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LUND UNIVERSITY
Faculty of Science

Faculty Board

General Syllabus for Third-Cycle Studies in Mathematical Statistics, NAMSTI02

This is a translation of the general syllabus approved in Swedish.

This syllabus was approved by the Board of the Faculty of Science on 18 December 2013 and applies to third-cycle students admitted from 1 January 2014.

The syllabus is based on the Higher Education Ordinance (1993:100) Chapter 6 Sections 1–11, 25–36, Chapter 7 Sections 34–41 and Annex 2 Qualifications Ordinance.

1. Available degrees

The programme described in this syllabus can lead to one of the following degrees:

Doctor of Philosophy in Mathematical Statistics
Licentiate of Philosophy in Mathematical Statistics

In consultation with the Faculty of Engineering/LTH, the Faculty Board has decided (NA35 643/2005) that students admitted to third-cycle studies at the Faculty of Science on the basis of an MSc in Engineering shall be entitled to be awarded the degrees of Doctor of Philosophy in Science or Licentiate of Science without special application.

2. Subject description

Mathematical Statistics comprises probability theory and statistical theory with applications within all sectors of society and especially within science, engineering, medicine and finance.

The principal task of probability theory is to develop mathematical models for describing and analysing processes characterised by chance and to study the mathematical properties of such models. Within statistical theory, focus is placed on the principles and methods for constructing and testing the models on the basis of empirical data. Another task of the discipline is to develop methods for experimental verification of the models in collaboration with the areas of application. Probability theory and statistical theory are closely associated, as statistical theory is based on probability theory and frequently highlights probability theory issues.

The research and research studies conducted within Mathematical Statistics deal both with basic probability theory and statistical theory and with different areas of application, mainly modelling within science, engineering and finance, and biostatistics and bioinformatics.

The current research areas are described on the department website http://www.maths.lu.se/forskning/forskningsavdelningar/matematisk-statistik/.

3. Objectives

Third-cycle courses and study programmes shall be based fundamentally on the knowledge acquired by students in first- and second-cycle courses and study programmes, or its equivalent. In addition to the requirements for first- and second-cycle courses and study programmes, third-cycle courses and study programmes shall develop the knowledge and skills required to be able to undertake autonomous research.

The third-cycle programme in Mathematical Statistics aims to provide students with basic knowledge of the different branches of Mathematical Statistics, good insights into research methodology, an overview of international developments within the discipline and the knowledge and understanding within at least one area that is required to pursue independent research. A further aim of the programme is to enable students to be well prepared for other tasks requiring profound insights into mathematical statistics and statistical research and investigation methods.

The general outcomes for third-cycle courses and study programmes are defined in the Higher Education Ordinance Annex 2 Qualifications Ordinance.

3.1. Outcomes for a degree of Doctor

Knowledge and understanding

For the degree of Doctor the third-cycle student shall

– demonstrate broad knowledge and systematic understanding of the research field as well as advanced and up-to-date specialised knowledge in a limited area of this field, and

– demonstrate familiarity with research methodology in general and the methods of the specific field of research in particular.

Competence and skills

For the degree of Doctor the third-cycle student shall

– demonstrate the capacity for scholarly analysis and synthesis as well as the ability to review and assess new and complex phenomena, issues and situations autonomously and critically

– demonstrate the ability to identify and formulate issues with scholarly precision critically, autonomously and creatively, and to plan and use appropriate methods to undertake research and other qualified tasks within predetermined time frames and to review and evaluate such work

– demonstrate through a thesis the ability to make a significant contribution to the formation of knowledge through his or her own research

– demonstrate the ability in both national and international contexts to present and discuss research and research findings authoritatively in speech and writing and in dialogue with the academic community and society in general

– demonstrate the ability to identify the need for further knowledge and

– demonstrate the capacity to contribute to social development and support the learning of others both through research and education and in some other qualified professional capacity.

Judgement and approach

For the degree of Doctor the third-cycle student shall

– demonstrate intellectual autonomy and disciplinary rectitude as well as the ability to make assessments of research ethics, and

– demonstrate specialised insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used.

Outcomes for a degree of Doctor in Mathematical Statistics

On completion of the programme, the doctoral student shall be able to conduct high-quality research within at least one area of Mathematical Statistics. The research shall be of a standard that is comparable with that required for a doctoral degree at peer institutions abroad.

3.2. Outcomes for a degree of Licentiate

Knowledge and understanding

For a Degree of Licentiate the third-cycle student shall

– demonstrate knowledge and understanding in the field of research including current specialist knowledge in a limited area of this field as well as specialised knowledge of research methodology in general and the methods of the specific field of research in particular.

Competence and skills

For a Degree of Licentiate the third-cycle student shall have:

– demonstrate the ability to identify and formulate issues with scholarly precision critically, autonomously and creatively, and to plan and use appropriate methods to undertake a limited piece of research and other qualified tasks within predetermined time frames in order to contribute to the formation of knowledge as well as to evaluate this work

– demonstrate the ability in both national and international contexts to present and discuss research and research findings in speech and writing and in dialogue with the academic community and society in general, and

– demonstrate the skills required to participate autonomously in research and development work and to work autonomously in some other qualified capacity.

Judgement and approach

For a Degree of Licentiate the third-cycle student shall

– demonstrate the ability to make assessments of ethical aspects of his or her own research

– demonstrate insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used, and

– demonstrate the ability to identify the personal need for further knowledge and take responsibility for his or her ongoing learning.

4. Admission requirements

The requirements for admission to third-cycle courses and study programmes are that the applicant meets the general and specific entry requirements that the higher education institution may have laid down, and is considered in other respects to have the ability required to benefit from the course or study programme.

General admission requirements

A person meets the general entry requirements for third-cycle courses and study programmes if he or she:

1. has been awarded a second-cycle qualification, or

2. has satisfied the requirements for courses comprising at least 240 credits of which at least 60 credits were awarded in the second cycle, or

3. has acquired substantially equivalent knowledge in some other way in Sweden or abroad.

The head of department may permit an exemption from the general entry requirements for an individual applicant, if there are special grounds.

Transitional provision: Those who meet the general admission requirements for doctoral programmes before 1 July 2007 will also be considered to meet the general admission requirements for third-cycle courses and study programmes until the end of June 2015.

If a specific number of credits or a qualification from previous first- or second-cycle courses and study programmes are required for admission to third-cycle courses and study programmes, those with corresponding credits or qualifications from undergraduate programmes awarded before 1 July 2007 will also be eligible.

Specific admission requirements

To be admitted to the third-cycle programme in Mathematical Statistics the student must have passed independent study courses in mathematics comprising at least 60 credits including at least 30 credits in mathematical statistics. A degree project of at least 30 credits is also required.

Equivalent knowledge acquired through corresponding programmes will be assessed individually.

5. Selection

In selecting between applicants who meet the requirements, their ability to benefit from the course or study programme shall be taken into account. However, the fact that an applicant is considered able to transfer credits from prior courses and study

programmes or for professional or vocational experience may not alone give the applicant priority over other applicants.

The following selection criteria will be applied:

Study record from undergraduate and Master's courses or the equivalent. The breadth, depth and relevance of undergraduate and Master's courses or the equivalent. The quality of the degree project and other independent work.

Other knowledge and skills of relevance to the research specialisation.

Suitable candidates should be called to an interview, if possible.

The recruitment and selection to third-cycle studies must always take diversity and gender balance into account, in compliance with the Lund University gender equality policy, equal opportunities policy and diversity plan. The underrepresented gender should always be given precedence in cases of equal qualifications, unless there are valid reasons to the contrary.

Furthermore, it must be possible for the department to offer expert supervision in the student's research specialisation.

6. Degree requirements

The completion of the third cycle programme results in a degree of Doctor of Philosophy or, if the student so wishes or if this is stated in the admission decision, a degree of Licentiate. The student may also but is not obliged to complete a degree of Licentiate as a stage in the third-cycle programme.

The degree of Doctor comprises 240 credits and the degree of Licentiate 120 credits.

For a degree of Doctor or Licentiate the research student must have successfully completed a PhD or Licentiate thesis and passed all courses and other components specified below. The head of department (or person to whom the task has been delegated) is to check and determine if all the formal requirements of a degree of Doctor or Licentiate have been satisfied.

6.1. Thesis

The programme is to include a research project documented in a PhD or Licentiate thesis. The thesis is to be defended orally at a public defence and reviewed by a faculty examiner (opponent).

PhD thesis

The PhD thesis is to comprise at least 120 credits.

The PhD thesis can be designed as *compilation thesis* or as a *monograph*.

A compilation thesis consists of copies of a number of research articles or manuscripts and a summarising chapter. The articles may be written by the doctoral student individually or in cooperation with others, but the summarising

chapter must be written individually by the doctoral student. The research articles must be of a quality required for publication in recognised peer-reviewed journals and it must be possible to determine the contributions of different authors. The summarising chapter is to consist of an introduction to the research area of the thesis and a presentation and discussion of the findings of the articles. The presentation and discussion shall be written in a form and style that is independent and different from the articles. This makes it possible to situate the findings in a wider context.

A monograph thesis is a unified report including descriptions of the research issue, research questions, methods, analysis, findings and discussion.

Licentiate thesis

The Licentiate thesis is to comprise at least 60 credits.

The Licentiate thesis can be designed as a summary of at least one research article (or manuscript), written by the student individually or in cooperation with others, or a unified research report (monograph). The thesis must be of a quality required for publication in recognised peer-reviewed journals and it must be possible to determine the contributions of different authors. For more information on summary and monograph theses, please see compilation thesis and monograph thesis above.

6.2. Courses and other programme components

The courses and other components of the third-cycle programme in Mathematical Statistics are to comprise 90–120 credits for a degree of Doctor and 40–60 credits for a degree of Licentiate.

The required courses and other components can be offered at Lund University or at other higher education institutions. The head of department (or person to whom the task has been delegated) determines the number of credits that can be transferred from courses and other components offered at other faculties or higher education institutions.

The individual study plan is to specify the courses required for the individual doctoral student and the courses for which the student may transfer credits. The compulsory courses include an introductory course of 1.5 credits and, for doctoral students who teach, the course Introduction to teaching methods (3 credits). The course component of the programme must also include courses in probability theory, stochastic theory and inference theory. The courses can be selected from the following areas:

Probability theory and stochastic processes: Mathematical Foundations of Probability, Measure Theory, Probability Theory, Weak Convergence, Martingales, Stochastic Differential Equations, Stationary Processes, Markov Processes, Diffusion Processes.

Inference Theory: Basic Inference Theory, Asymptotic Theory, Likelihood Theory, Bayesian Inference, Inferences for Stochastic Processes, Time Series Analysis, Non-Parametric Inference, Robust Inference.

In the individual study plan, the courses are to be grouped into components A–E below:

A. Introductory courses. On the basis of prior knowledge, the student is to select the courses in probability theory, stochastic processes and inference theory that provide a solid foundation for further studies on the programme.

B. Additional courses in probability theory and stochastic processes. Courses not included in A above.

C. Additional courses in inference theory. Courses not included in A above.

D. Courses in associated subjects. The student is primarily to select courses in mathematics, numerical analysis and computer science. Courses in science and economics, and relevant courses of a general character can also be included.

E. Specialisation courses. The student is to select courses in a specific field, usually within the field of the thesis topic. Courses in other subjects and project courses in applied mathematical statistics can be included here.

Degree of Doctor

For a degree of Doctor, the student must pass courses of at least 90 credits, including A courses of no more than 10 credits, and B, C and E courses of at least 10, 10 and 20 credits respectively.

Degree of Licentiate

For a degree of Licentiate, the student must pass courses of at least 40 credits, including A courses of no more than 10 credits, and B and C of at least 7.5 credits each.