



Experimental design, Advanced level, 7.5 ECTS. (Försöksplanering, AN, 7.5 hp) Course description

The course treats experimental methods used in social sciences, natural sciences, technology, medicine, and economics. The aim of the course is to give knowledge in statistical experimental design in regards to designing and conducting experiments and analysis of data generated from experiments. Experiments that are given special focus in the course include single factor experiments, randomized blocks, Latin squares, factorial experiments (e.g. 2^k factorial experiments), and analysis of variance. Particular attendance is given to different applications of experimental design and analysis of variance. The course provides a basis for further advanced studies and research studies in statistics.

Learning outcome

After completing the course, students should be able to:

- give an account of methods used for experimental design
- choose adequate experimental designs for different types of problems and situations
- analyse data generated by factorial experiments by using analysis of variance

Teaching format

The teaching consists of lectures and exercises including computer labs. During computer labs, students will gain practical skills regarding planning the experiments and analyzing data from experiments using the statistical software R. Detailed instructions will be given in connection with the computer lab.

A description of the lecture contents and reading instructions for the course literature is given in the *Reading Instructions* available at the latest when the course starts (see Athena). Time and location for lectures and computer labs are found in Athena. The last lecture, on **October 21, 12:00-15:00**, includes **presentation of course work** and is therefore **mandatory to attend**.

Course literature

Montgomery, D.C. (2017). *Design and Analysis of Experiments*, 9th edition. OR

Montgomery, D.C. (2013). *Design and Analysis of Experiments*, 8th edition.

In addition, you may consult

Atkinson, A.C., Donev, A.N., and Tobias, R.D. (2007). *Optimum experimental designs, with SAS*. Oxford University Press, Oxford, UK. Specifically, we use Chapters 12 and 13 of this book. Note that the book is available as eBook in our university's library, and you may download Chapters 12 and 13 from there.

Lecturers:

Hans Nyquist, tel. 08-162969, Hans.Nyquist@stat.su.se (lectures, course coordinator, examiner)

Mahmood Ul-Hassan, tel. 08-162970, mahmood.ul-hassan@stat.su.se (lectures; computer labs)

Examination and grading criteria

The examination of the course consists of a written exam, written reports of two home assignments, HA1 and HA2, and a course work with a written report with an oral presentation of a course work exercise.

The *written exam* (on **October 26, 14.00-19.00** and **December 1, 14.00-19.00**) consists of several problems that, if perfectly solved, give a total of 76 points. Note that you have to **sign up for the written examinations at least 8 days before the exam**. Otherwise you will not be allowed to participate. If you cannot sign up in Ladok, e-mail to expedition@stat.su.se at least 8 days in advance of the exam. The exam will be in an examination hall at Stockholm University

The two *home assignments* should be done individually without help of others. If perfectly solved they will give at most 7 points each. The software R should be used for completing the home assignments.

The *course work* can be done and presented in groups of up to 3 students, without help of other students, and may give at most 10 points. Deadlines for submission of the home assignments and course work are:

	First examination		Re-examination (if less than 50% of points at first examination)		
	Hand out	Submission deadline	Hand out	Submission deadline	
Home Assignment 1	Oct 7	Oct 14	Oct 31	Nov 7	Individual
Course work	Oct 11	Oct 18 and oral presentation: Oct 21	Oct 28	Nov 4; and oral presentation: Nov 8	Group work
Home Assignment 2	Oct 14	Oct 24	Nov 9	Nov 16	Individual

The points from the three examination parts are summed (maximum being 100 points) and determines the grade according to the table below.

A. Excellent	90-100 points and at least 50% of points in each of HA1, HA2 and course work
B. Very good	80-89 points and at least 50% of points in each of HA1, HA2 and course work
C. Good	70-79 points and at least 50% of points in each of HA1, HA2 and course work
D. Satisfactory	60-69 points and at least 50% of points in each of HA1, HA2 and course work
E. Adequate	50-59 points and at least 50% of points in each of HA1, HA2 and course work
Fx. Inadequate	None of the criteria above but at least 40 points in the written test
F. Totally Inadequate	Anything less than 40 points in the written test

Students who receive the grade Fx or F on an examination are entitled to at least four additional examinations to achieve the lowest grade E as long as the course is given. Students who receive the grade E or higher on an examination may not retake this examination in order to attempt to achieve a higher grade. Students who received the grade Fx or F on an examination on two occasions by the same examiner have the right to request that a different examiner be appointed to set the grade of the examination. Such a request must be in writing and sent to the head of the department. Here, the term examination denotes all compulsory elements of the course.

All the credit points from the assignments need to be achieved at this period of teaching. No credit points from the assignments achieved this semester can be transferred to the next time the course will be given.

Approved tools and aids and cheating on the examination

The course work is performed in groups. Naturally, discussion and collaboration between group members is both necessary and encouraged. Note however that grades are set individually and can vary between group members, and that it is the individual's performance in the group work that is examined.

The written exam and the two home assignments are to be done individually. All forms of collaboration for those are prohibited. **Plagiarism of all types is prohibited** for the course work and for the two home assignments. Text matching software may be used if needed.

Permitted facilities for the written exam are pocket calculator without stored formulas and text, and one page of paper size A4 (front-page only) with own handwritten notes and formulas. All necessary statistical tables will be distributed at the exam. Mobile phones with calculator applications are not permitted. Special tools may, if necessary, be allowed upon request and after approval of the examiner. Students who need special support and tools should contact the department's student counsellor as soon as possible, no later than 3 weeks before the exam. More information regarding examination regulations is available on the department and Stockholm University webpages.

Use of unauthorized means of assistance in examinations with the attempt to mislead during exams, or otherwise when study performance is to be assessed, will be reported to the disciplinary board in accordance with university rules.