Degree program and examination regulations for the Bachelor's degree program and the Master's degree program in Data Science at the Faculty of Sciences at Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU)
– FPODataScience –
dated March 5, 2026

Based on Section 9 (1) in conjunction with Section 80 (1)(1), Section 84 (2)(1), Section 88 (9), Section 90 (1)(2) and Section 96 (3) Bavarian Higher Education Innovation Act dated August 5, 2022 (**BayHIG**), in its currently valid version, FAU enacts the following degree program and examination regulations:

Contents:

Part I: General Provisions

Section 41 Scope

The degree program and examination regulations for the Bachelor's degree program and the consecutive Master's degree program in Data Science supplement the current version of the General Degree Program and Examination Regulations for Bachelor's and Master's Degree Programs at the Faculty of Sciences at Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU) (**ABMPO/NatFak**).

Section 42 Bachelor's Degree Program, Standard Duration of Study, Degree Programs in Equivalent Subjects

(1) [1]The Bachelor's degree program in Data Science shall consist of modules worth 180 ECTS credits distributed over six semesters as detailed in **Appendix 1**. [2]This includes the period for working on the Bachelor's thesis.

(2) Bachelor's degree programs count as related degree programs pursuant to Section 28 (1)(2)(2) **ABMPO/NatFak** if at least 65 ECTS credits are allocated to mathematics in the curriculum of the degree program, and the degree program also includes at least 55 ECTS credits from computer sciences.

Section 43 Master's Degree Program, Standard Duration of Study, Teaching Language, Degree Programs in Equivalent Subjects

(1) [1]The Master's degree program in Data Science builds on the content covered in the Bachelor's degree program in Data Science. [2]It consists of modules worth 120 ECTS credits including the Master's thesis, distributed over four semesters for the full-time degree program (**Appendix 2a**) or eight semesters for the part-time degree program (**Appendix 2b**).

(2) Master's degree programs count as related degree programs pursuant to Section 36 (2)(2) **ABMPO/NatFak** if at least 80 ECTS credits are allocated to mathematics in the curriculum of the degree program, and 30 ECTS credits are included from computer science.

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

Section 44 Examinations Committee

[1]An Examinations Committee consisting of two members of the Department of Mathematics or the Department of Data Science at the Faculty of Sciences and one member of the Department of Computer Science at the Faculty of Engineering shall be appointed for the Bachelor's and Master's degree programs in Data Science. [2]At least four of the members shall be professors as their main profession pursuant to Section 19 (1) **BayHIG**. [3]The chairperson shall be a member of the Department of Mathematics or the Department of Data Science at the Faculty of Sciences. [4]The members are proposed by the Department of Mathematics and Data Science and appointed by the Faculty Council of the Faculty of Sciences.

Part II: Special Provisions

1. Bachelor's Examination

Section 45 Structure of the Bachelor's Degree Program

[1]The Bachelor's degree program consists of:

a) compulsory modules for data science (nos. 1 and 2 and nos. 5 to 18 in **Appendix 1**)
b) compulsory elective modules for
   - the core modules in data science (nos. 3 and 4 in **Appendix 1** and pursuant to Section 47),
   - compulsory electives in mathematics (no. 19 in **Appendix 1** and pursuant to Section 48),
   - compulsory electives in computer science (no. 20 in **Appendix 1** and pursuant to Section 49),
   - specializations (no. 21 and 22 in **Appendix 1** and pursuant to Section 50) and
   - the application subject (no. 23 in **Appendix 1** and pursuant to Section 51),
c) elective modules for technical and non-technical key qualifications (no. 24 in **Appendix 1** and pursuant to Section 52) and
d) the Bachelor's thesis (no. 25 in **Appendix 1** and pursuant to Section 53).

[2]The distribution across the semesters, the type and duration of the examinations in the modules and the required number of ECTS credits are stipulated in the following provisions, in **Appendix 1** and the relevant module descriptions.

Section 46 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 (module numbers 5-9).

Section 47 Compulsory Elective Modules for Core Modules in Data Science

(1) The compulsory elective modules for the core modules Data science (nos. 3 and 4 in **Appendix 1**) comprise 10 ECTS credits.

(2) [1]The main learning outcome of the compulsory elective modules for the core modules of data science is to allow students to gain more in-depth and specialized knowledge of specializations in data science. [2]The modules pursue both a methodological and theoretical learning outcome, particularly by means of compulsory elective modules from the catalog for machine learning, as well as an application and project-oriented learning outcome from the catalog for the data science project, in which students work on practical problems. [3]The element of choice gives students the opportunity to develop a specific subject-related profile within data science, in particular in view of the area of data science they intend to specialize in or their future career. [4]The specific learning outcomes and examination subjects for the individual modules depend on the chosen module and are stated in the relevant module description.

(3) [1]Students choose compulsory elective modules for the core modules in data science by registering for the first examination in a module from the group of compulsory elective modules. [2]The compulsory elective modules for the core modules in data science are listed in module catalogs that are announced in accordance with local practice at the latest one week before the semester begins. [3]Changes to the module catalogs can be made by the Examinations Committee, to take effect from the following semester.

(4) [1]Possible examinations for modules offered by the Department of Mathematics or the Department of Data Science as compulsory elective modules for the core modules in data science are as follows:
1. written examination, in electronic form if applicable (60-120 min.),
2. oral examination (15-30 min.), or
3. tutorial achievement (approx. 30-45 pages)
and combinations of the above.
[2]Examinations in the seminar modules shall take one of the following forms:
1. Seminar achievement (presentation 30-80 min), possibly with written assignment (approx. 5-10 pages), or
2. Written assignment (approx. 5–10 pages).
[3]In the cases covered by Section 6 (2)(3) **ABMPO/NatFak**, it is possible to combine a written or oral examination with achievements as set forth in Section 6 (4) **ABMPO/NatFak**. [4]The type and scope of the examinations from other departments and faculties may deviate from the provisions stipulated in sentences 1 and 2. [5]Further details are stipulated in the relevant **degree program and examination regulations** or the module description.

(5) [1]Modules from the Department of Mathematics or the Department of Data Science 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 or the Department of Data Science amounting to 10 ECTS credits usually consist of lectures (4 SWS) and tutorials (up to 3 SWS). [3]Any exceptions are detailed in the relevant module description. [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 program and examination regulations** and/or the relevant module description.

Section 48 Compulsory Elective Modules in Mathematics

(1) [1]The compulsory elective module in mathematics (no. 19 pursuant to **Appendix 1**) accounts for between 5 and 20 ECTS credits and is divided into lecture modules and seminar modules. [2]Together with the compulsory elective modules in computer science, students must take modules coming to a total of 25 ECTS credits. [3]The seminar is usually used as preparation for the Bachelor's thesis.

(2) [1]The main learning outcome of the compulsory elective module in mathematics is to allow students to expand their specialist knowledge and to gain advanced skills in theoretical and applied mathematics. [2]While theoretical mathematics focuses on the abstraction of mathematical concepts, applied mathematics deals with developing theories and methods and how to apply them to practical problems. [3]A further learning outcome has a research focus, with students learning subject-related methods of research and exploring their subject in more depth. [4]In addition, the element of choice allows students to tailor their profile in view of the area of data science they intend to specialize in. [5]The specific learning outcomes and examination subjects for the individual modules depend on the chosen module and are stated in the relevant module description.

(3) Section 47 (3) to (5) shall apply accordingly.

Section 49 Compulsory Elective Modules in Computer Science

(1) [1]The compulsory elective module in computer science (no. 20 pursuant to **Appendix 1**) accounts for between 5 and 20 ECTS credits and is divided into lecture modules and seminar modules. [2]Together with the compulsory elective modules in mathematics, students must take modules amounting to a total of 25 ECTS credits. [3]The seminar is usually used as preparation for the Bachelor's thesis.

(2) [1]The overall learning outcome of the compulsory electives in computer science is to allow students to gain advanced skills that are relevant for data-driven applications, particularly in programing, algorithms and data structures, databases, software engineering, distributed systems and artificial intelligence and machine learning. [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 specialize in. [4]The specific learning outcomes and examination subjects for the individual modules depend on the chosen module and are stated in the relevant module description.

(3) [1]The specific learning outcomes and examination subjects and the type and scope of the examination and the teaching units depend on the specific manner in which the respective module is taught and are regulated by the applicable **degree program and examination regulations** and/or the module description. [2]The type and scope of teaching units and the examination in modules from the Department of Mathematics or the Department of Data Science are stipulated in Section 47 (3) to (5) respectively.

Section 50 Compulsory Elective Modules in Specializations

(1)[1]The compulsory elective modules in the specializations (nos. 21 and 22 in **Appendix 1**) are specifically aimed at allowing students to acquire more extensive skills in specific areas of mathematics and computer science. [2]The overall 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 specializations. [2]Students choose to specialize in mathematics, computer science or an interdisciplinary specialization. [3]Students shall acquire a minimum of 15 ECTS credits and a maximum of 20 ECTS credits from the chosen specialization. [4]The remaining 10 to 15 ECTS credits shall be submitted from the specializations that were not chosen. [5]Students shall take at least 10 ECTS credits in specialization modules offered by the Department of Mathematics or the Department of Data Science and the Department of Computer Science respectively.

(3)[1]The specializations are offered by different departments and consist of module packages. [2]The following specializations are available for mathematics and data science:

1. Mathematical statistical data analysis (MSD)
2. Data-oriented optimization (DO)
3. Mathematical theory / foundations of data science (MTG)

[3]The following specializations are available for computer science:

4. Databases and knowledge representation (DW)

5. Machine learning and artificial intelligence (AI)

[4]Simulation and numerics (SN) can be chosen as an interdisciplinary specialization.

(4) [1]The specializations have the following subject-specific learning outcomes:

1. In the specialization mathematical statistical data analysis (MSD), students acquire fundamental methodological skills covering various aspects of this field of study such as statistics, stochastics, image and data analysis or risk data analytics.
2. In the specialization data-oriented optimization (DO), students acquire fundamental methodological skills covering various aspects of this field of study such as linear and non-linear systems, and combinatorial, non-linear or robust optimization.
3. In the specialization mathematical theory/foundations of data science (MTG), students acquire fundamental methodological skills covering various aspects of this field of study such as differential equations and algebra.
4. In the specialization databases and knowledge representation (DW), students acquire fundamental 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.
5. In the specialization machine learning/artificial intelligence (AI), 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.
6. In the specialization simulation and numerics, students acquire fundamental methodological skills covering various aspects of this field of study such as scientific computing, differential equation models and discretization methods.

(5) [1]The specific learning outcomes and examination subjects and the type and scope of the examination and the teaching units depend on the specific manner in which the respective module is taught and are regulated by the applicable **degree program and examination regulations** and/or the module description. [2]The type and scope of teaching units and the examination in modules from the Department of Mathematics or the Department of Data Science are stipulated in Section 47 (3) to (5) respectively.

Section 51 Compulsory Elective Modules for Application Fields

(1) [1]Application fields (module no. 23 pursuant to **Appendix 1**) are module packages worth 10 ECTS credits each, of which one must be chosen. [2]The first learning outcome of the application fields is to give students the opportunity to explore the theory of at least one other area of application. [3]The second learning outcome is methodological, training students in interdisciplinary approaches, extending scientific perspectives and those from the social sciences to other fields of study and gathering experience in interdisciplinary scientific methods. [4]Thirdly, the element of choice gives students the opportunity to create their own individual profile in view of their future career. [5]Module packages can be chosen for the following application fields:

1. Chemistry

   [1]The learning outcomes here are the acquisition of fundamental knowledge in general and inorganic chemistry with professional skills with a focus on the interface between data science and chemistry. [2]The learning outcomes are geared towards the acquisition of subject-related and methodological skills in inorganic chemistry, physical chemistry, and theoretical chemistry. [3]In theoretical chemistry in particular, students learn the foundations of mathematics and how to apply them in thermodynamics and in quantum mechanics.
2. Digital humanities

[1]The learning outcomes here are the acquisition of skills at the interface between the humanities, digital technologies and data science with professional skills. [2]Students acquire the ability to critically analyze digital methods, tools and data and apply the gained results. [3]They learn how to answer questions from the humanities with computer-aided processes, and to interpret the results appropriately.

3. Geography:
   [1]The learning outcomes comprise teaching knowledge of geographic processes and their spatial relationships along with professional skills with a focus on the interface between data science and geography. [2]Students acquire the skills necessary to analyze and critically evaluate questions related to geography using data analysis and qualitative and quantitative methods. [3]They learn to evaluate spatial data and to communicate this data using suitable methods of representation.
4. Geosciences
   [1]The learning outcomes here are the acquisition of fundamental knowledge in geosciences with professional skills with a focus on the interface between data science and geosciences. [2]The learning outcomes focus, for example, on the acquisition of fundamental subject-related and methodological skills in the geosciences and applied geology, on interdisciplinary thinking in the Earth system, climate change, natural resources, and sustainability, and on the development of social, communication, and practical skills.
5. Medical data science
   [1]The learning outcomes in medical data science focus on teaching fundamental knowledge in medical data analysis with professional skills with a focus on the interface between data science and medical data science. [2]The focus lies on the analysis, processing and interpretation of medical and health-related data. [3]The objective for students is to acquire the skills needed to use statistical methods, machine learning processes and data-driven models responsibly and to analyze them critically.
6. Physics:
   [1]The learning outcomes here are the acquisition of fundamental knowledge in experimental physics with professional skills with a focus on the interface between data science and physics modules in which data is analyzed. [2]The learning outcomes focus in particular on the acquisition of fundamental subject-related and methodological skills in experimental physics, such as mechanics, thermodynamics and electrodynamics.
7. Materials science and engineering:
   [1]The learning outcomes here are the acquisition of fundamental knowledge in modules in materials science and engineering with professional skills with a focus on the interface between data science and materials science and engineering. [2]Students acquire skills about the structure, properties and behavior of materials. [3]The aim is to enable them to analyze, characterize and evaluate the relationships between the structure, processing and utilization of materials.
8. Information systems:
   [1]The learning outcomes here are the acquisition of fundamental skills at the interface between computer science, business administration and data science with professional skills. [2]The objectives are for students to learn how to analyze, design and improve information systems in companies and digital business processes.
9. Artificial intelligence in biomedical engineering (AIBE)
   [1]The learning outcomes here are the acquisition of fundamental skills at the interface between artificial intelligence in biomedical engineering and data science. [2]The objective for students is to gain skills to enable them to analyze and model

medical and biological data using data science. [3]In addition, students should learn how to assess AI-supported systems in a critical manner, to develop them and to use them in an interdisciplinary context.
[6]The Examinations Committee can approve additional application fields upon request.

(3) [1]The specific learning outcomes and examination subjects and the type and scope of the examination and the teaching units depend on the specific manner in which the respective module is taught and are regulated by the applicable **degree program and examination regulations** and/or the module description. [2]The type and scope of teaching units and the examination in modules from the Department of Mathematics or the Department of Data Science are stipulated in Section 47 (4) and (5) respectively.

Section 52 Elective Modules for Technical and Non-Technical Key Qualifications

(1) [1]The elective modules for technical and non-technical key qualifications comprise module package no. 24 pursuant to **Appendix 1.** [2]The main learning outcome of the key qualifications is the acquisition of interdisciplinary skills for work and research, for example in project management, teamwork or presentation skills. [3]In addition, it also enables students to broaden their horizons outside their own subject in fields beyond their main discipline or in practice-oriented application areas.

(2) [1]Students choose key qualification modules by registering for the first examination in the relevant module or by registering for the training course or internship. [2]The key qualification modules are listed in a module catalog, which is announced in accordance with local practice at the latest one week before the semester begins. [3]Changes to the module catalog can be made by the Examinations Committee, to take effect from the following semester.

(3) [1]The specific learning outcomes and examination subjects and the type and scope of the examination and the teaching units depend on the specific manner in which the respective module is taught and are regulated by the applicable **degree program and examination regulations** and/or the module description. [2]The type and scope of teaching units and the examination in modules from the Department of Mathematics or the Department of Data Science are stipulated in Section 47 (4) and (5) respectively.

Section 53 Bachelor's Thesis

(1) [1]The Bachelor's thesis module shall be worth a total of 10 ECTS credits. [2]Requirements for the Bachelor's thesis module shall be such that it can be completed within 12 weeks. [3]The subject of the Bachelor's thesis may only be returned once, provided the chairperson of the Examinations Committee grants approval and the subject is returned within the first two weeks of the period for thesis work.

(2) [1]All university lecturers and lecturers who have completed a habilitation and who are involved in the Bachelor's degree at the Department of Mathematics and Data Science as their main occupation pursuant to Section 43 (4) **BayHIG** shall be entitled to allocate subjects for Bachelor's theses as supervisors. [2]The Examinations Committee shall have the right to grant exceptions.

(3) [1]Notwithstanding Section 31 (2) **ABMPO/NatFak**, all university lecturers who are either employed at the Department of Computer Science as their main occupation pursuant to to Section 53 (4) **BayHIG** or secondary employment pursuant to Section 19 **BayHIG** shall also be entitled to assign Bachelor's theses as supervisors.

(4) Notwithstanding Section 31 7) **ABMPO/NatFak,** the Bachelor's thesis shall generally only be evaluated by the supervisor; Section 17 (4)(2) **ABMPO/NatFak** shall remain unaffected.

2. Master's Examination

Section 54 Admissions Committee for Master's Degree Programs

(1) The evaluation of the qualification and admission requirements for a Master's degree program shall be the responsibility of an admissions committee appointed for the Master's degree programs in Data Science according to paragraph 2.

(2)[1]The admissions committee pursuant to Section 12 **ABMPO/NatFak** shall consist of three full members and one non-voting member, who are employed at FAU as their main occupation pursuant to Section 53 (4) **BayHIG**. [2]One voting member must be a professor at the Department of Mathematics and Data Science. [3]One other voting member shall be a professor at the Department of Computer Science at the Faculty of Engineering. [4]The third voting member and the non-voting member shall be research associates from the Department of Mathematics and Data Science or from the Department of Computer Science at the Faculty of Engineering. [5]The members shall be appointed by the Faculty Council of the Faculty of Sciences upon the recommendation of the Department of Mathematics and Data Science for a term of office of three years; re-election shall be permitted.

Section 55 Qualification for a Master's Degree, Certificates and Admission Requirements

(1) A subject-specific degree as defined in Section 35 (1)(1)(1) **ABMPOMathe/NatFak** is a Bachelor's or Diplom degree program in mathematics, technomathematics, economics and mathematics, computer science, data science or physics at FAU or a degree from a university in Germany or another country with equivalent content.

(2) [1]Additional proof that must be submitted as stipulated in Section 2 (6)(3) of the **Appendix to 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 taken at least six years of English lessons at a German secondary 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 to ABMPO/NatFak**, the admissions committee shall deem the applicant qualified based on submitted documents if the final grade of the subject-specific or subject-related/equivalent degree fulfills the provisions under Section 35 (1)(1)(1) sentence 2 **ABMPO/NatFak**, or in the case of Section 35 (3) **ABMPO/NatFak** if the student has achieved an average of 2.5 (good) or better in their previous achievements; otherwise, (5)(3) of the **Appendix to ABMPO/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. [3]Notwithstanding (5)(4) of the **Appendix to ABMPO/NatFak**, only those applicants shall be invited to the oral admission examination whose average grade in modules related to mathematics and computer science in their undergraduate degree that is subject-specific, subject-related or relevant to the specific Master's degree program or another equivalent German or non-German qualification with equivalent content pursuant to Section 35 (1)(1)(1) sentence 2 **ABMPO/NatFak**, or in the case of Section 35 (3) **ABMPO/NatFak** is worse than 2.5 (good), but at least 2.8 (satisfactory).

(4) In the oral admission examination according to paragraph (5)(4) et seq of the **Appendix to ABMPO/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 knowledge in two subjects within a specialization suggested by the applicant pursuant to Section 50 (3) (35%),
3. Ability to hold an academic discussion in English on topics relating to mathematics and computer science (30%)

(5) [1]Notwithstanding (5) sentences 9 and 12 in the **Appendix** to **ABMPO/NatFak**, the admissions interview is conducted by two individuals with doctoral degrees appointed by the admissions committee whose main occupation pursuant to Section 53 (4) **BayHIG** is at the Department of Mathematics, Data Science or Computer Science. After the interview, they shall submit a recommendation to the admissions committee stating whether the applicant should be offered a place on the degree program or not. [2]The admissions committee decides on the basis of this recommendation whether to accept or reject the applicant.

Section 56 Content, Scope and Structure of the Master's Degree Program

(1) [1]The Master's degree program shall consist of the modules set forth in **Appendix 2a** and **2b**. [2]A total of 120 ECTS credits must be obtained during the Master's degree program as follows:
1. 15 ECTS credits from compulsory modules (nos. 1 to 3 pursuant to **Appendix 2 a** and **2b**),
2. 30 ECTS credits from compulsory elective modules from the major subject (no. 4 pursuant to **Appendix 2 a** or **2b** in conjunction with Section 57),
3. 20 ECTS credits from compulsory elective modules in minor subjects (no. 5 pursuant to **Appendix 2a** or **2b** in conjunction with Section 57),
4. 15 ECTS credits from application fields (no. 6 pursuant to **Appendix 2a** or **2b** in conjunction with Section 58),
5. 5 ECTS credits from elective modules from technical key qualifications (no. 7 pursuant to **Appendix 2a** or **2b** in conjunction with Section 59),
6. A Master's seminar amounting to 5 ECTS credits from the modules offered by the Department of Mathematics, the Department of Data Science or the Department of Computer Science (no. 8 pursuant to **Appendix 2a** or **2b**),
7. 30 ECTS credits from the Master's thesis in the main field of study (no. 9 pursuant to **Appendix 2a or 2b** or Section 60).

(2) [1]The Master's degree program in Data Science is taken in one of the following specializations.
1. Data-oriented optimization (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)

Further details are stipulated in Section 57 (2).
[2]Applicants state their chosen specialization in their application for admission to the Master's degree program, it can, however, be changed during the course of the degree program. [3]The chosen specialization shall be referred to as the major field of study, the specializations that are not chosen shall be referred to as minor fields of study. [4]Students shall take at least 20 ECTS credits from the specializations offered by the Department of Mathematics and Data Science and at least 20 ECTS credits from the specializations offered by the Department of Computer Science.

Section 57 Compulsory Elective Modules in Specializations

(1) [1]In the compulsory elective modules in the specializations (module group no. 4 and 5 pursuant to **Appendix 2a** and **2b**), students acquire skills in scientific methods for classifying mathematical structures, for modeling 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) [1]The individual areas of specialization pursuant to Section 56 (2) (1) have the following subject-specific learning outcomes:
1. In the specialization Data-oriented optimization (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 optimization.
2. In the specialization 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 specialization 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 specialization 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 specialization Simulation and numerics in data science, students acquire methodological skills covering various aspects of this field of study such as simulation, modeling, scientific computing or numerical methods for partial differential equations.
6. In the specialization 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) The specific learning outcomes and examination subjects for the individual modules depend on the chosen module and are stated in the relevant module description.

(4) [1]The specific learning outcomes and examination subjects and the type and scope of the examination and the teaching units depend on the specific manner in which the respective module is taught and are regulated by the applicable **degree program and examination regulations** and/or the module description. [2]The type and scope of teaching units and the examination in modules from the Department of Mathematics or the Department of Data Science are stipulated in Section 47 (3) to (5) respectively.

Section 58 Compulsory Elective Modules for Application Fields

(1) [1]Compulsory elective modules for application fields (module group no. 6 pursuant to **Appendix 2a** or **2b**) are module packages comprising a total of 15 ECTS credits. [2]The first learning outcome of the application fields is to give students the opportunity to explore the theory of one other area of application. [3]The second learning outcome is methodological, training students in interdisciplinary approaches, extending scientific perspectives and those from the social sciences to other fields of study and gathering experience in interdisciplinary scientific methods. [4]Thirdly, the element of choice gives students the opportunity to create their own individual profile in view of their future career. [5]Module packages can be chosen for the following application fields:

1. Chemistry:
   [1]The learning outcomes here are the acquisition of advanced skills in inorganic chemistry with professional skills with a focus on the interface between data science and chemistry. [2]The learning outcomes are geared towards the acquisition of subject-related and methodological skills in inorganic chemistry, physical chemistry, and theoretical chemistry. [3]In theoretical chemistry in particular, students learn the foundations of mathematics and how to apply them in thermodynamics and in quantum mechanics.
2. Digital humanities:
   [1]The learning outcomes here are the acquisition of skills at the interface between the humanities, digital technologies and data science with professional skills. [2]Students acquire the ability to critically analyze digital methods, tools and data and apply the gained results. [3]They learn how to answer questions from the humanities with computer-aided processes, and to interpret the results appropriately.
3. Geography:
   [1]The learning outcomes comprise teaching knowledge of geographic processes and their spatial relationships along with professional skills with a focus on the interface between data science and geography. [2]Students acquire the skills necessary to analyze and critically evaluate questions related to geography using data analysis and qualitative and quantitative methods. [3]They learn to evaluate spatial data and to communicate this data using suitable methods of representation.
4. Geoscience:
   [1]The learning outcomes here are the acquisition of knowledge in geosciences with professional skills with a focus on the interface between data science and geosciences. [2]The learning outcomes focus, for example, on the acquisition of technical and methodological skills in the geosciences and applied geology, on interdisciplinary thinking in the Earth system, climate change, natural resources, and sustainability, and on the development of social, communication, and practical skills.
5. International Information Systems:
   [1]The learning outcomes here are the acquisition of advanced skills in international information systems with professional skills with a focus on the interface between data science and international information systems. [2]Students acquire the skills necessary to analyze and design international information systems and support

data-based decisions in global contexts. [3]The intention is for students to learn how to apply methods in data analysis, information modeling and system development to issues related to international business.

6. Medical data science:
   [1]The learning outcomes in medical data science focus on teaching advanced knowledge in medical data analysis with professional skills with a focus on the interface between data science and medical data science. [2]The focus lies on the analysis, processing and interpretation of medical and health-related data. [3]The objective for students is to acquire the skills needed to use statistical methods, machine learning processes and data-driven models responsibly and to analyze them critically.
7. Physics:
   [1]The learning outcomes here are the acquisition of advanced knowledge in experimental physics with professional skills with a focus on the interface between data science and physics modules in which data is analyzed. [2]The learning outcomes focus in particular on the acquisition of fundamental subject-related and methodological skills in experimental physics, such as mechanics, thermodynamics and electrodynamics.
8. Materials science:
   [1]The learning outcomes here are the acquisition of advanced knowledge in modules in materials science and engineering with professional skills with a focus on the interface between data science and materials science and engineering. [2]Students acquire skills about the structure, properties and behavior of materials. [3]The aim is to enable them to analyze, characterize and evaluate the relationships between the structure, processing and utilization of materials.
9. Artificial intelligence in biomedical engineering (AIBE):
   [1]The learning outcomes here are the acquisition of fundamental skills at the interface between artificial intelligence in biomedical engineering and data science. [2]The objective for students is gain skills to enable them to analyze and model medical and biological data using data science. [3]In addition, students should learn how to assess AI-supported systems in a critical manner, to develop them and to use them in an interdisciplinary context.
10. Multimedia engineering:
    [1]The learning outcomes here are the acquisition of advanced skills in multimedia engineering with professional skills with a focus on the development, processing and integration of multimedia systems. [2]Students develop the skills necessary to design, implement and evaluate multimedia applications. [3]They also learn to use audio, video and graphics technologies with the aid of suitable methods and tools.

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

(2) [1]The specific learning outcomes and examination subjects and the type and scope of the examination and the teaching units depend on the specific manner in which the respective module is taught and are regulated by the applicable **degree program and examination regulations** and/or the module description. [2]The type and scope of teaching units and the examination in modules from the Department of Mathematics or the Department of Data Science are stipulated in Section 47 (4) and (5) respectively.

Section 59 Elective Modules for Technical Key Qualifications

(1) [1]Module package no. 7 pursuant to **Appendix 2a** and **2b** comprises elective modules for technical key qualifications. [2]The main learning outcome of the key qualifications is the acquisition of interdisciplinary skills for work and research, for example in

project management, teamwork or presentation skills. [3]In addition, it also enables students to broaden their horizons outside their own subject in fields beyond their main discipline or in practice-oriented application areas. [4]Technical key qualifications may be taken from the following modules:

1. Proof of having successfully completed selected modules in computer science.
2. Proof of having successfully completed selected modules in 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) [1]Students choose key qualification modules by registering for the first examination in the relevant module or by registering for the training course or internship. [2]The key qualification modules are listed in a module catalog, which is announced in accordance with local practice at the latest one week before the semester begins. [3]Changes to the module catalog can be made by the Examinations Committee, to take effect from the following semester.

(3) [1]The specific learning outcomes and examination subjects and the type and scope of the examination and the teaching units depend on the specific manner in which the respective module is taught and are regulated by the applicable **degree program and examination regulations** and/or the module description. [2]The type and scope of teaching units and the examination in modules from the Department of Mathematics or the Department of Data Science are stipulated in Section 47 (4) and (5) respectively.

Section 60 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 independently. [2]The Master's thesis usually deals with a scientific topic from the chosen specialization. [3]The requirements for the thesis shall be such that it can be completed within six months. [4]Notwithstanding Section 38 (5) **ABMPO/NatFak**, the subject of the Master's thesis may only be returned once, provided the chairperson of the Examinations Committee grants approval and the subject is returned within the first two weeks of the period for thesis work.

(2) [1]All university lecturers pursuant to Section 19 (1) **BayHIG** and lecturers who have completed a habilitation and who are employed at the Department of Mathematics and Data Science as their main occupation pursuant to Section 53 (4) **BayHIG** shall be entitled to allocate subjects for Master's theses (supervisors). [2]The Examinations Committee shall have the right to grant exceptions.

(3) Notwithstanding Section 31 (2) **ABMPO/NatFak**, anyone employed as a university lecturer as their main occupation as defined in Section 19 (1) **BayHIG** who is employed at the Department of Computer Science as their main occupation pursuant to Section 53 (4) BayHIG shall also be entitled to assign Master's theses (supervisors)

(4) Notwithstanding Section 31 (7) **ABMPO/NatFak,** the Master's thesis shall generally only be evaluated by the supervisor; Section 17 (4)(2) **ABMPO/NatFak** shall remain unaffected.

Part III: Final Provisions

Section 61 Legal Validity

(1) [1]These degree program and examination regulations shall come into effect on April 1, 2026. [2]They shall apply to all students starting a degree program from summer semester 2026 onwards.

(2) [1]The degree program and examination regulations for the Bachelor's and Master's degree program in Mathematics at Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU) – FPOMathe – dated March 11, 2015, last amended by the statute dated August 5, 2021 shall become invalid on September 30, 2031 for Bachelor's degree programs and on March 31, 2030 for Master's degree programs. [2]Examinations in accordance with the version of the FPOMathe stated in sentence 1 will be offered for the last time in summer semester 2031 for the Bachelor's degree program and in summer semester 2029/2030 for the Master's degree program.

Appendix 1: Structure of the Bachelor's Degree Program in Data Science

	No.	Module name	Teaching unit	SWS (semester hours)					Total ECTS cred-its	Distribution of workload per semester in ECTS credits						Type and scope of the examination	Grade factor
				L	T	P	S	T		1. sem.	2. sem.	3. sem.	4. sem.	5. sem.	6. sem.		
Core modules Data Science	1	Seminar: Data science in research and industry	Seminar: Data science in research and industry				2		**5**	5						Written examination 90 min	0
	2	Methods for mathematical data analysis	Methods for mathematical data analysis	2	1				**5**	5						Written examination 60 min	1
	3	Compulsory elective modules from the catalog for machine learning pursuant to Section 47	See Section 47 (5)						**5**		5					See Section 47 (4)	1
	4	Compulsory elective modules from the catalog for data science project pursuant to Section 47	See Section 47 (5)						**5**				0–5	0–5		See Section 47 (4)	1
		Total for core modules: Data science		**4**	**3**	**2**	**4**	**0**	**20**	**10**	**5**	**0**	**0–5**	**0–5**	**0**		
Foundational modules in mathematics and computer science	5	Mathematics for data science 1 GOP	Lecture Data science 1	4					**10**	10						Written examination 120 minutes (100%) and tutorial achievement (ungraded, 0%)	0
			Tutorial/exercise Data science 1		2												
			Blackboard exercise Data science 1		2												
	6	Mathematics for data science 2 GOP1	Lecture Data science 2	4					**10**		10					Written examination 120 mins, 100 %) and tutorial achievement (ungraded, 0%)	1
			Tutorial/exercise Data science 2		2												
			Blackboard exercise Data science 2		2												
	7	Foundations of Programming (GOP)	see FPOMT						**5**	5						see FPOMT	0
	8	Introduction to algorithms (GOP)	see FPOMT						**7.5**		7.5					see FPOMT	0

	No.	Module name	Teaching unit	SWS (semester hours)					Total ECTS cred-its	Distribution of workload per semester in ECTS credits						Type and scope of the examination	Grade factor
				L	T	P	S	T		1. sem.	2. sem.	3. sem.	4. sem.	5. sem.	6. sem.		
	9	Knowledge discovery in databases with tutorial (GOP)	see FPOINF						**5**		5					see FPOINF	1
		Total foundation modules in mathematics and Computer Science		**16**	**16**	**0**	**0**	**0**	**37.5**	**15**	**22.5**	**0**	**0**		**0**		

	No.	Module name	Teaching unit	SWS (semester hours)					Total ECTS cred-its	Distribution of workload per semester in ECTS credits						Type and scope of the examination	Grade factor
				L	T	P	S	T		1. sem.	2. sem.	3. sem.	4. sem.	5. sem.	6. sem.		
Intermediate modules in mathematics and computer science	**10**	Linear and combinatorial optimization [1]	see FPOWiMathe						**10**			10				see FPOWiMathe	1
	11	Introduction to numerics [1]	see FPOTechnoMathe						**10**			10				see FPOTechnoMathe	1
	12	Stochastic modeling [1]	see FPOWiMathe						**10**			10				see FPOWiMathe	1
	13	Parallel and functional programming [2]	see FPOINF						**5**			5				see FPOINF	1
	14	Introduction to software engineering [2]	see FPOINF						**5**			5				see FPOINF	1
	15	Secure systems [2]	see FPOINF						**5**				5			see FPOINF	1
	16	Introduction to databases [2]	see Section FPOINF						**7.5**				7.5			see FPOINF	1
	17	Foundations of logic in computer science [2]	see FPOINF						**5**			5				see FPOINF	1
	18	Information visualization[2]	see FPOINF						**5**				5			see FPOINF	1
		Total intermediate modules (AM) of mathematics and computer science		**20**	**14**	**0**	**0**	**0**	**35**	**0**	**0**	**25–30**	**5–10**	**0**	**0**		

1 Two out of three modules must be chosen. The third module can be taken from the compulsory elective modules in mathematics.
2 Two out of three modules must be chosen. The modules can be taken from the compulsory elective modules in computer 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	T		1. sem.	2. sem.	3. sem.	4. sem.	5. sem.	6. sem.		
Compulsory elective modules mathematics	19	Compulsory elective modules from the Catalog for compulsory elective modules in mathematics pursuant to Section 48	See Section 48 (3)						**5–20**				5–15		0–5	see Section 48 (3)	1
		Total compulsory elective modules in mathematics [3]		**6**	**5**	**0**	**2**	**1**	**5–20**	**0**	**0**	**0**	**5–15**	**0**	**0–5**		
Compulsory elective modules Computer Sci-	20	Compulsory elective modules from the Catalog for compulsory elective modules in computer science pursuant to Section 49	See Section 49 (3)						**5–20**				5–15		0–5	see Section 49 (3)	1
		Total compulsory elective modules in computer science [3]		**4**	**3**	**0**	**2**	**0**	**5–20**	**0**	**0**	**0**	**5–15**	**0**	**0–5**		
Specializations	21	Compulsory elective modules from the Catalog for the chosen specialization modules pursuant to Section 50	See Section 50 (5)						**15–20**					10–20	0–10	See Section 50 (5)	1
	22	Compulsory elective modules from the catalogs for specializations not chosen pursuant to Section 50	See Section 50 (5)						**10–15**					0–10	0–10	See Section 50 (5)	1
		Total for computer science specialization [4]		**12**	**8**	**0**	**2**	**0**	**30**	**0**	**0**	**0**	**0**	**20**	**10**		

[3] Students must take at least one module worth 5 ECTS credits and may only take modules worth a maximum of 20 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.

[4] Students shall take at least 10 ECTS credits in specialization modules offered by the Department of Mathematics or the Department of Data Science 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		1. sem.	2. sem.	3. sem.	4. sem.	5. sem.	6. sem.		
Application fields	23	Compulsory elective modules from the catalog for the application fields pursuant to Section 51	See Section 51 (3)						**10**					5	5	See Section 51 (3)	1
		Total: Application field		**2**	**4**	**8**	**0**	**0**	**10**	**0**	**0**	**0**	**0**	**5**	**5**		
Technical and non-technical key qualifications	24	Compulsory elective modules from the catalog of technical and non-technical key qualifications pursuant to Section 52	See Section 52 (3)						**12.5**	5	2.5	0–5	0–5			See Section 52 (3)	1
		Total technical and non-technical Key qualifications		**6**	**6**	**0**	**0**	**0**	**12.5**	**5**	**2.5**	**0–5**	**0–5**	**0**	**0**		
Bachelor's thesis	25	Bachelor's thesis							**10**						10	Bachelor's thesis (approx. 20–25 pages)	1
		Total Bachelor's thesis		**0**	**0**	**0**	**2**	**0**	**10**	**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) **ABMPO/NatFak**.

Appendix 2a: Structure of the Master's Degree Program 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		1. sem.	2. sem.	3. sem.	4. sem.		
Core modules Data Science	1	Mathematics of learning	Lecture Mathematics of learning	2				**5**	3				Written examination (60 min)	1
			Tutorial/exercise Mathematics of learning		1				2					
	2	Deep learning	see FPOINF					**5**		5			see FPOINF	1
	3	Selected topics in mathematics of learning	Lecture: Selected topics in mathematics of learning	2				**5**			3		Written examination (60 min)	1
			Tutorial: Selected topics in mathematics of learning		1						2			
		Total for core modules: Data science		**4**	**2**			**15**	**5**	**5**	**5**	**0**		
Major field of study	4	Compulsory elective modules from the catalog for chosen major field of study pursuant to Section 57	See Section 57 (4)						10	10	10	0	See Section 57 (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 catalogs for the minor fields of study not chosen pursuant to Section 57	see Section 57 (4)						10	10	0	0	See Section 57 (4)	1
		Total: Compulsory electives 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		1. sem.	2. sem.	3. sem.	4. sem.		
Application fields	**6**	Compulsory elective modules from the catalog of modules for the application fields pursuant to Section 58	see Section 58 (2)						5	0–5	5–10	0	See Section 58 (2)	1
		Total: Application field						**15**	**5**	**0–5**	**5–10**	**0**		
Technical key qualifications	7	Elective modules from technical key qualifications pursuant to Section 59	See Section 59 (3)						0	0–5	0–5	0	See Section 59 (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/NatFak	Master's seminar				2		0	0	5	0	Seminar achievement pursuant to Section 6 ABMPO/NatFak	1
		Total: Master's seminar		**0**	**0**	**0**	**2**	**5**	**0**	**0**	**5**	**0**		
Master's thesis	**9**	Master's thesis pursuant to Section 60	Master's thesis					**30**				30	Master's thesis (approx. 60 pages)	1
		Total: Master's thesis						**30**	**0**	**0**	**0**	**30**		
		Total SWS (minimum) and ECTS credits		**4**	**2**	**0**	**2**	**120**	**30**	**30**	**30**	**30**		
				8										

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

Appendix 2b: Structure of the Master's Degree Program in Data Science, part-time

	No.	Module name	Teaching unit	SWS (semester hours) L	T	P	S	T	ECTS credits	Distribution of workload per semester . sem.	2. sem.	3. sem.	4. sem.	5. sem.	6. sem.	7. sem.	8. sem.	Type and scope of the Examination	Grade factor
Core modules Data Science	1	Mathematics of learning	Lecture Mathematics of learning	2					5	5								Written examination (60 min)	1
			Tutorial/exercise Mathematics of learning		1														
	2	Deep learning	see FPOINF						5		5							see FPOINF	1
	3	Selected topics in mathematics of learning	Lecture: Selected topics in mathematics of learning	2					5			5						Written examination (60 min)	1
			Tutorial: Selected topics in mathematics of learning		1														
		Total for core modules: Data science		**4**	**2**				**15**	**5**	**5**	**5**	**0**						
Major field of study	4	Compulsory elective modules from the catalog for chosen major field of study pursuant to Section 57	see Section 57 (4)							0–10	0–10	0–10	0–10	0–10				See Section 57 (4)	1
		Total compulsory electives in major field of study							**30**	**0–10**	**0–10**	**0–10**	**0–10**	**0–10**					
Minor fields of study	5	Compulsory elective modules from the catalogs for the minor fields of study not chosen pursuant to Section 57	See Section 57 (4)							0–10	0–10	0–10	0–10	0–10				See Section 57 (4)	1
		Total: Compulsory electives for minor field of study							**20**	**0–10**	**0–10**	**0–10**	**0–10**	**0–10**					

	No.	Module name	Teaching unit	SWS (semester hours) L	T	P	S	T	ECTS credits	Distribution of workload per semester . sem.	2. sem.	3. sem.	4. sem.	5. sem.	6. sem.	7. sem.	8. sem.	Type and scope of the Examination	Grade factor
Application fields	**6**	Compulsory elective modules from the catalog of modules for the application fields pursuant to Section 58	See Section 58 (2)										0–5	0–5	5–10			See Section 58 (2)	1
		Total: Application field							**15**				**0–5**	**0–5**	**5–10**				
Technical key qualifications	**7**	Elective modules from technical key qualifications pursuant to Section 59	See Section 59 (3)										0–5	0–5	0–5			See Section 59 (3)	1
		Total: Technical key qualifications							**5**				**0–5**	**0–5**	**0–5**				
Master's seminar	**8**	Master's seminar pursuant to Section 6 **ABMPO/NatFak**	Master's seminar				2		**5**						5			Seminar achievement pursuant to Section 6 **ABMPO/NatFak**	1
		Total: Master's seminar					**2**		**5**						**5**				
Master's thesis	**9**	Master's thesis pursuant to Section 60	Master's thesis						**30**							30		Master's thesis (approx. 60 pages)	1
		Total: Master's thesis							**30**							**30**			
		Total SWS (minimum) and ECTS credits							**120**	**15**	**15**	**15**	**15**	**15**	**15**	**30**			

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