M. Sc. Data Science

Introductory Meeting
Master of Data Science

Program Coordination

Head of program
- Prof. Dr. Martin Grohe

Academic advisor
- Christof Löding
- email: data-science@cs.rwth-aachen.de
- Office Hours: see section “contact” on website
  https://www.data-science.rwth-aachen.de/
Outline

1. Program Structure

<table>
<thead>
<tr>
<th>Foundational (Core) Area (44 - 64 CP)</th>
<th>Computer Science (at least 18 CP)</th>
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<tbody>
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S/P (12 CP) Seminar (5 CP), Practical Course (7 CP)

Specialisation Area (14 - 22 CP)

Master's Thesis (30 CP)

Lecture courses from respective catalogues

Master's thesis

Additional Competences (0 - 12 CP)

Language course, non-technical courses from universities' program,...

2. Planning your Studies
Program Structure

Where to find information:

- Official Documents (only available in German):
  - “Übergreifende Prüfungsordnung” (general rules for all programs)
  - “Fachspezifische Prüfungsordnung” (subject specific rules)
- Slides from this meeting (will be published on the web)
- Descriptions on website https://www.data-science.rwth-aachen.de/
## Program Structure

### Foundational (Core) Area
- **(44 - 64 CP)**
  - **Computer Science (at least 18 CP)**
    - *Introduction to Data Science (6 CP) + further CS courses*
  - **Mathematics (at least 18 CP)**
    - *Mathematics of Data Science (9 CP) + further Math courses*
  - **Data Science Ethics**
    - *Ethics, Technology, and Data (4 CP)*

### S/P (12 CP)
- **Seminar (5 CP), Practical Course (7 CP)**
- **Specialisation Area**
  - **(14 - 22 CP)**
  - **Master's Thesis**
  - **(30 CP)**
- **Additional Competences**
  - **(0 - 12 CP)**

### Lecture courses from respective catalogues
- **Master’s thesis**

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<tr>
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<th>Mathematics (M)</th>
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| Language course, non-technical courses from universities’ program,... |

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**M. Sc. Data Science | Christof Löding | Computer Science 7 | RWTH Aachen | Winter Semester 2020/21**
Foundational (or Core) Area (44-64 CP)

Mandatory Courses

Introduction to Data Science (6 CP)
- Prof. Dr. Wil van der Aalst
- this semester

Mathematics of Data Science (9 CP)
- Prof. Dr. Erhard Cramer
- Prof. Dr. Holger Rauhut
- this semester

Ethics, Technology, and Data (4 CP)
- Prof. Dr. Sakia Nagel
- next semester
Foundational (or Core) Area (44-64 CP)

Elective Courses

**Computer Science** (at least 12 CP)
- Machine Learning  
- Data Analysis and Visualization  
- Probabilistic Programming  
- Privacy Enhancing Technologies for Data Science  
- Algorithmic Foundations of Data Science  
- Concepts and Models for Parallel Data-Centric Computation  
- Semantic Web

**Mathematics** (at least 9 CP)
- Applied Data Analysis  
- Exploratory Data Analysis  
- Nonlinear Optimization *Optimierung A*  
- Combinatorial Optimization *Optimierung B*  
- Mathematical Signal and Image Processing  
- High-Dimensional Probability for Mathematicians and Data Scientists

*this semester* (6 CP)
*this semester* (4 CP)
*this semester* (6 CP)
*this semester* (4 CP)
*this semester* (9 CP)
*this semester* (9 CP)
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Seminar and Practical Course (5+7 CP)

**Seminar:** oral presentation and written report on a subject assigned to you

**Practical course:** software project in a team

- Each semester, there is a variety of seminars and practical courses offered by the department.
- Registration and distribution of places outside of RWTHonline in a separate system *already at the end of the previous semester.*
- You will be informed via the mailing list when the process starts.
Specialisation Area (14 - 22 CP)

- Elective courses of 14-22 CP from one of the following areas:
  - Computer Science
  - Mathematics
  - Computer Science and Mathematics
  - Business Analytics
  - Computational Life Science
  - Computational Social Science
  - Physics (only of Students with a Bachelor’s Degree in Physics)

- For each area there is a catalogue of courses (see RWTHonline)
- Master’s Thesis in your Specialisation Area
- Formal election of Specialisation Area together with the registration of Master’s Thesis (at the latest)
Specialisation Area (14 - 22 CP)

Rules for Specialization

Business Analytics, Computational Life Science, Physics:
- at least 20 CP from the courses of the respective area

Computer Science, Mathematics, Computer Science and Mathematics:
- at least 10 CP from the courses of the respective area
- at most 6 CP of courses from any other specialization area

Computational Social Science
- at least 10 CP from the courses of the respective area
- at most 8 CP of courses from specialization CS or maths
Specialisation Area – Master’s Thesis (30 CP)

- Requirements for registration
  - “Introduction to Data Science”
  - “Mathematics of Data Science”
  - “Ethics, Technology and Data”
  - at least 60 CP
  - (specialization “Business Analytics”: at least one of “Combinatorial Optimization” or “Operations Research I”)

Specialisation Area – Master’s Thesis (30 CP)

- Requirements for registration
  - “Introduction to Data Science”
  - “Mathematics of Data Science”
  - “Ethics, Technology and Data”
  - at least 60 CP
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- topic from specialisation area
- thesis (27 CP) + oral presentation (3 CP)
- 6 Months duration. max 100 pages
- first reviewer should be from the specialisation area
- second reviewer should be from CS or math department
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Hand in

- 3 printed versions at ZPA (central examination office)
- data and source code digitally
Additional Competences (0-12 CP)

Twofold purpose:

- Opportunity to broaden your knowledge on non-technical subjects:
  - language course at RWTH language center (up to 4 CP): register today for this semester!
  - any “non-technical” course offered at RWTH Aachen
    (philosophy, history, social sciences, economics, …)

- You join with background on CS, maths, or physics. You can attend basic courses from CS or maths if this is not your background:
  - bridge courses (blended learning modules):
    Algorithms and Data Structures, Databases, Theory of Computation
    Stochastic II, Analysis II
  - or corresponding courses from CS/math bachelor (in German)
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Approval needed: Except for the language course, your choices for additional competences need to be approved by the academic advisor.

Rules for this area have changed last summer (so do not trust old information that you see or hear).

See also section “Additional Competences” for M.Sc. Data Science on website https://www.data-science.rwth-aachen.de/
# Program Structure – Summary

| Foundational (Core) Area (44 - 64 CP) | Computer Science (at least 18 CP)  
*Introduction to Data Science (6 CP) + further CS courses*  
Mathematics (at least 18 CP)  
*Mathematics of Data Science (9 CP) + further Math courses*  
Data Science Ethics  
*Ethics, Technology, and Data (4 CP)* |
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**Mathematics** (M)  
**Computer Science and Mathematics**  
Application Area (BA, CLS, CSS or P) |
| Master's Thesis (30 CP)              | Lecture courses from respective catalogues  
Master's thesis                        |
| Additional Competences (0 - 12 CP)   | Language course, non-technical courses from universities' program,...              |
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| Additional Competences (0 - 12 CP) | Language course, non-technical courses from universities' program, ... |

2. Planning your Studies

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<td>Electives from Mathematics ≥ 10</td>
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<td>Master's Thesis 30</td>
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Planning your Studies (Example)

Example for a first semester:

- Introduction to Data Science (6 CP, mandatory CS, core area)
- Mathematics of Data Science (9 CP, mandatory math, core area)
- Machine Learning (6 CP, electives CS, core area)
- Probabilistic Programming (6 CP, electives CS, core area)
- Language course (4 CP, additional competences)
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- Language course (4 CP, additional competences)

Example for a second semester:
- Ethics, Technology, and Data (4 CP, mandatory, core area)
- Algorithmic Foundations of Data Science (6 CP, electives CS, core area)
- High-Dimensional Probability for Mathematicians and Data Scientists (9 CP, electives maths, core area)
- first course from your specialization area (6 CP)
- Seminar (5 CP) or practical course (7 CP)
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- Algorithmic Foundations of Data Science (6 CP, electives CS, core area)
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- first course from your specialization area (6 CP)
- Seminar (5 CP)

Note: Some courses might be overlapping. But for almost all courses, a lot of digital material is provided, such that studying overlapping courses is possible.
- Campus management system (available in English)
- Schedule planing
- Offered lectures
- Registration for lectures and exams

RWTHonline

https://online.rwth-aachen.de
Finding and Choosing Courses

- Catalogue of courses generally offered in the data science program
- Before a semester starts, you can check in RWTHonline which courses are offered in that semester
- Elective courses of the computer science department (in general, not specific to data science) are usually presented at the beginning of the semester:
  https://www.graphics.rwth-aachen.de/media/resource_files/twominutemadness_ws_20.html

See also FAQ

See FAQ on https://www.data-science.rwth-aachen.de/
Question: “Where can I get information on the curriculum?”

Language

Teaching is done in English. Ask the lecturers if not.
Registration for Courses and Exams

Courses:
- Register in RWTHonline at beginning of semester (see there for deadlines, usually until a few weeks after start of semester)
- Registration does not imply that you actually have to take the course

Exams:
- Register in RWTHonline once you have decided which courses to take
- Deadlines currently vary because of Covid-19
- You should register in December or beginning of January to be on the safe side
- You can deregister from an exam until a few days before the exam (again, exact deadlines currently vary)
- Details on the exams (written, oral, or other components) are announced in the courses
- In some courses you need to do weekly exercises to get an admission for the exam.
Who is Doing What?

Individual research groups:
- offer courses and corresponding exams (look at the webpages of the individual research groups to find out more about their research and teaching)
- set up and administer registration for courses and exams

ZPA (central examination office):
- administration of your academic record

Academic advisor:
- answer questions, give advice, approve additional competences, ...
The End

Contact: data-science@cs.rwth-aachen.de

Office hours via zoom: see section “Contact” for M.Sc. Data Science on https://www.data-science.rwth-aachen.de/