Probability and Statistics

Title	Probability and Statistics
Semester	F2023
Master programme in	Matematik / Mathematical Physical Modelling / Mathematical Computer Modelling / Mathematical Bioscience / Physics and Scientific Modelling
Type of activity	Course
Teaching language	English
Study regulation	Read about the Master Programme and find the Study Regulations at ruc.dk Læs mere om uddannelsen og find din studieordning på ruc.dk

REGISTRATION AND STUDY ADMINISTRATIVE

Registration	Sign up for study activities at stads selvbetjening within the announced registration period, as you can see on the Studyadministration homepage. When signing up for study activities, please be aware of potential conflicts between study activities or exam dates. The planning of activities at Roskilde University is based on the recommended study programs which do not overlap. However, if you choose optional courses and/or study plans that goes beyond the recommended study programs, an overlap of lectures or exam dates may occur depending on which courses you choose.
Number of participants	
ECTS	5
Responsible for the activity	Carsten Lunde Petersen (lunde@ruc.dk)
Head of study	Jesper Schmidt Hansen (jschmidt@ruc.dk)
Teachers	
Study administration	INM Registration & Exams (inm-exams@ruc.dk)
Exam code(s)	U60166

ACADEMIC CONTENT

Overall objective	The overall objective of the course in Probability and Statistics is to endow the student with a fundamental understanding of how the mathematical theory of probability and statistics is constructed, enabling the student to critically reflect on how statistical analysis of data is applied.
Detailed description of content	Probability theory as an axiomatic mathematical theory: ● The classical mathematical formalisation and clarification of the concepts of probability. ● This includes probability spaces, probability distribution, independence, contingent probability, probability distributions on final, countable quantities and continuous distributions on the real axis ● The most common distributions Statistics: ● Resampling techniques and non-parametric statistics ● Introduction to likelihood-based statistical inference ● Examples
Course material and Reading list	There is no formal text-books in this course. The curriculum consists of former lecture notes which will be handed out through moodle.
Overall plan and expected work effort	The course will be planned as a mixture of lectures and solving of exercises including discussions of exercises. The workload is 5 ECTS corresponding to 135 hours The stipulated workload distribution is: ● Pre-class 42 hours ● Classes 42 hours ● Post classes 42 hours ● Exam preparation 10 hours.
Format	
Evaluation and feedback	The course includes formative evaluation based on dialogue between the students and the teacher(s). Students are expected to provide constructive critique, feedback and viewpoints during the course if it is needed for the course to have better quality. Every other year at the end of the course, there will also be an evaluation through a questionnaire in SurveyXact. The Study Board will handle all evaluations along with any comments from the course responsible teacher. Furthermore, students can, in accordance with RUCs 'feel free to state your views' strategy through their representatives at the study board, send evaluations, comments or insights form the course to the study board during or after the course.
Programme	The course will be planned as a mixture of lectures and solving of exercises including discussions of exercises. Class by Class program will emerge on Moodle during the course with the following themes.

Probability theory:

- The classical mathematical formalisation and clarification of the concepts of probability.
- This includes probability spaces, probability distribution, independence, contingent probability, probability distributions on final, countable quantities and continuous distributions on the real axis
- The most common distributions

Statistics:

- Resampling techniques and non-parametric statistics
- Introduction to likelihood-based statistical inference
- Examples

ASSESSMENT

Overall learning outcomes

After the course the student will be able to

- compute with and understand the theory behind probability distributions, and model random phenomena using probability theory, stochastic variables and mathematical reasoning,
- apply parametric statistics to data, in particular in formulating hypotheses, assessing estimators, computing test probabilities and interpreting the results using mathematical and statistical reasoning,
- apply digital tools for statistical investigations, model simulation, and analysis,
- describe and explain the mathematical structure of probability theory,
- demonstrate in-depth understanding of how parametric statistics is built upon probability theory.
- analyse, evaluate and formulate models of stochastic phenomena using mathematical and statistical reasoning.
- present stochastic and statistical theories and methods in a clear and concise manner using mathematical formalism

Form of examination

Individual oral exam without time for preparation.

Time allowed for exam including time used for assessment: 30 minutes.

Permitted support and preparation materials: All.

Assessment: 7-point grading scale.
Moderation: Internal co-assessor.

Form of Re-examination

Samme som ordinær eksamen / same form as ordinary exam

Type of examination in special cases

Examination and assessment criteria

The students produce a portefolio consisting of 3 sets of exercises and one mini-project. All 4 can be handed-in for review by the teacher.

At the beginning of the exam the student draws a random portfolio element for presentation without further preparation. The presentation may be interrupted by clarifying questions and the presentation will be

followed by a discussion and questioning with in the curriculum of the course.

The Assessement chriteria for the written part of the exam

- compute with and understand the theory behind probability distributions, and model random phenomena using probability theory, stochastic variables and mathematical reasoning,
- apply parametric statistics to data, in particular in formulating hypotheses, assessing estimators, computing test probabilities and interpreting the results using mathematical and statistical reasoning,
- apply digital tools for statistical investigations, model simulation, and analysis,
- describe and explain the mathematical structure of probability theory
- demonstrate in-depth understanding of how parametric statistics is built upon probability theory.
- analyse, evaluate and formulate models of stochastic phenomena using mathematical and statistical reasoning.
- present stochastic and statistical theories and methods in a clear and concise manner using mathematical formalism

The assessment of the oral exam is based on the student's ability to meet the criteria mentioned above and their ability to

- clearly present and communicate the scientific content of the course
- engage in a scientific dialogue and discussion with the assessor and co assessor

Furthermore, whether the performance meets all formal requirements in regard to both for the written og oral exam

Exam code(s)	Exam code(s) : U60166

Course days:

Hold: 1

Probability and Statistics (MATHBIO)

time	13-02-2023 08:15 til 13-02-2023 10:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	27.1-052 - lokale 2 (20)
Teacher	Carsten Lunde Petersen (lunde@ruc.dk)

Probability and Statistics (MATHBIO)

time	16-02-2023 08:15 til 16-02-2023 10:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	27.1-052 - lokale 2 (20)
Teacher	Carsten Lunde Petersen (lunde@ruc.dk)

Probability and Statistics (MATHBIO)

time	20-02-2023 08:15 til 20-02-2023 10:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	27.1-052 - lokale 2 (20)
Teacher	Carsten Lunde Petersen (lunde@ruc.dk)

Probability and Statistics (MATHBIO)

time	23-02-2023 08:15 til 23-02-2023 10:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	27.1-052 - lokale 2 (20)
Teacher	Carsten Lunde Petersen (lunde@ruc.dk)

Probability and Statistics (MATHBIO)

time	27-02-2023 08:15 til 27-02-2023 10:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	27.1-052 - lokale 2 (20)
Teacher	Carsten Lunde Petersen (lunde@ruc.dk)

Probability and Statistics (MATHBIO)

time	02-03-2023 08:15 til 02-03-2023 10:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	27.1-052 - lokale 2 (20)
Teacher	Carsten Lunde Petersen (lunde@ruc.dk)

Probability and Statistics (MATHBIO)

time	06-03-2023 08:15 til 06-03-2023 10:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	27.1-089 - teorirum 27 (66)
Teacher	Carsten Lunde Petersen (lunde@ruc.dk)

Probability and Statistics (MATHBIO)

time	09-03-2023 08:15 til 09-03-2023 10:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	27.1-089 - teorirum 27 (66)
Teacher	Carsten Lunde Petersen (lunde@ruc.dk)

Probability and Statistics (MATHBIO)

time	13-03-2023 08:15 til 13-03-2023 10:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	27.1-089 - teorirum 27 (66)
Teacher	Carsten Lunde Petersen (lunde@ruc.dk)

Probability and Statistics (MATHBIO)

time	16-03-2023 08:15 til 16-03-2023 10:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	27.1-089 - teorirum 27 (66)
Teacher	Carsten Lunde Petersen (lunde@ruc.dk)

Probability and Statistics (MATHBIO)

time	20-03-2023 08:15 til 20-03-2023 10:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	27.1-089 - teorirum 27 (66)
Teacher	Carsten Lunde Petersen (lunde@ruc.dk)

Probability and Statistics (MATHBIO)

time	23-03-2023 08:15 til 23-03-2023 10:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	27.1-089 - teorirum 27 (66)
Teacher	Carsten Lunde Petersen (lunde@ruc.dk)

Probability and Statistics (MATHBIO)

time	27-03-2023 08:15 til 27-03-2023 10:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	27.1-089 - teorirum 27 (66)
Teacher	Carsten Lunde Petersen (lunde@ruc.dk)

Probability and Statistics (MATHBIO)

time	30-03-2023 08:15 til 30-03-2023 10:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	27.1-089 - teorirum 27 (66)
Teacher	Carsten Lunde Petersen (lunde@ruc.dk)

Probability and Statistics (MATHBIO)

time	03-04-2023 08:15 til 03-04-2023 10:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	27.1-089 - teorirum 27 (66)
Teacher	Carsten Lunde Petersen (lunde@ruc.dk)

Probability and Statistics (MATHBIO)

time	13-04-2023 08:15 til 13-04-2023 10:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	27.1-089 - teorirum 27 (66)
Teacher	Carsten Lunde Petersen (lunde@ruc.dk)

Probability and Statistics (MATHBIO)

time	17-04-2023 08:15 til 17-04-2023 10:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	27.1-089 - teorirum 27 (66)
Teacher	Carsten Lunde Petersen (lunde@ruc.dk)

Probability and Statistics (MATHBIO)

time	20-04-2023 08:15 til 20-04-2023 10:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	27.1-089 - teorirum 27 (66)
Teacher	Carsten Lunde Petersen (lunde@ruc.dk)

Probability and Statistics (MATHBIO)

time	24-04-2023 08:15 til 24-04-2023 10:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	27.1-089 - teorirum 27 (66)
Teacher	Carsten Lunde Petersen (lunde@ruc.dk)

Probability and Statistics (MATHBIO)

time	27-04-2023 08:15 til 27-04-2023 10:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	27.1-089 - teorirum 27 (66)
Teacher	Carsten Lunde Petersen (lunde@ruc.dk)

Probability and Statistics (MATHBIO)

time	01-05-2023 08:15 til 01-05-2023 10:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	27.1-052 - lokale 2 (20)
Teacher	Carsten Lunde Petersen (lunde@ruc.dk)

Probability and Statistics (MATHBIO)

time	04-05-2023 08:15 til 04-05-2023 10:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	27.1-052 - lokale 2 (20)
Teacher	Carsten Lunde Petersen (lunde@ruc.dk)

Probability and Statistics (MATHBIO)

time	08-05-2023 08:15 til 08-05-2023 10:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	27.1-052 - lokale 2 (20)
Teacher	Carsten Lunde Petersen (lunde@ruc.dk)

Probability and Statistics (MATHBIO)

time	11-05-2023 08:15 til 11-05-2023 10:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	27.1-052 - lokale 2 (20)
Teacher	Carsten Lunde Petersen (lunde@ruc.dk)

Probability and Statistics (MATHBIO)

time	15-05-2023 08:15 til 15-05-2023 10:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	27.1-052 - lokale 2 (20)
Teacher	Carsten Lunde Petersen (lunde@ruc.dk)

Probability and Statistics (MATHBIO)

time	22-05-2023 08:15 til 22-05-2023 10:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	27.1-052 - lokale 2 (20)
Teacher	Carsten Lunde Petersen (lunde@ruc.dk)

Probability and Statistics - Exam (MATHBIO)

time	07-06-2023 08:15 til 07-06-2023 16:00
location	27.1-052 - lokale 2 (20)
Teacher	Carsten Lunde Petersen (lunde@ruc.dk)

Probability and Statistics - Reexam (MATHBIO)

time	08-08-2023 08:15 til 08-08-2023 16:00
location	27.1-052 - lokale 2 (20)
Teacher	Carsten Lunde Petersen (lunde@ruc.dk)