Statistics and Data Analysis for Engineers

ECTS
5

Prerequisites
It is expected that the student has mathematics at the level required for admission to the programme and has passed MSE1 or an equivalent course.

Purpose
The aim of the course is to provide students with a practical introduction to statistics and data analysis, with a strong focus on engineering applications. Students will acquire the necessary tools to collect, process, analyse, and visualise data originating from experiments, measurements, and simulations. They will also learn how to prepare and communicate analytical results effectively in ways that support engineering decision-making and problem-solving. The course is designed to enable students to critically evaluate data and statistical findings in an engineering context.

Knowledge
After completing the course, the student will have fundamental knowledge of:
- Descriptive statistics and data visualisation techniques
- Basic probability theory concepts needed for statistics (random variables, mean, variance)
- The most important discrete and continuous probability distributions (e.g., binomial, Poisson, and normal distributions) and their engineering applications
- Sampling distributions, including the central limit theorem
- Principles of estimation (point estimation and confidence intervals) and hypothesis testing (null and alternative hypothesis, p-value, significance level, type I and II errors)
- Simple linear regression and residual analysis
- Analysis of variance (ANOVA) and categorical data methods (e.g., chi-square tests)
- How statistical methods can be applied to data obtained from experiments, measurements, and simulations

Skills
After completing the course, the student will be able to:
- Collect data from experiments, measurements, or external data sources, and carry out relevant preprocessing and analysis
- Use appropriate software tools (e.g., Python with Pandas, NumPy, SciPy, Matplotlib, scikit-learn) for statistical computations and data analysis
- Calculate and interpret descriptive statistics and visualise data using histograms, scatterplots, and boxplots
- Formulate, perform, and interpret statistical hypothesis tests (e.g., t-tests, chi-square tests) and confidence intervals
- Carry out and interpret simple linear regressions and residual analysis
- Apply methods such as analysis of variance (ANOVA) and categorical data analysis (e.g., contingency tables, chi-square tests)
- Structure and present the results of statistical analyses in a form suitable for supporting engineering problem-solving and decision-making

Competences
After completing the course, the student can:
- Independently design and carry out a data analysis workflow, including data collection, statistical analysis, and preparation of results for engineering applications
- Critically assess and select appropriate statistical methods for analysing data related to typical engineering problems, including regression, analysis of variance (ANOVA), and categorical data analysis
- Communicate the results of statistical analyses clearly and effectively to both technical and non-technical stakeholders, demonstrating awareness of the assumptions, limitations, and uncertainty of the applied methods

Teaching methods and study activities
The course is classroom-based and consists of weekly lectures (2 × 45 minutes) delivered by the teacher. Alongside the lectures, students will work in groups on six practice-oriented assignments distributed throughout the semester. These assignments are designed to connect statistical theory with practical engineering applications. At the end of the course, students will complete a small group project where they analyse a more comprehensive engineering data set, apply relevant statistical methods, and present their findings. The assignments and project serve both as a means of learning and as preparation for the exam.

Exam
Exam prerequisites:
None

Type of exam:
The exam is a 20-minute oral examination that departs from one of the six assignments that the students made during the semester. The exam will also include a discussion of the group project.
The final grade will be based on an overall assessment of the assignment and the oral examination.
Internal assessment.

Tools allowed:
None

Re-exam:
Same as the ordinary exam.

Grading criteria
Grading based on the Danish 7-point scale.

Responsible
Richard Brooks (rib)

Valid from
01-08-2026

Course type
Elective for Software Engineering.