



DEPARTMENT OF MATHEMATICAL SCIENCES

MSA251 Experimental Design and Sampling, 7.5 credits

Försöksplanering och urvalsteori, 7,5 högskolepoäng

Second Cycle

Confirmation

This course syllabus was confirmed by Department of Mathematical Sciences on 2018-02-09 to be valid from 2018-02-09, spring semester of 2019.

Field of education: Science 100%

Department: Department of Mathematical Sciences

Position in the educational system

Main field of studies

Mathematical Statistics

Specialization

A1N, Second cycle, has only first-cycle course/s as entry requirements

Entry requirements

Knowledge corresponding to the courses *MMG200 Mathematics 1*, *MSG200 Statistical Inference*, and *MSG500 Linear Statistical Models*.

Learning outcomes

On successful completion of the course the student will be able to

- Describe the classical methods in optimal experimental design, their similarities and differences regarding design, execution and analysis.
- Choose a suitable experimental design for different problems and situations.
- Design an experiment from beginning to end, including planning and execution, data collection, statistical analysis and interpretation of results.
- Describe the most common sampling methods, in which situations they apply, and the corresponding population estimates and variance estimates.
- Describe and analyze both linear and non-linear estimation situations.

Course content

The aim of the course is to provide the student with knowledge of different methods in statistical experimental planning and sampling theory, to systematically plan, implement and analyze statistical surveys to obtain as much information as possible. The methods presented are widely used in technology and science to streamline and optimize processes and are a natural part of quality assurance in industry and society.

Topics covered in the course include

Experimental design:

- General design of experiments.
- Factorial and reduced factorial experiments.
- Analysis of variance (one-way and multi-factor ANOVA).
- Mixed effects models.
- Split plot designs.
- Linear and non-linear regression and optimala designer.
- Responce surface methods.

Sampling theory:

- Basic techniques of simple random sampling, systemic sampling, stratified sampling, probability proportional to size sampling, cluster sampling, and multi-stage sampling.
- Population estimation using Horvitz-Thompson, ratio and regression estimation.
- Variance estimation for complex sample designs, including they Taylor series expansion method, balanced repeated sampling, and jackknife methods.
- Optimal allocation and optimal sampling schemes.
- Model based inference and pseudo likelihood-methods.

Form of teaching

Lectures and exercise sessions.

Language of instruction: English

Assessment

Written exam.

If a student, who has failed the same examined component twice, wishes to change examiner before the next examination, a written application shall be sent to the department responsible for the course and shall be granted unless there are special reasons to the contrary (Chapter 6, Section 22 of Higher Education Ordinance).

Grades

The grading scale comprises: Pass with Distinction (VG), Pass (G) and Fail (U).

Course evaluation

At the end of the course the students will be asked to answer a questionnaire. The results of and possible changes to the course will be shared with students who participated in the evaluation and students who are starting the course.