DOCTORAL (PHD) STUDIES
COURSE DESCRIPTION

Course title	Field of science	Faculty	Institute
Finite Population Statistics	Mathematics (N 001)	Faculty of Mathematics and Informatics	Institute of Applied Mathematics, Institute of Data Science and Digital Technologies
Study method	Number of credits	Study method	Number of credits
Lectures	0	Consultations	1
Individual work	4	Seminars	0

Course summary
Sometimes the user needs a parameter value that depends on all the elements of the finite population, but it is not possible to survey each element of the population and calculate the value of the parameter. A subset of the population, called the sample, is then randomly selected for the study. The data of the sample elements are used to estimate the population parameter. The main areas of application of sampling methods are official statistics, market and public opinion research, educology, health care, natural research, etc. Research is being developed to find new, more accurate estimators, as well as estimators for population domains where sample sizes are small. These estimators use additional databases, administrative sources, and big data. Due to the growing need for more detailed and timely information, the number of statistical surveys using sampling methods is increasing. Therefore, to reduce the burden on respondents, administrative data sources are widely used in official statistics to prepare statistical information. Moreover, alternative data sources such as social networking or sensor data are integrated into the estimation. The course introduces the main estimators of the finite population parameters and the methods of estimating their errors. After this course, the doctoral student is able to create new estimators and carry out practical research. **The course covers the following topics:** 1. Design-based estimators of finite population parameters, their variances, and estimation of variances. Simple random, unequal probability, systematic, stratified, cluster, and multistage sampling. 2. Model-assisted estimation: ratio, regression, and calibrated estimators. 3. Application of repeated sampling methods to estimate variances of estimators. Random groups, bootstrap, and jackknife methods. 4. Estimation in domains where sample sizes are small. Indirect estimatation. Synthetic and composite estimators. Linear predictors, their mean square errors, and estimation of mean square errors. Ways to use additional information. 5. Dealing with non-response in surveys.
Main literature
1. Sarndal, C.-E., Swensson, B., Wretman, J. *Model Assisted Survey Sampling*. Springer-Verlag, New York, 1992.
2. Shao, J., Tu, D. *The Jackknife and Bootstrap*. New York: Springer-Verlag, 1995.
3. Valliant, R., Dever, J. A., Kreuter, F. *Practical tools for designing and weighting survey samples*. 2nd edition. New York: Springer, 2013.
4. Rao, J. N. K., Molina, I. *Small Area Estimation*. 2nd edition. John Wiley, New Jersey, 2015.
5. Tillé, Y. *Sampling and estimation from finite populations*. John Wiley & Sons, 2020.

Consulting teacher	Scientific degree	Pedagogical name	Main publications in the field of science of the last 5 year period
Rūta Levulienė	Dr.	Assoc. Prof.	1. Bagdonavičius, Vilijandas; Levulienė, Rūta. Testing proportional hazards for specified covariates // Modern stochastics: theory and applications. Vilnius; Kiev : VTeX. ISSN 2351-6046. eISSN 2351-6054. 2019, vol. 6, no. 2, p. 209-225. (Article in DB Clarivate Analytics Web of Science).

			2. Bagdonavičius, Vilijandas; Levulienė, Rūta. On accelerated life testing when the AFT model fails // IEEE transactions on reliability. Piscataway : IEEE. ISSN 0018-9529. eISSN 1558-1721. 2019, vol. 68, iss. 4, p. 1311-1319. (Article in DB Clarivate Analytics Web of Science) 3. Bagdonavičius, Vilijandas; Hafdi, Mohamed Ali; Levulienė, Rūta. Modeling and analysis of data with confounding covariates and crossing of the hazard functions // Communications in statistics - theory and methods. Philadelphia : Taylor & Francis. ISSN 0361-0926. eISSN 1532-415X. 2021, vol. 50, no. 20, p. [5262-5284]. (Article in DB Clarivate Analytics Web of Science) 4. Markevičiūtė, Jurgita; Bernatavičienė, Jolita; Levulienė, Rūta; Medvedev, Viktor; Treigys, Povilas; Venskus, Julius. Attention-based and time series models for short-term forecasting of COVID-19 spread. CMC-Computers, materials & continua, ISSN 1546-2218. eISSN 1546-2226. 2021, first published online. (Article in DB Clarivate Analytics Web of Science)
Andrius Čiginas	Dr.		1. Černiauskas, N., Čiginas, A. 2020. Measurement and decomposition of Lithuania's income inequality. *Baltic journal of economics*. **20**, 139-169. 2. Čiginas, A. 2020. Adaptive composite estimation in small domains. *Nonlinear analysis: modelling and control*. **25**, 341-357. 3. Čiginas, A. 2020. Linking of sample data to small areas. *Statistica Neerlandica*. **74**, 145-158. 4. Čiginas, A., Pumputis, D. 2020. Calibrated Edgeworth expansions of finite population L-statistics. *Mathematical population studies*. **27**, 59-80. 5. Čiginas, A., Pumputis, D. 2019. Calibrated bootstrap and saddlepoint approximations of finite population L-statistics. *Lithuanian mathematical journal*. **59**, 305-316.

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Board Chairman – assoc. prof. dr. Kristina Lapin