MODULE DESCRIPTION

Module title	Module code
Mathematics for Software Engineering III	

Lecturer(s)	Department where the module is delivered
Coordinator: assoc. prof. dr. Vilius Stakėnas **Other lecturers:**	Department of Mathematical Computer Science, Faculty of Mathematics and Informatics Vilnius University

Cycle	Type of the module
First	Compulsory

Mode of delivery	Semester or period when the module is delivered	Language of instruction
Face-to-face	4th semester	Lithuanian

Prerequisites
Prerequisites: Mathematics for Software Engineering I and II

Number of credits allocated	Student‘s workload	Contact hours	Self-study hours
5	132	70	62

<table>
<tr><th colspan="3">Purpose of the module: programme competences to be developed</th></tr>
<tr><td colspan="3">Purpose of the module – students should be acquainted with the basic knowledge necessary for quantitative analysis of random phenomena. They will learn how to choose a probabilistic model, raise questions of interest, compute and interpret numerical results, make statistical conclusions.

Specific competences:
Knowledge and skills of underlying conceptual basis (SC4).
Technological and methodological knowledge and skills, professional competence (SC6).</td></tr>
<tr><th>Learning outcomes of the module: students will be able to</th><th>Teaching and learning methods</th><th>Assessment methods</th></tr>
<tr><td>Construct the probabilistic model of random phenomena (the probabilistic space): define the algebra of events, probability, compute the probability of events with complex structure, evaluate and interpret the results.</td><td rowspan="4">Lectures, demonstrations of properties and laws of random phenomena using computer programs, analysis of examples, solution of exercises, individual and group consultations, individual reading.</td><td rowspan="4">Written tests (open and close-ended questions).</td></tr>
<tr><td>Understand the concept of random variable, will be able to compute basic numerical characteristics, will be acquainted with the basic types of discrete and continuous random variables, will know how to use them for description of the real phenomena.</td></tr>
<tr><td>Understand the statements of the limit theorems, the methods of proofs, will be able to apply them for approximate calculations.</td></tr>
<tr><td>Formulate correctly the problems of estimating of statistical parameters, testing statistical hypothesis, use the statistical methods and computers to obtain the numerical results, and interpret the results.</td></tr>
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Content: breakdown of the topics	Contact hours							Self-study work: time and assignments	
	Lectures	Tutorials	Seminars	Practice	Laboratory work (LW)	*Tutorial during LW*	**Contact hours**	**Self-study hours**	**Assignments**
1. The discrete probabilistic space.	2			2			**4**	4	
2. The algebra of events, axioms of probability theory and derived properties.	2			2			**4**		
3. Conditional probability and its properties. Independent events.	2			2			**4**	4	
4. Bernoulli trials. Binomial distribution. The Poisson and Moivre-Laplace theorems. Polynomial model.	4	2		4			**10**	4	
5. The discrete random variables: binomial, geometrical, hypergeometrical, Poissonian.	2			4			**6**	6	
6. Continuous random variables: uniform, exponential, normal. The Poisson process.	2			2			**4**	4	An individual set of exercises for work at the class and at home. Individual reading.
7. Independent random variables and vectors.	2			2			**4**	2	
8. Numerical characteristics of the random variables: expectation, variance, moments.	4			6			**10**	6	
9. The limit theorems for independent random variables: the law of large numbers, the central limit theorem.	4	2		2			**8**	4	
10. The problems and concepts of statistics. The descriptive statistics.	2						**2**		
11. The estimators and confidence intervals for the statistical parameters.	2			2			**4**	2	
12. The problems of testing the statistical hypothesis.	4			4			**8**	8	
13. Preparation for the mid-term exam.								8	
14. Preparation for the final exam, exam							**2**	10	10 hours preparation, 2 hours exam
Total	**32**	**4**		**32**			**70**	**62**	**132**

Assessment strategy	**Weight %**	**Deadline**	**Assessment criteria**
Work at the classes, solving homework assignments	50	During the semester	Solutions are estimated and credited with points. The accumulated grade is calculated according to the rule: 5×number of points assigned/maximal number of points.
Mid-term tests in theoretical questions	20	During the semester at a prescribed time at the end of 3 lectures	Answers to the test questions are credited with points. The accumulated grade is calculated according to the rule: 2×number of points assigned/maximal number of points.
The final exam	30 (or 50)	Exam session	Students can decide whether the grade accumulated for mid-term tests will be included into the final grade. If it is included, the weight of the exam question set is 30%, if not – the weight is 50%. The answers are credited with points. The grade is computed according to the rule: number of points assigned/maximal number of point of the question set.

Author	Publishing year	Title	Number or volume	Publisher or URL
Required reading				
V. Stakėnas	2010	Probability theory fundamentals (in Lithuanian)		http://www.mif.vu.lt/katedros/matinf/asm/vs/pask/ttinf/tt_vadovelis.pdf
V. Stakėnas	2010	Probability theory. Lectures slides (in Lithuanian)		http://www.mif.vu.lt/katedros/matinf/asm/vs/pask/ttinf/tttinf.htm
Recommended reading				
J. Kubilius	1996	Probability theory and mathematical statistics (in Lithuanian)		http://www.mif.vu.lt/katedros/ttsk/bylos/ku/files/ttms.html
V. Čekanavičius, G. Murauskas	2001	Statistics and its applications I (in Lithuanian)		Vilnius, TEV