Subject code	ECTS credits
MAT 3010	6

Course title in Lithuanian

MATEMATINĖ STATISTIKA

Course title in English

MATHEMATICAL STATISTIC

Short course annotation in Lithuanian (up to 500 characters)

Šis kursas — įvadas į matematinę statistikos teoriją. Nagrinėjamos temos apima aprašomąją statistiką, empirines charakteristikas ir jų pasiskirstymus, parametrų vertinimą, didelį dėmesį skiriant pakankamoms statistikoms ir didžiausio tikėtinumo įvertiniams, hipotezių tikrinimą, tikėtinumo santykio testus, t testus vienai ir dviem imtims, chi-kvadrat kriterijų ir regresiją.

Short course annotation in English (up to 500 characters)

An introduction to the mathematical theory of statistics. The course content includes basic descriptive statistics, main parametric distributions, empirical characteristics of distribution, estimation, with a focus on properties of sufficient statistics and maximum likelihood estimators, hypothesis testing, with a focus on likelihood ratio tests, one-sample and two-sample statistical inference, chi-square tests and regression.

Prerequisites for entering the course

Mathematical Analysis, Probability Theory.

Course aim

Course aim is to provide understanding of mathematical statistics.

Links between course outcomes, criteria of learning achievement evaluation, study methods and methods of learning achievement assessment

No	Course outcomes	Criteria of learning achievement evaluation	Study methods	Methods of learning achievement assessment
1.	To know propositions and proofs of mathematical statistics.	Knows main propositions of this course and can to proof them.	Lectures, practical works, individual work, consulting.	Final exam, mid-term exam, assessment of practical works.
2.	To estimate parameters of distributions.	Student is able to solve standard computational problems.	Lectures, practical works, individual work, consulting.	Mid-term exam, assessment of practical works.
3.	To find confidence intervals for parameters.	Student is able to solve standard computational problems.	Lectures, practical works, individual work, consulting.	Mid-term exam, assessment of practical works.
4.	To test parametric or nonparametric statistical hypothesis.	Student is able to test standard one-sample or two-sample hypothesis.	Lectures, practical works, individual work, consulting.	Final exam, mid-term exam, assessment of practical works.

Links between study programme outcomes and course outcomes

Study programme outcomes	Running number of course outcome			
	1	2	3	4
Comprehend and be able to apply probabilistic and statistical methods for data analysis	+	+	+	+
Summarize and evaluate critically scientific and professional literature, as well as use various tools for collecting of information	+	+	+	+

for the study process and for solving fixed practical/theoretical problems				
Identify the problem, collect and analyze real/theoretical data using various mathematical methods, tools and IT technologies	+			+
Having good foundations of mathematics, logically and critically recognize and describe relations between quantities of real life and mathematical concepts	+			+
Operating with formal mathematical symbols and terms, determine mathematical connections between various mathematical quantities; conceive mathematical propositions and logical proofs, construct and prove new statements	+	+	+	+
Think logically and analytically, evaluate alternative ways of task solving and implement optimal solutions	+			+

Content

No	Content (topics)
1.	Parametric and non-parametric statistical models.
2.	Populations and samples. Scales of measurement.
3.	Fundamental concepts in statistical inference. Estimates for the mean and variance.
4.	Histogram and nonparametric density estimation. Empirical distribution function.
5.	Likelihood function and minimal sufficient statistics.
6.	Estimation in parametric models. Method of moments, maximum likelihood estimators.
7.	Measures of quality of estimators. The Fisher Information, Cramer–Rao inequality.
8.	Confidence intervals.
9.	Hypothesis testing. The Neyman–Pearson lemma. Likelihood ratio tests.
10.	Parametric hypothesis testing. One-sample t-test and two-sample t-test.
11.	Nonparametric hypothesis testing. Chi-square test for independence.
12.	Simple linear regression. Method of least squares.

Distribution of workload for students (contact and independent work hours)

Lectures	**45**
Practical work	**30**
Individual students work	**85**
Total:	**160**

Structure of cumulative score and value of its constituent parts

Final written exam (50%), mid-term written exam (25%), assessment of practical works (25%).

Recommended reference materials

No	Publication year	Authors of publication and title	Publishing house	Number of copies in		
				University library	*Self study rooms*	*Other libraries*
Basic materials						
1.	2002	Aksomaitis A. Tikimybių teorija ir statistika	Kaunas, Technologija	23	2	
2.	1996	Kubilius J. Tikimybių teorija ir matematinė statistika	Vilnius, Mokslas	10	2	
Supplementary materials						
1.	2007	Bagdonavičius V., Kruopis J. Matematinė statistika	Vilnius, TEV			

2.	2003	Shao J. Mathematical Statistics, 2nd edition	Springer	
3.	2000	Knight K. Mathematical Statistics	Chapman & Hall/CRC	
4.	2012	Kaltenbach H.M. A Concise Guide to Statistics	Springer	

Course programme designed by

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