Degree Programme and Examination Regulations for the Bachelor's and Master's Degree Programme in Data Science at the Faculty of Sciences at Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU) – FPODataScience –
Dated 20 August 2020

amended by statutes of
11 March 2021

Based on Section 13 (1)(2), Section 43 (5)(2), Section 58 (1) and Section 61 (2)(1) of the Bavarian Higher Education Act (Bayerisches Hochschulgesetz, **BayHSchG**), FAU enacts the following degree programme and examination regulations:

Part I: General Provisions

Section 37 Scope

The degree programme and examination regulations for the Bachelor's degree programme and consecutive Master's degree programme in Data Science supplement the current version of the general degree programme and examination regulations for the Bachelor's degree programmes in Data Science, Mathematics, Industrial Mathematics and Economics and Mathematics as well as the Master's degree programmes in Data Science, Mathematics, Computational and Applied Mathematics and Economics and Mathematics at the Faculty of Sciences at FAU – **ABMPOMathe/NatFak** –.

Section 38 Bachelor's Degree Programme, Standard Duration of Studies, Related Degree Programmes

(1) [1]The Bachelor's degree programme in Data Science consists of modules worth 180 ECTS credits distributed over six semesters. [2]This includes the period for working on the Bachelor's thesis.

(2) Bachelor's degree programmes count as related degree programmes pursuant to Section 26 (1)(2)(2) **ABMPOMathe/NatFak** if at least 65 ECTS credits are allocated to mathematics in the curriculum of the degree programme, and the degree programme also includes at least 55 ECTS credits from computer sciences.

Section 39 Master's Degree Programme, Standard Duration of Studies, Teaching Language, Related Degree Programmes

(1) [1]The Master's degree programme in Data Science builds on the content covered in the Bachelor's degree programme in Data Science. [2]It consists of modules worth 120 ECTS credits including the Master's thesis, distributed over four semesters.

(2) Master's degree programmes count as related degree programmes pursuant to Section 32 (2)(2) **ABMPOMathe/NatFak** if at least 80 ECTS credits are allocated to mathematics in the curriculum of the degree programme, and 30 ECTS credits are included from computer science.

(3) [1]The teaching and examination language for the Master's degree programme in Data Science is German for the specialisations Mathematical theory/foundations of data science (MTG) and Mathematical statistical data analysis (MSD). [2]The teaching and examination language in the specialisations Data-based optimization (DO), Data bases and knowledge representation (DW), Machine learning/artificial Intelligence (AI), and Simulation and numerics (SN) is English. [3]Individual modules in the specialisations mentioned in sentences 1 and 2 can also be held in the other language; Section 4 (5) **ABMPOMathe/NatFak** shall remain unaffected.

Part II: Special Provisions

1. Bachelor's Examination

Section 40 Structure of the Bachelor's Degree Programme
[1]The Bachelor's degree programme consists of:
  a) compulsory modules for data science (nos. 1 and 2 and nos. 5 to 15),
  b) compulsory elective modules for
    − the core modules in data science (nos. 3 and 4 pursuant to Section 42),
    − compulsory electives in mathematics (no. 16 pursuant to Section 43),
    − compulsory electives in computer science (no. 17 pursuant to Section 44),
    − specialisations (no. 18 and 19 pursuant to Section 45), and
    − the application field (no. 20 pursuant to Section 46),
  c) elective modules for technical and non-technical key qualifications (no. 21 pursuant to Section 47) as well as
  d) Bachelor's seminar and Bachelor's thesis (nos. 22 and 23 pursuant to Section 48).
[2]Details are set forth hereinafter and in **Appendix 1**.

Section 41 Grundlagen- und Orientierungsprüfung (GOP)
In order to pass the Grundlagen- und Orientierungsprüfung (GOP), students must acquire a minimum of 30 ECTS credits from the foundation modules in mathematics and computer science.

Section 42 Compulsory Elective Modules for Core Modules in Data Science
(1) [1]The core modules in data science consist of the compulsory modules no. 1 and no. 2 and the compulsory elective modules no. 3 and no. 4 pursuant to **Appendix 1b**. [2]Students must acquire a total of 20 ECTS credits in the core modules in data science.

(2) [1]Students choose compulsory elective modules no. 3 and no. 4 by registering for the first examination in a module from the group of compulsory elective modules. [2]The modules are listed in module catalogues that are announced in accordance with local practice at the latest one week before the semester begins. [3]Changes to the module catalogues can be made by the Examinations Committee, to take effect from the following semester.

(3) [1]The type and scope of the examinations and the way in which the grade is determined for the compulsory elective modules for the core modules in data science depend on the specific manner in which the respective modules are taught; see module handbook for details. [2]Possible examination achievements for modules offered by the Department of Mathematics as compulsory elective modules for the core modules in data science are as follows:
1. Written examination (60-120 min),
2. Written assignment (approx. 5-10 pages),
3. Report (approx. 5-10 pages),
4. Oral examination (15-30 min),
5. Electronic examination (e-examination 30-60 min),
6. Tutorial achievement (approx. 30-45 pages),
7. Practical achievement (report approx. 5-10 pages or series of reports approx. 40 pages),
8. Seminar achievement (presentation 30-80 min), possibly with written assignment (approx. 5-10 pages),

9.   Excursion achievement (report approx. 5-10 pages or series of reports approx. 30-45 pages)

and combinations of the above. [3]In particular in the cases covered by Section 6 (2)(3) **ABMPOMathe/NatFak**, it is possible to combine a written or oral examination with achievements as set forth in Section 6 (4) **ABMPOMathe/NatFak**. [4]Further details are stipulated in the module handbook. [5]The type and scope of examinations and the way in which the grade is determined for the compulsory elective modules for the core modules in data science depend on the specific manner in which the modules are taught; see the relevant **(degree programme and) examination regulations** and/or the module handbook for details.

(4) [1]Modules from the Department of Mathematics amounting to 5 ECTS credits usually consist of lectures (2 SWS) and tutorials (up to 2 SWS) or seminars (2 SWS). [2]Modules from the Department of Mathematics amounting to 10 ECTS credits usually consist of lectures (4 SWS) and tutorials (up to 3 SWS). [3]Any exceptions are detailed in the module handbook. [4]Modules from other departments and faculties may deviate from the provisions stipulated in sentences 1 and 2. [5]Further details are stipulated in the respective **(degree programme and) examination regulations** and/or the module handbook.

Section 43 Compulsory Elective Modules in Mathematics

(1) [1]The compulsory elective modules in mathematics (no. 16 pursuant to **Appendix 1b**) account for between 5 and 15 ECTS credits. [2]Together with the compulsory elective modules in computer science, students must take modules coming to a total of 20 ECTS credits.

(2) [1]The learning outcome of the compulsory elective modules in mathematics is to allow students to gain a more in-depth knowledge of selected mathematical skills. [2]The second learning outcome has a research focus, with students learning subject-related methods of research and exploring their subject in more depth. [3]Thirdly, the element of choice allows students to tailor their profile in view of the area of data science they intend to specialise in.

(3) Section 42 (2) shall apply accordingly with respect to registering for the examination and announcing the modules students can choose from.

(4) The type and scope of teaching units and the examination are stipulated in Section 42 (3) and (4).

Section 44 Compulsory Elective Modules in Computer Science

(1) [1]The compulsory elective modules in computer science (no. 17 pursuant to **Appendix 1b**) account for between 5 and 15 ECTS credits. [2]Together with the compulsory elective modules in mathematics, students must take modules amounting to a total of 20 ECTS credits.

(2) [1]The learning outcome of the elective modules in computer science is firstly to allow students to acquire skills in a specific area of computer science. [2]The second learning outcome has a research and practical focus, with students learning subject-related methods of research and practical application, and exploring their subject in more depth. [3]Thirdly, the element of choice allows students to tailor their profile in view of the area of data science they intend to specialise in.

(3) Section 42 (2) shall apply accordingly with respect to registering for the examination and announcing the modules students can choose from.

(4) The type and scope of teaching units and the examination are stipulated in Section 42 (3)(5) and (4)(4).

Section 45 Compulsory Elective Modules in Specialisations

(1) [1]The compulsory elective modules in the specialisations (nos. 18 and 19 in **Appendix 1b**) are specifically aimed at allowing students to acquire more extensive skills in specific areas of mathematics and computer science. [2]The learning outcome has a research and practical focus, with students learning subject-related methods of research and exploring their subject in more depth. [3]The element of choice gives students the opportunity to tailor their profile in view of a subsequent Master's degree or their future career.

(2) [1]At least 30 ECTS credits must be obtained in the specialisations. [2]Students choose to specialise in mathematics, computer science or an interdisciplinary specialisation. [3]Students shall acquire a minimum of 15 ECTS credits and a maximum of 20 ECTS credits from the chosen specialisation. [4]The remaining 10 to 15 ECTS credits shall be submitted from the specialisations that were not chosen. [5]Students shall take at least 10 ECTS credits in specialisation modules offered by the Department of Mathematics and the Department of Computer Science respectively.

(3) [1]The specialisations (modules nos. 18 and 19 pursuant to **Appendix 1b**) are offered by different departments and consist of module packages.
[2]The following specialisations are available for mathematics:
 a) Mathematical statistical data analysis (MSD)
 b) Data-oriented optimisation (DO)
 c) Mathematical theory/foundations of data science (MTG).
[3]The following specialisations are available for computer science:
 a) Databases and knowledge representation (DW)
 b) Machine learning / artificial intelligence (AI).
[4]Students may also choose the interdisciplinary specialisation Simulation and numerics (SN).

(4) Section 42 (2) shall apply accordingly with respect to registering for the examination and announcing the modules students can choose from.

(5) The type and scope of teaching units and the examination are stipulated in Section 42 (3) and (4).

Section 46 Compulsory Elective Modules for Application Field

(1) [1]The application field (no. 20 pursuant to **Appendix 1b**) accounts for 10 ECTS credits. [2]The following application fields may be chosen:
1. Chemistry
2. Digital humanities
3. Geography
4. Geosciences
5. Medical data science
6. Physics

7. Materials science
8. Information systems.
[3]The Examinations Committee can approve additional application fields upon request.

(2) Section 42 (2) shall apply accordingly with respect to registering for the examination and announcing the modules students can choose from.

(3) The type and scope of teaching units and the examination are stipulated in Section 42 (3)(5) and (4)(4).

Section 47 Elective Modules for Technical and Non-Technical Key Qualifications

(1) [1]Module no. 20 pursuant to **Appendix 1b** comprises elective modules for technical and non-technical key qualifications. [2]Technical key qualifications may be selected from the following modules:
1. Selected modules from computer science,
2. Selected modules from mathematics,
3. Working as a tutor in mathematics or computer science for two semesters after participating in the relevant tutor training course,
4. Completing an internship approved by the Examinations Committee lasting (a minimum of) four weeks.

[3]The non-technical key qualification modules are listed in a module catalogue that is announced in accordance with local practice at the latest one week before the semester begins. [4]Changes to the module catalogue can be made by the Examinations Committee, to take effect from the following semester.

(2) Section 42 (2) shall apply accordingly with respect to registering for the examination and announcing the modules students can choose from.

(3) The type and scope of teaching units and the examination are stipulated in Section 42 (3) and (4).

Section 48 Bachelor's Seminar and Bachelor's Thesis

(1) [1]Specialist knowledge and skills relating to one specialist area of data science are acquired during a Bachelor's seminar worth 5 ECTS credits. [2]The subject of this Bachelor's seminar can be taken as the basis for the Bachelor's thesis, worth 10 ECTS credits, which is generally supervised by the person responsible for teaching the Bachelor's seminar.

(2) [1]Notwithstanding Section 29 (2) **ABMPOMathe/NatFak**, university lecturers employed full time at the Department of Computer Science are entitled to assign Bachelor's theses (supervisors). [2]Any exceptions are decided by the Examinations Committee.

2. Master's Examination

Section 49 Qualification for a Master's Degree, Certificates and Admission Requirements

(1) [1]A subject-specific degree according to Section 31 (1)(1)(1) **ABMPOMathe/NatFak** is a Bachelor's degree or a Diplom degree in the subjects mathematics, industrial mathematics, economics and mathematics, computer science or data science. [2]In particular, Bachelor's degrees in physics or engineering in which at least 60 ECTS credits were obtained for topics relating to mathematics and computer science shall be recognised as subject-related degrees within the meaning of Section 31 (1)(1)(1) **ABMPOMathe/NatFak**.

(2) [1]Additional proof that must be submitted as stipulated in Section 2 (2)(3) of the **Appendix ABMPOMathe/NatFak** shall be proof of language proficiency of at least English Level B 2 (Common European Framework of Reference for Languages – CEFR) Vantage or Upper Intermediate; evidence of this can be provided, in particular, by having participated in English lessons for 6 years at a German grammar school (Gymnasium). [2]Applicants who have completed their university entrance qualifications or their first degree in English are not required to provide proof of proficiency in English.

(3) [1]Notwithstanding (5)(3) **Appendix ABMPOMathe/NatFak**, the Admissions Committee shall decide if applicants are qualified for the degree programme on the basis of the written documents if the average grade of achievements in mathematics and computer science related modules totalling at least 60 ECTS credits or in the case of Section 34 (3) **ABMPOMathe/NatFak** the achievements obtained to date in these modules are at least 2.5 (good) or better; otherwise (5)(3) **Appendix ABMPOMathe/NatFak** shall remain unaffected. [2]The average grade shall be calculated by weighting the grades of the achievements according to the weighting of the ECTS credits in the individual modules; achievements in modules with more credits shall therefore have more weighting than modules with fewer credits.

(4) In the oral admission examination according to Section 5 (4) et seq. of the **Appendix ABMPOMathe/NatFak**, applicants shall be evaluated according to the following criteria:
1. Quality of knowledge in the foundations of the subject (analysis, linear algebra, algorithms and data structures) (35 %)
2. Quality of basic knowledge in two specialist areas within the specialisations suggested by the applicant pursuant to Section 45 (3) (35 %)
3. Ability to hold an academic discussion in English on topics relating to mathematics and computer science (30 %).

Section 50 Content, Scope and Structure of the Master's Degree Programme

(1) [1]The Master's degree programme shall consist of the modules set forth in **Appendix 2**. [2]A total of 120 ECTS credits must be obtained during the Master's degree programme as follows:
1. 20 ECTS credits from compulsory modules (nos. 1 to 3 and 8),
2. 30 ECTS credits from compulsory elective modules from major subject (no. 4 pursuant to (2) in conjunction with Section 51),
3. 20 ECTS credits from compulsory elective modules in minor subjects (no. 5 pursuant to (2) in conjunction with Section 51),

4. 15 ECTS credits from compulsory elective modules from the application field (no. 6 pursuant to Section 52),
5. 5 ECTS credits from elective modules from technical key qualifications (no. 7 pursuant to Section 53),
6. A Master's seminar amounting to 5 ECTS credits from the modules offered by the Department of Mathematics or the Department of Computer Science,
7. 30 ECTS credits from the Master's thesis in the main field of study.

(2) [1]The Master's degree programme in Data Science is taken in one of the following specialisations.
1. Data-oriented optimisation (DO),
2. Mathematical theory/foundations of data science (MTG),
3. Databases and knowledge representation (DW),
4. Machine learning/artificial intelligence (AI),
5. Simulation and numerics (SN),
6. Mathematical statistical data analysis (MSD).
[2]Applicants state their chosen specialisation in their application for admission to the Master's degree programme, but this can be changed over the course of the degree programme. [3]The chosen specialisation shall be referred to as the major field of study, the specialisations that are not chosen shall be referred to as minor fields of study. [4]Students shall take at least 20 ECTS credits in specialisation modules offered by the Department of Mathematics and the Department of Computer Science respectively.

Section 51 Compulsory Elective Modules in Specialisations

(1) [1]In the compulsory elective modules in the specialisations, students acquire skills in scientific methods for classifying mathematical structures, for modelling and for problem-solving strategies, and the ability to carry out academic work independently. [2]The learning outcome has a research focus, with students learning subject-related methods of research and exploring their subject in more depth. [3]The element of choice allows students to tailor their profile in view of their career plans.

(2) The specialisations have the following subject-specific learning outcomes:
1. In the specialisation Data-oriented optimisation (DO), students acquire methodological skills covering various aspects of this field of study such as linear and non-linear systems, and combinatorial, non-linear or robust optimisation.
2. In the specialisation Mathematical theory/foundations of data science, students acquire methodological skills covering various aspects of this field of study such as differential equations and algebra.
3. In the specialisation Databases and knowledge representation, students acquire methodological skills covering various aspects of this field of study such as data management in distributed systems, data warehouse systems, big data technology, and semantic web technologies.
4. In the specialisation Machine learning/artificial intelligence, students acquire methodological skills covering various aspects of this field of study such as symbolic and non-symbolic AI, supervised and non-supervised learning, deep learning.
5. In the specialisation Simulation and numerics in data science, students acquire methodological skills covering various aspects of this field of study such as simulation, modelling, scientific computing or numerical methods for partial differential equations.

6. In the specialisation Mathematical statistical data analysis in data science, students acquire methodological skills covering various aspects of this field of study such as statistics, stochastics, image and data analysis or risk data analytics.

(3) Section 42 (2) shall apply accordingly with respect to registering for the examination and announcing the modules students can choose from.

(4) The type and scope of teaching units and the examination are stipulated in Section 42 (3) and (4).

Section 52 Compulsory Elective Modules for Application Field
(1) [1]The application field (no. 6 pursuant to **Appendix 2b**) accounts for 15 ECTS credits. [2]The following application fields may be chosen:
   1. Chemistry
   2. Digital humanities
   3. Geography
   4. Geoscience
   5. International information systems
   6. Medical data science
   7. Physics
   8. Materials science.

[3]The Examinations Committee can approve additional application fields upon request.

(2) Section 42 (2) shall apply accordingly with respect to registering for the examination and announcing the modules students can choose from.

(3) The type and scope of teaching units and the examination are stipulated in Section 42 (3)(5) and (4)(4).

Section 53 Elective Modules for Technical Key Qualifications
(1) [1]Module no. 7 pursuant to **Appendix 2b** comprises elective modules for technical key qualifications. [2]Technical key qualifications may be selected from the following modules:
 1. Selected modules from computer science.
 2. Selected modules from mathematics.
 3. Working as a tutor in mathematics or computer science for two semesters after participating in the relevant tutor training course.
 4. Completing an internship approved by the Examinations Committee lasting (a minimum of) four weeks.

(2) Section 42 (2) shall apply accordingly with respect to registering for the examination and announcing the modules students can choose from.

(3) The type and scope of teaching units and the examination are stipulated in Section 42 (3) and (4).

Section 54 Mentoring and Individual Study Agreement
(1) [1]Each student is assigned a mentor upon commencing the Master's degree programme. The mentor is responsible for assisting the student in drawing up an individual study agreement and answering any questions students may have concerning their degree programme. [2]This mentoring relationship shall be maintained throughout the

Master's degree programme. [3]Applicants may suggest a mentor when applying to be admitted to the Master's degree programme.

(2) [1]At the beginning of the Master's degree programme, the mentor and the student shall work together to draw up an individual study agreement which should take the specific subject areas the student is interested in into account. [2]This study agreement shall remain valid for the duration of the Master's degree programme and shall list all the modules which are to be taken. [3]It shall be submitted to the Examination Office for approval by the date of the first examination in the Master's degree programme.

(3) [1]The study agreement may be updated in consultation with the mentor if necessary in order to ensure that the subject area suits the individual focus chosen by the student and can be studied accordingly. [2]The updated version shall be submitted to the Examination Office for approval without delay.

Section 55 Master's Thesis

(1) [1]The Master's thesis is intended to demonstrate students' ability to solve scientific problems in the field of data science. [2]Requirements for the thesis shall be such that it can completed within a period of six months.

(2) [1]Notwithstanding Section 34 (3) **ABMPOMathe/NatFak**, university lecturers employed full time at the Department of Computer Science are entitled to assign Bachelor's theses (supervisors). [2]Any exceptions are decided by the Examinations Committee.

(3) The Master's thesis shall usually deal with a scientific subject from the chosen branch of study.

(4) 30 ECTS credits shall be awarded for the Master's thesis.

Part III: Final Provisions

Section 56 Legal Validity

(1) [1]These examination regulations shall come into effect on the day after their publication. [2]They shall apply to all students who start the Bachelor's or Master's degree programme in Data Science in the winter semester 2020/2021 or later.

(2) [1]The first amendment statute shall come into effect on the day after its publication. [2]It shall apply to all students starting a degree programme from winter semester 2021/2022 onwards. [3]Notwithstanding sentence 2, the changes in **Appendix 1** also apply to all students who are already enrolled in the Bachelor's degree programme in Data Science at the time the first amendment statute comes into effect.

Appendix 1: Bachelor's degree programme in Data Science

Appendix 1a: Overview of Curriculum

Core modules: Data science 20 ECTS credits	Bachelor's thesis (6th semester) 15 ECTS credits		Technical and non-technical key qualifications 15 ECTS
	Application field (5th and 6th semesters) 10 ECTS credits		
	Specialisations (5th and 6th semesters) 30 ECTS credits		
	Compulsory elective modules mathematics (4th semester) 5 - 15 ECTS	Compulsory elective modules computer science (4th semester) 5 - 5 ECTS	
	Intermediate modules in mathematics and computer science (3rd and 4th semesters) 30 ECTS credits		
	Intermediate modules in mathematics and computer science (1st and 2nd semesters) 40 ECTS credits		

The regulations for the coloured blocks are explained in detail in the example degree programme structure below (see **Appendix 1b**).

Appendix 1b: Study Plan for the Bachelor's Degree Programme in Data Science

	No.	Module name	Teaching unit	L	T	P	S	T	Total ECTS credits	1st sem.	2nd sem.	3rd sem.	4th sem.	5th sem.	6th sem.	Type and scope of the examination	Grade factor
				SWS (semester hours)						**Distribution of workload per semester in ECTS credits**							
Core modules: Data science	1	Seminar: Data science in research and industry	Seminar: Data science in research and industry				4		5	5						Written examination with multiple choice 90 min	0
	2	Introduction to mathematical data analysis	Lecture: Introduction to mathematical data analysis	2					5		5					Written examination, 60 min	1
			Tutorial: Introduction to mathematical data analysis		1												
	3	Compulsory elective modules from the catalogue for machine learning pursuant to Section 42	see module catalogue pursuant to Section 42 (4)						5		5					see module catalogue pursuant to Section 42 (3)	1
	4	Compulsory elective modules from the catalogue for data science project pursuant to Section 42	see module catalogue pursuant to Section 42 (4)						5					5		see module catalogue pursuant to Section 42 (3)	1
		Total for core modules: Data science		**4**	**3**	**2**	**4**	**0**	**20**	**5**	**10**	**0**	**0**	**5**	**0**		

	No.	Module name	Teaching unit	L	T	P	S	T	Total ECTS credits	1st sem.	2nd sem.	3rd sem.	4th sem.	5th sem.	6th sem.	Type and scope of the examination	Grade factor
Foundational modules in mathematics and computer science	5	Mathematics for data science 1 GOP[1]	Lecture: Data science 1	4					10	10						Written examination 120 min and tutorial achievement (un-graded)	0
			Tutorial: Data science 1		2												
			Blackboard exercise: Data science 1		2												
	6	Mathematics for data science 2 GOP[1]	Lecture: Data science 2	4					10		10					Written examination 120 min and tutorial achievement (un-graded)	1
			Tutorial: Data science 2		2												
			Blackboard exercise: Data science 2		2												
	7a	Lecture: Algorithms and data structures for medical engineers (GOP[1], only applicable in conjunction with 7b)	see **FPOMT**						5	5						see **FPOMT**	0
	7b	Tutorial on algorithms and data structures for medical engineers (GOP[1], only applicable in conjunction with 7a)	see **FPOMT**						5	5						see **FPOMT**	0
	8	Conceptual modelling GOP[1]	see **FPOINF**						5		5					see **FPOINF**	1
	9	Parallel and functional programming GOP[1]	see **FPOINF**						5		5					see **FPOINF**	1
		Total foundation modules in mathematics and computer science		**16**	**16**	**0**	**0**	**0**	**40**	**20**	**20**	**0**	**0**	**0**	**0**		

[1]In order to pass the Grundlagen- und Orientierungsprüfung (GOP), students must acquire a minimum of 30 ECTS credits from the foundation modules in mathematics and computer science.

	No.	Module name	Teaching unit	L	T	P	S	T	Total ECTS credits	1st sem.	2nd sem.	3rd sem.	4th sem.	5th sem.	6th sem.	Type and scope of the examination	Grade factor
Intermediate modules in mathematics and computer science	10	Linear and combinatorial optimisation [2]	see **FPOWiMathe**						10			10				see **FPOWiMathe**	1
	11	Introduction to numerics [2]	see **FPOTechnoMathe**						10			10				see **FPOTechnoMathe**	1
	12	Stochastic modelling [2]	see **FPOWiMathe**						10			10				see **FPOWiMathe**	1
	13	Information visualisation [3]	Information visualisation	2					5			5				Written examination 90 min	1
	14	Knowledge discovery in databases and transaction systems [3]	see Section 39a **FPOINF**						5			5				see Section 39a **FPOINF**	1
	15	Foundations of logic in computer science [3]	see **FPOINF**						5			5				see **FPOINF**	1
		Total intermediate modules in mathematics and computer science		**20**	**14**	**0**	**0**	**0**	**30**	**0**	**0**	**30**	**0**	**0**	**0**		

[2] Two out of three modules must be chosen. The third module can be taken from the compulsory elective modules in mathematics.
[3] Two out of three modules must be chosen. The third module can be taken from the compulsory elective modules in computer science.

	No.	Module name	Teaching unit	L	T	P	S	T	Total ECTS credits	1st sem.	2nd sem.	3rd sem.	4th sem.	5th sem.	6th sem.	Type and scope of the examination	Grade factor
Compulsory elective modules mathematics	16	Compulsory elective modules from the catalogue for compulsory elective modules in mathematics pursuant to Section 43	see module catalogue pursuant to Section 43 (4)						5-15				5-15			see Section 43 (4)	1
		Total compulsory elective modules in mathematics [4]		**6**	**5**	**0**	**0**	**1**	**5-15**	**0**	**0**	**0**	**5-15**	**0**	**0**		
Compulsory elective modules in computer science	17	Compulsory elective modules from the catalogue for compulsory elective modules in computer science pursuant to Section 44	see module catalogue pursuant to Section 44 (4)						5-15				5-15			see Section 44 (4)	1
		Total compulsory elective modules in computer science [4]		**4**	**3**	**0**	**0**	**0**	**5-15**	**0**	**0**	**0**	**5-15**	**0**	**0**		
Specialisations	18	Compulsory elective modules from the catalogue for chosen specialisation pursuant to Section 45	see module catalogue pursuant to Section 45 (5)						15-20					10-20	0-10	see Section 45 (5)	1
	19	Compulsory elective modules from the catalogues for specialisations not chosen pursuant to Section 45	see module catalogue pursuant to Section 45 (5)						10-15					0-10	0-10	see Section 45 (5)	1
		Total for computer science specialisation [5]		**12**	**8**	**0**	**2**	**0**	**30**	**0**	**0**	**0**	**0**	**20**	**10**		

[4] Students must take at least one module worth 5 ECTS credits and may only take modules worth a maximum of 15 ECTS credits from the compulsory elective modules in mathematics and computer science. Students must take compulsory elective modules in mathematics and computer science amounting to a total of 20 ECTS credits.

[5] Students shall take at least 10 ECTS credits in specialisation modules offered by the Department of Mathematics and the Department of Computer Science respectively.

	No.	Module name	Teaching unit	SWS (semester hours)					Total ECTS credits	Distribution of workload per semester in ECTS credits						Type and scope of the examination	Grade factor
				L	T	P	S	T		1st sem.	2nd sem.	3rd sem.	4th sem.	5th sem.	6th sem.		
Application field	20	Compulsory elective modules from the catalogue for the application field pursuant to Section 46	see module catalogue pursuant to Section 46 (3)						10					5	5	see Section 46 (3)	1
		Total: Application field		**2**	**4**	**8**	**0**	**0**	**10**	**0**	**0**	**0**	**0**	**5**	**5**		
Technical and non-technical key qualifications	21	Technical and non-technical key qualifications (pursuant to Section 47)	see module catalogue pursuant to Section 47 (3)						15	5			10			see Section 47 (3)	1
		Total technical and non-technical key qualifications		**6**	**6**	**0**	**0**	**0**	**15**	**5**	**0**	**0**	**10**	**0**	**0**		
Bachelor's thesis	22	Bachelor's seminar	Bachelor's seminar (see section 48)				2		5						5	Seminar achievement pursuant to Section 6 **ABMPOMathe/NatFak**	1
	23	Bachelor's thesis							10						10	Bachelor's thesis (approx. 20-25 pages)	1
		Total Bachelor's thesis		**0**	**0**	**0**	**2**	**0**	**15**	**0**	**0**	**0**	**0**	**0**	**15**		
		Total SWS (at least) [2] and ECTS credits		**70**	**59**	**10**	**8**	**1**	**180**	**30**	**30**	**30**	**30**	**30**	**30**		

Key:
Tutorial achievement: see Section 6 (4) **ABMPOMathe/NatFak**.

Appendix 2: Master's degree programme in Data Science

Appendix 2a: Overview of Curriculum

Master's thesis 30 ECTS credits		
Core modules: Data science 15 ECTS credits	Master's seminar 5 ECTS credits	Application field 15 ECTS credits
	Technical key qualifications 5 ECTS credits	
	Major field of study 30 ECTS credits — Minor fields of study 20 ECTS credits	

The regulations for the coloured blocks are explained in detail in the example degree programme structure below (see **Appendix 2b**).

Appendix 2b: Study Plan for the Master's Degree Programme in Data Science

	No.	Module name	Teaching unit	SWS (semester hours)				Total ECTS credits	Distribution of workload per semester in ECTS credits				Type and scope of the examination	Grade factor
				L	T	P	S		1st sem.	2nd sem.	3rd sem.	4th sem.		
Core modules: Data science	1	Mathematical data science (MaDS)	Mathematical data science	2				5	3				Oral examination (15 min)	1
			Practical: Mathematical data science		2				2					
	2	Deep learning	see Section 43a **FPOINF**					5		5			see Section 43a **FPOINF**	1
	3	Mathematics of learning	Mathematics of learning	2				5			3		Oral examination (30 min)	1
			Tutorial: Mathematics of learning		2						2			
		Total for core modules: Data science						**15**	**5**	**5**	**5**	**0**		
Major field of study	4	Compulsory elective modules from the catalogue for chosen major field of study pursuant to Section 51	see module catalogue pursuant to Section 51 (4)						10	10	10	0	see Section 51 (4)	1
		Total compulsory electives in major field of study						**30**	**5-15**	**5-15**	**10**	**0**		
Minor fields of study	5	Compulsory elective modules from the catalogues for not chosen minor fields of study pursuant to Section 51	see module catalogue pursuant to Section 51 (4)						10	10	0	0	see Section 51 (4)	1
		Total: Compulsory electives for minor field of study						**20**	**5-15**	**5-15**	**0**	**0**		

	No.	Module name	Teaching unit	SWS (semester hours)				Total ECTS credits	Distribution of workload per semester in ECTS credits				Type and scope of the examination	Grade factor
				L	T	P	S		1st sem.	2nd sem.	3rd sem.	4th sem.		
Application field	6	Compulsory elective modules from the catalogue of modules for the application field pursuant to Section 52	see module catalogue pursuant to Section 52 (3)						5	0-5	5-10	0	see Section 52 (3)	1
		Total: Application field						**15**	**5**	**0-5**	**5-10**	**0**		
Technical key qualifications	7	Elective modules from technical key qualifications pursuant to Section 53	see module catalogue pursuant to Section 53 (3)						0	0-5	0-5	0	see Section 53 (3)	1
		Total: Technical key qualifications						**5**	**0**	**0-5**	**0-5**	**0**		
Master's seminar	8	Master's seminar pursuant to Section 6 **ABMPO-Mathe/NatFak**	Master's seminar				2		0	0	5	0	Seminar achievement pursuant to Section 6 **AB-MPOMathe/Nat-Fak**	1
		Total: Master's seminar		**0**	**0**	**0**	**2**	**5**	**0**	**0**	**5**	**0**		
Master's thesis	9	Master's thesis pursuant to Section 55	Master's thesis					30				25	Master's thesis (approx. 60 pages; 85 %) and presentation with oral examination (approx. 60 + 15 min, 15 %)	1
			Oral examination									5		
		Total: Master's thesis						**30**	**0**	**0**	**0**	**30**		
		Total SWS (minimum) and ECTS credits		**0**	**0**	**0**	**2**	**120**	**30**	**30**	**30**	**30**		

Key:
Seminar achievement: see Section 6 (4) and (5) **ABMPOMathe/NatFak**.