M. Sc. Data Science

Introductory Meeting – Summer 2021
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

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

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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

<table>
<thead>
<tr>
<th>Foundational (Core) Area (44 - 64 CP)</th>
<th>Computer Science (at least 18 CP)</th>
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+ **“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 (this semester 9 CP)
- Exploratory Data Analysis (6 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)
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 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 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”
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”
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- 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
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- Requirements for registration
  - at least 60 CP
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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!
  - “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 (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 count).
Additional Competences (0-12 CP)

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- Opportunity to broaden your knowledge on non-technical subjects:
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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

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| Specialisation Area (14 - 22 CP) | Lecture courses from respective catalogues |

| Master's Thesis (30 CP) | Master's thesis |

| Additional Competences (0 - 12 CP) | Language course, non-technical courses from universities' program, ... |

+ “Scientific Integrity”
Outline

1. Program Structure

   **Foundation Area**
   - Core Area: (44 - 64 CP)
   - Computer Science (at least 18 CP)
   - Mathematics (at least 18 CP)
   - Data Science Ethics

   **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

   **Master's Thesis** (30 CP)

   **Additional Competences** (0 - 12 CP)

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

2. Planning your Studies
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<td>5</td>
<td>4</td>
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| 1. (SS)    | ≥ 30    |
| 2. (WS)    | ≥ 30    |
| 3. (SS)    | ≥ 30    |
| 4. (WS)    | ≥ 30    |

Start in summer semester:

- Add. Comp. 1
- Mathematics of Data Science
- Introduction to Data Science
- Ethics, Technology, and Data Seminar
- Practical Course (Lab)
- Electives from Physics
- Electives from Mathematics
- Electives from other Specialisations
- Electives from Computer Science and Mathematics
- Electives from other Specialisations
- Electives from Business Analytics
- Electives from Computer Science
- Electives from other Specialisations
- Electives from Computational Life Science
- Electives from Computer Science
- Electives from other Specialisations
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- Electives from CS oder Maths
- Electives from other Specialisations
- Electives from Computer Science
Planning your Studies (Example)

Example for a first semester:

- Ethics, Technology, and Data (4 CP, mandatory, core area)
- Applied Data Analysis (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)
Planning your Studies (Example)

Example for a first semester:
- Ethics, Technology, and Data (4 CP, mandatory, core area)
- Applied Data Analysis (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)

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)
Campus management system (available in English): online.rwth-aachen.de
Browse courses that are offered
Plan your schedule
Registration for lectures and exams

**Tutorial**

PDF document: Presentation “Introduction to RWTHonline for Students”
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: sc.informatik.rwth-aachen.de/en/videos

See also FAQ

See FAQ on 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.
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 finally fail a mandatory course, then you have to stop the M.Sc. Data Science.
- You should avoid finally failing an elective course.
- 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), Gaby Cüpper:

- 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