COURSE DESCRIPTION CARD - SYLLABUS

Course name
Descriptive statistics [S1MNT1>SO]

Course

Field of study
Mathematics of Modern Technologies

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
15

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

The required knowledge concerns the knowledge of elementary functions, algebraic operations, the basics of mathematical analysis and the theory of probability.

Course objective

The aim of the course is to get to know the methods of descriptive statistics in depth and to acquire the ability to apply the acquired knowledge to the analysis of problems in various fields, including technical ones.

Course-related learning outcomes

Knowledge:
• knows and understands selected branches of mathematics to an advanced degree and has detailed knowledge of the applications of mathematical methods and tools in engineering and technical sciences [K_W01(P6S_WG)];
• knowsandunderstandstheconcepts,theoremsandmethodsformathematicalmodeling[K_W02(P6S_WG)];
• has knowledge and understands issues in computer science, including numerical methods; knows at least one software package, programming language [K_W07(P6S_WG)];

• knows and understands the techniques of measurement, acquisition, processing and analysis of data or signals at an advanced level [K_W08(P6S_WG)].

Skills:
• can use the knowledge of higher mathematics [K_U01(P6S_UW)];
• is able to choose the appropriate method and use measuring equipment to measure basic measurable quantities; can use the basic methods of processing and analyzing data or signals [K_U09(P6S_UW)];
• is able to independently plan and implement self-education in order to improve and update his/her competences [K_U17(P6S_UU)].

Social competences:
• is ready to critically assess the level of his/her knowledge in relation to research in exact and natural sciences as well as engineering and technical sciences [K_K01(P6S_KK)];
• is ready to deepen and expand knowledge to solve emerging technical problems [K_K02(P6S_KK)].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures: assessment of knowledge and skills shown in the written test;
Laboratory classes: one test.

Programme content

BASIC CONCEPTS OF DESCRIPTIVE STATISTICS
STAGES OF STATISTICAL RESEARCH
CLASSICAL AND POSITIONAL MEASUREMENTS OF THE LOCATION OF THE INVESTIGATED FEATURE.
CLASSICAL AND POSITIONAL MEASUREMENTS OF VARIABILITY OF THE INVESTIGATED TRAITS
CLASSICAL, POSITIONAL AND CLASSICAL-POSITIONAL MEASUREMENTS OF THE ASYMETRY OF THE INVESTIGATED FEATURE
MEASURES OF CONCENTRATION OF THE RESEARCH
ANALYSIS OF THE INTERDEPENDENCE OF TWO FEATURES AND MEASURE OF CORRELATION
REGRESSION ANALYSIS

Course topics

Lectures:
• introduction to descriptional statistics: basic statistical concepts, graphical presentation of data, construction of distributive series;
• measures of location: classical measures of location (averages: arithmetic, geometric and harmonic), position measures of location (dominant, median, quartiles);
• measures of variation: classical measures of variability (average deviation, variance, standard deviation, classical coefficient of variation, classical typical area of feature variation), positional measures of variation (range, interquartile range, quarterly deviation, positional coefficient of variation, positional typical area of feature variation);
• measures of asymmetry: positional measures of asymmetry (positional skewness index, positional asymmetry index), classical measures of asymmetry (third-order central moment, classical asymmetry index), position-classical measures of asymmetry (skewness index, pearson's asymmetry index);
• measures of concentration: kurtosis and excess coefficient, lorenz concentration curve and gini coefficient;
• analysis of the correlation of two characteristics: strength, direction and shape of the relationship. types of dependencies. ways of graphic presentations. boundary distributions. conditional distributions. correlation analysis for quantitative (pearson's linear correlation coefficient, spearman's rank correlation coefficient) and qualitative (coefficients based on chi-square statistics: yule's φ coefficient, czuprow's t coefficient, cramer's v coefficient, pearson's p contingency coefficient, kendall's q coefficient (only for measuring dichotomous features);
• regression analysis: introductionofbasicconcepts,linearregressionmodel(equation,modelresiduals, model fit evaluation), fit measures (residual variance, residual standard deviation, coefficient of random variation, coefficient of determination, coefficient of indetermination).
Laboratory classes:

• tasks for lecture 1: basic statistical concepts, graphical presentation of data, construction of distribution series, data visualization using histograms, boxplots, correlation diagrams;
• tasks for lectures 2 and 3: creating and loading and basic operations on data: basic numerical characteristics (mean, quantiles, variance, standard deviation, correlation coefficient);
• tasksforlecture4:calculatingasymmetrymeasures(classical,positionalandpositional-classicalasymmetry measures);
• tasks for lecture 5: calculation of concentration measures (determination of kurtosis and excess, creation of the Lorenz curve and calculation of the Gini coefficient;
• tasks for lecture 6: analysis of the correlation of two features (Pearson's linear correlation coefficient, Spearman's rank correlation coefficient and coefficients based on chi-square statistics);
• tasks for lecture 7: determination of the regression line, assessment of model fit.
• test

Teaching methods

Lectures: theory presented in connection with the current knowledge of students, during the lecture, frequent initiation of discussions, recommending materials for self-completion of the knowledge;
Laboratory classes: tasks closely related to the theory presented during the lecture, solving exemplary tasks, detailed reviewing of the solutions of the tasks by the laboratory teacher and discussion of comments.

Bibliography

Basic:
• E. Wasilewska, Statystyka opisowa od podstaw. Wydawnictwo SGGW, 2011;
• Bąk, I. Markowicz, M. Mojsiewicz, K. Wawrzyniak, Statystyka opisowa : przykłady i zadania. Wydawnictwo: CeDeWu, Warszawa, 2015;
• W. Starzyńska, Statystyka praktyczna. Wydawnictwo Naukowe PWN, Warszawa, 2012;
• M. Iwińska, B. Popowska, M. Szymkowiak, Statystyka opisowa. Wydawnictwo Politechniki Poznańskiej, 2011;
• J. Buga, H. Kassyk-Rokicka, Podstawy statystyki opisowej. Wydawnictwo: Vizja Press & IT, Warszawa, 2008.

Additional:
• A. Witkowska, M. Witkowski, Statystyka opisowa w przykładach i zadaniach. Wydawnictwo Uczelni Państwowej Wyższej Szkoły Zawodowej im. Prezydenta Wojciechowskiego, Kalisz 2007;
• W. Regel, Ćwiczenia z podstaw statystyki w Excelu. Wydawnictwo Naukowe PWN, Warszawa 2007;
• A. Aczel, Statystyka w zarządzaniu : pełny wykład (przekł.: Zbigniew Czerwiński, Wojciech Latusek). Wydawnictwo Naukowe PWN, Warszawa 2006.

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	20	1,00