Curriculum for the Master of Science in Data Engineering

Aalborg University
September 2015
PREFACE:
Pursuant to the Danish (Consolidation) Act no. 960 of August 14, 2014 on Universities (the University Act) with subsequent changes, the following curriculum for the Master’s program in Machine Intelligence is stipulated. The programme also follows the Framework Provisions and the Examination Policies and Procedures for the Faculties of Engineering, Science and Medicine.

AAU, October 2014

Lone Leth Thomsen
Chairman of Study Board for Computer Science

Table of contents

CHAPTER 1: LEGAL BASIS OF THE CURRICULUM, ETC. .............................................................. 3
  1.1 Basis in ministerial orders ......................................................................................... 3
  1.2 Faculty affiliation ..................................................................................................... 3
  1.3 Board of Studies affiliation .................................................................................... 3
  1.4 Body of external examiners .................................................................................. 3

CHAPTER 2: ADMISSION, DEGREE DESIGNATION, PROGRAMME DURATION ......................... 3
AND COMPETENCE PROFILE ............................................................................................... 3
  2.1 Admission ................................................................................................................ 3
  2.2 Degree designation in Danish and English .............................................................. 3
  2.3 The programme’s specification in ECTS credits ....................................................... 3
  2.4 Competence profile on the diploma ....................................................................... 3
  2.5 Competence profile of the programme: .................................................................. 4

CHAPTER 3: CONTENT AND ORGANIZATION OF THE PROGRAMME ....................................... 4
  1. semester, DE7 ........................................................................................................... 6
  2. semester, DE8 ......................................................................................................... 11
  3. semester, DE9 ......................................................................................................... 16
  4. semester, DE10 ....................................................................................................... 19

CHAPTER 4: ENTRY INTO FORCE, INTERIM PROVISIONS AND REVISION ............................... 20

CHAPTER 5: OTHER PROVISIONS ......................................................................................... 20
  5.1 Rules concerning written work, including the Master’s thesis ............................... 20
  5.2 Rules concerning credit transfer (merit), including the possibility for choice of modules that are part of another programme at a university in Denmark or abroad ........................................ 20
  5.3 Rules for examinations ......................................................................................... 20
  5.4 Exemption ............................................................................................................ 21
  5.5 Additional information .......................................................................................... 21

ENCLOSURE 1 ..................................................................................................................... 22
Chapter 1: Legal Basis of the Curriculum, etc.

1.1 Basis in ministerial orders
The Master’s programme in Data Engineering is organized in accordance with the Ministry of Higher Education and Science’s Ministerial Order no. 1520 of December 16, 2013 on Bachelor’s and Master’s Programmes at Universities (the Ministerial Order of the Study Programmes) and Ministerial Order no. 670 of June 19, 2014 on University Examinations (the Examination Order) with subsequent changes. Further reference is made to Ministerial Order no. 1488 of December 16, 2013 (the Admission Order) and Ministerial Order no. 250 of March 15, 2007 (the Grading Scale Order) with subsequent changes.

1.2 Faculty affiliation
The Master’s programme falls under the Faculty of Engineering and Science, Aalborg University.

1.3 Board of Studies affiliation
The Master’s programme falls under the Board of Studies for Computer Science.

1.4 Body of external examiners
Body of external examiners for Computer Science.

Chapter 2: Admission, Degree Designation, Programme Duration and Competence Profile

2.1 Admission
Admission to the Master’s programme in Data Engineering requires a Bachelor’s degree in computer science, software or the like.

Students with another Bachelor’s degree, upon application to the Board of Studies, will be admitted after a specific academic assessment if the applicant is deemed to have comparable educational prerequisites. The University can stipulate requirements concerning conducting additional exams prior to the start of study.

All students applying must document English language qualifications comparable to an ‘English B level’ in the Danish upper secondary school (minimum average grade 02).

2.2 Degree designation in Danish and English
The Master’s programme entitles the graduate to the designation cand.scient. (candidatus/candidata scientiarum) i datahåndtering. The English designation is: Master of Science (MSc) in Data Engineering.

2.3 The programme’s specification in ECTS credits
The Master’s programme is a 2-year, research-based, full-time study programme. The programme is set to 120 ECTS credits.

2.4 Competence profile on the diploma
The following competence profile will appear on the diploma:
A Candidatus graduate has the following competency profile:

A Candidatus graduate has competencies that have been acquired via a course of study that has taken place in a research environment.

A Candidatus graduate is qualified for employment on the labour market on the basis of his or her academic discipline as well as for further research (PhD programmes). A Candidatus graduate has, compared to a Bachelor, developed his or her academic knowledge and independence so as to be able to apply scientific theory and method on an independent basis within both an academic and a professional context.

2.5 Competence profile of the programme:

The graduate of the Master’s programme:

Knowledge

- has knowledge in data management and related areas that, in selected areas, is based on the highest international research in the subject area
- can understand and, on a scientific basis, reflect over the data management knowledge and identify scientific problems

Skills

- excels in the data management scientific methods and tools and general skills related to employment within data management
- can evaluate and select among the data management scientific theories, methods, tools and general skills and, on a scientific basis, advance new analyses and solutions
- can communicate research-based knowledge and discuss professional and scientific problems with both peers and non-specialists

Competences

- can manage work and development situations that are complex, unpredictable and require new solutions.
- can independently initiate and implement discipline-specific and interdisciplinary cooperation and assume professional responsibility.
- can independently take responsibility for own professional development and specialisation

Chapter 3: Content and Organization of the Programme

The programme is structured in modules and organized as a problem-based study. A module is a programme element or a group of programme elements, which aims to give students a set of professional skills within a fixed time frame specified in ECTS credits, and concluding with one or more examinations within specific exam periods. Examinations are defined in the curriculum.

The programme is based on a combination of academic, problem-oriented and interdisciplinary approaches and organized based on the following work and evaluation methods that combine skills and reflection:
- lectures
- classroom instruction
- project work
- workshops
- exercises (individually and in groups)
- teacher feedback
- reflection
- portfolio work

**Overview of the programme:**

All modules are assessed through individual grading according to the 7-point scale or Pass/Fail. All modules are assessed by external examination (external grading) or internal examination (internal grading or by assessment by the supervisor only).

<table>
<thead>
<tr>
<th>Semester</th>
<th>Module</th>
<th>ECTS</th>
<th>Assessment</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (DE7)</td>
<td>From Reality to Models in Data Engineering</td>
<td>15</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Data-Intensive Systems</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Programming Paradigms</td>
<td>5</td>
<td>7-point scale</td>
<td>External</td>
</tr>
<tr>
<td></td>
<td><strong>One of the following:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Advanced Topics in Distributed Systems</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Web Engineering</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td>2 (DE8)</td>
<td>From Models to Reality in Data Engineering</td>
<td>15</td>
<td>7-point scale</td>
<td>External</td>
</tr>
<tr>
<td></td>
<td>Advanced Algorithms</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Advanced Programming</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td><strong>One of the following:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Advanced Topics in Machine Intelligence</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Mobile Software Technology</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td>3 (DE9)</td>
<td>Pre-Specialisation in Database Technology</td>
<td>20</td>
<td>7-point scale</td>
<td>External</td>
</tr>
<tr>
<td></td>
<td>Specialisation Course in Database Technology</td>
<td>5</td>
<td>7-point scale</td>
<td>External</td>
</tr>
<tr>
<td></td>
<td>Entrepreneurship</td>
<td>5</td>
<td>Pass/Fail</td>
<td>Internal</td>
</tr>
<tr>
<td>4 (DE10)</td>
<td>Master's Thesis</td>
<td>30</td>
<td>7-point scale</td>
<td>External</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>120</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1. semester, DE7

Title: From Reality to Models in Data Engineering
(Fra virkelighed til modeller med fokus på data engineering)

Scope: 15 ECTS (Project)

Prerequisites: Mandatory course modules on DE7 are followed

Purpose: The student should learn how using advanced computational models can help identifying and solving a problem of application or research in data engineering and how analysis of computational problems can contribute to theory building in data engineering.

Reason: A graduate in data engineering should be able to apply advanced computational theory and model building to identify and contribute to solutions of problems in the area of computer science and in this context to reflect on the theories and building of models.

Objective: Knowledge:
Students who complete the module should be able to:
• explain the concepts, findings and theories in an advanced area of data engineering

Skills:
Students who complete the module should be able to:
• apply knowledge from a theory in data engineering to select and argue for a model within an advanced computer science field

• from such modeling provide a model of a computer science problem in data engineering and apply this model to understand the problem

Competences:
Students who complete the module should be able to:
• identify a problem given an open challenge in research or application of computer science

• contribute to solving the problem using their own modeling based on computational theories

• analyze and evaluate the resulting contribution to the solution

• analyze and evaluate the applications of relevant computational models to solve this problem

Type of instruction: Project work including
• an analysis of an open computer science challenge in data engineering
• formulation of a problem for this challenge
• establishment of an advanced computer science model that contributes to solving the problem

The project may include complete or partial implementation of a solution in the form of running software.

As an integrated part of the project work, the student must participate in the problem-based learning and project management workshop (1 ECTS). Approved participation is required to register for the project exam. See enclosure 1

Exam format: Oral exam, based on project
Assessment: Internal assessment, 7-point scale
Evaluation criteria: See the Framework Provisions

Title: Data-Intensive Systems (Data-intensive systemer)
Scope: 5 ECTS
Prerequisites: Knowledge of database systems
Objective: Knowledge:
Students should achieve knowledge on the following topics in data-intensive systems:
• concepts and techniques for analyzing large data volumes, such as data warehousing, On-Line Analytical Processing, and Data Mining
• concepts and techniques for handling spatio-temporal data, including indexing and processing of queries
• concepts and techniques for scalability for data-intensive systems, e.g., cloud computing

Topics will typically be exemplified by Internet-related application, such as web analytics, spatial web, and the like.

There will also be one or more optional subjects within data-intensive systems, including but not limited to:
• concepts and techniques for managing web-related data such as XML, Semantic Web, and Web2.0 data
• concepts and techniques for search engines
Skills:
The student should achieve the following skills:
• be able to explain concepts and techniques in data-intensive systems
• be able to select and apply relevant concepts and techniques for a given problem in data-intensive systems

Competences:
The student should be able to apply concepts and techniques from data-intensive systems, including design and implementation of data-intensive systems.

Teaching form: Course
Exam form: Oral or written exam
Assessment: Internal assessment, 7-point scale

Title: Programming Paradigms (Programmeringsparadigmer)
Scope: 5 ECTS (course module)
Prerequisites: Knowledge of Imperative Programming, Object Oriented Programming, Languages and Compilers, Syntax and Semantics, or the equivalent condition
Objective: Knowledge:
The student will acquire knowledge of programming paradigms that are alternative and complementary to the imperative paradigm and the object oriented paradigm. Furthermore, students should acquire knowledge on advanced topics in design, implementation and use of programming languages and environments, including
• function-oriented programming
• programming language with dynamic types
• programming techniques in the field of one or more of the four main paradigms: the function-oriented, the imperative, the object-oriented and the logic programming paradigms

Skills:
The student must achieve the following skills:
• be able to classify and explain the structures in programming languages in relation to the paradigms
• be able to relate language constructions that support different paradigms
• be able to assess the strengths and weaknesses of each paradigm in relation to specific tasks

Competencies:
The student should be able to use paradigmatic constructions in smaller
Title: Advanced Topics in Distributed Systems
(Avancerede emner indenfor distribuerede systemer)

Scope: 5 ECTS (elective)

Prerequisites: Knowledge of computer architectures and concurrent systems, programming skills, system programming. Or prerequisites corresponding to a qualifying undergraduate education, and in some cases, the relevant parts of the learning objectives of courses offered at the qualifying bachelor. These prerequisites can be obtained at the beginning of the course through special activities integrated into the course.

Objective: Knowledge:
The student will gain knowledge of advanced theories and methods in distributed and embedded systems:
• advanced infrastructures and applications for example. grid, cloud, peer-to-peer, or parallel / multi-core systems
• System and Network software for embedded systems
• examples of distributed embedded systems, such as ad-hoc sensor networks, home automation
• Distributed algorithms such as algorithms for mutual exclusion, selection, consensus, replication and fault tolerance
• paradigms of programming
• techniques for analysis, such as monitoring, testing, verification, and benchmarking

Skills:
The student must achieve the following skills:
• able to assess and explain precisely how and to what extent the results presented can be used using the appropriate subject terminology and notation,
• use appropriate writing skills in these contexts

Competencies:
The student must be able to apply concepts and techniques from distributed systems, and to design and analyze distributed and embedded systems.
Assessment: Internal assessment according to 7-point scale

Title: Web Engineering
(Web engineering)
Scope: 5 ECTS (elective)
Prerequisites: BSc in Computer Science, Software or the like
Objective: Knowledge:
The student should gain knowledge of developing web applications:
- types of web applications and their use (eg. Data-intensive, service-oriented collaboration, integration, social)

- types of web technologies
- methods for developing web applications
  - Requirements, design, implementation and testing techniques
  - Patterns for web applications
  - Development of web applications

- advanced topics in web development, for example.:
  - Service-oriented architecture
  - Semantic web
  - Rich Internet Applications
  - New trends

Skills:
The student should achieve the following skills:
- demonstrate knowledge of web applications, web development and web architecture
- perform model-based analysis of web applications
- apply methods for developing web applications, including requirements, design, implementation and testing techniques

Competencies:
The student should be able to apply concepts and techniques from Web engineering, including web applications and development and architecture, requirements, design, implementation, and testing techniques.

Teaching form: Course
Exam form: Oral or written exam
Assessment: Internal assessment, 7-point scale

2. semester, DE8

Title: From Models to Reality in Data Engineering  
(Fra modeller til virkelighed med fokus på data engineering)

Prerequisites: DE7 and that mandatory course modules on DE8 are followed

Purpose: The student should gain further insight into how using advanced computational models can help identifying and solving a problem of application or research in data engineering and how analysis of computational problems can contribute to theory formation in data engineering.

Reason: A graduate in data engineering should be able to apply advanced computational theory and model building to identify and to contribute to solutions of a computer science problem and in this context to reflect on the theories and building of models.

Objective:
Knowledge: Students who complete the module should be able to:
• explain the concepts, findings and theories in an advanced area of data engineering

Skills: Students who complete the module should be able to:
• apply knowledge from a theory in data engineering to select and argue for a model within an advanced computer science field

• from such modeling provide a model of a computer science problem in data engineering and apply this model to understand the problem

Competences: Students who complete the module should be able to:
• identify a problem given a an open challenge in research or application of computer science

• contribute to solving the problem using their own modeling based on computational theories

• analyze and evaluate the resulting contribution to the solution
- analyze and evaluate the applications of relevant computational models to solve this problem

Type of instruction: Project work including
- an analysis of an open computer science challenge in data engineering
- formulation of a problem for this challenge
- establishment of an advanced computer science model that contributes to solving the problem

The project may include complete or partial implementation of a solution in the form of running software.

Exam format: Oral exam, based on project
Assessment: External assessment, 7-point scale

Title: Advanced Algorithms (Avancerede algoritmer)
Scope: 5 ECTS (Course)
Prerequisites: BSc in Computer Science, Software or the like
Objective:
Knowledge:
Students should achieve knowledge on the following theories and methods:
- algorithm design techniques such as divide-and-conquer, greedy algorithms, dynamic programming, back-tracking, Branch-and-bound algorithms and plane-sweep algorithms
- algorithm analysis techniques such as recurrences, amortized analysis, analysis of the expected complexity and experimentation with algorithms
- a set of core algorithms and data structures for solving problems from different computer science areas: algorithms for external memory, multi-threaded algorithms, text search, advanced graph algorithms, heuristic search and computational geometry

There will also be one or more optional subjects in advanced algorithms including, but not limited to: approximate algorithms, randomized algorithms, linear programming and number theoretic algorithms such as cryptosystems.
**Skills:**
The student should achieve the following skills:
- ability to explain the principles behind the main algorithm design and algorithm analysis techniques
- select and apply the algorithm design and algorithm analysis techniques for a given problem
- recognize a number of problems from different computer science fields and select the most appropriate algorithms and data structures for solving them

**Competencies:**
When faced with a non-standard computer science problem, the student should be able to:
- develop efficient algorithms and data structures for solving the problem
- analyze the developed algorithms

**Teaching form:** Course

**Exam form:** Oral or written exam

**Assessment:** Internal assessment, 7-point scale

**Evaluation criteria:** Are stated in the Framework Provisions

**Title:** Advanced Programming (Avanceret programmering)

**Scope:** 5 ECTS (Course)

**Prerequisites:** BSc in Computer Science, Software or the like. Knowledge about language design and compiler construction is important.

**Objective:** Knowledge:
The student should gain knowledge of advanced programming technologies and techniques, including elements of the programming language that supports these techniques. The course will focus on both new trends in programming, and on classic advanced themes. Possible topics include:
- advanced libraries
- library design
- syntactic abstraction (macros) and language extensions
- declarative programming
- generic programming
- concurrent, parallel and distributed programming
- reactive programming
- typed and typeless programming
Skills:
Students should achieve skills in selecting appropriate programming tools for a given task. The student should be able to write correct, efficient and maintainable programs. The student should be able to assess use of resources and to perform optimizations and performance studies.

Competencies:
The student should be able to solve advanced programming tasks.

Teaching form: Course
Exam form: Exam form is defined and described by the lecturer.
Assessment: Internal assessment according to 7-point scale

Title: Advanced Topics in Machine Intelligence (Avancerede emner inden for maskinintelligens)
Scope: 5 ECTS (Course, elective)
Prerequisites: BSc in Computer Science, Software or the like
Objective:

Knowledge:
The student should gain knowledge of advanced topics dealing with methods and application of machine intelligence, e.g.:
- advanced techniques in data mining
- advanced methods for reasoning and decision making under uncertainty
- agent-based design of intelligent systems
- intelligent web-based systems

Skills:
Students should achieve skills to identify and use advanced techniques from machine intelligence for constructing intelligent systems

Competencies:
The student should be able to understand advanced methods for the design of intelligent systems and to analyze their applicability and efficacy in solving specific tasks.

Teaching form: Course
Exam form: Oral or written exam
Assessment: Internal assessment according to 7-point scale

Title: Mobile Software Technology
(Mobil softwareteknologi)

Scope: 5 ECTS (Course, elective)

Prerequisites: Knowledge and skills in object oriented programming, algorithms and data structures, database systems and design and evaluation of user interfaces.

Objective:
Knowledge:
The student should gain knowledge in the following topics within development of mobile software:
- issues relating to architecture and programming of mobile software, such as stand-alone, client / server and peer to peer
- positioning and tracking both indoors and outdoors
- mobile services and location-based services
- mobile databases
- interaction design for mobile technologies
- usability and user experience evaluation of mobile technologies

In addition, the following items may be included in the course:
- indoor / outdoor integration
- Middleware platforms for mobile services
- design sketching for mobile technologies
- paper prototype development for mobile technologies
- lab. vs. field-based evaluation of mobile technologies

Skills:
The student should be able to:
- design software architectures for mobile applications
- use positioning and tracking techniques in various indoor and outdoor scenarios
• explain the principles for mobile databases
• explain the principles of moving object databases
• produce and refine the interaction design for mobile systems, services or devices
• evaluate the quality of an interaction design empirical

**Competences:**
The student should learn typical technologies and interaction design principles for mobile software systems and be able to use these technologies and principles in various mobile application scenarios.

**Teaching form:** Course
**Exam form:** Oral or written exam
**Assessment:** Internal assessment, 7-point scale
**Evaluation criteria:** Are stated in the Framework Provisions

---

### 3. semester, DE9

**Title:** Pre-Specialisation in Database Technology *(Forspecialisering i databaseteknologi)*

**Scope:** 20 ECTS (Project)

**Prerequisites:** DE7 and DE8 project and course modules and that a course module from DE9 is followed simultaneously with project work

**Purpose:** The student should gain insight into a current research problem in data engineering and be able to communicate this problem so that the student can make his/her thesis on this basis.

**Reason:** University educations are research-based educations. On the master programmes, all students must achieve in-depth insight into current research issues and methods.

**Objective:**
**Knowledge:**
After having completed the project module, the student should be able to:
• demonstrate in-depth knowledge and overview of a current problem within the research area of data engineering.

**Skills:**
After having completed the project module, the student should be able to:
• use and reason about relevant concepts and techniques within the discipline
• use and create theories within the discipline in the formulation and analysis of a problem within the research area
• communicate a current computer science problem as well as the related concepts in the framework of the research area

Competencies:
After having completed the project module, the student should be able to:
• apply concepts and reasoning within the discipline to formulate and analyse a current open challenge within the research area

Teaching form:
Project work, including:
• formulation and analysis of a problem related to a current open challenge in the research area
• reasoned reflection on solving this problem

Exam form:
Individual oral exam based on project report

Assessment:
External assessment according to 7-point scale

Evaluation criteria:
Are stated in the Framework Provisions

Title: Specialisation Course in Database Technology
(Specialiseringskursus i databaseteknologi)

Scope: 5 ECTS (Course)

Prerequisites: 1st and 2nd semester of the MSc education or the like

Objective:
Knowledge:
The student should achieve in-depth insight into key issues in contemporary research in database technology.

Skills:
Based on a scientific article in the course’s central themes, the student should be able to:
• give a clear and understandable presentation of the article’s key issues, including its premises, problem(s), theory, methods, results and conclusions
• explain relevant / key theories, methods, and arguments presented in the article

Competences:
Based on a scientific article in the course’s central themes, the student should be able to:
• relate the theories, methods, and results presented in the article to the course topics
• assess the proposed solutions, results and/or conclusions of the article as well as assess their qualities and practicality and put them into perspective.

Teaching form: Course
Exam form: The student gives a lecture of 30 minutes on a defined scientific subject area (typically in the form of an article) in relation to issues addressed in the course. The selection of subject area and the framing of the task to each student are made by the course lecturer, usually in consultation with the student's project supervisor. The student is given 7 days of preparation. After the lecture, the examiner and censor can ask questions related to the student's presentation of the theme. This does not normally exceed 10 minutes.

Assessment: External assessment, 7-point-scale


Title: Entrepreneurship (Entreprenørskab)

Scope: 5 ECTS (Course)

Prerequisites: BSc in Computer Science, Software or the like

Objectives: Knowledge:
The student should achieve knowledge about entrepreneurship and business development related to software (information and communication technologies) including typically:
• different scientific approaches to entrepreneurship, including effectuation
• intra-/entrepreneurship
• competition and market conditions
• business models and business plans
• intellectual property rights
• market development and marketing
• growth strategies
• open entrepreneurship

Skills:
The student should achieve the following skills:
• the ability to explain course concepts precisely using the professional terminology of the discipline
• the ability to use those concepts to explain practical and empirical (case based) contexts

Competencies:
The student should be able to formulate, develop and present their own software-related business ideas to a qualified audience.

Teaching form: Course

Exam form: Oral or written exam

Assessment: Internal assessment, pass/fail

4. semester, DE10

**Title:** Master’s Thesis (Kandidatspeciale)

**Scope:** 30 ECTS (Project)

**Prerequisites:** Project and course modules at DE7-DE9

**Purpose:** That students are able to formulate, analyse and help solve a current research problem in data engineering in an independent, systematic and critical manner through the use of scientific theory and methodology.

**Reason:** University educations are research-based educations. On the master programmes, all students must achieve in-depth insight into current research issues and methods in a way that this insight can be brought to use in solving research problems.

**Objective:**

**Knowledge:**
After having completed the master’s thesis, the student should be able to:
• demonstrate in-depth knowledge and overview of a current problem within the research area of data engineering.

**Skills:**
After having completed the master’s thesis, the student should be able to:
• use and reason about relevant concepts and techniques within the discipline
• use and create theories within the discipline in the formulation and analysis of a problem within the research area
• communicate a current computer science problem as well as the related concepts in the research area framework

**Competences:**
After having completed the master’s thesis, the student should be able to:
• apply concepts and reasoning within the discipline to formulate and analyse a current open challenge within the research area

**Teaching form:** Project work, including formulation, analysis and contribution to the resolution of a current research problem within data engineering and usually follows the subject of the project module on the third semester (DE9).

**Exam form:** Oral exam based on project report

**Assessment:** External assessment according to 7-point scale

**Evaluation criteria:** Are stated in the Framework Provisions
Chapter 4: Entry into Force, Interim Provisions and Revision

The curriculum is approved by the Dean of the Faculty of Engineering and Science and enters into force as of September 2015.

Students who wish to complete their studies under the previous curriculum must conclude their education by the summer examination period 2016 at the latest, since examinations under the previous curriculum are not offered after this time.

In accordance with the Framework Provisions for the Faculty of Engineering and Science at Aalborg University, the curriculum must be revised no later than 5 years after its entry into force.

Chapter 5: Other Provisions

5.1 Rules concerning written work, including the Master’s thesis

In the assessment of all written work, regardless of the language it is written in, weight is also given to the student's spelling and formulation ability, in addition to the academic content. Orthographic and grammatical correctness as well as stylistic proficiency are taken as a basis for the evaluation of language performance. Language performance must always be included as an independent dimension of the total evaluation. However, no examination can be assessed as 'Pass' on the basis of good language performance alone; similarly, an examination normally cannot be assessed as 'Fail' on the basis of poor language performance alone. The Board of Studies can grant exemption from this in special cases (e.g., dyslexia or a native language other than Danish).

The Master’s thesis must include an English summary.¹ If the project is written in English, the summary must be in Danish.² The summary must be at least 1 page and not more than 2 pages. The summary is included in the evaluation of the project as a whole.

5.2 Rules concerning credit transfer (merit), including the possibility for choice of modules that are part of another programme at a university in Denmark or abroad

In the individual case, the Board of Studies can approve successfully completed (passed) programme elements from other Master’s programmes in lieu of programme elements in this programme (credit transfer). The Board of Studies can also approve successfully completed (passed) programme elements from another Danish programme or a programme outside of Denmark at the same level in lieu of programme elements within this curriculum. Decisions on credit transfer are made by the Board of Studies based on an academic assessment. See the Framework Provisions for the rules on credit transfer.

5.3 Rules for examinations

The rules for examinations are stated in the Examination Policies and Procedures published by the Faculty of Engineering and Science on their website.

¹ Or another foreign language (upon approval from the Board of Studies).
² The Board of Studies can grant exemption from this.
5.4 Exemption
In exceptional circumstances, the Board of Studies study can grant exemption from those parts of the curriculum that are not stipulated by law or ministerial order. Exemption regarding an examination applies to the immediate examination.

5.5 Additional information
The current version of the curriculum is published on the Board of Studies’ website, including more detailed information about the programme, including exams.

Completion of the Master’s programme
The Master’s programme must be completed no later than four years after it was begun.
**Title:**
Problem based learning and project management
(Problembaseret læring og projektledelse)

**Size:** 1 ECTS

**Prerequisites:**
None

**Objectives:**
The objective is to make newly started Master students coming from institutions other than AAU prepared to enter the problem based learning environment at AAU and manage study projects in close collaboration with peers.

After completion of the course the student should have acquired:
- **Knowledge** about AAU as a frame of study and student life in Aalborg
- **Knowledge** to describe in own words some of the fundamental principles of Problem Based Learning (PBL) as implemented in the Aalborg PBL model at the Faculty of Engineering and Science
- **Knowledge** to identify similarities and differences between the Aalborg PBL study environment and previous study environments, incl. strengths and weaknesses in both environments
- **Skills** to structure project management activities based on a well-formulated problem formulation
- **Skills** to assess project documentation based on scientific codes of conduct.
- **Competences** to plan for effective collaborative learning in an intercultural environment and manage group conflicts
- **Competence** to reflect on, plan and manage a study project in a PBL learning environment

**Type of instruction:** Three half day workshops

**Exam format:**
The assessment is performed based on active participation in the arranged workshops.

**Evaluation criteria:** The criteria for the evaluation are specified in the Framework Provisions.