

## Statistics I (C003558)

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

**Credits 6.0**

**Study time 165 h**

### Course offerings and teaching methods in academic year 2023-2024

A (semester 1)

Dutch

Gent

lecture

seminar

### Lecturers in academic year 2023-2024

Vansteelandt, Stijn

WE02

lecturer-in-charge

### Offered in the following programmes in 2023-2024

[Bachelor of Science in Mathematics](#)

**crdts**

**offering**

6

A

### Teaching languages

Dutch

### Keywords

Probability, mathematical statistics

### Position of the course

Develop a mathematical basis for probability and statistics. Build the theory from the axioms and thus acquire insight in the mathematical properties of stochastic structures. This must enable good comprehension of formal convergence properties for sequences of random variables and allow the student to subject simple new statistics to independent examination.

### Contents

- Axioms of probability, definition of conditional probability. Sequences of random experiments. Limit theorems of De Moivre-Laplace and of Poisson, Bayes' rule, ( conditional ) independence.
- Stochastic variables and distribution functions. Discrete and absolutely continuous random variables. Density Functions and the theorem of Radon-Nikodym.
- Multi-dimensional, marginal and conditional distribution functions. Independence of random variables. Distributions of transformed variables.
- The theoretical (conditional) expectation, (conditional) variance, covariance, correlation, skewness and kurtosis. Law of repeated expectation and (co) variance.
- Momentgenerating and characteristic functions, the uniqueness theorem.
- Population versus sample. Distribution of the sample mean.
- General review and estimation methods : the method of moments and the principles of maximum likelihood theory.
- Asymptotic behavior of estimators. Unbiased estimators. Consistent estimators. The weak law of large numbers. The continuity theorem and the central limit theorem. Weak and strong convergence. Slutsky's theorem, the continuous mapping theorem and the delta method.

### Initial competences

Final competences of the course Analyse I

### Final competences

- 1 The student must master the axiomatic development and the basic rules of probability and mathematical statistics.
- 2 She/he must know how to formalize convergence properties of a sequence of

random variables, how to prove and apply the central limit theorem.  
3 She/he can subject simple new statistics to formal study.

#### **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

#### **Extra information on the teaching methods**

Exchanges through the electronic learning environment.

!!Due to COVID19, alternative working methods might need to be applied!!

#### **Learning materials and price**

A syllabus is available by the student association (cost: 5 to 10 EUR) and online on Ufora.

Slides are available on Ufora.

#### **References**

- E. J. Dudewicz and S.N. Mishra. 'Modern Mathematical Statistics'; Wiley, 1988.
- W. Mendenhall. 'Mathematical Statistics with Applications' (6th edition); Duxbury Press, 2001.
- D. Boos and L. Stefanski. 'Essential Statistical Inference: Theory and Methods'; Springer, 2013.

#### **Course content-related study coaching**

Lectures and guided exercise sessions

#### **Assessment moments**

end-of-term assessment

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

Written assessment with open-ended questions

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

Written assessment with open-ended questions

#### **Examination methods in case of permanent assessment**

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

not applicable

#### **Extra information on the examination methods**

The knowledge and problem solving skills of the students are tested by means of a written open book exam. Ready familiarity with the basis concepts is tested via one brief question.

#### **Calculation of the examination mark**

Written exam (100%)