

MATH-449

Biostatistics

| Cursus | Sem. | Type |
|---------------|----------|------|
| Ing.-math | MA2, MA4 | Opt. |
| Mathématicien | MA2 | Opt. |

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| Language of teaching | English |
| Credits | 5 |
| Session | Summer |
| Semester | Spring |
| Exam | Oral |
| Workload | 150h |
| Weeks | 14 |
| Hours | 4 weekly |
| Courses | 2 weekly |
| Exercises | 2 weekly |
| Number of positions | |

Remark

Cours donnés en alternance tous les deux ans (pas donné en 2019-20)

Summary

Biostatistics is about the application of statistics to medicine and the life sciences. The course covers various methods and problems that are typical for these areas of application. Despite the applied context, the course treats the topic at a fairly abstract level.

Content

- Statistical tests: concept, Neyman-Pearson formulation, level of a test, power of a test, confidence intervals, important distributions.
- The analysis of counting data: estimating probabilities, tests and confidence intervals, comparison of two probabilities, the chi-squared statistic and Fisher's exact test, binary regression, log-linear models, the test of Cochran-Mantel-Haenszel
- Random effects: Linear, mixed and generalized linear Models for longitudinal studies,
- Multiple comparisons: type I error rates (FWER, k-FWER, FDR, sFDR), weak and strong controls, dependency assumptions (independence, positive dependence, PRDS, general dependence), multiple testing procedures (Bonferroni, Benjamini and Hochberg, etc.), different types of controls (global level, cluster level), post-selection inference, applications to genetics and neuroscience.
- Meta-analysis: combining evidence, inverse variance weights and meta-analysis, meta-analysis by variance stabilization, random effects vs. fixed effects, publication bias
- Analysis of survival times: likelihood for censored data, non-parametric estimates of the survival function, regression models

Keywords

see content

Learning Prerequisites**Required courses**

An introductory course covering the basics of statistical theory and probability theory.

Recommended courses

Linear Models

Important concepts to start the course

Likelihood theory, statistical testing.

Learning Outcomes

By the end of the course, the student must be able to:

- Choose an appropriate method for a given problem
- Apply the methods learned in the course
- Defend a data analysis he/she performed
- Critique published studies

Transversal skills

- Demonstrate the capacity for critical thinking
- Access and evaluate appropriate sources of information.
- Communicate effectively with professionals from other disciplines.

Teaching methods

Classroom lectures on the beamer supported by the blackboard, practical examples with R software shown on the beamer, theoretical and practical exercises in class and independent work.

Expected student activities

Participation in exercise sessions.

Assessment methods

Oral examination

Dans le cas de l'art. 3 al. 5 du Règlement de section, l'enseignant décide de la forme de l'examen qu'il communique aux étudiants concernés.

Supervision

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| Office hours | No |
| Assistants | Yes |
| Forum | No |

Resources**Virtual desktop infrastructure (VDI)**

No

Bibliography

A bibliography will be available on the moodle page of the course

Moodle Link

- <http://moodle.epfl.ch/course/view.php?id=14307>