

## QUANTITATIVE METHODS 30

### 30A00210 Mathematics and Statistics for Managers (6cr)

**Status of the course**

Compulsory course

**Level of the course**

Fundamentals of Business Knowledge

**Objectives**

Learn to understand and use basic mathematical and statistical tools in solving and modeling economic problems. Provide skills for reading literature in economics and management science.

**Content**

Mathematics: basic concepts of functions, vectors, matrices, systems of linear equations, linear programming. Statistics: population and sample, graphical data analysis, descriptive statistics, introduction to regression analysis, random numbers.

**Literature**

Levine, D., Krehbiel, T. and M. Berenson (2002) *Business Statistics: A First Course 3rd ed.*

Jacques, Ian (2003) *Mathematics for economics and business*

**Other course material**

Sydsäter, K. & Hammond, P: *Essential Mathematics for Economic Analysis*, 3rd edition, 2008

**Teacher(s)**

Lecturer Matti Karvonen (Mathematics)

Lecturer Jan-Erik Antipin (Statistics)

**Course format**

1. Lectures in mathematics 21 h, Matti Karvonen and lectures in statistics 21 h, Jan-Erik Antipin.
2. Exercises 12 h in mathematics and 12h in statistics.
3. Additional introductory lectures in mathematics for students who need to improve their skills.
4. The course can be completed by doing the exercises (20% of the final grade) and passing two midterm exams (80% of the final grade), or by passing the final exam.

**Timing**

Fall 2009: statistics in the first period and mathematics in the second period.

**Prerequisite**

High school mathematics

**Teaching and exam language**

English

**Registration**

Via WebOodi.

**Remarks**

Only one of the courses 30A00110 Matematiikkaa ja tilastotiedettä liikkeenjohtajille and 30A00210 Mathematics and statistics for managers can be included in the Bachelor's degree.

**Homepage**

<https://cie.hkkk.fi/30A00210/>

**30A00410 Quantitative Business Analysis (6cr)****Status of the course**

Compulsory course

**Level of the course**

Fundamentals of Business Knowledge

**Objectives**

To improve mathematical and statistical skills for problem solving, and to create theoretical foundations for further studies and understanding economic reference texts. This course is a continuum for Mathematics and Statistics for Managers (30A00210).

**Content**

Mathematics: derivative and partial derivative, integral calculus, foundations of unconstrained optimization and constrained optimization. Statistics: inference based on probability, conditional probability and Bayes formula. Random variable and its distribution, expectation, variance and standard deviation, decision trees, descriptive statistics, confidence intervals and hypothesis testing.

**Literature**

Levine, D., Krehbiel, T. and M. Berenson (2002) *Business Statistics: A First Course 3rd ed.*

Jacques, Ian (2003) *Mathematics for economics and business*

**Other course material**

Simon, C.P. & Blume, L.: *Mathematics for Economists*, W.W. Norton & Co, 1994.

Sydsäter, K. & Hammond, P: *Essential Mathematics for Economic Analysis*, 3rd edition, 2008

**Teacher(s)**

Professor Tuomas Kuosmanen (Mathematics)

Lecturer Jan-Erik Antipin (Statistics)

**Course format**

1. Lectures in mathematics 21 h, N.N. Lectures in statistics 21 h, Jan-Erik Antipin.
2. Fifth or newer edition of Jacques' book may be used.
3. Additional introductory lectures in mathematics for students who need to improve their skills 12h.
4. The course can be completed by doing the exercises (20% of the final grade) and passing two midterm exams (80% of the final grade) or by passing the final exam.

**Timing**

Fall 2009: mathematics in the first and statistics in the second period.

**Prerequisite**

30A00210 Mathematics and statistics for managers

**Teaching and exam language**

English

**Registration**

Via WebOodi.

**Remarks**

Only one of the courses 30A00310 Kvantitatiivinen analyysi taloustieteissä and 30A00410 Quantitative business analysis can be included in the Bachelor's degree.

**Homepage**

<https://cie.hkkk.fi/30A00410/>

**30C00100 Statistical Analysis (6cr)****Status of the course**

BT BSc program, common program studies.

**Level of the course**

Intermediate

**Objectives**

The course will provide students with additional knowledge in statistical theory and techniques.

**Content**

Probability, conditional probability, decision trees, probability distributions, estimation, hypothesis testing. Introduction to multivariate regression analysis, analysis of variance, non-parametric techniques.

**Literature**

Levine, David M. (2006) *Business statistics a first course*

**Teacher(s)**

Lecturer Jan-Otto Malmberg

Lecturer Tapani Lehtonen

**Course format**

1. Lectures 40h, Jan-Otto Malmberg.
2. Exercises 20h, Tapani Lehtonen.
3. The course can be completed by doing the exercises (20% of the final grade) and passing two midterm exams (80% of the final grade) or by passing the final exam.

**Timing**

Spring 2010: first and second period.

**Prerequisite**

Compulsory courses in quantitative methods.

**Teaching and exam language**

English.

**Registration**

Via WebOodi

**Homepage**

<https://cie.hkkk.fi/30C00100/>

**30C00200 Econometrics (6cr)****Status of the course**

BT BSc program, specialization studies.

**Level of the course**

Intermediate

**Objectives**

The main objective of the course is to obtain a basic understanding of the econometric methodology. The course focuses on least squares estimation and related statistical inferences. The assumptions of least squares estimation will be critically examined, and possible ways to alleviate those assumptions are established.

**Content**

Linear regression model and its assumptions, least squares estimation, tests of parameters and linear restrictions, endogeneity and instrumental variables, heteroskedasticity and autocorrelation. Introduction to time series and panel data models.

**Literature**

Dougherty, Christopher. (2007) *Introduction to econometrics / Christopher Dougherty*.

**Other course material**

Dougherty, C. Introduction to econometrics, 3 rd edition 2007

**Teacher(s)**

Professor Timo Kuosmanen

N.N.

**Course format**

1. Lectures 40 h, Timo Kuosmanen
2. Exercises and demonstrations 20 h, N.N.
3. Grading is based on exercises (20%) and the final exam (80%).

**Timing**

First and second periods of spring semester 2010

**Prerequisite**

Compulsory courses in quantitative methods.

**Teaching and exam language**

English.

**Registration**

Via WebOodi

**Homepage**

<https://cie.hkkk.fi/30C00200/>

**30C00300 Mathematical Methods for Economists (6cr)****Status of the course**

BT BSc program, specialization studies.

**Level of the course**

Intermediate

**Objectives**

To improve mathematical skills acquired in the basic courses.

**Content**

The course concentrates on mathematical methods useful in economics and business. The topics covered are matrix algebra, multivariate calculus and integrals, optimization and differential equations. The applications of the course will cover different areas in economics and management, especially finance, business technology and logistics. Computers are used to solve some of the problems.

**Literature**

Simon, Carl P. and Lawrence Blume (1994) *Mathematics for Economists*

**Other course material**

Additional readings: Dowling, E.T.: Introduction to mathematical economics (Schaum's outlines) McGraw-Hill 2001.

Sydsäter, K. & Hammond, P: Essential Mathematics for Economic Analysis, 3rd edition, 2008

**Teacher(s)**

Professor Tomi Seppälä

Lecturer Matti Karvonen

**Course format**

1. Lectures 40h, Tomi Seppälä
2. Exercises 20h, Matti Karvonen
3. The course can be completed by doing exercises (20% of the final grade) and by passing two midterm exams (80% of the final grade) or by passing the final exam.

**Timing**

Spring 2010, first and second periods.

**Prerequisite**

Compulsory courses in quantitative methods.

**Teaching and exam language**

English.

**Registration**

Via WebOodi.

**Homepage**

<https://cie.hkkk.fi/30C00300/>

**30C00400 Tools for Business Decisions 2 (6cr)****Status of the course**

BT Bachelor's program

**Objectives**

The aim is to familiarize students with analysis and decision making tools used in business.

**Content**

Modeling of problems. Non-linear programming methodologies including unconstrained and constrained optimization, quadratic programming, integer programming with examples from portfolio selection, schedul-

ing and inventory control. An introduction to multi-objective optimization and decision-making. Introduction to regression analysis. Monte Carlo simulation with business examples, basic queuing simulation models.

### Literature

Literature: Eppen, G. D., Gould, F. J., Schmidt, C. P., Moore, J. H. and Weatherford, L. R. (1998). *Introductory Management Science*. New Jersey, USA: Prentice-Hall and also

Ragsdale, C. T. (2001). *Spreadsheet Modeling and Decision Analysis*. Cincinnati, USA: South Western College Publishing.

### Literature

Eppen, G. D., Gould, F. J., Schmidt, C. P., Moore, Jeffrey H., Weatherford, Larry R. (1998) *Introductory management science : decision modeling with spreadsheets / G. D. Eppen ... et al. .*

Ragsdale, C. T. (2001) *Spreadsheet Modeling and Decision Analysis*

### Teacher(s)

N.N.

### Course format

40 Lectures and exercises, Grade consists of home assignments (20%) and final exam (80%)

### Timing

Second period of spring term 2010

### Prerequisite

Tools for Business Decisions 1 or Mathematical Methods for Economists

### Teaching and exam language

English

### Registration

Via Weboodi

### Homepage

N/A

## 57C99901 Bachelor's Thesis (10cr)

### Status of the course

B.Sc. (Econ.), Business Technology program.

### Level of the course

Compulsory course.

### Objectives

The objective is to learn and practice independent scientific thinking by setting up research questions and studying a specific topic. Students learn to get to know references, to find literature, and to apply it for resolving a research question. The thesis will be a structured, scientific report.

### Course format

The Bachelor's Thesis is carried out together with the Bachelor's Thesis Seminar (57C99902).

### Timing

Fall 2009, Spring 2010.

**Teaching and exam language**

English.

**Registration**

Register to 57C99902 Bachelor's Thesis Seminar via Weboodi.

**57C99902 Bachelor's Thesis Seminar (2cr)****Status of the course**

B.Sc. (Econ.), Business Technology program.

**Level of the course**

Compulsory course.

**Objectives**

The objective is to learn and practice independent scientific work.

**Content**

In the seminar, students get guidance in their research for Bachelor's Thesis. During the seminar, students will report the progress of their Thesis, present and defence the research results, act as an opponent, and participate actively.

**Teacher(s)**

Professor (act.) Johanna Bragge coordinates.

**Course format**

1. lectures 28 h
2. presentation of the research report
3. acting as an opponent and secretary.

**Timing**

Fall 2009, Spring 2010.

**Teaching and exam language**

English.

**Registration**

via WebOodi.

**Homepage**

<https://cie.hkkk.fi/57C99902/>

**57C99903 Maturity Test (0cr)****Status of the course**

B.Sc. (Econ.), Business Technology program.

**Level of the course**

Compulsory course.

**Objectives**

After finalizing the Bachelor's Thesis, students carry out a proficiency test in Mother Tongue. The objective is to show that a student can write an essay in her or his Mother Tongue and that she or he knows the basic

concepts in her or his Thesis. In general, the test is written in Finnish, but non-Finnish speakers are granted an exemption to write the test in English.

### **30E00150 Applied Optimization: Fundamentals and Methodologies (6cr)**

#### **Status of the course**

Masters and Doctoral program, specialization course.

#### **Level of the course**

Advanced

#### **Objectives**

The aim is to get acquainted with different types of optimization related problems which are encountered in business, engineering and science. Students will get an in-depth knowledge about different applied optimization methodologies popularly used in practice today. Fundamental optimality conditions will be discussed, followed by step-by-step description of the methods. Besides the classical numerical optimization methodologies, a major emphasis will be given in introducing evolutionary optimization methodologies and their scope in solving applied optimization problems. Issues such as constrained handling, multi-objective optimization and decision-making, customization procedures, hybrid methodologies, uncertainty-based optimization, and large-scale optimization will be covered.

#### **Content**

Part A: Optimization Fundamentals: Scope of optimization in business, engineering, and science, Fundamentals of optimization.

Part B: Non-linear programming: Unconstrained and constrained methodologies, structured optimization, such as integer programming and linear programming.

Part C: Evolutionary Optimization: Fundamentals, constrained handling, customization methodologies, multi-objective optimization and decision-making, multi-modal optimization, uncertainty handling leading to robust and reliability-based optimization.

#### **Literature**

Some chapters will be used from the following two texts:

Bazaraa, Sherali and Shetty: Nonlinear programming: Theory and Algorithms

Deb: Multi-objective optimization using Evolutionary Algorithms, Wiley (2001)

A number of research papers will be used and will be supplied in due course of time.

#### **Teacher(s)**

Professor Kalyanmoy Deb

#### **Course format**

Home assignments: Numerical problem solving and assignments

Final written examination

#### **Timing**

Second period of spring term 2010

#### **Prerequisite**

Elementary calculus and linear algebra.

#### **Teaching and exam language**

English.

**Registration**

By Weboodi.

**Homepage**

<https://cie.hkkk.fi/30E00100/>

**30E00400 Simulation (6cr)****Status of the course**

BT MSc program, specialization course.

**Level of the course**

Advanced

**Objectives**

To acquaint the student with the use of simulation methods, with applications to finance, operations management and logistics. To enhance Excel skills in advanced modeling and numerical calculations.

**Content**

Introduction to simulation models, simulation in Excel, random numbers, methods to simulate random events, managerial applications of risk analysis, Wiener process, valuation of stocks and options, system simulation, forecasting, advanced simulation techniques.

**Literature**

1. Evans J.R., Olson D.L.: Introduction to simulation and risk analysis, 2 nd edition, Prentice Hall, 2002.
2. Vose D.: Risk analysis: a quantitative guide, 2 nd edition, Wiley, 2000.

Supplementary readings:

3. Ross, S.: Simulation, 4 th edition. Academic Press, 2006.

**Teacher(s)**

Professor Tomi Seppälä

**Course format**

1. Lectures 40 h, Tomi Seppälä
2. Exercises 20 h, Tomi Seppälä
3. The grade consists of final exam (50%), exercises (20%) and project work (30%).

**Timing**

Fall term 2009, first and second periods.

**Prerequisite**

Basic knowledge in mathematics and statistics assumed. Moreover, basic knowledge in linear algebra and statistical analysis are recommended.

**Teaching and exam language**

English.

**Registration**

Via WebOodi

**Homepage**

<https://cie.hkkk.fi/30E00400/>

**30E00500 Quantitative Empirical Research (6cr)****Status of the course**

This course is intended for doctoral students but also be included in the minor studies of Quantitative Methods.

**Level of the course**

Advanced

**Objectives**

The objective of the course is to enable the students to use quantitative data analysis techniques in business and economic research. The course will provide the students with a set of tools useful in empirical research.

**Content**

Basic concepts, screening data, and visualizing multivariate observations are discussed. Furthermore, the course will define and introduce a set of statistical multivariate methods and explain when their use is appropriate and how they are related to each other. Some of the methods covered are linear regression, logistic regression analysis, principal component analysis, factor analysis, analysis of variance, and cluster analysis. Methodological aspects and interpretation of analysis are also explained. Excel and SAS programs will be used in exercises and demonstrations during the course.

**Literature**

Sharma, Subhash (1996) Applied multivariate techniques

Hair J.H., Tatham R.L., Anderson R.E.A., Black W. (1998) *Multivariate data analysis*

**Other course material**

Other material announced by the lecturers.

**Teacher(s)**

Professor Pekka Korhonen

**Course format**

1. Preliminary assignments
2. Lectures 42h, Professor Pekka Korhonen, exercises 18h, N.N.
3. Grading is based on a final exam (80% of the grade) and exercises (20% of the grade)

**Timing**

Second period of spring term 2010.

**Prerequisite**

Basic knowledge in mathematics and statistics is assumed. Moreover, basic knowledge in linear algebra and statistical analysis are recommended.

**Teaching and exam language**

English.

**Registration**

By Weboodi.

**Homepage**

<https://cie.hkkk.fi/30E00500/>

**30E00700 Advanced Statistical Methods (6cr)****Status of the course**

BT MSc program, specialization course.

**Level of the course**

Advanced

**Objectives**

To expand and deepen the student's knowledge of and ability to use statistical methods with applications in financial time series analysis.

**Content**

Topics in linear models and Time Series analysis: special estimation methods of regression models, ARMA models, forecasting, cointegration, ARCH and GARCH models. The content may change from year to year.

**Literature**

Brooks, C.: Introductory econometrics for finance. Cambridge University Press 2004.

ISBN 0-521-79018-2.

**Literature**

Brooks, Chris. (2002) *Introductory econometrics for finance / Chris Brooks*.

**Other course material**

Additional reading: Verbeek, M.: A Guide to Modern Econometrics. Second Edition, Wiley 2004. ISBN 978-0-470-85773-1.

**Teacher(s)**

Ph.D. Pekka Malo

**Course format**

1. Lectures 40h, Ph.D. Pekka Malo
2. Exercises 20h, Jan-Erik Antipin
3. The grade consists of a final exam (50%), exercises (20%) and a project (30%).

**Timing**

First period of spring term 2010.

**Prerequisite**

Basic knowledge in mathematics, statistics, econometrics and statistical analysis.

**Teaching and exam language**

English.

**Registration**

By Weboodi.

**Homepage**

<https://cie.hkkk.fi/30E00700/>

**57E99901 Master's Thesis (30cr)****Status of the course**

M.Sc.(Econ), Information and Service Management program, compulsory course.

**Level of the course**

Advanced

**Objectives**

The objective is to practice independent scientific thinking by setting up research questions and studying a specific research topic. The thesis will be a structured, scientific report.

**Remarks**

The Master's Thesis needs to be carried out together with the Master's Thesis Seminar (57E99902).

<b>57E99902 Master's Thesis Seminar (0cr)</b>
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**Status of the course**

M.Sc.(Econ), Information and Service Management program, compulsory course.

**Level of the course**

Advanced

**Objectives**

The objective is to practice independent scientific work.

**Content**

In the seminar, students get guidance in their research for Master's Thesis.

**Teacher(s)**

Professor Matti Rossi coordinates.

**Methods**

Seminar

**Timing**

Academic year 2009-2010

**Teaching and exam language**

English

**Registration**

Via WebOodi.

**Homepage**

<https://cie.hkkk.fi/57E99902>

<b>57E99903 Maturity Test (0cr)</b>
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**Status of the course**

M.Sc.(Econ), Information and Service Management program, compulsory course.

**Level of the course**

Advanced

**Objectives**

After finalizing the Master's Thesis, students carry out a proficiency test in Mother Tongue. The objective is to show a student can write an essay in her or his mother tongue and that she or he knows the basic concepts in her or his Thesis.

