M. Sc. Data Science

Introductory Meeting

Program Coordination

Head of program

- Prof. Dr. Torsten Kuhlen

Academic advisor

- Timo Gersing & Isaak Lim
- email: data-science@cs.rwth-aachen.de
- website: sc.informatik.rwth-aachen.de/en/studium/master/master-data-science

Outline

1. 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)	Computer Science (CS)	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,... |

2. Planning your Studies

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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 under
  sc.informatik.rwth-aachen.de/en/studium/master/master-data-science/program-structure/

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General Structure:
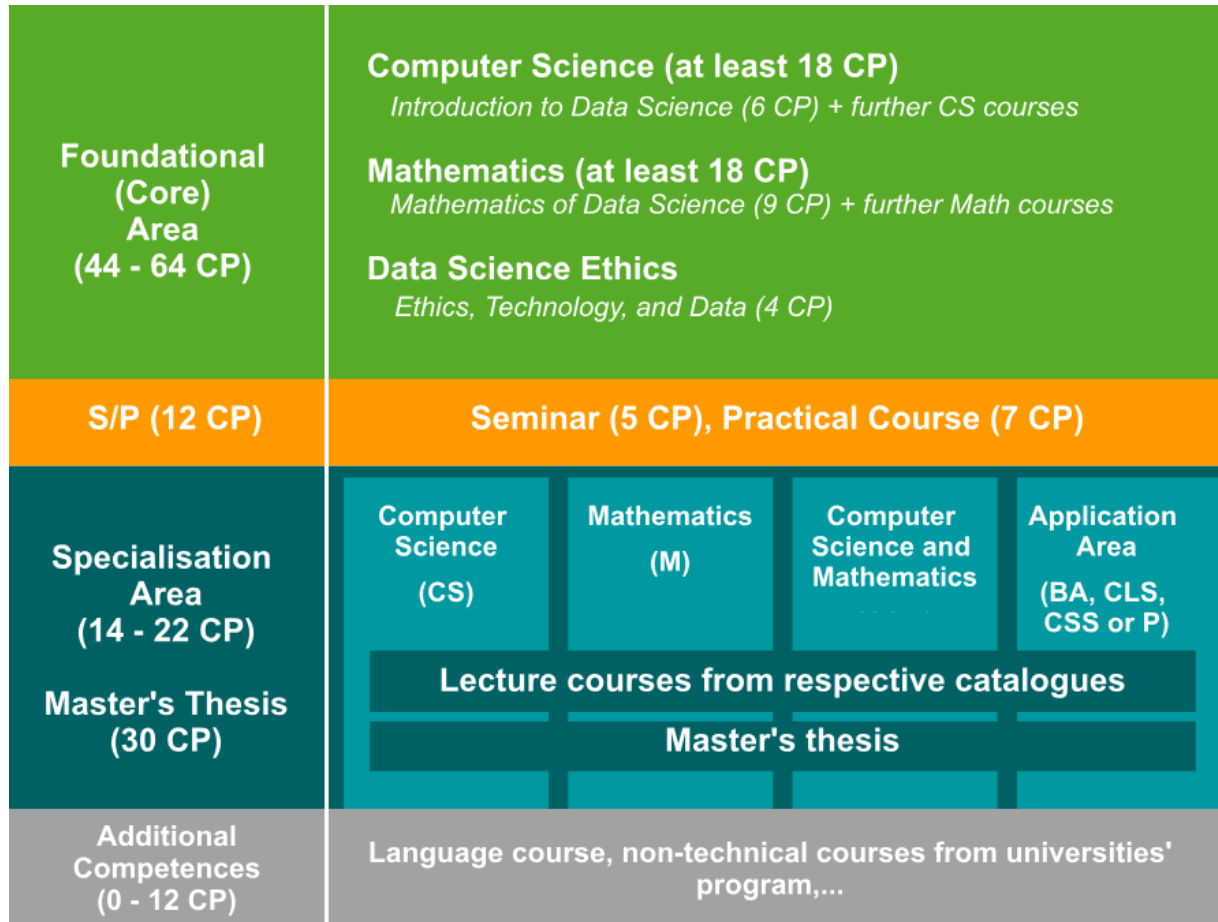
- You need to complete 120 CP (credit points = ECTS) for your degree.
- Master thesis counts for 30 CP.
- You have to choose and complete courses for 90 CP in total from different areas according to some rules, as explained in the following.

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$+$ "Scientific Integrity"

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Foundational (or Core) Area (44-64 CP)

Mandatory Courses

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

Mathematics of Data Science (9 CP)
- Prof. Dr. Erhard Cramer
- next semester

Ethics, Technology, and Data (4 CP)
- Prof. Dr. Sakia Nagel
- this semester

Foundational (or Core) Area (44-64 CP)

Elective Courses

Computer Science (at least 12 CP)
- Machine Learning (6 CP)
- Data Analysis and Visualization (4 CP)
- Probabilistic Programming **this semester** (6 CP)
- Privacy Enhancing Technologies for Data Science (4 CP)
- Algorithmic Foundations of Data Science **this semester** (6 CP)
- Concepts and Models for Parallel Data-Centric Computation **this semester** (6 CP)
- Semantic Web (4 CP)

Mathematics (at least 9 CP)
- Applied Data Analysis (9 CP)
- Nonlinear Optimization *Optimierung A* **this semester** (9 CP)
- Combinatorial Optimization *Optimierung B* (9 CP)
- Mathematical Methods of Signal and Image Processing (9 CP)
- High-Dimensional Probability for Mathematicians and Data Scientists (9 CP)
- Mathematical Foundations of Machine Learning (9 CP)

Seminar and Lab Course (5+7 CP)

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

Lab course (practical course): software project in a team

- Each semester, there is a variety of seminars and lab 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 for Students with a Bachelor's Degree in Physics)
- For each area there is a catalogue of courses (see RWTHonline)
- Formal election of specialisation area together with the registration of Master's Thesis (at the latest)

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- For each area there is a catalogue of courses (see RWTHonline)
- Formal election of specialisation area together with the registration of Master's Thesis (at the latest)

Rule for upper credit limit: One course "overflowing" the 22 CP is allowed. Example:

- 4 courses with 6 CP ($=$ 24 CP) would be fully counted.
- 5 courses with 6 CP are too many, one of them would not be counted.

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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
  - at least 60 CP
  - completed course "Scientific Integrity"
  - specialization "Business Analytics": at least one of "Combinatorial Optimization" or "Operations Research I"
  - always recommended: completed the mandatory courses "Introduction to Data Science", "Mathematics of Data Science", "Ethics, Technology and Data"

Specialisation Area – Master's Thesis (30 CP)

- Requirements for registration
  - at least 60 CP
  - completed course "Scientific Integrity"
  - specialization "Business Analytics": at least one of "Combinatorial Optimization" or "Operations Research I"
  - always recommended: completed the mandatory courses "Introduction to Data Science", "Mathematics of Data Science", "Ethics, Technology and Data"
- topic from specialisation area; there is no central list of topics, you have to directly contact the research groups
- thesis (27 CP) + oral presentation (3 CP)
- 6 Months duration, max 100 pages
- first reviewer from the specialisation area, second reviewer from CS or math department
- written within RWTH with a professor from your specialization area; external theses are an exception and should be coordinated with a research group from your specialization

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Computer Science

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Additional Competences (0-12 CP)

This area is optional!

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!**
  - "non-technical" courses offered at RWTH Aachen (up to 6 CP)
    (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):
    with background maths or physics: Algorithms and Data Structures, Databases (every semester)
    with background CS or physics: Stochastics II (winter)
  - or corresponding courses from CS/math bachelor (in German)

Grades of courses in additional competences do not count for the final grade (but the credits do count).

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  - or corresponding courses from CS/math bachelor (in German)

Grades of courses in additional competences do not count for the final grade (but the credits do count).

Approval needed: Except for the language course, your choices for additional competences currently need to be approved by the academic advisor.

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Scientific Integrity

- Online Course about good scientific practice (offered each semester)
- Mandatory for all master students of RWTH Aachen since winter 2020.
- Exam as so-called homework via Dynexite (offered twice per semester)
- No credits for this course
- More information: Web page for course Scientific Integrity

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See also descriptions on the website sc.informatik.rwth-aachen.de/en/studium/master/master-data-science/program-structure/

+ "Scientific Integrity"

Outline

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Planning your Studies

Example for a first semester:

- Ethics, Technology, and Data (4 CP, mandatory, core area)
- Two lectures from core area CS (2×6 CP)
- One lecture from core area Math (9 CP)
- Language course (4 CP, additional competences)

Planning your Studies

Example for a first semester:

- Ethics, Technology, and Data (4 CP, mandatory, core area)
- Two lectures from core area CS (2×6 CP)
- One lecture from core area Math (9 CP)
- Language course (4 CP, additional competences)

Example for a second semester:

- Introduction to Data Science (6 CP, mandatory CS, core area)
- Mathematics of Data Science (9 CP, mandatory Math, core area)
- One lecture from core area (CP vary)
- One or two lectures from specialization (CP vary)

Planning your Studies

Example for a third semester:

- Seminar (5 CP)
- Software Lab (7 CP)
- One or two lectures in specialization (CP vary)
- Remaining CP in core/specialization/additional competences (reach $\geq$90 CP)

Planning your Studies

Example for a third semester:

- Seminar (5 CP)
- Software Lab (7 CP)
- One or two lectures in specialization (CP vary)
- Remaining CP in core/specialization/additional competences (reach $\geq$90 CP)

Fourth semester: Master thesis (30 CP)

Planning your Studies

Example for a third semester:
- Seminar (5 CP)
- Software Lab (7 CP)
- One or two lectures in specialization (CP vary)
- Remaining CP in core/specialization/additional competences (reach $\geq$90 CP)

Fourth semester: Master thesis (30 CP)

Remarks:
- This is just an example, you may deviate from this structure. There is no guarantee that (core area) courses are offered every year. Plan ahead to obtain all necessary CP.
- Some courses might be overlapping. But for almost all courses, a lot of digital material is provided, such that studying overlapping courses is possible.
- It is also possible to do courses in parallel with the thesis.

Finding and Choosing Courses

- Catalogue of courses generally offered in the data science program in RWTHonline
- See also FAQ on sc.informatik.rwth-aachen.de
  Question: "Where can I get information on the curriculum?"
- 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:
  Webpage for elective courses of CS department in winter 2023/24
- Teaching is done in English. Ask the lecturers if not.

Registration:
- 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

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Exams

- 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.
- For the courses of a semester, usually two written exams are offered after the teaching period.
- If you fail the first attempt, you can register for the second one. You can also skip the first one and only take the second one.
- You have three attempts to pass the exam of a course. If you fail the two attempts of one semester, you have to wait until the course is offered again (or choose another course in case of electives).
- Register in RWTHonline once you have decided which courses to take.
- Current uniform registration deadlines (can vary for some courses):
  - First exam: May 15 – July 1
  - Second exam: until one week before exam
- You can deregister from an exam until three working days days before the exam.
- See webpage with information on exams: (de)registration, withdrawal due to illness,...

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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
sc.informatik.rwth-aachen.de