

The Departmental Council of the Department of Mathematics and Computer Science of Philipps-Universität Marburg, in accordance with §50(1) Hesse Higher Education Act (HessHG), as amended on 14 December 2009 (Law Gazette of the State of Hesse (GVBl.) I No. 22/2009, p. 666), most recently amended by Article 1 Act of 14 December 2021 (GVBl., p. 931) on 25 January 2023 has adopted the following Degree Program and Examination Regulations:

## **Degree Program and Examination Regulations**

for the program in

***“Data Science”***

leading to the degree of

**“Master of Science (M.Sc.)”**

**at Philipps-Universität Marburg**

**25 January 2023**

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## **I. General**

### **§1 Scope**

These Degree Program and Examination Regulations supplement the General Regulations for Master's Degree Programs at Philipps-Universität Marburg of September 13, 2010 (Official Bulletin of Philipps-Universität Marburg, No. 52/2010), as amended from time to time – hereinafter referred to as the General Regulations – and regulate the objectives, content, structure and organization of the degree program as well as the requirements and procedures for the examination grades in the degree program “Data Science” with the degree “Master of Science (M.Sc.)”.

### **§2 Goals of the degree program**

The master's program in Data Science serves the deepening and specialization in the subject area to acquire skills in finding solutions when dealing with (large) data. Taking into account new challenges in a digitalized society and the resulting changes in the professional world and the associated crossdisciplinarity, graduates of this master's degree program have expanded their skills and knowledge in the field of computer science and applied mathematics and are able to build on them, to develop solutions to technical problems independently scientifically, as well as to apply scientific findings, critically assess them and deal with them responsibly in an application context.

To achieve these goals, the master's degree program consists of specializations in computer science, such as machine learning, software development for scalable systems and big data technology as well as applied mathematics. In addition, there is also the option of choosing an area of application; currently there is a choice among the fields of medical informatics, social sciences, geoinformatics and languages. Graduates will also have become acquainted with concrete applications through the project-oriented parts of the degree program; likewise, they will have strengthened their social skills and driven their motivation for intrinsic learning. In the course of their master's thesis in particular, the students have scientifically dealt with current research literature and problems in the field of data science and developed a solution approach. The graduates are qualified through their successfully completed master's degree

- to work independently as a data scientist in industry and business, in particular with start-ups, banks, insurance companies, trading and consulting companies,
- to lead projects that focus on digital transformation and solving innovative problems with large and heterogeneous data,
- on planning and development tasks related to digitalization and big data in scientific and public institutions,
- to work as a research assistant or research associate at a university,
- to be admitted to a doctoral degree program.

### **§3 Master's degree**

(1) The master's degree examination is passed if all modules provided for in accordance with §6 have been passed.

(2) After successfully completing the program in accordance with paragraph 1, the Department of Mathematics and Information Technology will award the academic degree of “Master of Science (M.Sc.)”.

## **II. Program-related rules**

### **§4 Access requirements**

(1) The general admission requirement for the master's degree program is proof of completion of a relevant bachelor's degree program in Data Science or proof of a comparable domestic or foreign university professional degree.

In addition to the bachelor's degree in Data Science, a bachelor's degree in Mathematics or Computer Science entitles the student to admission if a total of at least 90 credits (Leistungspunkte, LP) in modules from the two scientific disciplines of mathematics and computer science have been completed as part of this or another degree program. At least 72 credits should be allocated to modules that correspond to the objectives and competencies of the following modules: Object-oriented programming, algorithms and data structures, system software and computer communication as well as efficient algorithms, machine learning, fundamentals of linear algebra, and either fundamentals of analysis and fundamentals of higher mathematics or Analysis I and Analysis II.

If no degree certificate with an overall grade is available by the application deadline, enrollment may be conditional. The prerequisite for an underlying bachelor's degree with a scope of 180 credits is that proof be provided that module examinations or partial module examinations have been passed representing at least 80% of the credits required for the bachelor's degree in question. The proof must contain an average grade that was determined on the basis of the graded module examinations and partial module examinations within the scope of the proven 80% of the credits required for the bachelor's degree. Enrollment can only take place under the proviso that all coursework and examination grades of the bachelor's degree have been completed before the start of the master's degree (deadline 31 March if the master's degree program starts in the summer semester or deadline 30 September if the master's degree program starts in the winter semester) and that proof of the degree certificate is provided by the end of the lecture period of the first subject semester.

(2) The examination committee (§16) will decide on the question of the relevance of the prior degree programs as defined in paragraph 1.

(3) The examination committee (§ 16) shall decide on the question of the comparability of the university degree within the meaning of paragraph 1.

(4) The examination committee (§16) may link admission to the condition that additional coursework grades and/or examination grades representing a maximum of 30 credits be completed. In this case, the degree program may be extended accordingly.

(5) The modules and courses of the degree program are generally offered in English. A German-language offering will be possible on an exceptional basis if all students in the module or course wish this. The coursework and examinations can be taken in either German or English, at the student's discretion. Optional offerings and elective courses may include import modules in German from bachelor's degree programs or other departments so that the choice may be limited here, if necessary.

The specific admission requirements are: Demonstrating either:

- a) English language skills at least at level C1 of the Common European Framework of Reference for Languages, or
- b) English language skills at least at level B1 of the Common European Framework of Reference for Languages and German language skills at least corresponding to the language examination level of "DSH-2".

(6) In addition to the general admission requirements for the degree program, participation in individual modules or parts of modules may be made dependent on the fulfillment of specific module admission requirements.

In this case, the prerequisites are listed in the module list (Appendix 2) under "Prerequisites for Participation".

## §5 Academic advising

General academic advising is provided by the Central Academic Advising Service (Zentrale Allgemeine Studienberatung, ZAS) at Philipps-Universität Marburg. Subject-specific academic advising is usually provided by the professors or by authorized persons.

## §6 Degree programs: structure, contents, curriculum and information

(1) The master's program in Data Science is divided into the study areas Compulsory Elective Modules in Mathematics, Free Compulsory Elective Modules, Application Area Modules, Practical and Seminar Modules and Final Modules.

(2) The degree program consists of modules that are assigned to the various study areas according to Para. 1. The program structure is as follows based on module assignments, the degree to which they are required, and the student's calculated workload in credits (Leistungspunkte, LP):

	Compulsory course (Pflicht, PF) / Compulsory elective course (Wahlpflicht, WP)	Credits (Leistungspunkte, LP)	Comment
<b>Compulsory Elective Modules in Mathematics</b>		<b>18</b>	
Matrix methods in data analysis*	WP	9	
Numerics (Basic Numerical Methods)*	WP	9	
Probabilistic Combinatorics*	WP	9	
Statistik/Statistics*	WP	9	
Topological Methods in Data Analysis*	WP	9	
<b>Free Compulsory Elective Modules***</b>		<b>24-48</b>	
Data Science in Biomedicine	WP	I 6	
Data Integration	WP	I 6	
Introduction to Natural Language Processing	WP	I 6	
Information Retrieval	WP	I 6	
<i>Import modules with content or methodological reference to the subject area of data science. *, **</i>	WP	I, M 0-48	at least 24 credits in computer science modules ("I")
<b>Application Area Modules***</b>		<b>0 or 18-24</b>	An application area is optionally electable**
Data Science in Biomedicine	WP	MI 6	
Introduction to Natural Language Processing	WP	S 6	
<i>Modules per Appendix 3: Import Module List</i>	WP	12-24	**

<b>Practical and Seminar Modules***</b>		<b>24-27</b>	
Independent Scientific Practice Data Science	PF	9	
Project Work Data Science	PF	12	
Selected Advanced Topics in Computer Science / Data Science (Seminar)	WP	3	at least one module
Selected Advanced Topics in Mathematics / Data Science (Seminar)	WP	3	
Selected Advanced Topics in Computer Science (Seminar)*	WP	3	
Selected Advanced Topics in Mathematics A (Seminar)*	WP	3	
<b>Final Module</b>		<b>30</b>	
Master's Thesis	PF	30	
<b>Total</b>		<b>120</b>	

\* Import module per Appendix 3 Import Module List.

\*\* In the field of Free Compulsory Elective Modules, a maximum of 18 credits can be completed in advanced modules.

\*\*\* In the areas of Free Compulsory Elective Modules, Application Area Modules, and Practical and Seminar Modules, a total of 72 credits can be earned.

\*\*\*\* The selection of an area of application is made by first registering for a module or for coursework or an exam in a module in the area of application.

(3) In the Compulsory Elective Modules in Mathematics area of study, students expand their knowledge and competencies in various applied mathematical disciplines according to their individual preferences.

(4) In the Free Compulsory Elective Modules area of study, modules from computer science and mathematics can be chosen according to a student's own interests, whereby students deepen and broaden their competencies and knowledge from the bachelor's degree program, and thus acquire the necessary prerequisites to write the master's thesis.

(5) In the optional Application Area Modules study area, modules can be selected from one application area. The list of selectable areas of application with the respective modules can be found in Appendix 3 or in the most up-to-date form on the website in accordance with paragraph 9. For this purpose, the application domains for the methods of data science are available at the time of the decision of these Degree Program and Examination Regulations in the fields of medical informatics, social sciences, geoinformatics and languages. The modules of this field of study are used to acquire basic competencies in the respective application domain. On the other hand, modules are also provided in which methods for data analysis tailored to the domain are taught.

(6) In the degree program area Practical and Seminar Modules, students deepen their practice-oriented scientific skills and apply them. The competence essential for data scientists to carry out a research project in group work is practiced, usually with the development of extensive software. In addition, one or two seminars serve to further profile building, where students learn to compare and evaluate research results. In the module Independent Scientific Practice Data Science, techniques of scientific work in data science are learned and practiced. The module also prepares students for the master's thesis, and it is recommended that it be taken with the prospective adviser for the master's thesis.

(7) The degree program is more research-oriented.

(8) The exemplary sequence of the modularized degree program is shown in the degree program schedule (cf. Appendix 1).

(9) General information and regulations in their current form are available on the course-related website at

<https://www.uni-marburg.de/de/fb12/studium/studiengaenge/m-sc-data-science>

In particular, the module handbook and the degree program curriculum can be viewed there. Furthermore, a list of the current import and export opportunities for the degree program is published there.

(10) The assignment of the individual courses to the modules of the degree program can be seen in the course catalog of Philipps-Universität Marburg, which is made available on the homepage of the university.

## **§7 General standard program duration and start of studies**

(1) The general standard period of study for the master's degree program Data Science is 4 semesters. On the basis of these Degree Program and Examination Regulations, the department will ensure a range of courses enabling students to complete all of the work required to pass the degree program, including preparing the master's thesis, within the general standard program duration.

(2) The degree program can be started in either winter or summer semester.

## **§8 Study abroad**

(1) The International Student Advisory Service of the respective department as well as the offices and academic units at Philipps-Universität Marburg responsible for study abroad programs will advise students on various destination universities as well as on internship opportunities abroad, technical requirements, options for getting study abroad work recognized as well as funding opportunities.

(2) Students will conclude a learning agreement with their department and the foreign host university prior to their stay abroad. The degree program to be completed abroad as well as the credits to be earned upon successful completion of a module or course must be specified in this kind of learning agreement. The students will agree to complete the agreed degree program at the host university as an integral part of their studies and the department will recognize the credits earned. The learning agreement is binding on the parties involved. To conclude a learning agreement, it is essential that the targeted learning outcomes and skills largely coincide. It is not necessary that the content be the same.

(3) In justified exceptional cases, the learning agreement can be modified or adapted before and during the stay abroad at the request of the student with the consent of the department. The consent of the foreign host university is also required.

(4) Departures from the commitments made in the learning agreement will be permitted after the fact only if they are not the student's fault and appropriate documentation is provided.

### **§9 Structural variant of the degree program**

The master's program in Data Science corresponds to the structural variant of a "single-subject program".

### **§10 Modules and credits**

The rules under §10 of the General Regulations apply.

### **§11 Practical modules and profile modules**

(1) The master's program in Data Science includes an internal practical module in the degree program area Practical and Seminar Modules in accordance with §6 of these Degree Program and Examination Regulations.

(2) The master's program in Data Science does not include an external practical module in accordance with §6 of these Degree Program and Examination Regulations.

(3) Otherwise, the provisions of §11 of the General Regulations apply.

### **§12 Module and course registration and module and course deregistration**

(1) Binding registration is required for modules or courses in individual cases, insofar as this is specified in the module handbook.

(2) The registration and deregistration procedure as well as the registration and deregistration deadlines will be announced in a timely fashion on the degree program-related website in accordance with §6(9). In the event of limited capacity, module or course placements are allocated in accordance with §13 of these Degree Program and Examination Regulations.

### **§13 Access to compulsory elective modules or courses with limited participation options**

(1) Registration caps may be set for compulsory elective modules and courses by means of a departmental council resolution, provided that this is absolutely necessary for the implementation of orderly teaching and degree program operations and for the achievement of the educational objective. Whenever the number of participants is fixed, this will be announced in an appropriate manner and in a timely fashion before the start of the compulsory elective module or course.

(2) For a compulsory elective module or a course with limited capacity, there is no entitlement to participate provided that there is open capacity to take at least one other alternative compulsory elective module or course.

(3) If the number of registrations for a compulsory elective module or course exceeds the number of available places, a selection must be made.

The selection will be conducted by lot.

In all cases, it must be ensured that, within the framework of the available capacity, hardship cases are considered in advance, in particular those as defined by §26(1 and 2) (Priority Group 1) and students with a special interest in participation (Priority Group 2).

A special interest exists in particular for students:

- for whom the required elective module or course is required due to an internal specialization,



- who did not receive a place in a previous semester despite having registered, even though the degree program curriculum provided for the compulsory elective module,
- who previously did not pass the compulsory elective module or course, if repeating the module or course is required to retake the examination.

If, in individual cases, the available places are not sufficient for consideration of the two priority groups, students from Priority Group 1 must have priority registration; within each group, the decision is then made by drawing lots.

#### **§14 Application of modules across degree programs**

(1) Modules are planned that are based on the provisions of other degree programs (“import modules”) in terms of what they offer and their examination rules. More detailed information on these modules is summarized in Appendix 3.

(2) Modules offered in the master’s program in Data Science, which can also be completed in the context of other programs, are subject to the regulations of §20(4) of these Degree Program and Examination Regulations as well as §14(2) of the General Regulations.

#### **§15 Academic grades**

§15(1) of the General Regulations applies.

### **III. Examination-related provisions**

#### **§16 Examination committee**

(1) The departmental council will appoint the examination committee.

(2) The members of the examination committee will consist of:

1. Four professors,
2. One research assistant, and
3. Two students.

One substitute member will be elected for each member.

Three of the members in accordance with item 1 should come from the field of computer science, and one should come from the field of mathematics.

(3) The term of office, the chairship, quorum and other issues are governed by §16 of the General Regulations.

#### **§17 Duties of the examination committee and examination administration**

The rules under §17 of the General Regulations apply.

#### **§18 Examiners and observers**

The rules under §18 of the General Regulations apply.

#### **§19 Recognition of academic grades and examination results**

The rules under §19 of the General Regulations apply.

#### **§20 Module list, import and export module list and module manual**

(1) The modules to be completed as part of the degree program are summarized in the module list (Appendix 2) as well as in the list of import modules (Appendix 3). These

lists as well as §6 provide the type of modules, their allocation to the various areas of the degree program, choices among modules and within modules, the prerequisites for participation in the modules as well as the credits to be earned, the form of examination, assessment and the expertise objectives. In the case of import modules, the original module lists of the offering degree program provide this information.

(2) The offer of import modules is subject to the provision that changes to the modules can be made by the offering academic units (e.g. in particular using accreditations). This does not require an amendment to these Degree Program and Examination Regulations. Such changes will be announced by the examination committee in a timely fashion on the program website. In addition, the examination committee may decide that in general or in individual cases upon a justified petition, additional modules may be allowed as import modules, provided that the offering department or institution agrees to this.

(3) Further information with detailed module descriptions as well as the current range of import modules will be published in a module handbook on the program website.

(4) The export modules are summarized in Appendix 4.

## **§21 Examinations**

The rules under §21 of the General Regulations apply.

## **§22 Examination types and durations; test-taking times; scopes**

(1) Written examinations will take the form of:

- Written examinations (*Klausuren*), which may also be administered in whole or in part as e-examinations (in accordance with Appendix 6 of the General Regulations) and in whole or in part as multiple-choice examinations (in accordance with Appendix 8 of the General Regulations),
- Written analyses (*schriftliche Ausarbeitungen*), or
- The master's thesis.

(2) Oral examinations will take the form of:

- Individual tests, or
- The oral defense of the master's thesis.

(3) Additional examination forms include:

- Seminar presentations
- Software creations

(4) The following durations or test-taking times and scopes are assigned to the examination forms mentioned above. In the case of written examinations that are not conducted under supervision, the total time available to take the tests should be longer. The duration of the individual examinations is 60-120 minutes for written examinations and 20-30 minutes for individual oral examinations.

Written analyses (*schriftliche Ausarbeitungen*) are usually 10-20 pages long and take about two weeks to complete; seminar presentations as given as part of a module event (maximum of 90 minutes). The test-taking time for software development as a course-related examination corresponds to approximately eight weeks; this examination form usually comprises artifact programming code, planning and user and programming

documentation as well as presentation material. The scope or length of the master's thesis is usually 30-90 pages. The oral defense lasts a maximum of 60 minutes.

(5) The corresponding regulations of the Degree Program and Examination Regulations for the degree programs from which the modules are imported, as amended, will apply to the import modules in accordance with Appendix 3 or the examinations provided for in that appendix.

(6) Multimedia-based written examinations ("e-examinations") will take place in accordance with the regulations in the General Provisions, Appendix 6.

(7) Multiple-choice examinations will take place in accordance with the provisions in the General Regulations ("answer-choice examinations"), Appendix 8.

(8) Otherwise, the provisions of §22 General Regulations apply.

### **§23 Master's thesis**

(1) The master's thesis (graduation paper) is a mandatory component of the degree program. It constitutes a final joint module together with an oral defense. The master's thesis must be written in German or English.

(2) The master's thesis is an examination paper with which the candidate is to demonstrate the ability to independently work on a delimited problem from the subject area of data science using scientific methods within a specified period of time. It aims at the candidate applying the knowledge acquired in the course of study to relevant questions, for the solution of which advanced knowledge, skills and techniques from computer science as well as methods and procedures in mathematics are used to a particular extent. It further aims to present the results in written form in a scientific/scholarly manner and to appropriately present and defend them publicly. The scope of the master's thesis is 27 credits. The final module includes an additional 3 credits for the oral defense.

(3) The master's thesis must be written as an individual work.

(4) Permission to write the master's thesis requires that at least 66 credits have been earned in the modules of the master's program.

(5) The candidate will propose an adviser and a reviewer authorized as examiner as the first reviewer for the master's thesis. The candidate also has the right to propose the second reviewer. The adviser and the first reviewer may be the same person. These proposals do not establish an entitlement. The first reviewer must be appointed by the examination committee for the examination of master's theses. The topic of the master's thesis is submitted to the examination committee by the first reviewer and assigned by the examination committee. If the candidate does not find an adviser and a first reviewer, the chair of the examination committee will appoint the adviser and the first reviewer and ensure that a topic for the master's thesis is issued in a timely fashion.

(6) The master's thesis must be completed within a thesis-writing period of 6 months. The topic of the thesis must be such that it can be written within this period. An extension of the thesis-writing time up to a maximum of 20% (e.g. due to unforeseen problems in obtaining literature or data) is possible upon justified petition by the candidate; this does not lead to the award of additional credits. The thesis-writing time

begins upon issuances of the topic; the issue date must be recorded. The topic should be issued in a timely manner such that, even if an extension of the thesis-writing time is granted, there is no extension of the program duration.

(7) The master's thesis must be submitted in a timely fashion to the examination committee or to an office designated by it in 3 printed copies as well as in digital form in accordance with the specifications of the examination committee. The time of submission must be recorded in the records. When submitting the thesis, the candidate must give written assurance that he or she wrote the thesis independently and did not use any sources or aids other than those indicated. If the master's thesis is not submitted on time, it will be graded as "insufficient" (0 points) in accordance with §28(2) of the General Regulations.

(8) The master's thesis has not been passed if the overall grade does not receive at least 5 points (grade of "sufficient") in accordance with §28(2) of the General Regulations; it may be repeated once. The oral defense as part of the final module can also be repeated once. The examination committee will ensure that the candidate receives a new topic within six weeks of notification of the failure. A return of the topic within the period specified in §23(7)(1) of the General Regulations is permitted only if the candidate did not make use of this option when writing the master's thesis for the first time. A second repetition of the master's thesis is excluded.

(9) Grade compensation for a failed master's thesis is not permitted. Grade compensation for a failed oral defense within the scope of the final module is also excluded.

(10) Otherwise, the provisions of §23 of the General Regulations apply.

#### **§24 Examination dates, examination registration and examination deregistration**

(1) The examination committee will announce the periods of examinations and repeat examinations. Dates for written examinations (*Klausuren*) and other examination dates that are equally valid for all participants of a module are announced in the course catalog. Examination dates to be agreed upon individually (such as presentations) will be listed in the course catalog with the note "n. V." (by arrangement).

(2) Examinations will be administered within the framework of the respective module courses or immediately thereafter. If examinations are administered after module courses, they should generally be offered in a two- to three-week examination period at the end of the lecture period or at the beginning or end of the subsequent lecture-free period. As a rule, examinations should be administered on the same day of the week and at the same time as the corresponding module course. The examiner should also provide for the preparation of examinations, such as term papers, during the lecture-free period.

(3) For the repetition of examinations, the first repetition date will be set in such a way that, in the case of successful participation, continued study in the following semester is guaranteed.

(4) Binding registration is required for participation in an examination. The examination committee will announce the deadlines and the form of registration in an appropriate manner no later than 4 weeks before the start of the registration period. Permission to

take the examination will be denied if the registration deadline is not met or if examination permission requirements are not met.

(5) When registering for examinations, students can autonomously choose between the first date and the repeat date. When choosing the date for the repeat examination, no further repeat examination will be offered in the same semester in case of failure. In this case, if subsequent modules build on each other (consecutive modules) and require the failed module, continuous study in deviation from §24(3) cannot be guaranteed the following semester.

(6) A binding examination registration may be withdrawn without stating reasons provided that this is done before the deadline set for this by the examination committee. These deadlines as well as the format for the withdrawal will be announced together with the corresponding regulations for registration.

(7) Upon application with justification to the examination committee, alternative dates will be set for examinations that cannot be taken due to limitations on work for religious reasons. Proof of membership in the appropriate religious community must be submitted with the application. The application must be submitted no later than four weeks before the examination date.

## **§25 Time requirements to earn credits**

The rules under §25 of the General Regulations apply.

## **§26 Family support, accommodations for hardships and informal part-time study**

(1) In courses and examinations, consideration must be given to the stress caused by pregnancy and raising children, by caring for relatives in need, and by a student's disability or chronic illness. The type and severity of the hardship must be proved by the student in a timely fashion to the person responsible for the course or to the office of the examination committee (Examination Office) with suitable documentation. In cases of doubt, the examination committee will decide upon written petition. In cases of illness, the examination committee may require a medical certificate from a public health officer. It must be made possible for students to utilize statutory maternity protection periods and parental leave.

(2) If a student can credibly demonstrate that he or she is unable to take the examination in whole or in part in the scheduled form due to a disability, a chronic illness, the care of dependents in need, pregnancy, or the raising of children, the examination committee will provide accommodations for these by taking appropriate measures, such as an extension of the test-taking time or a different arrangement of the examination procedure.

(3) In accordance with the applicable legal regulations, the degree program may, upon petition, be conducted in whole or in part as an informal part-time program. In the case of an approved informal part-time study, there is no entitlement to the provision of special teaching and study opportunities. In all cases, academic advising is strongly recommended before initiating informal part-time study.

### **§27 Absence, withdrawal, fraud, violation of regulations**

(1) Coursework will be deemed failed, or an examination will be graded as “insufficient” (0 points) in accordance with §28(2) of the General Regulations if the candidate misses an examination date that is binding on him or her without good reason or if he or she withdraws without good reason from a course or examination which he or she has already started. The same applies if a course or examination is not completed within the specified completion time.

(2) Notice of the cause asserted for the failure or withdrawal must be given in writing without delay and must be credible. In the case of illness, a medical certificate must be submitted. The examination results already available will be recognized in this case.

(3) If a candidate attempts to influence the result of a course or examination by deception or the use of unauthorized aids, the course or examination in question will be deemed failed (0 points) in accordance with §28(2) of the General Regulations. A candidate who disrupts the proper performance of a type of coursework or an examination may be excluded from continuing the performance of the type of coursework or examination by the respective examiner or supervisor; in this case, the respective coursework will also be deemed failed, or the examination will be graded as “insufficient” (0 points) in accordance with §28(2) of the General Regulations. In serious cases, the examination committee can exclude the candidate from taking further examinations such that the examination entitlement in the degree program expires.

(4) Decisions in accordance with paragraphs 1 to 3 must be communicated to the candidate in writing without delay, they must be substantiated, and they must be accompanied by instructions on how to appeal.

### **§28 Grading and grade composition**

(1) The modules Selected Advanced Topics in Mathematics/Data Science (Seminar), Project Work Data Science and Independent Scientific Practice Data Science are not assessed with points, in deviation from §28(2) General Regulations. Additional ungraded modules can be imported.

(2) The overall grade for the master’s examination in points in accordance with Column (a) in the table in §28(6) of the General Regulations is calculated from the mean value of the module evaluations weighted by credits (LP). Modules not graded with points (ungraded) are not taken into account.

(3) Otherwise, the provisions of §28 of General Regulations apply.

### **§29 Nonbinding examination option**

There is no provision for a nonbinding examination option.

### **§30 Repeating examinations**

(1) Passed examinations cannot be repeated.

(2) Failed examinations may be retaken three times.

(3) The one-time change of up to two definitively failed compulsory elective modules is permitted.

(4) §23(12) (1 & 2) General Regulations (Master's Thesis and Oral defense) and §21(3) (4) General Regulations (Compensated Partial Module Examinations) remain unaffected

### **§31 Loss of the right to take the examination and final failure**

(1) The right to take examinations in the degree program for which the student is enrolled is definitively lost in particular if

1. An examination has not been passed after exhausting all attempts to repeat it unless it is an examination in a module pursuant to §30(3);
2. There is a serious case of deception pursuant to §27(3)(cl. 3).

(2) A notice of final failure and the associated loss of the right to retake the examination will be issued, which will be accompanied with instructions on how to appeal.

### **§32 Invalidity of examination results**

The rules under §32 of the General Regulations apply.

### **§33 Certificate**

The rules under §33 of the General Regulations apply.

### **§34 Diploma**

The rules under §34 of the General Regulations apply.

### **§35 Diploma supplement**

The rules under §35 of the General Regulations apply.

### **§ 36 Transcript of records and complete grade record**

The rules under §36 of the General Regulations apply.

## **IV. Final provisions**

### **§37 Inspection of examination documents**

The rules under §37 of the General Regulations apply.

### **§38 Effective date and transitional provisions**

(1) These regulations come into force on the day after their publication in the Official Bulletin of Philipps-Universität Marburg. At the same time, the examination regulations will expire for the degree program in "Data Science" with the degree of Master of Science (M.Sc.) of 28 October 2015 (published in the Official Bulletin of Philipps-Universität Marburg No. 6/2016), including the version of the first amendment dated 1 June 2016 (published in the Official Bulletin of Philipps-Universität Marburg No. 56/2016) and the version of the second amendment dated 25 October 2017 (published in the Official Bulletin of Philipps-Universität Marburg No. 80/2017).

(2) These Degree Program and Examination Regulations will apply to all students who start their studies as of winter semester 2023/2024.

(3) Students who began their studies before these Degree Program and Examination Regulations came into force may take the master's examination in accordance with the

examination regulations of 28 October 2015, including their amended versions of 1 June 2016 and 25 October 2017, until summer semester of 2027 at the latest. The examination committee may issue rules for this transition period that favor a voluntary switch to these Degree Program and Examination Regulations. The switch to these Degree Program and Examination Regulations must be applied for in writing and is irrevocable.

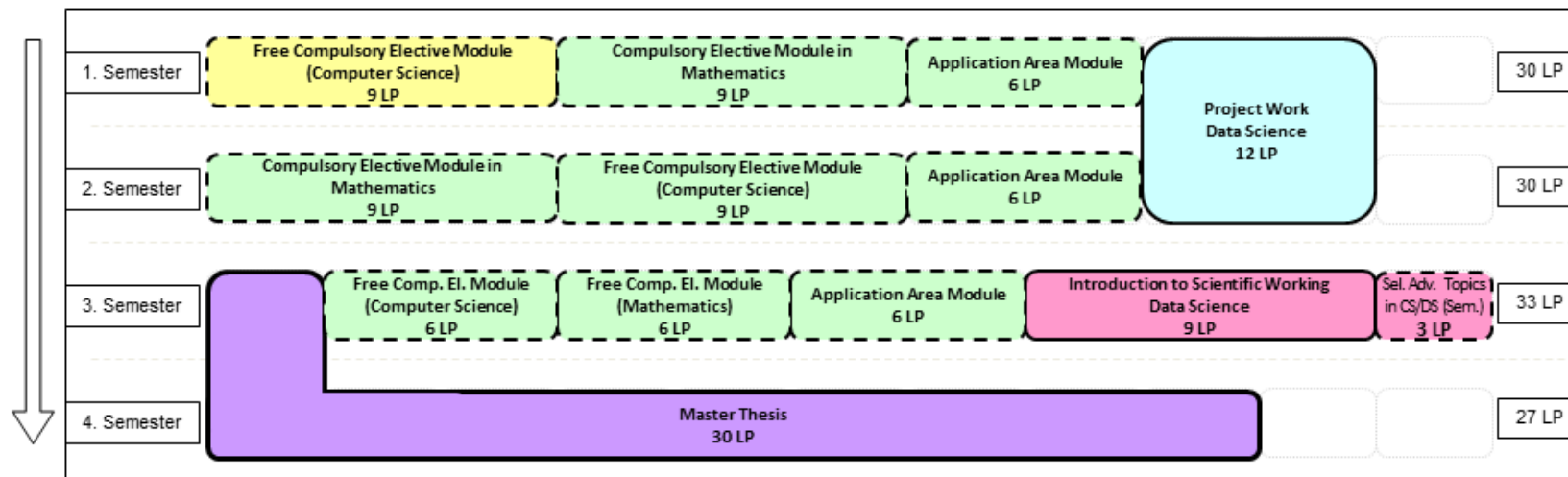
Marburg, 18 April 2023  
signed  
Prof. Dr. Bernd Freisleben  
Dean of the Department of  
Mathematics and Computer Science  
at Philipps-Universität Marburg



## Appendix 1: Example degree program curriculum

### Data Science (M.Sc.)<sup>1</sup>

Studienbeginn in einem Wintersemester oder einem Sommersemester



#### Anmerkungen

<sup>1</sup> Dargestellt wird hier der kürzest mögliche Studienverlauf mit exemplarischen Inhalten. Entsprechend verändert sich dieser nach Zeitpunkt der Aufnahme des Studiums oder einer zeitlichen Streckung. Zudem stellen gestrichelt skizzierte Wahlpflichtmodule nur eine beispielhafte Auswahl dar, zu der Alternativen möglich sind.



<b>Anlage 1: Exemplarischer Studienverlaufsplan</b>	<b>Appendix 1: Example degree program curriculum</b>
<b>Data Science (M.Sc.)<sup>†</sup></b>	<b>Data Science (M.Sc.)<sup>†</sup></b>
Studienbeginn in einem Wintersemester oder einem Sommersemester	Start of program in winter or summer semester
1. Semester	1. Semester
<b>Free Compulsory Elective Module (Computer Science) 9 LP</b>	<b>Free Compulsory Elective Module (Computer Science) 9 LP</b>
<b>Compulsory Elective Module in Mathematics 9 LP</b>	<b>Compulsory Elective Module in Mathematics 9 LP</b>
<b>Application Area Module 6 LP</b>	<b>Application Area Module 6 LP</b>
2. Semester	2. Semester
<b>Compulsory Elective Module in Mathematics 9 LP</b>	<b>Compulsory Elective Module in Mathematics 9 LP</b>
<b>Free Compulsory Elective Module (Computer Science) 9 LP</b>	<b>Free Compulsory Elective Module (Computer Science) 9 LP</b>
<b>Application Area Module 6 LP</b>	<b>Application Area Module 6 LP</b>
<b>Project Work Data Science 12 LP</b>	<b>Project Work Data Science 12 LP</b>
30LP	30 LP
30LP	30 LP
3. Semester	3. Semester
<b>Free Comp. EI Module (Computer Science) 6 LP</b>	<b>Free Comp. EI. Module (Computer Science) 6 LP</b>
<b>Free Comp. EI Module (Mathematics) 6 LP</b>	<b>Free Comp. EL. Module (Mathematics) 6 LP</b>
<b>Application Area Module 6 LP</b>	<b>Application Area Module 6 LP</b>
<b>Introduction to Scientific Working Data Science 9 LP</b>	<b>Introduction to Scientific Working Computer Science 9 LP</b>
<b>Sel. Adv. Topics in CS/DS (Sem.) 3 LP</b>	<b>Sel. Adv. Topics in CS/DS (Sem.) 3 LP</b>
33 LP	33 LP
4. Semester	4. Semester

Master Thesis 30 LP	Master's Thesis 30 LP
27 LP	27 LP
Anmerkungen	Footnotes
<sup>1</sup> Dargestellt wird hier der kürzest mögliche Studienverlauf mit exemplarischen Inhalten. Entsprechend verändert sich dieser nach Zeitpunkt der Aufnahme des Studiums oder einer zeitlichen Streckung. Zudem stellen gestrichelt skizzierte Wahlpflichtmodule nur eine beispielhafte Auswahl dar, zu der Alternativen möglich sind.	<sup>1</sup> The shortest possible degree program curriculum with content examples is presented here. Accordingly, this changes after the date that the program is started or an extension. In addition, elective modules outlined in dashed lines represent only an example selection for which alternatives are possible.
Legende	Legend
Pflichtmodule	Compulsory module
Wahlpflicht	Compulsory Elective
Basis	Basic
Aufbau	Advanced
Vertiefung	Specialization
Praxis	Practice
Profil	Profile
Abschluss	Degree

## Appendix 2: List of modules

Name of module <i>German translation</i>	LP	Degree of obligation	Level	Qualification goals	Prerequisites	Prerequisites to earn credits (LP)
<b>Free Compulsory Elective Modules</b>						
<b>Data Integration</b> <i>Datenintegration</i>	CS 671 6	Compulsory elective module	Advanced module	Students: <ul style="list-style-type: none"> <li>- know basic similarity measures for simple and complex data types (data matching),</li> <li>- are familiar with methods for metadata extraction and for determining data dependencies (data profiling),</li> <li>- know techniques for mapping, integrating and transforming schemas and their data (schema alignment),</li> <li>- know algorithms for the detection and resolution of duplicates and other data errors (entity resolution),</li> <li>- are familiar with the architectures and functions of modern, integrated information systems (Integrated Information Systems),</li> <li>- have practical skills in dealing with heterogeneous, contaminated data and their integration,</li> <li>- are able to apply scientific working methods in independently identifying, formulating, and solving problems,</li> <li>- are able to speak freely about scientific content both in front of an audience and in a discussion.</li> </ul>	None.  The competencies taught in the Algorithms and Data Structures and Database Systems modules are recommended.	Credit requirement(s): Earn at least 50% of the points from the weekly practice assignments and an oral presentation of the solution to at least two of the practice assignments.  Testing: In-class written examination ( <i>Klausur</i> ) or oral examination (individual examination)
<b>Information Retrieval</b> <i>Information Retrieval</i>	CS 572 6	Compulsory elective module	Advanced module	Students: <ul style="list-style-type: none"> <li>- know the most important models for information retrieval,</li> <li>- have been given an overview of the architecture of IR systems,</li> <li>- know indexing techniques,</li> <li>- understand optimization of requests in IR,</li> <li>- can use IR in the field of web and multimedia,</li> <li>- have practiced scientific working methods (recognizing, formulating, solving problems, training the ability to abstract),</li> <li>- are able to speak freely about scientific content both in front of an audience and in a discussion.</li> </ul>	None.  Skills taught in the module Algorithms and Data Structures are recommended.	Credit requirement(s): Earn at least 50% of the points from the weekly practice assignments and an oral presentation of the solution to at least two of the practice assignments.  Testing: Oral examination (individual examination) or in-class written examination ( <i>Klausur</i> )
<b>Free Compulsory Elective Modules and Application Area Modules</b>						
<b>Data Science in Biomedicine</b> <i>Data Science in Biomedizin</i>	CS 544 6	Compulsory elective module	Advanced module	Students know the most important methods from biomedical data science that are required for calculations in the natural sciences. They will have understood these methods and will be able to select, perform and implement suitable procedures for concrete case studies.	None.  Recommended competencies are those taught in the modules Machine Learning and	Credit requirement(s): Earn at least 50% of the points from the weekly practice assignments and an oral presentation of the solution to at least

Name of module <i>German translation</i>	LP	Degree of obligation	Level	Qualification goals	Prerequisites	Prerequisites to earn credits (LP)
					either Fundamentals of Statistics or Elementary Stochastics.	two of the practice assignments.  Testing: Oral examination (individual examination) or in-class written examination ( <i>Klausur</i> )
CS 539 <b>Introduction to Natural Language Processing</b> <i>Einführung in die natürliche Sprachverarbeitung (NLP)</i>	6	Compulsory elective module	Advanced module	Students: - are familiar with the technical perspective of Natural Language Processing (NLP), i.e. the field of artificial intelligence that deals with the processing and understanding of human language. - know methods for developing computer software that understands and processes human language. - are familiar with modern data-driven approaches, with a focus on machine learning techniques. - can apply their knowledge in group work on real NLP projects. - are able to develop their own systems that interpret written language. The applications covered vary in complexity and include, for example, entity recognition, sentiment analysis, semantic similarity and question answering.	None.  Recommended competencies are those taught in the modules Machine Learning and either Fundamentals of Statistics or Elementary Stochastics.	Credit requirement(s): Earn at least 50% of the points from the weekly practice assignments and an oral presentation of the solution to at least two of the practice assignments.  Two subtests: Written examination (3 credits (LP)) and Written Analysis (3 credits (LP))
<b>Practical and Seminar Modules</b>						
CS 695 <b>Independent Scientific Practice Data Science</b> <i>Selbstständiges wissenschaftliches Arbeiten Data Science</i>	9	Compulsory module	Profile module	Students: - are able to independently review and expand the state of knowledge in a scientific area from the field of data science based on literature recommendations and familiarize themselves with the state of research, - are able to conduct literature searches in accordance with subject-specific methods, - are able to use systems that support scientific work in the field of the master's thesis.	None.  The skills taught in the advanced and specialization modules are recommended.	Testing: Written analysis ( <i>schriftliche Ausarbeitung</i> )  <b>Ungraded module</b>
CS 694 <b>Project Work Data Science</b> <i>Projektarbeit Data Science</i>	12	Compulsory module	Practice module	Students: - are able to work on an extensive task from computer science/data science in a team of several students. This includes: elaboration, adaptation, extension and development of problem-relevant methods, - can plan and carry out the modeling and processing of data as part of a project, - are able to learn, plan and work independently, - are proficient in project control and monitoring methods, e.g.: goal descriptions, planning, milestones, record keeping, deadlines, delegation, controlling,	None.	Testing: Creating a piece of software (the term "software" includes all created artifacts, in particular the program code, planning documents, user and developer manuals, and presentation materials).

Name of module <i>German translation</i>	LP	Degree of obligation	Level	Qualification goals	Prerequisites	Prerequisites to earn credits (LP)
				<ul style="list-style-type: none"> <li>- have team-related social skills: Cooperation, team development, leadership, motivation, well-structured team of employees, working under deadline pressure,</li> <li>- have mastered methods of documentation and presentation of IT projects for users and third parties in the form of program documentation, project reports and, if necessary, publications.</li> </ul>		<b>Ungraded module</b>
CS 611 <b>Selected Advanced Topics in Computer Science / Data Science ("Seminar")</b> <i>Ausgewählte fortgeschrittene Themen der Informatik / Data Science („Seminar“)</i>	3	Compulsory elective module	Profile module	Students are able to: <ul style="list-style-type: none"> <li>- independently work on a special topic in computers science/data science,</li> <li>- work in an independent, advanced and scientific manner,</li> <li>- prepare, divide and supplement explanatory content in computer science/data science,</li> <li>- work with scientific literature and know how to search for it,</li> <li>- know how to give a structured presentation tailored to the expertise of the audience,</li> <li>- deal with presentation media in an advanced manner,</li> <li>- lead structured discussions in groups about computer science content.</li> </ul>	None.  Previous knowledge is recommended, depending on the specialization of the seminar, but generally knowledge from the basic modules of computer science and mathematics.	Two subtests: Seminar lecture (weight: 1 credit) Written analysis (weight: 2 credits)
CS 617 <b>Selected Advanced Topics in Mathematics / Data Science ("Seminar")</b> <i>Ausgewählte fortgeschrittene Themen der Mathematik / Data Science („Seminar“)</i>	3	Compulsory elective module	Profile module	Students are able to: <ul style="list-style-type: none"> <li>- work out a special topic in mathematics independently,</li> <li>- work in an independent, advanced and scientific manner,</li> <li>- prepare and break down mathematical relationships and to supplement them with explanatory content,</li> <li>- work with scientific literature and know how to search for it,</li> <li>- know how to give a structured presentation tailored to the expertise of the audience,</li> <li>- deal with presentation media in an advanced manner,</li> <li>- conduct group-based discussions on mathematical content,</li> <li>- deal with mathematical text typesetting programs.</li> </ul>	None.	Two subtests: Seminar presentation Written analysis ( <i>schriftliche Ausarbeitung</i> )  <b>Ungraded module</b>
Final Module						
CS 696 <b>Master's Thesis</b> <i>Masterarbeit</i>	30	Compulsory module	Final module	Students are able to work on an extensive task from the field of data science using scientific methods under guidance as well as to present a paper and the results contained therein appropriately in writing and orally.	A minimum of 66 credits (LP) must have been earned.	Two subtests: Master's thesis (weighting: 27 credits) and oral defense (weighting: 3 credits)

Name of module <i>German translation</i>	LP	Degree of obligation	Level	Qualification goals	Prerequisites	Prerequisites to earn credits (LP)
Conditional Modules ( <i>Auflagenmodule</i> ) Note: These credits (LP) serve to fulfill conditional requirements only and do not count toward the 120 credits to be earned for the degree.						

Name of module <i>German translation</i>	LP	Degree of obligation	Level	Qualification goals	Prerequisites	Prerequisites to earn credits (LP)
<b>Conditional Module 1 (small)</b> <i>Kleines Auflagenmodul 1</i>	6	--- (Auflagen-modul)	--- (Auflagen-modul)	Within the framework of their bachelor's degree, students have already gained the ability to independently acquire knowledge and skills. As a part of this module, students should fill skills gaps that exist in a subject area that has been specified in more detail within the scope of a condition under §4(4) of these Degree Program and Examination Regulations. They will develop the skills by reading specialized literature and/or participating in (online) courses.	The prerequisite for this module is that it be specified as a requirement for admission to the program as part of a condition under §4(4).	Testing: Oral examination (individual examination) or in-class written examination ( <i>Klausur</i> )
<b>Conditional Module 2 (small)</b> <i>Kleines Auflagenmodul 2</i>	6	--- (Auflagen-modul)	--- (Auflagen-modul)	Within the framework of their bachelor's degree, students have already gained the ability to independently acquire knowledge and skills. As a part of this module, students should fill skills gaps that exist in a subject area that has been specified in more detail within the scope of a condition under §4(4) of these Degree Program and Examination Regulations. They will develop the skills by reading specialized literature and/or participating in (online) courses.	The prerequisite for this module is that it be specified as a requirement for admission to the program as part of a condition under §4(4).	Testing: Oral examination (individual examination) or in-class written examination ( <i>Klausur</i> )
<b>Conditional Module 3 (small)</b> <i>Kleines Auflagenmodul 3</i>	6	--- (Auflagen-modul)	--- (Auflagen-modul)	Within the framework of their bachelor's degree, students have already gained the ability to independently acquire knowledge and skills. As a part of this module, students should fill skills gaps that exist in a subject area that has been specified in more detail within the scope of a condition under §4(4) of these Degree Program and Examination Regulations. They will develop the skills by reading specialized literature and/or participating in (online) courses.	The prerequisite for this module is that it be specified as a requirement for admission to the program as part of a condition under §4(4).	Testing: Oral examination (individual examination) or in-class written examination ( <i>Klausur</i> )
<b>Conditional Module 4 (small)</b> <i>Kleines Auflagenmodul 4</i>	6	--- (Auflagen-modul)	--- (Auflagen-modul)	Within the framework of their bachelor's degree, students have already gained the ability to independently acquire knowledge and skills. As a part of this module, students should fill skills gaps that exist in a subject area that has been specified in more detail within the scope of a condition under §4(4) of these Degree Program and Examination Regulations. They will develop the skills by reading specialized literature and/or participating in (online) courses.	The prerequisite for this module is that it be specified as a requirement for admission to the program as part of a condition under §4(4).	Testing: Oral examination (individual examination) or in-class written examination ( <i>Klausur</i> )
<b>Conditional Module 5 (small)</b> <i>Kleines Auflagenmodul 5</i>	6	--- (Auflagen-modul)	--- (Auflagen-modul)	Within the framework of their bachelor's degree, students have already gained the ability to independently acquire knowledge and skills. As a part of this module, students should fill skills gaps that exist in a subject area that has been specified in more detail within the scope of a condition under §4(4) of these Degree Program and Examination Regulations. They will develop the skills by reading specialized literature and/or participating in (online) courses.	The prerequisite for this module is that it be specified as a requirement for admission to the program as part of a condition under §4(4).	Testing: Oral examination (individual examination) or in-class written examination ( <i>Klausur</i> )
<b>Conditional Module 1 (large)</b> <i>Großes Auflagenmodul 1</i>	9	--- (Auflagen-modul)	--- (Auflagen-modul)	Within the framework of their bachelor's degree, students have already gained the ability to independently acquire knowledge and skills. As a part of this module, students should fill skills gaps that exist in a subject area that has been specified in more	The prerequisite for this module is that it be specified as a requirement for admission to the	Testing: Oral examination (individual examination)

Name of module <i>German translation</i>	LP	Degree of obligation	Level	Qualification goals	Prerequisites	Prerequisites to earn credits (LP)
				detail within the scope of a condition under §4(4) of these Degree Program and Examination Regulations. They will develop the skills by reading specialized literature and/or participating in (online) courses.	program as part of a condition under §4(4).	or in-class written examination ( <i>Klausur</i> )
<b>Conditional Module 2 (large)</b> <i>Großes Auflagenmodul 2</i>	9	--- ( <i>Auflagenmodul</i> )	--- ( <i>Auflagenmodul</i> )	Within the framework of their bachelor's degree, students have already gained the ability to independently acquire knowledge and skills. As a part of this module, students should fill skills gaps that exist in a subject area that has been specified in more detail within the scope of a condition under §4(4) of these Degree Program and Examination Regulations. They will develop the skills by reading specialized literature and/or participating in (online) courses.	The prerequisite for this module is that it be specified as a requirement for admission to the program as part of a condition under §4(4).	Testing: Oral examination (individual examination) or in-class written examination ( <i>Klausur</i> )
<b>Conditional Module 3 (large)</b> <i>Großes Auflagenmodul 3</i>	9	--- ( <i>Auflagenmodul</i> )	--- ( <i>Auflagenmodul</i> )	Within the framework of their bachelor's degree, students have already gained the ability to independently acquire knowledge and skills. As a part of this module, students should fill skills gaps that exist in a subject area that has been specified in more detail within the scope of a condition under §4(4) of these Degree Program and Examination Regulations. They will develop the skills by reading specialized literature and/or participating in (online) courses.	The prerequisite for this module is that it be specified as a requirement for admission to the program as part of a condition under §4(4).	Testing: Oral examination (individual examination) or in-class written examination ( <i>Klausur</i> )



## Appendix 3: Import Module List

The degree programs listed below can be selected at the time of the adoption of these Degree Program and Examination Regulations. Pursuant to §14(1) of the General Regulations, the specifications of the Degree Program and Examination Regulations within the framework of which the modules are offered (in particular with regard to qualification objectives, prerequisites, credits (LP) and examination modalities) apply to these modules. Options for combining modules are set forth by the learning unit that offers them, as applicable.

The catalog of selectable degree programs can be changed or supplemented by the examination committee especially if the range of degree programs offered by the departments at Philipps-Universität Marburg changes. Such changes will be published by the examination committee on the respective program website. In individual cases or in general, the utilization of the following degree programs can be made dependent on the prior attendance of a degree program advising session or a binding registration. In case of enrollment caps, the corresponding regulations of the Degree Program and Examination Regulations apply. Otherwise, no guarantee is given that the courses listed below will actually be offered and can be taken.

Upon justified request by the student, it is permissible to approve additional import modules beyond the regular opportunities in individual cases; this requires that the offering department or institution also agree.

**The current import opportunities are always published on the program website of the department offering the module as an export option.**

**Students should take note of the corresponding information and advising offerings in the department offering the module before starting coursework.**

**Any prerequisites or recommendations for participation as well as combination rules must be observed. If the department offering a module has specified combination rules and created export packages, depending on the scope of their own import window, only limited module course offerings will in fact be available.**

At the time of the last resolution by the departmental council on the present Degree Program and Examination Regulations, an agreement existed on the following modules:

### **The following modules can be used for Compulsory Elective Modules in Mathematics**

The current import offer as well as possible occupancy regulations and restrictions are presented on the website of the degree program (§6 (10)) or in the online module handbook linked there.

Mathematics and Computer Science (Dept. 12), Degree program BSc Data Science	Matrix Methods in Data Analysis	Advanced module	9
Mathematics and Computer Science (Dept. 12),	Numerics (Basic Numerical Methods)	Advanced module	9

Degree program BSc Mathematics	Topological methods in data analysis	Advanced module	9
Mathematics and Computer Science (Dept. 12),	Statistics	Advanced module	9
Degree program BSc Business Mathematics	Probabilistic Combinatorics	Specialization module	9

**The following modules can be used for Free Compulsory Elective Modules**

The current import offer as well as possible occupancy regulations and restrictions are presented on the website of the degree program (§6 (10)) or in the online module handbook linked there. Computer science modules are marked with “I”; mathematics modules are marked with “M”.

Mathematics and Computer Science (Dept. 12), Degree program BSc Data Science	Efficient Algorithms	Advanced module	<sup>I</sup> 9
	Machine Learning	Advanced module	<sup>I</sup> 9
	Matrix Methods in Data Analysis	Advanced module	<sup>M</sup> 9
Mathematics and Computer Science (Dept. 12), Degree program BSc Computer Science	Introduction to Bioinformatics	Advanced module	<sup>I</sup> 6
	Introduction to Cryptography and Its Applications	Advanced module	<sup>I</sup> 6
	Design and Administration of Databases	Advanced module	<sup>I</sup> 6
	Graphics Programming	Advanced module	<sup>I</sup> 9
	Advanced Module Computer Science 1 (large)	Advanced module	<sup>I</sup> 9
	Advanced Module Computer Science 2 (large)	Advanced module	<sup>I</sup> 9
	Advanced Module Computer Science 3 (large)	Advanced module	<sup>I</sup> 9
	Advanced Module Computer Science 4 (large)	Advanced module	<sup>I</sup> 9
	Advanced Module Computer Science 5 (large)	Advanced module	<sup>I</sup> 9
	IT Security	Advanced module	<sup>I</sup> 9
	Advanced Module Computer Science 1 (small)	Advanced module	<sup>I</sup> 6
	Advanced Module Computer Science 2 (small)	Advanced module	<sup>I</sup> 6
	Advanced Module Computer Science 3 (small)	Advanced module	<sup>I</sup> 6
	Advanced Module Computer Science 4 (small)	Advanced module	<sup>I</sup> 6
	Advanced Module Computer Science 5 (small)	Advanced module	<sup>I</sup> 6
	Logic	Advanced module	<sup>M</sup> 9
	NoSQL Database Systems	Advanced module	<sup>I</sup> 6
	Computer Networks	Advanced module	<sup>I</sup> 9
	Software Design and Programming Techniques	Advanced module	<sup>I</sup> 6
	Software Quality	Advanced module	<sup>I</sup> 9
Mathematics and Computer Science (Dept. 12), Degree program MSc Computer Science	Theoretical Computer Science	Advanced module	<sup>I</sup> 9
	Distributed Data Management	Advanced module	<sup>I</sup> 9
	Algorithm Engineering	Specialization module	<sup>I</sup> 9
	Algorithms in Bioinformatics	Specialization module	<sup>I</sup> 6
	Algorithmic Network Analysis	Specialization module	<sup>I</sup> 6
	Operating Systems	Specialization module	<sup>I</sup> 6

	Image Synthesis	Specialization module	<sup>I</sup> 9
	Dialog Systems	Specialization module	<sup>I</sup> 6
	Ethical Hacking and Practical Cryptoanalysis	Specialization module	<sup>I</sup> 6
	Advanced Methods of System Development	Specialization module	<sup>I</sup> 6
	Advanced Topics in Cryptography	Specialization module	<sup>I</sup> 6
	Geo Databases	Specialization module	<sup>I</sup> 6
	Large Specialization Module Computer Science 1	Specialization module	<sup>I</sup> 9
	Large Specialization Module Computer Science 2	Specialization module	<sup>I</sup> 9
	Large Specialization Module Computer Science 3	Specialization module	<sup>I</sup> 9
	Large Specialization Module Computer Science 4	Specialization module	<sup>I</sup> 9
	Large Specialization Module Computer Science 5	Specialization module	<sup>I</sup> 9
	Advanced Algorithmics	Specialization module	<sup>I</sup> 9
	Implementation of Database Systems	Specialization module	<sup>I</sup> 9
	Index and Storage Structures	Specialization module	<sup>I</sup> 6
	Content-based Image and Video Analysis	Specialization module	<sup>I</sup> 6
	Small Specialization Module Computer Science 1	Specialization module	<sup>I</sup> 6
	Small Specialization Module Computer Science 2	Specialization module	<sup>I</sup> 6
	Small Specialization Module Computer Science 3	Specialization module	<sup>I</sup> 6
	Small Specialization Module Computer Science 4	Specialization module	<sup>I</sup> 6
	Small Specialization Module Computer Science 5	Specialization module	<sup>I</sup> 6
	Artificial Intelligence	Specialization module	<sup>I</sup> 6
	Model-driven Software Development	Specialization module	<sup>I</sup> 9
	Modern Methods of System Development	Specialization module	<sup>I</sup> 9
	Multimedia Signal Processing	Specialization module	<sup>I</sup> 9
	Neural Networks	Specialization module	<sup>I</sup> 6
	Parameterized Algorithms	Specialization module	<sup>I</sup> 6
	Software as a Medical Device	Specialization module	<sup>I</sup> 6
	Software Evolution	Specialization module	<sup>I</sup> 6
	Statistical Bioinformatics	Specialization module	<sup>I</sup> 6
	Distributed Systems	Specialization module	<sup>I</sup> 6
	Virtual Machines	Specialization module	<sup>I</sup> 6
	Visual Languages	Specialization module	<sup>I</sup> 6
	Web Technologies	Specialization module	<sup>I</sup> 6
Mathematics and Computer Science (Dept. 12), Degree program BSc Mathematics	Numerics (Basic Numerical Methods)	Advanced module	<sup>M</sup> 9
	Topological methods in data analysis	Advanced module	<sup>M</sup> 9
Mathematics and Computer Science (Dept. 12),	Approximation Theory	Specialization module	<sup>M</sup> 9

Degree program MSc Mathematics	Large Specialization Module Numerical Mathematics/Optimization	Specialization module	<sup>M</sup> 9
	Small Specialization Module Numerical Mathematics/Optimization	Specialization module	<sup>M</sup> 6
	Numerical Solution Methods for Finite Dimensional Problems	Specialization module	<sup>M</sup> 9
	Numerical Solution Methods for Differential Equations	Specialization module	<sup>M</sup> 9
Mathematics and Computer Science (Dept. 12), Degree program BSc Business Informatics	Fundamental Technologies for IoT Data Generation of Physical and Nonphysical Sizes — IoT Sensor Systems	Advanced module	<sup>I</sup> 6
Mathematics and Computer Science (Dept. 12), Degree Program MSc Business Informatics	Cloud Computing	Specialization module	<sup>I</sup> 6
Mathematics and Computer Science (Dept. 12), Degree program BSc Business Mathematics	Measure and Integration Theory	Advanced module	<sup>M</sup> 6
	Statistics	Advanced module	<sup>M</sup> 9
Mathematics and Computer Science (Dept. 12), Degree Program MSc Business Mathematics	Large Specialization Module Stochastics	Specialization module	<sup>M</sup> 9
	High-Dimensional Statistics and Machine Learning	Specialization module	<sup>M</sup> 6
	Small Specialization Module Stochastics	Specialization module	<sup>M</sup> 6
	Small Specialization Module Stochastics without Tutorial	Specialization module	<sup>M</sup> 3
	Mathematical and Nonparametric Statistics	Specialization module	<sup>M</sup> 9
	Probabilistic Combinatorics	Specialization module	<sup>M</sup> 9
	Stochastic Analysis	Specialization module	<sup>M</sup> 9
	Probability Theory	Specialization module	<sup>M</sup> 9

### The following modules can be used for Application Area Modules

The current import offer as well as possible occupancy regulations and restrictions are presented on the website of the degree program (§6 (10)) or in the online module handbook linked there. Modules of medical informatics are indicated with “MI”, of social sciences with “SW”, of geoinformatics with “GI” and of the languages area with “S”.

Area of Application: Medical Informatics			
Medical (Dept. 20), Degree program BSc Human Biology	Biochemical, molecular biological and human genetic foundations	Basic Module	<sup>WED</sup> 9
	Infectious Biology	Basic Module	<sup>MI</sup> 6
Medical (Dept. 20), Degree program MSc Human Biology	Data Science Internship Computational Science in Medicine	Profile module	<sup>MI</sup> 6
	Data Science Internship with a focus on genetic epidemiology	Profile module	<sup>MI</sup> 6
	Data Science Internship with focus on infection biology	Profile module	<sup>MI</sup> 6

	Data Science Internship with a focus on neurobiology	Profile module	MI 6
	Data Science Internship with focus on tumor biology	Profile module	MI 6
Mathematics and Computer Science (Dept. 12), Degree program MSc Computer Science	Algorithms in Bioinformatics	Specialization module	MI 6
Mathematics and Computer Science (Dept. 12), Degree program MSc Computer Science	Statistical Bioinformatics	Specialization module	MI 6
<b>Area of Application: Social Sciences</b>			
German and Art Studies (Dept. 09), Degree Program MA Cultural Data Studies	Cultural Data Management Lab	Practical module	SW 6
	Data analysis in the humanities and social sciences	Specialization module	SW 6
	Data management in the humanities and social sciences	Advanced module	SW 6
	Introduction to Cultural Data Studies	Basic Module	SW 6
Mathematics and Computer Science (Dept. 12), Degree program BSc Computer Science	Software development tools for data science applications	Practical module	SW 6
<b>Area of Application: Geoinformatics</b>			
Geography (Dept. 19), Degree program BSc Geography	Remote Sensing	Basic Module	GI 3
Geography (Dept. 19), Degree Program MSc Physical Geography	Geographic Information Systems	Advanced module	GI 6
	Environmental Information Systems I	Specialization module	GI 6
	Environmental Information Systems II	Specialization module	GI 6
	Environmental Systems	Advanced module	GI 6
Mathematics and Computer Science (Dept. 12), Degree program MSc Computer Science	Geo Databases	Specialization module	GI 6
<b>Area of Application: Languages</b>			
German and Art Studies (Dept. 09), Degree Program MA Linguistics: Cognition and Communication	Psycholinguistics and Neurolinguistics I	Advanced module	S 12
German and Art Studies (Dept. 09), Degree program MA Speech Science/Phonetics	Current research questions (M 7)	Specialization module	S 12
Mathematics and Computer Science (Dept. 12), Degree program MSc Computer Science	Dialog Systems	Specialization module	S 6

**The following modules can be used for Practical and Seminar Modules**

The current import offer as well as possible occupancy regulations and restrictions are presented on the website of the degree program (§6 (10)) or in the online module handbook linked there.

Mathematics and Computer Science (Dept. 12), Degree program MSc Computer Science	Selected Advanced Topics in Computer Science (Seminar)	Profile module	3
Mathematics and Computer Science (Dept. 12), Degree program MSc Mathematics	Selected Advanced Topics in Mathematics A (Seminar)	Profile module	3

## Appendix 4: Export Module List

The current export opportunities is always published on the program website of the department offering the module as an export opportunity.

Any prerequisites or recommendations for participation as well as combination rules must be observed. If the department offering a module has specified combination rules and created export packages, depending on the scope of their own import window, only limited module course offerings will in fact be available.

The degree programs listed below can be selected at the time of the adoption of these Degree Program and Examination Regulations. The catalog of export opportunities can be changed or supplemented by the examination committee especially if the export opportunities change. Such changes will be published by the examination committee on the degree program website in accordance with §6.

### §1 Export of curricular modules to other degree programs

The following modules as listed in Appendix 2 may also be taken as part of other degree programs, as long as this is agreed upon with the department(s) in whose degree program(s) these modules are elective.

Name of module <i>German translation</i>	
<b>Data Integration</b> <i>Datenintegration</i>	CS 671
<b>Data Science in Biomedicine</b> <i>Data Science in Biomedizin</i>	CS 544
<b>Information Retrieval</b> <i>Information Retrieval</i>	CS 572
<b>Introduction to Natural Language Processing</b> <i>Einführung in die natürliche Sprachverarbeitung (NLP)</i>	CS 539