

Official Communications  
Promulgating Publication of the University of Paderborn Am.Uni.PB

Edition 44.17 of June 16<sup>th</sup> 2017

Examination Regulations for the master's degree course Computer Science of the Faculty for Electrical Engineering, Computer Engineering and Mathematics at the University of Paderborn

From June 16<sup>th</sup> 2017

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Based on § 2 section 4 and § 64 section 1 of the law of the Universities of the state North–Rhine Westphalia (Higher Education Act – HEA) of September 16<sup>th</sup> 2014 (GV.NRW. p. 547), last changed by the law of December 15<sup>th</sup> 2016 (GV.NRW. p. 1154), the University of Paderborn has issued the following regulations:

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## **I. General Issues**

### **§1. Purpose of the exams, aim of studies**

- (1) The Master's exam constitutes a second professional university degree of the studies of Computer Science.
- (2) The Master's exam shall examine whether the students have extended the necessary knowledge and deepened it in chosen areas for the work experience in a previous Bachelor study program, so they have the ability to use suitable scientific methods to solve problems in Computer Science and develop it in their chosen field of academic specialisation. To the requirements of the work experience in Computer Science also belongs the ability of communicating in English language orally and in written form in professional activities.
- (3) The course of studies delivers the students not only the general aims of studies of § 58 HG the ability to use and develop scientific methods of Computer Science in their work and, concerning the effects of technological change, to act responsibly.

### **§2. Academic degree**

If the Master program is completed successfully, the faculty for Electrical Engineering, Computer Science and Mathematics confers the academic degree "Master of Science", abbreviated "M.Sc.".

### **§3. Beginning of studies**

Beginning of studies is in the winter term or summer term.

### **§4. Admission requirements**

- (1) In the Master program Computer Science can only be inscribed who cumulatively
  1. has the A-level certificate (in general or connected to a subject) or, according to a legislative decree, an advanced technical college certificate or one through a legal regulation or an educational qualification approved as equal by the responsible public authority or has the requirements for the qualified in a professional education or meets the requirements of the regulation of university access for foreign national with university entry qualifications.
  2. has a qualification which fulfils the following requirements:
    - a) It must involve a first higher education degree qualifying for entering a profession with a regular program length of at least six semesters at the University of Paderborn or a public or publicly accepted university or a state or state-approved university of cooperative education. Qualifications of a foreign state or state-approved university ensure an access, as long as regarding the gained competences there is no significant difference to a qualification of the University of Paderborn according to paragraph 1. For foreign educational attainments equivalency agreements approved by the Standing Conference of the State Ministers of

Education and the Arts in the Federal Republic of Germany and the Conference of Presidents and Rectors of Universities and other Higher Education Institutions or corresponding legal regulations have to be considered. As far as agreements of the Federal Republic of Germany made with other states about the equivalency in the higher education sector (equivalence treaty) favour students from foreign states differing from paragraph 2, regulations of the equivalence treaty will take precedence. Apart from that, in case of doubts about presence or non-existence of significant differences the central office for foreign education has to be consulted. The Examination Board takes the statement about the requirements according to paragraph 2.

- b) The qualification must at least contain 20 CP in the subject "Software Technics", at least 20 CP in the subject "Theoretical Computer Science", at least 15 CP in the subject "Mathematical Foundations in Computer Science" and at least 8 CP in the subject "Human-Machine-Interaction". The question of whether these requirements are fulfilled will be resolved by the Examination Board. If there is a lack of up to 30 CP, the inscription can be made under the condition to make up the requirements throughout proper studies within up to three pre-master courses and to verify them with the completion of related exams. The statement about this will be made by the Examination Board. The exams should be completed within the first two semesters of the Master degree program. They are the requirements for the participation in the exams of the subject-related modules of the focus areas. They have to be proven during the registration to the module "Master Thesis" again. Further details are regulated in appendix 1.
  - c) The qualification must be made with a total grade of at least 3.0.
3. has sufficient language skills according to paragraphs 2 and 3.
  4. is an international applicant, who is not on an equal footing with Germans according to international law, attests his or her ability to study throughout the results of GRE Revised General Test. Usually at least 157 points are required in the part "Quantitative Reasoning" at least 4,0 points in the part "Analytical Writing" of the GRE Revised General Test. If there is an excellent grade in the qualification according to no. 2, the Examination Board can accept a lower number of points, depending on the qualification. Prospective students with a German eligibility for entry to higher education are exempted from the proof of the ability to study.
- (2) To the Master's degree program Computer Science will be admitted who
1. has language skills in English proven through transcripts or documents of
    - a) a successfully completed school instruction in English language from grade 5 and a duration of at least 5 years – as developing nations – or
    - b) a language test at least on the level TOEFL 500 (paper and pencil) or TOEFL 61 (internet-based) or
    - c) equivalent skills (e.g. Cambridge First Certificate (FCE) grade B or IELTS with a minimum result 5.0)
  2. is an applicant who has not acquired her or his entry requirements at a German facility and has sufficient skills in German language. A verification of the linguistic ability to study is needed for unlimited admission or enrolment to all study programs. Details are governed by the regulations for the German language examination for university enrolment at the University of Paderborn in the respective current version.
- (3) In alternative to paragraph 2, the applicant will be enrolled as well, who does not have the necessary German language skills, but has profound English language skills instead, which can be proven by certificates or documents of

- a) a Bachelor's degree in an English-speaking country<sup>1</sup> or in an English-speaking accredited national degree program or
  - b) a Test of English as Foreign Language (TOEFL) "Internet-based" test (ibt) with a result of at least 80 points or
  - c) a TOEFL "paper-based" test (PBT) with a result of at least 550 points or
  - d) an IELTS-test with a result of at least 6.5 or
  - e) a Cambridge Test – Certificate in Advanced English (CAE) grade B  
or tests on an equivalent level.
- (4) According to paragraph 3, enrolled students have to prove German language skills of the competency level A2 GER (European Frame of Reference) before completion of their Master program. These can be acquired in German language courses and are credited with 12 CP maximum within the extracurricular studies.
- (5) Enrolment is to be declined, if
- 1. the conditions mentioned in paragraph 1 to 3 are not fulfilled
  - 2. the candidate has definitely failed an examination, which is essential according to the examination regulations, in the desired degree program at a university within the scope of the basic law or
  - 3. the candidate has definitely failed an examination, which is essential according to the examination regulations, in a degree program at a university within the scope of the basic law, if the unsuccessful degree program has an essential content-related similarity to the Master degree course Computer Science at the University of Paderborn. The Examination Board decides about the essential content-related similarity.

### **§5. Standard period of study and scope of studies**

- (1) The regular program length for the master program including the Master's examination takes four semesters. Students are expected to have a total amount of work (workload) according to 120 CP (= 3,600 hours).
- (2) The master program includes modules with an overall scope of 120 CP.
- (3) All students have to complete modules and related examinations in the main subject with a scope of at least 24 CP in English language.
- (4) If the master program in Computer Science is completely studied in English language, one has to be alert to a minor limitation of the freedom of choice. The same applies if just the amount of the required modules according to paragraph 3 is chosen in English language.
- (5) The indicated CP correspond to the points to be awarded according to the European Credit Transfer System (ECTS). One CP equals a workload of 30 hours in average. One semester usually covers 30 CP and consequently a workload of 900 hours. The content of the modules is chosen in a way in which the workload provided by the CP is taken account for.
- (6) The Faculty for Computer Science, Electrical Engineering and Mathematics has created an exemplary timetable and a module manual on the basis of these examination regulations. These documents provide insight especially on the aims of the individual modules and on the courses assigned to the

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<sup>1</sup> Within the frame of these regulations these are Australia, Great Britain, Ireland, Canada, New Zealand and the United States of America.

modules as well as on the necessary prior knowledge and content. The exemplary timetable and the module manual are attached to this edition of the examination regulations. The module manual is informative about the current state at the time the resolution was adopted for the examination regulations. The module manual is updated on a regular basis and is published on the website of the Department of Computer Science.

- (7) A scope of 12 LP is provided in the master program for the extracurricular studies and an optional minor subject. Examinations have to be taken in the optional minor in terms of § 15. In the extracurricular studies a performance in examination has to be taken in a chosen course. In courses of extracurricular studies in which no performance in examinations has to be taken, an evidence of a qualified participation has to be provided.

## **§6. Modules**

- (1) The master program Computer Science is offered in a modularised form. Modules are thematically and temporally rounded independent units of qualification concluded in themselves and equipped with credit points, which can be examined. The modules have a scope of 5 to 30 CP and can usually be completed within one to two semesters.
- (2) Besides the project group modules (20 CP) and master thesis submitted for the master's degree (30 CP) as well as besides the extracurricular studies and subsidiaries (altogether 12 CP) the master's degree is structured into eight compulsory elective modules (6 CP each) and two seminars (5 CP each).
- (3) A module may contain compulsory and compulsory elective courses. If a module contains compulsory options, these are chosen from a course catalogue, which is part of the module description.

## **§7. Accreditation of achievements**

- (1) Achievements which have been provided in other degree programs or in degree programs at other state or state-approved universities, at state or state-approved colleges of cooperative education or in degree programs at foreign state or state-accepted universities, are accepted on application, as long as there is no major difference concerning the gained competences compared to the achievements which will be replaced. No schematic comparison but an overall examination regarding the accreditation purpose of the continuation of studies and taking exams has to be performed. Paragraphs 1 and 2 apply to the accreditation of achievements made via state-accepted distance learning or for distance learning units developed by the state North Rhine-Westphalia in connection with other states and the federal government.
- (2) For the accreditation of achievements at foreign universities the equivalency agreements made by the Standing Conference of the State Ministers of Education and the Arts in the Federal Republic of Germany and the Conference of Presidents and Rectors of Universities and Other Higher Education Institutions as well as the agreements within the university partnerships have to be respected. As long as agreements of the Federal Republic of Germany have been made with other states in the higher education sector (equivalency agreements) favouring students of foreign states differing from paragraph 1 regulations of the equivalency agreements shall prevail. Otherwise, in case of doubts about presence or non-existence of significant differences the Central Office for Foreign Education has to be consulted.
- (3) Based on the accreditation according to paragraph 1, the Examination Board has to classify a student at a semester on her or his request.

- (4) Knowledge and skills proven in the placement examination of applicants, who are qualified to begin their studies on the basis of a placement examination according to § 49 paragraph 12 HG, will be accepted. The assessment in the placement test certificate are binding for the Examination Board.
- (5) Other skills and qualifications can be accepted on application by the Examination Board on the basis of submitted documents, if these skills and qualifications are equivalent in content and level to the achievements which are supposed to be replaced.
- (6) The Examination Board is responsible for accreditations according to paragraphs 1 and 5. Before assessment about presence or non-existence of significant differences or of equivalence, responsible expert representatives have to be consulted. A failure of the assessment is to be explained.
- (7) The applicant has to submit the information needed for accreditation (especially knowledge and skills gained through achievements and examination results) in a form determined by the Examination Board. The Examination Board has to decide about applications according to paragraph 1 within ten weeks after a complete submission of all relevant information.
- (8) The accreditation will be marked in the certificate. If achievements are accredited, grades have to be taken over after a conversion if necessary, and to be included in the respective grade calculation, as far as the grading systems are comparable. If there is no grade or if the grading systems are not comparable, the note "passed" is included.
- (9) An achievement can only be approved once. This applies for the assessment of further skills and qualifications as well.

## **II. Organisation of the Examinations**

### **§8. Examination Board**

- (1) The Faculty Board of the Faculty of Computer Science, Electrical Engineering and Mathematics assembles an examination board for the master program in Computer Science. It is especially responsible for
  - the organisation of examinations and the supervision of their provision.
  - the compliance of the examination regulations and the consideration of the procedure regulations made for the provision of the examinations.
  - the decisions about contradictions against decisions made in the assessment procedure,
  - the writing of an annual report to the Faculty Board about the development of the examinations and periods of study,
  - other tasks explicitly assigned to the Examination Board by these regulations.

The chairperson of the Examination Board is assigned certain tasks by these regulations. Furthermore, the Examination Board is able to assign the completion of matters to the chairperson, which do not have any fundamental meaning; this does not apply to decisions for contradictions and reports meant for the Faculty Board. The chairperson reports to the Examination Board about decisions made by her or him alone. The Examination Board and the chairperson of the Examination Board are supported by the Central Examination Office.

- (2) The Examination Board consists of one chairperson, one representative chairperson and five additional members. On suggestion of the individual group, the chairperson, the representative chairperson, two more members of the group of professors, one member of the group of academic staff and two members

of the group of students are elected by their respective representatives of the Faculty Board. Accordingly representatives for the members of the Examination Board are elected, except for the chairperson and the representative chairperson. The term of office of the members from the group of professors and the members of the academic employees takes two years and goes from October 1st of the election year until September 30th of the next but one year. The term of office of students takes one year and goes from October 1st of the elective year until September 30th of the next but one year. A re-election is allowed. The regulations of gender equality according to § 11c HG have to be considered.

- (3) The Examination Board is the authority in the sense of administrative procedures and administrative procedural law.
- (4) The Examination Board has a quorum if, besides the chairperson or the representative chairperson and two more professors, at least one more member participates in voting and is present. The Examination Board decides with a simple majority. In case of a tie in the voting the vote of the chairperson shall decide. The student members of the Examination Board only have an advising voice in case of educational–scientific decisions, especially concerning the assessment or acceptance of performances.
- (5) The Examination Board is convened by the chairperson. The convocation must be made when at least three members demand it.
- (6) The sessions of the Examination Board are not public. The members of the Examination Board, its representatives, examiners and assessors are officially sworn to secrecy. As long as they are not in public service, they are not obliged to secrecy by the chairperson of the Examination Board.
- (7) The members of the Examination Board have the right to attend the acceptance of examinations.

### **§9. Examiners and observers**

- (1) The chairperson of the Examination Board appoints the examiners and observers. Examiners are all independent professors of courses in which according to the curriculum and the module descriptions performances in examinations can be made. As an observer, only someone who has at least made the corresponding Master's examination or a comparable examination is able to be appointed.
- (2) Examiners are independent in their audit activity.
- (3) The candidate can suggest examiners for the thesis and for the oral exam, if there are several persons to choose from. Suggestions shall be taken into account if necessary. There is no legal claim.
- (4) The Examination Board ensures that the candidate receives the names of the examiners on time, usually four, at least two weeks before the date of the examination. The announcement in the Campus Management System of the University of Paderborn is sufficient.

## **III. Master's examination**

### **§10. Aim, Scope and Manner of the Master's examination**

- (1) The Master's examination spreads over the following so–called Focus Areas
  1. Software Engineering
  2. Algorithm Design
  3. Networks and Communication

4. Computer Systems
5. Intelligence Data
6. Data Science

One of these six Focus Areas has to be chosen as Specialization Area.

(2) A standard subject can be selected from the following subjects:

1. Electrical Engineering
2. Mathematics
3. Media Studies
4. Philosophy
5. Psychology
6. Business Information Technology
7. Economics

An agreement on the minor exists for each with a matched module offer for minor subjects; the agreements about the minor are included in the appendix of these regulations. The schedules are coordinated during the process of creating the course catalogue.

A sufficient offer, completely in English language, is guaranteed in the minors Electrical Engineering and Business Information Technology.

The Examination Board can permit another subject as a minor on a case-by-case basis and on request. In this case it decides about performances in examination which have to be made and informs the applicant about them.

(3) The Master's examination consists of

1. three study-related module examinations in compulsory elective modules with a scope of 6 CP each in the Specialization Area,
2. a study-related module examination in a compulsory elective module and in one of the Focus Areas differentiated from the Specialization Area with a scope of 6 CP,
3. four study-related module examinations in compulsory elective modules with a scope of 6 CP each out of optionally selectable Focus Areas,
4. the project group module (20 CP),
5. two seminar modules (5 CP each),
6. the Master's thesis module (30 CP) including work scheduling (5 CP), a presentation of a duration of circa 45 minutes,
7. examinations in an optional minor or an examination within the module "Extracurricular Studies" with a scope of at least 12 CP in total.

(4) Modules and related examinations in the main subject with a scope of at least 24 CP must be completed in English language. This means, concerning the framework of these regulations, that lectures and examinations must be held in English language.

(5) The certificate on the completion of "English-language master program in Computer Science" according to § 2 section 2 will be issued if

1. the examination has been fully completed in English language according to paragraph 3 no. 6 (Master thesis module) and
  2. these have been completed according to paragraph 3 no. 1 to 5 (compulsory elective modules), except modules and examinations with a scope of maximum 18 CP according to the form described in paragraph 4.
- (6) Examinations in the optional minor module with a scope of 12 CP have to be taken. Alternatively, extracurricular studies have to be completed with a scope of 12 CP. In this case in one course chosen in the extracurricular studies an examination performance has to be attained. In courses within the extracurricular studies, in which no performances in examination have to be made, an evidence of the qualified participation has to be provided. More details regarding the standard subsidiaries can be found in appendix 2. In case of admission according to § 4, paragraph 3 the necessary German language courses can be approved as examinations in the extracurricular studies according to paragraph 3 no 5. It is not allowed to complete courses for Computer Science in the extracurricular studies. The Examination Board decides about exceptions.

### **§11. Admission to the Master's examination**

- (1) Students who are enrolled in the master program Computer Science at the University of Paderborn or are permitted as cross-registered students according to § 52 HG will be permitted to examinations in the master program in Computer Science. During examinations these requirements must be existent as well.
- (2) According to the available capacities, on application at the Examination Board and beyond paragraph 1, students of the bachelor's degree course in Computer Science, who have gained at least 150 CP relevant for graduating in the bachelor program and have registered the bachelor thesis, can be approved to modules of the master program with a scope of maximum 30 CP for one semester. The project group module is excluded from this regulation. This regulation can only be made use of once. A repetition of a failed early Master's examination is just possible after being enrolled in the master program in Computer Science. Students do not have any claim on receiving an access to the master program in Computer Science to a later point in time.
- (3) Students who have successfully completed modules with the scope of 48 CP (at least 18 CP of them gained in the chosen Specialization Area) can be admitted to the Master Thesis module. In case of enrolment with conditions according to § 4 passing the related examinations must be proven additionally. The assignment of the master thesis topic is made by the chairperson of the Examination Board right after the written-down acceptance of the work plan from the supervisor. The date of the announcement has to be filed with the Central Examination Office.
- (4) The notification concerning the master thesis has to be provided in writing to the chairperson via the Central Examination Office. When providing the notification about the master thesis the language in which the master thesis will be written has to be indicated.
- (5) The admission to an examination has to be declined when the requirements stated in paragraphs 1 and 3 are not fulfilled.
- (6) Usually, a subject studied during the first degree has to be chosen as a minor; the Examination Board decides about exceptions. The determination about the minor takes place with the explicit registration as a minor subject examination and taking of the first examination in this subject. Non-appearance or withdrawal reasonable grounds according to § 22 is equal to taking the examination. The candidate registers her or his participation in an examination in the minor at the Examination Board in each case not later than two weeks before the date of the examination.

## **§12. Registration and examination deadline**

- (1) For each module a separate registration in the Campus Management System is necessary. In addition to every examination a separate notification in the Campus Management System within the specified periods is necessary. The deadlines of the application phase for examinations will be announced on the respective information websites of the Campus Management System.
- (2) The registration for oral examinations according to § 13, paragraph 2, for which an examination block is established by the teachers, are made within determined time periods, meanwhile the individual examinations are taking place (comprehensive examination). The registration for examinations according to § 13, paragraph 2, which are offered as oral examinations without a specification of an examination block (individual examinations), is made within the determined periods in the Campus Management System. The examiner assigns the specific date for the examination. Professors schedule the application dates for the project group and the seminars ahead of the time period for the registration for examinations.
- (3) Examinations can be taken as soon as the necessary requirements for admission set in § 11 are fulfilled, the candidate is registered according to paragraphs 1 and 2 and has been approved.
- (4) In case of registration, cancellation and withdrawal regulations of the individual relevant examination regulations of the offered subject will be applied in modules of the chosen minors. For modules of the extracurricular studies in case of registration, cancellation, withdrawal, examination offence, compliance and assessment of the examination performances the regulations of these examination regulations will be applied.

## **§13. Completion of a module**

- (1) Every module is completed through a module examination. The module examination takes place in temporal connection with the module. A module examination usually consists of an exam at the end of the module (*Modulabschlussprüfung*). The module examination can also consist of several sub-module examinations (*Modulteilprüfungen*). If a module consists of several partial examinations, every partial examination has to be passed. The module grade is equivalent to the grade achieved in the module examination.
- (2) Credit points can only be acquired if the module has been completed successfully. A module is completed successfully if all module exams or all sub-module examinations have been assessed with at least "satisfactory" and the possibly required qualified participations has been approved.

## **§14. Examination performances in modules**

- (1) In modules examination performances are taken according to the module descriptions. The final grade of the Master's examination will be based on the results of the module examinations.
- (2) As long as the module descriptions contain framework specifications about the form and/or duration/scope of the performances in examination, the Examination Board determines how the examination performances have to be taken concretely in consultation with the examiner(s). In all modules respective professors announce not later than three weeks after the beginning of the term how performances in examination can be rendered. This counts in accordance with the proof of the qualified participation and coursework credits completed. The performances in examinations relate in each case to the content and competences of the related courses.

- (3) All examinations are taken along with the studies. The examinations usually take place only twice during an academic year. The repetition usually takes place within the same semester, no later than six months after.

### **§15. Forms of performance in examinations in modules, study performances and qualified participation**

- (1) Performances in examination can be made in form of oral examinations, written examinations or in another forms.

Usually the assessment has to be announced to the students, except for oral examinations, no later than six weeks after the performance in the Campus Management System of the University of Paderborn.

1. Oral examinations:

- In the oral examinations, the candidate has to prove that she or he recognizes correlations and is able to rank specific questions into these correlations. Furthermore, the oral examination shall prove that the candidate disposes a wide knowledge about scientific methods in Computer Science.
- Oral examinations are performed in front of two examiners or in front of one examiner in presence of a competent assessor according to § 9. § 20, paragraph 5 remains untouched. Before the determination of the grade the examiners consult with one another or the examiner gathers the assessor's opinion in absence of the candidate.
- Oral examinations usually take at least 25 minutes and not more than 50 minutes. In case of group examinations, the time given can be extended adequately.
- Significant subjects and results of the oral examination have to be documented in a protocol. The examiner has to communicate the result of the examination to the candidate subsequently to the oral examination.
- Students, who want to take the same oral examination at a later examination date, are permitted according to spatial conditions, as long as a candidate doesn't disagree. The admission doesn't cover the consultation about the examination result and its announcement.

2. Written examinations:

- The candidate has to prove that he or she is able to recognize problems on his or her field of study in a given time with the auxiliaries allowed by the examiner and to solve them with common methods of the subject.
- Every written exam has to be assigned by an examiner in accordance with § 9. § 20 remains untouched.
- Written exams take at least 90 minutes and not more than 180 minutes.

3. Examination performance in the seminar:

A lecture or speech is given in the seminar, taking between 45 and 60 minutes, and a written summary is prepared.

4. Examination Performance in the Project Group Module:

In the project group module, the successful editing of a project has to be proven by the submission of software and documentation, which counts as a phase-related examination. A grade is given for the total amount of edited projects.

- (2) The qualified participation is usually proven through a research paper about an internship, followed by a conversation. A qualified participation is present only when the rendered performances indicate that the subjects have been dealt with more than just superficially.
- (3) Exercises which are usually provided as homework and/or attendance tasks on a weekly basis can be required as a coursework.
- (4) In the extracurricular studies oral or written performances in examination are rendered. These are usually a sit-down examination (maximum four hours), a term paper (maximum 25 pages) or an oral examination (maximum 45 minutes).

### **§16 Assessment of performances in modules**

- (1) The respective examiner determines the grades for the individual performances in examination. For the assessment of the performances in examination the following grades have to be used:
 

1 = very good:	an excellent performance
2 = good:	a performance which lies significantly above the average requirements
3 = satisfactory:	a performance which meets the average requirements
4 = sufficient:	a performance which meets the requirements despite its deficiencies
5 = fail:	a performance which does not meet the requirements due to significant deficiencies
- (2) For a differentiated assessment interim values can be built by lowering or rising of the individual grades at 0.3. Interim grades 0.7; 4.3; 4.7 and 5.3 are excluded.
- (3) If an examination performance is assessed by several examiners, the grade is determined from the arithmetic mean of the individual grades. Incidentally paragraph 4, section 2 and 3 apply accordingly.
- (4) If a module grade is determined from several grades, the arithmetic mean has to be calculated. Thereof deviations are regulated in the module descriptions. The result has to be truncated after the first decimal point after the digit. The grade is:
  - at an average of including 1.5 = very good,
  - at an average of above 1.5 until including 2.5 = good,
  - at an average of above 2.5 until including 3.5 = satisfactory,
  - at an average of above 3.5 until including 4.0 = sufficient,
  - at an average of above 4.0 until 5.0 = fail.
- (5) In addition to the examination performances, voluntary performances can be made within a bonus system (bonus performances), which are assessed and can improve the module grade according to a specified scale. The bonuses are made along the studies and exclusively in relation with one concrete course. Term papers, short lectures or project works are allowed as forms of fulfilling the course requirements. The bonus shall prepare students step by step for following examination performances. The Examination Board decides in consultation with the respective professors whether a bonus can be performed in a course or the possible scale contributes to the improvement of the module grade and the respective professor announces it not later than in the third week after the beginning of the term. The module examination has to be passed independently from the bonus. The bonus can improve a module grade about 0.7 maximum.

- (6) Academic performances are assessed with "passed" or "failed".
- (7) Qualified participations have to be proven.

### **§17 Thesis**

- (1) The master thesis module (30 CP) entails of work planning (5 CP) and the master thesis including a presentation (25 CP). The topic has to be chosen from the Specialization Area.
- (2) The master thesis is an examination paper, which concludes a scientific education and shall show that the candidate has the ability to process a task from the field of Computer Science within a certain deadline and according to scientific methods. The task has to be designed in a way in which it equals a workload of five months full-time work. The work has to be submitted five months after the issue. The thesis usually does not have to be longer than 120 DIN A4 pages.
- (3) The master thesis is issued and supervised by a person with inspector qualifications chosen by the chairperson of the Examination Board according to § 9. On application of the candidate, the Examination Board can approve an examiner who represents the minor chosen by the candidate to mentor the master thesis. In this case the Examination Board designates a second examiner from the field of Computer Science with whom the work plan has to be adjusted. The candidate has to be given the opportunity to make suggestions for the topic of the master thesis; but this does not justify a legal claim.
- (4) On application, the chairperson of the Examination Board ensures that the candidate receives the topic of the master thesis in time. The date of the assignment has to be made on record.
- (5) The master thesis can also be permitted in form of a group work, if the contribution of each candidate which will be counted as an examination performance, is clearly distinguishable and assessable according to the indication of paragraphs, page numbers or other, objective criteria, which enable an explicit distinction, and fulfils the requirements according to paragraph 2.
- (6) The topic and the task of the master thesis are communicated to the candidate in writing. The topic can only be returned once and within the first six months after the issue. If the topic of the master thesis is returned after this period of time, the master thesis is considered as failed. The time allowed for the completion begins once again with the assignment of the new topic, after the acceptance of the new work plan. Exceptionally and in individual cases the Examination Board can extend the time allowed for the completion for six weeks based on an explained application which has to be provided at the Examination Board not later than one week before the expiration of the deadline, the time allowed for completion can be extended up to six weeks when the reasons for this are related to the topic of the thesis and the mentor supports it according to paragraph 3.
- (7) In case of illness within the time allowed for completion the candidate can extend the deadline on application on not longer than four weeks. In addition, the immediate submission of a medical certificate is necessary. A medical certificate about the existence of the inability of taking an examination is sufficient. If there are sufficient acutal indications which let an ability of taking an examination appear as probable or another proof as appropriate, a medical certificate of a medical officer of the University of Paderborn can be requested at the expense of the university. If the Examination Board grants the application, it will be communicated to the candidate in writing. The extension is equivalent to the period of sick leave; it does not entail an extension of the regular program length. If the duration of the illness extends four weeks, the candidate may choose to quit the thesis within the deadline which has been extended for four weeks or request a new topic. If the Examination Board rejects the request, it will be communicated to the candidate in writing as well.
- (8) The work plan has to contain the following elements: description of the task to be processed, motivation of the thesis, explicit formulation of the target setting, description of the tasks that have to be carried out

in order to succeed, including a related schedule as well as a setup of a provisional structure of a written elaboration.

- (9) It is not allowed to having used the master thesis, not even in extracts, for any other passed examination.
- (10) In submitting the master thesis, the candidate must certify in writing that she or he has independently composed the thesis or the corresponding portion of the group thesis or group project, and has used no sources than those indicated nor aids other than those permissible, and has appropriately declared all citations. The work plan has to be submitted with the thesis.

### **§18. Acceptance and Assessment of the Master Thesis**

- (1) The master thesis has to be submitted to the Central Examination Office in time and in two copies (typewritten, tied and paginated) as well as it has additionally to be sent once in electronic form via a physical medium; the date of submission has to be filed. When delivering the thesis via mail the moment of the delivery at the post office (postmark) is decisive. If the master thesis is not submitted within the stipulated period, it has to be assessed with "failed" (5.0).
- (2) The master thesis has to be assessed by two examiners according to § 9. The presentation of the student, taking 45 minutes, is included in the assessment. It takes place not later than four weeks after time of submission. The person who has provided the topic has to be one of the examiners. The chairperson of the Examination Board chooses the second examiner. The candidate has a right of proposal. This does not justify a legal claim. The individual assessment has to be made according to § 16, paragraphs 1 to 3 and has to be explained in writing. The grade for the thesis is assembled of the arithmetic mean of the individual grades, as long as the difference is not bigger than 1.0 and each of the grades of the individual assessments are at least "sufficient". If the difference is bigger than 1.0 or if the assessment is "failed", but the others are at least "sufficient", the Examination Board decides about a third examiner for the assessment of the master thesis. In this case, the grades of the thesis are calculated from the arithmetic mean of the three grades. The thesis can only be assessed as "sufficient" or better when at least two grades are "sufficient" or better.
- (3) The grade of the master thesis is simultaneously the grade of the master thesis module.
- (4) Students have to be informed about the assessment of the master thesis in the Campus Management System of the University of Paderborn usually not later than six weeks after the submission of the master thesis.

### **§19. Assessment of the Master Thesis and calculating the final grade**

- (1) The master's examination is passed if all module examinations and the master thesis are at least assessed with "sufficient" (4.0).
- (2) The overall grade is calculated by weighting all modules grades in accordance with their credit points. Differing from the CP determined in § 10, paragraph 3 the project work module is weighted with 8 weight points, the master thesis module with 50 weighted points and the extracurricular studies module with 4 weighting points.

When calculating the results only the first digit after the comma is considered, all other digits are deleted without being rounded up or down.

The grade is:

At an average of including 1.5 = very good

At an average of above 1.5 until including 2.5 = good

At an average of above 2.5 until including 3.5 = satisfactory

At an average of above 3.5 until including 4.0 = sufficient

At an average of above 4.0 until 5.0 = failed

- (3) The overall judgement "passed with excellence" is given if the overall grade is 1.3 or better.

### **§20. Repetition of examinations, compensation**

- (1) Passed examinations cannot be re-taken.
- (2) Every failed module examination can be repeated twice.
- (3) A passed examination, which is booked as an additional performance according to § 21, can be exchanged for a passed or a not yet or definitely failed examination (compensation) upon request, as long as these can be booked according to the principles.
- (4) A module is failed if a module examination or a sub-module examination cannot be repeated or compensated according to paragraph 3.
- (5) Retests for which there is no possibility for compensation have to be assessed by at least two examiners according to § 9.
- (6) If the master thesis module has been assessed with the grade "failed" (5.0), it is possible to repeat it once. A new topic has to be provided then. A second retake is not possible. A return of the topic of the master thesis according to the deadline listed in § 27, paragraph 6, section 2 is only permitted if this possibility was not used at the first attempt.
- (7) The candidate can suggest another examiner for the retake of the master thesis. This does not justify a legal claim.

### **§21. Additional modules**

- (1) Besides performances required in § 10 students can render performances in modules with a scope of up to 18 CP. Regulations for modules limited on the number of participants according § 59 HG remain unaffected. Successfully completed modules are documented in the "Transcript of Records", unless the student requests to not list those modules after the submission of the thesis. These are excluded in the grading of the Master's examination.
- (2) Under consideration of the indicated upper limit mentioned in paragraph 1, the change for the purpose of a compensation according to § 20, paragraph 3 is possible. Failed examinations are included in the upper limit.
- (3) Additional modules have to be marked as such during the registration.

### **§22. Failure, withdrawal, fraudulent behaviour, infringement of regulations, precautionary regulations and students with family responsibilities**

- (1) A deregistration from examinations can be made not later than a week before the respective examination date and without giving any reasons. A deregistration from individual examinations can be made not later than a week before the respective examination date via the Campus Management System without

giving any reasons. A deregistration from comprehensive examinations according to section 1 can only be made not later than a week before the start of this examination block. Deregistration dates for the project group and the seminars are set by teachers from the beginning of the registration phase.

- (2) An examination performance has to be assessed with "failed" (5.0) if the candidate does not appear at an examination date without good reasons or withdraws from an examination after the beginning of an examination without good reasons or withdraws from the examination after the end of the deregistration deadline according to paragraph 3 without giving good reasons. The same applies if the written performance in examination is not completed within the given time allowed for completion.
- (3) The reasons which gave rise to the failure or withdrawal have to be displayed in writing and made credible to the Examination Board immediately and not later than five workdays after the respective examination date. In case of illness of the candidate a medical certificate about the existence of inability of taking the examination dated on not later than the day before the examination suffices. If sufficient actual indications exist, which let assume an inability to take an examination as probable or let an evidence seem appropriate, a medical certificate of an independent medical officer of the University of Paderborn at the expense of the university may be required. The illness of the candidate proven by a medical certificate according to § 25, paragraph 5 of the Federal Law on Support for Education and Training applies as the candidate's inability of taking an examination if the care could not be granted in a different manner, especially in case of mainly sole care. If the Examination Board accepts the reasons, it will be communicated to the candidate in writing and a new examination date will be set. Examination results which are already set have to be accredited in this case. If the Examination Board does not recognise the reasons, it will be communicated to the candidate in writing.
- (4) If a candidate cheats or she or he tries to cheat, the concerning examination has to be assessed with "failed" (5.0). If a candidate carries an unauthorized aid, the concerning examination has to be assessed with "failed". The respective supervisor records the incidents. The respective examiner makes the determination according to section 1 or the decision according to section 2.
- (5) A candidate who disturbs the proper procedure of the examination can be excluded from taking any further part in the examination by the respective examiner, usually after being called to order; in this case the respective performance in examination has to be graded with "failed" (5.0). The reasons for the exclusion have to be recorded.
- (6) In serious cases of cheating or disturbance, the Examination Board is able to exclude the candidate from other examination performances. Furthermore, acts of cheating can be punished with a fine of up to 50,000 € according to § 63, paragraph 5 HG and may lead to de-registration.
- (7) The candidate may request that the Examination Board reviews the decisions according to paragraph 4, sections 1 and 2 and paragraph 5 within 14 days. Negative decisions of the Examination Board have to be communicated in writing to the candidate immediately, explained and provided with information on the candidate's legal remedies available. Before making the decision, the opportunity to be heard fairly has to be given to the candidate.
- (8) Furthermore the Examination Board regulates the compensation for disability for students with a disability or a chronic disease. If the student is not able to take performances completely or partially according to the foreseen modalities due to her or his disability or chronic disease, shall receive a compensation for disability. As a compensation for disability especially granting of organizational measures and aid, extension of the time allowed for completion or the granting of other, equivalent form of taking a performance are eligible. The disability or chronic disease has to be made credible. Additionally, a medical certificate or a psychological report can be requested. The application shall name and explain the desired modifications. Upon request of the student or the Examination Board the representative for the interest of students with disabilities and chronic illnesses can issue recommendations for the design of the compensation for disability.

- (9) The special situation of students with family responsibilities during their studies and during taking examinations are considered. This occurs, inter alia, in the following forms:
- a. On application of a candidate the safeguard arrangements according to §§ 3, 4, 6 and 8 of the Maternity Protection Act have to be taken into account accordingly. The required verifications have to be added to the application. The Examination Board may determine other forms of taking examinations in consideration of the individual case. Deadlines for maternity rights interrupt any deadline of this examination regulation; the period of maternity leave will not be included in the deadline.
  - b. The deadlines of the parental leave according to the respectively applicable Parental Benefit Act and Parental Leave Act have to be considered as well. The candidate has to notify the Examination Board and include relating documents not later than four weeks before the date when she or he wants to take parental leave, for which period of time she or he wants to make use of the parental leave. The Examination Board examines if legal requirements exist, which would cause a claim for parental leave according to the Parental Benefit Act and Parental Leave Act for an employee and sets new dates and deadlines under consideration of the individual case. The submission deadline of the master thesis can be extended on not longer than twice of the foreseen time allowed for completion. Otherwise, the set thesis is not assigned and the candidate receives a new topic after expiration of the parental leave.
  - c. On application, the Examination Board considers lost periods caused by care and education of children according to § 25, paragraph 5 of the Federal Law on Support for Education and Training and lost periods caused by care of the spouse, the registered life partner, the partner of a marriage-like community or a relative in straight line or relative by marriage in first degree and determines deadlines and dates under consideration of the individual case. Apart from that sections 4 and 5 starting from letter b) apply accordingly.

### **§23. Completion of studies, definite failure**

- (1) The studies are successfully completed if the Master's examination is passed and all modules have been completed successfully. The Master's examination is passed if all module examinations as well as examinations in the optional minor or in extracurricular studies have been assessed at least with the grade "sufficient" (4.0).
- (2) The Master's examination is definitely failed if a module has been definitely failed or the master thesis module has been assessed with the grade "failed" for a second time.
- (3) The chairperson of the Examination Board informs the candidate about a definitely failed Master's examination in writing. The notification has to be provided with information on the candidate's legal remedies available.
- (4) If the candidate has definitely failed the Master's examination, she or he will receive a testimonial upon request which contains gained credit points if necessary and shows that the Master's examination is definitely failed.
- (5) Students who leave the university without a degree for other reasons have to receive a testimonial upon request after the de-registration which contains the rendered performances and gained credit points if necessary.

### **§24. Certificate, Transcript of Records, Diploma Supplement**

- (1) If the candidate has successfully completed her or his studies, she or he receives a certificate about the result. That certificate contains the name of the degree program, the Specialization Area, the regular length of the degree program and the final grade. That certificate contains a date on which the last performance in examination has been taken. Besides this, it contains the date on which the certified copy has been made. The chairperson of the Examination Board has to sign the certificate.
- (2) The candidate also receives a Transcript of Records, which includes all taken performances and the duration of the degree program. The Transcript of Records contains information about the credit points and grades of completed modules and about the master thesis. Furthermore, it contains the topic of the master thesis and the final grade of the Master's examination.
- (3) In addition to the certificate the graduate also receives a Diploma Supplement.
- (4) The Diploma Supplement is a certificate supplement in English and German language and with standardised information about the German university degrees, which explain the German education system and classify the respective degree. The Diploma Supplement informs about the completed degree program and the academic and professional qualifications gained with the degree. It contains the significant content underlying the qualification, the course of studies, competences gained with the degree as well as the conferring university.
- (5) If examination performances have been completed in English language sufficiently, the degree "English-language master program in Computer Science" is documented on the certificate and the Transcript of Records, according to § 10, paragraph 5.

#### **§25. Master's Degree Certificate**

- (1) At the same time as being given the grade sheet as certificate of the successfully completed master's degree, the candidate receives the Master's Degree Certificate with the date of the grade sheet. The conferment of the Master Degree according to § 2 is documented in it.
- (2) The chairperson of the Examination Board and the dean of the faculty for Computer Science, Electrical Engineering and Mathematics sign the master's certificate and provided with the seal of the University of Paderborn.
- (3) A translation in English is added to the Master's Degree Certificate.

#### **§26. Inspection of examination files**

- (1) The candidate may be given the opportunity to inspect her or his examination performances and the related assessments of the examiners after the announcement of the grades. The examiner decides about place and time of the insight and announces it in an appropriate form.
- (2) As long as paragraph 1 is not applied, the candidate is allowed to inspect her or his performances in written examinations, the related assessments of the examiners and the examination protocols upon request. Within one year after handing out the certificate the candidate will be granted inspection of the master thesis, the related report of the examiners and the examination protocols. The chairperson of the Examination Board decides about place and time of taking the insight; she or he can delegate these tasks to the examiners.

### **IV. Final Provisions**

### **§27. Invalidity of Master's examination**

- (1) If the candidate has cheated during an examination and should this fact come to light after the conferment of the degree, the Examination Board can subsequently correct the grades of those examination performances in which the candidate has cheated and declare the examination as entirely or partly failed.
- (2) If the requirements for the admission to an examination were not fulfilled, without the candidate intending to fraud on these, and should it come to light after the conferment of the degree, this deficiency is healed by passing the examination. If the candidate has obtained the admission deliberately unjustly, the Examination Board decides about the legal consequences under consideration of the Administrative Procedure Act of the state North–Rhine Westphalia.
- (3) Before making a decision, the affected person has to be given the opportunity to make a statement.
- (4) The incorrect certificate has to be retracted and a new one has to be handed out if necessary. A decision according to paragraph 1 and paragraph 2, section 2 is excluded after the end of a deadline of five years after the issue of the examination certificate.
- (5) If the examination is overall assessed as “failed”, the master's degree is to be revoked as well as the according certificate. The withdrawal of the master's degree is only permitted within five years since the conferment of the degree.

### **§28. Withdrawal of the Master's degree**

The Master's degree can be withdrawn if it subsequently turns out that it has been acquired by cheating or if essential prerequisites for the conferment have been considered erroneously. The Examination Board decides about the withdrawal with two thirds of its members. The withdrawal is only allowed within five years since the conferment of the degree.

### **§29. Transition Regulations**

- (1) These examination regulations count for all students who have been enrolled for the first time starting from the winter term 2017/18 for the master's degree course Computer Science of the faculty for Electrical Engineering, Computer Science and Mathematics at the University of Paderborn.
- (2) Students who have been enrolled at the University of Paderborn for the master's degree course Computer Science before the winter term 2017/18 can take their master's examination including the resits in the summer term of 2020 for the last time according to the examination regulations in the edition from February 28<sup>th</sup> 2013 (AM.Uni.Pb 11.13), changed by the rules from January 29<sup>th</sup> 2016 (AM.Uni.Pb 06.16). Stricter deadlines from older transitional provisions remain untouched. Starting from winter term 2020/2021 the master's examination including the resits can be taken according to these examination regulations.
- (3) On application students can change into these examination regulations. The change is irrevocable.

### **§30. Date of effectiveness and publication**

- (1) The examination regulations come into force with effect from October 01<sup>st</sup> 2017. At the same time the Master's examination regulations from February 28<sup>th</sup> 2013 (AM.Uni.Pb 11.13), changed by the rules from January 29<sup>th</sup> 2016 (AM.Uni.Pb 06.16) cease to be in force. § 29 remains untouched.
- (2) The examination regulations are published in the Official Communications of the University of Paderborn (AM.Uni.Pb.).

Issued due to the resolution of the faculty executive committee of the faculty for Electrical Engineering, Computer Science and Mathematics April 24<sup>th</sup> 2017 and the legality audit by the President's cabinet of the University of Paderborn from Mai 17<sup>th</sup> 2017.

Paderborn, June 16<sup>th</sup> 2017

For the President  
The Vice president for economic administration personnel management  
Of the University of Paderborn

Simone Probst

## Appendix 1: Modules and Forms of Examination

As a consequence of the development of research and teaching content of the departments of Computer Science and of Electrical Engineering and Information Engineering can be omitted or replaced in small number in the compulsory elective area modules of the following list or by modules which professionally belong to the same area. Changes are announced in the module guide. Regulations of performances, about scope as well as requirements for participation remain unapplied.

Focus Area Module	LP Modules SWS	Forms of Examination	Notes
<b>Software Engineering</b>	<b>6</b>	Oral examination or written examination as final module examination	Mandatory elective module  In case of enrolment with requirements with the pre-master-course <input type="checkbox"/> <b>Software Engineering 1 and 2</b>  passing the according examination and the registration of the module have to be proven.  Requirement for participation in the module examination: coursework
One of the modules <input type="checkbox"/> Advanced Software Engineering: Methods, Architectures, Industrial Applications <input type="checkbox"/> Designing code analyses for large-scale software systems <input type="checkbox"/> Empiric Performance Evaluation <input type="checkbox"/> Fundamentals of Model-Driven Engineering <input type="checkbox"/> High-Performance Computing <input type="checkbox"/> Logic Programming for Artificial Intelligence <input type="checkbox"/> Model Checking <input type="checkbox"/> Software Analysis <input type="checkbox"/> Software Quality Assurance <input type="checkbox"/> Type Systems for Correctness and Security	3+2		
<input type="checkbox"/> Contextual Informatics (HMI)	3+2	Oral examination or written examination as final module examination	Mandatory elective module  In case of enrolment with requirements with the pre-master-course <input type="checkbox"/> <b>Human-Machine-Interaction</b>  passing the according examination and the registration of the module have to be proven.  Requirement for participation in the module examination: coursework
<input type="checkbox"/> Build It, Break It, Fix It	3+2	Phase-related examination (100% of the module grade)	Mandatory elective module  In case of enrolment with requirements with the pre-master-course <input type="checkbox"/> <b>Software Engineering 1 and 2</b>

Focus Area Module	LP Modules SWS	Forms of Examination	Notes
			<p>passing the according examination and the registration of the module have to be proven.</p> <p>Requirement for participation in the module examination: coursework</p>
<b>Algorithm Design</b>	<b>6</b>	Oral examination or written examination as final module examination	<p>Mandatory elective module</p> <p>In case of enrolment with requirements with the pre-master-courses</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> <b>Mathematics 1 and 2 and/or</b></li> <li><input type="checkbox"/> <b>Models and Algorithms 1 and 2</b></li> </ul> <p>passing the according examination and the registration of the module have to be proven.</p> <p>Requirement for participation in the module examination: coursework</p>
<p>One of the modules</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Advanced Algorithms</li> <li><input type="checkbox"/> Advanced Complexity Theory</li> <li><input type="checkbox"/> Advanced Distributed Algorithms and Data Structures</li> <li><input type="checkbox"/> Algorithms for Highly Complex Virtual Scenes</li> <li><input type="checkbox"/> Clustering Algorithms</li> <li><input type="checkbox"/> Computational Geometry</li> <li><input type="checkbox"/> Foundations of Cryptography</li> <li><input type="checkbox"/> Linear and Integer Optimization</li> <li><input type="checkbox"/> Public–Key Cryptography</li> <li><input type="checkbox"/> Routing and Data Management in Networks</li> </ul>	3+2		
<b>Networks and Communication</b>	<b>6</b>	Oral examination or written examination as final module examination	<p>Mandatory elective module</p> <p>In case of enrolment with requirements with the pre-master-courses</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> <b>Mathematics 1 and 2 and/or</b></li> <li><input type="checkbox"/> <b>Systems 1 and 2</b></li> </ul> <p>passing the according examination and the registration of the module have to be proven.</p> <p>Requirement for participation in the module examination: coursework</p>
<p>One of the modules</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Advanced Distributed Algorithms and Data Structures</li> <li><input type="checkbox"/> Bitcoins, Cryptocurrencies, and Privacy–Enhancing Technologies</li> <li><input type="checkbox"/> Cooperative Mobile Systems</li> <li><input type="checkbox"/> Empiric Performance Evaluation</li> <li><input type="checkbox"/> Future Internet</li> <li><input type="checkbox"/> Mobile Communication</li> <li><input type="checkbox"/> Network Simulation</li> <li><input type="checkbox"/> Networked Embedded Systems</li> <li><input type="checkbox"/> Routing and Data Management in Networks</li> <li><input type="checkbox"/> Vehicular Networking</li> </ul>	3+2		
<b>Computer Systems</b>	<b>6</b>	Oral examination or written examination as final module examination	<p>Mandatory elective module</p> <p>In case of enrolment with requirements with the pre-master-course</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> <b>Systems 1 and 2</b></li> </ul> <p>passing the according examination and the registration of the module have to be proven.</p> <p>Requirement for participation in the module examination: coursework</p>
<p>One of the modules</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Advanced Computer Architecture</li> <li><input type="checkbox"/> Algorithms for Synthesis and Optimization of Integrated Circuits</li> <li><input type="checkbox"/> Architectures of Parallel Computer Systems</li> <li><input type="checkbox"/> Empiric Performance Evaluation</li> <li><input type="checkbox"/> Hardware/Software Codesign</li> <li><input type="checkbox"/> High–Performance Computing</li> <li><input type="checkbox"/> Intelligence in Embedded Systems</li> <li><input type="checkbox"/> Reconfigurable Computing</li> </ul>	3+2		

Focus Area Module	LP Modules SWS	Forms of Examination	Notes
<input type="checkbox"/> • VLSI Testing			
<b>Intelligence and Data</b>	<b>6</b>	Oral examination or written examination as final module examination	Mandatory elective module  In case of enrolment with requirements with the pre-master-courses <input type="checkbox"/> <b>Models and Algorithms 1 and 2 and/or</b> <input type="checkbox"/> <b>Mathematics 1 and 2 and/or</b> <input type="checkbox"/> <b>Software Engineering 1 and 2</b>  passing the according examination and the registration of the module have to be proven.  Requirement for participation in the module examination: coursework
One of the modules <input type="checkbox"/> Clustering Algorithms <input type="checkbox"/> Computational Argumentation <input type="checkbox"/> Foundations of Knowledge Graphs <input type="checkbox"/> Information Retrieval <input type="checkbox"/> Intelligence in Embedded Systems <input type="checkbox"/> Interactive Data Visualization <input type="checkbox"/> Logic and Automated Reasoning <input type="checkbox"/> Logic Programming for Artificial Intelligence <input type="checkbox"/> Machine Learning I <input type="checkbox"/> Machine Learning II <input type="checkbox"/> Planning and Heuristic Search <input type="checkbox"/> Statistic Natural Language Processing <input type="checkbox"/> Statistic Signal Processing	3+2		
<b>Data Science</b>	<b>6</b>	Oral examination or written examination as final module examination	Mandatory elective module  In case of enrolment with requirements with the pre-master-courses <input type="checkbox"/> <b>Models and Algorithms 1 and 2 and/or</b> <input type="checkbox"/> <b>Mathematics 1 and 2 and/or</b> <input type="checkbox"/> <b>Software Engineering 1 and 2</b>  passing the according examination and the registration of the module have to be proven.  Requirement for participation in the module examination: coursework
One of the modules <input type="checkbox"/> Advanced Algorithms <input type="checkbox"/> Advanced Distributed Algorithms and Data Structures <input type="checkbox"/> Advanced Software Engineering: Methods, Architectures, Industrial Applications <input type="checkbox"/> Approximation Algorithms <input type="checkbox"/> Digital Speech Signal Processing <input type="checkbox"/> Empiric performance evaluation <input type="checkbox"/> Foundations of Knowledge Graphs <input type="checkbox"/> High-Performance Computing <input type="checkbox"/> Information Retrieval <input type="checkbox"/> Interactive Data Visualization <input type="checkbox"/> Linear and Integer Optimization <input type="checkbox"/> Machine Learning I <input type="checkbox"/> Machine Learning II <input type="checkbox"/> Statistical Natural Language Processing <input type="checkbox"/> Topics in Pattern Recognition and Machine Learning <input type="checkbox"/> Topics in Signal Processing	3+2		
<b>Project group</b>	<b>20</b>	Module examination of the project work as a phase-related examination	Compulsory module  In case of enrolment with requirements with the pre-master-course <input type="checkbox"/> <b>Soft Skills, Management</b>

Focus Area Module	LP Modules SWS	Forms of Examination	Notes
			passing the according examination and the registration of the module have to be proven. Requirement for participation in the module examination: coursework
<b>Seminar I</b>	<b>5</b>	Lecture given at a seminar and written assignment, grade equals the module grade	Compulsory module  In case of enrolment with requirements with the pre-master-course <input type="checkbox"/> <b>Soft Skills, Management</b> passing the according examination and the registration of the module have to be proven. Requirement for participation in the module examination: coursework
<b>Seminar II</b>	Identical to Seminar I		
<b>Minor or Extracurricular Studies</b>	<b>12</b>		Either a minor subject or extracurricular studies is studied (except Business Information Technology and Economics)
Minor subject	12	Module Examination according to the agreements about the minor subject	Selectable minor from the catalogue of the standard minors or the non-standard minor (upon request)
Extracurricular Studies	12	Examination in the extracurricular studies	
<b>Master Thesis</b>	<b>30</b>	Examination according to §17 and §18	Consisting of work planning, preparation of the master thesis including the closing presentation

In case of **enrolment with requirements** according to §4, section c, pre-master-courses have to be completed, before a module can be started, if necessary. The following pre-master-courses are foreseen as requirements for modules:

Pre-master-courses	Scope	Requirement for modules of the Focus Area
<b>Basics in Human–Machine–Interaction</b>	2 SWS	Software Engineering: Contextual Informatics
<b>Mathematics 1 and 2</b>	4 SWS	Algorithm Design Networks and Communication Intelligence and Data Data Science
<b>Models and Algorithms 1 and 2</b>	4 SWS	Algorithm Design

		Intelligence and Data Data Science
<b>Soft Skills, Management</b>	2 SWS	Seminar I and II Project group
<b>Software Engineering 1 and 2</b>	4 SWS	Software Engineering excluding the module Contextual Informatics Intelligence and Data Data Science
<b>System 1 and 2</b>	4 SWS	Networks and Communication Computer Systems

## Appendix 2: Agreements about subsidiary for standard subsidiaries in the master's degree course Computer Science

Preliminary remark: more detailed examination modalities conform to regulations of the examination regulations of the respective relevant degree program in the respective current version.

Legend:

MP = Module Examination (*Modulprüfung*)

SP = qualified participation proved by the preparation of a seminar paper

qT= qualified participation (*qualifizierte Teilnahme*)

### 1. Electrical Engineering

1 <sup>st</sup> – 3 <sup>rd</sup> Semester	2 modules out of • Circuit Engineering • Control Engineering • Communications Engineering • Energy Engineering	MP	6
		MP	6
		<b>Sum</b>	<b>12</b>

### 2. Mathematics

1 <sup>st</sup> – 3 <sup>rd</sup> Semester	Pursuing modules from the canon of mathematics courses	MP	9
		<b>Sum</b>	<b>9</b>

When choosing this subsidiary 3 CP have to be additionally completed in the extracurricular studies.

### 3. Media Studies

1 <sup>st</sup> – 3 <sup>rd</sup> Semester	Basis module Media theory/– history		
	Introduction	SP	4
	Seminar/ Course	SP	4
	Seminar/ Course	SP	4
		<b>Sum</b>	<b>12</b>

#### 4. Philosophy

1 <sup>st</sup> – 3 <sup>rd</sup> Semester	Advanced module 1: Anthropology and Cultural philosophy  <b>Or</b> Advanced module 2: Practical Philosophy  <b>Or</b> Advanced module 3: Theoretical Philosophy	In each case: Overall meeting seminar  Seminar  Module examination	<b>In each case:</b> qT qT  qT  MP	In each case: 12
			<b>Sum</b>	<b>12</b>

#### 5. Psychology

1 <sup>st</sup> , 2 <sup>nd</sup> and 3 <sup>rd</sup> semester	Research colloquium cognitive psychology	qT	2
	2 seminars from the course provision from the sub–area of cognitive psychology and work and organisation psychology	qT qT	4 4
	Portfolio examination	MP	2
		<b>Sum</b>	<b>12</b>

#### 6. Business Information Technology

1 <sup>st</sup> , 2 <sup>nd</sup> and 3 <sup>rd</sup> semester	All modules from the module catalogue of the faculty for economics with the number M.184.43XX	MP	10
		<b>Sum</b>	<b>10</b>

When choosing the subsidiary 2 CP have to be completed in the extracurricular studies.

#### 7. Economics

1 <sup>st</sup> , 2 <sup>nd</sup> and 3 <sup>rd</sup> semester	All modules from the module catalogue of the faculty for economics with the number M.184.43XX	MP	10
		<b>Sum</b>	<b>10</b>

When choosing the subsidiary 2 CP have to be completed in the extracurricular studies.

#### Appendix 3: Course Timetable

Schedule Computer Science Master (exemplary)					
1 <sup>st</sup> semester	Compulsory elective module I (6CP)	Compulsory elective module II	Compulsory elective III (6 CP)	Compulsory elective module IV	Compulsory elective module V

		(6 CP)		(6 CP)	(6 CP)
2 <sup>nd</sup> semester	Project group (20 CP)	Compulsory elective module VI (6 CP)		Seminar I (5 CP)	SG/NF
3 <sup>rd</sup> semester		Compulsory elective module VII (6 CP)	Compulsory elective module VII (6 CP)		SG/NF
4 <sup>th</sup> semester	Master Thesis (30 CP)				

#### Appendix 4: Module guide