LINKÖPINGS UNIVERSITET

Master's Programme in Statistics and Machine Learning

Master's Programme in Statistics and Machine Learning
120 credits

F7MML

Valid from: 2024 Autumn semester

Determined by

Board of the Faculty of Arts and Sciences

Date determined

2023-06-01

Revised by

Chairman of the Course and Programme Syllabus Board at the Faculty of Arts
and Sciences

Revision date

2023-12-20

Registration number

LiU-2023-02082

Offered first time

Autumn semester 2024

Offered for the last time

Replaced by

Introduction

The rapid development of IT has led to society being flooded with enormous
volumes of information generated by large or complex systems. These information
volumes can be updated in real-time, stored in large databases, or result from the
interaction between the system and the learning environment. This advanced-
level program applies models and algorithms in statistics and machine learning to
meet the challenges of learning from information volumes. Statistical models and
analyses are integrated with machine learning, data mining, and data
management to form a solid foundation for professional work using information
modeling and data analysis in everything from small to large, complex
systems. The program also provides excellent qualifications for a research career.

Aim

National Qualifications according to the Swedish Higher Education Act

Knowledge and understanding

For a master's degree, the student shall

- demonstrate knowledge and understanding in the main field of statistics,
  including both broad knowledge of the field and considerably deepened
  knowledge in certain parts of the field, as well as deep insight into current
  research and development work, and
- demonstrate deepened methodological knowledge in the main field of
  statistics.

Competence and skills

For a Master'a degree, the student shall

- demonstrate the ability to critically and systematically integrate knowledge
  and to analyze, assess, and handle complex phenomena, issues, and
  situations even with limited information,
- demonstrate the ability to critically, independently, and creatively identify
  and formulate issues, to plan and with adequate methods carry out
  qualified tasks within given time frames and thereby contribute to
  knowledge development as well as to evaluate this work,
- demonstrate, both nationally and internationally, the ability to orally and in
  writing clearly
- present and discuss conclusions and the knowledge and arguments
  underlying them in dialogue with different groups
- demonstrate the proficiency required to participate in research and
  development work or to independently work in other qualified activities.

Judgement and approach

For a master's degree, the student shall

- demonstrate the ability to make assessments in the main field of statistics with regard to relevant scientific, societal, and ethical aspects and demonstrate awareness of ethical aspects of research and development work,
- demonstrate insight into the possibilities and limitations of science, and especially the possibilities and limitations of statistics, its role in society, and people's responsibility for how it is used, and
- demonstrate the ability to identify their need for further knowledge and to take responsibility for their knowledge development.

Local goals

For a master's degree, the student shall be able to

- implement powerful, modern analysis models in statistics and machine learning using appropriate programming languages,
- extract, structure, and model information volumes generated by large or complex systems using advanced software,
- combine information from data with different sources of prior information to enhance statistical inference, predictive ability, and decision-making,
- discover and statistically review patterns and trends in data.

Content

The program incorporates data-analytical education created through courses in statistics and machine learning in synergy with complementary courses in computer science. The program consists of initial, mandatory courses in statistics, machine learning, and computer science during the first year. Profiling and complementary elective courses are offered in the third semester. For elective courses, at least five students are required for the course to be given. The program concludes with a master's thesis in statistics during the fourth semester.

Initial, mandatory courses contain theoretical and practical tools necessary to solve various problems in statistics and machine learning. The profiling courses include models and methods in statistics that provide a deeper probabilistic understanding of machine learning and data analysis. Complementary courses have a diverse character related to statistics or machine learning and are aimed at a specific application area or an advanced method domain. In the third semester, there is also the opportunity for exchange studies.

The master's thesis in statistics (30 credits) allows students to apply their theoretical and practical knowledge to solve a current practical data-analytical problem or delve into a research-related project.

The heading "Curriculum" contains a list of courses included in the programme. The course syllabuses for these describe in more detail the contents, teaching and working methods, and examination.

Teaching and working methods

The program's courses consist of lectures, computer labs, seminars, and supervision.

The course syllabuses describe in more detail the contents, teaching and working methods, and examination.

Entry requirements

- Bachelor's degree equivalent to a Swedish Kandidatexamen in one of the
  following subject areas:
  -statistics
  -mathematics
  -applied mathematics
  -computer science
  -engineering
  or a similar degree
- Completed courses with passing grade in following subjects:
  - calculus
  - linear algebra
  - statistics
  - programming
- English corresponding to the level of English in Swedish upper secondary
  education (Engelska 6 or Engelska nivå 2)
  Exemption from Swedish

Threshold requirements

For admission to courses within the programme, see the respective syllabus for
specific entry requirements

Degree requirements

A student in the program can obtain a degree certificate with the designation
Master of Science (120 credits) with a major in Statistics, provided that the
student has completed courses equivalent to 90 credits, including mandatory
courses equivalent to 60 credits. The student shall also have completed the
mandatory master's thesis course comprising 30 credits. In addition, the student
must meet the general and specific entry requirements, including proof of holding
a bachelor's degree or equivalent degree.

Completed courses will be listed in the degree certificate.

Course requirements to achieve a degree can be found in Appendix 2 to the Higher
Education Ordinance (1993:100). Precise requirements for general degrees at
first-cycle and second-cycle level can be found in LiU's current regulations.

A degree certificate will be issued by the faculty board on application by the
student. A diploma supplement will be included as an appendix to the degree
certificate.

Degree in Swedish

Filosofie masterexamen med huvudområde Statistik

Degree in English

Degree of Master of Science (120 credits) with a major in Statistics

Specific information

Teaching language

The teaching language is English.

Transferred credits

Decisions about transferring credit are taken by the faculty board, or by a person designated by the board, after application from the student.

Other information

If special circumstances prevail, the vice-chancellor may in a special decision specify the preconditions for temporary deviations from this programme syllabus, and delegate the right to take such decisions.

Curriculum

Semester 1 (Autumn 2026)

Course code	Course name	Credits	Level	Weeks	Timetable module	ECV
732A60	Advanced Academic Studies	3	A1N	v202635-202644	4	C
732A94	Advanced Programming in R	6	A1N	v202636-202644	1	C
732A83	Statistical Methods	9	A1N	v202636-202649	3	C
732A99	Machine Learning	9	A1N	v202645-202702	1/4	C
732A70	Introduction to Python	3	A1N	v202649-202702	4	C

Semester 2 (Spring 2027)

Preliminary courses

Course code	Course name	Credits	Level	Weeks	Timetable module	ECV
732A54	Big Data Analytics	6	A1N		3	C
732A75	Advanced Data Mining	6	A1F		3	C
732A82	Deep Learning	6	A1F		4	C
732A89	Computational Statistics	6	A1N		2	C
732A91	Bayesian Learning	6	A1F		2	C

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Semester 3 (Autumn 2027)

Preliminary courses

Course code	Course name	Credits	Level	Weeks	Timetable module	ECV
732A51	Bioinformatics	6	A1F		3	E
732A57	Database Technology	6	A1F		1	E
732A63	Probability Theory	6	A1F		3	E
732A76	Research Project	6	A1F		4	E
732A80	Time Series and Sequence Learning	6	A1F		2	E
732A81	Text Mining	6	A1F		2	E
732A88	Multivariate Statistical Methods	6	A1F		4	E
732A96	Advanced Machine Learning	6	A1F		1	E
732A98	Visualization	6	A1N		4	E

Semester 4 (Spring 2028)

Preliminary courses

Course code	Course name	Credits	Level	Weeks	Timetable module	ECV
732A67	Master Thesis in Statistics	30	A2E		1/2/3/4	C

ECV = Elective / Compulsory /Voluntary
*Kursen läses över flera terminer