Linnæus University

Dnr: 2019/4025-3.1.2.2

# Course syllabus

Faculty of Technology

Department of Mathematics

## 1MA905 Tillämpad sannolikhetslära och statistik, 7,5 högskolepoäng

## 1MA905 Applied Probability Theory and Statistics, 7.5 credits

**Main field of study**
Mathematics

**Subject Group**
Mathematics

**Level of classification**
First Level

**Progression**
G1F

**Date of Ratification**
Approved by Faculty of Technology 2019-12-06
The course syllabus is valid from autumn semester 2020

**Prerequisites**
Linear algebra 7.5 credits and Anlaysis I 5 credits or the equaivalent.

## Objectives

After completing the course, the student should be able to:
A. *Knowledge and understanding*

- A.1 Explain central concepts in probability and statistics as random variable, probability mass function, probability distribution function, cumulative distribution function, expectation, variance, standard deviation, joint distribution, marginal distribution, covariance, confidence interval, *p*-value, standard random variables like the binomial-, poisson-, normal- and exponential distribution and typical applications, as well as
- A.2 formulate, and explain the relevance of, central results in probability and statistics as the central limit theorem.

B. *Ability and skills*

- B.1 Determine probabilities, expectations, variances, covariances, correlation coefficients, joint and marginal distributions for one- and two-dimensional

random variables,
- B.2 calculate and estimate parameters and confidence intervals, perform hypthesis tests and linear regression for statistical data,
- B.3 present and explain calculations and mathematical reasoning in written form in a mathematically correct, structured and logically coherent way, as well as
- B.4 use mathematical software in problem solving and visualisation.

C. *Judgement and approach*

- C.1 Use probabalistic models in problem solving activities (this includes e.g. introducing adequate variables and statistical models, reformulating a problem as an appropriate mathematical problem, devise a plan, carry out the plan, and looking back), as well as
- C.2 interpret and judge results in problem solving. This may also include reformulating the result as solution of a more general problem.

## Content

The main goal of the course is to give an introduction to probability and statistics with applications in data analysis, technology and economics. This includes, among other things, theoretical work with probabalistic models and statistical inference.

- Descriptive statistics: mean, median, variational coefficient, quartiles, variance, correlation coefficients, visualization of data, bar diagrams, histograms, box plots.
- Discrete and continous random variables: probability mass function, probability density function, cumulative distribution function, expectation, independent random variables, Bienaymés formula, Chebychev's inequality, binomial distribution, geometric distribution, poisson distribution, normal distribution, exponential distribution, uniform distribution and typical domains of application.
- Two-dimensional distributions: joint distribution, independent random variables, marginal distribution, expectation, variance covariance, correlation coefficient, conditional expectation.
- Functions of random variables: Sums of random variables and something about convolution.
- Central limmit theorem and the law of large numbers.
- Modelling an problemsolving with random variables using Polya's fours steps in problem solving.
- Classical statistical inference: point estimates, interval estimates, hypothesis testing, and linear regression.
- Problem solving using mathematical software like Matlab.

## Type of Instruction

Lectures and exercises.

## Examination

The examination of the course is divided as follows:

| Code | Designation | Grade | Credits |
|---|---|---|---|
| 2101 | Assignment | U/G | 1,50 |
| 2102 | Written exam | AF | 6,00 |

The course is assessed with the grades A, B, C, D, E, Fx or F.

The grade A constitutes the highest grade on the scale and the remaining grades follow in descending order where the grade E is the lowest grade on the scale that will result in a pass. The grade F means that the student’s performance is assessed as fail (i.e. received the grade F).

To pass the course it is required to get at least E on the written exam, and to pass the assignment. The final grade is determened by the grade on the written exam.

Repeat examination is offered in accordance with Local regulations for courses and examination at the first and second-cycle level at Linnaeus University.

If the university has decided that a student is entitled to special pedagogical support due to a disability, the examiner has the right to give a customised exam or to have the student conduct the exam in an alternative way.

**Objectives achievement**

The examination elements are linked to the course objectives in the following ways:

| **Goal** | 2101 | 2102 |
|---|---|---|
| A.1 | | ☑ |
| A.2 | | ☑ |
| B.1 | ☑ | ☑ |
| B.2 | ☑ | ☑ |
| B.3 | ☑ | ☑ |
| B.4 | ☑ | |
| C.1 | ☑ | ☑ |
| C.2 | ☑ | |

## Course Evaluation

During the implementation of the course or in close conjunction with the course, a course evaluation is to be carried out. Results and analysis of the course evaluation are to be promptly presented as feedback to the students who have completed the course. Students who participate during the next course instance receive feedback at the start of the course. The course evaluation is to be carried out anonymously.

## Credit Overlap

The course cannot be included in a degree along with the following course/courses of which the content fully, or partly, corresponds to the content of this course: 1MA511 Applied probability and statistics, 7.5 credits and 1MA501 Probability and Statistics, 7.5 credits

## Other

The course will be performed in way that the experience and knowledge of the students becomes visible and develops. For example, this means that we have an including approach and that no one should feel excluded. This can be manifest in various ways,

for example the teacher is supposed to use examples that are neutral with respect to gender.

## Required Reading and Additional Study Material

**Required reading**

Walpole, R.E., Myers, R.H., Myers, S.L. och Ye, K., Probability and Statistics for Engineers and Scientists, latest edition, Pearson. Number of pages: 443 out of 816.

**Optional reading**

Blom, Gunnar, Probability and Statistics, Springer, latest edition.