M. Sc. Data Science

Introductory Meeting

Computer Science
RWTH AACHEN UNIVERSITY

Program Coordination

Head of program

- Prof. Dr. Torsten Kuhlen

Academic advisor

- Isaak Lim
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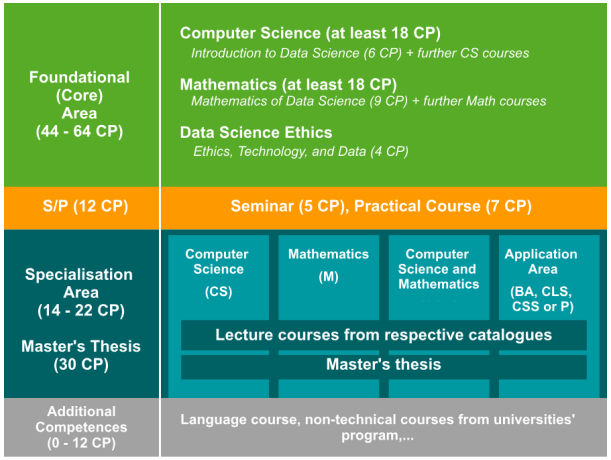
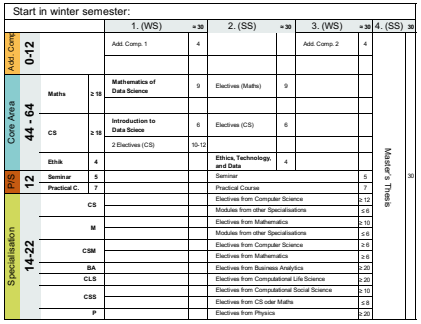
- website: sc.informatik.rwth-aachen.de/en/studium/master/master-data-science

Outline

1. Program Structure



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

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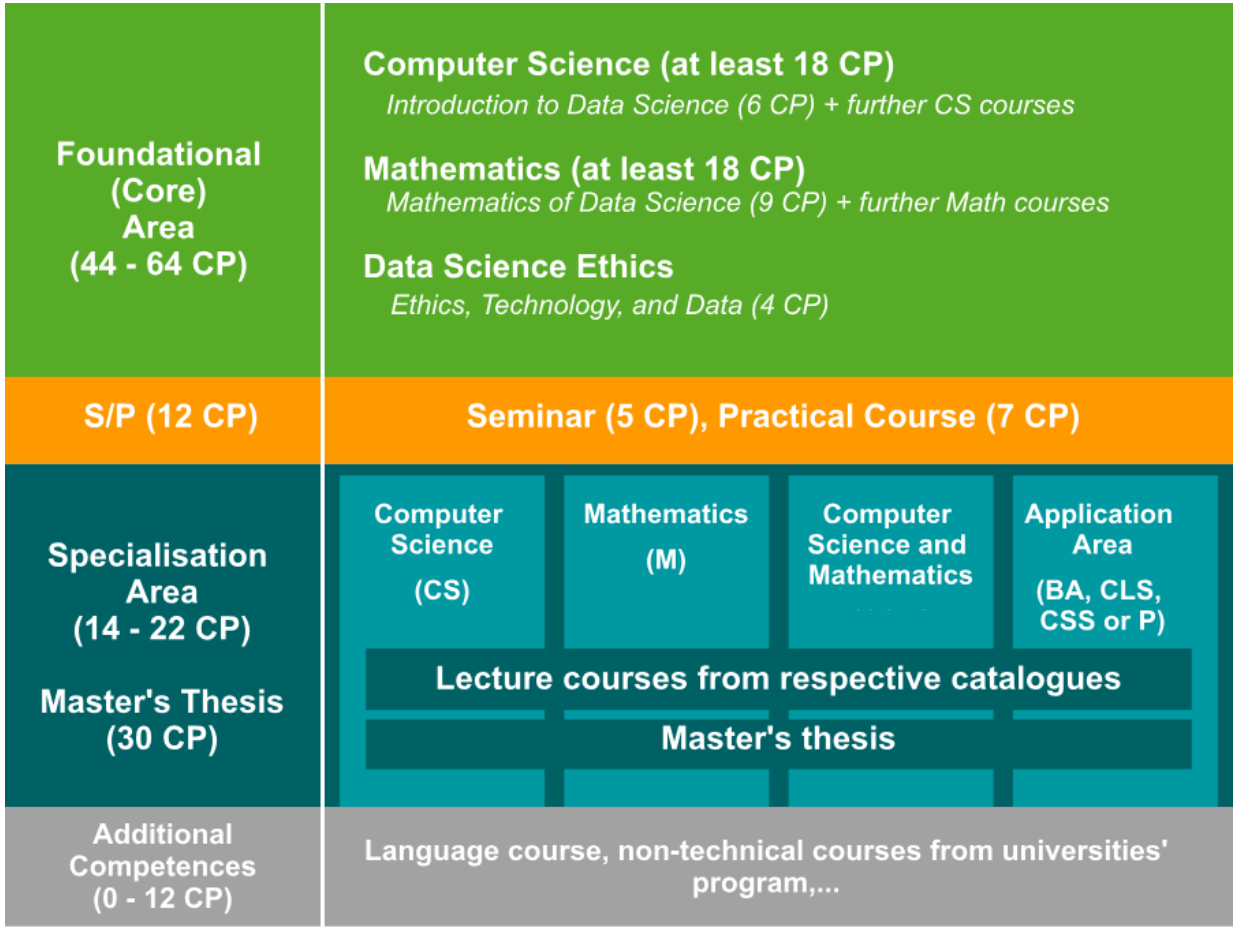
General Structure:

- 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.

Program Structure



+ "Scientific Integrity"

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

Mathematics (at least 9 CP)

- Applied Data Analysis (9 CP)
- Nonlinear Optimization *Optimierung A* (9 CP)
- Combinatorial Optimization *Optimierung B* **this semester** (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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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.

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

Specialisation Area – Master's Thesis (30 CP)

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

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).

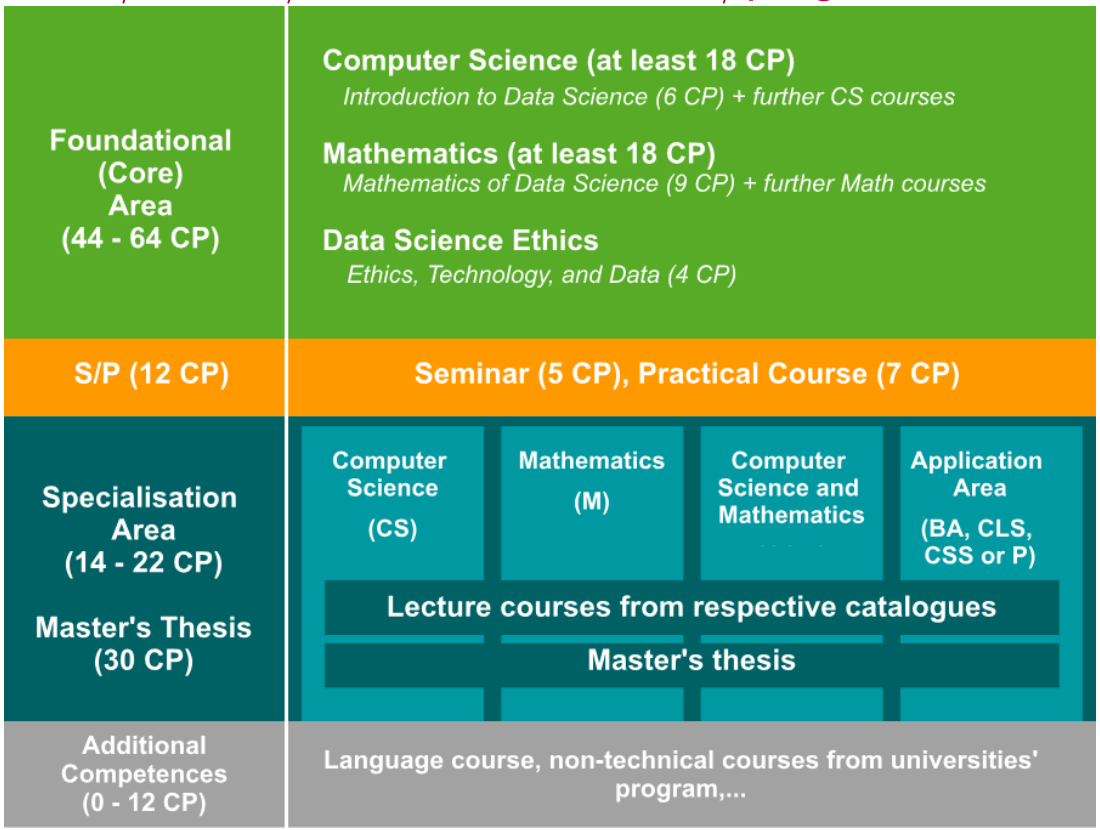
Approval needed: Except for the language course, your choices for additional competences currently need to be approved by the academic advisor.

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

Program Structure – Summary

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



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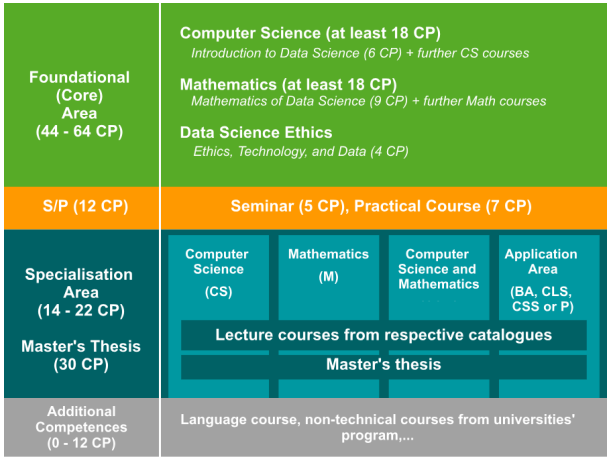

2. Planning your Studies

Start in winter semester:

				1. (WS)	≈ 30	2. (SS)	≈ 30	3. (WS)	≈ 30	4. (SS)	30
Add. Cont.	0-12			Add. Comp. 1	4			Add. Comp. 2	4		
Core Area	44 - 64	Maths	≥ 18	Mathematics of Data Science	9	Electives (Maths)	9			Master's Thesis	30
		CS	≥ 18	Introduction to Data Scince	6	Electives (CS)	6				
				2 Electives (CS)	10-12						
		Ethik	4			Ethics, Technology, and Data	4				
P/S	12	Seminar	5			Seminar	5				
		Practical C.	7			Practical Course	7				
Specialisation	14-22	CS				Electives from Computer Science	≥ 12				
						Modules from other Specialisations	≤ 8				
		M				Electives from Mathematics	≥ 10				
						Modules from other Specialisations	≤ 8				
		CSM				Electives from Computer Science	≥ 6				
						Electives from Mathematics	≥ 8				
		BA				Electives from Business Analytics	≥ 20				
		CLS				Electives from Computational Life Science	≥ 20				
		CSS				Electives from Computational Social Science	≥ 10				
						Electives from CS oder Maths	≤ 8				
		P				Electives from Physics	≥ 20				

Planning your Studies

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)
- Data Analysis and Visualization (4 CP, electives CS, core area)
- Language course (4 CP, additional competences)

Planning your Studies

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)
- Data Analysis and Visualization (4 CP, electives CS, core area)
- 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)
- Concepts and Models for Parallel Data-Centric Computation (6 CP, electives CS, core area)
- Mathematical Foundations of Machine Learning (9 CP, electives maths, core area)
- first course from specialization CS (6 CP)

Planning your Studies

Example for a third semester:

- Seminar (5 CP)
- Software Lab (7 CP)
- Privacy Enhancing Technologies for Data Science (4 CP, electives CS, core area)
- second course from specialization CS (8 CP)
- third course from specialization CS (6 CP)

Fourth semester: Master thesis (30 CP)

Planning your Studies

Example for a third semester:

- Seminar (5 CP)
- Software Lab (7 CP)
- Privacy Enhancing Technologies for Data Science (4 CP, electives CS, core area)
- second course from specialization CS (8 CP)
- third course from specialization CS (6 CP)

Fourth semester: Master thesis (30 CP)

Remarks:

- This is just an illustrative example for specialization CS. There is no guarantee that the mentioned courses are offered in the corresponding semester.
- 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

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 registration deadlines:
  - First exam: November 15 – January 15
  - 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,...

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