



Welcome to Paderborn

Introduction to the Master Program in Computer Science

Dr. Harald Selke · October 2023





Paderborn University

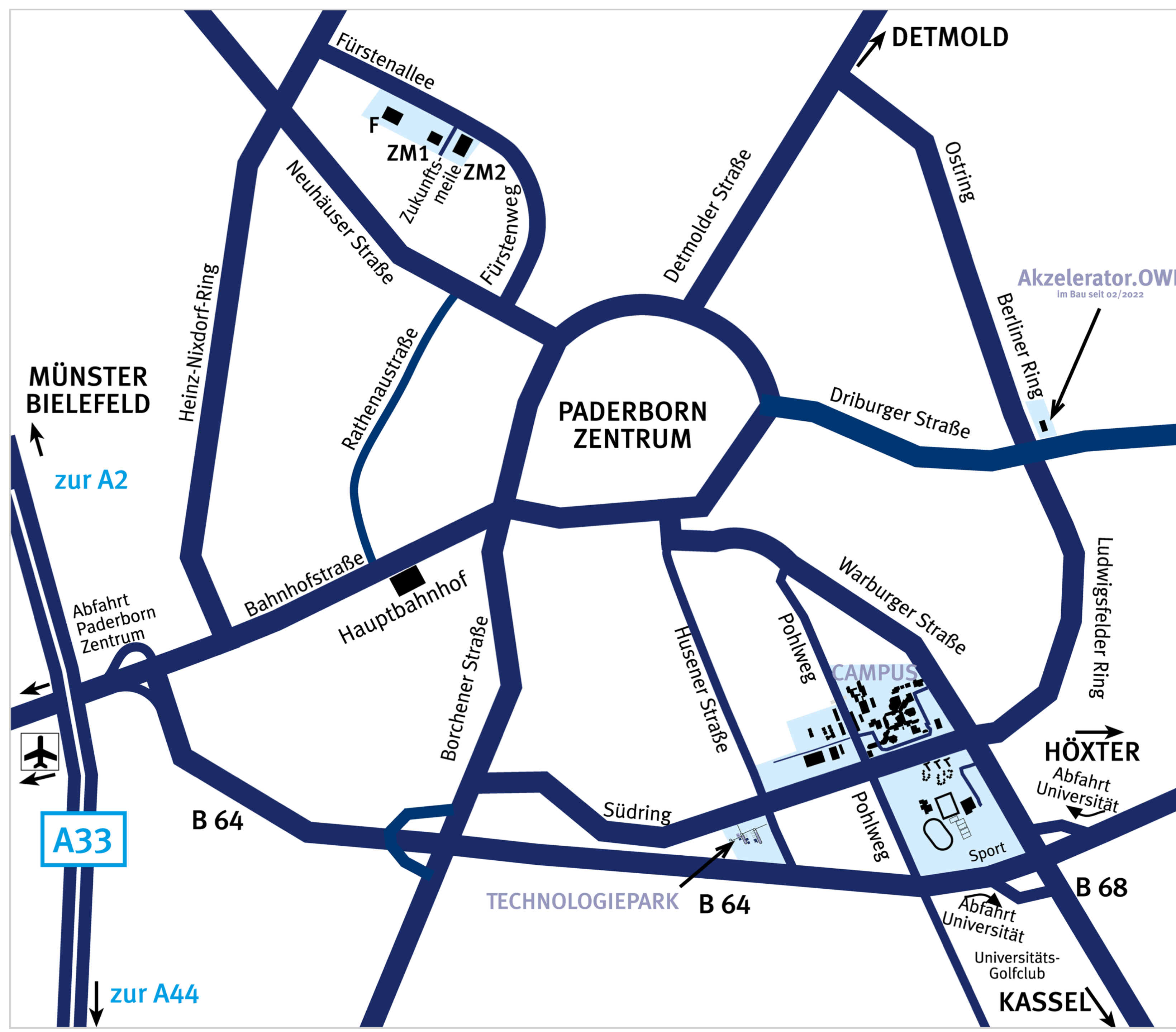
Main campus in southern part of the city

Central institutions like

- International Office (building I, 4th floor)
- Central Examination Office (building C, 2nd floor)
- Notebook Cafe (building I, ground floor)
- Lecture halls, class rooms, work spaces
- Part of the CS Department (building O)

Smaller campus at Fürstenallee

- Part of the CS Department (building F) – and me





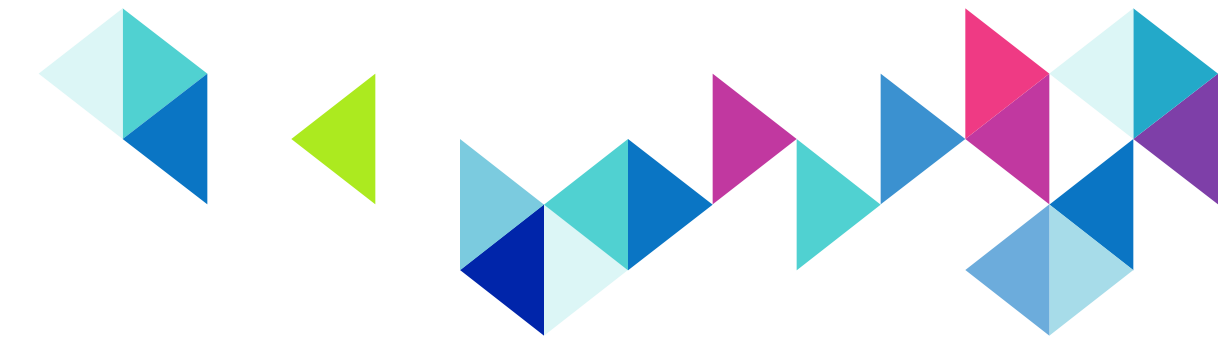
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Address Fürstenallee 11, room F1.219
Office hours Thursdays 10:00 am – 11:00 am

YouTube: <https://www.youtube.com/user/FakultaetEIM>



Semester start

- Lectures start on 9 October.
- Courses will be „in real life“, not online.
- Make sure to be there for the first lecture – all important information will be given there
 - If you can't be there, check PANDA for information or contact the lecturer.
- Information from our student's council: <https://fsmi.uni-paderborn.de>



Getting into the right mindset

- Check your knowledge with our self-assessment.
 - If you experience difficulties in a certain area, try to find a good book to improve your knowledge.
- Get acquainted with the standards of good scientific practice.
 - In particular, make sure you are aware of the problem of plagiarism.
- Be aware of the fact that you will have to organize yourself.
 - From planning your master studies to visiting lectures and tutorials to finding a master's thesis.
- Don't be afraid to talk to us!
 - When something is not clear or there is a problem, talk to your lecturer, us, the examination office – whoever might be able to help. And don't wait too long!



What every lecturer will expect from you

Ability to apply foundations of Computer Science

- usage of formal methods to specify problems, structures, systems, languages, ...
- formal methods to analyze algorithms
- formal methods to check solutions
- proving properties of algorithms (correctness, performance, ...)

Experience in doing practical work

- application of methods and tools for software design and implementation
- solid background in object-oriented concepts
- substantial experience in at least one programming language
- ability to switch to a new programming language within a short time



There's more to it!

Ability to do scientific work

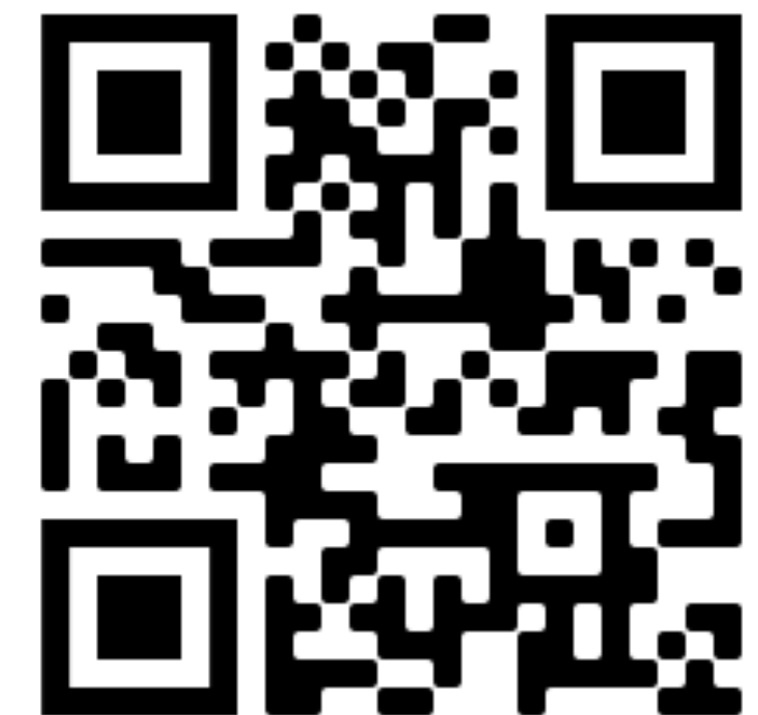
- searching for and investigating scientific publications
- writing scientific documents
- adequate structure, clear descriptions and explanations, citations and references, correct English
- developing and giving presentations
- avoid plagiarism <https://cs.uni-paderborn.de/en/studies/formalities/notes-on-plagiarism>





Planning for your first semester

- Check the course catalog for the upcoming semester at <https://paul.uni-paderborn.de>
 - "Faculty of Computer Science, Electrical Engineering and Mathematics" – "Computer Science" – "Computer Science Studies" – "Master Studies"
- Browse through the courses from the first seven entries, the focus areas, to identify courses you might wish to take.
 - Check if there is a self-assessment for the course for prior knowledge.
- You can't take a seminar or a project group in your first semester here.





Planning for your first semester

- The recommended workload for each semester is 30 credits, i. e. 5 courses in the first semester of 6 credits each.
- Self-assessment tests are available for many courses: <https://cs.uni-paderborn.de/en/studies/getting-started/information-for-international-students/self-assessment-tests-for-master-lectures>
- Keep in mind that this workload may be too high:
 - Language courses (optional)
 - Getting used to living in Germany
 - Getting used to the German university system
- You need to register for the modules as well as the courses – until 27 October.





Program structure

Seven Focus Areas

- Algorithm Design
- Computer Systems
- Data Science
- Intelligence and Data
- Networks and Communication
- Security
- Software Engineering

You have to choose one of these areas as specialization area when applying for a master's thesis.

- No need to decide now, but it's good to have an idea.
- Yet: Plan ahead and ideally try to you have three modules in the focus area you wish to write your Master's thesis in after three semesters.
- You can't start your Master's thesis without meeting this requirement!





Modules

Every student has to

- study three modules in the area of specialization,
- study one module in some other focus area,
- study four more modules in whatever area they like.
- Hence every student has to take 8 modules overall.
- Most modules are offered once per year.

Every module has 6 ECTS points and

- belongs to one or more focus areas (of the seven).
- consists of exactly one class (from that focus area).
- is described in the module handbook (Modulhandbuch).
- If a module belongs to more than one focus area, you can move it later to meet the specialization area requirement.





Module Handbook

Contains detailed descriptions of all courses

- Content of the course
- Type of exam
- Course achievement (if any)
- Language of instruction (> 95% are in English)
- When to expect: winter or summer semester
- Also contains lists which module is in which focus areas.
- Updated each semester, see <https://cs.uni-paderborn.de/en/studies/advice-and-support/study-service>





Master Degree Program in Paderborn (Example)

1	Module I	Module II	Module III	Module IV	Module V
2	Project Group	Module VI		Seminar I	Extracurricular Studies
3		Module VII	Module VIII	Seminar II	
4	Master's Thesis				





Master Degree Program in Paderborn (Example)

1	Advanced Computer Architecture (Computer Systems)	Advanced Algorithms (Algorithm Design)	Information Retrieval (Data Science)	Designing code analyses ... (SE)	Foundations of Knowledge Graphs (I&D)
2	Project Group	Game Theory (Algorithm Design)		Seminar I	Extracurricular Studies
3		Foundations of Cryptography (Algorithm Design)	Networked Embedded Systems (N&C)	Seminar II	
4	Master's Thesis				





Master Degree Program in Paderborn (Example)

1	Introduction to Quantum Computation (Algorithm Design)	Advanced Algorithms (Algorithm Design)	Real World Crypto Engineering (Algorithm Design)	Advanced Complexity Theory (Algorithm Design)	Foundations of Knowledge Graphs (I&D)
2	Project Group	Game Theory (Algorithm Design)		Seminar I	Extracurricular Studies
3		Foundations of Cryptography (Algorithm Design)	Routing and Data Management in Networks (Algorithm Design)	Seminar II	
4	Master's Thesis				





Master Degree Program in Paderborn (Example)

1	Model-Based Systems Engineering (SE)	Advanced Algorithms (Algorithm Design)	High-Performance Computing (Computer Systems)	Intelligence in Embedded Systems (Computer Systems)	Foundations of Knowledge Graphs (I&D)
2	Project Group	Game Theory (Algorithm Design)		Seminar I	Extracurricular Studies
3		Foundations of Cryptography (Algorithm Design)	VLSI Testing (Computer Systems)	Seminar II	
4	Master's Thesis				





Recommendations for the first semester

- Pick five modules that you believe to be the most interesting for you.
- If you already have an idea which focus area you might wish to specialize in, pick at least two in that area.
- If you don't have an idea which focus area you might wish to specialize in, don't worry! Just pick modules according to your interests.
- Check whether there is a self-assessment for the module and take it.
- Register for the module as well as the course.
- Also register for the course achievement and the exam during the registration phase.
- If you struggle with a course or your total workload proves to be too high, concentrate on those modules that you are confident to pass.
- Deregister from the course achievement and the exam in those courses that you wish to drop.
- Keep track of all important deadlines and enter them into your electronic calendar with a reminder!



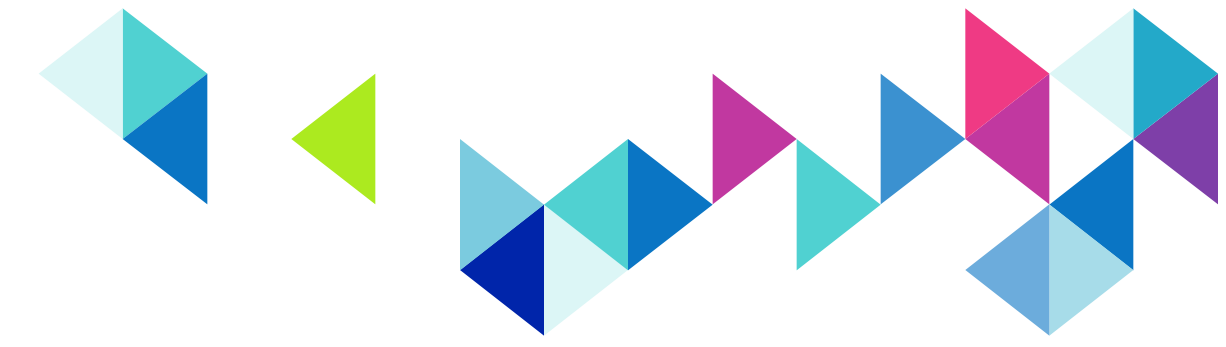


Modules in Algorithm Design

- Advanced Algorithms
- Advanced Complexity Theory
- **Advanced Distributed Algorithms and Data Structures**
- Algorithms for Highly Complex Virtual Scenes
- Efficiency in Games
- Foundations of Cryptography

- **Game Theory**
- **Introduction to Quantum Computation**
- Post-Quantum Cryptography
- Quantum Algorithms
- Quantum Complexity Theory
- Quantum Information
- **Real World Crypto Engineering**





Modules in Computer Systems

- **Advanced Computer Architecture**
- Approximate Computing
- High-Performance Computing
- **Human Factors in Security and Privacy**
- Reconfigurable Computing
- Usable Security and Privacy
- **VLSI Testing**





Modules in Data Science

- Advanced Algorithms
- **Advanced Distributed Algorithms and Data Structures**
- **Data Science for Dynamical Systems**
- Data Science in Industrial Applications
- Digitale Sprachsignalverarbeitung
- Explainable Artificial Intelligence
- Foundations of Knowledge Graphs
- High-Performance Computing
- Information Retrieval
- **Machine Learning I**
- Machine Learning II
- Statistical Natural Language Processing
- **Topics in Pattern Recognition and Machine Learning**
- Topics in Signal Processing
- **Unsupervised Learning and Evolutionary Optimisation Using R**



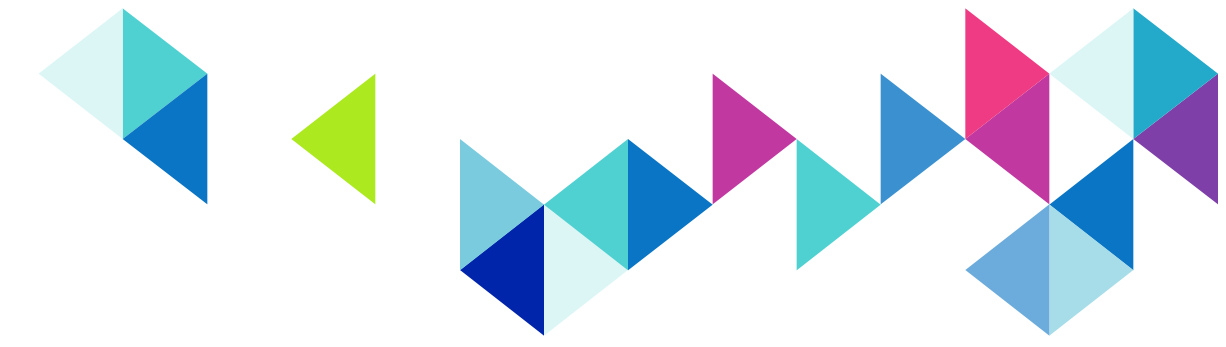


Modules in Intelligence and Data

- **Data Science for Dynamical Systems**
- Explainable Artificial Intelligence
- Foundations of Knowledge Graphs
- Information Retrieval
- **Logic Programming for Artificial Intelligence**
- **Machine Learning I**
- Machine Learning II

- **Machine Learning for Biometrics**
- Optimization Methods for Machine Learning
- Privacy-preserving Natural Language Processing
- Statistical Natural Language Processing
- **Statistical Signal Processing**
- **Unsupervised Learning and Evolutionary Optimisation Using R**





Modules in Networks and Communication

- **Advanced Distributed Algorithms and Data Structures**
- Advanced Networked Systems
- Web Security





Modules in Security

- **Advanced Distributed Algorithms and Data Structures**
- **Designing code analyses for large-scale software systems 1**
- Designing code analyses for large-scale software systems 2
- Foundations of Cryptography
- **Human Factors in Security and Privacy**
- **Introduction to Quantum Computation**
- **Machine Learning for Biometrics**
- Post-Quantum Cryptography
- **Privacy and Technology**
- Quantum Complexity Theory
- Quantum Information
- **Real World Crypto Engineering**
- Usable Security and Privacy
- Web Security





Modules in Software Engineering

- Build It, Break It, Fix It
- **Data-Driven Innovation and Engineering**
- Data Science in Industrial Applications
- **Designing code analyses for large-scale software systems 1**
- Designing code analyses for large-scale software systems 2
- High-Performance Computing
- **Human Factors in Security and Privacy**
- **Kontextuelle Informatik (in German)**
- **Logic Programming for Artificial Intelligence**
- Model-Based Systems Engineering
- **Software Architecture Design and Recovery**
- Software Quality Assurance





Seminars are special

- Count for 5 ECTS points
- 2 meeting hours per week or compact on two to three days
- Teacher proposes topics (Seminarthemen)
- Every student selects or is assigned one topic to work on and then
 - prepares a talk with slides (Seminarvortrag)
 - submits a seminar paper (Ausarbeitung)
- You need to work scientifically and be aware of good practices and the problem of plagiarizing in particular!
- Seminars do not belong to specific focus areas. You are free to choose.
- See <https://cs.uni-paderborn.de/en/studies/study-elements/seminars-of-computer-science/> for information on how to apply for a seminar.





Project Groups are even more special

- Workload: 20 ECTS points in one year – including semester breaks
- Presentation of all project groups in a public event (Projektgruppenvorstellung) in the last week of teaching season – you should participate to find a group that suits you.
- Interested students apply for a project group and 8 to 16 students are accepted.
- Ranking by you as well as by the lecturers.
- Working for two semesters on a project (often: concept and implementation of some software)





Project Groups are even more special

- Highly self-organized
 - You have to contribute actively!
 - You will be evaluated continuously.
 - Usually requires at least two days per week being present in Paderborn.
-
- All our project groups are in English!
 - Project groups do not belong to specific focus areas. You can apply to any one.
-
- All details at <https://cs.uni-paderborn.de/en/studies/study-elements/project-groups/>





Master's Thesis (Masterarbeit)

Workload: Full-time for one semester (30 ECTS)

All of this: within 6 months (formally checked!)

What has to be done?

- Literature review
 - Research: develop new results!
 - Obey rules of good scientific practice!
 - Often: implementation of some software
 - Writing a thesis (~ 80-120 pages) on scientific level
- First a planning phase (typically 1 month)
 - Then the real work (5 months)





Master's Thesis (Masterarbeit)

Finding an advisor (Betreuer)

- talk to professors working in an area that interests you
- talk to the organizer of your project group
- ask friends

Finding a topic (Thema) is an interactive process between student and advisor

- own ideas?
- project group topic?
- discussion with the (potential) advisor!

The Master's thesis defines your area of specialization – where you need to have three modules completed before you can register the thesis.





German Language Course (Deutschkurs)

- Language courses are optional!
- Language Courses hosted by the International Office
- You can cover the complete „General Studies“ part with language courses (12 ECTS)
- Check <https://www.uni-paderborn.de/en/studium/international-office/deutschkurse/>





What you need to do to get your degree

Every student has to...

- | | |
|--|------------|
| • ... take three modules from the area of specialization | 18 credits |
| • ... take one module in one other area | 6 credits |
| • ... take four modules in whatever area | 24 credits |
| • ... take two seminar modules | 10 credits |
| • ... take part in a project group | 20 credits |
| • ... write a Master's thesis (must be from your specialization area) | 30 credits |
| • ... take minor subject, do general studies or take the German language courses | 12 credits |

Adding up to: 120 credits

It is your own responsibility to meet these criteria!





Examinations: Normal modules

Oral or written exam about the class

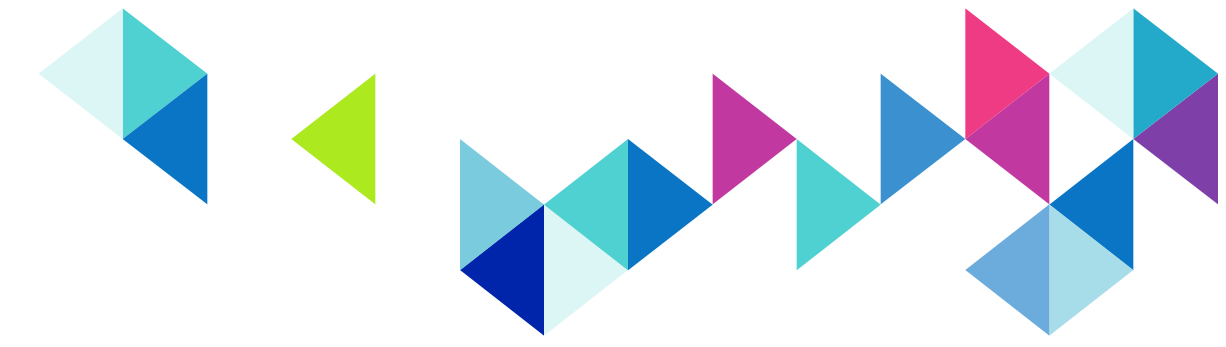
- Oral exams: individual appointment with the lecturer
- Written exams: usually two dates offered in the semester breaks

Class may include written homework or project work as pre-requisite („course achievement“ or „Studienleistung“).

You need to register for the exams!

- All with PAUL
- Registration for first exam period:
23 October to 23 November
- Registration for second exam period:
26 February to 8 March (no late registrations!)

De-register if you don't want to take an exam!
Otherwise you might be stuck with that module.



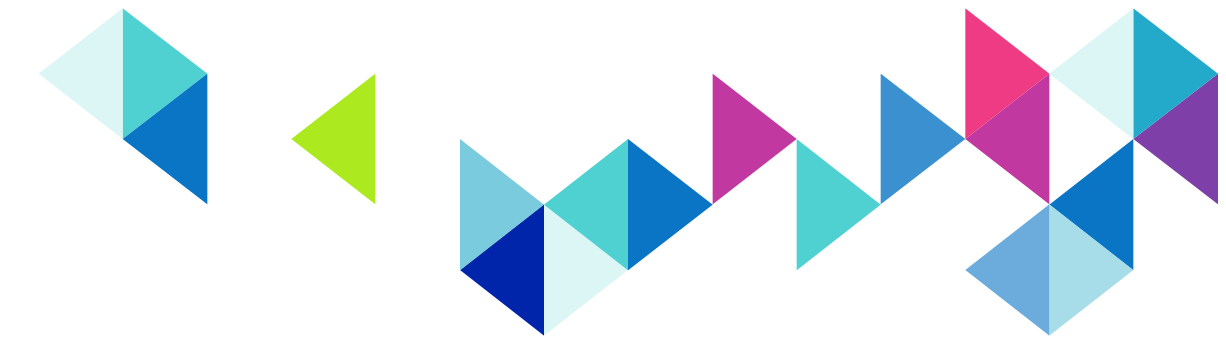
Examinations: Other types

Seminar: Evaluation of presentation and seminar paper

Project group: Permanent evaluation throughout the project

Master's Thesis: Evaluation by the advisor and a co-advisor





Examinations: Repetition

Module exams can be repeated twice.

Seminars can be repeated twice.

Project group can be repeated twice (you really don't want that!).

Master's Thesis can be repeated once.





Examinations: Compensation

There are (limited) ways

- to shift aside („compensate“) exam failures
 - e.g. failure in one module
 - give up on that one and try another one instead
- to improve exam results
 - e.g. you succeeded in a module exam but with an unsatisfactory result, you can try a different module additionally.
 - You can't retake a module that you have passed.





Final failure is possible! If ...

... you have no more options to use compensation and you are no more able to fulfill the requirements:

- 3 modules in the specialization area
- 5 more modules with at least one of them in another area

OR

- three attempts for a project group failed

OR

- one seminar failed three times

OR

- two attempts for a Master's thesis failed





Common pitfalls

- Deadlines are important. Some things can be amended if you miss a deadline, some can't or may result in delays of up to a year!
- You need to register for all sorts of things. Do it – and mind the deadlines!
- If you don't want to complete a course, de-register it and everything associated with it – and mind the deadlines. Otherwise you may be blocked from taking other courses as there is an upper limit of courses you can take.
- Pay your semester fees as early as possible. Otherwise you might not be able to participate in the seminar or project group distribution – which will result in a delay of one semester at least.
- Never miss the first meeting of a course.
- Always – ALWAYS! – visit the first lecture in a semester where all necessary information about the course will be given!



Important deadlines in this semester

Until 27 October

Registration for modules and courses

Between 23 October and 23 November

Registration for course achievement

Registration for qualified participation (if applicable)

Registration for exams

Until 19 January

De-registration from course achievement

De-registration from qualified participation

One week before exam

De-registration from exam

Between 26 February and 8 March

Registration for 2nd exam phase, also late registration for course achievement

If you missed this registration phase, you will most likely have to wait for almost one year to take your exam in that course!

Add those dates to your favourite calendar tool with a reminder!





Final remarks

- PAUL is your friend
 - Most important information is sent via the PAUL system or is shown there when you log in.
 - Check your university email address regularly!
 - Check out the PAUL introduction playlist at YouTube
- Many courses use the PANDA system for information and course material.
- Watch out for the project group presentation and attend it!
- Join in on our monthly live stream on the Faculty's YouTube channel at <https://www.youtube.com/user/FakultaetEIM>
 - usually third Thursday each month (except March and September) at 6 pm local time
 - Q&A for the Master program





Welcome to Paderborn

Please give us some feedback at
<https://komo.uni-paderborn.de/course/view.php?id=492>

