COURSE UNIT DESCRIPTION - PROBABILITY THEORY AND MATHEMATICAL STATISTICS

Course unit title	Code
PROBABILITY THEORY AND MATHEMATICAL STATISTICS	

Lecturer(s)	Department(s
Coordinator: Jolita IGNATAVIČIŪTĖ **Other(s):**	Faculty of Mathematics and Informatics Department of Computer Science, Naugarduko . 24 str, LT-03225 Vilnius

Cycle	Level of the course unit	Type of the course unit
Full-time studies (1st stage)	1 out of 1	Compulsory

Mode of delivery	Period of delivered	Language(s) of instruction
Face-to-face	3th semester, autumn	Lithuanian

Prerequisites and corequisities	
Prerequisites: Fundamentals of mathematical analysis.	**Corequisities (if any):** None

Number of credits allocated to the course unit	Student's total workload	Contact hours	Self-study and research hours
5	**133**	**64**	**69**

Purpose of the course unit: programme competences to be developed

The course unit aims to develop:

Subject-specific competences:

- mathematical skills related to random events, random variables and its sequences;
- skills of mathematical description and analysis of sequences of random variables and monitoring results.

General competences:

- analytical and critical thinking
- skills for self-development, learning skills in order to study general science resources;
- ability to use computer skills as tools for expression and communication, for accessing information sources, for data and document filling, for presentation tasks, for learning and research.

Learning outcomes of the course unit	Teaching and learning methods	Assessment methods
Explains main concepts related to random events, random variables and mathematical statistics and to use them.	Classical lecture Interactive lecture Practice Individual work Individual reading	Written tests
Formulates and proves main propositions on the distribution of random objects, statistical estimates and hypothesis testing.		
Creates the probabilistic model of experiment and solves typical problems of probability theory.		
Formulates and solves the problems of the parameter estimates for unknown distributions to test the statistical hypothesis.		
Analyses and interprets results, communicates in subject related situations.		

Course content: breakdown of the topics	Contact hours						Self-study work: time and assignments	
	Lectures	Tutorials	Seminars	Practice classes	Assessment	**Contact hours**	**Self-study hours**	**Assignments**
1. Probability	**3**			**3**		**6**	**4**	Individual reading. Problem solving.
Random events. Statistical and classical definitions of probability. Geometric probability.	1			1		**2**	**2**	
Axioms of probability theory. Probability properties. Conditional probability. Independent events.	1			1		**2**	**1**	
Complete probability formula. Bayesian formula. Bernoulli scheme.	1			1		**2**	**1**	
2. Random variable	**4**			**4**		**8**	**6**	Individual reading. Problem solving.
Concept of a random variable. Algebraic and analytic operations with random variables. Discrete and uniform random variables. Distributions of random variables and their properties.	1			2		**3**	**2**	
Multidimensional random variables. Independent random variables. Moments and other numerical characteristics.	2			1		**3**	**2**	
Basic types of distribution functions.	1			1		**2**	**2**	
3. Sequence of random variables	**1**			**1**		**2**	**1**	Individual reading. Problem solving.
Convergence of a sequence of random variables. Large number law.	1			1		**2**	**1**	
4. Descriptive statistics	**4**			**4**		**8**	**8**	Individual reading. Problem solving.
The main problems of mathematical statistics. Empirical characteristics of random variables. Grouping of observation data.	1			1		**2**	**2**	
Characteristics of data aspect.	1			1		**2**	**2**	
Characteristics of data dispersion.	1			1		**2**	**2**	
Characteristics of the form of frequency distributions. Standard values and selections. Graphical representation of observations.	1			1		**2**	**2**	
5. Estimate	**6**			**6**		**12**	**10**	Individual reading. Problem solving.
Eventuality of samples. Statistics. Point estimates. Consistent, unbiased and efficient estimates.	2			1		**3**	**2**	
Estimating by moment and maximum likelihood methods.	2			2		**4**	**4**	
Confidence intervals.	2			3		**5**	**4**	
6. Dependence of random variables.	**6**			**6**		**12**	**14**	Individual reading. Problem solving.
Distribution of a two-dimensional random variable. Conditional distributions of components, conditional expectations.	2			2		**4**	**5**	
Covariation and correlation coefficient.	2			1		**3**	**4**	
Linear, manifold and logistic regression.	2			3		**5**	**5**	
7. Statistical hypothesis	**7**			**7**		**14**	**12**	Individual reading. Problem solving.

Concept of a statistical hypothesis. Statistical criterion, critical region.	1					**1**	**3**	
Statistical inference from a sample.	3			4		**7**	**5**	
Statistical inferences from two samples. Non-parameter tests. Analysis of variance. Regression, cluster, discriminating and factor analysis.	3			3		**6**	**4**	
8. Prediction of the values of a random variable	**1**			**1**		**2**	**1**	Individual reading. Problem solving.
Dynamic series.	1			1		**2**	**1**	
Exam.						**2**		
Total	**32**			**32**		**64**	**69**	

Assessment strategy	**Weight,%**	**Assessment period**	**Assessment criteria**
Tests (written)	30	During semester	There are 12 tests during practice lectures. Each test is assessed by 0,25 points as follows: 0,25 – excellent knowledge and abilities; 0,20 – strong knowledge and abilities; 0,15 – mediocre knowledge and abilities; 0,10 – satisfactory knowledge and abilities; 0,05 – minimal knowledge and abilities; < 0,05 – minimal requirements are not satisfied.
Exam (written)	70	January	Exam consists of theoretical questions and problems. Exam work is assessed by 7 points as follows: 7 – excellent knowledge and abilities; 6 – very good knowledge and abilities; 5 – good knowledge and abilities; 4 – mediocre knowledge and abilities; 3 – satisfactory knowledge and abilities; 2 – minimal knowledge and abilities; 1 – minimal requirements are not satisfied; 0 – minimal requirements are not satisfied.
Total	100		

Author	**Year of publica-tion**	**Title**	**Issue of a periodical or volume of a publication**	**Publishing place and house or web link**
Compulsory reading				
V. Čekanavičius, G. Murauskas	2002, 2004	Statistics and application (in Lithuanian)	I, II	Vilnius, TEV
A. Bakštys	2006	Statistics and probability (in Lithuanian)		Vilnius, TEV
J. Kubilius	1980	Probability theory and mathematical statistics (in Lithuanian)		Vilnius, Mokslas
Optional reading				
F. Mišeikis	1997	Statistics and econometrics (in Lithuanian)		Vilnius, Technika
V. Mackevičius	1998	Integrals and measure (in Lithuanian)		Vilnius, TEV
V. Sakalauskas	1998	Statistics with "Statistics" (in Lithuanian)		Vilnius, Margi raštai