M098	Obligatory Semester 3	**Introduction to Probability and Statistics**	L	S	E	ECTS
			2	0	2	6

Course objectives. To introduce students to basic concepts of probability theory and statistics. The focus is put on introducing the basic concepts, their interpretation, adoption and understanding of their basic properties, gaining basic techniques and methods and their application.

Course prerequisites. Differential Calculus, Integral Calculus

Syllabus.

1. Basic concepts of the probability theory (sample space, probability as a ratio, the frequency interpretation of probability, other examples of probability, the properties of probability, finite probability space, conditional probability and independence, law of total probability, Bayes' formula).
2. Random variables (discrete and continuous random variables, distribution of discrete random variable, distribution function of random variable, mathematical expectation (expected value) of random variable and its properties, other numerical characteristics of random variable and their applications (Markov's inequality, Chebyshev's inequality), the interpretation of numerical characteristics of a random variable).
3. Parametric families of random variables (Bernoulli, binomial, (Moivre-Laplace theorem - application, Poisson approximation - application), Poisson, geometric, normal, uniform, exponential).
4. Random vectors (two-dimensional discrete random vector, covariance and correlation, dependence and conditional distributions, independence of random variables, two-dimensional normal random vector, independent normal random variables, chi-square distribution, Student's t-distribution). Weak law of large numbers, central limit theorem.
5. Descriptive statistics (data types, tabular and graphical data display, measures of central tendency, measures of dispersion, two-dimensional data, scatter diagram (scatterplot), the method of least squares, regression line).
6. Basic concepts of statistical inference (population and random sample, statistics, statistical model of a random sample from the Bernoulli population, the statistical model of random sample from normal population, simple linear regression, estimation of parameters in these models, confidence intervals for the parameters in these models, testing the hypothesis on parameter values in these models).

LEARNING OUTCOMES

No.	LEARNING OUTCOMES
1.	Distinguish between deterministic and random experiment.
2.	Accurately use probability, conditional probability, random variable and random vector and their properties in the application.
3.	Calculate and interpret numerical characteristics of random variables and random vectors.

4.	Distinguish between dependent and independent random variables in the classical examples.
5.	Identify the conditions for the application of typical distribution in specific problems.
6.	Identify the conditions for the application of weak law of large numbers and central limit theorem.
7.	Prepare the data for statistical analysis.
8.	Apply simple statistical models for statistical inference.
9.	Carry out a mathematical proof of soundness of the procedures and formulas used in this course.

COUPLING OF THE EXPECTED LEARNING OUTCOMES, TEACHING PROCESS ORGANIZATION AND THE EVALUATION OF THE TEACHING OUTCOMES

TEACHING PROCESS ORGANIZATION	ECTS	LEARNING OUTCOMES **	STUDENT ACTIVITY *	EVALUATION METHOD	SCORE	
					min	max
Attending lectures	1	1-9	Attending lectures, discussions, teamwork and individual work on problems	Participant lists, monitoring activities	0	5
Homework	1	1-9	Solving problems independently	Checking the correctness of the results (grading)	0	15
Mid-term exam	2	1-9	Preparation for the exam	Checking correctness of answers (grading)	20	40
Final exam	2	1-9	Preparation for the exam	Oral exam	30	40
TOTAL	6				50	100

Teaching methods and student assessment.
Attending lectures and exercises is required. Exercises related to the descriptive statistics and basic statistical inference are performed using statistical software (e.g. Statistica, S+). Students' knowledge is continuously checked throughout the semester by means of mid-term exams and homework. After the completion of lectures and exercises students take the exam in written and oral form.

Can the course be taught in English: Yes

Basic literature:

1. M. Benšić, N. Šuvak*, Uvod u vjerojatnost i statistiku*, Odjel za matematiku, Sveučilište u Osijeku, 2014.
2. M. Benšić, N. Šuvak*, Primijenjena statistika*, Odjel za matematiku, Sveučilište u Osijeku, 2013.

Recommended literature:

1. L. E. Bain, M. Engelhardt, *Introduction to Probability and Mathematical Statistics*, BROOKS/COLE Cengage Learning, 2008.
2. N. Elezović, *Diskretna vjerojatnost*, Element, Zagreb, 2007.
3. N. Elezović, *Slučajne varijable*, Element, Zagreb, 2007.
4. N. Elezović, *Statistika i procesi*, Element, Zagreb, 2007.
5. N. Sarapa, *Teorija vjerojatnosti*, Školska knjiga, Zagreb, 2002.