Institute of Applied Mathematics			Spring semester 2025-26-2			
Subject:	Code:	Credit:	Weekly hours			
				lec	sec	lab
Probability theory and mathematical statistics	NMXVS1HMNF	5	Full-time	2	2	0
Responsible for subject: Dr. habil. Csiszár Gábor			Associate professor			
Lecturer: Dr. Baják Szabolcs						
Prerequisites:						
Requirement:	Exam					

Course syllabus	
Course aims:	The aim of the subject is to provide the theoretical foundation for understanding and quantifying uncertainty, enabling students to model and analyze random phenomena and draw reliable conclusions. The course helps the students apply probability distributions and statistical inferences to the analysis or the evaluations of real data. We provide theoretical foundation for various important decision-making methods in several areas of science. Students develop the ability to apply the knowledge acquired during the course and to use probabilistic models in concrete situations, recognizing the appropriate frameworks and analytical tools.
Course contents:	Events and operations on events. Probability. Random variables. Properties of random variables. Laws of large numbers. Central limit theorem. Statistics. Sample, ordered sample. Statistical estimation. Hypothesis testing. Correlation and regression.

Schedule	
Week	Course content
1	Introduction to probability theory. Experiments, elementary events, events, event space. Operations on events.
2	Events and operations on events. Probability. Relative frequency. The axioms of probability. Geometric probability. Conditional probability.

3	Probability. Random variables and their properties. Independence, distribution function, density function. Characteristics of random variables, expectation, standard deviation, moments, other characteristics.
4	Discrete random variables and their properties. Important discrete probability distributions. Binomial, hypergeometric, Poisson, uniform distribution.
5	Continuous random variables and their properties.
6	Continuous random variables and their properties. Important continuous probability distributions. Uniform, exponential, Gamma, normal, lognormal distribution.
7	Laws of large numbers and the Central Limit Theorem.
8	Introduction to statistics.
9	Introduction to statistics. The statistical sample. Ordered samples.
10	Theory of statistical estimation. Properties of estimators. Methods of estimation.
11	Statistical hypothesis testing. Parametric and nonparametric tests.
12	Correlation and regression theory.
Requirements	
Requirements for achieving seminar signature:	Participation in classes and the end-term seminar test on Week 13 is mandatory, not more than 30% of classes can be missed. Students are required to achieve at least sufficient mark (50 %) in the end-term seminar test. In case of a fail or certified absence during the end-term test, students are entitled a retake on Week 14.
End-term test	
Week	Course content
13	End-term seminar test
14	End-term seminar test retake (if needed)
Seminar grade	

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Retake	
Retake for achieving seminar signature:	In the first 10 days of the exam period, there will be an opportunity to achieve seminar signature for those who failed at the end-term and end-term retake. This opportunity is subject to a fee according to university regulations.
Exam	
Written and oral exam (includes both theoretical and practical parts)	
Final grade	
The calculation of the final grade will be based on the results of the end-term seminar test and the exam (50 points for the seminar test and 50 points for the exam).	
Percentages for the final grades:	
0-50% Insufficient; 51-60%: Sufficient; 61-74%: Satisfactory; 75-90%: Good; 91-100%: Excellent	
Literature	
Mandatory:	Lectures and seminar notes (on Moodle).
Recommended:	D. C. Montgomery – G. C. Runger: Applied statistics and probability for engineers. Wiley, 2018.
Other material:	In the Moodle course.