School of Economics and Management

EAGDA, Master's Programme in Data Analytics and Business Economics, 60 credits

Magisterprogram i Data Analytics and Business Economics, 60 högskolepoäng

Second cycle degree programme requiring previous university study / *Program med akademiska förkunskapskrav och med slutlig examen på avancerad nivå*

Decision

The programme syllabus is established by The Faculty Board of the School of Economics and Management 17-06-2020 to be valid from 30-08-2021, autumn semester 2021.

Programme description

The programme aims to train students in understanding the role of data analytics in the digital economy in general, and in particular how organisations can utilize the increasing availability of "big data" to their advantage by making better-informed decisions. Students will learn programming and data management, how to use statistical machine learning tools in order to explore and deduct patterns from data, and how to incorporate the results obtained into strategic decision making.

Furthermore, the aim is for students to develop their communicative and collaborative skills. In particular, students should not only be able to work the number and draw conclusions but should also be able to clearly communicate their results to data technicians and business managers alike. For this to be possible, students must understand the business-economic context in which they will be working and have the means to communicate the information contained in results derived from advanced statistical techniques in an easy-to-understand fashion. The students must also be aware of the relevant data legislation and ethical considerations, and why it is important to ensure regulatory compliance when working with sensitive data.

The aim of the programme is achieved through a careful mix of lectures, seminars,

hands-on case assignments, computer labs and self-studies. While the bulk of the instructors are selected expert researchers from across the departments of the School, parts of the teaching is carried out in collaboration with partner companies and institutions that are working with data analytics.

Career opportunities

An increasing number of companies are searching for analytically talented individuals with statistical and programming skills that also understand the business-economic context in which they will be working, as well as the relevant legal and ethical boundaries of that work. Our employer partners tell us that this combination of skills is particularly sought after and that is something many other analysts fall well short of. The aim of the present programme is to fill this gap in the labour market.

Connections to further studies

The students of this programme may come from different disciplines; however, they are all technically oriented. After graduating, they have a solid background in statistical machine learning and empirical data work. These are treats that are highly valued in PhD education in, for example, economics, business and statistics. Programme graduates are therefore well equipped to pursue such further education.

Goals

In accordance with the Higher Education Ordinance, a Master of Science (60 credits) is awarded to students who at the completion of the programme accomplish the following:

Knowledge and understanding

For a Degree of Master (60 credits) the student must:

- demonstrate knowledge and understanding in data analytics and business economics, including both an overview of the field and specialised knowledge in certain areas of the field as well as insight into current research and development work
- demonstrate specialised methodological knowledge in data analytics and business economics

Competence and skills

For a Degree of Master (60 credits) the student must:

- demonstrate the ability to integrate knowledge and analyse, assess and deal with complex phenomena, issues and situations even with limited information
- demonstrate the ability to identify and formulate issues autonomously as well as to plan and, using appropriate methods, undertake advanced tasks within predetermined time frames
- demonstrate the ability in speech and writing to report clearly and discuss his or her conclusions and the knowledge and arguments on which they are based in dialogue with different audiences
- demonstrate the skills required for participation in research and development

work or employment in some other qualified capacity
- demonstrate the ability to manage and work in multicultural teams

Judgement and approach

For a Degree of Master (60 credits) the student must:

- demonstrate the ability to make assessments in the main field of study, informed by relevant disciplinary, social and ethical issues and also to demonstrate awareness of ethical aspects of research and development work
- demonstrate insight into the possibilities and limitations of research, its role in building an innovative and sustainable society and the responsibility of the individual for how it is used
- demonstrate the ability to identify the personal need for further knowledge and take responsibility for his or her on-going learning

Independent project (degree project)

For a Master of Science (60 credits) students must have completed an independent project (degree project) worth at least 15 credits in Data Analytics and Business Economics within the framework of the course requirements.

Course information

This one-year Master's degree comprises of 60 credits. The year is divided into two 30 credits semesters.

Semester 1 comprises the following courses:

- Programming in R (3.5 cr)
- Data Visualisation (4 cr)
- Machine Learning from a Regression Perspective (7.5 cr)
- Legal Aspects of Data Analytics (4 cr)
- Working with Databases, (3.5 cr)
- Advanced Machine Learning (7.5 cr)

Semester 2 comprises the following courses:

- Analytics-based Strategic Management (7.5 cr)
- Elective (7.5 cr)
- Master Essay I (degree project) (15 cr)

Mandatory courses

DABN11 Programming in R (3.5 cr)

The following topics will be covered in the course:

- basic programming concepts, data structures, conditional statements, functions, scope, and classes, as well as the basic R-syntax for these concepts
- using built-in functions in R, such as "lm", "max" and "apply"
- creating own functions in R
- using basic R data types, such as lists, vectors and matrices

- using an integrated development environment, such as R-studio
- basic debugging procedures
- loading and using basic R-packages
- using modern data manipulation packages, such as "dplyr"

DABN12 Data Visualisation (4 cr)

The course provides an introduction to theoretical and practical aspects of data visualisation. The following topics are covered in the course:

- introduction and background
- introduction to R and ggplot2
- visualisation of data with few observations
- choice of colour, symbols, scales, and perspective (2D, 3D)
- summation and abstraction (many observations)
- interactive visualisations
- maps and spatial data
- visualisation of statistical modelsBasic programming concepts, data structures, conditional statements, functions, scope, and classes

DABN13 Machine Learning from a Regression Perspective (7.5 cr)

Machine learning refers to statistical model predictions that that improve through experience; as new data arrive, the model learns and adapts. The price that the supermarket can charge for advertisements depends critically on its ability to learn from the data which customers that are likely prospects for a particular supplier's product. Similarly, the price that Google can charge for space for sponsored links is directly tied to their ability to correctly identify people likely to follow the link. That is where machine learning comes in. This course teaches the basics of machine learning and it does so by focusing on those methods that build in one way or another on standard regression analysis. Some of the topics covered are classification based on logistic regression, model selection using information criteria and cross-validation, shrinkage methods such as lasso, ridge regression and elastic nets, dimension reduction methods such as principal components regression and partial least squares, and neural networks. Theoretical studies are interwoven with empirical applications to problems in business and economics, which are carried out using the R software.

DABN14 Advanced Machine Learning (7.5 cr)

This course covers advanced machine learning methods that are relevant for applications in business and economics, and is intended as a continuation of Machine Learning from a Regression Perspective. Some of the topics covered include bootstrapping, ensemble methods such as boosting and random forests, unsupervised machine learning methods such as principal components analysis and clustering algorithms as well as applications of machine learning methods to problems that are relevant for business and economics, such as causal inference and text analysis. Theoretical studies are interwoven with empirical applications to problems in business and economics, which are carried out using the R software.

DABN15 Working with Databases (3.5 cr)

This course covers data, data management and databases from a practical

perspective. The student will gain a basic understanding of what databases are and what they are used for, as well as a vocabulary to use when communicating with database administrators and IT technicians. The course also treats how to extract data from a database using techniques such as SQL (Structured Query Language) and how to analyse such data in R. Data are important in today's industry and society, and this course aims to make the student ready and able to use them to his or her advantage.

DABN16 Legal Aspects of Data Analytics (4 cr)

The course introduces legal thinking, and it provides an overview as well as a practical application of legal concepts and methods used to analyse the relevant legal rules and principles related to data analytics. The content of the course is focused on understanding the relevance of key legal rules and principles, related to data analytics, for informed decision-making. The main legal areas covered by the course are European law on intellectual property, data protection, competition law, and the law of contract, as applied to data analytics. An essential part of the course is exercises of an applied nature where legal rules and principles are applied from a strategic and informed decision-making perspective.

DABN17 Analytics-based Strategic Management (7.5 cr)

The overall aim of the course is that the students will acquire a working method that will characterize them as action-oriented business analysts. The course will provide theory-based knowledge of strategic management, and an understanding of the connections between different theories in strategic management. Theoretical concepts and models will be related to real-world challenges in companies and applied accordingly in analysis and to present business solutions. The students will acquire abilities to argue in favor of their standpoints in both written and oral presentation.

The course includes the following four parts:

- economic organization and the boundaries of the firm
- markets and competition between firms
- strategic positioning and competitive advantage of firms
- strategic organization of firms

An objective of the course is to provide students with specific business cases, which can serve both as empirical illustration and as bases for theoretical analysis. The particular theoretical perspective should thereby prepare student for analyzing and evaluating actual strategy decisions in companies.

DABN01 Master essay I (15 cr)

The course consists of writing an essay that is publicly defended at a seminar with a discussant and to discuss another essay at a seminar. The essay shall be written individually or by two students writing together. In the process of writing, the student is advised by one or more tutors. The course starts with some gatherings for general information on writing essays and seeking information through the library.

Example of elective courses in Economics, Statistics and Informatics

The selection of elective courses may vary between semesters depending on availability.

INFN65 Business and Artificial Intelligence (7.5 cr)

All organisations are affected by and dependent on processes, decisions and their digitalisation. Most of today's managerial work requires knowledge and toolsets to manage business to be supported by and automated through Artificial Intelligence (AI). Moreover, to get real business value from AI, businesses must focus their efforts in AI on improving processes and decisions. This course aims to provide an insight into designing business and Artificial Intelligence supporting business.

On completion of the course, students shall have a thorough understanding of how processes, decisions and AI shape today's businesses and their design. Students shall be able to identify problems that can be solved by, or decisions that can be made or supported by AI in a business and be able to implement solutions to aid the aforementioned.

The course focuses on the challenges that business digitalisation and Artificial Intelligence poses in the modern organisation. To properly manage business, both managerial and technological aspects must be considered in conjunction. By studying business and Artificial Intelligence and through hands on workshops, the course focuses on how AI and business digitalisation alters internal and external parts of business within and across organisations.

NEKN33 Applied Microeconometrics (7.5 cr)

This course covers modern econometric tools and empirical strategies used by economists and demographers for the analysis of cross-sectional and panel micro-data. The course teaches the econometric theory behind these techniques but also requires reading of high-quality empirical articles and applications of the taught methods using real data sets. Topics covered in the course includes: The randomized experiment as a golden standard and the analysis of social experiments; fixed-effects methods, such as difference-in-differences techniques applied to panel data, but also applied to other data structures such as family-level data, (2) instrumental variables estimation; regression discontinuity design; matching estimators, such as propensity scores and kernel-matching; limited dependent variables.

NEKN34 Time Series Analysis (7.5 cr)

The course gives an introduction to basic concepts within time series analysis. The univariate analysis of time series in this course is based upon ARMA/ARIMA and ARCH-/GARCH models. Multivariate time series analysis is based on VAR models. Nonstationary time series are analysed using unit root tests, cointegration methods and VEC models. Theoretical studies are interwoven with practical applications in financial economics and macroeconomics.

STAN47 Deep Learning and Artificial Intelligence Methods (7.5 cr)

This course presents an application-focused and hands-on approach to learning neural networks and reinforcement learning. It can be viewed as first introduction to deep learning methods, presenting a wide range of connectionist models which represent

the current state-of-the-art. It explores the most popular algorithms and architectures in a simple and intuitive style. The course covers the fundamentals of machine learning, and the mathematical and computational prerequisites for deep learning; feed-forward neural networks, convolutional neural networks, and the recurrent connections to a feed-forward neural network; a brief history of artificial intelligence and neural networks, and reviews interesting open research problems in deep learning and connectionism.

Additional information in appendix EAGDA Programme structure.

Degree

Degree titles

Degree of Master of Science (60 credits)
        Major: Data Analytics and Business Economics
Filosofie magisterexamen
        Huvudområde: Dataanalys och ekonomi

Degree requirements

The degree requirements for a *Degree of Master of Science, major in Data Analytics and Business Economics* consists of 60 credits at advanced level. The following must be included in the degree: the courses that comprises the current programme structure (see appendix) which includes the course *DABN01 Master essay I, 15 cr*.

Requirements and Selection method

Requirements

The programme is developed for students who have recently finished an undergraduate degree (BA/BSc) of at least three years, 180 credits, in a subject matter including quantitative methods. This opens up for a broad spectrum of backgrounds from mathematics, statistics, economics, informatics and elsewhere. It is of special importance that the undergraduate studies include courses in quantitative methods (statistics and linear algebra are of particular importance).

More specifically, it is required that the students have:

- one of the following backgrounds:
  - an undergraduate degree including at least 30 credits in statistics and mathematics with at least one course in statistics that includes regression analysis and one course in mathematics;

  - an undergraduate degree including at least 60 credits in economics, informatics or business administration with at least one course in econometrics or regression analysis and one course in statistics or mathematics;

  - an undergraduate degree including at least 60 credits in statistics with at least one course in regression analysis,

- documented language proficiency knowledge equivalent to English B/English 6 at Swedish upper secondary school.

It is recommended that students have at least 10 credits in economics and 10 credits in business administration.

Selection method

Selection is based on academic merits from university studies. In the assessment, special weight will be given to grades on courses that prepare students for the curriculum of this study programme.

Other information

Programme management

The programme director, who is appointed by the Board of LUSEM, is responsible for the quality development and quality assurance of the programme. The Board of the School also assigns each programme to a host department at LUSEM. The host department is responsible for providing professional services to the students and faculty of the programme.

Each programme also organizes a programme management group, in which student representatives and faculty representatives of the programme, together with the programme director, coordinator and other professional services meet regularly.

All programmes at LUSEM are evaluated yearly and the outcome of a programme scorecard is presented to the Board of the School as part of LUSEM's Quality Development and Assurance system.

Grading scale

At the School of Economics and Management grades are awarded in accordance with a criterion-based grading scale A-U(F):

A (Excellent) 85-100 points/percent. A distinguished result that is excellent with regard to theoretical depth, practical relevance, analytical ability and independent thought.

B (Very good) 75-84 points/percent. A very good result with regard to theoretical depth, practical relevance, analytical ability and independent thought.

C (Good) 65-74 points/percent. The result is of a good standard with regard to theoretical depth, practical relevance, analytical ability and independent thought and lives up to expectations.

D (Satisfactory) 55-64 points/percent. The result is of a satisfactory standard with regard to theoretical depth, practical relevance, analytical ability and independent thought.

E (Sufficient) 50-54 points/percent. The result satisfies the minimum requirements with regard to theoretical depth, practical relevance, analytical ability and independent thought, but not more.

U/F (Fail) 0-49 points/percent. The result does not meet the minimum requirements with regard to theoretical depth, practical relevance, analytical ability and independent thought.

To pass the course, the students must have been awarded the grade of E or higher.

It is up to the teaching professor to decide whether the credits of a course should be converted into a total of 100 points for each course, or if the scale above should be used as percentage points of any chosen scale instead.

Academic integrity

The University views plagiarism very seriously, and will take disciplinary actions against students for any kind of attempted malpractice in examinations and assessments. The penalty that may be imposed for this, and other unfair practice in examinations or assessments, includes suspension from the University.

Programme structure for Master's Programme in Data Analytics and Business Economics

The programme of 60 ECTS-credits has the following structure:

Semester 1, autumn (30 cr)		Semester 2, spring (30 cr)	
Period 1 **Sep-Oct**	**Period 2** **Nov-Dec**	**Period 3** **Jan-Mar**	**Period 4** **Apr-Jun**
DABN11 Programming in R (3.5 cr)	DABN14 Advanced machine learning (7.5 cr)	DABN17 Analytics-based strategic management (7.5 cr)	
DABN12 Data visualisation (4 cr)	DABN15 Working with databases (3.5 cr)	Elective (7.5 cr)	DABN01 Master essay I (degree project) (15 cr)
DABN13 Machine learning from a regression perspective (7.5 cr)	DABN16 Legal aspects of data analytics (4 cr)		

The School's programme portfolio is continuously developed and sometimes changes to courses may occur after you have accepted your study seat. These changes are usually a result of student feedback, or research development. Changes can take the form of altered course content, teaching formats or assessment styles. Any such changes are intended to enhance the student learning experience. If the programme includes elective courses, students will in most cases be placed in the elective(s) of their choice, but there are no guaranteed places.

1 credit (cr) = 1 ECTS credit