



## QUANTITATIVE DECISION MAKING

<b>Course code</b>	<i>FUN118</i>
<b>Course title</b>	<i>Quantitative decision making</i>
<b>Type of course</b>	<i>Main</i>
<b>Study level</b>	<i>First</i>
<b>Department</b>	<i>Undergraduate studies</i>
<b>Year of study</b>	<i>First, second</i>
<b>Semester</b>	<i>Fall</i>
<b>ECTS</b>	<i>6: 12 h of lectures, 24 h of practice, 12 h of homework defense, 114 h of self-studies</i>
<b>Coordinating lectures</b>	<i>Juozas Granskas</i>
<b>Study form</b>	<i>Full-time</i>
<b>Course prerequisites</b>	–
<b>Language of instruction</b>	<i>English</i>

### Summary

This is a practical course dealing with the mathematical models supporting decision making in various fields of social sciences and practical environment, i.e. management, economics, and politics. In particular, what-if analysis, forecasting, optimization, multi-criteria decision making and data analysis are dealt in the course. Computer spreadsheets are used all over the course.

### Objectives

Objectives of the course include:

- To develop structural and algorithmic mindset in dealing with operational issues.
- To develop necessary skills for problem formulation, setting goals and parameters of the problem, choosing relevant model, translating it into the spreadsheet, and justifying alternative solutions of the problem
- To develop skills of data analysis;
- To develop skills of using computer spreadsheets.

<b>Course learning outcomes (CLO)</b>	<b>Learning methods</b>	<b>Assessment methods</b>
CLO1. To be able to develop a mathematical model for relevant problems in economics, finance, business and politics	Lectures, computer lab seminars, textbook analysis, homework assignments	Homework defense, examination, examination retake
CLO2. To be able to select relevant methods for the analysis of mathematical models, to draw quantitatively justified conclusions and to choose the best alternative	Lectures, computer lab seminars, textbook analysis, homework assignments	Homework defense, examination, examination retake
CLO3. To be able to analyze the mathematical model by means of the computer spreadsheet	Lectures, computer lab seminars, textbook analysis, homework assignments	Homework defense, examination, examination retake
CLO4. To be able to analyze big arrays of data by means of the computer spreadsheet	Lectures, computer lab seminars, textbook analysis, homework assignments	Homework defense, examination, examination retake

### Quality assurance

Active and interactive lecturing methods and seminars in the computer lab, class assignments, team homework assignments, feedback to students, students' assessment.

### Cheating prevention

Variety of homework assignments, individual and team homework defense assignments, individual examination problems.

## Topics

Week	Topic	Contact hours		Textbook chapters
		Lectures	Seminars	
1	Problem for Homework No. 1. Developing a model of a problem: example.		2	[2:10–100, 111–128 p.],
	<b>Introduction to the subject. Decision making principles</b>	2		[1: Ch1]
2	Data types and formats. Absolute and relative addresses of the cells. Developing and copying formulas. What-If Analysis tools: Data table, Goal Seek, Scenarios.		2	[2:130–137, 230–232 p.],
	Defense of Homework No.1		2	
3	Problem for Homework No. 2. Building and modifying charts: examples.		2	[2:187–210 p.],
	<b>Graphical models for decision making. Creating good charts.</b>	2		
4	Inventory management model. Column, Pie, Pareto charts. Data analysis tools.		2	[1: Ch6]
	Defense of Homework No.2		2	
5	Problem for Homework No. 3. Regression curves: examples.		2	[2:211–217 p.],
	<b>Regression curves and forecasting. The method of least squares.</b>	2		[1: Ch5]
6	The method of least squares using Solver Add-In. Scatter (XY) chart. Trend line and TREND function.		2	
	Defense of Homework No.3		2	
7	Problem for Homework No. 4. Linear programming problems: examples.		2	[2: 138–154 p.]
	<b>Linear programming models. Stability of the optimal solution. Integer optimal solutions.</b>	2		[1: Ch7]
8	SUMPRODUCT function. Solver Add-In, it's options and available reports.		2	
	Defense of Homework No.4		2	
9	Problem for Homework No. 5. Using Expected Monetary Value (EMV) criterion and decision tree: an example.		2	
	<b>Decision making under uncertainty. Expected monetary value. Expected value of perfect information. Decision trees.</b>	2		[1: Ch3,4]
10	Total probability and Bayes' model as integral part of the decision tree. Copying and correcting formulas by blocks. REPLACE tool.		2	
	Defense of Homework No.5		2	
11	Problem for Homework No. 6. Multi-criteria decision making: examples.		2	[2: 155–188 p.]
	Multi-criteria decision making. Analytical Hierarchy Process.	2		
12	Analytical Hierarchy Process: practical issues.		2	
	Defense of Homework No.6		2	
<b>Total hours:</b>		<b>12</b>	<b>36</b>	

### Individual work and grading

Assignment	Topic	Hours	Weight of the grade, %
Defense of Homework No.1	Developing a model of a problem.	12	10
Defense of Homework No.2	Graphical models for decision making	12	10
Defense of Homework No.3	Regression curves and forecasting.	12	10
Defense of Homework No.4	Linear programming models.	12	10
Defense of Homework No.5	Decision making under uncertainty.	12	10
Defense of Homework No.6	Multi-criteria decision making.	12	10
Final examination		42	40
<b>Total:</b>		<b>114</b>	<b>100%</b>

### Assignments

There are 6 homework assignments (HW) and final examination (E) in the course. Homework is defended in the computer lab by answering questions given by the lecturer on the corresponding topic indicated above and demonstrating What-If analysis skills.

These are drill-in problems to the homework assignment; therefore, you should prepare your homework in advance and use the file containing the worksheet on the computer in the lab. Homework is graded during the seminar in the lab, giving an instant feedback.

Totally, grades for the homework assignments make 60 percent of the final grade; the rest 40 percent are for the final examination. Final examination is closed-book written exam in the lab. Composition of the final grade:

$$\text{Final grade} = 0,1 \times \text{HW}_1 + 0,1 \times \text{HW}_2 + 0,1 \times \text{HW}_3 + 0,1 \times \text{HW}_4 + 0,1 \times \text{HW}_5 + 0,1 \times \text{HW}_6 + 0,4 \times \text{E}$$

In case the final grade is less than five (not passed) and all 6 homework tasks are completed, student is allowed to retake the exam once. The weight of the retake – 40 percent.

### Textbook

1. Render B., Stair R., Hanna M. Quantitative analysis for management. Prentice hall. 2003 (8th ed.) 726 p.

### Supplementary (fits any text on spreadsheets)

2. Vidžiūnas, Antanas. Microsoft Excel 2007: skaičiuoklių taikymas apskaitoje ir vadyboje.
3. A. Vidžiūnas, M. Vidžiūnaitė. Microsoft Excel 2010. Skaičiuoklių taikymas apskaitoje ir vadyboje. – Kaunas: „Smaltijos“ leidykla, 2011. 352 p.