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PROBABILITY THEORY and MATHEMATICAL STATISTICS

(title of the course in English)

Author	Dr.phys. Jesús Alberto Cázares Montes after Mg. Math. Jelena Mihailova's program
LAIS course code	DatZ1021
Form of evaluation	3 Tests. Homework
Academic credit points (ECTS credit points)	3 ECTS
The total number of contact lessons	16
The number of lectures	8
The number of practical classes	8
Prerequisites	School course of mathematics Mathematical analysis I
Part of the study programme	General education study courses

Study course objective

The course objective is to acquire the main concepts, methods and results from probability theory and mathematical statistics and to learn to use them to solve practical tasks.

Study results

After this course, the student will be able to:
- calculate the probability of diferent kind of events.
- know the most important probability distributions of random variables.
- understand the basics of sampling and processing of statistical data.
- understand the regression analysis.

Organization mode of students' individual work

Regular course of study substances learning through lecture materials, textbooks, internet resourses. Regular homework performance. Weekly teacher consultations. Students work in groups. Preparing for the exam.

Evaluation of study results

Course assessment consists of two parts:
Homework (25%)
Three exams (25% each one) according to the main topics of the course.

Study course outline

No.	Title of the topic
1.	**Elements of Probability:** Sets and Functions. Classical definition of probability. Inclusion-Exclusion principle. Conditional probability. Independent events. Bayes formula. Counting and binomial coefficients.
2.	**Random Variables and Expectation:** Random variables. Distribution and Density functions of a random variable. Joinly distributed dandom variables. Independent random variables. Expected value. Variance. Moment generationg functions. Chebyshev's inequality and the weak law of large numbers. Bernoulli and binomial random variables. Binomial distribution function. Poisson random varialbe and Poisson distribution function. Hypergeometric random variable. Uniform random variable. Normal random variable. Exponential random variable. t-distribution. F-distribution.
3.	**Mathematical Statistics:** *Descriptive Statistics:* Sample mean, sample median, sample mode, sample variance, sample standard deviation. Chebyshev's inequality. Paired data sets and the sample correlation coefficient. *Distributions of Sampling Statistics:* Central limit theorem. Sample variance. Sampling distributions from a normal population. Sampling from a finite population.
4.	**Regression:** Estimators. Correlation coefficient. Linear regression equation.

Study course schedule

No. of the class (by week)	Title of the topic	Type of class (lectures, seminars, practical classes, laboratory work), amount of academic hours
1.	**Elements of Probability:** Set and functions.	Lecture and practical class
2.	Classical definition of probability. Inclusion-Exclusion principle.	Lecture and practical class
3.	Conditional probability. Independent events. Bayes formula.	Lecture and practical class
4.	Counting and binomial coefficients.	Lecture and practical class

No. of the class (by week)	Title of the topic	Type of class (lectures, seminars, practical classes, laboratory work), amount of academic hours
5.	**Random Variables and Expectation:** Random variables. Distribution and density functions of a random variable. Jointly distributed random variables. Independent random variables.	Lecture and practical class
6.	Test for weeks 1-4	**Test**
7.	Expected value. Variance.	Lecture and practical class
8.	Moment generation functions. Chebyshev's inequality and the weak law of large numbers.	Lecture and practical class
9.	Bernoulli and binomial random variables. Binomial distribution function. Poisson random variable and Poisson distribution function.	Lecture and practical class
10.	Hypergeometric random variable. Uniform random variable. Normal random variable.	Lecture and practical class
11.	Exponential random variable. t-distribution. F-distribution.	Lecture and practical class
12.	**Mathematical Statistics** – *Descriptive Statistics:* Mean, median, mode, variance and standard deviation for a sample. Chebyshev's inequality. Paired data sets and the sample correlation coefficient.	Lecture and practical class
13.	Test for weeks 5-11	**Test**
14.	*– Distributions of Sampling Statisics:* Central limit theorem. Sample variance. Sampling distributions from a normal population. Sampling from a finite population.	Lecture and practical class
15.	**Regression:** Estimators. Correlation coefficient. Linear regression equation.	Lecture and practical class
16.	Test for weeks 12-15	**Test**

Basic literature

S.M. Ross "Introduction to Probability and Staticstics for Engineer and Scientists" Academic Press.

R.V. Hogg & A.T. Craig “Introduction to Mathematical Statistics” Macmillan.

A.M. Mood, F.A. Graybill & D.C. Boes “Introduction to the Theory of Statistics” McGraw-Hill.

Supplementary literature

M.R. Spiegel & L.J. Stephens “Theory and Problems of Statistics” (Schaum’s). McGraw-Hill.

M. Mitzenmacher & E. Upfal “Probability and Computing: Randomized Algorithms and Probabilistic Analysis” Cambridge University Press.

Other source of information

https://www.khanacademy.org/math/ap-statistics