



Национальный исследовательский университет «Высшая школа экономики»
Программа дисциплины «Эконометрика»
для направления 080100.62 подготовки бакалавра

**Санкт-Петербургский филиал федерального государственного
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образования "Национальный исследовательский университет
"Высшая школа экономики"**

Факультет экономики

Программа дисциплины Spreadsheet Modeling in Economics

для направления 080100.62 подготовки бакалавра

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I. COURSE DESCRIPTION

Managerial decisions are increasingly based on quantitative models from the discipline of management science. Management science techniques are widely used in manufacturing, marketing and finance. This course is designed to introduce students to the various ways of modeling decision problems in order to enhance decision-making skills. Fundamental topics of management science are covered including linear programming, integer programming, nonlinear optimization, network optimization, multiple criteria decision-making and applications of probability theory. In addition, some advanced Microsoft Excel functions useful for data management and data processing are studied.

All classes take place in a computer lab, where students learn how to apply quantitative methods to real-life problems related to business analysis and economics using spreadsheets (in particular, Microsoft Excel). The emphasis will be on model formulation and interpretation of results, not on mathematical theory. The emphasis is on models that are widely used in diverse industries and functional areas.

Students are expected to know the basics of working with Excel spreadsheets. These include developing and copying formulas with relative and absolute cell addresses, and using the function and chart wizards. We also expect that students have taken courses in calculus, linear algebra, optimization methods, introductory microeconomics and macroeconomics.

II. LEARNING OUTCOMES

By the end of the course students should be able to:

- Apply advanced techniques and tools to a variety of specialized Operations Research/Management Science questions.
- Develop mathematical models that can be used to improve decision making within an organization.
- Sharpen their ability to structure problems and to perform logical analyses.
- Practice translating descriptions of decision problems into formal models, and investigate those models in an organized fashion.
- Identify settings in which models can be used effectively and apply modeling concepts in practical situations.
- Strengthen their computer skills, focusing on how to use the computer to support decision-making.



The key competencies are listed below:

Competency	Code	Descriptors	Types of activities
Ability to use computer software	ИК-1	Uses MS Excel 2007 without teacher's help for solving economic problems	<ul style="list-style-type: none">Computer labsSelf-study at home
Ability to choose tools for data analysis appropriate for solving a particular problem and justify the obtained results	ПК-5	Justifies the choice of tools for solving a problem, applies and interprets the results of applying the selected tool for data processing	<ul style="list-style-type: none">Computer labsSelf-study at home
Ability to build econometric models based on the description of economic processes and to interpret the obtained results	ПК-6	Estimates an appropriate model based on the verbal description of a problem and makes comprehensive conclusions	<ul style="list-style-type: none">Solving verbal problems that require mathematical formalization
Ability to use modern technical tools to solve analytic and research problems	ПК-10	Applies "Solver" add-in and special statistical and mathematical functions of Microsoft Excel 2007 for economic modeling and the automation of calculations that are common in economics and management science	<ul style="list-style-type: none">Computer labsSelf-study at home

III. COURSE OUTLINE

№	Topic	Class hours	Self-study
1	Linear Programming	4	6
2	Integer Programming	4	6
3	Transportation and workforce scheduling problems	4	6
4	Network optimization	4	6
5	Nonlinear programming	4	6
6	Multiobjective Decision Making: Goal Programming and Analytic Hierarchy Process	4	6



7	Decision making under uncertainty	4	6
8	Markov Analysis	4	8
9	Advanced Microsoft Excel functions	8	18
Total		40	68

1. Linear Programming

Advertising Models. Workforce Scheduling Models. Aggregate Planning Models. Blending Models. Production Process Models. Financial Models. Data Envelopment Analysis (DEA).

2. Integer Programming

Capital Budgeting Models. Fixed-Cost Models. Set-Covering and Location-Assignment Models. Cutting Stock Models.

3. Transportation and workforce scheduling problems

Balanced transportation problem. Unbalanced transportation problem. Workforce scheduling problems.

4. Network optimization

Minimum Cost Network Flow Models. Shortest Path Models. Other Network Models.

5. Nonlinear programming

Pricing Models. Advertising Response and Selection Models. Facility Location Models. Models for Rating Sports Teams. Portfolio Optimization Models. Estimating the Beta of a Stock.

6. Multiobjective Decision Making: Goal Programming and Analytic Hierarchy Process

Goal Programming. The Analytic Hierarchy Process.

7. Decision making under uncertainty

Binomial distribution. Poisson distribution. Exponential distribution. Normal distribution.

8. Markov Analysis

The Characteristics of Markov Analysis. The Transition Matrix. Steady-State Probabilities. Additional Examples of Markov Analysis. Special Types of Transition Matrices. Excel Solution of the Debt Example.

9. Advanced Microsoft Excel functions

Advanced functions for working with tables. Database functions. Text functions.

IV. TYPES OF ACTIVITIES



Every week students have 2 classes (i.e. 160 minutes) in a row dedicated to the course. This gives an opportunity to combine theory and practice effectively.

1. Theoretical background: during the first 80 minutes the lecturer gives theoretical background and shows examples of problems and their solutions with the help of Microsoft Excel using VNC system that allows teachers to share their screen with students.
2. Computer sessions: during the next 80 minutes students work out a problem set that consists of several problems or cases that should be solved using Microsoft Excel. The result of their work is a set of numeric values that can be entered in LMS and an Excel Workbook that can be used to justify their solution if necessary.

V. SAMPLE TASKS

1. A retail chain wants to locate its stores in such a way that they are available to people living in 17 municipal districts, that are the most active shoppers according to statistical data. A store is considered to be close to a municipal district if it is located not further than 1 km from its border. You can choose from 12 potential locations, each of which is situated nearby some of the municipal districts. Which locations should you choose in order minimize the number of chosen locations while covering all 17 municipal districts?

Location	Is the location close to the municipal district? (1 – yes, 0 – no)																
	M ₁	M ₂	M ₃	M ₄	M ₅	M ₆	M ₇	M ₈	M ₉	M ₁₀	M ₁₁	M ₁₂	M ₁₃	M ₁₄	M ₁₅	M ₁₆	M ₁₇
P ₁	0	0	0	1	0	1	0	0	1	0	1	0	0	0	0	0	0
P ₂	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
P ₃	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	1	0
P ₄	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0
P ₅	1	0	0	0	1	0	1	0	0	1	0	0	1	0	0	0	0
P ₆	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1
P ₇	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0
P ₈	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
P ₉	1	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0
P ₁₀	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
P ₁₁	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0
P ₁₂	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0



2. An investor considers buying one of the 3 mid-sized companies. The potential for growth is moderately preferable to the current profitability. The matrices of pairwise comparisons are presented below.

	Profitability		
Company	A	B	C
A	1	1/3	7
B	3	1	9
C	1/7	1/9	1

	Growth potential		
Company	A	B	C
A	1	1/2	1/5
B	2	1	1/3
C	5	3	1

Use AHP (Analytic Hierarchy Process) to choose the best company for investments.

VI. ASSESSMENT

Type of testing	Form of testing	Details	Weight
Classwork	Problem sets	75-min. tests given at classroom every week. Each Problem Set consists of 2-5 problems. Classwork is assessed using the average grade across all 10 problem sets.	50%
Current	Test	Take-home problem set covering topics 1-6	20%
Final test	Final test	75-minutes test covering all topics	30%

All types of testing are implemented using HSE's corporate Learning Management System eFront.

VII. RECOMMENDED READINGS

Books are sorted in the descending order of relevance to the course:



1. Taylor, Bernard W. Introduction to management science 9th ed. – Prentice Hall, 2006.
2. Мур Дж., Уэдерфорд Л. и др. Экономическое моделирование в Microsoft Excel, 6-е изд.: Пер с англ. – М.: «Вильямс», 2004.
3. Chiang A.C, and Wainwright K. Fundamental Methods of Mathematical Economics 4th Ed. - McGraw-Hill, 2005.
4. Cornell. P. Accessing and Analyzing Data with Microsoft Excel. – Microsoft Press, 2003.
5. Lee, S. M., and Clayton, E. R. "A Goal Programming Model for Academic Resource Allocation." Management Science 8, no. 8 (1972): 395408.
6. Saaty, T. The Analytic Hierarchy Process. New York: McGraw-Hill, 1988

VIII. INSTRUCTORS' CONTACTS

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