Department of Statistics
2024-11-04/PGA

# Course description/Teaching plan

# Inference theory

7.5 Higher Education Credits (ECTS Credits) , advanced level
Course code: ST4301
Fall 2024

### Contents

The course consists of one unit:

1. Statistical Inference. 7.5 ECTS credits

### Course literature

- Casella G. & Berger R. L. Statistical Inference, Second Edition, Duxbury Press (Thomson Learning Academic Resource Center
- Additional material may be distributed during the course

### Learning outcomes

After completing the course the student should be able to

- derive important point estimators, interval estimators, and test statistics in some selected applications
- demonstrate understanding of important theorems in inference theory
- demonstrate understanding of convergence-properties of estimators

### Teaching

Welcome to the demanding and wonderful world of statistical inference! Here we will expand and deepen the knowledge of methods and applications. Some theory will probably be known from previous courses, but we will also look into 'new' techniques, especially when we deal with asymptotic theory. As usual in a course like this, there are three main topics to be covered: point estimation, interval estimation and hypothesis testing.

Teaching consists of lectures (L1-L12), exercises (E1-E8) and one computer exercise (C1) according to the course schedule.
A list of exercises will appear separately.

Lectures

*L1:* 3.4-3.5: Exponential families, location and scale families, 6.1-6.2.2: sufficient and minimal sufficient statistics, the factorization theorem.

*L2:* 6.2.3-6.3.1: Ancillarity and completeness, Basu's theorem.

*L3:* 7.1-7.2.2: The likelihood principle, point estimators: the method of moments and the maximum likelihood method.

*L4:* 7.3-7.3.3: Best unbiased estimator (UMVUE), Cramér-Raos inequality, the Rao-Blackwell theorem.

*L5:* 8.1-8.3.1 (except 8.2.2): Hypothesis testing, methods: likelihood ratio tests, evaluation of tests: error probabilities and the power function.

*L6:* 8.3.2-8.3.4: Most powerful tests, the Neyman-Pearson lemma, monotone likelihood-ratio: Karlin-Rubin's theorem, p-values.

*L7:* 9.1-9.2.3: Interval estimators, methods: 'inverting' tests, pivots.

*L8:* 9.3.1-9.3.2: Evaluation of tests and interval estimators: 'optimality'.

*L9:* 5.5.1-5.5.4: Convergence in probability and in distribution, the Delta method.

*L10:* 10.1.1-10.1.3, 10.2-10.3: Asymptotics: point estimators: consistency and efficiency. Point estimator: robustness, asymptotic distribution for likelihood-ratio statistics, Wald- och score tests, interval estimators.

*L11:* 7.2.3, 7.3.4, 8.2.2, 8.3.5, 9.2.4, 9.3.3-9.3.4: Bayesian methodology, decision theory, loss and risk functions.

*L12:* Summary.

### Examination

The examination consists of

- A written examination, where the allowed tools are a pocket calculator and one *handwritten* paper of A4 size, where it is allowed to write on both sides.

Do not forget to sign up for the exam in time! This is your own responsibility. After the exam there will be a note on Athena when the exams are marked and available for return.

### Grading Criteria

The written examination is graded as A, B, C, D, E, Fx and F. The passing grades are A, B, C, D and E, where A is the highest and E is the lowest. Failing grades are F and Fx, where F is lower than Fx. When obtaining a failing grade F or Fx in the written examination, we will not give extra exercises or extra assignments to obtaining a passing grade.

### Grading criteria for the written examination

The maximum total credit is thus 100 points for each examination. Grades are given on a seven-point rating scale:

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|---|---|
| A | 90-100 points |
| B | 80-89 points |
| C | 70-79 points |
| D | 60-69 points |
| E | 50-59 points |
| Fx | 40-49 points |
| F | 00-39 points |

To pass the course a minimum grade of E is required.

For more information about examination, see the course plan.

**Teachers and Communication**

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