr>
<tr><td colspan="4">Literature
8. Sweeting, P. (2017) Financial Enterprise Risk Management, 2nd Edition. Cambridge University Press.
9. Hull, J. C. (2018) Risk Management and Financial Institutions, 5th Edition. John Wiley & Sons Ltd.
10. Holton, G. A. (2014) Value-at-Risk – Theory and Practice, 2nd Edition. Published by the author.
11. Miller, M. (2018) Quantitative Risk Management, John Wiley & Sons Ltd.</td></tr>
<tr><td>Number of active teaching classes</td><td colspan="2">Theoretical teaching: 30</td><td>Practical teaching: 45</td></tr>
<tr><td colspan="4">Method of carrying out the teaching
Presentation, dialogue, graphics, programming language demonstration, individual work.</td></tr>
<tr><td colspan="4">Evaluation of knowledge (maximum number of points 100)</td></tr>
<tr><td>Pre-exam obligations</td><td>points</td><td>Final exam</td><td>points</td></tr>
<tr><td>Activity during lectures</td><td>10</td><td>Written exam</td><td>50</td></tr>
<tr><td>Practical teaching</td><td>10</td><td>Oral exam</td><td>0</td></tr>
<tr><td>colloquium</td><td>20</td><td>Project presentation</td><td>0</td></tr>
<tr><td>Paper work-case study</td><td>10</td><td>Total</td><td>100</td></tr>
</table>

Table 5.2 Specification of subjects

Study program: Advanced Data Analytics in Business

Name of the subject: Time Series Forecasting

Teacher(s): Vinko Lepojević, Vesna Janković-Milić

Status of the subject: Core subject

Number of ECTS credits: 8

Conditions: completed course Programming for business applications 1

Subject goal

Mastering models and methods in the analysis and forecasting of time series and preparing students for the application of acquired knowledge to data from various fields of economics. This course offers a comprehensive approach to advanced modelling of time series. Students can master various analytical tools that will enable them to understand time series.

Outcome of the subject

After this course students will be able to:

- Use Python to perform calculations with time and date based data;
- Create models for time series data;
- Use models for forecasting;
- Identify which models are suitable for a given dataset;
- Visualize time series data;
- Transform standard data into time series format;
- Clean and pre-process time series;
- Create ARIMA and exponential smoothing models,
- Identify the best time series libraries for a given problem;
- Compare the accuracy of different models.

Subject content

Theory

Working with data sets and time in Python, Time Series Data Pre-Processing and Vizualization, Statistical Background for Time Series Analysis and Forecating, ARIMA models, Multivariate Time Series Analysis, Neural Networks in Time Series Analysis.

Practical learning

Application of time series analysis and forecasting methods on concrete data using programming language Python.

Literature

12. Brooks, C. M. (2014). *Introductory Econometrics for Finance* [3rd Edition],Cambridge University Press.
13. Montgomery, D., Jennings, C., Kulachi, M.(2015). *Introduction to Time Series Analysis and Forecasting*, Wiley
14. Mather, B. (2019). *Time Series with Python: How to Implement Time Series Analysis and Forecasting Using Python.* Kindle Edition.

Number of active teaching classes	**Theoretical teaching:** 45	**Practical teaching:** 30

Method of carrying out the teaching

Presentation, dialogue, graphics, programming language demonstration, indvidual work.

Evaluation of knowledge (maximum number of points 100)

Pre-exam obligations	points	**Final exam**	points
Activity during lectures	10	Written exam	
Practical teaching	10	Oral exam	
colloquium	20	Project presentation	50
Seminar(s)	10	**Total**	**100**