

Department of Statistics

General Syllabus for Third-Cycle Studies in Statistics for the Degree of Doctor at Lund University School of Economics and Management

The syllabus for third-cycle studies in Statistics was adopted by the Board of the School of Economics and Management on 30 June 2016, revised on 19 October 2018. Replaces earlier syllabus with reg. no U 2016/314. See also *Regulations for third-cycle studies at the School of Economics and Management*, reg. no STYR 2018/1589.

Third-cycle studies are offered to the extent that available resources allow.

1. Description of third-cycle subject area

Statistics is a science that deals with methods and techniques for the collection, analysis and interpretation of empirical data. Central to the subject is quantification of variation and uncertainty using probability theory. Statistical methods are used in social sciences, such as business administration, economics and economic history, as in science, technology and medicine.

2. Aim of the programme and learning outcomes

The third-cycle programme in statistics is to provide students with broad knowledge of the central aspects of the subject of statistics, specialised knowledge in one area of statistical expertise, the ability to apply statistical methods to practical problems and the ability to monitor published research in the subject and conduct their own research.

Knowledge and understanding

For a Degree of Doctor, the doctoral student shall

- demonstrate broad knowledge and systematic understanding of the research field as well as advanced and up-to-date specialised knowledge in his or her artistic field, and
- demonstrate familiarity with artistic research methodology in general and the methods of the specific field of research in particular.

Competence and skills

For a Degree of Doctor, the doctoral student shall

- demonstrate creative capacity in his or her artistic field
- demonstrate the capacity for artistic analysis and synthesis as well to review and assess new and complex phenomena, issues and situations autonomously and critically

- demonstrate the ability to identify and formulate artistic issues with scholarly precision critically, autonomously and creatively, and to plan and use appropriate methods to undertake research and other qualified artistic tasks within predetermined time frames and to review and evaluate such work
- demonstrate through a documented artistic research project 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 a Degree of Doctor, the doctoral student shall

- demonstrate intellectual autonomy, artistic integrity and disciplinary rectitude as well as the ability to make assessments of research ethics, and
- demonstrate specialised insight into the possibilities and limitations of art, its role in society and the responsibility of the individual for how it is used.

3. Admission requirements

3.1 General admission requirements

An applicant meets the general admission requirements for third-cycle studies if he or she has

- 1) obtained a second cycle degree,
- 2) completed at least 240 credits, including at least 60 second cycle credits, or
- 3) acquired equivalent knowledge in some other way, in Sweden or abroad.

3.2 Specific admission requirements

An applicant is eligible to be admitted to the third-cycle programme in statistics if he or she meets the general admission requirements and has

- 1) completed at least 90 credits in statistics, including an independent project worth at least 15 credits, or has
- 2) completed 60 second cycle credits in statistics.

An applicant may also be considered to have fulfilled the specific admission requirements if he or she has acquired equivalent knowledge in some other way, either in Sweden or abroad.

4. Admission and selection

There are no regular periods of application for third-cycle studies; rather, admission takes place in connection with a vacancy announcement. Admission decisions are made by the head of department after preparation by a collegial body. Since places are limited, a selection must be made among the applicants, based on their qualifications at the time of application. A crucial selection criterion is their

ability to benefit from the programme. The selection is primarily based on the students' academic performance and the quality of their independent project/s.

A financing plan must be submitted by the time of admission, stating the financial circumstances of the applicant for the duration of their studies. For admission, the student must be deemed to be financed to an extent allowing successful completion of the programme within four years of full-time study for a doctoral degree.

5. Programme structure and content

5.1. Programme structure

The third-cycle programme leading to a doctoral degree normally demands four years of full-time study. If the student is appointed to a doctoral studentship and carries out departmental duties to an extent of no more than 20 per cent of the post, the duration of the period of study will be extended correspondingly. The programme comprises 240 credits, divided into a course component of 100 credits and a thesis component of 140 credits.

The teaching consists of courses and seminars, held at the department and/or Division of Mathematical Statistics to enable students to establish contacts with the doctoral students there.

Furthermore, the organisation *GRAPES* offers joint courses for doctoral students in statistics at several Swedish higher education institutions. *GRAPES* helps to ensure that the courses have a sufficient number of students, thereby creating a common environment that is otherwise difficult to sustain in view of the limited number of doctoral students in statistics in Sweden.

Exams on courses and literature take place during or in connection with the courses. They may be oral and/or written and are graded either Pass or Fail. Participation in advanced seminar activities is compulsory, unless there are special circumstances.

5.2. Individual study plan

An individual study plan shall be drawn up for all doctoral students, stating the structure of the studies and the financing. The study plan is to be drawn up in consultation with the supervisors and approved by the head of department. It is to be reviewed at least once every year. If the doctoral student substantially neglects his or her undertakings in the individual study plan his or her right to supervision and other study resources may be withdrawn.

5.3. Supervision

At least two supervisors shall be appointed for each doctoral student at the department. At least one of the supervisors is to have the qualifications of an associate professor. All supervisors are to have undergone training for supervision in third-cycle education. When assigning supervisors, the requests of the students are to be taken into account as much as possible.

Information regarding the change of supervisor is available in *Procedure for the change of supervisor at the School of Economics and Management*, reg. no STYR 2016/860.

5.4 Courses

The course component is divided into three blocks: compulsory courses, strongly recommended general specialisation courses and courses that specifically concern the thesis topic of the doctoral student. For a degree of doctor, the following courses are compulsory:

- a) Probability Theory, 15 credits,
- b) Statistical Inference Theory, 15 credits
- c) Advanced Statistics, 15 credits

The first two courses, which are normally taken during the first year of study, cover basic and advanced concepts in the subject and are occasionally offered in cooperation with the Division of Mathematical Statistics, or within the framework of *GRAPES*. The third course, which is to be taken during the second year or in the beginning of the third, introduces the doctoral student to the latest results in the field of their respective thesis topics.

The strongly recommended courses offered by the department are:

- a) Multivariate Analysis
- b) Financial Statistics
- c) Data Mining and Visualisation
- d) Statistical Calculation Methods

Each course comprises 7.5 credits. They are offered as second cycle courses, and in order to be able to transfer the credits towards a doctoral degree, the student must complete an additional exam or a supplementary minor research project.

Additionally, a course in Research ethics (3 credits) is highly recommended by the faculty. If possible, the course is to be taken early during the studies. The research ethics course aims to give doctoral students good conditions to conduct their research in accordance with applicable ethics and good research practice.

Doctoral students may also select additional courses among the following courses offered at the Division of Mathematical Statistics:

- a) Stationary Stochastic Processes
- b) Markov Processes
- c) Statistical Modelling of Multivariate Extreme Values
- d) Monte Carlo and Empirical Methods for Stochastic Inference
- e) Spatial Statistics with Image Analysis
- f) Stationary and Non-Stationary Spectral Analysis

Doctoral students may also choose courses offered within *GRAPES*.

5.5 Thesis project

As part of the thesis project, doctoral students are to actively participate in seminars on the research activities of the department and the thesis projects of other doctoral students. The doctoral students shall be given the opportunity to present theoretical and/or methodological issues of their projects, submit thesis drafts, and critically review the papers of other doctoral students. The students are

to present their thesis projects at no less than three seminars, and are expected to present their research results at national or international conferences.

The thesis is to be an independent research project, designed either as a single cohesive work (monograph thesis) or as a compilation of research papers and a brief summary (compilation thesis). The papers that are part of a compilation thesis should either have been published in an international journal with an associated peer review or be of such high quality that publication can be expected.

A draft for a final version of the thesis should be ready for evaluation three months prior to the planned public defence. An external expert will be appointed to assess whether the thesis meets the requirements. (The expert must have the qualifications of at least an associate professor and thus be eligible for nomination as a member of the examining committee for the thesis.) The assessment is to be taken into account when preparing the final version of the thesis.

All doctoral theses must be defended at a public defence. A critical reviewer and examining committee will be appointed by the School of Economics and Management. The thesis will be graded either Pass or Fail. Further information regarding the thesis, public defence and the examining committee is available in *Regulations for third-cycle studies at the School of Economics and Management*, reg. no STYR 2018/1589.

General Syllabus for Third-Cycle Studies in Statistics for the Degree of Licentiate at Lund University School of Economics and Management

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1. Description of third-cycle subject area

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2. Aim of the programme and learning outcomes

The third-cycle programme in statistics is to provide students with broad knowledge of the central aspects of the subject of statistics, specialised knowledge in one area of statistical expertise, the ability to apply statistical methods to practical problems and the ability to monitor published research in the subject and conduct their own research.

Knowledge and understanding

For a degree of Licentiate, the research students shall:

- 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 research students shall:

- 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 research students 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.

3. Admission requirements3.1 General admission requirements

An applicant meets the general admission requirements for third-cycle studies if he or she has

- 4) obtained a second cycle degree,
- 5) completed at least 240 credits, including at least 60 second cycle credits, or
- 6) acquired equivalent knowledge in some other way, in Sweden or abroad.

3.2 Specific admission requirements

An applicant is eligible to be admitted to the third-cycle programme in statistics if he or she meets the general admission requirements and has

- 3) completed at least 90 credits in statistics, including an independent project worth at least 15 credits, or has
- 4) completed 60 second cycle credits in statistics.

An applicant may also be considered to have fulfilled the specific admission requirements if he or she has acquired equivalent knowledge in some other way, either in Sweden or abroad.

4. Admission and selection

There are no regular periods of application for third-cycle studies; rather, admission takes place in connection with a vacancy announcement. Admission decisions are made by the head of department after preparation by a collegial body. Since places are limited, a selection must be made among the applicants, based on their qualifications at the time of application. A crucial selection criterion is their ability to benefit from the programme. The selection is primarily based on the students' academic performance and the quality of their independent project/s.

A financing plan must be submitted by the time of admission, stating the financial circumstances of the applicant for the duration of their studies. For admission, the student must be deemed to be financed to an extent allowing successful completion of the programme within two years of full-time study for a licentiate degree.

5. Programme structure and content

5.1 Programme structure

The third-cycle programme leading to a licentiate degree normally demands two years of full-time study. If the student is appointed to a doctoral studentship and carries out departmental duties to an extent of no more than 20 per cent of the post, the duration of the period of study will be extended correspondingly. The programme comprises 120 credits, divided into a course component of 60 credits and a thesis component of 60 credits.

The teaching consists of courses and seminars, held at the department and/or Division of Mathematical Statistics to enable students to establish contacts with the research students there.

Furthermore, the organisation *GRAPES* offers joint courses for research students in statistics at several Swedish higher education institutions. *GRAPES* helps to ensure that the courses have a sufficient number of students, thereby creating a common environment that is otherwise difficult to sustain in view of the limited number of research students in statistics in Sweden.

Exams on courses and literature take place during or in connection with the courses. They may be oral and/or written and are graded either Pass or Fail. Participation in advanced seminar activities is compulsory, unless there are special circumstances.

5.2 Individual study plan

An individual study plan shall be drawn up for all research students, stating the structure of the studies and the financing. The study plan is to be drawn up in consultation with the supervisors and approved by the head of department. It is to be reviewed at least once every year. If the research student substantially neglects his or her undertakings in the individual study plan his or her right to supervision and other study resources may be withdrawn.

5.3 Supervision

At least two supervisors shall be appointed for each research student at the department. At least one of the supervisors is to have the qualifications of an associate professor. All supervisors are to have undergone training for supervision in third-cycle education. When assigning supervisors, the requests of the students are to be taken into account as much as possible. Instructions concerning changing supervisors are provided in *Procedure for the change of supervisor at the School of Economics and Management*, reg. no STYR 2016/860.

5.4 Courses

The course component is divided into three blocks: compulsory courses, strongly recommended general specialisation courses and courses that specifically concern the thesis topic of the research student. For a degree of licentiate, the following courses are compulsory:

- a) Probability Theory, 15 credits,
- b) Statistical Inference Theory, 15 credits

These courses, which are normally taken during the first year of study, cover basic and advanced concepts in the subject and are occasionally offered in cooperation with the Division of Mathematical Statistics, or within the framework of *GRAPES*.

The strongly recommended courses offered by the department are:

- a) Multivariate Analysis
- b) Financial Statistics
- c) Data Mining and Visualisation
- d) Statistical Calculation Methods

Each course comprises 7.5 credits. They are offered as second cycle courses, and in order to be able to transfer the credits towards a licentiate degree, the research student must complete an additional exam or a supplementary minor research project.

Additionally, a course in Research ethics (3 credits) is highly recommended by the faculty. If possible, the course is to be taken early during the studies. The research ethics course aims to give research students good conditions to conduct their research in accordance with applicable ethics and good research practice.

Research students may also select additional courses among the following courses offered at the Division of Mathematical Statistics:

- a) Stationary Stochastic Processes
- b) Markov Processes
- c) Statistical Modelling of Multivariate Extreme Values
- d) Monte Carlo and Empirical Methods for Stochastic Inference
- e) Spatial Statistics with Image Analysis
- f) Stationary and Non-Stationary Spectral Analysis

Research students may also choose courses offered within *GRAPES*.

5.5 Thesis project

As part of the thesis project, research students are to actively participate in seminars on the research activities of the department and the thesis projects of other research students. The students shall be given the opportunity to present theoretical and/or methodological issues of their projects, submit thesis drafts, and critically review the papers of other research students. The students are to present their thesis projects at one seminar at least.

The licentiate thesis is to be an independent research project, designed either as a single cohesive work (monograph thesis) or as a compilation of research papers and a brief summary (compilation thesis).

The licentiate thesis is to be defended at a public seminar. A critical reviewer and examiner for the seminar will be appointed by the School of Economics and Management. The critical reviewer must at least have a PhD. The examiner is to have the qualifications of at least an associate professor and may not be one of the research student's supervisors. The thesis will be graded either Pass or Fail.

Further information regarding the thesis, public defence and the examiner is available in *Regulations for third-cycle studies at the School of Economics and Management*, reg. no STYR 2018/1589.