The Departmental Council of the Department of Mathematics and Computer Science, 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

"Computer 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 dated 13 September 2010 (Official Notices of Philipps-Universität Marburg, No. 52/2010) as amended from time to time – hereinafter referred to as the General Regulations – and govern the objectives, content, structure and organization of the degree program as well as the requirements and procedures for the examination achievements for the degree program in "Computer Science" leading to the degree of "Master of Science (M.Sc.)".

§2 Goals of the degree program

Upon completion of the master's degree program in "Computer Science", graduates will possess the necessary professional knowledge, skills and methods of computer science, taking into account the requirements and changes in the increasingly digital professional world (business, industry, public service), to work independently in accordance with scientific principles at an advanced level, and to analyze and critically assess modern scientific knowledge. They will have deepened and broadened the knowledge and skills they have acquired as a part of their bachelor's degree and will have an overview of specialized contexts in computer science.
Graduates will have acquired specialized knowledge and skills through the identification of individual focus areas, an introduction to independent scientific work, the degree program of current research literature, and the preparation of an individual master's thesis scientifically investigating a research-related problem in computer science and developing an approach to solving it. If applicable, they will have emphasized one area of applicability by studying a profile area.

Graduates of the master's degree program in "Computer Science" are also not limited to a set job description due to their ability to engage in abstract ideas and the conceptual, analytical and logical thinking they have trained in. They will have acquired the necessary skills to:

- work independently in industry, business and the public sector,
- lead projects that involve analyzing, modeling and solving scientific, business or technical problems,
- perform planning, development and research duties in academic and public institutions,
- work as a research assistant or research associate at a university, as well as
- 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 the field of computer science or proof of a comparable domestic or foreign university degree providing professional qualifications.

In addition to the bachelor's degree in computer science, a degree in teacher education and certification to teach at university-preparatory high schools (*Gymnasium)* (First State Examination or a master's degree) with computer science as a subject entitles the student to admission. A bachelor's degree in another discipline entitles the student to admission if at least 90 credits have been completed in the two scientific disciplines of mathematics and computer science as part of this or another degree program. Of these, at least 12 credits should be from modules in mathematics, and at least 72 credits should be from modules in computer science. In mathematics, expertise should be acquired in the fundamentals of analysis, linear algebra and statistics. In computer science, at least 36 credits should be allocated to modules corresponding to the objectives and expertise in the following modules: algorithms and data structures, declarative programming, object-oriented programming, systems software and computer communications. In addition, expertise should be acquired in the areas of database systems, software engineering, theoretical computer science and technical computer science.
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 will generally be 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 degree program in Computer Science is divided into the degree program areas of Compulsory Elective Modules in Computer Science, Profile 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 (Leistung-spunkte, LP)	Comment
Compulsory elective modules in computer science		***51-54*** *or* ***63-66***	***
Advanced Algorithmics	WP	T 9	
Advanced Methods of System Development	WP	P 6	
Advanced Programming Concepts	WP	T 6	
Advanced Topics in Cryptography	WP	T 6	
Algorithm Engineering	WP	P 9	
Algorithmic Network Analysis	WP	T 6	
Algorithms in Bioinformatics	WP	P 6	
Artificial Intelligence	WP	P 6	
Compiler Construction	WP	T 9	
Computational Complexity Theory	WP	T 9	
Content-based Image and Video Analysis	WP	P 6	
Dialog Systems	WP	P 6	
Distributed Systems	WP	P 6	
Ethical Hacking and Practical Cryptoanalysis	WP	P 6	
Formal Methods in Software Engineering	WP	T 9	
Geo Databases	WP	P 6	
Image Synthesis	WP	P 9	
Implementation of Database Systems	WP	P 9	
Index and Storage Structures	WP	P 6	

Large Specialization Module Computer Science 1	WP	P 9	
Large Specialization Module Computer Science 2	WP	T 9	
Large Specialization Module Computer Science 3	WP	T 9	
Large Specialization Module Computer Science 4	WP	T 9	
Large Specialization Module Computer Science 5	WP	T 9	
Model-driven Software Development	WP	P 9	
Modern Methods of System Development	WP	P 9	
Multimedia Signal Processing	WP	P 9	
Neural Networks	WP	P 6	
Operating Systems	WP	P 6	
Parameterized Algorithms	WP	T 6	
Small Specialization Module Computer Science 1	WP	P 6	
Small Specialization Module Computer Science 2	WP	P 6	
Small Specialization Module Computer Science 3	WP	P 6	
Small Specialization Module Computer Science 4	WP	P 6	
Small Specialization Module Computer Science 5	WP	P 6	
Software as a Medical Device	WP	P 6	
Software Evolution	WP	P 6	
Statistical Bioinformatics	WP	P 6	
Virtual Machines	WP	P 6	
Visual Languages	WP	P 6	
Web Technologies	WP	P 6	
Import modules relating to Computer Science in terms of content or methodology, ***	WP	P, T 0-66	
Profile Area Modules		***0** or **12***	Optional is possible
*Import module in a profile area from another scientific discipline**	WP	12	
Practical and Seminar Modules		***24-27***	
Further Selected Advanced Topics in Computer Science (Seminar)	WP	3	
Independent Scientific Practice Computer Science	PF	9	
Project Work Computer Science	PF	12	
Selected Advanced Topics in Computer Science (Seminar)	PF	3	
Final Module		***30***	
Master's Thesis	PF	30	

Total		***120***	

* Cf. Appendix 3 Import Module List.
** In the area of Compulsory Elective Modules in Computer Science, a maximum of 18 credits may be earned in advanced modules and at least one module each in Theoretical Computer Science (marked with a “T”) and Practical Computer Science (“P”) must be completed.
*** The scope of the Compulsory Elective Modules in Computer Science area is reduced from 66 credits to 63, 54 or 51 credits depending on whether the optional second seminar in the Practical and Seminar Modules area and/or the optional Profile Area Modules area is taken.

(3) In the degree program area Compulsory Elective Modules in Computer Science, students deepen and broaden their knowledge and expertise in different disciplines of Practical and Theoretical Computer Science. This way, they broaden their spectrum of knowledge about computer science and acquire specialized knowledge that introduces them to current research questions and modern applications of computer science.

(4) In the optional program area Profile Area Modules, students gain knowledge in another subject where ways of thinking and methods of computer science can be beneficially applied. In doing so, the ability to form analogies between ways of thinking and contents of computer science and those from another subject is learned. The list of subjects from which modules can be chosen, which can be extended in coordination with other departments, can be found in Appendix 3 or in the most current form on the website in accordance with paragraph 8.

(5) In the degree program area Practical and Seminar Modules, students deepen their practice-oriented scientific and scholarly skills. They will practice the expertise essential for computer scientists to carry out a research project as a part of group work, usually developing comprehensive 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 Computer Science, students learn and practice techniques in scientific and scholarly work in computer science. The module also prepares students for the master’s thesis, and it is recommended that they take it with their prospective adviser for the master’s thesis.

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

(7) An example sequence of the modularized program is given in the degree program curriculum (cf. Appendix 1).

(8) 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-informatik

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.

(9) 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 available on the homepage of the university.

§7 General standard program duration and start of studies

(1) The general standard program duration for the master’s degree program in computer 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 Computer 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 Computer Science includes an internal practical module in the degree program area of Practical and Seminar Modules in accordance with §6 of these Degree Program and Examination Regulations.

(2) The master's program in Computer 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(8). 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) In the case of a compulsory elective module or a course with a registration cap, students have no entitlement to participate, provided that registration is not capped for at least one other alternative required 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 Computer Science, which can also be completed as a part of other programs, are subject to the regulations under §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 examination duration 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 be administered in accordance with the provisions under General Regulations, Appendix 6.

(7) Multiple-choice examinations will be administered in accordance with the regulations under General Regulations ("Multiple-choice procedure"), 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 by which the candidate must demonstrate the ability to work independently on a delimited problem in the subject area of computer science using scientific/scholarly methods within a specified period of time. The goal is for the candidate to apply the knowledge acquired over the course of

study to relevant questions for whose the solution advanced knowledge, skills and techniques in computer science are used to a large 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 examinations and other examination dates that are equally valid for all participants of a module are also 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.

§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 reason asserted for the absence 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 Project Work Computer Science and Independent Scientific Practice Working Computer Science will not be graded with points, departing from §28(2) of the General Regulations.

(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 has been a serious case of fraud pursuant to §27(3)(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 Computer 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.

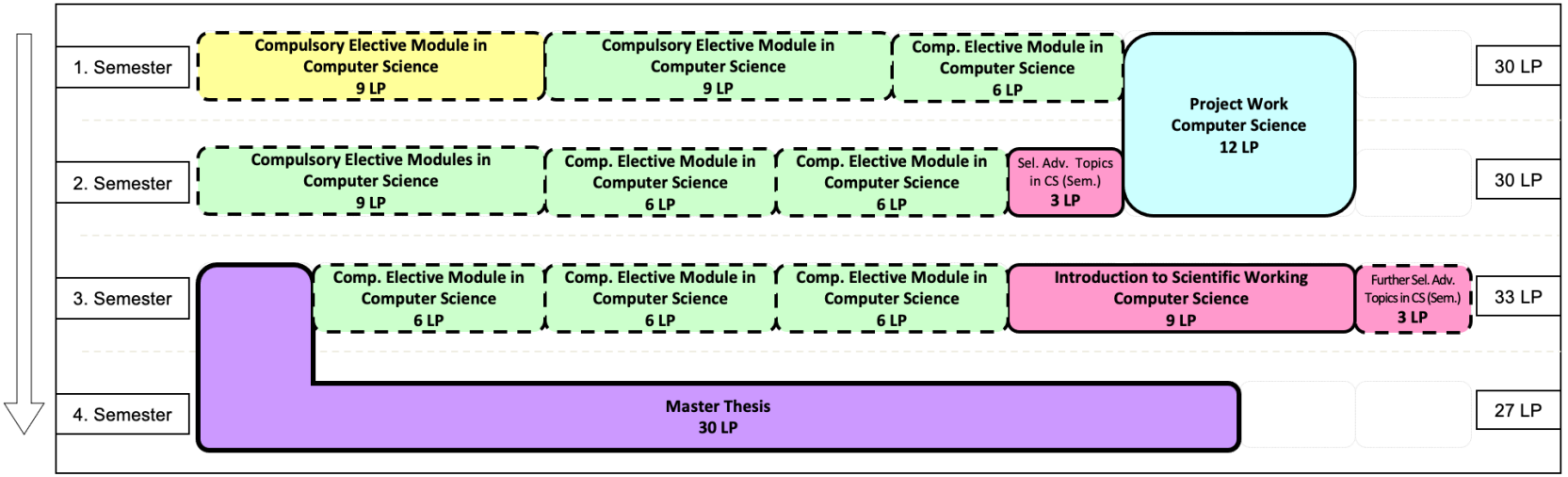
(3) Students who began their studies before these Degree Program and Examination Regulations came into force may take the master's examination in accordance with the examination regulations of 28 October 2015, including their amended versions of 1 June 2016 and 25 October 2017, until summer semester 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

Computer Science (M.Sc.)[1]

Studienbeginn in einem Wintersemester oder einem Sommersemester



Anmerkungen

[1] 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.

Anlage 1: Exemplarischer Studienverlaufsplan	Appendix 1: Example degree program curriculum
Computer Science (M.Sc.)[1]	**Computer Science (M.Sc.)[1]**
Studienbeginn in einem Wintersemester oder einem Sommersemester	Start of program in winter or summer semester
1. Semester	1. Semester
Compulsory Elective Module in Computer Science 9 LP	**Compulsory Elective Module in Computer Science 9 LP**
Compulsory Elective Module in Computer Science 9 LP	**Compulsory Elective Module in Computer Science 9 LP**
Compulsory Elective Module in Computer Science 6 LP	**Compulsory Elective Module in Computer Science 6 LP**
2. Semester	2. Semester
Compulsory Elective Modules in Computer Science 9 LP	**Compulsory Elective Modules in Computer Science 9 LP**
Comp. Elective Module in Computer Science 6 LP	**Comp. Elective Module in Computer Science 6 LP**
Comp. Elective Module in Computer Science 6 LP	**Comp. Elective Module in Computer Science 6 LP**
Sel. Adv. Topics in CS (Sem.) **3 LP**	Sel. Adv. Topics in CS (Sem.) **3 LP**
Project Work Computer Science 12 LP	**Project Work Computer Science 12 LP**
30LP	30 LP
30 LP	30 LP
3. Semester	3. Semester
Comp. Elective Module in Computer Science 6 LP	**Comp. Elective Module in Computer Science 6 LP**
Comp. Elective Module in Computer Science 6 LP	**Comp. Elective Module in Computer Science 6 LP**
Comp. Elective Module in Computer Science 6 LP	**Comp. Elective Module in Computer Science 6 LP**
Introduction to Scientific Working Computer Science 9 LP	**Introduction to Scientific Working Computer Science 9 LP**
Further Sel. Adv. Topics in CS (Sem.) **3 LP**	Further Sel. Adv. Topics in CS (Sem.) **3 LP**

33 LP	33 LP
4. Semester	4. Semester
Master Thesis 30 LP	**Master's Thesis 30 LP**
27 LP	27 LP
Anmerkungen	**Footnotes**
[1] 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.	[1] 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 *German translation*	**LP**	**Degree of obligation**	**Level**	**Qualification goals**	**Prerequisites**	**Prerequisites to earn credits (LP)**
Compulsory Elective Modules in Computer Science						
CS 627 **Advanced Algorithmics** *Höhere Algorithmik*	9	Compulsory elective module	Advanced module in theoretical computer science	Students will be able to: - design algorithms for computational problems from a wide variety of application contexts, - select an adequate algorithmic approach from a set of advanced algorithmic techniques for a concrete computational problem, - evaluate the efficiency of algorithms in different analysis models, - prove the algorithmic difficulty of computational problems.	None. The skills taught in the Algorithms and Data Structures and Efficient Algorithms 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: Oral examination (individual examination)
CS 607 **Advanced Methods of System Development** *Fortgeschrittene Methoden der Systementwicklung*	6	Compulsory elective module	Advanced module in practical computer science	Students: - are familiar with research results form current scientific articles in national and international journals as well as from conferences in the field of systems development, - are able to apply scientific working methods in independently identifying, formulating, and solving problems, - are able to speak freely about scientific content both in front of an audience and in a discussion.	None. The skills taught in the basic modules Object-Oriented Programming and 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 (*Klausur*)
CS 609 **Advanced Programming Concepts** *Fortgeschrittene Konzepte der Programmierung*	6	Compulsory elective module	Advanced module in theoretical computer science	Students: - are familiar with the basic techniques in formally describing the syntax and semantics of programming languages, - are able to apply these to formally describe their own small programming languages, - are familiar with research results from current scientific contributions in national and international journals as well as from conferences in the field of programming language design, - are able to apply scientific working methods in independently identifying, formulating, and solving problems, - are able to speak freely about scientific content both in front of an audience and in a discussion.	None. The skills taught in the intermediate modules in Theoretical Computer Science 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 (*Klausur*)

Name of module *German translation*	LP	Degree of obligation	Level	Qualification goals	Prerequisites	Prerequisites to earn credits (LP)
CS 556 **Advanced Topics in Cryptography** *Fortgeschrittene Themen der Kryptographie*	6	Compulsory elective module	Advanced module in theoretical computer science	Students: - have in-depth knowledge of the basic principles and methods of cryptography required for an evaluation of cryptographic security and its application in the field of IT security, - understand the design-related and analytical principles for cryptographic procedures, - have insight into current research issues in the field of cryptography.	None. The skills taught in the modules Introduction to Cryptography and Its Applications or IT Security are recommended.	Credit requirement(s): Earn at least 50% of the points from the weekly practice assignments. Testing: Oral examination (individual examination) or in-class written examination (*Klausur*)
CS 628 **Algorithm Engineering** *Algorithm Engineering*	9	Compulsory elective module	Advanced module in practical computer science	Students: - are able to develop efficient algorithms for computationally difficult graph problems, - have experience estimating runtime and storage requirements, - master the use of modern algorithm libraries, - are able to organize project work on a team, adequately document their work and describe their developed algorithms and implementations in short presentations.	None. The skills taught in the modules Object-Oriented Programming, Algorithms and Data Structures are recommended.	Credit requirement(s): Presentation of 4 milestones in program development. Testing: Creating a piece of software
CS 529 **Algorithmic Network Analysis** *Algorithmische Netzwerkanalyse*	6	Compulsory elective module	Advanced module in theoretical computer science	Students can model various issues using networks and formulate various analysis tasks as concrete computational problems. For these computational problems, they can select or design efficient algorithms or show that such algorithms do not exist in accordance with current thinking.	Successful participation in the module Algorithms and Data Structures is required; Successful participation in the module Efficient Algorithms is 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 (*Klausur*)
CS 594 **Algorithms in Bioinformatics** *Algorithmische Bioinformatik*	6	Compulsory elective module	Advanced module in practical computer science	Students: - understand basic issues and goals in bioinformatics, - are familiar with basic concepts of DNA and protein modeling, - have knowledge of algorithmic basics of bioinformatics applications, - understand methods of knowledge discovery in biological databases and can apply them, - are able to apply scientific working methods in independently identifying, formulating, and solving problems, - are able to speak freely about scientific content both in front of an audience and in a discussion.	None. Basic knowledge within the scope of the module Introduction to Computer Science is recommended. Biological foundations are reviewed, corresponding prior knowledge is therefore not a prerequisite.	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 (*Klausur*) or oral

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						examination (individual examination)
CS 592 **Artificial Intelligence** *Künstliche Intelligenz*	6	Compulsory elective module	Advanced module in practical computer science	Students: - have knowledge of the most important AI methods and their application in practice and can use them, - are able to create knowledge-based inference systems in predicate logic (Prolog), - are able to use knowledge representation forms, - have knowledge of problem solving, search, and planning algorithms, - have an overview of common methods of estimation: Bayes, Demster/Shafer, fuzzy inference, - know methods of knowledge acquisition from the field of machine learning and knowledge engineering, - have an insight into non-classical logics, - are able to apply scientific working methods in independently identifying, formulating, and solving problems, - are able to speak freely about scientific content both in front of an audience and in a discussion.	None. Skills from the basic computer science 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: Oral examination (individual examination) or in-class written examination (*Klausur*)
CS 551 **Compiler Construction** *Compilerbau*	9	Compulsory elective module	Advanced module in theoretical computer science	Students: - know the distinction between different aspects of programming languages (lexis, syntax, semantics, pragmatics), - have knowledge about the structure of compilers and compiler phases, - understand compiler generation tools and can apply them, - know basic principles of code generation, denotational semantics and abstract machines, - be able to program individual parts of a compiler, - are able to apply scientific working methods in independently identifying, formulating, and solving problems, - are able to speak freely about scientific content both in front of an audience and in a discussion.	None. Skills taught in the Theoretical Computer Science module 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 (*Klausur*) or oral examination (individual examination)
CS 576 **Computational Complexity Theory** *Komplexitätstheorie*	9	Compulsory elective module	Advanced module in theoretical computer science	Students will be able to: - classify problems in terms of their computational complexity, - compare different classes of problems with each other, - compare the computational power of different machine models such as randomized and nondeterministic Turing machines.	Successful completion of the Theoretical Computer Science module from the Bachelor of Computer Science program.	Credit requirement(s): Presentation of interim results, participation in the block session. Testing: Oral examination (individual examination) or in-class written examination (*Klausur*)

Name of module *German translation*	**LP**	**Degree of obligation**	**Level**	**Qualification goals**	**Prerequisites**	**Prerequisites to earn credits (LP)**
CS 516 **Content-based Image and Video Analysis** *Inhaltsbasierte Bild- und Videoanalyse*	6	Compulsory elective module	Advanced module in practical computer science	Students: - understand and are able to apply the necessary methods of content-based analysis of image and video data; these include methods of image and moving image processing and machine learning, - are able to design software systems for image recognition and implement them based on deep learning libraries (Caffe, Tensorflow, etc.), - are able to apply scientific working methods in independently identifying, formulating and solving problems.	None. The skills taught in the basic modules on Practical Computer Science are recommended. In addition, programming experience in Python and C++ is recommended and basic knowledge of Linux is helpful.	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 (*Klausur*)
CS 569 **Dialog Systems** *Dialogsysteme*	6	Compulsory elective module	Advanced module in practical computer science	Students: - know the basic functionality of dialog systems, voice assistants and conversation systems, - know implementation approaches of such systems, - are able realize simple dialog systems, - are able to apply scientific working methods in independently identifying, formulating and solving problems.	None. Recommended skills are those taught in the Machine Learning, Introduction to Natural Language Processing and Fundamentals of Statistics or Elementary Stochastics modules.	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 (*Klausur*) or oral examination (individual examination)
CS 513 **Distributed Systems** *Verteilte Systeme*	6	Compulsory elective module	Advanced module in practical computer science	Students: - know how distributed systems work, - are familiar with algorithms for problems of distributed systems, - are able to apply scientific working methods in independently identifying, formulating, and solving problems, - are able to speak freely about scientific content both in front of an audience and in a discussion.	None. The skills taught in the modules Object-Oriented Programming, Data Structures and Algorithms, System Software and Computer Communications and Operating Systems 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 (*Klausur*)
CS 575 **Ethical Hacking and Practical Cryptoanalysis** *Ethisches Hacken und praktische Kryptoanalyse*	6	Compulsory elective module	Advanced module in practical computer science	Students: - know selected techniques for breaking security systems and cryptographic procedures, - are able to implement these practically (implementation and project work), especially with regard to server security,	None. The skills taught in Introduction to Cryptography and Its	Credit requirement(s): Earn at least 50% of the points from the weekly practice assignments and an oral presentation of the

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				network security, computer-aided analysis of cryptographic procedures and security architectures, - are familiar with ethical and legal concerns with hacking.	Applications or IT Security are recommended.	solution to at least two of the practice assignments. Testing: Oral examination (individual examination) or in-class written examination (*Klausur*)
CS 510 **Formal Methods in Software Engineering** *Formale Methoden in der Softwaretechnik*	9	Compulsory elective module	Advanced module in theoretical computer science	Students: - are able to formalize systems, system properties and software development activities, - know how to automatically analyze and verify system properties, - are able to assess the strengths and weaknesses of formal methods in software engineering, - are able to apply scientific working methods in independently identifying, formulating, and solving problems, - are able to speak freely about scientific content both in front of an audience and in a discussion.	None. Recommended skills are those taught in the Theoretical Computer Science, Logic, and Software Engineering modules.	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 (*Klausur*)
CS 573 **Geo Databases** *Geo-Datenbanken*	6	Compulsory elective module	Advanced module in practical computer science	Students: - have knowledge of extending object-relational database systems for geospatial applications, - are familiar with principles of basic algorithms and data structures for geo-databases, - have knowledge of the data models for geo-data, - are familiar with query processes in geo databases, - know how to handle geo-information systems and geo-database systems, - are able to apply scientific working methods in independently identifying, formulating, and solving problems, - are able to speak freely about scientific content both in front of an audience and in a discussion.	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 (*Klausur*)
CS 681 **Image Synthesis** *Bildsynthese*	9	Compulsory elective module	Advanced module in practical computer science	Students: - know and can use methods for creating computer-generated images of high visual quality; this includes, for example, topics such as modeling a dynamic virtual scene, free-form curves and surfaces, methods for global illumination, or methods for displaying volume data, - understand the architecture of current graphics cards and understand the graphics card as an enormously powerful stream processor with many parallel computing units that can	None. The skills taught in the Object Oriented Programming and Graphics Programming 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:

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				also be used for complex calculations outside of computer graphics, - are able to apply parallel programming on the graphics card, - are able to apply scientific working methods in independently identifying, formulating, and solving problems, - are able to speak freely about scientific content both in front of an audience and in a discussion.		Oral examination (individual examination) or in-class written examination (*Klausur*)
CS 672 **Implementation of Database Systems** *Implementierung von Datenbanksystemen*	9	Compulsory elective module	Advanced module in practical computer science	Students: - are able to evaluate the performance of database systems, - know techniques for developing efficient data structures and algorithms in database systems, - are able to evaluate external data structures with regard to runtime, storage space, and throughput, - know how to handle index structures in commercial database systems, - have knowledge of query optimization techniques and their availability in commercial systems, - have insights into architectures of modern database systems.	None. The skills 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: Oral examination (individual examination) or in-class written examination (*Klausur*)
CS 571 **Index and Storage Structures** *Index und Speicherstrukturen*	6	Compulsory elective module	Advanced module in practical computer science	Students: - know techniques for developing efficient external data structures and algorithms, - are able to evaluate external data structures with regard to runtime, storage space and throughput, - are able to create data structures within a system-oriented environment, - know how to handle index structures in commercial database systems, - are able to apply scientific working methods in independently identifying, formulating, and solving problems, - are able to speak freely about scientific content both in front of an audience and in a discussion.	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 (*Klausur*)
CS 647 **Large Specialization Module Computer Science 1** *Großes Vertiefungsmodul Informatik 1*	9	Compulsory elective module	Advanced module in practical computer science	Students: - have advanced in-depth knowledge and skills in a selected specialty area of computer science, - are familiar with current research findings and how to use research literature, - are able to apply working methods from computer science for the selected special field of computer science (develop and apply basic solution strategies and their formal description, training of the ability to abstract, system development), - are able to apply scientific work practices in solving problems independently and communicate the solution,	None. Skills taught in the advanced modules (depending on the topic) 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 (*Klausur*) or oral

Name of module *German translation*	**LP**	**Degree of obligation**	**Level**	**Qualification goals**	**Prerequisites**	**Prerequisites to earn credits (LP)**
				- have acquired skills preferably from the field of Practical Computer Science.		examination (individual examination)
CS 525 **Large Specialization Module Computer Science 2** *Großes Vertiefungsmodul Informatik 2*	9	Compulsory elective module	Advanced module in theoretical computer science	Students: - have advanced in-depth knowledge and skills in a selected specialty area of computer science, - are familiar with current research findings and how to use research literature, - are able to apply working methods from computer science for the selected special field of computer science (develop and apply basic solution strategies and their formal description, training of the ability to abstract, system development), - are able to apply scientific work practices in solving problems independently and communicate the solution, - have acquired skills preferably from the field of theoretical computer science.	None. Skills taught in the advanced modules (depending on the topic) 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 (*Klausur*) or oral examination (individual examination)
CS 526 **Large Specialization Module Computer Science 3** *Großes Vertiefungsmodul Informatik 3*	9	Compulsory elective module	Advanced module in theoretical computer science	Students: - have advanced in-depth knowledge and skills in a selected specialty area of computer science, - are familiar with current research findings and how to use research literature, - are able to apply working methods from computer science for the selected special field of computer science (develop and apply basic solution strategies and their formal description, training of the ability to abstract, system development), - are able to apply scientific work practices in solving problems independently and communicate the solution, - have advanced in-depth knowledge and skills a selected specialty area of technical computer science.	None. Skills taught in the advanced modules (depending on the topic) 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 (*Klausur*) or oral examination (individual examination)
CS 623 **Large Specialization Module Computer Science 4** *Großes Vertiefungsmodul Informatik 4*	9	Compulsory elective module	Advanced module in theoretical computer science	Students: - have advanced in-depth knowledge and skills in a selected specialty area of computer science, - are familiar with current research findings and how to use research literature, - are able to apply working methods from computer science for the selected special field of computer science (develop and apply basic solution strategies and their formal description, training of the ability to abstract, system development), - are able to apply scientific work practices in solving problems independently and communicate the solution, - have advanced in-depth knowledge and skills a selected specialty area of applied computer science.	None. Skills taught in the advanced modules (depending on the topic) 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 (*Klausur*) or oral examination (individual examination)
CS 624	9	Compulsory elective module	Advanced module	Students: - have advanced in-depth knowledge and skills in a selected specialty area of computer science,	None.	Credit requirement(s): Earn at least 50% of the points from the weekly

Name of module *German translation*	LP	Degree of obligation	Level	Qualification goals	Prerequisites	Prerequisites to earn credits (LP)
Large Specialization Module Computer Science 5 *Großes Vertiefungsmodul Informatik 5*			in theoretical computer science	- are familiar with current research findings and how to use research literature, - are able to apply working methods from computer science for the selected special field of computer science (develop and apply basic solution strategies and their formal description, training of the ability to abstract, system development), - are able to apply scientific work practices in solving problems independently and communicate the solution, - have advanced in-depth knowledge and skills a selected specialty area of artificial intelligence.	Skills taught in the advanced modules (depending on the topic) are recommended.	practice assignments and an oral presentation of the solution to at least two of the practice assignments. Testing: In-class written examination (*Klausur*) or oral examination (individual examination)
CS 561 **Model-driven Software Development** *Modellgetriebene Softwareentwicklung*	9	Compulsory elective module	Advanced module in practical computer science	Students: - understand the paradigm of model-driven software development, - are able to model and develop application software in a model-driven manner, - have knowledge of the core concepts and techniques of model-driven development, - understand the possibilities and limitations of model-driven software development, - have a basic understanding of the tools presented in the course and their practical application, - are able to apply scientific working methods in independently identifying, formulating, and solving problems, - are able to speak freely about scientific content both in front of an audience and in a discussion.	None. The skills taught in the Basic Computer Science modules and the Advanced Software Engineering and Software Internship 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: Oral examination (individual examination) or in-class written examination (*Klausur*)
CS 507 **Modern Methods of System Development** *Moderne Methoden der Systementwicklung*	9	Compulsory elective module	Advanced module in practical computer science	Students: - are familiar with new research results from current scientific articles in national and international journals as well as from conferences in the field of software development, - are able to apply scientific working methods in independently identifying, formulating, and solving problems, - are able to speak freely about scientific content both in front of an audience and in a discussion.	None. The skills taught in the basic modules Object-Oriented Programming and 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 (*Klausur*)
CS 682 **Multimedia Signal Processing** *Multimediale Signalverarbeitung*	9	Compulsory elective module	Advanced module in practical computer science	Students: - are able to create content for modern communication media, - have in-depth knowledge of procedures for digitally capturing, processing, storing and transmitting multimedia data, especially audio and visual media,	None.	Credit requirement(s): Earn at least 50% of the points from the weekly practice assignments and an oral presentation of the

Name of module *German translation*	LP	Degree of obligation	Level	Qualification goals	Prerequisites	Prerequisites to earn credits (LP)
				- are able to design media and identify, formulate and solve practical problems.		solution to at least two of the practice assignments. Testing: Oral examination (individual examination) or in-class written examination (*Klausur*)
CS 593 **Neural Networks** *Neuronale Netze*	6	Compulsory elective module	Advanced module in practical computer science	Students: - have an insight into the theory of neural networks as well as an overview of the different architectures, possibilities and limitations of artificial neural networks, - are familiar with supervised learning and deep learning, - are able to design a data-driven solution for artificial neural networks based on a concrete problem using specified program libraries, - are able to apply scientific working methods in independently identifying, formulating, and solving problems, - are able to speak freely about scientific content both in front of an audience and in a discussion.	None. The skills taught in the Machine Learning and Fundamentals of Statistics 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: Oral examination (individual examination) or in-class written examination (*Klausur*)
CS 512 **Operating Systems** *Betriebssysteme*	6	Compulsory elective module	Advanced module in practical computer science	Students: - know how distributed systems work, - be able to independently program operating system modules, - are able to apply scientific working methods in independently identifying, formulating, and solving problems, - are able to speak freely about scientific content both in front of an audience and in a discussion.	None. The skills taught in the modules Object-Oriented Programming, Algorithms and Data Structures, and System Software and Computer Communication 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 (*Klausur*)
CS 531 **Parameterized Algorithms** *Parametrisierte Algorithmen*	6	Compulsory elective module	Advanced module in theoretical computer science	Students will be able to: - identify adequate parameterizations for hard computational problems, - develop efficient fixed parameter algorithms and analyze their runtime, - design data reduction rules and analyze their effectiveness, and - prove the algorithmic difficulty of parameterized computational problems.	Successful participation in the module Algorithms and Data Structures is required; successful participation in the module Efficient Algorithms is 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:

Name of module *German translation*	**LP**	**Degree of obligation**	**Level**	**Qualification goals**	**Prerequisites**	**Prerequisites to earn credits (LP)**
						Oral examination (individual examination) or in-class written examination (*Klausur*)
CS 549 **Small Specialization Module Computer Science 1** *Kleines Vertiefungsmodul Informatik 1*	6	Compulsory elective module	Advanced module in practical computer science	Students: - have in-depth knowledge and skills in a selected specialty area of computer science, - are familiar with current research findings and how to use research literature, - are able to apply working methods from computer science for the selected special field of computer science (develop and apply basic solution strategies and their formal description, training of the ability to abstract, system development), - are able to apply scientific work practices in solving problems independently and communicate the solution, - have acquired skills preferably from the field of practical computer science.	None. Skills taught in the advanced modules (depending on the topic) 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 (*Klausur*) or oral examination (individual examination)
CS 590 **Small Specialization Module Computer Science 2** *Kleines Vertiefungsmodul Informatik 2*	6	Compulsory elective module	Advanced module in practical computer science	Students: - have in-depth knowledge and skills in a selected specialty area of computer science, - are familiar with current research findings and how to use research literature, - are able to apply working methods from computer science for the selected special field of computer science (develop and apply basic solution strategies and their formal description, training of the ability to abstract, system development), - are able to apply scientific work practices in solving problems independently and communicate the solution, - have acquired skills preferably from the field of theoretical computer science.	None. Skills taught in the advanced modules (depending on the topic) 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 (*Klausur*) or oral examination (individual examination)
CS 644 **Small Specialization Module Computer Science 3** *Kleines Vertiefungsmodul Informatik 3*	6	Compulsory elective module	Advanced module in practical computer science	Students: - have in-depth knowledge and skills in a selected specialty area of computer science, - are familiar with current research findings and how to use research literature, - are able to apply working methods from computer science for the selected special field of computer science (develop and apply basic solution strategies and their formal description, training of the ability to abstract, system development), - are able to apply scientific work practices in solving problems independently and communicate the solution, - have advanced in-depth knowledge and skills a selected specialty area of technical computer science.	None. Skills taught in the advanced modules (depending on the topic) 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 (*Klausur*) or oral examination (individual examination)

Name of module *German translation*	**LP**	**Degree of obligation**	**Level**	**Qualification goals**	**Prerequisites**	**Prerequisites to earn credits (LP)**
CS 646 **Small Specialization Module Computer Science 4** *Kleines Vertiefungsmodul Informatik 4*	6	Compulsory elective module	Advanced module in practical computer science	Students: - have in-depth knowledge and skills in a selected specialty area of computer science, - are familiar with current research findings and how to use research literature, - are able to apply working methods from computer science for the selected special field of computer science (develop and apply basic solution strategies and their formal description, training of the ability to abstract, system development), - are able to apply scientific work practices in solving problems independently and communicate the solution, - have advanced in-depth knowledge and skills a selected specialty area of applied computer science.	None. Skills taught in the advanced modules (depending on the topic) 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 (*Klausur*) or oral examination (individual examination)
CS 645 **Small Specialization Module Computer Science 5** *Kleines Vertiefungsmodul Informatik 5*	6	Compulsory elective module	Advanced module in practical computer science	Students: - have in-depth knowledge and skills in a selected specialty area of computer science, - are familiar with current research findings and how to use research literature, - are able to apply working methods from computer science for the selected special field of computer science (develop and apply basic solution strategies and their formal description, training of the ability to abstract, system development), - are able to apply scientific work practices in solving problems independently and communicate the solution, - have advanced in-depth knowledge and skills a selected specialty area of artificial intelligence.	None. Skills taught in the advanced modules (depending on the topic) 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 (*Klausur*) or oral examination (individual examination)
CS 558 **Software as a Medical Device** *Software als Medizinprodukt*	6	Compulsory elective module	Advanced module in practical computer science	Students: - have knowledge and skills for software development for medicine, - are able to recognize cross connections to computer science, - are able to apply ways of thinking and working from regulatory authorities to concrete issues, including technically motivated problems, - have an intuition for the development of software as a medical device and can translate this into precise terms and formal justifications, - are able to speak freely about scientific content both in front of an audience and in a discussion.	None. Basic knowledge of Software Engineering is 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 (*Klausur*)
CS 563 **Software Evolution** *Softwareevolution*	6	Compulsory elective module	Advanced module in practical computer science	Students: - are able to systematically familiarize themselves with a given software project, - are able to work out a coherent evolution plan, - are able to perform minor evolution tasks,	None. The skills taught in the Basic Computer Science modules and	Credit requirement(s): Earn at least 50% of the points from the weekly practice assignments and an oral presentation of the

Name of module *German translation*	**LP**	**Degree of obligation**	**Level**	**Qualification goals**	**Prerequisites**	**Prerequisites to earn credits (LP)**
				- are able to speak freely about scientific content, both in front of an audience and in a discussion, - are able to work on a project in a team.	the Advanced Software Engineering and Software Internship modules are recommended.	solution to at least two of the practice assignments. Testing: Oral examination (individual examination) or in-class written examination (*Klausur*)
CS 543 **Statistical Bioinformatics** *Statistische Bioinformatik*	6	Compulsory elective module	Advanced module in practical computer science	Students will know the most important methods from statistical bioinformatics 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. The skills taught in the modules Introduction to Bioinformatics and Fundamentals of Statistics 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 (*Klausur*)
CS 530 **Virtual Machines** *Virtuelle Maschinen*	6	Compulsory elective module	Advanced module in practical computer science	Students will be able to: - describe and explain the basic concepts of process- and system-based virtual machines, - describe the structure of virtual machines, - develop components of process-based VMs (such as scheduler, garbage collection, just-in-time compiler), - explain the methods of system-based VMs (hypervisor, hardware emulation, hardware virtualization, paravirtualization), - explain optimizations in virtual machines, - present modern examples of research work in the field of VM technology, - compare implementation approaches for programming language concepts (code transformation vs. VM support).	None. The skills taught in the Basic Computer Science modules and the Advanced Software Engineering and Software Internship 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: Oral examination (individual examination) or in-class written examination (*Klausur*)
CS 562 **Visual Languages** *Visuelle Sprachen*	6	Compulsory elective module	Advanced module in practical computer science	Students: - have an understanding of the differences between textual and visual languages, - are familiar with methods for defining visual languages, - have basic knowledge of using designer tools for visual languages, - are able to familiarize themselves with an unfamiliar visual language and evaluate it using a small test application,	None. The skills taught in the Basic Computer Science modules and the Advanced Software Engineering and Software Internship	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:

Name of module *German translation*	**LP**	**Degree of obligation**	**Level**	**Qualification goals**	**Prerequisites**	**Prerequisites to earn credits (LP)**
				- are able to apply scientific working methods in independently identifying, formulating, and solving problems, - are able to speak freely about scientific content both in front of an audience and in a discussion.	modules are recommended.	Oral examination (individual examination) or in-class written examination (*Klausur*)
CS 533 **Web Technologies** *Webtechnologien*	6	Compulsory elective module	Advanced module in practical computer science	Students: - are familiar with what web technologies exist and how to use them, - are able to understand the possible applications and the power of these techniques, - have an understanding of the interplay and dependencies between technologies, - have practiced scientific working methods (recognizing, formulating, solving problems, training the ability to abstract), - have practiced oral communication skills in the exercises by practicing free speech in front of an audience and in discussion.	None. Basic knowledge of programming and software engineering is 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 (*Klausur*)
Practical and Seminar Modules						
CS 567 **Further Selected Advanced Topics in Computer Science (Seminar)** *Weitere ausgewählte fortgeschrittene Themen der Informatik („Seminar")*	3	Compulsory elective module	Profile module	Students: - are able to work out a special topic of computer science independently, - are able to further develop and expand, as appropriate, corresponding skills already acquired in the Selected Advanced Topics in Computer Science (Seminar) module, - are able to prepare and break down contexts in computer science and supplement them with explanatory content, - know how to handle and search for scientific literature, - know how to give a structured presentation tailored to the expertise of the audience, - know how to deal with presentation media, - know how to discuss computer science content in a structured way in a group.	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 (*schriftliche Ausarbeitung*) (weight: 2 credits)
CS 698 **Independent Scientific Practice Computer Science** *Selbstständiges wissenschaftliches Arbeiten Informatik*	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 computer 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 (*schriftliche Ausarbeitung*) ***Ungraded module***
CS 697 **Project Work Computer Science**	12	Compulsory module	Practice module	Students: - are able to work on an extensive task from computer science in a team of several students. This includes: elaboration,	None.	Testing: Creating a piece of software (the term "software" includes

Name of module *German translation*	**LP**	**Degree of obligation**	**Level**	**Qualification goals**	**Prerequisites**	**Prerequisites to earn credits (LP)**
Projektarbeit Informatik				adaptation, extension and development of problem-relevant methods, - 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, - have team-related social skills: Cooperation, team development, leadership, motivation, well-structured team of employees, working under deadline pressure, - master methods of documentation and presentation of IT projects for users and third parties in the form of program documentation, project report and, if necessary, publications.		all created artifacts, in particular the program code, planning documents, user and developer manuals, and presentation materials). ***Ungraded module***
CS 610 **Selected Advanced Topics in Computer Science (Seminar)** *Ausgewählte fortgeschrittene Themen der Informatik („Seminar")*	3	Compulsory module	Profile module	Students will be able to: - work independently on a special topic in computer science, - prepare, divide and supplement explanatory content in computer science, - know how to handle and search for scientific literature, - know how to give a structured presentation tailored to the expertise of the audience, - know how to deal with presentation media, - know how to discuss computer science content in a structured way in a group.	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 (*schriftliche Ausarbeitung*) (weight: 2 credits)
Final Module						
CS 699 **Master's Thesis** *Masterarbeit*	30	Compulsory module	Final module	Students will be able to work on an extensive task in the field of computer science using scientific methods under guidance as well as to present a paper and the results contained therein appropriately in written and oral formats.	A minimum of 66 credits (LP) must have been earned.	Two subtests: Master's thesis (weight: 27 credits) and oral defense (weight: 3 credits)

Name of module *Deutscher Modultitel*	**LP**	**Degree of obligation**	**Level**	**Qualification goals**	**Prerequisites**	**Prerequisites to earn credits (LP)**
Conditional Modules (*Auflagenmodule*) Note: These credits (LP) serve to fulfill conditional requirements only and do not count toward the 120 credits to be earned for the degree.						
Conditional Module 1 (small) *Kleines Auflagenmodul 1*	6	--- (*Auflagenmodul*)	--- (*Auflagenmodul*)	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 (*Klausur*)

Name of module *Deutscher Modultitel*	**LP**	**Degree of obligation**	**Level**	**Qualification goals**	**Prerequisites**	**Prerequisites to earn credits (LP)**
Conditional Module 2 (small) *Kleines Auflagenmodul 2*	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 (*Klausur*)
Conditional Module 3 (small) *Kleines Auflagenmodul 3*	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 (*Klausur*)
Conditional Module 4 (small) *Kleines Auflagenmodul 4*	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 (*Klausur*)
Conditional Module 5 (small) *Kleines Auflagenmodul 5*	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 (*Klausur*)
Conditional Module 1 (large) *Großes Auflagenmodul 1*	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 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 (*Klausur*)
Conditional Module 2 (large) *Großes Auflagenmodul 2*	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	Testing: Oral examination (individual examination) or in-class

Name of module *Deutscher Modultitel*	**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.	admission to the program as part of a condition under §4(4).	written examination (*Klausur*)
Conditional Module 3 (large) *Großes Auflagenmodul 3*	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 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 (*Klausur*)

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 computer science The current import opportunities as well as possible allocation regulations and restrictions are shown on the website for the degree program (§6[9]) or in the online module handbook linked there. Modules for Practical Computer Science are marked with a “P,” modules for Theoretical Computer Science with “T.”			
Mathematics and Computer Science (Dept. 12), Degree program “B.Sc. Data Science”	Efficient Algorithms	Advanced module	T 9
	Machine Learning	Advanced module	P 9
Mathematics and Computer Science (Dept. 12), Degree Program “M.Sc. Data Science”	Data Science in Biomedicine	Specialization module	P 6
	Data Integration	Specialization module	P 6
	Introduction to Natural Language Processing	Specialization module	P 6
	Information Retrieval	Specialization module	P 6
Mathematics and Computer Science (Dept. 12), Degree program “B.Sc. Computer Science”	Introduction to Bioinformatics	Advanced module	P 6
	Introduction to Cryptography and Its Applications	Advanced module	T 6
	Design and Administration of Databases	Advanced module	P 6
	Graphics Programming	Advanced module	P 9
	Advanced Module Computer Science 1 (large)	Advanced module	P 9
	Advanced Module Computer Science 2 (large)	Advanced module	P 9
	Advanced Module Computer Science 3 (large)	Advanced module	P 9
	Advanced Module Computer Science 4 (large)	Advanced module	P 9
	Advanced Module Computer Science 5 (large)	Advanced module	P 9
	IT Security	Advanced module	P 9
	Advanced Module Computer Science 1 (small)	Advanced module	P 6
	Advanced Module Computer Science 2 (small)	Advanced module	P 6
	Advanced Module Computer Science 3 (small)	Advanced module	P 6
	Advanced Module Computer Science 4 (small)	Advanced module	P 6
	Advanced Module Computer Science 5 (small)	Advanced module	P 6
	NoSQL Database Systems	Advanced module	P 6
	Computer Networks	Advanced module	P 9
	Software Design and Programming Techniques	Advanced module	P 6
	Software Quality	Advanced module	P 9
	Distributed Data Management	Advanced module	P 9
Mathematics and Computer Science (Dept. 12), Degree program “B.Sc. Business Informatics”	Agile and Classic Requirements Engineering	Advanced module	P 6
	Fundamental Technologies for IoT Data Generation of Physical and Nonphysical Sizes — IoT Sensor Systems	Advanced module	P 6
Mathematics and Computer Science (Dept. 12), Degree Program “M.Sc. Business Informatics”	Cloud Computing	Specialization module	P 6
	Project Management for Software Development	Specialization module	P 6
	Specialization Module Business Systems	Specialization module	P 6

	Specialization Module Digital Transformation	Specialization module	[P] 6
	Specialization Module Design and Operation of Information Systems	Specialization module	[P] 6
	Specialization Module Information Management	Specialization module	[P] 6
	Specialization Module Model-based Decision Support, Business Intelligence & Analytics	Specialization module	[P] 6
	Specialization Module Process Management	Specialization module	[P] 6
	Specialization Module Knowledge Management and Collaborative Technologies	Specialization module	[P] 6

The following modules can be used for the Profile Area Business Administration The current import opportunities as well as possible allocation regulations and restrictions are shown on the website for the degree program (§6[9]) or in the online module handbook linked there.			
Economics (Dept. 02), Degree program “B.Sc. Business Administration”	Sales Management	Basic Module	[B] 6
	Accounting and Financial Statements	Basic Module	[B] 6
	Business Intelligence (export module)	Specialization module	[C] 6
	Business Administration Abroad I (B.Sc.)	Specialization module	6
	Controlling with Key Figures (export module)	Specialization module	[C] 6
	Digitalization and Process Management I	Specialization module	[C] 6
	Digitalization and Process Management II	Specialization module	[C] 6
	Entrepreneurial Finance	Specialization module	[C] 6
	Entrepreneurship and Innovative Business Models I	Specialization module	[C] 6
	Entrepreneurship and Innovative Business Models II	Specialization module	[C] 6
	Decision-Making, Finance and Investment	Basic Module	[B] 6
	Foundations of Taxation	Basic Module	[C] 6
	Foundations of Business Informatics	Basic Module	[B] 6
	Intermediate Finance (export module)	Specialization module	[C] 6
	International Business Strategy	Specialization module	[C] 6
	Annual Financial Statements	Basic Module	[B] 6
	Annual Financial Statement and Annual Financial Statement Analysis (export module)	Specialization module	[C] 6
	Cost and Performance Accounting	Basic Module	[B] 6
	Management Accounting (export module)	Specialization module	[C] 6
	Management and Marketing Tools (export module)	Specialization module	[C] 6
	Managing Innovation and Entrepreneurship	Specialization module	[C] 6
	Organization Structures and Behavior in Organizations	Specialization module	[C] 6

	Human Resources Management	Specialization module	[C] 6
	Quantitative Empirical Methods of Business and Market Research (export module)	Basic Module	[C] 6
	Strategic Problem-Solving and Communication	Specialization module	[C] 6
	Technology and Innovation Management	Specialization module	[C] 6
	Corporate Governance	Basic Module	[A] 6

The following modules can be used for Profile Area Biology Before starting up study in the profile area, interested students should register with the contact person in the Department of Mathematics and Computer Science for the profile area of Biology. In addition, registration with the Office of the Dean of Studies for the Department of Biology is required prior to beginning studies in the profile area. Since the choices may be limited due to enrollment caps, we recommend you attend the information event about selecting a module and, if necessary, also make use of the advisory services offered by the Department of Biology if you have any questions. The current import opportunities as well as possible allocation regulations and restrictions are shown on the website for the degree program (§6[9]) or in the online module handbook linked there.			
Biology (Dept. 17), Degree program “B.Sc. Biology”	Current Topics in Ecology	Profile module	6
	Biochemistry I	Profile module	6
	Animal biology	Profile module	6
	Digital Light Microscopy	Profile module	6
	Introduction to *Drosophilia* cross-genetics	Profile module	6
	Introduction to Laser Scanning Confocal Microscopy	Profile module	6
	Electron Microscopy	Profile module	6
	Experimental Design and Data Analysis in Ecology	Profile module	6
	Forensic Biology	Profile module	6
	Fungal Diversity and Conservation	Profile module	6
	Functional Morphology and Animal Biochemistry	Profile module	6
	Molecular Biology and Metabolism of Prokaryotes	Profile module	6
	Molecular Mycology	Profile module	6
	Neuroethology	Profile module	6
	Next Generation Sequencing in Eukaryotes	Profile module	6
	Insect Ecology and Biodiversity	Profile module	6
	Knowledge of Central European Plants	Profile module	6
	Spatial Aspects of Biodiversity	Profile module	6
	Synthetic Biology/”Marburg does iGEM”	Profile module	6
	Participation in the International iGEM Competition	Profile module	6
	Mediterranean Vegetation (Mallorca)	Profile module	6

	Advanced Species Knowledge in Ornithology	Profile module	6
	Philosophy of Science, Ethics, and History of Biology	Profile module	6
Biology (Dept. 17), Degree program „LAaG Biology”	Anatomy and Physiology of Plants for Future High School Teachers	Basic Module	6
	Anatomy and Physiology of Animals for Future High School Teachers	Basic Module	6
	Introduction to Organic Biology for Future High School Teachers	Basic Module	6
	Genetics and Microbiology for Future High School Teachers	Basic Module	6
	Cellular and Developmental Biology for Future High School Teachers	Basic Module	6

The following modules can be used for Profile Area Geography The current import opportunities as well as possible allocation regulations and restrictions are shown on the website for the degree program (§6[9]) or in the online module handbook linked there.			
Geography (Dept. 19), Degree program “B.Sc. Geography”	Basic knowledge: Population Geography	Basic Module	T1 3
	Basic knowledge: Biogeography	Basic Module	T1 3
	Basic knowledge: Soil Geography	Basic Module	T1 3
	Basic knowledge: Geography of Peripheral Areas	Basic Module	T1 3
	Basic knowledge: Geomorphology	Basic Module	T1 3
	Basic knowledge: Hydrogeography	Basic Module	T1 3
	Basic knowledge: Climate Geography	Basic Module	T1 3
	Basic knowledge: Spatial Planning and Development	Basic Module	T1 3
	Basic knowledge: Urban Geography	Basic Module	T1 3
	Basic knowledge: Economic and Service Geography	Basic Module	T1 3
	Remote Sensing	Basic Module	M2 3
	Geoinformatics	Basic Module	M2 3
	Basic skills: Population Geography	Basic Module	T1 6
	Basic skills: Biogeography	Basic Module	T1 6
	Basic skills: Soil Geography	Basic Module	T1 6
	Basic skills: Geography of Peripheral Areas	Basic Module	T1 6
	Basic skills: Geomorphology	Basic Module	T1 6
	Basic skills: Hydrogeography	Basic Module	T1 6
	Basic skills: Climate Geography	Basic Module	T1 6
	Basic skills: Humans and the Environment	Basic Module	T1 6

	Basic skills: Spatial Planning and Development	Basic Module	T1 6
	Basic skills: Urban Geography	Basic Module	T1 6
	Basic skills: Economic and Service Geography	Basic Module	T1 6
	Cartography and GIS	Basic Module	M1 6
	Geography Project I	Specialization module	T2 6
	Geography Project II	Specialization module	T2 6
	Special Cartography	Basic Module	M2 3
	System Dynamics	Basic Module	M2 3
Geography (Dept. 19), Degree Program “M.Sc. Physical Geography”	Biogeography	Advanced module	T3 6
	Soil Geography and Hydrogeography	Advanced module	T3 6
	Terrain Climatology	Advanced module	T3 6
	Geographic Information Systems	Advanced module	T3 6
	Geomorphology	Advanced module	T3 6
	Global Change	Basic Module	T3 6
	Environmental Information Systems I	Specialization module	T3 6
	Environmental Information Systems II	Specialization module	T3 6
	Environmental Systems	Advanced module	T3 6
Geography (Dept. 19), Degree Program “M.Sc. Economic Geography”	Globalization of Innovation and Knowledge	Basic Module	T3 6
	Innovation and Growth in Space	Basic Module	T3 6
	Modeling and Simulation	Advanced module	T3 6
	Socioeconomic Globalization Processes	Basic Module	T3 6

The following modules can be used for Profile Area Mathematics The current import opportunities as well as possible allocation regulations and restrictions are shown on the website for the degree program (§6[9]) or in the online module handbook linked there.			
Mathematics and Computer Science (Dept. 12), Degree program “B.Sc. Data Science”	Matrix Methods in Data Analysis	Advanced module	9
Mathematics and Computer Science (Dept. 12), Degree program “B.Sc. Mathematics”	Algebra	Advanced module	9
	Selected Topics in Mathematics A (introductory seminar)	Advanced module	3
	Selected Topics in Mathematics B (seminar)	Advanced module	3
	Representation Theory	Advanced module	9
	Discrete Geometry	Advanced module	6
	Discrete Mathematics and Analysis of Algorithms	Advanced module	9
	Elementary Algebraic Geometry	Advanced module	9
	Elementary Topology	Advanced module	6

	Function Theory and Vector Analysis	Advanced module	9
	Large Advanced Module Algebra/Geometry	Advanced module	9
	Large Advanced Module Analysis/Topology	Advanced module	9
	Large Advanced Module Numerics/Optimization	Advanced module	9
	Small Advanced Module Algebra/Geometry	Advanced module	6
	Small Advanced Module Analysis/Topology	Advanced module	6
	Small Advanced Module Numerics/Optimization	Advanced module	6
	Lie Groups and Lie Algebras	Advanced module	9
	Numerics (Basic Numerical Methods)	Advanced module	9
	Number Theory	Advanced module	9
Mathematics and Computer Science (Dept. 12), Degree Program “M.Sc. Mathematics”	Algebraic Geometry: Projective Varieties	Specialization module	9
	Algebraic Geometry: Advanced Methods	Specialization module	9
	Algebraic Lie Theory	Specialization module	9
	Algebraic Topology I	Specialization module	9
	Analytic Number Theory	Specialization module	9
	Approximation Theory	Specialization module	9
	Differential Geometry I	Specialization module	9
	Differential Geometry II	Specialization module	9
	Functional Analysis	Specialization module	9
	Galois Theory	Specialization module	9
	Large Specialization Module Algebra/Geometry	Specialization module	9
	Large Specialization Module Analysis/Topology	Specialization module	9
	Large Specialization Module Numerical Mathematics/Optimization	Specialization module	9
	Holomorphic Functions and Abelian Varieties	Specialization module	9
	Small Specialization Module Algebra/Geometry	Specialization module	6
	Small Specialization Module Analysis/Topology	Specialization module	6
	Small Specialization Module Numerical Mathematics/Optimization	Specialization module	6
	Commutative Algebra (Large Specialization Module)	Specialization module	9
	Commutative Algebra (Small Specialization Module)	Specialization module	6
	Noncommutative Algebra	Specialization module	9
	Numerical Solution Methods for Finite Dimensional Problems	Specialization module	9
	Numerical Solution Methods for Differential Equations	Specialization module	9
	Partial Differential Equations	Specialization module	9
Mathematics and Computer Science (Dept. 12),	Elementary Stochastics	Advanced module	9

Degree program “B.Sc. Economic Mathematics”	Financial Mathematics I	Advanced module	6
	Large Advanced Module Stochastics	Advanced module	9
	Small Advanced Module Stochastics	Advanced module	6
	Measure and Integration Theory	Advanced module	6
	Statistics	Advanced module	9
Mathematics and Computer Science (Dept. 12), Degree Program “M.Sc. Economic Mathematics”	Selected Topics on Financial Mathematics	Specialization module	3
	Financial Optimization	Specialization module	6
	Financial Mathematics II	Specialization module	6
	Large Specialization Module Stochastics	Specialization module	9
	Small Specialization Module Stochastics	Specialization module	6
	Small Specialization Module Stochastics without Tutorial	Specialization module	3
	Mathematical and Nonparametric Statistics	Specialization module	9
	Quantitative Risk Management	Specialization module	6
	Non-Life Insurance Mathematics	Specialization module	3
	Stochastical Analysis	Specialization module	9
	Stochastic Processes	Specialization module	6
	Probability Theory	Specialization module	9

The following modules can be used for Profile Area Physics The current import opportunities as well as possible allocation regulations and restrictions are shown on the website for the degree program (§6[9]) or in the online module handbook linked there.			
Physics (Dept. 13), Degree program “B.Sc. Physics”	Experimental Physics for Natural Scientists I	Basic Module	6
	Experimental Physics for Natural Scientists II	Basic Module	6

The following modules can be used for Profile Area Economics The current import opportunities as well as possible allocation regulations and restrictions are shown on the website for the degree program (§6[9]) or in the online module handbook linked there.			
Economics (Dept. 02), Degree program “B.Sc. Macroeconomics”	Applied Institutional Economics (export module)	Specialization module	[C] 6
	Development Economics: An Introduction (export module)	Specialization module	[C] 6
	Introduction to Institutional Economics (export module)	Basic Module	[B] 6
	Introduction to Macroeconomics	Basic Module	[A] 6
	Introduction to Law and Economics (export module)	Specialization module	[C] 6
	Empirical Economic Research	Basic Module	[C] 6
	Foundations of Finance (export module)	Advanced module	[C] 6

	International Economics (export module)	Advanced module	C 6
	Macroeconomics II (export module)	Advanced module	C 6
	Macroeconomics I (export module)	Basic Module	B 6
	Markets and Organizations (export module)	Specialization module	C 6
	Microeconomics II (export module)	Advanced module	C 6
	Microeconomics I	Basic Module	A 6
	Environmental Economics (export module)	Specialization module	C 6
	Competition and Regulation (export module)	Specialization module	C 6
	Economic Policy (export module)	Advanced module	C 6

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. Changes of this type will be published by the examination committee on the 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 *German translation*	
Advanced Algorithmics *Höhere Algorithmik*	CS 627
Advanced Methods of System Development *Fortgeschrittene Methoden der Systementwicklung*	CS 607
Advanced Programming Concepts *Fortgeschrittene Konzepte der Programmierung*	CS 609
Advanced Topics in Cryptography *Fortgeschrittene Themen der Kryptographie*	CS 556
Algorithm Engineering *Algorithm Engineering*	CS 628
Algorithmic Network Analysis *Algorithmische Netzwerkanalyse*	CS 529
Algorithms in Bioinformatics *Algorithmische Bioinformatik*	CS 594
Artificial Intelligence *Künstliche Intelligenz*	CS 592
Compiler Construction *Compilerbau*	CS 551
Computational complexity theory *Komplexitätstheorie*	CS 576
Content-based Image and Video Analysis	CS 516

Name of module *German translation*	
Inhaltsbasierte Bild- und Videoanalyse	
Dialog Systems *Dialogsysteme*	CS 569
Distributed Systems *Verteilte Systeme*	CS 513
Ethical Hacking and Practical Cryptoanalysis *Ethisches Hacken und praktische Kryptoanalyse*	CS 575
Formal Methods in Software Engineering *Formale Methoden in der Softwaretechnik*	CS 510
Geo Databases *Geo-Datenbanken*	CS 573
Image Synthesis *Bildsynthese*	CS 681
Implementation of Database Systems *Implementierung von Datenbanksystemen*	CS 672
Index and Storage Structures *Index und Speicherstrukturen*	CS 571
Large Specialization Module Computer Science 1 *Großes Vertiefungsmodul Informatik 1*	CS 647
Large Specialization Module Computer Science 2 *Großes Vertiefungsmodul Informatik 2*	CS 525
Large Specialization Module Computer Science 3 *Großes Vertiefungsmodul Informatik 3*	CS 526
Large Specialization Module Computer Science 4 *Großes Vertiefungsmodul Informatik 4*	CS 623
Large Specialization Module Computer Science 5 *Großes Vertiefungsmodul Informatik 5*	CS 624
Model-driven Software Development *Modellgetriebene Softwareentwicklung*	CS 561
Modern Methods of System Development *Moderne Methoden der Systementwicklung*	CS 507
Multimedia Signal Processing *Multimediale Signalverarbeitung*	CS 682
Neural Networks *Neuronale Netze*	CS 593
Operating Systems *Betriebssysteme*	CS 512
Parameterized Algorithms *Parametrisierte Algorithmen*	CS 531
Small Specialization Module Computer Science 1 *Kleines Vertiefungsmodul Informatik 1*	CS 549
Small Specialization Module Computer Science 2	CS 590

Name of module *German translation*	
Kleines Vertiefungsmodul Informatik 2	
Small Specialization Module Computer Science 3 *Kleines Vertiefungsmodul Informatik 3*	CS 644
Small Specialization Module Computer Science 4 *Kleines Vertiefungsmodul Informatik 4*	CS 646
Small Specialization Module Computer Science 5 *Kleines Vertiefungsmodul Informatik 5*	CS 645
Software as a Medical Device *Software als Medizinprodukt*	CS 558
Software Evolution *Softwareevolution*	CS 563
Statistical Bioinformatics *Statistische Bioinformatik*	CS 543
Virtual Machines *Virtuelle Maschinen*	CS 530
Visual Languages *Visuelle Sprachen*	CS 562
Web Technologies *Webtechnologien*	CS 533