

## Statistical Inference (C004080)

**Course size** *(nominal values; actual values may depend on programme)*

**Credits 6.0**

**Study time 180 h**

**Course offerings and teaching methods in academic year 2024-2025**

A (semester 2)

English

Gent

lecture

seminar

**Lecturers in academic year 2024-2025**

De Keersmaecker, Frederik

WE02

lecturer-in-charge

**Offered in the following programmes in 2024-2025**

[Master of Science in Statistical Data Analysis](#)

**crdts**

6

**offering**

A

**Teaching languages**

English

**Keywords**

Estimation theory, hypothesis testing

**Position of the course**

The students are introduced to the most important concepts and methods in the theory of estimators and hypothesis testing and to the theoretical foundations of statistics. This training enables the students to gain insight into the statistical methods used in the different domains and applications of statistics. Students learn to develop inference methods to solve specific statistical problems using this general theory.

**Contents**

- Properties of estimators: bias, variance, mean squared error, asymptotic bias, consistency
- Maximum Likelihood Estimators, Score vectors, Fisher information, the Cramer-Rao inequality
- Large sample inference: convergence in distribution and probability, the Weak Law of Large Numbers, the Central Limit Theorem, Consistency of estimators, Slutsky's Lemma and the Delta Method
- Fundamentals of confidence intervals and hypothesis testing
- Likelihood-based hypothesis testing: the Wald, Score and Likelihood ratio tests
- Bayesian methods: Bayesian versus frequentist statistics, Bayes' Rule, prior and posterior, Bayesian estimation and credible intervals, conjugate priors
- M-estimators: unbiased estimating equation, sandwich estimator of the variance
- Inference under the bootstrap
- Missing data: assumptions (missing completely at random, missing at random, missing not at random), multiple imputation, data augmentation, multiple imputation by chained equations (MICE)

**Initial competences**

Having successfully followed the courses Principles of Statistical Data Analysis and Analysis of Continuous Data or having acquired the intended competences in another way.

**Final competences**

- 1 Have knowledge of the basics of statistical inference theory.
- 2 Apply in a specific context the most important estimation methods and inference techniques of statistics.
- 3 Derive the relevant properties of estimators and test procedures.
- 4 Judge the applicability and limitations of statistical methods.
- 5 Use methods to solve practical statistical problems.

6 Correctly interpret the properties of the methods in the specific context of the application.

**Conditions for credit contract**

Access to this course unit via a credit contract is determined after successful competences assessment

**Conditions for exam contract**

This course unit cannot be taken via an exam contract

**Teaching methods**

Seminar, Lecture

**Study material**

Type: Slides

Name: Slides made by lecturer

Indicative price: Free or paid by faculty

Optional: no

Available on Ufora : Yes

**References**

Wasserman, L. (2004). All of Statistics (1<sup>st</sup> Edition), Springer.

Casella G. en Berger, R.L. (2002). Statistical Inference, Duxbury Press.

Aronow, P. M., Miller B. T. (2019). Foundations of Agnostic Statistics (1<sup>st</sup> Edition), Cambridge.

Boos, D. and Stefanski, L. (2013) Essential Statistical Inference. Springer New York.

**Course content-related study coaching**

Interactive support via Ufora (e-mail) and personally after electronic appointment.

**Assessment moments**

end-of-term and continuous assessment

**Examination methods in case of periodic assessment during the first examination period**

Written assessment

**Examination methods in case of periodic assessment during the second examination period**

Written assessment

**Examination methods in case of permanent assessment**

Assignment

**Possibilities of retake in case of permanent assessment**

examination during the second examination period is not possible

**Calculation of the examination mark**

Periodical evaluation (75%) + non-periodical evaluation (25%).