Catalogue report

LUT School of Business and Management

Master's Program in Business Analytics

Industrial Engineering and Management (IEM) combines the fields of technology and business management. The goal of the degree programme is to equip students for organisational development and business process management by merging technology and management skills.

The graduates are professional developers of businesses, organisations and processes. Due to the interdisciplinary nature of the degrees in IEM, they are employed by a wide spectrum of industries, research institutions and public administration. As a result, not tied to any specific industry, the success or failure of individual industries does not have a significant impact on the graduates' career prospects.

The graduates have good career prospects, as they are equipped to learn and adapt to different job profiles and industrial contexts.

Degree structures

Learning outcomes:

After completing the degree, the graduate can

• apply data-analysis and machine learning methods in solving industrial and business problems
• use business analytics methods and software in practice
• interpret analysis results and present them visually
• model industrial and business processes and perform simulation analyses to study and to enhance them
• make logical conclusions and recommendations in strategic decision-making situations based on output from decision-support methods
• plan and manage development and projects based on business-analytics
• understand how analytics and information systems can be used to enhance competitiveness of business
• apply new scientific knowledge and methods to develop their competence

Degree structure in Business Analytics 2017-18
Master of Science in Technology 120 ECTS cr, Industrial Engineering and Management

Core studies 19 ECTS cr
Specialisation studies 101 ECTS cr (min.)

Master's Programme in Business Analytics 2017-18

Degree structure status: published

Academic year: 2017-18

Beginning date of the academic year: 01.08.2017

Core Studies 19 ECTS cr (min 19 cp)

If a student has completed some core course during the B.Sc. degree, she/he will be relieved of that course and further, she/he has to choose elective studies to attain min. 120 ECTS cr in M.Sc. degree.

CS38A0010: Free analytics environment R, 6 cp
A210A0601: Information Systems in Corporate Management and Decision-making, 6 cp
A220A0052: Investment and Business Analysis with Excel, 3 cp
BM20A5001: Principles of Technical Computing, 4 cp

Specialisation studies (min 101 cp)

TuDSpecBusAn: Business Analytics Specialisation Studies, 90 - 101 cp
- *Compulsory specialisation studies 90 ECTS cr*
  - BM20A6500: Simulation and System Dynamics, 6 cp
  - CS38A0020: Optimization in business and industry, 6 cp
  - CS38A0040: Marketing analytics, 6 cp
  - CS38A0050: Big data in business and industry, 6 cp
  - A220A0550: Advanced Decision-making, 6 cp
  - A220A0752: Analytics for Business, 6 cp
  - A210A0350: Real Options and Managerial Decision Making, 6 cp
  - BM20A3102: Fuzzy Sets and Fuzzy Logic, 6 cp
  - BM20A3602: Fuzzy Data Analysis, 6 cp
  - BM20A6100: Advanced Data Analysis and Machine Learning, 6 cp
  - CS90A0060: Master's Thesis, 30 cp
- *Elective specialisation studies min. 11 ECTS cr*
  - A220A0000: Financial Econometrics, 6 cp
  - CS30A1391: Systems Engineering, 6 cp
  - BM40A0801: Machine Vision and Digital Image Analysis, 6 cp
  - BM40A0701: Pattern Recognition, 6 cp

Free Elective Studies

If a student is relieved of some core study courses on the basis of the B.Sc. studies, he/she shall choose enough courses to attain the min. of 120 ECTS in the M.Sc. degree.
If the student needs free elective studies it is recommended that he/she selects the courses from the elective specialisation studies list or considers the courses CT60A4303 Tietokantojen perusteet (taught in Finnish) or CT60A7650 Database Systems Management if he/she doesn't have previous experience in data bases.
Free elective studies can be any courses offered by LUT if the required prerequisites are fulfilled.

Courses and study modules not included in degree structures

Course descriptions

Descriptions of courses and study modules included in the degree structures

CS38A0010: Free analytics environment R, 6 cp

Validity: 01.01.2017 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Business and Management
Grading: Study modules 0-5,P/F
Teachers: Jozsef Mezei

Year:
M.Sc. (Tech.) 1
Period:
3
Teaching Language:
English
Teacher(s) in Charge:
Jozsef Mezei, D.Sc., Research Fellow
Aims:
The main goal of the course is to introduce the students to the statistical computing environment R as a tool for business analytics. In the course, students will explore the fundamentals of the R language fundamentals, with the main focus on understanding how to utilize it to perform data analysis. The course will make extensive use of real life datasets to illustrate the various features of R. After the completion of the course, the students: know how to work with data in R; understand the main tasks and applications of data science; create and customize visualization in R; know how to perform descriptive analytics in R; can create functions and implement basic methods; know how to perform predictive analytics using R.
Contents:
Core content: basics of data analysis with R; R as a data analysis environment for business analytics problems; performing descriptive and predictive analytics using R
Additional content: R as a programming environment for data science
Special content: role of visualization in business analytics
Teaching Methods:
Introduction to R completed with online platform studies (10 h). Programming with R for Data Science (50 h).
10 h of computer room tutorials. Reading and practicing additional material 20 h. Course project on performing data analysis 70 hours. Total workload for the student 160 h.
Examination in Examination schedule (Yes/No):
No
Examination in Moodle (Yes/No):
No
Examination in Exam (Yes/No):
No
Assessment:
Finishing online courses (30%), course assignment (70%), grading 0-5.
Course Materials:

The book R Kabacoff, 2011: R in action
Additional material distributed in the course.
Prerequisites:
Basic knowledge of statistics. Only for master's program students.
Limitation for students? (Yes, number, priorities/Leave empty):
Yes. 80, priority to MBAN students (Master's program in business analytics)
Places for exchange-students? (Yes, number/No):
No
Places for Open University Students?(Yes, number/No):
No

A210A0601: Information Systems in Corporate Management and Decision-making, 6 cp

Validity: 01.08.2014 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Business and Management

Grading: Study modules 0-5,P/F

Teachers: Mikael Collan

Year:
M.Sc. (Econ. & Bus. Adm.) 1
Period:
2
Teaching Language:
English
Teacher(s) in Charge:
professor, D.Sc. (Econ. & Bus. Adm.) Mikael Collan
Aims:
The aim of the course is to give extensive general knowledge about corporate information systems and how they are used in corporate decision-making, business control, and as a driver of business development. After the course the students: have an understanding of the corporate information systems stack and the most common types of corporate information systems and where they are used; are able to view a business as a system and its parts as parts of a system; know how information systems can collect, summarize, and analyze corporate information; understand what the practice of fact based management is based on and how it is connected to information systems; know the concept of intelligent systems, know selected methods and tools, understand the types of results that they can provide, and the importance of such results for, for example, making the business more effective through optimization; can identify situations where information systems can be used to develop business practices
Contents:
Core content: corporate information stack, business intelligence
Additional content : controlling in a modern corporation based on IS, intelligent systems in business process development, concepts of optimization, neural networks, simulation, and fuzzy logic
Special content: importance of visualizing knowledge
Teaching Methods:
Lectures 20 h, independent reading assignments (articles) and preparation for lectures 55h. Written exam and preparation for the exam 85 h. Total workload for the student 160 h. Possibly an excursion.
Examination in Examination schedule (Yes/No):
Yes
Examination in Moodle (Yes/No):
Ei
Examination in Exam (Yes/No):
Ei
Assessment:
Grade 0-5, evaluation 0-100 points, written exam 100%.
Course Materials:
Lecture slides Assigned reading, collection of articles.

Prerequisites:
Only for the students accepted for the Master's Degree Programmes.
Limitation for students? (Yes, number, priorities/Leave empty):
Yes. 200, priority for MSF and MBAN students.
Places for exchange-students? (Yes, number/No):
Yes, 30
Places for Open University Students?(Yes, number/No):
This course has 1-5 places for open university students. More information on the web site for open university instructions.
Related to:
to sustainability

A220A0052: Investment and Business Analysis with Excel, 3 cp

Validity: 01.08.2015 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Business and Management

Grading: Study modules 0-5,P/F

Teachers: Azzurra Morreale

Year:
M.Sc. (Econ. & Bus. Adm.) 1
Period:
4
Teaching Language:
English
Teacher(s) in Charge:
Azzurra Morreale
Aims:
The aim of the course is to give the students a general understanding of how spreadsheet software can be used in diverse analyses connected to corporate finance and practical skills to use spreadsheet software to independently create and use analysis tools After the course the students: - Can plan and create simple analysis tools with spreadsheet software and perform analyses related to corporate finance - Know selected in-built tools of spreadsheet software, e.g., for optimization and for statistical analysis and are able to use them - Are able to use classification and ordering capabilities of spreadsheet software to find relevant information from data.
Contents:
Spreadsheet software functionality, planning and constructing spreadsheet tools for analyses relevant to corporate finance. Using selected built-in optimization and statistical tools. Importing data into the spreadsheet from other programs, using reporting graphics.
Teaching Methods:
Lectures and exercises 20 h, reading materials and preparation for the test 25 h, course work 35 h. Total workload for the student 80 h. Moodle is used in this course.
Examination in Examination schedule (Yes/No):
No
Examination in Moodle (Yes/No):
Yes
Examination in Exam (Yes/No):
No
Assessment:
Grade pass-fail, evaluation 0-100 points, exercises 100%
Course Materials:
Lecture materials, assigned reading Beginning Excel What-If Data Analysis Tools: Getting Started with Goal Seek, Data Tables, Scenarios, and Solver, Paul Cornell, 2006, Apress – available as an eBook in the library database.
Limitation for students? (Yes, number, priorities/Leave empty):
Yes, max 100 students
Number of exercise groups where enrollment is in WebOodi (Number/Leave empty):

2
Places for exchange-students? (Yes, number/No):
No

BM20A5001: Principles of Technical Computing, 4 cp

Validity: 01.08.2014 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Engineering Science

Grading: Study modules 0-5,P/F

Teachers: Matylda Jablonska-Sabuka

Year:
B.Sc. (Tech.) 2. M.Sc. (Tech.) 1
Period:
1
Teaching Language:
English
Teacher(s) in Charge:
D.Sc. (Tech.) Matylda Jablonska-Sabuka
Aims:
Students get a good understanding of Matlab syntax and programming, gain fluency in principles of technical computing and are able to apply the skills to basic mathematical and engineering problems (the skills are applicable in big part to Octave and R programming, too).
Contents:
Working with various data structures (multidimensional arrays, cell arrays, etc.) and variable types (numeric, logical, textual, etc.), Matlab symbolic functionality, conditional statements (if-else, switch-case), loops (for and while), using built-in functions, handling external data, 2-D and 3-D plotting, writing user-defined functions, optimization of code speed, style and efficiency.
Teaching Methods:
Lectures 12 h, computer class exercises 24 h, independent study 30 h, preparation for exam 34 h, 1st period. Total 100 h. EXAM-tentti.
Examination in Examination schedule (Yes/No):
No
Examination in Moodle (Yes/No):
No
Examination in Exam (Yes/No):
Yes
Assessment:
0-5, examination 100 %.
Course Materials:
Lecture material available in Moodle, based partly on textbook: Gilat, A.: An Introduction to Matlab with Applications.
Prerequisites:
Basic University Calculus required. Recommended first year university calculus necessarily including matrix calculus.
Places for exchange-students? (Yes, number/No):
Yes, 1-10
Places for Open University Students?(Yes, number/No):
This course has 1-5 places for open university students. More information on the web site for open university instructions.
Related to:
to sustainability

TuDSpecBusAn: Business Analytics Specialisation Studies, 90 - 101 cp

Validity: 01.08.2017 -
Form of study:
Type: Study module
Unit: LUT School of Business and Management
Grading: Study modules 0-5,P/F

No course descriptions.

Compulsory specialisation studies 90 ECTS cr

BM20A6500: Simulation and System Dynamics, 6 cp

Validity: 01.08.2017 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Engineering Science
Grading: Study modules 0-5,P/F
Teachers: Virpi Junttila, Azzurra Morreale

Note:

Suitable also for doctoral studies.
Replaces the course BM20A2000 Simulation 4 ECTS cr.

Year:

M.Sc. (Tech.) 1

Period:

2-3

Teaching Language:

English

Teacher(s) in Charge:

Post-Doctoral Researcher, D.Sc. (Tech.) Virpi Junttila
Post-Doctoral Researcher, Ph.D. Azzurra Morreale

Aims:

The course gives an introduction to the concepts of discrete and continuous simulation models and methods together with numerical examples. After the course, the student is able to create and use different simulation models to solve practical problems. Among the discrete-event based models, the student is able to model basic queuing, server, scheduling and storage size problems. Also, the student is able to create basic operations and model dynamic systems with Simulink and use Simulink to solve different simulation problems.

Contents:

Basic concepts of discrete and continuous systems. Model-based design, basic modeling work-flow, basic simulation work-flow, running the simulations and interpreting the results. Random numbers, discrete event generation by random numbers. Statistical and empirical distributions for event generation. Building numerical simulation examples with Matlab and Simulink. Modeling dynamics systems and simulation models for dynamic systems with Simulink.
Application examples: queuing systems, storage size optimization, profitability analysis, supply chain management, investment analysis

Teaching Methods:

Lectures 21 h, exercises 14 h, homework 21 h, 2nd period. Lectures 21 h, exercises 14 h, homework 21 h, 3rd period. Practical assignment 22 h, preparation for examination and the examination 22 h, 2nd-3rd period. Total 156 h.

Suitability for doctoral studies (Yes/Leave empty):

Yes

Examination in Examination schedule (Yes/No):

Yes

Assessment:

0-5, examination 80 %, homework and practical assignment 20 %.

Prerequisites:

Recommended BM20A1401 Tilastomatematiikka I.

Places for exchange-students? (Yes, number/No):

No

Places for Open University Students?(Yes, number/No):

This course has 1-15 places for open university students. More information on the web site for open university instructions.

CS38A0020: Optimization in business and industry, 6 cp

Validity: 01.08.2017 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Business and Management
Grading: Study modules 0-5,P/F
Teachers: Pasi Luukka, Sirkku Parviainen

Year:

M.Sc. 1.

Period:

4

Teaching Language:

English

Teacher(s) in Charge:

Pasi Luukka, D.Sc. (Tech.), Associate Professor
Sirkku Parviainen, Lic.Phil., Lecturer

Aims:

In the end of the course student is expected to be able to
- formulate mathematical models of various optimization problems
- understand the principles of different optimization algorithms for linear, mixed-integer linear, and nonlinear optimization
- use optimization software

Contents:

Formulation of optimization models. Linear programming and mixed-integer linear programming, nonlinear optimization algorithms.
Solving optimization problems using Matlab Optimization Toolbox. Business and industry oriented practical examples, i.e. factory, warehouse, sales allocation models etc.

Teaching Methods:

Lectures 28 h, exercises 28 h, 4th period. Independent study 74 h, practical assignment 30 h. Written examination. Total work load 160 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, examination 100 %

Course Materials:

Eppen, G.D., Gould, F.J., Schmidt, C.P.: Introductory management science, Prentice-Hall, 1993
Nocedal, J., Wright, S.J.: Numerical optimization, Springer, 2006
Taha, H.A.: Operations Research an introduction, 8th edition, Prentice-Hall, 2007

Prerequisites:

Experience in programming or using mathematical software required.
BM20A4301 Johdatus tekniseen laskentaan or BM20A5001 Principles of Technical Computing

Places for exchange-students? (Yes, number/No):

Yes, 20

Places for Open University Students?(Yes, number/No):

Yes, 10

CS38A0040: Marketing analytics, 6 cp

Validity: 01.08.2017 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Business and Management
Grading: Study modules 0-5,P/F
Teachers: Jozsef Mezei

Year:

M.Sc. (Tech) 1

Period:

4

Teaching Language:

English

Teacher(s) in Charge:

Jozsef Mezei, D.Sc., Research Fellow

Aims:

The aim of the course is to offer extensive knowledge on the use of various analytical techniques in marketing. The students will be introduced to the process of decision support in marketing using analytics in various typical problems. Through several practical examples, the course aims to provide the tools that focus on data understanding and preprocessing, modelling choices and implementation until the interpretation, visualization and utilization of the analysis in various marketing-related problems. The course will provide hands-on lectures to using the various methodologies in the R statistical computing environment, one of the most widely used analytics tools in modern organizations. After the course the students: have an understanding of the process of performing marketing analytics; know how to collect,

understand and preprocess data to be used in marketing problems; know the most important applications and can identify the appropriate tool for a specific problem; are capable of performing marketing analytics using the R statistical environment; understand the role of big data in marketing.

Contents:

Core content: role of data in modern marketing, traditional methods (clustering, forecasting, market-basket analysis), machine learning-based methods in marketing (recommendation systems, advertising on the web)
Additional content: social network analysis, sentiment analysis
Special content: use of the introduced methods in R

Teaching Methods:

Lectures 20 h, computer room tutorials 10 hours, course assignments involving data analysis with R 75h. Written exam and preparation for the exam 55 h. Total workload for the student 160 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

Course assignments (70% of the grade), written examination (30% of the grade), grading 0-5.

Course Materials:

The course will largely be based on the free online book (http://www.mmds.org/)
Leskovec-Rajaraman-Ullman: Mining of Massive Datasets
Additional material will be distributed in the course.

Prerequisites:

The course will use the statistical software R, the LUT "Free analytics environment R" or equivalent background knowledge in R is required. Basic knowledge in statistics.

Limitation for students? (Yes, number, priorities/Leave empty):

Yes. 50, priority to MBAN students (Masters program in business analytics)

Places for exchange-students? (Yes, number/No):

No

Places for Open University Students?(Yes, number/No):

No

CS38A0050: Big data in business and industry, 6 cp

Validity: 01.08.2017 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Business and Management
Grading: Study modules 0-5,P/F
Teachers: Jozsef Mezei

Note:

Lectured first time in academic year 2018-19.

Year:

M.Sc. (Tech.) 2

Period:

1

Teaching Language:

English

Teacher(s) in Charge:

Jozsef Mezei, D.Sc., Research Fellow

Aims:

The course discusses the most important new tools for understanding the potential impact of big data analytics on decision making and business performance. Through analyzing typical business decision problems from the perspective of data requirements, the course discusses the role of big data analytics in modern organizations. After the completion of the course, the students: know the most important technological requirements of performing big data analytics; understand the role of big data in transforming modern organizations through data driven decision making; understand the impact of data volume, variety, and velocity; understand how to create value with big data; become familiar with the techniques and tools for capturing, processing, and interpreting big data; know the most important methods to reduce big data sets by extracting the most important information; are familiar with several real-world scenarios of big data use from different business sectors; understand the role of big data in creating business value; know how to apply the discussed concepts and tools to business projects.

Contents:

Core content: big data technology; data and dimension reduction; role of data driven decision making in modern organizations
Additional content: machine learning methods for big data analytics; network analysis
Special content: text analytics

Teaching Methods:

Lectures 20 h, computer room tutorials 10 hours, course assignments involving big data analysis with R 75 h. Written exam and preparation for the exam 55 h. Total workload for the student 160 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

Course assignments (70% of the grade), written examination (30% of the grade), grading 0-5.

Course Materials:

The following two books cover several topics introduced in the course:
Vignesh Prajapati, 2013: Big Data Analytics with R and Hadoop
Thomas Davenport, 2015: Big Data at Work
Additional material will be distributed in the course.

Prerequisites:

The course will use the statistical software R, the LUT course
Free analytics environment R
or equivalent background knowledge in R is required. Basic knowledge in statistics.

Places for exchange-students? (Yes, number/No):

No

Places for Open University Students?(Yes, number/No):

No

A220A0550: Advanced Decision-making, 6 cp

Validity: 01.08.2014 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Business and Management

Grading: Study modules 0-5,P/F

Teachers: Jan Stoklasa

Year:

M.Sc. (Econ. & Bus. Adm.) 2

Period:

3

Teaching Language:

English

Teacher(s) in Charge:

D.Sc. (Tech.) Jan Stoklasa

Aims:

The students learn principles of some modern methods for multiple criteria decision-making, decision analysis, and about systems for supporting decision-making. Students learn about the history of decision-support and operational research and understand that there is a constant evolution in decision support methods. Students are able to understand the benefits of modern decision-support methods in real world business situations. Students can put some models and analysis methods into use with MATLAB or Excel, where applicable.

Contents:

Core content: This course covers the main topics of multiple criteria decision making under certainty, uncertainty and risk. The topics discussed during the course therefore include: principles of decision making under certainty, uncertainty, risk and ignorance, multiple criteria decision-making (MCDM) and evaluation methods (TOPSIS, AHP), the use evaluations of absolute and relative type, efficiency assessment models (DEA), game theory (non-cooperative games of two players, cooperative games of two players with/without transferable gains, games against nature), validation of decision support systems and models and sensitivity analysis. MATLAB and Excel are used to build the models and solve assignments, to showcase the practical application of the presented methods. Additional content: The history of operational research is summarized. Additionally, fuzzy logic in decision-making is also covered, along with topics such as decision-support systems (DSS), expert systems and optimization. Special content: The course also introduces students to the basics of multiple expert decision-making and reaching consensus, Delphi method.

Teaching Methods:

Lectures and exercises approximately 24 h, reading materials and preparation for the lectures (60 h) & the exam (76 h). Course work, which will reduce the number of hours needed for lecture & test preparation. Total workload for the student 160 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

Grade 0-5, based on a written exam. Bonus points can be awarded for homework assignments (up to 30% of the exam points).

Course Materials:

Lecture materials, Assigned reading and assigned course books MATLAB / Octavia materials available on the mathworks www-site Mengov, G.: Decision Science: A Human-Oriented Perspective, Springer, 2015.

Srinivasan, R.: Strategic Business Decisions - A Quantitative Approach, Springer, 2014. San Cristóbal, J. R.: Multi Criteria Analysis in the Renewable Energy Industry, Springer, 2012.

Prerequisites:

Required: BM20A4301 Johdatus tekniseen laskentaan or BM20A5001 Principles of technical computing
Suggested: Information Systems in Corporate Management and Decision-Making

Places for exchange-students? (Yes, number/No):

No

Places for Open University Students?(Yes, number/No):

No

A220A0752: Analytics for Business, 6 cp

Validity: 01.01.2017 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Business and Management

Grading: Study modules 0-5,P/F

Teachers: Azzurra Morreale

Year:

M.Sc. (Econ. & Bus. Adm.) 1-2

Period:

4

Teaching Language:

English

Teacher(s) in Charge:

Post- doctoral researcher, Azzurra Morreale

Aims:

This course enables to learn a significant understanding of data science: the fundamental concepts and principles that underlie techniques for extracting useful knowledge from data. These concepts underlie the analysis of data-centered business problems, the creation and evaluation of data science solutions, and the evaluation of general data science strategies, and proposals. Through several practical examples, at the end of the course the student will acquire a broad range of techniques and practical skills to independently plan and create analysis tools able to finding anomalies, patterns and correlations within large data sets to predict outcomes. Students will be also able to put some models and analysis methods into use with MATLAB and EXCEL.

Contents:

Core content: Data understanding and data preparation; supervised learning (decision-trees, linear regressions, logistic regression, super vector machine); unsupervised learning (clustering methods)
Additional content: neural networks (self-organizing map)
Special content: Performance measure and overfitting: (Roc curve, area under Roc (Auc), confusion matrix, cross-validation)

Teaching Methods:

Lectures and exercises 35 h, reading materials and preparation for the exam (75 h). Course work (50 h). Total workload for the student 160 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

Yes

Examination in Exam (Yes/No):

No

Assessment:

During the course the will be several single assignments (50%), where the illustrated methods are applied to new data and a group assignment (50%), where in a seminal paper, at the end of the course, the group will work on a real case study.

Course Materials:

Lecture materials, Assigned reading, Course book
Data Science for Business : What you need to know about data mining and data-analytic thinking, by Foster Provost, Tom Fawcett, 2013- available as an eBook in the library database
Moro S., Cortez. P. and Rita P. (2014). A Data-Driven Approach to Predict the Success of Bank Telemarketing. Decision Support System, 22-31.
Collan M., Ekulnd T., Back. (2007). Using the Self-Organizing Map to Visualize and Explore Socio-Economic Development. EBS Review.
Huysmans J, Baesens B, Vanthienen J, van Gestel T (2006). Failure prediction with self organizing maps. Exp Syst Appl 30:479–487

Prerequisites:

Principles of technical computing course (BM20A5001) or the same in Finnish. is required. Only for master degree students.

Places for exchange-students? (Yes, number/No):

Yes

Places for Open University Students?(Yes, number/No):

No

A210A0350: Real Options and Managerial Decision Making, 6 cp

Validity: 01.08.2011 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Business and Management
Grading: Study modules 0-5,P/F
Teachers: Mikael Collan, Azzurra Morreale

Year:

M.Sc. (Econ. & Bus. Adm.) 2

Period:

3 (intensive week 9)

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Econ. & Bus. Adm.) Mikael Collan
Post-doc researcher D.Eng. Azzurra Morreale

Aims:

The aim of the course is to give students know-how about how to use the real options approach as a part of decision making in companies and how to apply real options thinking in valuation and analysis in the presence of uncertainty. After the course the students:
- know the mathematical foundations of real options and the connections between the real options approach and financial theory
- know the research tradition of real options and are able to evaluate the limits of the approach
- understand and analyze the role of uncertainty and risk in decision making

- apply the real options approach in managerial decision situations, where suitable
- know the main model types used in real option valuation

Contents:

Core content: real options vs. financial options, modeling the real options and the limits of modeling, the usability of real options in strategic decision making
Additional content :the use of mathematical tools applied in the real options context
Special content: how to use the real options approach in managerial decision making situations exemplified by means of different real cases, extra curricular project of constructing a simple real option valuation tool with excel or with matlab

Teaching Methods:

Lectures and exercises 18 h, independent reading assignments (articles) and preparation for lectures 46h. Written exam and preparation for the exam 95 h. Total workload for the student 160 h. Extra curricular project.

Suitability for doctoral studies (Yes/Leave empty):

Yes

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

Grade 0-5, evaluation 0-100 points, written exam 100%, possibility to upgrade the grade by one full point by submitting an extra curricular project by the set deadline.

Course Materials:

Collan, M., 2012, The Pay-Off Method: Re-Inventing Investment Analysis – With numerical application examples from different industries, CreateSpace, Charleston, SC, USA (ISBN 978-14-782-3842-3) Lecture slides, Assigned reading, collection of articles. Material will be available in Moodle (except for the course book)

Prerequisites:

For 2nd year master´s program students only

Limitation for students? (Yes, number, priorities/Leave empty):

Yes. 100, priority for MSF and MBAN students.

Places for exchange-students? (Yes, number/No):

Yes, 20.

Further information:

For those who take the course as a doctoral course the extra-curricular task of building a valuation tool is obligatory. In addition they have to do a separate examination of the book:
Amram, M. And Kulatilaka, N., 1999, Real Options: Managing Strategic Investment in an Uncertain World, Harvard Business School Press, Boston, MA, USA

BM20A3102: Fuzzy Sets and Fuzzy Logic, 6 cp

Validity: 01.08.2017 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Engineering Science

Grading: Study modules 0-5,P/F

Teachers: Pasi Luukka

Note:

Suitable also for doctoral studies.
Replaces the course BM20A3101 Fuzzy Sets and Fuzzy Logic 6 ECTS cr.

Year:

M.Sc. (Tech.) 1-2

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Associate Professor, D.Sc. (Tech.) Pasi Luukka

Aims:

In the end of the course student is expected to be able to understand basic mathematical concepts related to fuzzy set theory and fuzzy logic. Able to model uncertain concepts, create fuzzy models, apply and solve them.

Contents:

The course consists of concept of fuzziness, some algebras of fuzzy sets, fuzzy quantities, logical aspects of fuzzy sets, operations of fuzzy sets, fuzzy relations, fuzzy compositional calculus, aggregation operators, possibility theory, fuzzy inference systems, information uncertainty.

Teaching Methods:

Lectures 28 h, exercises 14 h, 1st period. Lectures 28 h, exercises 14 h, 2nd period. Preparation for exam and the exam 70 h. Altogether 154 h from which independent work 70 h.

Suitability for doctoral studies (Yes/Leave empty):

Yes

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, examination 100 %.

Course Materials:

Nguyen, H.T., Walker, E.A.: A First Course in Fuzzy Logic, 2nd Ed., Chapman & Hall/CRC, 2000.
Klir, G., Yuan, B.:Fuzzy Sets and Fuzzy Logic. Theory and Applications, Prentice Hall, 1995.
Fullér, R.: Introduction to Neuro-Fuzzy Systems, Physica-Verlag, 2000.

Prerequisites:

Bachelor level basic math courses.

Places for exchange-students? (Yes, number/No):

No

Places for Open University Students?(Yes, number/No):

This course has 1-15 places for open university students. More information on the web site for open university instructions.

BM20A3602: Fuzzy Data Analysis, 6 cp

Validity: 01.08.2010 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Engineering Science
Grading: Study modules 0-5,P/F
Teachers: Pasi Luukka

Year:

M.Sc. (Tech.) 1-2

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

Associate Professor, D.Sc. (Tech.) Pasi Luukka

Aims:

In the end of the course student is expected to be able to
- understand theoretical aspects of data analysis
- understand the principles of multi-criteria decision making and is capable of applying them
- model and analyze uncertainty in different problem settings
- apply fuzzy principal component analysis, fuzzy clustering and classification methods to data analysis problems

Contents:

Fuzzy sets and relations. Uncertainty measures. Qualitative and quantitative analysis of fuzzy data. Introduction to possibility theory and generalized measure theory. Principles of individual multiperson, multicriteria making, fuzzy interpolation, fuzzy principal component analysis, fuzzy clustering and classification, fuzzy regression analysis. Evaluation of methods.

Teaching Methods:

Lectures 28 h, exercises 28 h 3rd period. Project work, 75 h, 4th period. Preparation for exam and the exam 30 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, examination 100 %. Project work.

Course Materials:

Bandemer, H., Näther, W.: Fuzzy Data Analysis, Kluwer Academic Publ., 1992.

Prerequisites:

Recommended BM20A3101 Fuzzy Sets and Fuzzy Logic

Places for exchange-students? (Yes, number/No):

No

Places for Open University Students?(Yes, number/No):

This course has 1-15 places for open university students. More information on the web site for open university instructions.

BM20A6100: Advanced Data Analysis and Machine Learning, 6 cp

Validity: 01.08.2015 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Engineering Science

Grading: Study modules 0-5,P/F

Teachers: Heikki Haario, Lasse Lensu

Year:

M.Sc. (Tech.) 2

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Professor, Ph.D. Heikki Haario

Aims:

The student can pre-process, visualise and analyse multivariate synthetic and real-world data. The student is able to understand and use state-of-the-art regression methods, graphical models and deep learning. The student can use selected methods to solve a practical assignment, analyse the results and report the findings.

Contents:

Characteristics of data sources, and data pre-processing, dimensionality reduction and outlier detection. Principal component and other advanced regression methods. Graphical models and Bayesian networks. Deep learning and convolutional neural networks. Case-based topics on advanced data analysis by visiting lecturers.

Teaching Methods:

Preparation for lectures 7 h, lectures 14 h, preparation for exercise 21 h, exercises 14 h, 1st period. Preparation for lectures 7 h, lectures 14 h, preparation for exercise 21 h, exercises 14 h, practical assignment 36 h, 2nd period. Self-study 5 h. Exam 3 h. Total amount 156 h.

Assessment:

0-5, exam 50 %, exercises 25 %, practical assignment 25 %.

Course Materials:

Lecture notes in Moodle. Other literature will be announced when the course starts.

Prerequisites:

Recommended: BM20A1901 Statistics II, BM20A2701 Numerical Methods II, BM20A3001 Statistical Analysis in Modelling, BM40A0700 Pattern Recognition or equivalent knowledge.

Places for Open University Students?(Yes, number/No):

This course has 1-15 places for open university students. More information on the web site for open university instructions.

CS90A0060: Master's Thesis, 30 cp

Validity: 01.08.2008 -

Form of study: Basic studies

Type: Master's Thesis

Unit: LUT School of Business and Management

Teachers: Timo Pirttilä

Year:

M.Sc. (Tech.) 2

Period:

1-4

Teaching Language:

Finnish

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Timo Pirttilä
Other teachers: Professors and Associate Professors of Industrial Engineering and Management

Aims:

In their Master’s thesis, students demonstrate their knowledge of a topic of scientific and societal importance in a specific professional area. The student
must demonstrate the ability to carry out the project independently and following a plan. The thesis must be organised coherently, the presentation
academic and the language revised.

Contents:

The Master’s thesis is the final project of the degree of Master of Science (Technology). Usually it involves a development project commissioned by a
company and takes about six months. The work entails working on a development project related to industrial management, preparing a report in the form of a
thesis, and presenting the work in a way that the professor of the major subject requires.
Topic of the master's thesis has to be confirmed as soon as the topic has been decided with the supervisor. Use form 1A in UNI-portal.

Teaching Methods:

Development project and related report, presentation of the work (professor of the major subject defines the way), maturity test (usually on the contents of the thesis).

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0 - 5. Master’s thesis 100 %.

Prerequisites:

B.Sc. (Tech.) degree (not required of students admitted directly into a Master’s programme), complementary studies (for students admitted directly into
a Master’s programme).

Places for exchange-students? (Yes, number/No):

No

Places for Open University Students?(Yes, number/No):

NO

Related to:

to sustainability

Elective specialisation studies min. 11 ECTS cr

A220A0000: Financial Econometrics, 6 cp

Validity: 01.08.2011 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Business and Management
Grading: Study modules 0-5,P/F
Teachers: Jan Stoklasa

Note:

Additional requirements for doctoral students: read Mikosch, T., Kreiß, J., Davis, R. A., & Andersen, T. G. (2009). Handbook of Financial Time Series. Springer eBooks – selected part(s) after consulting with the teacher in charge, term paper will be written by the student on the selected advanced topic.

Year:

M.Sc. (Econ. & Bus. Adm.) 2

Period:

1

Teaching Language:

English

Teacher(s) in Charge:

D.Sc. (Tech.) Jan Stoklasa

Aims:

At the end of this course a student is expected to have a concise overall understanding of the mechanisms behind the econometrics models covered in the course so that he/she:
- Is able to describe the main ideas of the models and methods and assess the appropriateness of their use in specific application cases, incl. the testing of assumptions of the models
- Is capable of formulating the main questions of his/her empirical research in terms of the econometrics models and their parameters
- Is able to select appropriate methods for the given practical application in financial data analysis and construct appropriate econometrics models and assess their quality
- Is able to design econometrics models for financial data prediction (in case of time series)
- Is able to interpret the outputs of the econometrics models in the context of financial data analysis
- Is able to use the methods and their outputs to explain phenomena in financial data and to assess hypothesis concerning financial data
- Is able to utilize the models in financial theory building and assessment as well as in time series analysis and prediction and financial data analysis in general.
- Is able to implement the designed econometrics models in MATLAB using its econometrics package.

The models covered in this course include for example:
Classical linear regression models, univariate time series models, ARMA processes, multivariate time series models, models for simultaneous equations systems, vector autoregressive (VAR) model, ARCH and GARCH-type models.

Contents:

This course deepens students' knowledge on empirical research methods in financial econometrics. The focus is on the empirical techniques used most often in the analysis of financial markets and how they are applied to actual market data.The course is designed to give advanced-level (Master) knowledge of financial econometrics – that is to provide sufficient insight in the financial econometrics models and hypothesis testing and practical experience with building models for financial econometrics in MATLAB. The course covers four different areas in econometrics: 1) univariate and multivariate statistical analyses, 2) time series models, 3) modeling volatility and correlation, 4) modeling long-run relationships in financial markets. The students will use MATLAB econometrics package to run analyses.

Teaching Methods:

Lectures & exercises: 36 h, period 1. Preparation for lectures and exam: 64 h, period 1. home assignments: 60 h, period 1. Total workload: 160 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

Grade 0-5, on the basis the exam (50%) and home assignments (50%). Students are required to achieve 50 percent of the maximum points in both.

Course Materials:

1. Brooks, Chris: Introductory econometrics for finance. Cambridge, 2002 or newer (Text book) 2. Handouts in class and all additional material required by the lecturer 3. MATLAB materials available on the mathworks www-site

Prerequisites:

Required: BM20A4301 Johdatus tekniseen laskentaan or BM20A5001 Principles of technical computing Compulsory bachelor's level courses in finance and economics.

Places for exchange-students? (Yes, number/No):

No

Places for Open University Students?(Yes, number/No):

No

CS30A1391: Systems Engineering, 6 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Business and Management

Grading: Study modules 0-5,P/F

Teachers: Andrzej Kraslawski

Year:

M.Sc. (Tech) 2

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

Professor, Ph.D. Andrzej Kraslawski

Aims:

After fulfilling all of the requirements of the course, the students will be able to: 1. Understand the basic concepts of systems engineering 2. Apply the basic methods of systems analysis 3. Work in a team during systems design.

Contents:

The key topics of the course are: the concept of system, developing system requirements, the index of performance, system development and integration, system modelling, multi-criteria decision-making, ranking the alternatives.

Teaching Methods:

The course is organised as a combination of regular lectures and interactive problem-solving sessions and project work. The classroom problem-solving sessions will be based on team work in groups of 3-5 students. The 2-3 projects will be carried out in groups of 3-4 students independently and will result in the preparation of a project report. Classroom teaching and problem-solving sessions 30 hours. Project work 100 hours. Period 3. in-class activities (lectures, problem solving), period 4. out-of-class activities (project work). Total workload 130 hours.
Lectures, in-class 30 h, period 3. Project work, out-of class, 100 h, period 4.

Suitability for doctoral studies (Yes/Leave empty):

Yes

Doctoral School course where enrollment is in WebOodi (Yes/Leave empty):

Yes

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5. Evaluation: solutions generated in classroom sessions 30%, project reports 40%, written exam 30%. Obligatory presence during 80% of in-class activities.

Course Materials:

Course slides.
Blanchard, B. S., Fabrycky, W. J.,
Systems Engineering and Analysis, Pearson, 2014

Liu Dahai
Systems Engineering, CRC Press, 2016

Alexander I., Beus-Dukic L.
Discovering Requirements, Wiley, 2009

Gibson J., Scherer W., Gibson W.
How to Do Systems Analysis, Wiley, 2007

Martin J.
Systems Engineering Guidebook, CRC, 1996

Prerequisites:

Basic courses on management.

Limitation for students? (Yes, number, priorities/Leave empty):

Yes, 60

Places for exchange-students? (Yes, number/No):

Yes, 30

Places for Open University Students?(Yes, number/No):

This course has 1-5 places for open university students. More information on the web site for open university instructions.

BM40A0801: Machine Vision and Digital Image Analysis, 6 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Engineering Science

Grading: Study modules 0-5,P/F

Teachers: Heikki Kälviäinen

Note:

The course will be lectured every other year, next during the academic year 2017-2018.
Replaces the course BM40A0800 Machine Vision and Digital Image Analysis.
Suitable also for doctoral studies.

Year:

M.Sc. (Tech.) 1-2

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Heikki Kälviäinen

Aims:

After the course a student is expected to be able to explain the fundamental steps of image processing and analysis; to introduce and compare machine vision applications; to plan a solution to a given object recognition problem; and to implement practical solutions for machine vision problems using Matlab or other suitable programming language.

Contents:

Digital image processing: digital image, image transforms, image enhancement, image compression. Image analysis: segmentation, representation and description, recognition and interpretation. Hardware, software and applications.

Teaching Methods:

Lectures and seminars 21 h, exercises 14 h, 3rd period. Lectures and seminars 21 h, exercises 14 h, 4th period. Preparation for the seminar presentations and acting as an opponent, homework, and practical assignment 47 h, self-studying of taught matters and relevant literature and preparation for the exam 36 h, 3rd and 4th period. Exam 3 h. Total amount 156 h.

Suitability for doctoral studies (Yes/Leave empty):

Yes

Doctoral School course where enrollment is in WebOodi (Yes/Leave empty):

Yes

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, exam 50 %, exercises 50 %. Seminar presentation. Acting as an opponent. Practical assignment.

Course Materials:

References and material published on the course web page.

Prerequisites:

Recommended BM40A0701 Pattern Recognition, BM40A0901 Computer Vision, BM40A1201 Digital Imaging and Image Preprocessing, BM40A0501 Johdatus laskennalliseen älykkyyteen

Places for exchange-students? (Yes, number/No):

Yes, 5

Places for Open University Students?(Yes, number/No):

No

BM40A0701: Pattern Recognition, 6 cp

Validity: 01.01.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Engineering Science

Grading: Study modules 0-5,P/F

Teachers: Lasse Lensu

Note:

Suitable also for doctoral studies.

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Lasse Lensu

Aims:

A student can understand a pattern recognition problem, select an appropriate pattern recognition method, and implement a working solution. A student can analyse the performance and quality of a pattern recognition system.

Contents:

Introduction to pattern recognition, supervised and unsupervised learning. Statistical pattern recognition and Bayesian inference. Linear and non-linear classifiers such as artificial neural networks, support vector machines and decision trees. Reinforcement learning and unsupervised pattern recognition.

Teaching Methods:

Lectures 14 h, lecture preparation 7 h, exercises 14 h, exercise preparation 21 h, 1. period. Lectures 14 h, lecture preparation 7 h, exercises 14 h, exercise preparation 21 h, practical assignment 40 h, 2. period. Self-study 4 h. Total amount 156 h.

Suitability for doctoral studies (Yes/Leave empty):

Yes

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

Yes (for remote participants)

Number of mid-term examinations:

0

Assessment:

0 - 5. Homework and exercises 30%, exercise quizzes (or exam) 40%, practical assignment 30%.

Course Materials:

Duda, R.O., Hart, P.E., Stork, D.G.: Pattern Classification, Wiley, 2001. Theodoridis, S., Koutroumbas, K.: Pattern Recognition, Academic Press, 2003.

Prerequisites:

Recommended BM20A4301 Johdatus tekniseen laskentaan, BM20A5001 Principles of Technical Computing, BM20A5800 Funktiot, lineaarialgebra ja vektorit, BM20A5810 Differentiaalilaskenta ja sovellukset, BM20A5820 Integraalilaskenta ja sovellukset, BM20A5840 Usean muuttujan funktiot ja sarjat, CT60A0210 Käytännön ohjelmointi, BM20A1401 Tilastomatematiikka I, BM20A1501 Numeeriset menetelmät I, BM20A1601 Matriisilaskenta, BM40A0501 Johdatus laskennalliseen älykkyyteen, or equivalent knowledge.

Places for exchange-students? (Yes, number/No):

Yes, 5

Places for Open University Students?(Yes, number/No):

This course has 1-5 places for open university students. More information on the web site for open university instructions.

Descriptions of courses and study modules not included in the degree structures

BM20A3101: Fuzzy Sets and Fuzzy Logic, 6 cp

Validity: 01.08.2008 - 31.12.2017
Form of study: Basic studies
Type: Course
Unit: LUT School of Engineering Science
Grading: Study modules 0-5,P/F

No course descriptions.