



Course Description – PROBABILITY THEORY AND ELEMENTS OF MATHEMATICAL STATISTICS

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1 Introduction

The document provides a description of a training course on probability theory and mathematical statistics.

2 Overview

The course includes practical tasks on probability theory and mathematical statistics. The course of probability theory and elements of mathematical statistics is based on the knowledge and practical skills obtained by students in secondary school and during Basic Course 1 and Basic Course 2. The issues addressed are the basis for exploring the subsequent sections of the course.

3 Course objectives

By the end of the semester students should be able to understand:

- the main concepts of probability theory
- the main concepts of mathematical statistics
- evaluation of probabilities
- using of some remarkable distributions
- testing statistic hypotheses
- using of elements of correlation theory

4 Course duration

120 hours:

Lectures – 32 hours

Practical classes – 32 hours

Independent work – 56 hours

5 Prerequisites

Knowledge of secondary school, Basic Course 1 and Basic Course 2 of mathematics is required.

6 Teaching and learning methods

The course is organized as a combination of lectures, practical tasks (problem solving), individual work of a student.

	Topics	Lecture(in-class hours)	Practice(in-class hours)
1.	Event and probability. Main rules of evaluating probabilities	6	6
2.	Random variables. The distribution function and density. Number characteristics of random variables	8	8
3.	Some remarkable distributions	4	4
4.	Elements of mathematical statistics	10	10
5.	Elements of correlation theory	4	4
Total hours		32	32

7 Course content

Lecture 1-3.Event and probability. Main rules of evaluating probabilities

Trial and event. Elements of combinatorics. Classic definition of probability. Statistic definition of probability. Sum and product of events. Axioms of probability theory. Corollaries. Formulae of total probability and Bayes.

Lecture 4-7.Random variables. The distribution function and density.

Number characteristics of random variables

A random variable. Bernoulli [binomial] distribution. Poisson formula and distribution. Laplace local and integral theorems. The distribution function of a random variable. The distribution density of a random variable. The mathematical expectation of a random variable. The dispersion

and root-mean-square deviation. Moments of a random variable.

Lecture 8-9. Some remarkable distributions

The uniform distribution. The normal distribution. The exponential distribution. Bernoulli [binomial] distribution. Poisson formula and distribution.

Lecture 10-14. Elements of mathematical statistics

General remarks. Sampling method. Variation series. Approximate determination of the distribution law of a random variable. Estimation of parameters of the distribution law of a random variable. Testing statistic hypotheses.

Lecture 15-16. Elements of correlation theory

The regression function. The regression equation. Correlation dependence. Functional dependence. The form of correlation dependence. The closeness of relation between random variables. The correlation coefficient. The correlation table.

8 Method of evaluation

Evaluation Item	The Number of Times	Evaluation Proportion	Remarks
attendance		20%	80% of the classes
midterm exam			
final exam	1	30%	
final report			
homework		20%	
test	2	30%	

Basic Grading Scale

$\geq 90\%$: 9
 $\geq 80\%$: 8, 7
 $\geq 60\%$: 6, 5
 $\geq 50\%$: 4
 $< 50\%$: 1 – 3

References

1. Davar Khoshnevisan, Firas Rassoul-Agha Math 5010. Introduction to Probability. – 2012.
2. J.F. Kosolapov Probability theory and mathematical statistics. – 2008.