



M. Sc. Data Science

Introductory Meeting – Summer 2023

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 www.data-science.rwth-aachen.de

Outline

1. Program Structure

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

Start in winter semester:									
		1. (WS)	=30	2. (SS)	=30	3. (WS)	=30	4. (SS)	=30
Add. Comp.	0-12								
		Add. Comp. 1	4			Add. Comp. 2	4		
Core Area	44 - 64	Maths	>18	Mathematics of Data Science	9	Elective (Maths)	9		
		CS	>18	Introduction to Data Science	6	Elective (CS)	6		
			2 Electives (CS)	10-12					
			Ethics, Technology, and Data	4					
S/P	12	Seminar	5						
		Practical C.	7			Practical Course	7		
Specialisation	14-22								
		CS				Elective from Computer Science	2-12		
						Modules from other Specialisations	2-6		
		M				Elective from Mathematics	2-6		
						Modules from other Specialisations	2-6		
		CSM				Elective from Computer Science	2-6		
						Elective from Mathematics	2-6		
		BA				Elective from Business Analytics	2-20		
CLS				Elective from Computational Life Science	2-20				
				Elective from Computational Social Science	2-20				
				Elective from CS oder Math	2-8				
				Elective from Physics	2-20				

Program Structure

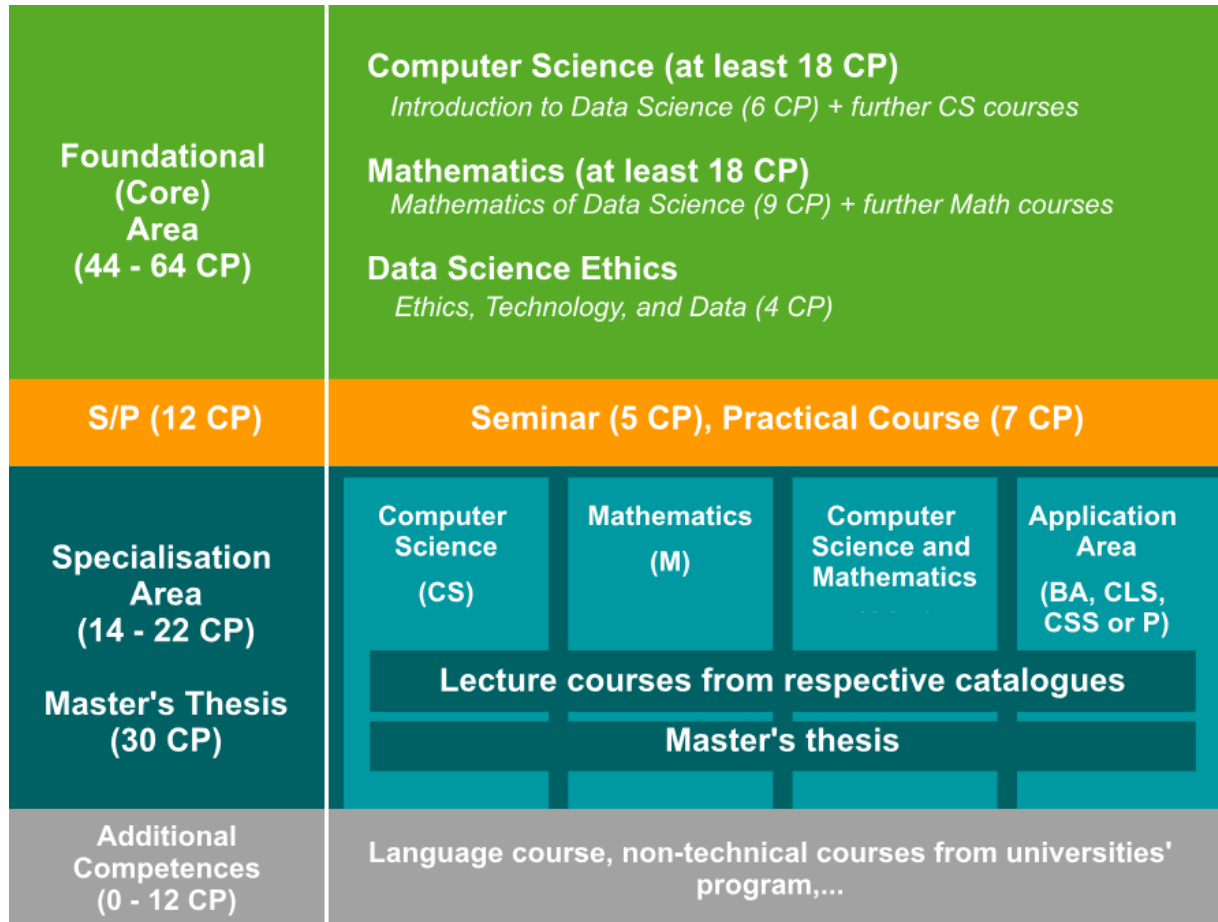
Where to find information:

- 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 www.data-science.rwth-aachen.de

General Structure:

- You need to complete 120 CP (credit points) 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
- next semester



Mathematics of Data Science (9 CP)

- Prof. Dr. Erhard Cramer
- Prof. Dr. Holger Rauhut
- 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 (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)
- Exploratory Data Analysis **this semester** (6 CP)
- Mathematical Foundations of Machine Learning (9 CP)
- Nonlinear Optimization (*Optimierung A*) **this semester** (9 CP)
- Combinatorial Optimization (*Optimierung B*) (9 CP)
- Mathematical Signal and Image Processing (9 CP)
- High-Dimensional Probability for Mathematicians and Data Scientists **this semester** (9 CP)

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

Credit Bounds

The minimum requirements for the parts Computer Science, Mathematics, and Ethics in the core area are:

- **Computer Science:** at least 18 CP (including the mandatory course)
- **Mathematics:** at least 18 CP (including the mandatory course)
- **Ethics:** 4 CP (only the mandatory course)

Adding up these minimum values gives 40 CP.

But you have to do at least 44 CP in the whole area.

So you need at least one extra course of 4 CP for the overall minimum requirement of the core area.

Seminar and Lab Course (5+7 CP)

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

Lab 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** via the **SuPra System**
- You will be informed via the mailing list when the process starts.

Note: Only one seminar and one lab are part of the curriculum. If you have passed a seminar/lab, you cannot take another seminar/lab (if you do, it will not be counted for your degree).

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)

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 Areas

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”
- written thesis (27 CP) + oral presentation (3 CP)
- 6 months duration starting from official registration
- **topic from specialisation area**; there is no central list of topics, you have to directly contact the research groups
- **first reviewer from the specialisation area**, second reviewer from CS or math department (in particular, you cannot just look for an external thesis)

See [section “Master thesis”](#) on the web page for Data Science

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 till Monday 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):
Algorithms and Data Structures, Databases (every semester)
Stochastic II
 - 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 count).

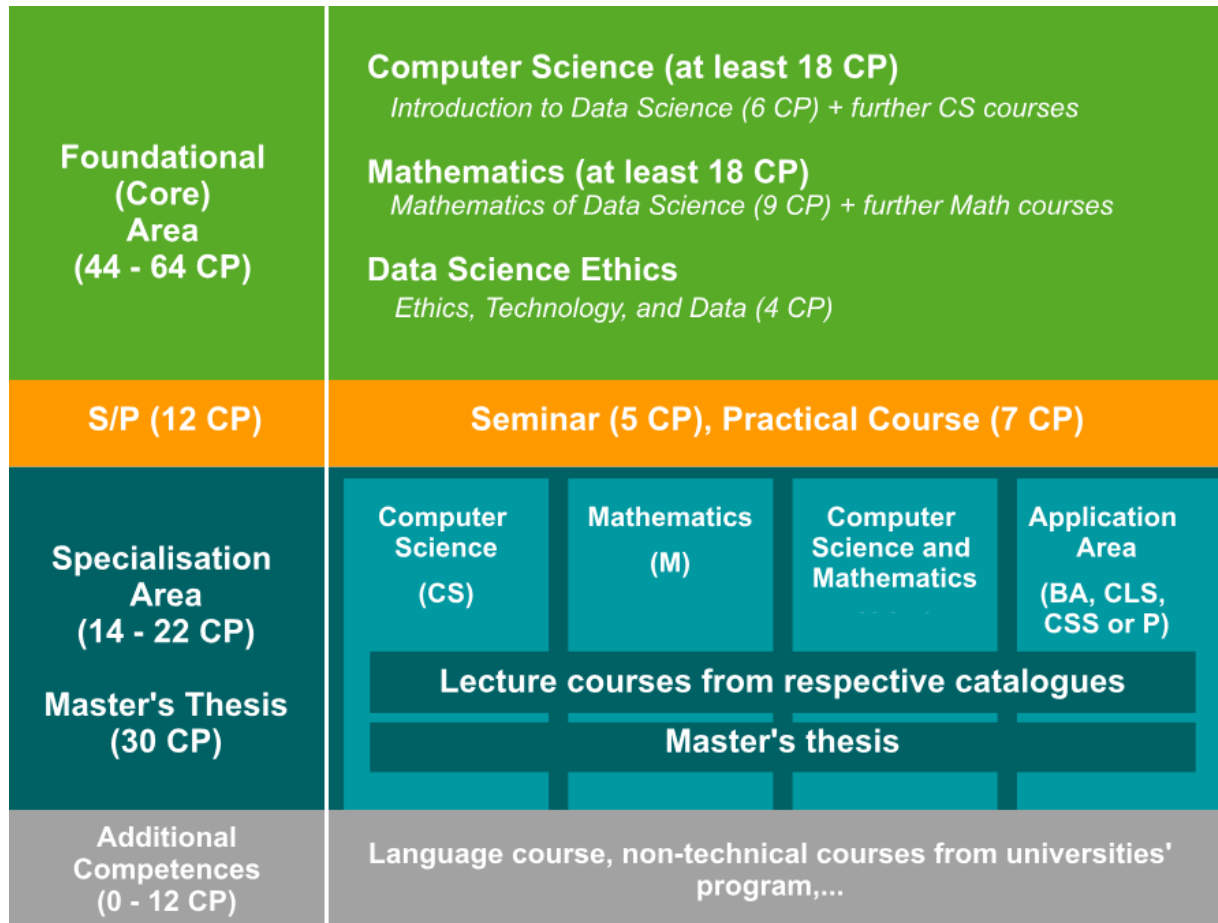
Approval needed: Except for the language course, your choices for additional competences currently need to be approved by the academic advisor (they are not yet modelled in RWTHonline).

See also section “Additional Competences” for M.Sc. Data Science on website www.data-science.rwth-aachen.de

Scientific Integrity

- Online Course about good scientific practice (offered each semester)
- Mandatory for all master students of RWTH Aachen who started from October 1st 2020.
- Exam as so-called homework via Dynexite (offered twice per semester).
- More information: [Web page for course Scientific Integrity](#)

Program Structure – Summary



+ “Scientific Integrity”

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		2 Electives (CS)	10-12			
Ethics				Ethics, Technology, and Data	4	
S/P	12	Seminar	5		Seminar	5
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Specialisation 14-22						Master's Thesis 30
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				Modules from other Specialisations	2-6	
	CSM			Electives from Computer Science	2-6	
				Electives from Mathematics	2-6	
	BA			Electives from Business Analytics	2-6	
CLS			Electives from Computational Life Science	2-6		
			Electives from Computational Social Science	2-6		
CSS			Electives from CS oder Math	2-6		
P			Electives from Physics	2-6		

Planning your Studies

Example for a first semester:

- **Ethics, Technology, and Data (4 CP, mandatory, core area)**
- High-Dimensional Probability for Mathematicians and Data Scientists (9 CP, electives maths, core area)
- Concepts and Models for Parallel Data-Centric Computation (6 CP, core area)
- Algorithmic Foundations of Data Science (6 CP, electives CS, core area)
- Language course (4 CP, additional competences)

Note: This example only lists core courses (except the language course).

There is no requirement on the order of courses. You can also take courses from the specialization.

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)**
- Machine Learning (6 CP, electives CS, core area)
- first course from your specialization area (6 CP)
- Seminar (5 CP)

Finding and Choosing Courses

- Catalogue of courses generally offered in the data science program in RWTHOnline
- See also [FAQ on www.data-science.rwth-aachen.de](http://www.data-science.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:
[Web page for elective courses of CS department in summer 2023](#)
- 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
- Registration for a course is not a registration for the exam

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.
- Register in RWTHonline once you have decided which courses to take.
- Current registration deadlines:
 - First exam: May 15 – July 1
 - Second exam: until one week before exam
- You can deregister from an exam until three working days before the exam.
- See web page with [information on exams: \(de\)registration, withdrawal due to illness,...](#)

Number of Attempts, Changing an Elective

- You have three attempts for passing a course. If you fail three times, the course is finally failed. If you fail the third attempt of a written exam, then there is the possibility of a supplementary oral exam, [see this web page](#)
- If you finally fail a mandatory course, then you have to stop the M.Sc. Data Science.
- You do not have to complete elective courses that you started (even if you failed the exam once or twice).
- For “changing an elective” just register for another one. Only the courses that you pass are counted for your degree.
- If you fail a seminar or lab, just register for another one in the next semester (you do not have to repeat this specific seminar or lab).
- For seminar and lab, you also have three attempts, respectively.

Who is Doing What?

Individual research groups:

- offer courses and corresponding exams (look at the web-pages 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), Lisa Schwier:

- 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 www.data-science.rwth-aachen.de