**DESCRIPTION OF COURSE**

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|---|---|
| **University:** University of Economics in Bratislava | |
| **Faculty:** Faculty of Economic Informatics | |
| **Course code:** KAI FHI/IIA21550/21 | **Title of course:** Big Data |
| **Type, load and method of teaching activities:**<br>**Form of course:** Lecture / Practical<br>**Recommended load of course ( number of lessons ):**<br>**Per week:** 2 / 2 **Per course:** 26 / 26<br>**Method of study:** present | |
| **Number of credits:** 6 | |
| **Recommended semester/trimester of study:** 2. | |
| **Degree of study:** II. | |
| **Prerequisites:** | |
| **Requirements to complete the course:**<br>Exercises 40% Exercises include the development and defense of projects, which students work on in exercises during the semester. Each project submitted is graded separately and the student must achieve at least a 51% pass rate when the results are aggregated. Verifies the summative level of learning outcomes D., E.<br>Examination 60% of the grade. The exam consists of two parts: a test and a specific problem-solving task. The test verifies the level of learning outcomes A.,B., C. | |
| **Student workload:**<br>Total study load (in hours): 6 credits x 26 hours = 156 hours<br>Distribution of study load<br>Lectures and seminar participation: 52 hours<br>Preparation for seminars: 13 hours<br>Written assignments: 13 hours<br>Final exam preparation: 60 hours | |
| **Teaching results:**<br>Upon completion of the course, students should be able to:<br>A. define the basic concepts of big data management and analysis,<br>B. recognize the challenges that organizations face with big data<br>C. understand big data as it affects business, scientific progress, and our daily lives.<br>D. the ability to design scalable solutions for organizations of different types<br>E. Analyze and solve problems related to the processing and use of big data both conceptually and practically for a variety of industries such as government organizations, manufacturing, retail, education, banking/finance, healthcare and pharmaceuticals, and more. | |
| **Indicative content:**<br>1. Introduction to the problem of big data.<br>2. Current challenges, trends and applications of big data<br>3. Data types and data formats of big data.<br>4. Introduction to Hadoop, how Hadoop works<br>5. Hadoop ecosystem<br>6. Principles of HDFS<br>7. Technologies for big data management | |

8. YARN, HBase, Hive, Pig
9. Basic principles and data processing with MapReduce
10. HBase principles
11. Technologies for big data management
12. Algorithms for big data analysis
13. Big data application perspective and big data implementation issues

**Support literature:**

1. Hendl, J.:Big data - Věda o datech, základy a aplikace (česky), Grada 2021
2. Holubová I., Kosek j., Minařík k., Novák D.: Big Data a NoSQL databáze. Grada, 2015, ISBN 9788024754666
3. Matthew J. Salganik. (2017). Bit by Bit: Social Research in the Digital Age. Princeton University Press.
4. Cathy O'Neil. (2016). Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy. Penguin Books.
5. Rob Kitchin. (2014). The Data Revolution: Big Data, Open Data, Data Infrastructures and Their Consequences. SAGE Publications
6. Lockwood, Glenn. (2014). Conceptual Overview of Map-Reduce and Hadoop. Blog Post (http://www.glennklockwood.com/data-intensive/hadoop/overview.html)
7. Lazer, David, Ryan Kennedy, Gary King, and Alessandro Vespignani. (2014). The Parable of Google Flu: Traps in Big Data Analysis. Science 343(6176): 1203-1205.
8. Lazer, David. (2015). The Rise of the Social Algorithm. Science 348(6239): 1090-1091.
9. Anand Rajaraman and Jeffrey David Ullman (2011) Mining of Massive Datasets ISBN-10: 1107015359
ISBN-13: 978-1107015357
10. Murugesan, San; Bojanova, Irena, (2016) Encyclopedia of cloud computing. Wiley-IEEE Press. ISBN: 9781118821954

**Syllabus:**

Within the course, the content will focus on the following three areas:
• Introduction to the problem of big data. Current challenges, trends and applications.
It also includes topics such as the history of big data, their elements, types, advantages, disadvantages, etc.
Definition of big data, enterprise / structured data, social / unstructured data, unstructured data for analytical services, which are large data sets, sources of big data, industries using big data, challenges we face in the field of big data.
Use of big data in enterprises and businesses. A Big Data application perspective that covers topics such as the use of big data in marketing, analysts, retail, healthcare, consumer goods, defense, government, and so on.
• Algorithms for analyzing big data. Knowledge mining algorithms and UIs that have been developed specifically to solve the problems of processing big data.
Data mining algorithms for big data and data streams.
• Technologies for managing big data. Big Data technologies and tools, with special emphasis on the Map-Reduce paradigm and the Hadoop ecosystem.
This area covers such topics as the introduction to Hadoop, the operation of Hadoop, Cloud computing (features, benefits, applications). Understanding the Hadoop and its ecosystem, which includes HDFS, MapReduce, YARN, HBase, Hive, Pig, Sqoop, Zookeeper, Flume, Oozie, etc.
The basics of MapReduce and HBase emphasize the creation of a simple mapreduce framework and the concepts that apply to it. This area also covers the stack of large data files, i. data source layer, receive layer, source layer, security layer, visualization layer, visualization approaches, etc.

This area also covers information about NoSQL data management systems, including document databases, relationships, graph databases, schema-free databases, and so on

**Language whose command is required to complete the course:**
slovak

**Notes:**

**Assessment of courses**
Total number of evaluated students: 541

| A | B | C | D | E | FX |
|---|---|---|---|---|---|
| 32.16 | 31.05 | 17.56 | 9.24 | 9.8 | 0.18 |

**Lecturer:** doc. Ing. Jaroslav Kultan, PhD., Ing. Mgr. Peter Schmidt, PhD.

**Date of the latest change:** 01.02.2022

**Approved by:** Person responsible for the delivery, development and quality of the study programme doc. Ing. Andrea Furková, PhD., Person responsible for the delivery, development and quality of the study programme doc. Dr. Ing. Miroslav Hudec, Person responsible for the delivery, development and quality of the study programme prof. Ing. Ivan Brezina, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Martin Mišút, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Jaroslav Kultan, PhD.

# DESCRIPTION OF COURSE

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|---|---|
| **University:** University of Economics in Bratislava | |
| **Faculty:** Faculty of Economic Informatics | |
| **Course code:** KAI FHI/IIA21500/21 | **Title of course:** Business Intelligence |

**Type, load and method of teaching activities:**
**Form of course:** Lecture / Practical
**Recommended load of course ( number of lessons ):**
**Per week:** 2 / 2 **Per course:** 26 / 26
**Method of study:** present

**Number of credits:** 6

**Recommended semester/trimester of study:** 1.

**Degree of study:** II.

**Prerequisites:**

**Requirements to complete the course:**
Exam 60% The exam consists of two parts: the evaluation of the theoretical knowledge and knowledge of modelling of a specific example. The first part, verifies the achievement level of the teaching results A. C. E. G., whereas the second part verifies the level of the teaching results D, F. Assignments during the semester 40% The project should be designed and defended. The evaluation of the students involves project and answers to the supplementary questions. The project evaluation and subsequent short test shall assess the following teaching results: A. B., C. D. H. I.

**Student workload:**
Student workload (in hours):
6 credits x 26 hours = 156 hours
Distribution of study load:
Attendance at seminars: 26 hours
Preparation for seminars: 26 hours
Preparation for project and test: 52 hours
Preparation for the exam: 26 hours

**Teaching results:**
In particular, students acquire the following abilities:
A. knowing how to create multidimensional data models and different approaches for developing data warehouses,
B. managing the creation of data warehouses in the MySQL database and modelling in SqlDBM,
C. be capable of creating and managing ETL processes at the conceptual, logical and physical levels,
D. developing data hypercubes and applying MDX queries,
E. knowing how to apply reporting and visualisation methods (queries, charts, dashboards),
F. optimizing data warehouse (materialized views, bitmap and bitmap-join indexes, partitions)
G. understanding the basic concepts of data mining for business intelligence,
H. working with the software and platforms approved by university;
I. managing team cooperation in the development of a business intelligence solutions.

**Indicative content:**
1. Business intelligence concept and the disposition level of data, comparison with the transactional level.

2. Multidimensional data models, data warehouses and data marts (Inmonn and Kimball approaches).
3. Managing slowly and fastly changing dimensions and managing hierarchies of dimensions.
4. ROLAP, MOLAP and HOLAP.
5. Conceptual model of data warehouse and MultiDim.
6. ETL / ELT processes.
7. External and internal data sources and data quality indicators.
8. Data governance a master data management.
9. Business intelligence architectures.
10. Querying data warehouses SQL a MDX queries.
11. Reporting a visualization (dashboard, graphical outputs, critical indicators of performance).
12. Data warehouse optimization.
13. Life cycles of business intelligence solutions, project team, managing project team and pre-project analyses.

**Support literature:**

NĚMEC R. (2014). Principy projektování a implementace systémů business intelligence. VŠB-TU Ostrava, Ostrava.
VAISMAN A., ZIMANYI E. (2014). Data Warehouse Systems - Design and Implementation. Springer-Verlag, Berlin Heidelberg.
KIMBALL R. (2002). The Data Warehouse Toolkit, John Wiley & Sons.
HUMPHRIES M., HAWKINS M., DY M.. (2002) Data warehousing Principy a praxe, Computer Press.
GROSSMANN W., RINDERLE-MA S. (2015). Fundamentals of Business Intelligence. Springer-Verlag Berlin Heidelberg.
BRAMER M. (2020). Principles of Data Mining. Springer-Verlag London.
JENSEN C.S., PEDERSEN T.B., THOMSEN C. (2010). Multidimensional Databases and Data Warehousing. Morgan & Claypool.

**Syllabus:**

**Language whose command is required to complete the course:**
slovak

**Notes:**

**Assessment of courses**
Total number of evaluated students: 599

| A | B | C | D | E | FX |
|---|---|---|---|---|---|
| 14.86 | 24.87 | 31.72 | 19.87 | 7.85 | 0.83 |

**Lecturer:** doc. Dr. Ing. Miroslav Hudec, Ing. Veronika Horniaková, PhD.

**Date of the latest change:** 01.02.2022

**Approved by:** Person responsible for the delivery, development and quality of the study programme doc. Ing. Andrea Furková, PhD., Person responsible for the delivery, development and quality of the study programme doc. Dr. Ing. Miroslav Hudec, Person responsible for the delivery, development and quality of the study programme prof. Ing. Ivan Brezina, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Martin Mišút, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Jaroslav Kultan, PhD.

# DESCRIPTION OF COURSE

**University:** University of Economics in Bratislava

**Faculty:** Faculty of Economic Informatics

| **Course code:** KAI FHI/IIA21530/21 | **Title of course:** Business Process Modelling |
|---|---|

**Type, load and method of teaching activities:**
**Form of course:** Lecture / Practical
**Recommended load of course ( number of lessons ):**
**Per week:** 2 / 2 **Per course:** 26 / 26
**Method of study:** present

**Number of credits:** 5

**Recommended semester/trimester of study:** 1.

**Degree of study:** II.

**Prerequisites:**

**Requirements to complete the course:**
40 % assignments: the content of the exercise is the elaboration and defense of an individually assigned project. Part of the student's evaluation is also their activity on opposing and evaluating other students' projects. The results of the work (project) are submitted for assessment during the semester three times. By evaluating projects and evaluating the opposition of the results of other students' work, the achievement of the following learning outcomes is evaluated: D., E., G., H., I., J., K.
60 % final exam: the exam consists of two parts: a test and a design of a model set for a specific environment. The test verifies the achieved level of learning outcomes A., B., C., F. The designing of models for the described environment verifies the achieved level of learning outcomes D., E., G.

**Student workload:**
Total study load (in hours): 5 credits x 26 hours = 130 hours
Distribution of study load
Lectures and seminar participation: 52 hours
Preparation for seminars: 13 hours
Written assignments: 30 hours
Final exam preparation: 35 hours

**Teaching results:**
After completing the course, students should be able to:
A. understand the principles of business process modelling,
B. know the role of IT in business process modelling and the role of IS in the process approach
C. know methods, standards and norms for process modelling and analysis
D. identify, analyze and model business processes so that it can define and describe the links between processes and the needs for their information support through information systems
E. analyze and model processes using MMABP methodology
F. define the relationship of process management and information systems of the organization
G. compile a business process model and further analyze this model
H. apply various methods for the analysis of process models and use these in the creation of information systems
I. practically use tools for modelling and analysis of business processes.
J. to present and defend at a professional level their proposed solutions

K. to develop technical documentation (report) describing the solution proposed by the students

**Indicative content:**
1. Introduction to terminology and modelling theory.
2. Types of models and types of processes.
3. Principles of model creation, information model of organization.
4. Processes and objects, structure modelling and modelling of process dynamics.
5. Standards for modelling (PP, BPML / BPMN, UML profiles, IDEF, ISO).
6. Process system modelling.
7. Process modelling, process diagram,
8. Business process modelling - process description, consistency of models. Consistency criteria.
9. Example of linking processes with object classes, structural consistency of models.
10. Process approach and IS. Integration of the organization's information system through business processes.
11. Methodologies of modelling and analysis of business processes. (ARIS, BSP, ISAC, DEMO, MMABP)
12. Process Modeling Tools (CABE)
13. The most common mistakes in business process modelling.

**Support literature:**
1. Řepa, V.: Procesně řízená organizace. Praha: Grada Publishing, 2012.
2. Řepa, V.: Podnikové procesy. Procesní řízení a modelování. 2.aktualizované a rozšířené vydání. Praha: Grada Publishing, 2007.
3. Tomáš Bruckner, Jiří Voříšek, Alena Buchalcevová a kolektív : Tvorba informačních systémů, Principy, metodiky, architektury, Praha: Grada Publishing, 2012
4. Roseman, M – vom Brocke, J. 2010. Handbook on Business Process Management vol.1. New York : Springer, 2010
5. Chang, J F. 2006. Business Process Management Systems. New York : Auerbach Publications, 2006

**Syllabus:**

**Language whose command is required to complete the course:**
slovak

**Notes:**

**Assessment of courses**
Total number of evaluated students: 605

| A | B | C | D | E | FX |
|---|---|---|---|---|---|
| 7.44 | 28.1 | 33.06 | 23.31 | 7.27 | 0.83 |

**Lecturer:** doc. Ing. Martin Mišút, CSc.

**Date of the latest change:** 01.02.2022

**Approved by:** Person responsible for the delivery, development and quality of the study programme doc. Ing. Andrea Furková, PhD., Person responsible for the delivery, development and quality of the study programme doc. Dr. Ing. Miroslav Hudec, Person responsible for the delivery, development and quality of the study programme prof. Ing. Ivan Brezina, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Martin Mišút, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Jaroslav Kultan, PhD.

**DESCRIPTION OF COURSE**

| | |
|---|---|
| **University:** University of Economics in Bratislava | |
| **Faculty:** Faculty of Economic Informatics | |
| **Course code:** KŠ FHI/IID22341/22 | **Title of course:** Data Mining |
| **Type, load and method of teaching activities:**<br>**Form of course:** Lecture / Practical<br>**Recommended load of course ( number of lessons ):**<br>**Per week:** 2 / 2 **Per course:** 26 / 26<br>**Method of study:** present | |
| **Number of credits:** 4 | |
| **Recommended semester/trimester of study:** 2. | |
| **Degree of study:** II. | |
| **Prerequisites:** | |
| **Requirements to complete the course:**<br>Seminars (40%):<br>− Assignment (20 %)<br>− Seminar work (20 %)<br>Final exam (60%):<br>− Theoretical part (20 %)<br>− Practical part (40 %) | |
| **Student workload:**<br>Total study load (in hours): 156 hours<br>Lectures participation: 26 hours,<br>Seminar participation: 26 hours,<br>Preparation for seminars: 26 hours,<br>Written assignment: 26 hours,<br>Seminar work preparation: 22 hours,<br>Final exam preparation: 30 hours | |
| **Teaching results:**<br>Successful completion of the course is a guarantee that students will gain a basic overview of the data mining process in practice. Students acquire the following:<br>abilities<br>− knowledge of basic concepts, principles, methods and procedures used in data mining,<br>− knowledge of individual stages of the process of extracting information from databases,<br>− knowledge of theoretical principles of data mining models.<br>− skills<br>− Students will be able to implement individual steps of the process of extracting information from databases using professional software SAS Enterprise Miner.<br>− Students will learn to adequately apply the methods and procedures of data mining and interpret the results.<br>competencies<br>− Students will be able to apply the acquired knowledge and skills in solving data mining problems in practice. | |
| **Indicative content:** | |

The data mining process provides a framework to extract nontrivial information from data. With the advent of massive storage, increased data collection, and advanced computing paradigms, the data at our disposal are only increasing. To extract knowledge from these massive data assets, we need to employ advanced approaches like data mining algorithms, in addition to simple statistical processing. Studying of subject enables to understand sense and possibilities of data mining.

**Support literature:**

1. TEREK, M., HORNÍKOVÁ, A., LABUDOVÁ, V. Hĺbková analýza údajov. Bratislava: Iura Edition, 2010. ISBN 978-80-8078-336-5
2. BERKA, P. Dobývání znalostí z databází. Praha: Academia, 2003. ISBN 80-200-1062-9
3. PETR, P. Data Mining: Díl I. Pardubice: Univerzita Pardubice, 2008, 139 s. ISBN 978-80-7395-098-9
4. SKALSKÁ, H. Data mining a klasifikační modely. Hradec Králové: Gaudeamus, 2010. ISBN 978-80-7435-088-7
5. LABUDOVÁ, V. Hĺbková analýza údajov s programom SAS Enterprise Miner (praktikum). Bratislava: Ekonóm, 2012. ISBN 978-80-225-3402-4
6. LABUDOVÁ, V. Rozhodovacie stromy ako prediktívna modelovacia technika. Slovenská štatistika a demografia: vedecký časopis. Roč. 27, č. 3 (2017), s. 60-76. Bratislava: Štatistický úrad Slovenskej republiky. ISSN 1210-1095
7. KANTARDZIC, M. Data Mining. Concepts, Models, Methods and Algorithms. USA, J. Wiley and Sons, 2003. ISBN 0-471-22852-4
8. GUIDICI, P. Applied Data Mining. New York, J. Wiley and Sons, 2004. ISBN 0-470-84679-8
9. LAROSE, D. T. Discovering Knowledge in Data. An Introduction to Data Mining. USA: Wiley 2005. ISBN 978-0-471-66657-8
10. LAROSE, D. T. Data Mining. Methods and Models. USA: Wiley 2006. ISBN 0-471-66656-4

**Syllabus:**

1. Knowledge discovery in databases, Data mining. The Data mining process.
2. Data mining – objectives and tasks. Big data and data mining. Data mining and application areas.
3. Data mining methodology. Data mining tools.
4. Databases. Data preparation (data cleaning and preparation, data transformation, classification).
5. Data preparation (outlier detection, data reduction).
6. Decision trees (classification and regression trees).
7. Process of growing a decision tree (Shannon entropy, Gini index). Pruning decision trees. Generating decision rules.
8. Logistic regression. Point estimation of parameters and odds ratio. Interpretation.
9. Statistical inference for logistic regression.
10. Artificial neural networks and its architectures.
11. Association rules.
12. Evaluation of models. Criteria for Evaluating Models.
13. Summary of the lectured subject matter.

**Language whose command is required to complete the course:**

Slovak

**Notes:**

**Assessment of courses**

Total number of evaluated students: 18

| A | B | C | D | E | FX |
|---|---|---|---|---|---|
| 16.67 | 44.44 | 22.22 | 5.56 | 11.11 | 0.0 |

**Lecturer:** doc. RNDr. Viera Labudová, PhD.

**Date of the latest change:** 30.03.2022

**Approved by:** Person responsible for the delivery, development and quality of the study programme doc. Ing. Andrea Furková, PhD., Person responsible for the delivery, development and quality of the study programme doc. Dr. Ing. Miroslav Hudec, Person responsible for the delivery, development and quality of the study programme prof. Ing. Ivan Brezina, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Martin Mišút, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Jaroslav Kultan, PhD.

**DESCRIPTION OF COURSE**

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|---|---|
| **University:** University of Economics in Bratislava | |
| **Faculty:** Faculty of Economic Informatics | |
| **Course code:** KOVE FHI/ IIB21560/22 | **Title of course:** Decisions Support Systems |

**Type, load and method of teaching activities:**
**Form of course:** Lecture / Practical
**Recommended load of course ( number of lessons ):**
**Per week:** 2 / 2 **Per course:** 26 / 26
**Method of study:** present

**Number of credits:** 6

**Recommended semester/trimester of study:** 3.

**Degree of study:** II.

**Prerequisites:**

**Requirements to complete the course:**
40 % final paper and continuous testing
60 % final exam

**Student workload:**
Total study load (in hours): 6 credits x 26 hours = 156 hours
Lectures participation: 26 hours
Seminars participation: 26 hours
Final paper preparation: 52 hours
Preparation for the exam and continuous tests: 52 hours

**Teaching results:**
In particular, students acquire the following abilities:
- on systems for optimization calculations, on advantages and disadvantages of individual systems
- on programming in VBA language under MS Excel
- on programming in the GAMS language.

Students acquire in particular the following skills:
- to select adequate software support to solve the related problem based on a mathematical model
- solve specific optimization problems by creating programs in two languages (VBA under MS Excel and GAMS)

Students will acquire the following competencies:
- practical skills and competences in creating programs to solve various optimization problems that occur in economic practice

**Indicative content:**
1. Description of MS Excel tools for solving mathematical programming problems.
2. Using of standard MS Excel functions for solving problems of structure analyses and models of replacement.
3. Visual Basic commands.
4. Creation of user's functions of models of inventory.
5. Creation of user's functions of models of queuing theory.
6. Solving mathematical programming problems using Solver.
7. Solving the Traveling Salesman Problem using Solver.

8. Introduction to GAMS language, optimization calculations.
9. Basic GAMS language commands, control features.
10. Solving linear programming problems using GAMS.
11. Solving nonlinear problems using GAMS.
12. Solving location-allocation problems using GAMS.
13. Solving the Traveling Salesman Problem using GAMS.

**Support literature:**

1. Ivaničová, Z. – Brezina, I. – Pekár, J.: Operačná analýza, IURA Edition, Bratislava 2007
2. Pecinovský, J.: Excel 2002 (podrobný průvodce pokročilého uživatele), Grada, 2002
3. Premium Solver Platform for use with Microsoft Excel, Frontline Systems, 2000
4. Pekár, J. – Čičková, Z.: Softvérová podpora vybraných modelov operačného výskumu. Ekonóm 2013.
5. Rosenthal, R. E.: A GAMS Tutorial by Richard E. Rosenthal, dostupné na: https://www.gams.com/latest/docs/UG_Tutorial.html

**Syllabus:**

**Language whose command is required to complete the course:**
Slovak

**Notes:**

**Assessment of courses**
Total number of evaluated students: 42

| A | B | C | D | E | FX |
|---|---|---|---|---|---|
| 35.71 | 21.43 | 19.05 | 19.05 | 4.76 | 0.0 |

**Lecturer:** prof. Mgr. Juraj Pekár, PhD.

**Date of the latest change:** 21.02.2022

**Approved by:** Person responsible for the delivery, development and quality of the study programme doc. Ing. Andrea Furková, PhD., Person responsible for the delivery, development and quality of the study programme doc. Dr. Ing. Miroslav Hudec, Person responsible for the delivery, development and quality of the study programme prof. Ing. Ivan Brezina, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Martin Mišút, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Jaroslav Kultan, PhD.

# DESCRIPTION OF COURSE

**University:** University of Economics in Bratislava

**Faculty:** Faculty of Economic Informatics

| **Course code:** KAI FHI/IIA21540/21 | **Title of course:** Distributed technologies |
|---|---|

**Type, load and method of teaching activities:**
**Form of course:** Lecture / Practical
**Recommended load of course ( number of lessons ):**
**Per week:** 2 / 2 **Per course:** 26 / 26
**Method of study:** present

**Number of credits:** 5

**Recommended semester/trimester of study:** 1.

**Degree of study:** II.

**Prerequisites:**

**Requirements to complete the course:**
Exam 60% marks. The exam consists of two parts: a test and the construction of a model for a specific environment.
Exercises 40% (elaboration and defence of the project)
The test verifies the achievement of learning outcomes A., B., C., D., the creation of a model for the described environment verifies the achievement of learning outcome E.

**Student workload:**
Total study load (in hours):
Attendance at lectures and seminars: 52 hours
Preparation for seminars: 13 hours
Written assignments: 30 hours
Preparation for the final exam: 35 hours

**Teaching results:**
Upon completion of the course, students should be able to:
A. assess the appropriateness of building centralized or distributed information systems for a given application domain,
B. understand the nature of the technical, programmatic, technological and economic prerequisites for the implementation of DSD,
C. assess the need for building own IS, outsourcing it, or Cloud Computing,
D. analyze the need for data fragmentation and allocation,
E. to minimize the requirements for data transmission and processing in distributed DDBS to propose a DIS solution or selected DIS components for a specific application domain.

**Indicative content:**
1. Distributed data processing - Introducing DDP
2. Communication subsystem
3. Client / server architecture
4. DDP model reference
5. Distributed transaction
6. Distributed operating systems
7. Distributed computing environment
8. Distributed computer systems

9. Mobile DDP
10. Cloud Computing
11. Distributed application subsystem
12. Service-oriented architectures
13. DIS management

**Support literature:**

Závodný, P.: Počítačové siete v hospodárskej praxi, Ekonóm, Bratislava 2005.
ZÁVODNÝ, Peter - TURŇA, Ľubomír - RUBLÍK, Martin. Počítačové siete v hospodárskej praxi. 2. dopln. vyd. Bratislava : Vydavateľstvo EKONÓM, 2009. 356 s. ISBN 978-80-225-2731-6.
Tanenbaum, A.S.: Computer networks, Prentice Hall, 1989.
Sportack, M., A.: Směrování v sítích IP, Computer press, Brno 2004.
Hunt, C.: Konfigurace a správa sítí TCP/IP, Computer press, Brno 1997.
Kálay, F. - Peniak, P.: Počítačové sítě a jejich aplikace, Grada, Praha 2003.

**Syllabus:**

**Language whose command is required to complete the course:**
slovak

**Notes:**

**Assessment of courses**
Total number of evaluated students: 578

| A | B | C | D | E | FX |
|---|---|---|---|---|---|
| 25.26 | 27.16 | 30.45 | 12.63 | 3.29 | 1.21 |

**Lecturer:** Ing. Mgr. Peter Schmidt, PhD.

**Date of the latest change:** 01.02.2022

**Approved by:** Person responsible for the delivery, development and quality of the study programme doc. Ing. Andrea Furková, PhD., Person responsible for the delivery, development and quality of the study programme doc. Dr. Ing. Miroslav Hudec, Person responsible for the delivery, development and quality of the study programme prof. Ing. Ivan Brezina, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Martin Mišút, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Jaroslav Kultan, PhD.

# DESCRIPTION OF COURSE

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|---|---|
| **University:** University of Economics in Bratislava | |
| **Faculty:** Faculty of Economic Informatics | |
| **Course code:** KOVE FHI/ IIB21570/22 | **Title of course:** Environmental Models |
| **Type, load and method of teaching activities:**<br>**Form of course:** Lecture / Practical<br>**Recommended load of course ( number of lessons ):**<br>**Per week:** 2 / 2 **Per course:** 26 / 26<br>**Method of study:** present | |
| **Number of credits:** 4 | |
| **Recommended semester/trimester of study:** 3. | |
| **Degree of study:** II. | |
| **Prerequisites:** | |
| **Requirements to complete the course:**<br>30% semester seminar work, resp. project,<br>10% continuous processing of tasks, worksheets resp. case studies.<br>60% written exam. | |
| **Student workload:**<br>104 hours<br>26 hours of lectures,<br>26 hours of exercise,<br>26 hours of self-study in preparation for the exam,<br>26 hours elaboration of a semester project. | |
| **Teaching results:**<br>Upon successful completion of the course, students will acquire the following knowledge:<br>- basic knowledge of environmental and economic processes that respect environmental requirements,<br>- knowledge of modeling in distribution and production logistics, in the supply chain process and in the deployment of models,<br>- basic knowledge of the application of optimization models in various economic and environmental areas.<br>Upon successful completion of the course, students will acquire the following skills:<br>- ability to use basic model approaches in both economic and economical-environmental processes,<br>- based on the set conditions, appropriately formulate the problem in economic processes and supplement it with an environmental aspect and then propose a suitable solution.<br>Upon successful completion of the course, students will acquire the following competencies:<br>- practical skills and knowledge associated with the management of economic processes about the environmental aspect.<br>- knowledge in the environment of optimization with the application of methods and algorithms in the modeling of production processes, logistics processes, data analysis. | |
| **Indicative content:**<br>1. Environmental aspects in economic processes. Optimization of economic processes. Goal setting and prioritization. | |

2. Circular economy and circular economy. General principles and specific tools of mathematical modeling of economic and ecological systems.
3. Eco-eco approach. Aggregation of target criteria. Multi-criteria decision making. Optimization processes and their modification. Evaluation of eco-efficiency of models.
4. Circular economy and circular economy. Product life cycle and waste management. Product design.
5. Reverse logistics. Green logistics.
6. Environmental modeling in distribution logistics. Models of transport.
7. Environmental modeling in the procurement and supply process.
8. Environmental modeling in production logistics.
9. Deployment of models in environmental modeling. Modeling of consumption of renewable and non-renewable resources.
10. Modeling in waste management and the role of distribution and transport.
11. Agro-ecology and industrial ecology. Models of air pollution and water pollution.
12. Economic and legislative motivational tools to support the objectives of environmental policy, and climate protection.
13. Human and environmental models, global trends and their modeling. Global environmental and demographic trends.

**Support literature:**
1. Metódy logistiky prepravy, rozmiestňovania a rozvrhovania, (Aplikácie matematických modelov v jazyku Python), Ivan Brezina – Juraj Pekár – Pavel Gežík, Bratislava : Letra Edu, 2020
2. Teória grafov pre ekonómov, Ivan Brezina – Pavel Gežík, Bratislava : Letra Edu, 2018
3. Modelovanie reverznej logistiky - optimalizácia procesov recyklácie a likvidácie odpadu. Ivan Brezina a kol., Bratislava : Vydavateľstvo EKONÓM, 2009.
4. Quantitative models for reverse logistics. Moritz Fleischmann, Rotterdam : Selbstverl 2000.
5. Reverse Logistics, Quantitative Models for Closed-Loop Supply Chains, Rommert Dekker a kol., Berlin : Springer-Verlag, 2004

**Syllabus:**

**Language whose command is required to complete the course:**
Slovak, English

**Notes:**

**Assessment of courses**
Total number of evaluated students: 70

| A | B | C | D | E | FX |
|---|---|---|---|---|---|
| 24.29 | 50.0 | 25.71 | 0.0 | 0.0 | 0.0 |

**Lecturer:** prof. Ing. Ivan Brezina, CSc., Ing. Pavel Gežík, PhD.

**Date of the latest change:** 21.02.2022

**Approved by:** Person responsible for the delivery, development and quality of the study programme doc. Ing. Andrea Furková, PhD., Person responsible for the delivery, development and quality of the study programme doc. Dr. Ing. Miroslav Hudec, Person responsible for the delivery, development and quality of the study programme prof. Ing. Ivan Brezina, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Martin Mišút, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Jaroslav Kultan, PhD.

# DESCRIPTION OF COURSE

**University:** University of Economics in Bratislava

**Faculty:** Faculty of Economic Informatics

| **Course code:** KAI FHI/IIA21620/21 | **Title of course:** Evolutionary Algorithms |
|---|---|

**Type, load and method of teaching activities:**
**Form of course:** Lecture / Practical
**Recommended load of course ( number of lessons ):**
**Per week:** 0 / 2 **Per course:** 0 / 26
**Method of study:** present

**Number of credits:** 4

**Recommended semester/trimester of study:** 2.

**Degree of study:** II.

**Prerequisites:**

**Requirements to complete the course:**
Requirements to complete the course:
- final exam - written form, 60% (passing the exam means obtaining 51% from the evaluation of exam) The exam consists of two parts: verification of theoretical knowledge (test with different types of questions). The theoretical part verifies the achieved level of educational results A, B, D. Verification of practical skills (work in MATLAB), where the level of educational results C, D, E is verified.
Seminars
- working in small teams: elaboration and seminar topic presentation 20%, work over the final project 20%
Together: 40%
By evaluating individual work and evaluating work in teams, the following educational results are developed and evaluated: B, C, E, F.

**Student workload:**
Total study load (in hours):
4 credits x 26 hours= 104 hours
Study load distribution:
Seminar participation: 26 hours
Preparation for seminars: 10 hours
Project preparation: 24 hours
Preparation for the final exam: 44 hours

**Teaching results:**
After studying this course, students gain the knowledge and should be able to:
A. Understanding the evolutionary principles of state-space solutions.
B. To be able to choose suitable representations of problems, to design effective coding schemes.
C. Apply appropriate genetic, hybrid, correction, and other operators, set the parameters of the evolutionary algorithm.
D. Orientation in IT tools and environments suitable for solving problems by evolutionary algorithms.
E. To be able to apply evolutionary algorithms to solve practical optimization problems.
F. Learn to communicate and work in a team to solve complex tasks.

**Indicative content:**
1. State-space, state-space search, and search strategies
2. Heuristic state-space search algorithms and their relation to optimization problems
3. Evolutionary Darwin process and the importance of evolutionary algorithms
4. Genetic algorithm, basic concepts, state-space representation, state coding, parallel state-space search
5. Introduction to working with MATLAB software, examples of genetic algorithms
6. Blocks of genetic algorithm (selection, mutation, and crossing) and parameter setting
7. Genetic programming, types of genetic programs, and their implementation
8. The importance of genetic algorithms in obtaining knowledge from data
9. Parallel evolutionary techniques, coevolutionary algorithms cooperatively
10. Competitive coevolutionary algorithms
11. Evolutionary algorithms in artificial intelligence, in multi-agent systems
12. Work in teams on final projects
13. Presentation and defense of final projects

**Support literature:**
Odporúčaná literatúra:
1. KVASNIČKA, V. -- POSPÍCHAL, J. -- TIŇO, P. Evolučné algoritmy. Bratislava : STU v Bratislave, 2000.. ISBN 80-227-1377-5
2. MACH, M. Evolučné algoritmy: Prvky a princípy. TU Košice, 2009. ISBN 978-80-8086-123-0
3. OPLATKOVÁ, Z., OŠMERA, P., ŠEDA, M., VČELAŘ, F., ZELINKA, I.: Evoluční výpočetní techniky - principy a aplikace. BEN - technická literatura, Praha, 2008, ISBN 80-7300-218-3
4. MICHALEWICZ, Z.: Genetic Algorithms + Data Structures = Evolution Programs. Berlin: Springer Verlag, 1992, ISBN 978-3-540-60676-5
5. RUSSELL, S.J., NORVIG, P.: Artificial Intelligence, A Modern Approach, Prentice Hall, A Modern Approach, Global Edition, 2021
6. NEGNEVITSKY, M.: Artificial Intelligence: A Guide to Intelligent Systems (3nd Edition), Pearson Education Limited, 2011, ISBN-13: 978-1408225745
7. XINJIE, Y., MITSUO, G.: Introduction to Evolutionary Algorithms, Springer Verlag, ISBN 978-1-84996-128-8
8. EIBEN, A.E., SMITH, J.E, Introduction to Evolutionary Computing, 2nd ed. Springer-Verlag Berlin Heidelberg, 2015, ISBN 978-3-662-44873-1
9. Norvig, P., Russell, S., Artificial Intelligence: A Modern Approach, Global Edition, 2021

**Syllabus:**

**Language whose command is required to complete the course:**
slovak

**Notes:**

**Assessment of courses**
Total number of evaluated students: 35

| A | B | C | D | E | FX |
|---|---|---|---|---|---|
| 5.71 | 28.57 | 51.43 | 11.43 | 2.86 | 0.0 |

**Lecturer:** RNDr. Eva Rakovská, PhD.

**Date of the latest change:** 01.02.2022

**Approved by:** Person responsible for the delivery, development and quality of the study programme doc. Ing. Andrea Furková, PhD., Person responsible for the delivery, development and quality of the study programme doc. Dr. Ing. Miroslav Hudec, Person responsible for the delivery,

development and quality of the study programme prof. Ing. Ivan Brezina, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Martin Mišút, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Jaroslav Kultan, PhD.

# DESCRIPTION OF COURSE

| | |
|---|---|
| **University:** University of Economics in Bratislava | |
| **Faculty:** Faculty of Economic Informatics | |
| **Course code:** KAI FHI/IIA21560/21 | **Title of course:** Fuzzy Sets in Decision Making Processes |

**Type, load and method of teaching activities:**
**Form of course:** Lecture / Practical
**Recommended load of course ( number of lessons ):**
**Per week:** 2 / 2 **Per course:** 26 / 26
**Method of study:** present

**Number of credits:** 6

**Recommended semester/trimester of study:** 3.

**Degree of study:** II.

**Prerequisites:**

**Requirements to complete the course:**
Exam 60% The exam consists of two parts: the evaluation of the theoretical knowledge and knowledge of modelling specific tasks. The first part, verifies the achievement level of the teaching results A., D., F., H., whereas the second part verifies the level of the teaching results B., C., E., G. Assignments during the semester 40% The purpose of seminars is to develop and defend the tasks related to modeling uncertainties and a test. The evaluation of the students also their activity during the semester. The following teaching results are evaluated B., C., D., E. G.

**Student workload:**
Total study load (in hours):
6 credits x 26 teaching hours = 156 h
Distribution of study load:
lectures and seminars participation: 52 h
seminar participation: 24 h
tasks and test preparation: 40 h
preparation of exam: 40 h

**Teaching results:**
In particular, students acquire the following abilities:
A. understanding the semantic uncertainty of real-world and appropriately handling by fuzzy sets and fuzzy logic,
B. creating flexible database queries,
C. logically aggregating elementary conditions,
D. developing and interpreting linguistic summaries from data,
E. applying fuzzy inference and classification models,
F. handling and managing work with imprecise data in databases,
G. applying acquired knowledge and skills in solving real-world tasks,
H. gaining the overview of the role of fuzzy logic in explainable artificial intelligence.

**Indicative content:**
1. Introduction into fuzzy sets and fuzzy logic, and comparison with the classical logic and set theory.
2. Fuzzy arithmetic.

3. Logic aggregation functions and their applications in evaluating entities and summarizing information from data.
4. Flexible (fuzzy) relational database queries.
5. Empty and overabundant problems in queries.
6. Linguistic summaries on numeric and categorical data.
7. Fuzzy inference (Mamdani and Sugeno model, defuzzification).
8. Flexible rule-based systems and IF-THEN rules (developing rule-based systems and evaluating their quality).
9. Fuzzy relational databases (basic model and fuzzy meta model).
10. Querying on fuzzy relational databases and data warehouses.
11. Possibility and necessity measures in data evaluation.
12. Overview of the advanced concepts: type II fuzzy sets, hesitant fuzzy sets, intuitionistic fuzzy sets
13. Fuzzy logic in explainable artificial intelligence.

**Support literature:**

HUDEC M. (2015). Fuzzy logika pre hospodársku informatiku. Ekonóm, Bratislava.
KOLESÁROVÁ A., KOVÁČOVÁ M. (2004). Fuzzy množiny a ich aplikácie. Slovenská technická univerzita v Bratislave, Bratislava.
KLIR, G., YUAN, B. (1995). Fuzzy sets and fuzzy logic, theory and applications. Prentice Hall, New Jersey.
SILER W., BUCKLEY, J. (2005). Fuzzy expert systems and fuzzy reasoning. John Wiley & Sons, Inc, New Jersey.
ZIMMERMANN H. J. (2001). Fuzzy set theory – and its applications. Kluwer Academic Publishers, London.
HUDEC M. (2016). Fuzziness in Information Systems - How to Deal with Crisp and Fuzzy Data in Selection, Classification, and Summarization. Springer, Cham.
GALINDO, J. (Ed.) (2008). Handbook of Research on Fuzzy Information Processing in Databases. IGI Global,Hershley.

**Syllabus:**

**Language whose command is required to complete the course:**
slovak

**Notes:**

**Assessment of courses**
Total number of evaluated students: 139

| A | B | C | D | E | FX |
|---|---|---|---|---|---|
| 15.83 | 20.14 | 26.62 | 25.18 | 11.51 | 0.72 |

**Lecturer:** doc. Dr. Ing. Miroslav Hudec, Ing. Erika Mináriková

**Date of the latest change:** 01.02.2022

**Approved by:** Person responsible for the delivery, development and quality of the study programme doc. Ing. Andrea Furková, PhD., Person responsible for the delivery, development and quality of the study programme doc. Dr. Ing. Miroslav Hudec, Person responsible for the delivery, development and quality of the study programme prof. Ing. Ivan Brezina, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Martin Mišút, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Jaroslav Kultan, PhD.

# DESCRIPTION OF COURSE

**University:** University of Economics in Bratislava

**Faculty:** Faculty of Economic Informatics

| **Course code:** KOVE FHI/ IIB21540/22 | **Title of course:** Game Theory |
|---|---|

**Type, load and method of teaching activities:**
**Form of course:** Lecture / Practical
**Recommended load of course ( number of lessons ):**
**Per week:** 2 / 2 **Per course:** 26 / 26
**Method of study:** present

**Number of credits:** 6

**Recommended semester/trimester of study:** 3.

**Degree of study:** II.

**Prerequisites:**

**Requirements to complete the course:**
40 % final paper and continuous testing
60 % final exam

**Student workload:**
Total study load (in hours): 5 credits x 26 hours = 130 hours
Lectures participation: 26 hours
Seminars participation: 26 hours
Final paper preparation: 39 hours
Preparation for the exam and continuous tests: 39 hours

**Teaching results:**
In particular, students acquire the following abilities:
- basic knowledge of conflict decision-making situations, types of conflicts, decision-making and the possibility of taking an equilibrium strategy in conflict decision-making situations in the case of antagonistic and non-antagonistic conflicts

Students acquire in particular the following skills:
- skills to analyze and solve conflicting decision-making situations

Students will acquire the following competencies:
- practical skills and competencies with the application of optimization methods in the field of conflict decision-making situations, their analysis and solving using appropriate software (Python language)

**Indicative content:**
1, Decision theory, utility theory and related paradoxes
2, Games against nature
3, Basic concepts of conflict situation modeling, two player games, game definition, game classification, problems of equilibrium decision making in games
4, Bimatrix games, equilibrium solution of the game, solution of the game in pure strategies, solution of the game in mixed strategies (special types of games).
5, Bimatrix games, solving the game in mixed strategies (special types of games), Kuhn-Tucker's optimality conditions, solving the game in mixed strategies, cooperative solving

6, Matrix games, equilibrium strategies of players, their existence and properties, solving games in pure strategies, solving games in mixed strategies (special types of games)
7, Matrix games, solving games in mixed strategies, relationships between matrix games and linear programming problems
8, Multiplayer games, non-cooperative game solutions
9, Multiplayer games, cooperative game solutions
10, Multiplayer games, voting games
11, Repeated games
12, Extensive form games
13, Application of game theory in various fields (examples of various practical applications)

**Support literature:**

Chobot M. – Turnovec F. – Ulašín V.: Teória hier a rozhodovania. Alfa, Bratislava 1991
Goga M.: Teória hier. Iura Edition, 2012
Dlouhý M. – Fiala, P.: Teorie ekonomických a politických her. Oeconomica, 2015
Čičková a kol.: Vybrané aplikácie teórie hier. Letra Edu, 2019
Gibbons R. Game theory for applied economics. Princenton University Press, Princenton 1992.

**Syllabus:**

**Language whose command is required to complete the course:**
Slovak

**Notes:**

**Assessment of courses**
Total number of evaluated students: 588

| A | B | C | D | E | FX |
|---|---|---|---|---|---|
| 20.24 | 17.01 | 18.54 | 12.07 | 27.89 | 4.25 |

**Lecturer:** doc. Ing. Zuzana Čičková, PhD.

**Date of the latest change:** 21.02.2022

**Approved by:** Person responsible for the delivery, development and quality of the study programme doc. Ing. Andrea Furková, PhD., Person responsible for the delivery, development and quality of the study programme doc. Dr. Ing. Miroslav Hudec, Person responsible for the delivery, development and quality of the study programme prof. Ing. Ivan Brezina, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Martin Mišút, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Jaroslav Kultan, PhD.

# DESCRIPTION OF COURSE

**University:** University of Economics in Bratislava

**Faculty:** Faculty of Economic Informatics

| **Course code:** KAI FHI/IIA21930/22 | **Title of course:** Information Management |
|---|---|

**Type, load and method of teaching activities:**
**Form of course:**
**Recommended load of course ( number of lessons ):**
**Per week: Per course:**
**Method of study:** present

**Number of credits:** 10

**Recommended semester/trimester of study:**

**Degree of study:** II.

**Prerequisites:**

**Requirements to complete the course:**

**Student workload:**

**Teaching results:**

**Indicative content:**

**Support literature:**

**Syllabus:**

**Language whose command is required to complete the course:**

**Notes:**

**Assessment of courses**
Total number of evaluated students: 63

| A | B | C | D | E | FX |
|---|---|---|---|---|---|
| 28.57 | 31.75 | 19.05 | 9.52 | 4.76 | 6.35 |

**Lecturer:**

**Date of the latest change:** 30.03.2022

**Approved by:** Person responsible for the delivery, development and quality of the study programme doc. Ing. Andrea Furková, PhD., Person responsible for the delivery, development and quality of the study programme doc. Dr. Ing. Miroslav Hudec, Person responsible for the delivery, development and quality of the study programme prof. Ing. Ivan Brezina, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Martin Mišút, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Jaroslav Kultan, PhD.

# DESCRIPTION OF COURSE

**University:** University of Economics in Bratislava

**Faculty:** Faculty of Economic Informatics

| **Course code:** KAI FHI/IIA21570/21 | **Title of course:** Information Systems Management |
|---|---|

**Type, load and method of teaching activities:**
**Form of course:** Lecture / Practical
**Recommended load of course ( number of lessons ):**
**Per week:** 0 / 4 **Per course:** 0 / 52
**Method of study:** present

**Number of credits:** 6

**Recommended semester/trimester of study:** 3.

**Degree of study:** II.

**Prerequisites:**

**Requirements to complete the course:**
Mid-term evaluation 70%
40 points elaboration and defense of the project - students develop a project during the semester on a selected topic assigned by the teacher at the beginning of the semester. Topics cover a variety of areas of IT management. This is how we verify the following learning outcomes: E., F., G.
30 continuous tests - students take a short weekly didactic test, which is used to verify the scope of memorized curriculum from the lecture. This is how we verify the following learning outcomes: A., B., C., D., F.
Final evaluation 30%
30 points for the written exam - the exam consists of questions verifying the acquired knowledge of the following learning outcomes: A., C., D., F. and a practical task that verifies the following learning outcomes: C., E., G.

**Student workload:**
Total study load (in hours):
6x26=156 hrs
participation in seminars 52 hrs
preparation for seminars 22 hrs
elaboration of a semester project 22 hrs
preparation for continuous tests 22 hrs
preparation for the exam 38 hrs

**Teaching results:**
Po absolvovaní predmetu majú byť študenti schopní:
A. Porozumieť základom a teoretickým východiskám fungovania informačných systémov.
B. Porozumieť ako sa IS využívajú v globálnych organizáciách, teda v komplexnom prostredí systémov.
C. Porozumieť významu kľúčových prvkov IS – ľudia, softvér, hardvér, procesy, dáta a komunikačné technológie.
D. Porozumieť ako sú tieto komponenty navzájom integrované a manažované pre dosiahnutie konkurenčnej výhody organizácie.
E. Získať náhľad na využívanie informácií v organizáciách a ako IT podporujú zlepšovanie kvality, rýchlosti a agility organizácií.

F. Porozumieť základným poznatkom z oblasti systémovej integrácie, informačných stratégií, kritických faktorov implementácie a prevádzky IS, outsourcingu IS, auditu IS a efektívnosti IS.
G. Získať prehľad o nových trendoch v oblasti tvorby, riadenia a kontroly IS v organizáciách.

**Indicative content:**

1. Introduction to information systems
2. Structure and components of business information systems
3. Management and decision making in the organization
4. Business process management
5. Large enterprise information systems (ERP, CRM, ..)
6. Globalization and IS
7. Enterprise architecture (EA)
8. IS integration
9. Security and protection of IS
10. IS implementation strategies
11. IS economics and IT management
12. Audit IS
13. Modern IS trends

**Support literature:**

BASL, J.: Inovace podnikových informačních systémů. Professional Publishing. 2011. ISBN 978-80-7431-045-4
BASL, J. - BLAŽÍČEK, R.: Podnikové informační systémy. 3. aktualizované a rozšířené vydání , Grada, 2012. ISBN 978-80-247-4307-3
BRUCKNER, T. - VOŘÍŠEK, J. - BUCHALCEVOVÁ, A. - STANOVSKÁ, I. - CHLAPEK, D. - ŘEPA, V. Tvorba informačních systémů : principy, metodiky, architektury.. Praha. Grada. 2012. ISBN 978-80-247-4153-6
GÁLA. L. - POUR. J. - ŠEDIVÁ. Z. Podniková informatika 3. aktualizované vydání. Grada. 2015. ISBN: 978-80-247-5457-4
ŘEPA, V. Procesně řízená organizace. Praha: Grada, 2012. 301 s. Management v informační společnosti. ISBN 978-80-247-4128-4.
SODOMKA, P. Informační systémy v podnikové praxi. Brno. Computer Press. 2006. ISBN 80-251-1200-4

**Syllabus:**

**Language whose command is required to complete the course:**
slovak

**Notes:**

**Assessment of courses**
Total number of evaluated students: 530

| A | B | C | D | E | FX |
|---|---|---|---|---|---|
| 29.81 | 33.58 | 20.75 | 9.25 | 6.42 | 0.19 |

**Lecturer:** Ing. Veronika Horniaková, PhD.

**Date of the latest change:** 01.02.2022

**Approved by:** Person responsible for the delivery, development and quality of the study programme doc. Ing. Andrea Furková, PhD., Person responsible for the delivery, development and quality of the study programme doc. Dr. Ing. Miroslav Hudec, Person responsible for the delivery, development and quality of the study programme prof. Ing. Ivan Brezina, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Martin Mišút,

CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Jaroslav Kultan, PhD.

# DESCRIPTION OF COURSE

| | |
|---|---|
| **University:** University of Economics in Bratislava | |
| **Faculty:** Faculty of Economic Informatics | |
| **Course code:** KAI FHI/IIA21610/21 | **Title of course:** Knowledge acquisition by computational intelligence |

**Type, load and method of teaching activities:**
**Form of course:** Lecture / Practical
**Recommended load of course ( number of lessons ):**
**Per week:** 2 / 2 **Per course:** 26 / 26
**Method of study:** present

**Number of credits:** 4

**Recommended semester/trimester of study:** 4.

**Degree of study:** II.

**Prerequisites:**

**Requirements to complete the course:**
Exam 60% The exam consists of two parts: the evaluation of the theoretical knowledge and knowledge of modelling particular tasks. The first part, verifies the achievement level of the teaching results A., B., C., F., whereas the second part by the solving tasks verifies the level of the teaching results E., G.
Assignments during the semester 40% The purpose of seminars is designing and defending the project. Students are cooperating in small groups on projects. The evaluation of the students involves achievement in the project, answers to the supplementary questions and short test. The evaluation assesses the following teaching results: A., D., E., G., H., I.

**Student workload:**
Total study load (in hours):
4 credits x 52 teaching hours = 130 h
Distribution of study load:
lectures and seminars participation: 52 h
seminar participation: 13 h
project and test preparation: 30 h
preparation of exam: 35 h

**Teaching results:**
After finishing this course, students will be able to:
A. comprehend the relevance and necessity of the data preparation for data mining tasks,
B. understand the basic concepts of the four so-called super problems in data mining: classification, clustering, outlier detection and association rules,
C. understand computational intelligence, machine learning and their applications,
D. be familiar with the environments and programming languages for computational intelligence
E. logically aggregating elementary requirements for the purposes of knowledge discovery in data,
F. acquiring overview about the relevance and problems of computational intelligence and machine learning,
G. how to achieve explainability of achieved solutions,
H. applying acquired knowledge and skills for solving real-world task,
I. individually working with the chosen software tools for data mining and knowledge discovery tasks.

**Indicative content:**

1. Introduction into data mining (principles, explaining the basics and relevance of data mining in knowledge discovery form data).
2. Introduction into computational intelligence and machine learning for the purpose of interpreting knowledge form data.
3. Data types, their properties and conversion.
4. Distance and similarity metrics, normalization methods in data preparation in extracting knowledge from data.
5. The key areas in data mining: clustering, associative rules, outlier detection and classification.
6. Exploring the MATLAB and WEKA environment, working with the language Python.
7. Python in tasks from data preparation to visualization of results.
8. Types of neural networks and classification by neural networks.
9. Modelling rule-based systems and inference in discovering knowledge from data mining.
10. Evolutionary algorithms and their applicability.
11. Modeling recommender systems based on customers requirements, similarities among items and historical data
12. Interactive acquisition of knowledge from data (environments for unsupervised data mining)
13. Automatic acquisition of knowledge from data (environments for supervised data mining)

**Support literature:**

BRAMER, Max. Principles of data mining. London: Springer-Verlag, 2020.
AGGRAWAL, C. Data Mining: The Textbook. Cham: Springer, 2015
BERKA, Petr. Dobývání znalostí z databází. Praha: Academia, 2003.
SKALSKÁ, Hana. Data mining a klasifikační modely. Hradec Králové: Gaudeamus, 2010.
BRUNTON, S.L., KUTZ, J.N., Data-Driven Science and Engineering. Machine learning, Dynamical Systems and Control, Cambridge University press, 2019
NEGNEVITSKY, M. Artificial Intelligence A Guide to Intelligent Systems, Pearson, 2011
MARČEK, D., Neurónové siete a ich aplikácie, EDIS, 2006
NÁVRAT, P. a kol., Umelá inteligencia, STU, 2011
CHOLLET, F., Deep learning v jazyku Python, GRADA, 2019
PECINOVSKÝ, R., Python - Kompletní příručka jazyka pro verzi 3.8, GRADA, 2019

**Syllabus:**

**Language whose command is required to complete the course:**

anglický

**Notes:**

**Assessment of courses**

Total number of evaluated students: 26

| A | B | C | D | E | FX |
|---|---|---|---|---|---|
| 11.54 | 53.85 | 15.38 | 19.23 | 0.0 | 0.0 |

**Lecturer:** doc. Dr. Ing. Miroslav Hudec, RNDr. Eva Rakovská, PhD., Ing. Erika Mináriková

**Date of the latest change:** 01.02.2022

**Approved by:** Person responsible for the delivery, development and quality of the study programme doc. Ing. Andrea Furková, PhD., Person responsible for the delivery, development and quality of the study programme doc. Dr. Ing. Miroslav Hudec, Person responsible for the delivery, development and quality of the study programme prof. Ing. Ivan Brezina, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Martin Mišút,

CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Jaroslav Kultan, PhD.

**DESCRIPTION OF COURSE**

| | |
|---|---|
| **University:** University of Economics in Bratislava | |
| **Faculty:** Faculty of Economic Informatics | |
| **Course code:** KŠ FHI/IID22100/21 | **Title of course:** Machine Learning |

**Type, load and method of teaching activities:**
**Form of course:** Lecture / Practical
**Recommended load of course ( number of lessons ):**
**Per week:** 2 / 2 **Per course:** 26 / 26
**Method of study:** present

**Number of credits:** 6

**Recommended semester/trimester of study:** 3.

**Degree of study:** II.

**Prerequisites:**

**Requirements to complete the course:**
40% assignment in Python
60% final exam

**Student workload:**
Total study load (in hours): 156
Lecture participation: 26
Seminar participation: 26
Preparation for seminars: 26
Written assignments: 38
Final exam preparation: 40

**Teaching results:**
Successful completion of the course is a guarantee that students will gain a basic overview of the nature and possibilities of machine learning in practice.
Knowledge
Students acquire:
− knowledge of basic concepts, principles, methods and procedures used in machine learning,
− knowledge of Python programming language
Skills
− students will learn to implement statistical methods into codes
− students will be able to construct machine learning models and algorithms in the Python programming language and will know how to combine them in solving problems
− students will learn to adequately apply machine learning procedures and methods
− students will learn to use libraries in Python, including the popular Scikit-learn and TensorFlow for machine learning
Competences
− students will be able to use the acquired knowledge and skills in solving tasks of machine learning

**Indicative content:**
The subject represents the area of machine learning, which is currently being intensively developed in close connection with artificial intelligence. It gives an overview of the basic types of machine learning, the main problems and methods and lists some typical algorithms.

**Support literature:**

1. MŰLLER, A. C., & GUIDO, S. (2016). Introduction to Machine Learning with Python: A Guide for Data Scientists (1st ed.). O'Reilly Media. ISBN 978-1-449-36941-5
GÉRON, A. (2019). Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems (2nd ed.). O'Reilly Media. ISBN 978-1492032649
2. AMR, T. (2020). Hands-On Machine Learning with scikit-learn and Scientific Python Toolkits: A practical guide to implementing supervised and unsupervised machine learning algorithms in Python. Packt Publishing.
3. ALBON, C. (2018). Machine Learning with Python Cookbook: Practical Solutions from Preprocessing to Deep Learning (1st ed.). O'Reilly Media. ISBN 978-1491989388
4. LIU, Y. (2020). Python Machine Learning By Example: Build intelligent systems using Python, TensorFlow 2, PyTorch, and scikit-learn (3rd ed.). Packt Publishing. ISBN 978-1800209718

**Syllabus:**

1. Introduction to machine learning and Python
2. Data preparation and data cleaning
3. Training, validation, and test sets
4. Classification a Regression
5. K-Nearest Neighbor
6. Random Forest and Decision Trees
7. Support Vector Machine algorithm
8. Naïve Bayes algorithm
9. Unsupervised learning. Clustering – K means clustering
10. Artificial Neural Networks I
11. Artificial Neural Networks II
12. Model validation. Model quality evaluation criteria.
13. Summary

**Language whose command is required to complete the course:**
Slovak

**Notes:**

**Assessment of courses**
Total number of evaluated students: 629

| A | B | C | D | E | FX |
|---|---|---|---|---|---|
| 9.06 | 28.46 | 36.09 | 20.19 | 6.04 | 0.16 |

**Lecturer:** Ing. Silvia Komara, PhD., doc. Ing. Mária Vojtková, PhD.

**Date of the latest change:** 07.02.2022

**Approved by:** Person responsible for the delivery, development and quality of the study programme doc. Ing. Andrea Furková, PhD., Person responsible for the delivery, development and quality of the study programme doc. Dr. Ing. Miroslav Hudec, Person responsible for the delivery, development and quality of the study programme prof. Ing. Ivan Brezina, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Martin Mišút, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Jaroslav Kultan, PhD.

# DESCRIPTION OF COURSE

**University:** University of Economics in Bratislava

**Faculty:** Faculty of Economic Informatics

| **Course code:** KAI FHI/IIA21920/22 | **Title of course:** Master Thesis and its Defense |
|---|---|

**Type, load and method of teaching activities:**
**Form of course:**
**Recommended load of course ( number of lessons ):**
**Per week: Per course:**
**Method of study:** present

**Number of credits:** 10

**Recommended semester/trimester of study:**

**Degree of study:** II.

**Prerequisites:**

**Requirements to complete the course:**

**Student workload:**

**Teaching results:**

**Indicative content:**

**Support literature:**

**Syllabus:**

**Language whose command is required to complete the course:**

**Notes:**

**Assessment of courses**
Total number of evaluated students: 63

| A | B | C | D | E | FX |
|---|---|---|---|---|---|
| 41.27 | 36.51 | 15.87 | 3.17 | 3.17 | 0.0 |

**Lecturer:**

**Date of the latest change:** 30.03.2022

**Approved by:** Person responsible for the delivery, development and quality of the study programme doc. Ing. Andrea Furková, PhD., Person responsible for the delivery, development and quality of the study programme doc. Dr. Ing. Miroslav Hudec, Person responsible for the delivery, development and quality of the study programme prof. Ing. Ivan Brezina, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Martin Mišút, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Jaroslav Kultan, PhD.

# DESCRIPTION OF COURSE

**University:** University of Economics in Bratislava

**Faculty:** Faculty of Economic Informatics

| **Course code:** KAI FHI/IIA21590/21 | **Title of course:** Mobile Applications Development |
|---|---|

**Type, load and method of teaching activities:**
**Form of course:** Lecture / Practical
**Recommended load of course ( number of lessons ):**
**Per week:** 0 / 4 **Per course:** 0 / 52
**Method of study:** present

**Number of credits:** 4

**Recommended semester/trimester of study:** 3.

**Degree of study:** II.

**Prerequisites:**

**Requirements to complete the course:**
Exercises (100% of the course grade)
Exercises are devoted to solving the given programming tasks. In addition to these tasks, students solve independent home programming assignments thematically related to the solved programming tasks from the exercises. Students comment on their solutions of the independent homework assignments, with their technical description, and defend them in a possible discussion in front of other students of their study group. Students' solutions to the independent programming homework assignments are graded (10% of the course grade). The solution and assessment of independent homework assignments verifies the achievement of learning outcomes B, C, D, E, F, G and H. As part of the practicum, students complete an independent written assignment, solving a programming assignment in an integrated development environment, which is assessed (40% of the course grade). The solution and assessment of the problem problem from the independent written work verifies the achievement of learning outcomes B, C, D, E, F and G. In the final practicum, students present and defend their semester project (50% of the course grade), which includes solving a programming assignment with a resulting mobile application. The solution and assessment of the problem assignment from the semester project verifies the achievement of learning outcomes A, B, C, D, E, F and G.

**Student workload:**
Total study load (in hours): 4 credits x 26 h = 104 h
Distribution of study load
participation in exercises 26 h,
preparation for exercises 13 h,
homework processing 13 h,
preparation for independent written work 24 h,
semester project 28 h

**Teaching results:**
Upon completion of the course, students should be able to:
A. orient themselves in the choice of programming language and development environment for the creation of the mobile application in question

B. establish and build a multi-platform, Android, iOS and Microsoft Windows 10 Mobile application project, or a single-platform Android mobile application in a selected multi-platform development environment
C. configure, set up, test, and use an Android emulator
D. navigate two ways of creating the user interface of an Android mobile application, in XAML and in C#
E. learn the Xamarin.Forms object-oriented programming framework and implement it to create an Android mobile application
F. be familiar with the MVVM (Model-View-ViewModel) architectural model of mobile application design and implement it in an Android Xamarin.Forms mobile application
G. implement an appropriate search or ordering algorithm in the source code of an Android Xamarin.Forms mobile application when solving a programming problem
H. implement an appropriate numerical derivation or integration algorithm in the source code of the Android Xamarin.Forms mobile application when solving a programming problem

**Indicative content:**
1) Programming languages and development environments used in the creation of single-platform and multi-platform mobile applications
2) The process of setting up and building a cross-platform mobile app project for three software platforms, Android, iOS and Microsoft Windows 10 Mobile, in a cross-platform development environment
3) The process of setting up and building a single-platform Android mobile application project in a multi-platform development environment
4) Configuration, setup and testing of Android emulator functionality, overview of emulators of other platforms
5) Differences in the way of creating user interface of Android mobile application in XAML and C#, comparison of advantages and disadvantages of both ways
6) Implementation of creating Android mobile application user interface in XAML and C# in two Android applications
7) Object oriented programming framework Xamarin.Forms, its importance, features and usage in creating an Android mobile application. Creating an Android Xamarin.Forms mobile application.
8) Model-View-ViewModel (MVVM) architectural model of mobile application design, its importance, features and use in creating Android mobile application. Implementation of MVVM model in Android Xamarin.Forms mobile application.
9) Using advanced data structures in the source code of a mobile application. Implementing a unidirectional linear list in Android Xamarin.Forms mobile application.
10) Implementation of selected search algorithms in the source code of Android Xamarin.Forms mobile application.
11) Implementation of selected ordering algorithms in the source code of Android Xamarin.Forms mobile application.
12) Implementation of selected numerical derivation algorithms of mathematical functions in the source code of Android Xamarin.Forms mobile application.
13) Implementation of selected algorithms of numerical integration of mathematical functions in the source code of Android Xamarin.Forms mobile application.

**Support literature:**
1. LACKO Ľ. Vývoj aplikací pro Android, Computer Press, 2015, ISBN 9788025143476
2. PETZOLD, Ch. Creating Mobile Apps with Xamarin.Forms Cross-platform C# programming for iOS, Android, and Windows. Xamarin Inc., Redmond: Microsoft Press, 2016. 1166 p. ISBN: 978-1-5093-0297-0

3. BRITCH, D. Enterprise Application Patterns using Xamarin.Forms. Redmond: DevDiv, .NET and Visual Studio produc teams, A division of Microsoft Corporation, 2017. 99 p.
4. Microsoft Corporation. https://docs.microsoft.com/sk-sk/xamarin/xamarin-forms/

**Syllabus:**

**Language whose command is required to complete the course:**
slovak

**Notes:**

**Assessment of courses**
Total number of evaluated students: 89

| A | B | C | D | E | FX |
|---|---|---|---|---|---|
| 37.08 | 37.08 | 16.85 | 6.74 | 2.25 | 0.0 |

**Lecturer:** Ing. Igor Košťál, PhD., Ing. Ján Pittner, PhD., Ing. Mgr. Peter Schmidt, PhD.

**Date of the latest change:** 01.02.2022

**Approved by:** Person responsible for the delivery, development and quality of the study programme doc. Ing. Andrea Furková, PhD., Person responsible for the delivery, development and quality of the study programme doc. Dr. Ing. Miroslav Hudec, Person responsible for the delivery, development and quality of the study programme prof. Ing. Ivan Brezina, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Martin Mišút, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Jaroslav Kultan, PhD.

# DESCRIPTION OF COURSE

| | |
|---|---|
| **University:** University of Economics in Bratislava | |
| **Faculty:** Faculty of Economic Informatics | |
| **Course code:** KOVE FHI/ IIB21520/22 | **Title of course:** Multicriteria Decision-Making |

**Type, load and method of teaching activities:**
**Form of course:** Lecture / Practical
**Recommended load of course ( number of lessons ):**
**Per week:** 2 / 2 **Per course:** 26 / 26
**Method of study:** present

**Number of credits:** 5

**Recommended semester/trimester of study:** 2.

**Degree of study:** II.

**Prerequisites:**

**Requirements to complete the course:**
30 % work at seminars and writing of projects
70 % combined final exam

**Student workload:**
5 credits x 26 hours = 130 hours
26 hours lecture attendance
26 hours seminar attendance
13 hours preparation for lectures
13 hours preparation for seminars
26 hours writing a seminar paper
26 hours preparation for final exam

**Teaching results:**
Upon successful completion of the course, students will acquire the following knowledge:
- knowledge of multicriteria decision-making for the analysis of economic phenomena and processes,
- knowledge of multicriteria decision-making to model economic phenomena and processes.
- knowledge of multi-criteria decision-making to evaluate and set strategies for economic processes.

Upon successful completion of the course, students will acquire the following skills:
- ability to use models and methods of multicriteria decision making,
- control of adequate software to solve multicriteria decision-making tasks.

Upon successful completion of the course, students will acquire the following competencies:
- practical skills and competencies associated with the application of models and methods of multicriteria decision-making in the analysis of economic problems in the field of economic practice using adequate software.

**Indicative content:**
The course is focused on the issue of multicriteria decision-making, while the content of the course is the areas of defining the concepts of multicriteria programming, goal programming and areas of multicriteria evaluation of variants. Students will get acquainted with the problems of evaluation in mathematical programming problems with multiple criteria. The basis is the definition of the efficiency of the solution, efficient solutions in context of goal programming problems and the

methods to solve these problems. Part of the course is the use of optimization software products (Python language).

**Support literature:**

1. Steuer, R. E.: Multiple Criteria Optimization: Theory, Computation, and Application, John Willey & Sons 1986.
2. PEKÁR, Juraj - FURKOVÁ, Andrea. Prípadové štúdie z viackriteriálneho rozhodovania. Bratislava : Vydavateľstvo EKONÓM, 2014.
3. Vincent Barichard, Matthias Ehrgott, Xavier Gandibleux, and Vincent T'Kindt. 2009. Multiobjective Programming and Goal Programming: Theoretical Results and Practical Applications (1st. ed.). Springer Publishing Company, Incorporated.
4. Constantin Zopounidis, Michael Doumpos: Multiple Criteria Decision Making: Applications in Management and Engineering 1st ed. 2017 Edition

**Syllabus:**

1. The role of multicriteria decision making. Geometric interpretation of the problem of multicriteria decision making.
2. Non-dominance and effectiveness of the solution. The concept of the dominant set. The principle of optimality and acceptability in multicriteria decision-making problems.
3. Goal programming. Distance metrics.
4. Archimedean goal programming. Min-max goal programming.
5. Lexicographic goal programming.
6. Efficient solutions and goal programming problems.
7. Methods for generation of efficient solutions – The weighted sum method.
8. Methods for generation of efficient solutions – The constraint method.
9. Methods for generation of efficient solutions - Ideal point (ideal alternative).
10. Interactive methods of multicriteria decision making - STEM method.
11. Multiple Attribute Decision Making (MADM) methods.
12. PROMETHEE methods.
13. Data Envelopment Analysis (DEA)

**Language whose command is required to complete the course:**
Slovak, English

**Notes:**

**Assessment of courses**
Total number of evaluated students: 589

| A | B | C | D | E | FX |
|---|---|---|---|---|---|
| 18.85 | 18.51 | 21.22 | 16.13 | 21.05 | 4.24 |

**Lecturer:** doc. Ing. Andrea Furková, PhD., Peter Knížat, MSc.

**Date of the latest change:** 21.02.2022

**Approved by:** Person responsible for the delivery, development and quality of the study programme doc. Ing. Andrea Furková, PhD., Person responsible for the delivery, development and quality of the study programme doc. Dr. Ing. Miroslav Hudec, Person responsible for the delivery, development and quality of the study programme prof. Ing. Ivan Brezina, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Martin Mišút, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Jaroslav Kultan, PhD.

**DESCRIPTION OF COURSE**

| | |
|---|---|
| **University:** University of Economics in Bratislava | |
| **Faculty:** Faculty of Economic Informatics | |
| **Course code:** KŠ FHI/IID22261/22 | **Title of course:** Multivariate Statistical Methods |

**Type, load and method of teaching activities:**
**Form of course:** Lecture / Practical
**Recommended load of course ( number of lessons ):**
**Per week:** 2 / 2 **Per course:** 26 / 26
**Method of study:** present

**Number of credits:** 4

**Recommended semester/trimester of study:** 3.

**Degree of study:** II.

**Prerequisites:**

**Requirements to complete the course:**
40 % semester project processed in SAS Enterprise Guide
60 % final exam

**Student workload:**
Total study load (in hours): 156 hours
Distribution of study load
Lectures participation: 26 hours
Seminar participation: 26 hours
Preparation for seminars: 13 hours
Elaboration of Semester project: 26 hours
Presentation of Semester project: 13 hours
Preparation for final exam: 52 hours

**Teaching results:**
At the end of the semester, students will have a good overview of multivariate statistical methods, which are currently widely used in various areas of economic practice, such as:
Knowledge
- Students will distinguish multivariate statistical methods in terms of their classification and will know the basic principles, starting points and conditions of use of individual multivariate statistical methods. In the final exam, students will use this knowledge to solve practical problems using the statistical software package SAS.
Skills
- Students will be able to design and identify a suitable multivariate statistical method to achieve the goal of analysis, indicating the possibilities of its further use.
Competencies
- Students will know how to: apply a suitable multivariate statistical method, verify the conditions of its use, interpret and present the results of the analysis;
- evaluate the acquired knowledge in solving real economic and social tasks in practice using the SAS system.

**Indicative content:**
Multivariate statistical analysis is one of the most important statistical tools characterizing various phenomena. It is accompanied by wide range of methods and procedures that address multivariate

problems in various respects. The course provides theoretical analysis of multivariate statistical methods, control of their basic principles, implementation of individual steps of analysis of the methods, the conditions under which individual methods are used as well as their application.

**Support literature:**

1. VOJTKOVÁ, M. - STANKOVIČOVÁ, I.: Viacrozmerné štatistické metódy s aplikáciami v softvéri SAS. Bratislava: Letra Edu, 2020. 2. vydanie. ISBN 978-80-89962-58-7 (print), ISBN 978-80-89962-59-4 (online)
2. MELOUN, M. – MILITKÝ, J. – HILL, M: Statistická analýza vícerozměrných dat v příkladech. Praha: Karolinum, 2017. ISBN 80-200-1254-0
3. MELOUN, M. – MILITKÝ, J.: Interaktivní statistická analýza dat. Praha: Karolinum, 2012. ISBN 80-200-1254-0
4. MELOUN, M. – MILITKÝ, J.: Kompendium statistického zpracování dat. Praha: Karolinum, 2012. ISBN 80-200-1254-0
5. HEBÁK, P. - HUSTOPECKÝ, J. - JAROŠOVÁ, E. – PECÁKOVÁ, I.: Vícerozměrné statistické metódy (1). Informatorium, Praha 2004. ISBN 80-7333-025-3
6. HEBÁK, P. - HUSTOPECKÝ, J. – MALÁ, I.: Vícerozměrné statistické metódy (2). Informatorium, Praha 2005. ISBN 80-733-036-9
7. HEBÁK, P. - HUSTOPECKÝ, J. - PECÁKOVÁ, I. – PRŮŠA, M. – ŘEZÁNKOVÁ,H. – VLACH, P. – SVOBODOVÁ, A.. : Vícerozměrné statistické metódy (3). Praha: Informatorium, 2005. ISBN 80-7333-039-3
8. BAKYTOVÁ, H.- BODJANOVÁ, S.- RUBLÍKOVÁ, E.: Viacrozmerná analýza. Bratislava: ES VŠE, 1988 resp. 1991.
9. TABACHNICK, B.G. – FIDELL, L. S.: Using Multivariate statistics. 6th ed., Edinburg: Pearson Education Limited, 2014. ISBN 13: 978-1-292-02131-7
10. HAIR, J. F. - BLACK, W. C. - BABIN, B. J. - ANDERSON, R. E.: Multivariate data analysis. 7th ed. New York: Macmillan Publishing Company, 2010. ISBN 13: 978-0138132637
11. SHARMA, S.: Applied multivariate techniques. New York: John Wiley & Sons, 1996. ISBN 0-471-31064-6
12. RENCHER. A. C..: Methods of Multivariate Analysis. New York: John Willey & Sons, 1995. ISBN 0-471-57152-0
Literature will be continuously updated with the latest scientific and professional titles.

**Syllabus:**

1. Basic concepts of multivariate analysis.
2. Methods of multicriteria evaluation.
3. Principal component analysis.
4. Factor analysis. Methods for estimating factor model parameters.
5. Rotation of factors. General scheme of application of factor analysis.
6. Comparison of factor analysis and principal component analysis.
7. Cluster analysis. Hierarchical clustering methods.
8. Non-hierarchical clustering methods. Interpretation of clusters.
9. Canonical correlation analysis.
10. Discriminant analysis. Analytical task of discriminant analysis.
11. Classification task of discriminant analysis. Verification of classification accuracy.
12. Logistic regression.
13. Summary of lectured topics.

**Language whose command is required to complete the course:**

Slovak

**Notes:**

**Assessment of courses**

Total number of evaluated students: 0

| A | B | C | D | E | FX |
|---|---|---|---|---|---|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

**Lecturer:** doc. Ing. Mária Vojtková, PhD.

**Date of the latest change:** 30.03.2022

**Approved by:** Person responsible for the delivery, development and quality of the study programme doc. Ing. Andrea Furková, PhD., Person responsible for the delivery, development and quality of the study programme doc. Dr. Ing. Miroslav Hudec, Person responsible for the delivery, development and quality of the study programme prof. Ing. Ivan Brezina, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Martin Mišút, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Jaroslav Kultan, PhD.

# DESCRIPTION OF COURSE

**University:** University of Economics in Bratislava

**Faculty:** Faculty of Economic Informatics

| **Course code:** KOVE FHI/ IIB21510/22 | **Title of course:** Optimal Programming I |
|---|---|

**Type, load and method of teaching activities:**
**Form of course:** Lecture / Practical
**Recommended load of course ( number of lessons ):**
**Per week:** 2 / 2 **Per course:** 26 / 26
**Method of study:** present

**Number of credits:** 5

**Recommended semester/trimester of study:** 1.

**Degree of study:** II.

**Prerequisites:**

**Requirements to complete the course:**
30 % work at seminars and writing of projects
70 % combined final exam

**Student workload:**
130 hours
26 hours lecture attendance
26 hours seminar attendance
13 hours preparation for lectures
13 hours preparation for seminars
26 hours writing a seminar paper
26 hours preparation for final exam

**Teaching results:**
Upon successful completion of the course, students will acquire the following knowledge:
- knowledge and understanding of the possibilities of using optimal programming approaches as instruments to support decision-making,
-knowledge and understanding of selected methods for solving optimization problems of linear, integer and bivalent programming.
Upon successful completion of the course, students will acquire the following skills:
- ability to use selected methods for solving linear, integer and bivalent programming problems,
- ability to work with Python software system and with Solver for Excel software system for solving linear, integer and bivalent programming problems.
Upon successful completion of the course, students will acquire the following competencies:
-practical skills and competencies associated with the application of models and methods of linear, integer and bivalent programming in the analysis of specific decision-making tasks using adequate software (Python, Solver for Excel).

**Indicative content:**
1. Optimal programming as an instrument to support decision making. Overview of mathematical methods (disciplines) in the field of optimal programming. Concepts of economic model and economic-mathematical model. Classification of economic-mathematical models.

2. General formulation of the mathematical programming problem. Scalar optimization problem and multicriteria decision making problem. Linear and nonlinear programming problems. Integer and bivalent programming problems. Specific examples of economic formulation of mathematical programming problems.
3. Linear programming concepts. Linear programming as part of mathematical programming. Basic concepts and properties of solving linear programming problems. Graphical and algebraic solution of the linear programming problem.
4. Methods for solving linear programming problems - classification: simplex method (primary and dual algorithm, revised algorithm), interior-point method. Algorithms and their complexity.
5. Simplex method - primary algorithm, primary algorithm using artificial variables.
6. Special cases in solving linear programming problems.
7. Theory of duality in linear programming problems. Economic interpretation of duality theory. Duality properties.
8. Dual simplex algorithm.
9. Sensitivity analysis and its economic interpretation.
10. Revised simplex algorithm.
11. Interior-point method.
12. Models with integer and bivalent variables and their economic interpretations. Cutting planes method for solving integer programming problems. Branch and bound method for solving integer programming problems.
13. Bivalent programming - explicit enumeration, Balas additive algorithm.

**Support literature:**

1. CHOCHOLATÁ, M. 2013. Lineárne programovanie pre manažérov. Bratislava: Vydavateľstvo EKONÓM.
2. WILLIAMS, H.P. 2013. Model Building in Mathematical Programming. London: John Wiley and Sons.
3. LAŠČIAK, A. a kol. 1990. Optimálne programovanie. 2. upravené vydanie. Bratislava: Alfa.

**Syllabus:**

**Language whose command is required to complete the course:**
Slovak

**Notes:**

**Assessment of courses**
Total number of evaluated students: 681

| A | B | C | D | E | FX |
|---|---|---|---|---|---|
| 11.31 | 13.95 | 16.74 | 24.08 | 23.79 | 10.13 |

**Lecturer:** doc. Ing. Michaela Chocholatá, PhD., Ing. Pavel Gežík, PhD.

**Date of the latest change:** 21.02.2022

**Approved by:** Person responsible for the delivery, development and quality of the study programme doc. Ing. Andrea Furková, PhD., Person responsible for the delivery, development and quality of the study programme doc. Dr. Ing. Miroslav Hudec, Person responsible for the delivery, development and quality of the study programme prof. Ing. Ivan Brezina, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Martin Mišút, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Jaroslav Kultan, PhD.

# DESCRIPTION OF COURSE

**University:** University of Economics in Bratislava

**Faculty:** Faculty of Economic Informatics

| **Course code:** KAI FHI/IIA21600/21 | **Title of course:** Parallel Programming |
|---|---|

**Type, load and method of teaching activities:**
**Form of course:** Lecture / Practical
**Recommended load of course ( number of lessons ):**
**Per week:** 0 / 4 **Per course:** 0 / 52
**Method of study:** present

**Number of credits:** 4

**Recommended semester/trimester of study:** 4.

**Degree of study:** II.

**Prerequisites:**

**Requirements to complete the course:**
Requirements to complete the course:
Individual work
independent work
combined examination
1. Activity on the exercise (40%). The achieved level of skills A, - E. is verified.
2. Combined examination (60 %, of which the written part of the examination 30 % and the oral part of the examination 30 %). The theoretical part verifies the level of competence A. - I.

**Student workload:**
Total study load (in hours): 4 credits x 26 h = 104 h
Student load distribution
participation in exercises, seminars 26 h,
preparation for seminars 26 h,
preparation for individual written work 26 h,
preparation for the exam 26 h.

**Teaching results:**
Students will acquire the following competencies:
A. in more advanced object-oriented programming principles in Python.
B. with the paradigms of sequential, concurrent (competing), and parallel programming.
C. introduce students to variants of parallelism and concurrent computation.
D. to implement competing versions of originally sequential algorithms developed in Python.
E. apply performance metrics of parallel and competing code.
F. implement Python tools for competitive and parallel programming (threads, processes, locks, ...).
G. Understand the benefits, limitations, and features of parallel programming.
H. Figure out how to create a responsive and high-performance program.
I. Implement a parallel algorithm on a graphics processor using the PyCUDA module.
Upon completion of the course, the student should be able to:
A. Students will master the paradigm of competitive and parallel programming in an object-oriented environment.
B. Students will learn to create competitive and parallel algorithms and programs that can utilize all the computational capacity of variably powerful computer systems.

C. Listeners will gain information about threads, processes, locks, synchronization, communication, deadlocks, and more.
D. Listeners will understand the benefits, limitations, and features of a parallel program.
F. Listeners will improve their Python programming skills with more advanced, multi-threaded, and multi-process tasks.

**Indicative content:**
1. algorithm and programming languages,
2. data types in programming languages
3. principles of object-oriented programming in programming languages,
4. paradigm of concurrent and parallel programming from the point of view of theoretical and applied informatics,
5. benefits and risks of concurrent and parallel algorithms,
6. memory management of parallel and concurrent algorithms,
7. threads, processes, synchronization, locks,
8. using of Python libraries for concurrent and parallel algorithms,
9. communication between processes and between threads,
10. deadlock and solution proposals,
11. parallel programming using graphics processors,
12. parallel architectures,
13. implementation of parallelism in the Python programming language.

**Support literature:**
1. Gove, D.: Programování aplikací pro vícejádrové procesory: Vydavateľstvo Computer press, Addison Wesley, 2011. ISBN: 978-80-251-3487-0.
2. Hanák, J.: Moderné paralelné programovanie, 2. vydanie. Bratislava : Vydavateľstvo EKONÓM, 2013.
3. Ben-Ari M.: Principles of Concurrent and Distributed Programming, 2nd Edition. Addison Wesley, 2006. ISBN 032131283X3. Andrews G. R.: Foundations of Multithreaded, Parallel, and Distributed Programming. Addison-Wesley, 2000. ISBN 0201357526

**Syllabus:**

**Language whose command is required to complete the course:**
slovak

**Notes:**

**Assessment of courses**
Total number of evaluated students: 20

| A | B | C | D | E | FX |
|---|---|---|---|---|---|
| 20.0 | 25.0 | 15.0 | 15.0 | 25.0 | 0.0 |

**Lecturer:** Ing. Igor Košťál, PhD.

**Date of the latest change:** 01.02.2022

**Approved by:** Person responsible for the delivery, development and quality of the study programme doc. Ing. Andrea Furková, PhD., Person responsible for the delivery, development and quality of the study programme doc. Dr. Ing. Miroslav Hudec, Person responsible for the delivery, development and quality of the study programme prof. Ing. Ivan Brezina, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Martin Mišút, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Jaroslav Kultan, PhD.

# DESCRIPTION OF COURSE

**University:** University of Economics in Bratislava

**Faculty:** Faculty of Economic Informatics

| **Course code:** KOVE FHI/ IIB21530/22 | **Title of course:** Project Management |
|---|---|

**Type, load and method of teaching activities:**
**Form of course:** Lecture / Practical
**Recommended load of course ( number of lessons ):**
**Per week:** 2 / 2 **Per course:** 26 / 26
**Method of study:** present

**Number of credits:** 5

**Recommended semester/trimester of study:** 2.

**Degree of study:** II.

**Prerequisites:**

**Requirements to complete the course:**
30% semester seminar work, resp. project,
10% continuous processing of tasks, worksheets resp. case studies.
60% written exam.

**Student workload:**
130 hours,
26 hours of lectures,
26 hours of exercise,
58 hours of self-study in preparation for the exam,
20 hours elaboration of a semester project.

**Teaching results:**
Upon successful completion of the course, students will acquire the following knowledge:
- basic knowledge of graph theory and the use of graph theory in the modeling of information systems and some economic processes,
- basic knowledge in the field of project management, network analysis and the use of network analysis models in the optimization of economic and managerial processes.

Upon successful completion of the course, students will acquire the following skills:
- understand and be able to use the principles of project management in the management of human and material resources in the project process,
- ability to apply methods to support decision-making in the management of IS projects,
- ability to use basic concepts, techniques and algorithms of graph theory and network analysis,
- control of corresponding software, software products Excel, Python, specialized software products.

Upon successful completion of the course, students will acquire the following competencies:
- practical skills and competencies associated with the application of methods and algorithms to support decision-making in the management of IS projects, skills associated with the use of project management principles in the management of human and material resources in the project process, data analysis using Python software.

**Indicative content:**
1. Project management and planning.

2. Project planning tools. Quality of projects.
3. IT project management. Tasks of the project leader. Motivation.
4. Program management of projects. Organizational structures.
5. Introduction to graph theory, use and properties of graphs, descriptions of graph structure.
6. Acyclic graphs, spanning tree graphs, decision tree graphs, UML.
7. Paths in the graph. Eulerian and Hamiltonian paths and circuits. The problem of the shortest path.
8. Modifications of roads in the graph. Sightseeing tours. Computational complexity of roundabouts. Optimization, heuristic, and metaheuristic algorithms for solving roundabouts.
9. Project management and main properties of graphs for project management. Node-oriented and edge-oriented graphs and their creation.
10. Methods of project management. CPM method.
11. Cost and probabilistic analysis in project management. PERT method.
12. MPM method.
13. Software tools in project management. Use of Jira, Asana, MS Project and Excel, Python.

**Support literature:**

1. Teória grafov pre ekonómov, Ivan Brezina – Pavel Gežík, Bratislava : Letra Edu, 2018
2. Kvantitatívne metódy projektového riadenia pre ekonómov, Ivan Brezina – Pavel Gežík, Bratislava : Letra Edu, 2020
3. Sieťová analýza, Ivan Brezina – Pavel Gežík - Zuzana Čičková. Bratislava : Vydavateľstvo EKONÓM, 2012.
4. Riadenie projektov informačných systémov, Závodný, P, Bratislava : Ekonóm, 2013.
5. Informační management v informační spoločnosti, Doucek, P a kol., Praha: Professional Publishing, 2013.

**Syllabus:**

**Language whose command is required to complete the course:**
Slovak, English

**Notes:**

**Assessment of courses**
Total number of evaluated students: 531

| A | B | C | D | E | FX |
|---|---|---|---|---|---|
| 15.44 | 18.46 | 19.4 | 21.28 | 16.2 | 9.23 |

**Lecturer:** prof. Ing. Ivan Brezina, CSc., Ing. Pavel Gežík, PhD.

**Date of the latest change:** 21.02.2022

**Approved by:** Person responsible for the delivery, development and quality of the study programme doc. Ing. Andrea Furková, PhD., Person responsible for the delivery, development and quality of the study programme doc. Dr. Ing. Miroslav Hudec, Person responsible for the delivery, development and quality of the study programme prof. Ing. Ivan Brezina, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Martin Mišút, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Jaroslav Kultan, PhD.

# DESCRIPTION OF COURSE

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<tr><td colspan="2">Faculty: Faculty of Economic Informatics</td></tr>
<tr><td>Course code: KAI FHI/IIA21900/22</td><td>Title of course: Seminar to Final Thesis I</td></tr>
<tr><td colspan="2">Type, load and method of teaching activities:<br>Form of course: Lecture / Practical<br>Recommended load of course ( number of lessons ):<br>Per week: 0 / 2 Per course: 0 / 26<br>Method of study: present</td></tr>
<tr><td colspan="2">Number of credits: 2</td></tr>
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<tr><td colspan="2">Degree of study: II.</td></tr>
<tr><td colspan="2">Prerequisites:</td></tr>
<tr><td colspan="2">Requirements to complete the course:</td></tr>
<tr><td colspan="2">Student workload:</td></tr>
<tr><td colspan="2">Teaching results:</td></tr>
<tr><td colspan="2">Indicative content:</td></tr>
<tr><td colspan="2">Support literature:</td></tr>
<tr><td colspan="2">Syllabus:</td></tr>
<tr><td colspan="2">Language whose command is required to complete the course:</td></tr>
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<tr><td colspan="2">Date of the latest change: 30.03.2022</td></tr>
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# DESCRIPTION OF COURSE

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<tr><td colspan="2">Type, load and method of teaching activities:<br>Form of course: Lecture / Practical<br>Recommended load of course ( number of lessons ):<br>Per week: 0 / 2 Per course: 0 / 26<br>Method of study: present</td></tr>
<tr><td colspan="2">Number of credits: 2</td></tr>
<tr><td colspan="2">Recommended semester/trimester of study: 4.</td></tr>
<tr><td colspan="2">Degree of study: II.</td></tr>
<tr><td colspan="2">Prerequisites:</td></tr>
<tr><td colspan="2">Requirements to complete the course:</td></tr>
<tr><td colspan="2">Student workload:</td></tr>
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<tr><td colspan="2">Indicative content:</td></tr>
<tr><td colspan="2">Support literature:</td></tr>
<tr><td colspan="2">Syllabus:</td></tr>
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<tr><td colspan="2">Date of the latest change: 30.03.2022</td></tr>
<tr><td colspan="2">Approved by: Person responsible for the delivery, development and quality of the study programme doc. Ing. Andrea Furková, PhD., Person responsible for the delivery, development and quality of the study programme doc. Dr. Ing. Miroslav Hudec, Person responsible for the delivery, development and quality of the study programme prof. Ing. Ivan Brezina, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Martin Mišút, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Jaroslav Kultan, PhD.</td></tr>
</table>

# DESCRIPTION OF COURSE

| | |
|---|---|
| **University:** University of Economics in Bratislava | |
| **Faculty:** Faculty of Economic Informatics | |
| **Course code:** KOVE FHI/ IIB21250/22 | **Title of course:** Simulation Modelling |

**Type, load and method of teaching activities:**
**Form of course:** Lecture / Practical
**Recommended load of course ( number of lessons ):**
**Per week:** 2 / 2 **Per course:** 26 / 26
**Method of study:** present

**Number of credits:** 5

**Recommended semester/trimester of study:**

**Degree of study:** II.

**Prerequisites:**

**Requirements to complete the course:**
40 % Assignments and Final project presentation;
60 % Final exam

**Student workload:**
156 hours
Distribution of study load
Lectures participation: 26 hours
Seminar participation: 26 hours
Elaboration of the final project: 52 hours
Preparation for final exam: 52 hours

**Teaching results:**
In particular, students will acquire the following abilities:
- knowledge of economic data analysis,
- knowledge of the construction of simulation models,

Students will acquire in particular the following skills:
- ability to construct and use simulation models,
- ability to gather and analyze data
- ability to use simulation software
- ability to formulate clear and convincing presentations of their work results in both written and oral form.

Students will acquire the following competencies:
- practical skills and competencies with the application of simulation methods in the analysis of economic problems in the field of waiting line theory and inventory theory using simulation software.

**Indicative content:**
1. Introduction to simulation modelling. Analytical and simulation models.
2. Monte Carlo methods. Problems solving using the Monte Carlo method.
3. Discrete event simulation
4. The concept of a random number. Pseudorandom numbers. Generation of random numbers. Congruence methods. Testing of generated random numbers.

5. Discrete and continuous probability distributions.
6. Analysis of simulation model input data.
7. Validation and verification of the simulation model.
8. Analysis of simulation model output data.
9. Simulation optimization and comparison of variants.
10. Simulation software overview.
11. Waiting line models simulation
12. Inventory problem simulation
13. Case studies

**Support literature:**

Domonkos, T.: Simulácie. Bratislava : Letra Edu, 2018. 80 s. ISBN 978-80-89962-01-3.
2. Dlouhý, M., Fábry, J., Kuncová, M., Hladík, T.: Simulace podnikových procesú. Brno: Computer Press, 2011. 206 s. ISBN 978-80-251-3449-8.
3. Banks, J., Carson Ii, S. J., Nelson, B. N., Nicol, D. M.: Discrete-event system simulation. New Jersey: Pearson Prentice Hall, 2005, 608 s. ISBN 0-13-144679-7.
4. Law, A. M.: Simulation Modeling and Ananlysis. New York: McGraw-Hill, 2014, 800 s. ISBN 0073401323

**Syllabus:**

**Language whose command is required to complete the course:**
Slovak, English

**Notes:**

**Assessment of courses**
Total number of evaluated students: 138

| A | B | C | D | E | FX |
|---|---|---|---|---|---|
| 26.09 | 36.23 | 23.91 | 10.87 | 1.45 | 1.45 |

**Lecturer:** doc. Ing. Marian Reiff, PhD.

**Date of the latest change:** 21.02.2022

**Approved by:** Person responsible for the delivery, development and quality of the study programme doc. Ing. Andrea Furková, PhD., Person responsible for the delivery, development and quality of the study programme doc. Dr. Ing. Miroslav Hudec, Person responsible for the delivery, development and quality of the study programme prof. Ing. Ivan Brezina, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Martin Mišút, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Jaroslav Kultan, PhD.

# DESCRIPTION OF COURSE

**University:** University of Economics in Bratislava

**Faculty:** Faculty of Economic Informatics

| **Course code:** KOVE FHI/ IIB21550/22 | **Title of course:** Simulation Modelling |
|---|---|

**Type, load and method of teaching activities:**
**Form of course:** Lecture / Practical
**Recommended load of course ( number of lessons ):**
**Per week:** 2 / 2 **Per course:** 26 / 26
**Method of study:** present

**Number of credits:** 5

**Recommended semester/trimester of study:**

**Degree of study:** II.

**Prerequisites:**

**Requirements to complete the course:**
40 % Assignments and Final project presentation;
60 % Final exam

**Student workload:**
Total study load (in hours): 130 hours
Distribution of study load
Lectures participation: 26 hours
Seminar participation: 26 hours
Elaboration of the final project: 52 hours
Preparation for final exam: 26 hours

**Teaching results:**
In particular, students will acquire the following abilities:
- knowledge of economic data analysis,
- knowledge of the construction of simulation models,
Students will acquire in particular the following skills:
- ability to construct and use simulation models,
- ability to gather and analyze data
- ability to use simulation software
- ability to formulate clear and convincing presentations of their work results in both written and oral form.
Students will acquire the following competencies:
- practical skills and competencies with the application of simulation methods in the analysis of economic problems in the field of waiting line theory and inventory theory using simulation software.

**Indicative content:**
1. Introduction to simulation modelling. Analytical and simulation models.
2. Monte Carlo methods. Problems solving using the Monte Carlo method.
3. Discrete event simulation
4. The concept of a random number. Pseudorandom numbers. Generation of random numbers. Congruence methods. Testing of generated random numbers.

5. Discrete and continuous probability distributions.
6. Analysis of simulation model input data.
7. Validation and verification of the simulation model.
8. Analysis of simulation model output data.
9. Simulation optimization and comparison of variants.
10. Simulation software overview.
11. Waiting line models simulation
12. Inventory problem simulation
13. Case studies

**Support literature:**

Domonkos, T.: Simulácie. Bratislava : Letra Edu, 2018. 80 s. ISBN 978-80-89962-01-3.
2. Dlouhý, M., Fábry, J., Kuncová, M., Hladík, T.: Simulace podnikových procesú. Brno: Computer Press, 2011. 206 s. ISBN 978-80-251-3449-8.
3. Banks, J., Carson Ii, S. J., Nelson, B. N., Nicol, D. M.: Discrete-event system simulation. New Jersey: Pearson Prentice Hall, 2005, 608 s. ISBN 0-13-144679-7.
4. Law, A. M.: Simulation Modeling and Ananlysis. New York: McGraw-Hill, 2014, 800 s. ISBN 0073401323

**Syllabus:**

**Language whose command is required to complete the course:**
Slovak, English

**Notes:**

**Assessment of courses**
Total number of evaluated students: 408

| A | B | C | D | E | FX |
|---|---|---|---|---|---|
| 22.55 | 25.0 | 23.53 | 13.73 | 15.2 | 0.0 |

**Lecturer:** doc. Ing. Marian Reiff, PhD.

**Date of the latest change:** 21.02.2022

**Approved by:** Person responsible for the delivery, development and quality of the study programme doc. Ing. Andrea Furková, PhD., Person responsible for the delivery, development and quality of the study programme doc. Dr. Ing. Miroslav Hudec, Person responsible for the delivery, development and quality of the study programme prof. Ing. Ivan Brezina, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Martin Mišút, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Jaroslav Kultan, PhD.

# DESCRIPTION OF COURSE

**University:** University of Economics in Bratislava

**Faculty:** Faculty of Economic Informatics

| **Course code:** KAI FHI/IIA21510/21 | **Title of course:** Software Engineering I |
|---|---|

**Type, load and method of teaching activities:**
**Form of course:** Lecture / Practical
**Recommended load of course ( number of lessons ):**
**Per week:** 2 / 2 **Per course:** 26 / 26
**Method of study:** present

**Number of credits:** 5

**Recommended semester/trimester of study:** 1.

**Degree of study:** II.

**Prerequisites:**

**Requirements to complete the course:**
60 % final exam: The final exam consists of two parts: a test and a specific problem to solve. The test verifies the achieved level of educational results A., C., F., G., the solution of the problem task verifies the achieved level of educational results B., C., D., E.
40 % assignments: The aim of the assignments is to develop and defend a project on which students work in groups that have a defined team leader. The students choose the leader from among themselves. Students organize group work autonomously and are managed by a team leader. The evaluation of the results of the group's work (submitted project) is evaluated as a whole for the whole group. The evaluation of the contribution of individual members of the group to the evaluation of the group is the result of the group's internal agreement. Part of the evaluation of an individual student is also his activity in opposing and evaluating other groups' projects. The results of the work (project) are submitted by the group for evaluation during the semester three times. The following educational results are evaluated by evaluating projects and evaluating the opposition of the work results of other groups: B., C., D., E., G., H., I.

**Student workload:**
Total study load (in hours): 5 credits x 26 hours = 130 hours
Distribution of study load
Lectures and seminar participation: 52 hours
Preparation for seminars: 13 hours
Written assignments: 45 hours
Final exam preparation: 20 hours

**Teaching results:**
After completing the course, students should be able to:
A. Understand the causes of the software crisis and how to solve it, know the software life cycle
B. Analyze user needs and record them using techniques of selected methods
C. Choose the appropriate method of analysis and design of software system
D. Define functional and non-functional software requirements
E. Define a conceptual data and functional model of the problem domain
F. Understand the essence of software process models, know the strengths and weaknesses of specific methodologies
G. Understand the way the team is working and organized and know how to work as part of a team

H. Present and defend the solutions they propose at a professional level
I. Develop technical documentation (report) describing their proposed solution

**Indicative content:**
1. History of computer use. Software crisis. Software engineering. Concepts and goals of software engineering. Software as a product, Features of software products, Software life cycle, Stages of software systems development, The role of errors in the software process
2. Overview of SE methods (structured approach, data-oriented approach, object-oriented approach), Requirements Engineering (Requirements definition), Requirements analysis and specification (functional and non-functional requirements, requirements validation, formal specifications), Specification document, Listing method requirements, Requirements specification methods.
3. Requirements analysis and specification (functional and non-functional requirements, requirements validation, formal specifications), specification document, Requirements specification methods.
4. Introduction to the analysis and design of software systems. Functional model, data model and behavior model. Structured analysis - overview, modeling techniques, data flow diagram.
5. Conceptual data modeling, entity-relational diagrams, logical data models.
6. Structured analysis - data dictionary, mini-specifications, summary
7. Modeling of functional requirements through use cases (diagram, description, notation, ...)
8. Modeling of automata - state diagrams
9. Software process models, software life cycle models
10. Agile development methodologies, extreme programming and prototyping.
11. Design phase and introduction to software system architecture
12. Visual modeling
13. Introduction to UML

**Support literature:**
1. Russev S. a kol.:Softvérové inžinierstvo, Ekonóm Bratislava 2006
2. Somerville, I.: Software Engineering, Addison-Wesley, 9. edition, 2011
3. Bieliková M.: Ako úspešne vytvoriť projekt, Slovenská technická univerzita v Bratislave, STU, Bratislava 2000, ISBN 80-227-1329-5
4. Richta, K., Sochor, J.: Softwarové inženýrství I. Praha, ČVUT 1996.

**Syllabus:**

**Language whose command is required to complete the course:**
slovak

**Notes:**

**Assessment of courses**
Total number of evaluated students: 568

| A | B | C | D | E | FX |
|---|---|---|---|---|---|
| 9.33 | 38.73 | 32.04 | 16.73 | 2.46 | 0.7 |

**Lecturer:** doc. Ing. Martin Mišút, CSc., Ing. Igor Bandurič, PhD.

**Date of the latest change:** 01.02.2022

**Approved by:** Person responsible for the delivery, development and quality of the study programme doc. Ing. Andrea Furková, PhD., Person responsible for the delivery, development and quality of the study programme doc. Dr. Ing. Miroslav Hudec, Person responsible for the delivery, development and quality of the study programme prof. Ing. Ivan Brezina, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Martin Mišút,

CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Jaroslav Kultan, PhD.

# DESCRIPTION OF COURSE

**University:** University of Economics in Bratislava

**Faculty:** Faculty of Economic Informatics

| **Course code:** KAI FHI/IIA21520/21 | **Title of course:** Software Engineering II |
|---|---|

**Type, load and method of teaching activities:**
**Form of course:** Lecture / Practical
**Recommended load of course ( number of lessons ):**
**Per week:** 2 / 2 **Per course:** 26 / 26
**Method of study:** present

**Number of credits:** 5

**Recommended semester/trimester of study:** 2.

**Degree of study:** II.

**Prerequisites:**

**Requirements to complete the course:**
40 % assignments: The aim of the assignments is to develop and defend a project on which students work in groups that have a defined team leader. The students choose the leader from among themselves. Students organize group work autonomously and are managed by a team leader. The evaluation of the results of the group's work (submitted project) is evaluated as a whole for the whole group. The evaluation of the contribution of individual members of the group to the evaluation of the group is the result of the group's internal agreement. Part of the evaluation of an individual student is also his activity in opposing and evaluating other groups' projects. The results of the work (project) are submitted by the group for evaluation during the semester three times. The following educational results are evaluated by evaluating projects and evaluating the opposition of the work results of other groups: A., B., D., E., F., H., I., J.
60 % final exam: The final exam consists of two parts: a test and a specific problem to solve. The test verifies the achieved level of educational results A., C., D., E., F., G., the solution of the problem task verifies the achieved level of educational results B., D., E., F.

**Student workload:**
Total study load (in hours): 5 credits x 26 hours = 130 hours
Distribution of study load
Lectures and seminar participation: 52 hours
Preparation for seminars: 13 hours
Written assignments: 45 hours
Final exam preparation: 20 hours

**Teaching results:**
After completing the course, students should be able to:
A. Design software systems using an object-oriented approach
B. Know the basic diagrams of UML and the rules of their creation
C. Distinguish between the basic ideas of modern and classical software engineering methodologies.
D. Use appropriate OO modelling methods and techniques to define, analyze, design, implement, test, and operate software systems.
E. Know and apply the basic principles in designing modern software architecture.
F. Know the principles of software testing and design test scenarios.

G. Understand the importance of the maintenance phase.
H. Understand how the team is working and organized and know how to work as part of a team.
I. Present and defend at a professional level their proposed solutions.
J. Prepare technical documentation (report) describing their proposed solution.

**Indicative content:**
1. Basics of OO principles (object, class, abstractions, encapsulation, inheritance, polymorphism). Modeling, levels of abstraction, Modeling techniques of object-oriented design, Unified Modeling Language (UML), description, classification dg. UML in the stages of software development, Class diagram
2. Class diagram, properties, associations, stereotypes,
3. Analytical model design (analytical classes), Sequence diagram,
4. Objects storage - OR mapping, Activity diagram, Collaboration (Status diagram).
5. Software design, Architecture and architecture design
6. Packages (package diagram), Component diagram. Patterns
7. Transition to the design stage, design classes, user interface design
8. Comparison of individual approaches to analysis and design. Software systems implementation: programming languages, implementation strategies, software product documentation.
9. Software systems testing: static and dynamic testing; testing techniques (white box, black box, program browsing, program verification), testing strategies, The role of validation and verification in software development
10. Operation and maintenance of software systems (reusability, changes in requirements, versioning, reengineering), software system configuration management. Computer aided software development, CASE resources.
11. Introduction to software project management. Basic processes of software project management (initialization, planning, management, execution, termination), economics of software development
12. Economics of software development, formal requirements and creation of contractual relations in software projects.
13. Quality management and measurement in software engineering. Ethics of software development, protection of intellectual property, code of ethics of a software engineer.

**Support literature:**
1. Somerville, I.: Software Engineering, Addison-Wesley, 9. vydanie, 2011.
2. Russev S. a kol.:Softvérové inžinierstvo, Ekonóm Bratislava 2006
3. Fowler, M. 2009. Destilované UML. Grada Publishing a.s., ISBN 9788024720623.
4. Kadlec, V. 2004. Agilní programování: metodiky efektivního vývoje softwaru. Computer Press, ISBN 9788025103425.
5. Kanisová, H. 2006. UML srozumitelně. Computer Press, ISBN 9788025110836.
6. Schach, S.R. 2002. Object-oriented and classical software engineering. McGraw-Hill, ISBN 9780071122634.

**Syllabus:**

**Language whose command is required to complete the course:**
slovak

**Notes:**

**Assessment of courses**
Total number of evaluated students: 491

| A | B | C | D | E | FX |
|---|---|---|---|---|---|
| 5.7 | 25.05 | 39.92 | 21.59 | 6.72 | 1.02 |

| |
|---|
| **Lecturer:** doc. Ing. Martin Mišút, CSc., Ing. Igor Bandurič, PhD. |
| **Date of the latest change:** 01.02.2022 |
| **Approved by:** Person responsible for the delivery, development and quality of the study programme doc. Ing. Andrea Furková, PhD., Person responsible for the delivery, development and quality of the study programme doc. Dr. Ing. Miroslav Hudec, Person responsible for the delivery, development and quality of the study programme prof. Ing. Ivan Brezina, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Martin Mišút, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Jaroslav Kultan, PhD. |

**DESCRIPTION OF COURSE**

| | |
|---|---|
| **University:** University of Economics in Bratislava | |
| **Faculty:** Faculty of Economic Informatics | |
| **Course code:** KAI FHI/IIA21580/21 | **Title of course:** UX Design |
| **Type, load and method of teaching activities:**<br>**Form of course:** Lecture / Practical<br>**Recommended load of course ( number of lessons ):**<br>**Per week:** 0 / 2 **Per course:** 0 / 26<br>**Method of study:** present | |
| **Number of credits:** 4 | |
| **Recommended semester/trimester of study:** 2. | |
| **Degree of study:** II. | |
| **Prerequisites:** | |
| **Requirements to complete the course:**<br>Final exam - written form, 60% (passing the exam means obtaining a minimum of 51% of the exam grade). The exam consists of two parts: verification of theoretical knowledge (test with different types of questions). The theoretical part verifies the level of learning outcomes A,B,D. Verification of practical skills, where the level of learning achievement C,E is verified.<br>Exercises<br>- work in small teams: elaboration and presentation of the seminar topic 20%, work on the final project and its defence 20%<br>Total: 40%<br>The assessment of independent work and the assessment of work in teams develops and assesses the following learning outcomes C, E. | |
| **Student workload:**<br>Total study load (in hours):<br>104 hrs (participation in seminars 26 hrs, preparation for seminars 13 hrs, elaboration of a semester project 52 hrs, preparation for continuous tests 13 hrs) | |
| **Teaching results:**<br>Upon completion of the course, the student should be able to:<br>A. understand the firm, the needs of internal (intra-firm) target groups and external target groups<br>B. know how to search for these needs, name them, set appropriate assignments, and design and create user-friendly products and services, both physical and digital, to meet the needs of the firm derived from the needs of the users.<br>C. define the rules for writing UX<br>D. students will understand the basic principles of UX research and be able to define a research project<br>E. Students will be able to create and test a prototype and deliver a quality assignment to technical specialists. | |
| **Indicative content:**<br>1. Basic principles of UX design;<br>2. Relationship between UX and AI, interdependence between UX and AX,BX,CX;<br>3. Design and implementation of UX research;<br>4. The most common mistakes and shortcomings of UX; | |

5. Advanced UX design
6. Creating low-fidelity wireframe
7. Using psychology in UX design
8. Basics of interaction design
9. Working with design patterns
10. Design of user interfaces
11. Flow Modeling application
12. Using Natural mapping
13. Strategies to improve UX.

**Support literature:**

1. Marsh J.: UX pro začátečníky. Zoner Press, 2019, ISBN 9788074133978
2. Krupa M.: E-Shop od nápadu po úspech, Wolters Kluwer, 2018, ISBN 9788081688621
3. Norman, D. A.(1990) The Design of Everyday Things. New York: Doubleday, 1990.
4. Norman, D. A (2005). Emotional Design. Basic Books. ISBN 0-465-05136-7.
5. Unger, R – Chandler, C. (2012 )A Project Guide to UX Design: For user experience designers in the field or in the making, New Rider, Berkeley
6. Levy, J. (2021) UX Strategy: Product Strategy Techniques for Devising Innovative Digital Solutions, O´Reilly

**Syllabus:**

**Language whose command is required to complete the course:**
slovak

**Notes:**

**Assessment of courses**
Total number of evaluated students: 133

| A | B | C | D | E | FX |
|---|---|---|---|---|---|
| 48.12 | 23.31 | 14.29 | 8.27 | 6.02 | 0.0 |

**Lecturer:** Ing. Mgr. Peter Schmidt, PhD., Ing. Peter Procházka, PhD.

**Date of the latest change:** 01.02.2022

**Approved by:** Person responsible for the delivery, development and quality of the study programme doc. Ing. Andrea Furková, PhD., Person responsible for the delivery, development and quality of the study programme doc. Dr. Ing. Miroslav Hudec, Person responsible for the delivery, development and quality of the study programme prof. Ing. Ivan Brezina, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Martin Mišút, CSc., Person responsible for the delivery, development and quality of the study programme doc. Ing. Jaroslav Kultan, PhD.