Curriculum for the Bachelor Programme in Data Science at the IT University of Copenhagen

The curriculum of 1 August 2017

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Background

This curriculum for the Bachelor Programme in Data Science has been drawn up by the Board of Studies at the IT University of Copenhagen (in the following referred to as the Board of Studies ITU). The curriculum has been drawn up in compliance with the current legislation governing bachelor's and master's (Candidatus) programmes at the universities.

Students enrolled in autumn 2023 and forward will study according to the curriculum.

Chapter 1

Programme Title and Objectives

Programme Title

Section 1. A student, who has completed the programme, has the right to use the title Bachelor (BSc) i datavidenskab.

Subsection 2. The title in English is Bachelor of Science (BSc) in Data Science.

Programme Objectives

Section 2. The objectives of the Bachelor Programme in Data Science are to provide students with the scientific qualifications to independently design and execute efficient, computation intensive, data-centered, empirical analysis of real-world problems. This requires bachelors to acquire broad theoretical, practical and methodological knowledge tailored specifically to data science from mathematics, computer science, statistics, and computational social science, as well as an understanding of technical communication and research ethics.

Subsection 2. Bachelors will be able to play an independent reflective role in all aspects of the acquisition and communication of data driven intelligence. In particular, they will obtain comprehensive analytical and technical skills covering handling, analysing, and operationalising data. They also will become practically skilled in the application of these skills for the formulation and analysis of real-world problems, as well as the effective communication of these results.

Subsection 3. Bachelors will be qualified for generalist Data Science jobs in industry. Further, bachelors will obtain admission qualifications for the IT University's Master's programmes, allowing them to specialise their competencies within a particular field of application.

Objectives for Learning Output

Section 3. On completion of the programme, the student must have attained the following learning output objectives. The learning output is divided into the categories knowledge and understanding, skills, and competences; cf. the Danish Qualifications Framework for higher education.

Subsection 2. Knowledge and Understanding

The bachelor must:

- have research-based knowledge of theory, methodology and practice within data-science specific areas of mathematics: optimisation, machine learning, statistical analysis, network analysis, experiment design, and algorithms.
- have research-based knowledge of theory, methodology and practice within data-science specific areas of computing: programming languages, query languages, databases, data processing, and large-scale data analysis.
- have research-based knowledge of social science, be able to reflect on relevant social theories.
- be able to understand and reflect on theories, scientific methodologies and practice of the above areas.
- be able to understand and reflect on existing data and analytical software-platforms and their adequacy to specific data science problems.
- be able to consider data within a global perspective, with respect to different contexts and cultures.

Subsection 3. Skills

The bachelor must:

- be able to develop software in a general-purpose programming language.
- be able to implement scalable algorithms for fundamental data analysis tasks (e.g. in machine learning, statistical inference), based on technical descriptions in textbooks or the research literature.
- be able to evaluate theoretical issues of problems in order to select and apply appropriate machine learning methods, algorithms, and software tools to perform data analysis, statistical inference, or predictive analytics tasks, based on scalability and performance.
- be able to apply systems for data management in order to clean, transform, and query data.
- be able to carry out adequate empirical evaluation of model performance in order to ensure optimal accuracy.
- be able to organise, summarise, and visualise data and the outcomes of inferential processes for relevant stakeholders.
- be able to communicate the academic issues associated with inferential processes and computational requirements to relevant stakeholders.
- be able to assess the level of privacy and security ensured by a technical solution and communicate it in a way that is understandable to non-specialists, both from a global perspective as well as within a particular cultural context.

Subsection 4. Competencies

The bachelor must:

- be able to independently and collaboratively dissect complex situations in order to identify the domain knowledge necessary for robust data processing and interpretation of outcomes, and to plan data collection on which robust statistical conclusions can be made.
- be able to independently and collaboratively develop domain-specific data cleaning, statistical models, and select algorithms and analysis and machine learning, based on input from domain experts.
- be able to articulate the importance of data origins, data collection context and impacts of inferential processes as part of reporting of findings.
- be able to independently and collaboratively consider the relevant context of decision-making given available data, and critically assess implications of data analytics and of the inferential process in a domain, including privacy and ethical concerns.
- be able to maintain and develop professional competencies for global state-of-the-art technologies, and adapt to new domains of application.
- be able to develop data-driven analyses and solutions from the bottom up, both independently and collaboratively.

Chapter 2

Programme Structure, Content and Programme Language

Programme Structure

Section 4. The programme comprises mandatory study activities worth 150 ECTS points, optional study activities worth 15 ECTS points, and a bachelor project worth 15 ECTS points.

Subsection 2. The study activities listed below constitute the core elements of the programme and are worth 165 ECTS points.

List of modules

- Introduction to Data Science and Programming (15 ECTS)
- Linear Algebra and Optimisation (7.5 ECTS)
- Mathematical Thinking and Probability Theory (7.5 ECTS)
- Projects in Data Science (7.5 ECTS)
- Algorithms and Data Structures (7.5 ECTS)
- Applied Statistics (15 ECTS)
- Machine Learning (15 ECTS)
- Introduction to Database Systems (7.5 ECTS)
- Network Analysis (7.5 ECTS)
- Natural Language Processing and Deep Learning (15 ECTS)
- Large Scale Data Analysis (7.5 ECTS)
- Data Visualisation and Data-driven Decision Making (7.5 ECTS)
- Technical Communication (7.5 ECTS)
- Security and Privacy (7.5 ECTS)
- Software Development and Software Engineering (7.5 ECTS)
- Reflections on Data Science (7.5 ECTS)
- Bachelor Project (15 ECTS)

Subsection 3. The study activities of the programme consist of *modules.* A module consists of a *course* and a *project* that are assessed, or of a *course* or a *project* that is assessed.

Section 5. Each semester comprises three or four modules: Two courses worth 7.5 ECTS points and one course with a project worth 15 ECTS points, or a large, independent project worth 15 ECTS points or four courses worth 7.5 ECTS points.

Subsection 2. The modules appear in the table below. The Board of Studies in advance of each semester publishes courses and course descriptions in the course catalogue on the IT University's website.

Semester	15 ECTS		7.5 ECTS	7.5 ECTS
1	Introduction to Data Science and Programming		Linear Algebra and Optimisation	Mathematical Thinking and Probability Theory
2	Applied Statistics		Algorithms and Data Structures	Projects in Data Science
3	Machine Learning		Introduction to Database Systems	Network Analysis
4	Natural Language Processing and Deep Learning		Data Visualisation and Data-driven Decision Making	Large-scale Data Analysis
5	Technical Communication	Security and Privacy	Software Development and Software Engineering	Elective
6	Bachelor Project		Reflections on Data Science	Elective

Programme Language

Section 7. The programme is conducted in English in the three years of study.

Subsection 2. Students must therefore be able to read texts in English, participate actively in teaching conducted in the English language, and write and present assignments and projects in English.

Subsection 3. Students will be trained in making presentations in oral and written English.

Subsection 4. All examinations will be conducted in English.

Chapter 3

General Rules and Miscellaneous regulation

Subsection 2. Furthermore, please refer to the IT University's rules and regulation, appendix to this curriculum.

Chapter 4

Date of Commencement and Transitional Regulations

Section 9. This curriculum comes into force 1 August 2023 and applies to all students admitted to the Bachelor Programme in Data Science from autumn 2023.

Subsection 2. When a new curriculum is published, or in the event of significant changes to this curriculum, transitional regulations will be set out in the curriculum as appendix.

Revision approved by the Board of Studies 25 November 2022

Revision approved by Vice Chancellor Per Bruun Brockhoff 08 December 2022

P. B. Brockhoff