Module Guide
24-M-PT-ST5a Selected Topics in Probability Theory and Statistics 1

Fakultät für Mathematik

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This module guide reflects the current state and is subject to change. Up-to-date information and the latest version of this document can be found online via the page

https://ekvv.uni-bielefeld.de/sinfo/publ/modul/533548625

The current and valid provisions in the module guide are binding and further specify the subject-related regulations (German "FsB") published in the Official Announcements of Bielefeld University.

24-M-PT-ST5a Selected Topics in Probability Theory and Statistics 1

Faculty

Fakultät für Mathematik

Person responsible for module

Herr Prof. Dr. Martin Wahl

Regular cycle (beginning)

This module is part of a long-term overall curriculum plan for the Master's programme, which ensures that modules with an amount of at least 20 CP are offered in all five fields each year. The module is offered at irregular intervals as part of this overall curriculum planning.

Credit points

5 Credit points

Competencies

Non-official translation of the module descriptions. Only the German version is legally binding.

Students expand and deepen their mathematical knowledge and skills in the field of Probability Theory and Statistics and can apply them in a current research context.

Course type Lecture with tutorials:
The students master the basic contents and methods of a special subject area of Probability Theory and Statistics, in particular they can independently carry out complex proofs in this area requiring a high level of mathematical expertise. Furthermore, students recognise further-reaching connections to previously acquired mathematical facts. They can transfer and apply the knowledge and methods they have learnt so far to other, deeper mathematical problem areas. Students also expand their mathematical intuition through further and more intensive study.
In the tutorials, students develop their ability to discuss mathematical topics and thus further prepare themselves for the requirements of the Master's module, in particular for the scientific discussion within the Master's seminar presentation and the defence of their Master's thesis.

Course type Seminar:

Students are able to give a specialised mathematical presentation independently. They can independently develop a mathematical problem from Probability Theory and Statistics, prepare it for a presentation and present it in an understandable way in the presentation and prepare a technically correct elaboration on the contents of the presentation. They will be able to independently fill any gaps, e.g. missing proofs/proof steps or missing illustrative examples.
With the seminar presentation and the preparation of the presentation, students develop both their ability to discuss and write mathematical texts. This prepares them further for the requirements of the Master's module, in particular the writing of the Master's thesis, the Master's seminar presentation including scientfic discussions and the defence of their Master's thesis.

Course type Project:
Students are able to plan, carry out and evaluate a specialised mathematical project (e.g. mathematical modelling of a concrete application situation, creation of a mathematical simulation, programming or software project,

development of a mathematical treatise/mathematical materials as part of a reading course) in the field of Probability Theory and Statistics, independently. In particular, they will have mastered the scientific content and methods required for the project, especially the independent proving of mathematical theorems.

Content of teaching

The courses in this module lead to current research questions in the field of Probability Theory and Statistics in terms of method and content. Possible contents include:

- Mathematics of machine learning
- Mathematics of Data Science
- Theory of large deviations
- Ruin probabilities
- Random walks
- High-dimensional statistics
- High-dimensional probability theory
- Random matrices
- Non-commutative probability theory

Recommended previous knowledge

Depending on the chosen subject, the requirements will be specified in the course announcement.

Necessary requirements

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Explanation regarding the elements of the module

In the module, students either attend a lecture with a tutorial or a seminar or carry out a project.

Module structure: 1 SL, 1 bPr [1]

Courses

Title	Type	Regular cycle	Workload [5]	LP [2]

Lecture Selected Topics in Probability Theory and Statistics	lecture	This module is part of a long-term overall curriculum plan for the Master's programme, which ensures that modules with an amount of at least 20 CP are offered in all five fields each year. The module is offered at irregular intervals as part of this overall curriculum planning.	30 h (30 + 0)	1 [Pr]
Project Selected Topics in Probability Theory and Statistics	project	This module is part of a long-term overall curriculum plan for the Master's programme, which ensures that modules with an amount of at least 20 CP are offered in all five fields each year. The module is offered at irregular intervals as part of this overall curriculum planning.	90 h (15 + 75)	3 [SL] [Pr]

Seminar Selected Topics in Probability Theory and Statistics	seminar	This module is part of a long-term overall curriculum plan for the Master's programme, which ensures that modules with an amount of at least 20 CP are offered in all five fields each year. The module is offered at irregular intervals as part of this overall curriculum planning.	90 h (30 + 60)	3 [SL] [Pr]
Tutorials Selected Topics in Probability Theory and Statistics	exercise	This module is part of a long-term overall curriculum plan for the Master's programme, which ensures that modules with an amount of at least 20 CP are offered in all five fields each year. The module is offered at irregular intervals as part of this overall curriculum planning.	60 h (30 + 30)	2 [SL]

Study requirements

Allocated examiner	Workload	LP[2]

Teaching staff of the course **Project Selected Topics in Probability Theory and Statistics (project)** *Regular exchange and scientific discussion on the project, for example in the form of short reports on the project status and questions on further project design*	see above	see above
Teaching staff of the course **Seminar Selected Topics in Probability Theory and Statistics (seminar)** *Regular contributions to the scientific discussion in the seminar, for example in the form of comments and questions on the seminar presentations.*	see above	see above
Teaching staff of the course **Tutorials Selected Topics in Probability Theory and Statistics (exercise)** *Regular completion of the exercises, each with a recognisable solution approach, as well as participation in the exercise groups for the module's lecture. As a rule, participation in the exercise group includes presenting solutions to exercises twice after being asked to do so as well as regular contributions to the scientific discussion in the exercise group, for example in the form of comments and questions on the proposed solutions presented. The organiser may replace some of the exercises with face-to-face exercises.*	see above	see above

Examinations

Allocated examiner	Type	Weighting	Workload	LP[2]
Teaching staff of the course **Lecture Selected Topics in Probability Theory and Statistics (lecture)** *(electronic) written examination in presence of usually 90 minutes, oral examination in presence or remote of usually 30 minutes, A remote electronic written examination is not permitted.*	e-Klausur o. Klausur o. mündliche e-Prüfung o. mündliche Prüfung	1	60h	2
Teaching staff of the course **Project Selected Topics in Probability Theory and Statistics (project)** *A corresponding product is created as part of the project ending date (e.g. mathematical model. simulation software, computer programme, treatise /materials). The project includes the planning, implementation and analysis of the project idea on a mathematical topic, the technically correct and comprehensible written description and evaluation (analysis) of the project, including essential mathematical contexts for the genesis and use of the product. The project must be 5-10 pages in length.*	Projekt mit Ausarbeitung	1	60h	2

Teaching staff of the course **Seminar Selected Topics in Probability Theory and Statistics (seminar)** *Correct and comprehensible presentation of a mathematical topic including essential steps of proof in a presentation, usually 90 minutes in length including a technical discussion.* *Technically correct and comprehensible written elaboration of the presentation including essential proof steps, 5-10 pages in length.*	Referat mit Ausarbeitung	1	60h	2

Further notices

If the module is taken together with module 24-M-PT-ST5b, the competences must have been acquired in different courses.

Legend

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1	The module structure displays the required number of study requirements and examinations.
2	LP is the short form for credit points.
3	The figures in this column are the specialist semesters in which it is recommended to start the module. Depending on the individual study schedule, entirely different courses of study are possible and advisable.
4	Explanations on mandatory option: "Obligation" means: This module is mandatory for the course of the studies; "Optional obligation" means: This module belongs to a number of modules available for selection under certain circumstances. This is more precisely regulated by the "Subject-related regulations" (see navigation).
5	Workload (contact time + self-study)
SoSe	Summer semester
WiSe	Winter semester
SL	study requirement
Pr	Examination
bPr	Number of examinations with grades
uPr	Number of examinations without grades