DOCTORAL (PHD) STUDIES

COURSE UNIT DESCRIPTION

Course unit title	Scientific areas	Faculty	Institute, department
Statistical Modelling and Stochastic Programming	Informatics, 09 P	Mathematics and Informatics faculty	Data Science and Digital Technologies Institute, Operations Research Group

Study method	Number of credits	Study method	Number of credits
Lectures	1	Consultations	1
Individual works	1	Seminars	4

Summary

The course is interdisciplinary, combining data science and informatics methods. It is desirable that a doctoral student choosing this subject would know the basics of probability theory and mathematical statistics, had the skills working with scientific literature and mathematical software (e.g., MATLAB, MathCad, Python).

The main goal of the unit is to provide knowledge about statistical modeling and stochastic programming methods. The course acquaints doctoral students with the theory and applications of modern statistical modeling and computation methods.

Subject topics:

1. Introduction to statistical modeling. Definitions. Models. Methods.
2. Methods of generating random variables.
3. Fundamentals of the Monte Carlo method.
   - 3.1. General scheme of the application of the Monte Carlo method.
   - 3.2. Monte Carlo integration.
   - 3.3. Markov Chain Monte Carlo (MCMC).
   - 3.4. Metropolis-Hastings algorithm.
   - 3.5. Gibbs sampler.
4. Estimation of statistical model parameters.
5. Verification of the modeling. Lemeshko's methodology.
6. Elements of stochastic optimization.
   - 6.1. Linear and nonlinear problems of stochastic programming.
   - 6.2. Applied problems of stochastic linear programming.
   - 6.3. Two-stage stochastic linear programming problems.

Practical tasks:

1. Calculation of the definite integral by the Monte Carlo method.
2. Application of Markov Chain Monte Carlo.
3. Estimation of statistical model parameters.
4. Verification of the adequacy of the modeling.
5. Solution of two-stage stochastic linear programming problem.

The unit consists of 8 lectures, 3 seminars, 3 reports.

Main literature

D. P. Kroese, J. C. C. Chan, Statistical Modeling and Computation, Springer, 2014

J. R. Birge, F. V. Louveaux, Introduction to Stochastic Programming, Springer Verlag, 2011 (2nd ed.)
Further reading
C. P. Robert, G. Casella, Monte Carlo Statistical Methods, Springer New York, 2004 R. Y. Rubinstein, D. P. Kroese, Simulation and the Monte Carlo Method, Wiley, 2007
K. Žilinskas, Stochastinio tiesinio programavimo Monte Karlo metodu tyrimas, Vilnius, 2007

Lecturer(s) (name, surname)	Science degree	Main publications
Igoris Belovas	dr.	http://www.elaba.mb.vu.lt/mif/?aut=Igoris+Belovas
Martynas Sabaliauskas	dr.	http://www.elaba.mb.vu.lt/mif/?aut=Martynas+Sabaliauskas
Aidas Medžiūnas	dr.	http://www.elaba.mb.vu.lt/mif/?aut=Aidas+Medžiūnas