RTU Course "Probability Theory and Mathematical Statistics"

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General data

Code	DMS212
Course title	Probability Theory and Mathematical Statistics
Course status in the programme	Compulsory/Courses of Limited Choice
Course level	Undergraduate Studies
Course type	Academic
Field of study	Mathematics and Statistics
Responsible instructor	Oksana Pavļenko
Academic staff	Kārlis Šadurskis Andrejs Matvejevs Nataļja Budkina Aija Pola Māris Buiķis Marija Dobkeviča Daina Pūre Vaira Buža Jolanta Goldšteine Jeļena Mihailova
Volume of the course: parts and credits points	1 part, 2.0 Credit Points, 3.0 ECTS credits
Language of instruction	LV, EN
Annotation	Classical definition of probability. Axiomatic definition of probability. Algebra of events. Bernully's scheme. Formulas of complete probability and Baijes. Continuous and discrete random variable. Distributive and density of functions. Large numbers law. Central limit theoreme. Elements of mathematical statistics. Combinatoric. Test of hypothesis.
Goals and objectives of the course in terms of competences and skills	The objective of the course is to acquaint students with basics of probability theory and its mathematical apparatus both on the classical scheme level, and also on axiomatic level. Allow to understand the regularities of the random phenomena that occur mass-repeating. Giving an overview of mathematical statistics mission and the possibility of using probability theory apparatus to solve them.
Structure and tasks of independent studies	The course provides an independent homework performance for each topic considered in practical work.
Recommended literature	1. O.Krastiņš. Varbūtību teorija un matemātiskā statistika. R:Zvaigzne,1985. 2. M.Buiķis,J.Carkovs,B.Siliņa. Varbūtību teorija un matemātiskās statistikas elementi.-Zvaigzne, 1996. 3. E.Vasermanis, D.Šķiltere Varbūtību teorija un matemātiskā statistika. "Izglītības soļi", Rīga, 2003. 4. J.Smotrovs. Varbūtību teorija un matemātiskā statistika I. R:Zvaigzne ABC,2004. 5. J.Smotrovs. Varbūtību teorija un matemātiskā statistika II. R:Zvaigzne ABC,2007. 6. I.Arhipova, S.Bāliņa Statistika ekonomikā un biznesā. Datorzinību centrs, 2006. 7. M.Baron. Probability and Statistics for Computer Scientists. CRC Press, 2014. 8. O.Pavļenko, K.Šadurskis. Varbūtību teorija un matemātiskā statistika. Lekciju konspekts. RTU, 2011. 9. O.Pavļenko, K.Šadurskis. Varbūtību teorija un matemātiskā statistika. Praktiskie darbi. RTU, 2011.
Course prerequisites	Linear algebra and analytic geometry, calculus.

Course outline

Theme	Hours
Sample space, events, algebra of events. Classical definition of probability, Geometric probability, probability axioms.	2
Practical class. Operations with events. Combinatorics. Classical scheme.	2
Conditional probability, total probability and Bayes' formula. Bernoulli scheme, limit theorems for Bernoulli scheme.	2
Practical class. Conditional probability, total probability and Bayes' formula. Bernoulli scheme.	2
Discrete random variables. Distribution law of discrete random variable, expectation, variance, their properties.	2
Practical class. Test. Random events.	2
Special distributions of discrete random variables.	2
Practical class. Construction of distribution law for discrete random variable. Expected value, variance, functions of discrete random variables.	2
Continuous random variables. Cumulative distribution function, probability density function. Covariance, correlation coefficient. Expected value, variance, skewness, kurtosis.	2
Practical class. Distribution and probability density function. Expected value, variance, standard dviation, moments, skewness, kurtosis.	2
Important continuous distributions. The law of large numbers. Central limit theorem.	2
Practical class. Test. Random variables.	2

Elements and principal problems of mathematical statistics. Data visualisation. Statistical estimates. Confidence intervals.	2
Practical class. Graphical representation of distributions. Statistical estimates. Problems about confidence intervals ofexpected value and variance.	2
Hypoteses testing. Correlation. Linear regression. Least squares.	2
Practical class. Hypoteses testing about expected value and variance. Analysis of correlation. Linear regression and forecasting.	2

Learning outcomes and assessment

Learning outcomes	Assessment methods
Calculation of probabilities for random events. Application of probability axioms, classical definition, conditional probability, total probability and Bayes' and Bernoulli formulae.	Problems included in test 1 and in the exam
Random variables. Application of major facts on probability distributions (discrete and continuous), distribution function, density, numeric characteristics.	Problems included in test 2 and in the exam
Elements of mathematical statistics. Application of statistical estimates and confidence intervals, hypotheses testing. Linear regression.	Problems included in the exam

Study subject structure

Part	CP	Hours per Week			Tests		
		Lectures	Practical	Lab.	Test	Exam	Work
1.	2.0	1.0	1.0	0.0		*	