

Syllabus for
Statistics and probability theory - Autumn 2026
Wojciech Mydlarczyk
October, 2026

This is a syllabus for the course "Statistics and probability theory". The course provides an introduction to the statistical methods used for learning from data.

Topics include:

1. the descriptive statistics - a description of the basic features of a dataset, providing an overview of its characteristics through numerical summaries and graphical representations like mean, median, mode, standard deviation, and charts;
2. probabilistic space,
3. conditional probability, independence of events,
4. random variable and its distribution; multidimensional random variables; independence of random variables, density, marginal density, quantiles,
5. parametrization of distributions of random variables, expected value, higher order moments, variance, conditional expectation
6. overview of distributions and their genealogy: Bernoulli, Poisson, geometric and normal distributions.
7. sources of new distributions; exponential distribution, Weibull's distribution, gamma distribution, chi-square distribution, beta distribution
8. Markov's and Chebyshev's inequalities, Law of large numbers, Lindeberg-Levy's and Lapunov's Central limit theorems
9. statistics as a discipline that helps modelling random events; statistics as random variables and their distributions - basic tools in statistical inference; importance of the size of a sample
10. point estimation, properties of estimators, method of moments, maximal likelihood method
11. confidence intervals

12. testing of hypothesis, 1. and 2. type errors
13. nonparametric tests. chi-square consistency test, Neyman's test, chi-square independence test, Wilcoxon-Mann-Whitney's test.
14. covariance matrix, correlation coefficient, linear regression, the least squares estimators; prediction

Instructor

Wojciech Mydlarczyk, wojciech.mydlarczyk@pwr.edu.pl, Office at Institute of Theoretical Physics, Faculty of Fundamental Problems of Technology, A-1/r. 441

Attendance

The attendance at lectures and classes is obligatory. Two absences on lectures are permitted without excusing. The requirements for classes will be given by the corresponding instructors.

Course Objectives

By the end of the course, you would/should have:

1. learned and used various statistical methods for exploring datasets
2. got a feeling and gained insight into the complexity of statistics

Prerequisites

Basic knowledge of calculus and linear algebra is assumed. You will benefit from having familiarity with Matlab(Octave)/Mathematica and Excel spreadsheets.

Texts

Our main reference is the handbook [1] .

Additional recommended texts and readings

You will also find great insight in [2]-[5].

Literature

- [1] Moore D., McCabe G., Introduction to the Practice of Statistics, Freeman, 2003
- [2] Larsen R. J., Marx M. L. (2006), An introduction to Mathematical Statistics, Pearson Prentice Hall, New York
- [3] Shao J. (2003). Mathematical Statistics. Springer Texts in Statistics. Springer-Verlag, New York, second edition.
- [4] Bickel P.J., Doksum K.A. (1997) Mathematical Statistics. Holden Day, San Francisco.

- [5] Bickel P.J., Doksum K.A. (2001). Mathematical Statistics. Basic Ideas and Selected Topics, volume I. Prentice Hall, Upper Saddle River, New Jersey, second edition.
- [6] Kryszewski. W i inni, Rachunek prawdopodobieństwa i statystyka matematyczna w zadaniach cz. I i II, PWN, Warszawa, 2007
- [7] Greń, J. Statystyka matematyczna. Modele i zadania, PWN, Warszawa, 1976
- [8] Kordecki W. Rachunek prawdopodobieństwa i statystyka matematyczna. Definicje, twierdzenia, wzory, Ofic. Wyd. GiS, Wrocław, 2002
- [9] Jasiulewicz H., Kordecki W. Rachunek prawdopodobieństwa i statystyka matematyczna. Przykłady i zadania, Ofic. Wyd. GiS, Wrocław, 2001
- [10] Gajek L., Kałuska M., Wnioskowanie statystyczne. Modele i metody, WNT, Warszawa, 2004
- [11] Klonecki W., Statystyka matematyczna, PWN, Warszawa, 1999
- [12] Koronacki J., Mielniczuk J., Statystyka dla studentów kierunków technicznych i przyrodniczych, WNT, Warszawa, 2004

Homework

Sets of tasks will be provided for use in class and for self-studying.

Grading policy

Final written exam.

Dates of the exam: (to be fixed)

Room location and hours

Lectures take place at D-1, room 312b, on Fridays, from 9:15 am to 11:00 am.

Classes take place at D-1, room 312b, on Fridays, from 13:15 am to 15:00 am.

Office hours:

(will be announced soon)

Course website

<https://mydlarczyk.kft.pwr.edu.pl>

The website contains this syllabus, the problem sets updates and other announcements related to the course.