UNIVERSITY OF GOTHENBURG

IT FACULTY

Reference no. G 2016/183

Programme Syllabus for Applied Data Science, Master's programme 120 credits

Applied Data Science masterprogram, 120 högskolepoäng

Second Cycle/N2ADS

1. Confirmation

The syllabus is confirmed by the IT Faculty Board 2016-06-17. This syllabus is to be valid from 2017-08-28 (autumn semester 2017).

The Department of Computer Science and Engineering is responsible for the study programme.

2. Purpose of the study programme

The aim is to provide students with an appropriate background with advanced knowledge in Data Science, enabling them to pursue a specialist career in industry or academic research.

It is intended that the Master's programme in Applied Data Science should be accessible to students with a wide range of Bachelor's degrees. Specifically, the programme does not require a Bachelor's degree in Computer Science or closely related subjects; Master's level education in Applied Data Science will be of benefit to students with backgrounds in many different areas who recognise that being able to work effectively with large data sets will be important in their future careers. Some previous programming experience is required, and the programme will build on this. The programme will give students an overview of the techniques and technologies that are relevant to Data Science, an appreciation of when and how these can be used, and practical skills in their application.

Learning outcomes include knowledge and skills related to the computational techniques needed to process and analyse large data sets. On the technical side, this includes detailed understanding of relevant computational and statistical methods. It also includes recognising how these methods are applied in different fields, and the challenges of working with large-scale data.

3. Higher education qualifications to which the study programme leads

After the completion of the programme with 120 credits of which 67.5 credits are specialised study in the main field Data Science, on request a degree certificate is issued with the designation Degree of Master of Science (120 credits) with a major in Data Science. For a Degree of Master of Science the student must have accomplished an independent project (degree project) of at least 30 credits within the specialised study in the main field.

4. Main field of study for the programme

Main field of study for the programme is Data Science.

5. Learning outcomes

Second-cycle courses and study programmes shall be based fundamentally on the knowledge acquired by students during first-cycle courses and study programmes, or its equivalent.

Second-cycle courses and study programmes shall involve the acquisition of specialist knowledge, competence and skills in relation to first-cycle courses and study programmes, and in addition to the requirements for first-cycle courses and study programmes shall:

- further develop the ability of students to integrate and make autonomous use of their knowledge,
- develop the students' ability to deal with complex phenomena, issues and situations, and
- develop the students' potential for professional activities that demand considerable autonomy, or for research and development work.

(The Swedish Higher Education Act (Ordinance 2006:173), chapter 1, section 9.)

5.1. Learning outcomes for Degree of Master of Science (120 credits) according to the Higher Education Ordinance

Knowledge and understanding

For a Degree of Master of Science (120 credits) the student shall

- demonstrate knowledge and understanding in the main field of study, including both broad knowledge of the field and a considerable degree of specialised knowledge in certain areas of the field as well as insight into current research and development work, and
- demonstrate specialised methodological knowledge in the main field of study.

Competence and skills

For a Degree of Master of Science (120 credits) the student shall

- demonstrate the ability to critically and systematically 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 critically, autonomously and creatively as well as to plan and, using appropriate methods, undertake advanced tasks within predetermined time frames and so contribute to the formation of knowledge as well as the ability to evaluate this work,
- demonstrate the ability in speech and writing both nationally and internationally to clearly report and discuss his or her conclusions and the knowledge and arguments on which they are based in dialogue with different audiences, and
- demonstrate the skills required for participation in research and development work or autonomous employment in some other qualified capacity.

Judgement and approach

For a Degree of Master of Science (120 credits) the student shall

- 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 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.

(Higher Education Ordinance, Qualifications Ordinance, Annex 2)

5.2. Local learning outcomes

Knowledge and understanding

For a Degree of Master of Science (120 credits) with a major in Data Science the student shall

- describe and compare different techniques for data analysis and management.

Competence and skills

For a Degree of Master of Science (120 credits) with a major in Data Science the student shall

- use tools and technologies for data analysis and management,
- apply data science methods to solving problems in a variety of application areas, and
- independently, as well as in cooperation with others, investigate and make relevant observations and discoveries based on the methods of data science.

Judgement and approach

For a Degree of Master of Science (120 credits) with a major in Data Science the student shall

- discuss advantages and disadvantages of various techniques and technologies for data analysis and management,
- determine how different data science methods may be applicable in different situations, and

- construct arguments and discuss the consequences of actions with respect to different ethical frameworks.

6. The main content and structure of the study programme

The programme consists of courses in applied Data Science and related subjects. The programme includes a total of 120 credits. Of these are 67.5 credits from compulsory courses in the main field of Data Science, including 30 credits independent project (thesis).

The courses are progressively arranged so that they, within the framework of learning outcomes, contribute separately and jointly, with developing the student's skills and abilities in the field.

The education is given at full time. An academic year is divided into two semesters and four study periods. A semester includes two study periods, each of 15 credits. Students normally attend two courses in parallel in each study period.

The education is conducted in the form of lectures, seminars, teacher-led exercises, and tutoring as well as projects in which students apply and deepen their knowledge.

The language of tuition is English.

Study process

The following compulsory second-cycle courses are included in the main field of Data Science[1]:

- Introduction to Data Science, 7.5 credits
- Thinking and Working Mathematically, 7.5 credits
- Statistical Methods for Applied Data Science, 7.5 credits
- Applied Machine Learning, 7.5 credits
- Techniques for Large-scale Data, 7.5 credits
- Master's Thesis in Data Science, 30 credits

In addition to these compulsory second-cycle courses, students should take first-cycle course Databases (DIT620), which is offered in study period 2 and in study period 3, and is included in the main field of study. Normally this course will be taken in study period 2, but it may be taken in study period 3 if that fits better with the student's chosen optional courses.

Students have the possibility to take optional second cycle courses outside the programme, including second cycle courses in the area of their Bachelor's degree. Entry requirements for optional courses must be satisfied.

The following optional courses are included in the main field of Data Science:

- Research Methods for Data Science, 7.5 credits
- Research Mini-project in Data Science, 7.5 credits

[1] Many compulsory courses mentioned above are still preliminary and will be confirmed during the coming years.

Research Mini-project in Data Science may be taken in any study period.

The course "Master's Thesis in Data Science" includes an independent project (degree project) of 30 credits. The Master's thesis can be done either full-time in study periods 3 and 4, or half-time during study periods 2 and 3 then full-time in study period 4, depending on the student's choice of optional courses.

The following schema shows the ordinary study process with compulsory and optional courses arranged in the four study periods. The two variants for Year 2 are shown.

Table 1. The following schema shows the study process during year 1.

Year 1			
Study Period 1	**Study Period 2**	**Study Period 3**	**Study Period 4**
Introduction to Data Science 7.5 credits	Statistical Methods for Applied Data Science 7.5 credits	Applied Machine Learning 7.5 credits	Techniques for Large-scale Data 7.5 credits
Thinking and Working Mathematically 7.5 credits	Databases 7.5 credits or Optional course	Databases 7.5 credits or Optional course	Optional course

Table 2. The following schema shows the study process during year 2.

Year 2			
Study Period 1	**Study Period 2**	**Study Period 3**	**Study Period 4**
Research Methods for Data Science 7.5 credits	Optional course	Master's Thesis in Data Science 30 credits	
Optional course	Optional course		

Table 3. The following schema shows an alternative study process during year 2.

Year 2			
Study Period 1	**Study Period 2**	**Study Period 3**	**Study Period 4**
Research Methods for Data Science 7.5 credits	Master's Thesis in Data Science 30 credits		
Optional course	Optional course	Optional course	

7. Entry requirements

Bachelor's degree of 180 credits including an independent project (degree project) of at least 15 credits or equivalent in a subject relevant to the study of Data Science, either as a basis for Data Science methods or as an area where Data Science can be applied.

At least 15 credits from programming or eqvivalent

English 6/English B from Swedish Upper Secondary School or eqvivalent.

Specific entry requirements for admission to a course within the study programme

Within the study programme there can be specific entry requirements for admission to individual courses. These specific entry requirements are documented in each course syllabus and state which entry requirements are necessary to be registered on a course within the study programme.

Selection

Selection is according to the Higher Education Ordinance and the University of Gothenburg admission regulations for education on first and second cycle.

8. Guaranteed admission

Students who are follow the study programme at the prescribed pace have guaranteed admission to all compulsory and optional courses offered within the programme provided that specific entry requirements are fulfilled and the student applies to the course within the study programme within the prescribed application period.

For optional courses outside the study programme local admission regulations are valid and there is no guaranteed admission.

9. Additional information

Credit transfer of former education

In some cases, the student has the right to be given credit for former higher education according to the legislative regulations of the Higher Education Ordinance.

Evaluation

The courses of the study programme are evaluated according to each course syllabus. The result will be used for planning and implementation of upcoming courses. A summary is given to students at the start of the courses.