COURSE DESCRIPTION CARD - SYLLABUS

Course name
Probability and Statistics in Business [S1DSwB1>PiSwB]

Course

Field of study
Data Science in Business

Year/Semester
2/3

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
0

Laboratory classes
0

Other
0

Tutorials
60

Projects/seminars
0

Number of credit points

5,00

Coordinators

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Lecturers

Prerequisites

The student should have the following skills and knowledge: - Basic knowledge of mathematical analysis - operations on real numbers, fundamentals of functions, derivatives, and integrals; - Fundamental concepts of logic and discrete mathematics - propositional calculus, set operations, principles of combinatorics (permutations, combinations, variations); - Knowledge of matrix calculus - matrix operations, determinants, systems of linear equations; - Proficiency in using spreadsheets.

Course objective

The aim of the course is to introduce students to the fundamental concepts of probability and statistics and their practical applications in business data analysis and decision-making. Students will learn to model uncertainty using probability spaces, analyze random variables, and apply probability distributions to real-world business problems. The course will cover estimation methods, hypothesis testing, regression analysis, and time series analysis, enabling students to interpret data and draw statistical conclusions. Special emphasis will be placed on the applications of probability theory in market analysis, trend forecasting, and decision- making under uncertainty. The course will equip students with practical skills in data analysis, statistical result interpretation, and the use of probabilistic methods in business process optimization.

Course-related learning outcomes

Knowledge:
1. Defines basic concepts of probability theory and statistics, including probability spaces, random variables, and their distributions [DSB1_W01].
2. Characterizes estimation methods and statistical hypothesis testing, as well as their applications in business data analysis [DSB1_W02].
3. Describes regression analysis techniques, time series analysis, and Bayesian statistics in the context of trend forecasting and business decision-making [DSB1_W03].

Skills:
1. Calculates probabilities of events and analyzes the properties of random variables and their distributions [DSB1_U02].
2. Selects appropriate methods for estimation and statistical hypothesis testing, and interprets the obtained results in the context of business data analysis [DSB1_U05].
3. Applies regression analysis and time series techniques to model and forecast market trends [DSB1_U09].
4. Analyzes data using Bayesian statistics and evaluates uncertainty and risk in decision-making processes [DSB1_U07].
5. Visualizes data and results of statistical analyses using tools for data presentation and reporting [DSB1_U04].

Social competences:
1. Formulates well-founded conclusions based on probabilistic and statistical analyses, considering the limitations arising from data and methods [DSB1_K01].
2. Integrates statistical and probabilistic methods in interdisciplinary analytical teams, supporting data-driven decision-making [DSB1_K02].
3. Takes responsibility for the correctness of statistical analyses and their interpretation, preventing erroneous conclusions in business [DSB1_K05].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Two midterm exams, each graded on a 50-point scale. The final grade is determined by the total score from both exams. The first exam takes place in the middle of the course, while the second one is held at the end. The passing threshold is 50 points in total from both exams.

Programme content

The course covers fundamental concepts of probability and statistics and their applications in business data analysis. It includes probability spaces, classical probability definitions, random variables and their distributions, as well as estimation methods and statistical hypothesis testing.
Students will become familiar with regression analysis techniques, time series analysis, and Bayesian statistics, which are used in business decision-making and market trend forecasting. Special emphasis will be placed on the practical application of statistical tools in data analysis and result visualization.

Course topics

Probability space and classical definitions of probability
Conditional probability, total probability, and event independence
Bayes' theorem and its applications in business
Discrete and continuous random variables
Probability distributions (Bernoulli, Poisson, normal, exponential)
Expected value, variance, and standard deviation
Central limit theorem
Business data analysis using descriptive statistics
Measures of central tendency, measures of dispersion
Data visualization: histograms, box plots
Basics of point and interval estimation
Confidence intervals for the mean and proportion in business analysis
Application of confidence intervals in market research
Statistical hypothesis testing for population mean
Statistical hypothesis testing for two means
Proportion test
Regression and correlation analysis
Time series analysis
Bayesian statistics in business analysis

Teaching methods

Practical classes in a computer lab. Analysis of teaching materials provided to students. Group work.

Bibliography

Basic:
Statystyka, M. Sobczyk, Wydawnictwo Naukowe PWN, Warszawa 2007.
Statystyka w zarządzaniu, A.D. Aczel, Wyd. Naukowe PWN, Warszawa 2007.

Additional:
Szopa, T., Pancewicz, T., & Matyjewski, M. (2022). Probabilistyka dla inżynierów: w przykładach i zadaniach. Wydawnictwo Naukowe PWN.

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,00
Classes requiring direct contact with the teacher	60	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	65	2,50